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# PENGARUH SUBSTITUSI TEPUNG TERIGU DENGAN TEPUNG BONGGOL PISANG TERHADAP SERAT PANGAN, AKTIVITAS ANTIOKSIDAN, DAN SIFAT ORGANOLEPTIK *COOKIES*

*The Effect of Substitution Wheat Flour with Banana Corm Flour on Dietary Fiber Content, Antioxidant Activity, and Organoleptic Properties Cookies*

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## ABSTRACT

**Banana corm had high fiber content and antioxidant activity. This search aimed to analyze of effect of cookie substitution with banana corm on its fiber content, antioxidant activity, and organoleptic. This study used a randomized design method (RAL) with one factor (wheat flour substitution with banana corm with proportion banana corm flour: wheat flour are 25 percent: 75 percent (F1), 50 percent: 50 percent (F2), 75 percent: 25 percent (F3), and 100 percent : 0 percent (F4)). The result showed that substitution using banana corm increased fiber content significantly (p=0,038) but did not affect antioxidant activity (p=0,136). The substitution also significantly affected aroma (p=0,028), taste (p=0,000), and texture (p=0,000) but did not affect significantly the color of cookies (P=0,078). The best formula was F4 which contained ash, fat, protein, carbohydrate, dietary fiber, and antioxidant activity were 6.09 percent, 21.43 percent, 6.10 percent, 59.57 percent, 29.31 percent, and 42536.20 ppm respectively.**

**Keywords: antioxidant activity, banana corm flour, cookies, dietary fiber**

## ABSTRAK

**Tepung bonggol pisang mengandung tinggi serat pangan dan aktivitas antioksidan. Tujuan penelitian ini untuk menganalisis pengaruh substitusi tepung bonggol pisang terhadap kandungan serat pangan, aktivitas antioksidan, dan sifat organoleptik cookies. Metode yang digunakan dalam penelitian ini ialah Rancangan Acak Lengkap (RAL) dengan satu faktor (substitusi tepung terigu dengan tepung bonggol pisang dengan proporsi tepung bonggol pisang : tepung terigu 25 persen : 75 persen (F1), 50 persen : 50 persen (F2), 75 persen : 25 persen (F3), dan 100 persen : 0 persen (F4). Hasil penelitian menunjukkan bahwa *cookies* dengan substitusi tepung bonggol pisang berpengaruh nyata (p=0,038) terhadap kenaikan kadar serat pangan tetapi tidak terhadap aktivitas antioksidan (p=0,136). Substitusi tepung bonggol pisang juga berpengaruh nyata terhadap tingkat kesukaan panelis terhadap aroma (p=0,028), rasa (p=0,000), dan tekstur *cookies* (p=0,000) namun tidak berpengaruh nyata terhadap tingkat kesukaan panelis terhadap warna *cookies* (p=0,078). Formula *cookies* terbaik adalah F4 yang mengandung kadar air (6,09%), kadar abu (6,82%), lemak (21,43%), Protein (6,10%), karbohidrat (59,57%), kadar serat pangan (29,31%), dan aktivitas antioksidan (42.536,2 ppm).**

**Kata kunci: aktivitas antioksidan, *cookies*, tepung bonggol pisang, serat pangan**

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## PENDAHULUAN

Menurut World Health Organization, prevalensi obesitas di dunia terus meningkat, lebih dari 650 juta orang berusia 18 tahun keatas mengalami obesitas pada tahun 2016. Sementara itu, secara nasional masalah obesitas di Indonesia pada orang berusia 18 tahun ke atas masih terbilang tinggi. Menurut data Riskesdas, prevalensi obesitas di Indonesia mengalami peningkatan selama tiga periode, yaitu dari 10,5 persen pada 2007, kemudian 14,3 persen pada 2013, dan 21,8 persen pada 2018.[1]

Meningkatnya prevalensi obesitas pada negara berkembang, salah satunya di Indonesia disebabkan oleh perubahan perilaku makan dan gaya hidup. Pola makan masyarakat saat ini cenderung mengonsumsi makanan yang tinggi kalori, lemak, karbohidrat, kolesterol namun kandungan serat yang rendah.[2] Angka Kecukupan Gizi (AKG) 2019 menganjurkan asupan serat yang baik untuk orang dewasa berusia diatas 18 tahun adalah 20-37 gram per hari sedangkan penduduk Indonesia rata-rata hanya mengonsumsi serat pangan sebesar 10-14 gram perhari.[3] Jika dilihat dari angka tersebut penduduk Indonesia belum memenuhi kebutuhan serat sehingga masih diperlukannya peningkatan asupan serat pangan. Serat pangan terbukti memiliki manfaat bagi kesehatan salah satunya untuk menjaga pengaturan berat badan.[4] Asam lemak rantai pendek yang dihasilkan dari proses fermentasi serat pangan di usus besar mengubah pola makan dengan melepaskan peptida dan hormon kolesistokinin dan hormon GLP-1 (*Glucagon Like Peptide-1*) sehingga mengurangi rasa lapar dan meningkatkan rasa kenyang.[5]

Obesitas juga dapat menjadi pemicu timbulnya penyakit degeneratif seperti kardiovaskuler, stroke, dan kanker.[6] Hal tersebut terjadi akibat dari inflamasi atau peradangan karena stress oksidatif. Stress oksidatif merupakan ketidakseimbangan radikal bebas dan antioksidan dalam tubuh.[7] Aktivitas antioksidan dapat mengurangi kelebihan produksi *reactive oxygen species* (ROS) dan *reactive nitrogen species* (RNS). Dampak merugikan dari oksidan, radikal bebas, dapat dicegah dengan mengonsumsi pangan yang mengandung antikosidan. Selain itu, hal tersebut juga dapat mencegah produksi ROS yang kemudian tidak membuat terjadinya inflamasi.[8]

Berdasarkan pernyataan diatas, diperlukan upaya untuk meningkatkan asupan serat pangan dan antioksidan dengan cara memanfaatkan bahan pangan lokal, yaitu bonggol pisang. Berdasarkan data BPS tahun 2019 produksi pisang sebanyak 7,28 juta ton di Indonesia maka ketersediaan bonggol pisang juga akan melimpah, mengikuti produksi pisang tersebut. Dalam 100 gram tepung bonggol pisang kepok mengandung 44,87 gram serat pangan dan aktivitas antioksidan 29.498,72 ppm. Beradasarkan penelitian Wenas *et al* menyebutkan bahwa terdapat senyawa flavonoid, saponin dan tanin pada ekstrak bonggol pisang kepok.[9] Selain itu, masih minimnya penelitian yang meneliti bonggol pisang, terutama dengan menguji aktivitas antioksidannya.

Adapun bentuk produk makanan yang praktis, mudah dibawa dan memiliki daya simpan yang relatif lama ialah *cookies*.[10] *Cookies* di sukai semua orang mulai dari anak-anak hingga orang dewasa. Produk cookies ini diharapkan dapat meningkatkan asupan serat dan antioksidan untuk mencegah maupun mengatasi obesitas. Tujuan penelitian ini untuk menganalisis pengaruh substitusi *cookies* dengan tepung bonggol pisang terhadap serat pangan, aktivitas antioksidan, dan sifat organoleptik, serta menentukan formula terpilih dan nilai gizinya.

## METODE PENELITIAN

Metode yang digunakan dalam penelitian ini ialah Rancangan Acak Lengkap (RAL) satu faktorial dengan dua ulangan yang terdiri dari empat taraf perlakuan, yaitu perbandingan tepung bonggol pisang dan tepung terigu, F1 (25% : 75%), F2 (50% : 50%), F3 (75% : 25%), dan F4 (100% : 0%). Penelitian ini berlangsung dari bulan februari sampai bulan juni 2022.

Pengujian kandungan serat pangan tepung bonggol pisang dilakukan di Laboratorium Saraswati Indo Genetech (SIG) dan aktivitas antioksidan pada tepung bonggol pisang dilakukan di Laboratorium Jasa Pengujian, Kalibrasi, dan Sertifikasi Institut Pertanian

Bogor. Sementara pengujian serat pangan *cookies* dilakukan di Laboratorium Saraswati Indo Genetech (SIG) dan pengujian aktivitas antioksidan di MBRIO *Food Laboratory*. Sementara itu, uji organoleptik dilakukan di rumah masing-masing responden.

Uji organoleptik menggunakan 30 panelis semi terlatih yang terdiri dari mahasiswa aktif program studi gizi program sarjana semester 5 sampai dengan semester 8. Penilaian uji hedonik meliputi warna, aroma, rasa dan tekstur *cookies* dengan 5 skala yaitu sangat tidak suka, tidak suka, biasa, suka dan sangat suka.

Tahapan pertama pembuatan *cookies* dimulai dengan mempersiapkan alat dan bahan. Bahan untuk membuat *cookies* ini antara lain tepung terigu, tepung bonggol pisang, gula halus, kuning telur, margarin, *baking powder,* susu skim bubuk, coklat bubuk, dan vanili. Kemudian bahan-bahan tersebut ditimbang. Setelah itu, margarin, kuning telur, dan gula halus dicampur menggunakan mixer. Setelah tercampur secara merata bahan-bahan kering ditambahkan dan kembali diratakan, bahan kering yang dimasukkan berupa baking powder, susu skim bubuk, coklat bubuk, vanili, tepung bonggol pisang dan tepung terigu. Langkah selanjutnya adonan akan dicetak dan dipanggang selama 20 menit dalam oven pada suhu 150°C, ketika sudah selesai adonan akan didinginkan.

Data kadar serat pangan dan aktivitas antioksidan dianalisis menggunakan Analysis of Variance (ANOVA) dengan uji lanjut Duncan, sementara untuk data sifat organoleptik dianalisis menggunakan uji Kruskal-Wallis dengan uji lanjut *Mann-Whitney*. Penentuan formula terpilih dengan Metode Perbandingan Eksponensial (MPE) mempertimbangkan hasil analisis serat pangan, aktivitas antioksidan dan hasil uji organoleptik, parameter yang digunakan pada uji organoleptik yaitu warna, aroma, rasa dan tekstur.

### Analisis Serat Pangan, Metode Gravimetri

Analisis serat pangan menggunakan metode gravimetri, dimulai dengan menimbang sampel sebanyak 1 gram[11]. Campurkan 1 gram sampel dengan buffer dalam labu Erlenmeyer dan 0,1 ml larutan termamyl dan panaskan dengan suhu 100°C selama 15 menit. Kemudian tambahkan 20 mL akuades dan HCL 4 M sampai tercapai pH 1,5 jika larutan sudah dingin. Pada suhu 400C, tambahkan 100 mg pepsin lalu diaduk selama 1 jam kemudian tambahkan sampel dengan 20 ml akuades dan NaOH 1 N sampai mencapai pH 4,5. Selanjutnya tambahkan enzim AMG, lalu tutup labu erlenmeyer dan aduk sesekali selama 60 menit pada suhu 400C. Setelah itu, tambahkan NaOH 1 N hingga mencapai pH 6,8, lalu saring sampel dengan cawan krusibel dan bilas endapan sebanyak dua kali dengan 10 ml aquades.

### Analisis Aktivitas Antioksidan, Metode DPPH

Analisis ini menggunakan metode DPPH dengan tujuan mengetahui ekuivalen yang dapat memberikan 50 persen efek aktivitas antioksidan ($IC_{50}$)[12]. Analisis aktivitas antioksidan diawali dengan pembuatan larutan DPPH dengan cara melarutkan 1,97 mg DPPH dalam metanol untuk setiap analisis dan melarutkannya dalam labu ukur hingga 100 mL untuk mendapatkan larutan konsentrasi 50 µM. Campurkan 1 mL larutan sampel dengan 4 mL larutan DPPH dengan konsentrasi 50 µM pada tabung, lalu dihomogenkan pada tempat gelap selama 30 menit, dan di ukur serapannya menggunakan spektrofotometer UV-Vis dengan panjang gelombang 517 nm. Terbentuknya warna kuning pada sampel menunjukkan adanya antioksida.

## HASIL

### Serat Pangan

Hasil ANOVA menunjukkan bahwa substitusi tepung bonggol pisang berpengaruh nyata (p=0,038) terhadap peningkatan kadar serat pangan *cookies*. Berdasarkan hasil tersebut dilakukan uji lanjut DMRT (*Duncan Multiple Range*). Kemudian, kadar serat pangan F4 berbeda nyata dengan F1 dan F2. Tabel 1 menunjukkan hasil uji serat pangan *cookies* dengan substitusi tepung bonggol pisang diketahui memiliki kandungan serat pangan antara 14,86 persen hingga 29,31 persen. Formulasi F4 memiliki kandungan serat pangan tertinggi (29,31%) dan F1 memiliki kandungan serat terendah (14,86%).

### Aktivitas Antioksidan

Hasil uji aktivitas antioksidan dapat dilihat pada Tabel 2. *Cookies* dengan substitusi tepung bonggol pisang memiliki aktivitas antioksidan

sebesar 47.071,4-42.536,2 ppm. Pada penelitian ini dapat disimpulkan bahwa F4 memiliki aktivitas antioksidan terkuat (42.536,2 ppm) dan F1 memiliki aktivitas antioksidan terlemah (47.071,4 ppm). Hasil ANOVA menujukkan bahwa substitusi tepung bonggol pisang kepok pada *cookies* tidak berpengaruh nyata (p=0,14) terhadap aktivitas antioksidan

Tabel 1

Kadar Serat Pangan *Cookies* dengan Substitusi Tepung Bonggol Pisang Kepok

| Komponen | Formula *Cookies* | | | |
|---|---|---|---|---|
| | F1 | F2 | F3 | F4 |
| Serat Pangan (%) | 14,86±5,37[a] | 19,55±1,05[ab] | 24,87±2,65[bc] | 29,31±6,29[c] |

Keterangan: [a.b.c] = notasi huruf sama artinya tidak ada perbedaan nyata pada taraf Uji Duncan memiliki nilai 5 persen

Tabel 2

Aktivitas Antioksidan *Cookies* dengan Substitusi Tepung Bonggol Pisang Kepok

| Komponen | Formula *Cookies* | | | |
|---|---|---|---|---|
| | F1 | F2 | F3 | F4 |
| Aktivitas Antioksidan (ppm) | 47.071,4±1713,9[a] | 46.140,3±2941,7[a] | 43.140,7±415,5[a] | 42.536,2±20,3[a] |

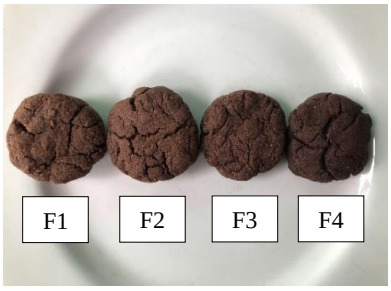
Keterangan: [a.b.c] = notasi huruf sama artinya tidak ada perbedaan nyata pada taraf Uji Duncan memiliki nilai 5 persen

Tabel 3

Hasil Uji Hedonik *Cookies* dengan Substitusi Tepung Bonggol Pisang Kepok

| Parameter | Formula *Cookies* | | | |
|---|---|---|---|---|
| | F1 | F2 | F3 | F4 |
| Warna | 4 (3-5)[a] | 4 (2-5)[a] | 4 (2-5)[a] | 4 (2-5)[a] |
| Aroma | 4 (2-5)[a] | 4 (2-5)[a] | 4 (2-5)[ab] | 3 (2-5)[b] |
| Rasa | 4 (1-5)[a] | 3 (2-5)[b] | 3 (1-4)[bc] | 2 (1-4)[c] |
| Tekstur | 4 (2-5)[a] | 3 (2-4)[b] | 3 (2-5)[bc] | 2 (1-5)[c] |

Keterangan: 1 = sangat tidak suka; 2 = tidak suka; 3 = biasa; 4 = suka; 5 = sangat suka
[a.b.c] = notasi huruf sama artinya tidak ada perbedaan nyata pada taraf Uji Duncan memiliki nilai 5 persen




Gambar 1

*Cookies* dengan Substitusi Tepung Bonggol Pisang

**Sifat Organoleptik**

*Warna*

Tingkat kesukaan panelis terhadap warna *cookies* dengan substitusi tepung bonggol pisang cukup baik dengan nilai median 4 (suka). Berdasarkan hasil uji kruskal wallis didapatkan nilai p value sebesar 0,078 sehingga diketahui bahwa substitusi tepung bonggol pisang tidak memiliki pengaruh nyata terhadap tingkat kesukaan panelis terhadap warna cookies.

*Aroma*

Hasil menunjukkan bahwa aroma pada formula *cookies* F4 memiliki nilai median terendah. Berdasarkan uji kruskal wallis didapatkan nilai p value sebesar 0,028 sehingga dapat diketahui bahwa substitusi tepung bonggol pisang kepok memiliki pengaruh nyata terhadap aroma *cookies.* Berdasarkan hasil tersebut, perlu dilakukannya uji *Mann-Whitney*. Hasil uji *Mann-Whitney* menunjukkan tingkat kesukaan panelis terhadap aroma *cookies* dengan substitusi tepung bonggol pisang tidak berbeda nyata pada F1 dan F2 (p=0,440), F1 dan F3 (p=0,059), F2 dan F3 (p=0,272), serta F3 dan F4 (p=0,372). Namun terdapat perbedaan nyata pada F1 dan F4 (p=0,005), serta F2 dan F4 (p=0,045) terhadap tingkat kesukaan aroma *cookies* dengan substitusi tepung bonggol pisang kepok.

*Rasa*

Hasil menunjukkan bahwa rasa pada formula *cookies* F1 memiliki nilai median tertinggi dan F4 memiliki nilai median terendah seperti yang disajikan pada Tabel 3. Berdasarkan uji kruskal wallis didapatkan nilai p value sebesar 0,000 sehingga diketahui bahwa substitusi tepung bonggol pisang kepok memiliki pengaruh nyata terhadap rasa *cookies*. Berdasarkan hasil tersebut, perlu dilakukan uji *Mann-Whitney*. Hasil uji *Mann-Whitney* menunjukkan bahwa tingkat kesukaan rasa *cookies* dengan substitusi tepung bonggol pisang tidak berbeda nyata pada F2 dan F3 (p=0,058) serta F3 dan F4 (p=0,102). Namun, terdapat perbedaan yang signifikan antara F1 dan F2 (p=0,001), F1 dan F3 (p=0,000), F1 dan F4 (p=0,000), serta F2 dan F4 (p=0,001) terhadap tingkat kesukaan rasa *cookies* dengan substitusi tepung bonggol pisang kepok.

*Tekstur*

Hasil menunjukkan bahwa tekstur pada formula *cookies* F1 memiliki nilai median tertinggi dan F4 memiliki nilai median terendah seperti yang disajikan pada Tabel 3. Berdasarkan uji kruskal wallis didapatkan nilai p value sebesar 0,000 sehingga diketahui bahwa substitusi tepung bonggol pisang kepok memiliki pengaruh nyata terhadap tekstur *cookies*. Berdasarkan hasil tersebut, perlu dilakukan uji *Mann-Whitney*. Hasil uji *Mann-Whitney* menunjukkan tingkat kesukaan panelis terhadap tekstur *cookies* dengan subtitusi tepung bonggol pisang tidak berbeda nyata pada F2 dan F3 (p=0,142) serta F3 dan F4 (p=0,284). Namun terdapat perbedaan yang signifikan pada F1 dan F2 (p=0,003), F1 dan F3 (p=0,000), F1 dan F4 (p=0,000) serta F2 dan F4 (p=0,014) terhadap tingkat kesukaan tekstur *cookies* dengan substitusi tepung bonggol pisang kepok.

**Penentuan Formula Terpilih**

Hasil perhitungan menggunakan Metode Perbandingan Eksponensial didapatkan bahwa

formulasi F4 *cookies* dengan substitusi tepung bonggol pisang 100 persen memiliki skor terkecil sehingga formula tersebut merupakan formula terpilih yang diharapkan dalam penelitian ini.

## BAHASAN

### Serat Pangan

Serat pangan mampu mencegah obesitas karena dapat memberikan rasa kenyang yang lama.[5] Hal itu sejalan dengan penelitian Crus-Requana *et al* yang mengatakan diet tinggi serat pangan dapat membantu untuk menjaga pengaturan berat badan.[4] Uji serat pangan pada *cookies* ini menggunakan metode enzimatik gravimetri. Peningkatan kadar serat pangan pada setiap formula disebabkan oleh kandungan kadar serat pangan pada tepung bonggol pisang kepok (44,80 gram per 100 gram) lebih besar dibandingkan dengan tepung terigu (0,30 gram per 100 gram). Artinya, kadar serat pangan *cookies* akan semakin meningkat seiring dengan meningkatnya presentase substitusi tepung bonggol pisang. Hal tersebut sesuai dengan penelitian Saragih & Dollu yang mengatakan bahwa *cookies* dengan formulasi tepung bonggol pisang terbanyak memiliki kadar serat tertinggi.[13]

Peraturan BPOM No.13 Tahun 2016 menyatakan suatu produk pangan dapat ditetapkan tinggi serat apabila dalam 100 gram mengandung setidaknya 6 gram serat pangan (6%). Produk *cookies* dengan substitusi tepung bonggol pisang kepok menghasilkan 14,86-29,31 persen kadar serat pangan. Maka dari itu, *cookies* dalam penelitian ini telah memenuhi syarat untuk diklaim sebagai tinggi serat.

### Aktivitas Antioksidan

Senyawa yang dapat menangkal radikal bebas disebut antioksidan. Senyawa antioksidan tersebut kemudian mendonorkan elektron agar radikal bebas tersebut dapat dinetralkan kembali dan tidak mengganggu metabolisme tubuh.[14] Parameter dari metode DPPH diketahui dengan nilai IC50.[15] Semakin kecil nilai IC50 semakin kuat aktivitas antioksidan. Hasil ANOVA menunjukkan bahwa substitusi tepung bonggol pisang tidak berpengaruh nyata (p=0,14).

Salah satu faktor penyebab lemahnya aktivitas antioksidan adalah lemahnya aktivitas antioksidan yang terkandung dalam tepung bonggol pisang kepok yaitu sebesar 29.498,72 ppm per 100 gram. Selain itu, hal yang menyebabkan lemahnya aktivitas antioksidan ialah pemanasan. Menurut Cahyani *et al*, semakin rendah suhu dan singkat waktu pengeringan yang digunakan maka semakin kuat aktivitas antioksidannya karena senyawa antioksidan sensitif terhadap suhu tinggi dan waktu yang lama.[16] Pemanasan menjadi penyebab terjadinya dekomposisi senyawa-senyawa bioaktif yang terkandung di dalamnya.[17] Menurut penelitian Wenas *et al*, bonggol pisang mengandung golongan senyawa flavonoid, saponin, dan tanin[9]. Senyawa flavonoid dan tanin rusak pada suhu diatas 50$^{o}$C karena dapat mengalami perubahan struktur.[18]

### Sifat Organoleptik

*Warna*

Warna memberikan kesan pertama yang menarik perhatian konsumen, yang mempengaruhi daya terima produk sebelum mengenal atau mengetahui sifat lainnya.[19] Tepung bonggol pisang kepok memiliki karakteristik berwarna coklat gelap sehingga sangat berpengaruh terhadap warna *cookies* yang dihasilkan. Warna coklat pada tepung bonggol pisang disebabkan karena proses pengeringan dan penjemuran yang menyebabkan perubahan warna.[20] Semakin banyak tepung bonggol pisang kepok yang disubstitusikan pada formulasi pembuatan *cookies*, warna *cookies* yang dihasilkan juga akan semakin berwarna coklat gelap.

*Aroma*

Salah satu faktor terpenting dalam penerimaan suatu produk adalah aroma. Konsumen dapat menilai enak atau tidaknya suatu produk melalui aroma.[21] Semakin banyaknya tepung bonggol pisang kepok yang disubstitusikan pada formula *cookies* F4, maka semakin tercium aroma khas tepung bonggol pisang kepok. Terdapat penelitian lain yang menyatakan hal serupa, yaitu penelitian yang dilakukan oleh Saputra *et al* menyatakan aroma *cookies* tepung bonggol pisang kepok memiliki aroma yang khas dari tepung bonggol pisang kepok.[22]

*Rasa*

Salah satu faktor penentu cita rasa makanan adalah rasa. Rasa menjadi faktor

penting dalam pengambilan keputusan akhir, apakah suatu produk dapat diterima, sekalipun warna, aroma, tekstur baik namun jika rasa produk tidak enak, konsumen tidak menyukai produk tersebut.[22] Penyebab formula *cookies* F4 dengan substitusi tepung bonggol pisang kepok sebesar 100 persen tidak disukai panelis adalah rasa sepat dari tepung bonggol pisang kepok. Rasa sepat atau ketir pada bonggol pisang disebakan karena pada getah bonggol pisang mengandung saponin dan tanin.[21] Sejalan dengan penelitian Rizki yang menunjukkan penambahan tepung bonggol pisang yang semakin banyak maka rasa pahit atau sepat pada *cookies* akan terasa.[19]

*Tekstur*

Tekstur merupakan nilai raba pada suatu permukaan produk, apakah kasar, halus, lembut dan keras. Tekstur mempengaruhi penampilan suatu produk.[21] Tekstur formula *cookies* F4 dengan substitusi tepung bonggol pisang kepok sebesar 100 persen memiliki tekstur yang mudah hancur. Sejalan dengan penelitian Saputra *et al* yang menunjukkan bahwa tekstur *cookies* tepung bonggol pisang memiliki tekstur yang rapuh atau mudah hancur.[21] Menurut Saragih, penyebab tekstur yang mudah hancur ialah kadar air pada tepung bonggol pisang kepok hanya sebesar 0,99 persen, karena kurangnya cairan didalam tepung tersebut yang menyebabkan adonan sulit untuk dibentuk dan mudah hancur.[23]

**Penentuan Formula Terpilih**

Formula terpilih ditentukan dengan menggunakan Metode Perbandingan Eksponensial (MPE). Parameter yang dipertimbangkan adalah hasil serat pangan, aktivitas antioksidan dan uji hedonik produk. Penentuan bobot *cookies* sebagai berikut : kadar serat pangan (40%), aktivitas antioksidan (40%), dan masing-masing dari parameter sifat organoleptik (5%). Rangking 1 (satu) diberikan pada formula dengan total skor terkecil. Takaran saji yang disarankan dalam penelitian ini sebesar 40 gram sehingga kadar serat pangan *cookies* penelitian ini telah memenuhi 10 persen dari kebutuhan, yang dimana pada formula terpilih (F4) mengandung energi 182,22 kkal, protein 2,44 gram, lemak 8,58 gram, karbohidrat 23,82 gram, serat pangan 11,72 gram, dan aktivitas antioksidan sebesar 17.014,4 ppm.

## SIMPULAN DAN SARAN

### Simpulan

Substitusi tepung bonggol pisang berpengaruh terhadap kenaikan kadar serat pangan, tetapi tidak pada aktivitas antioksidan. Peningkatan substitusi tepung bonggol pisang kepok berbanding lurus dengan peningkatan kadar serat pangan dan aktivitas antioksidan. Substitusi tepung bonggol pisang berpengaruh terhadap tingkat kesukaan panelis terhadap aroma, rasa, dan tekstur, namun tidak berpengaruh terhadap tingkat kesukaan panelis terhadap warna *cookies*. Formula terpilih ditentukan dengan uji ranking terhadap parameter kadar serat pangan, aktivitas antioksidan, serat hasil uji organoleptik.

### Saran

Penelitian selanjutnya perlu dilakukannya analisis mengenai nilai indeks glikemik serta melakukan intervensi mengenai efektivitas produk pada penderita obesitas.

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# PENGARUH PEMBERIAN MINUMAN KELOJA TERHADAP BERAT BADAN, PERSEN LEMAK TUBUH, DAN MASSA OTOT PADA LANSIA GIZI KURANG DI PANTI WERDHA 2 CENGKARENG JAKARTA BARAT

*The Effect of Providing Keloja Drink on Body Weight, Body Fat Percentage, and Muscle Mass in Undernourished Elderly at Panti Werdha 2 Cengkareng West Jakarta*

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**ABSTRACT**

**Elderly individuals with malnutrition are at risk of experiencing sarcopenia. One of the preventive measures is through the provision of Oral Nutritional Supplements (ONS). Keloja drink is one form of modified ONS. This study aims to assess the provision of Keloja drink on body weight, body fat percentage, and muscle mass in malnourished elderly individuals. Materials and Methods: The study was conducted at Panti Werdha 2, Cengkareng, West Jakarta, using a pre-experimental research design, specifically a one-group pre-test-post-test design. The subjects were all independently living malnourished elderly individuals totaling 13 elderly. Data on body weight, body fat percentage, and muscle mass were obtained using a Tanita scale, data on energy intake and nutrients were obtained using a 24-hour food recall form, data on Keloja drink consumption were obtained using observation sheets, and subject characteristics were obtained using a questionnaire. Results: The effect of Keloja drink provision on body weight, body fat percentage, muscle mass, and carbohydrate intake were analyzed using the Wilcoxon test, while the effect of Keloja drink provision on energy intake and other macronutrient nutrients was analyzed using the paired sample t-test. Provision of Keloja drink increased body weight (0.6 kg, p=0.182), body fat percentage (0.7%, p=0.423), but not muscle mass. Similarly, there was an increase in energy intake (10.6 kcal, p=0.923) and carbohydrates (19.6 g, p=0.507), but not protein and fat intake. The provision of Keloja drink did not significantly affect body weight, body fat percentage, and muscle mass (p>0.05).**

**Keywords: body weight, body fat percentage, muscle mass**

**ABSTRAK**

**Lansia gizi kurang berisiko mengalami sarkopenia. Salah satu upaya pencegahannya ialah dengan pemberian *Oral Nutritional Supplements* (ONS). Minuman Keloja merupakan salah satu bentuk modifikasi ONS. Tujuan penelitian ini untuk menilai pemberian minuman Keloja terhadap berat badan, persen lemak tubuh, dan massa otot pada lansia gizi kurang. Penelitian dilakukan di Panti Werdha 2, Cengkareng, Jakarta Barat. Desain penelitian pre-eksperiment yakni *one-group pre test-post test*. Subjek merupakan seluruh lansia mandiri berstatus gizi kurang yang berjumlah 13 lansia. Data berat badan, persen lemak tubuh, dan massa otot diperoleh dengan timbangan Tanita, data asupan energi dan zat gizi diperoleh dengan formulir *food recall* 1x24 jam, data konsumsi minuman Keloja diperoleh dengan lembar observasi, dan karakteristik subjek dengan lembar kuesioner. Efek pemberian minuman Keloja terhadap berat badan, persen lemak tubuh, massa otot, dan asupan karbohidrat dianalisis menggunakan *Wilcoxon test*, sedangkan efek pemberian minuman Keloja terhadap asupan energi dan zat gizi makro lainnya dianalisis menggunakan *paired sample t-test*. Pemberian minuman Keloja meningkatkan berat badan (0,6 kg, p=0,182), persen lemak tubuh (0,7%, p=0,423), tetapi tidak dengan massa otot. Demikian pula terdapat peningkatan asupan energi (10,6 kkal, p=0,923) dan karbohidrat (19,6 g, p=0,507), tetapi tidak dengan asupan protein dan lemak. Pemberian minuman Keloja tidak nyata memengaruhi berat badan, persen lemak tubuh, dan massa otot (p>0,05).**

**Kata kunci: berat badan, persen lemak tubuh, masa otot**

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## PENDAHULUAN

Lanjut usia (Lansia) merupakan tahap perkembangan terakhir dalam siklus kehidupan dan termasuk golongan yang rentan. Berdasarkan Peraturan Presiden Republik Indonesia Nomor 88 Tahun 2021 bahwa lanjut usia merupakan seseorang yang berusia 60 tahun ke atas.[1] Berdasarkan data Badan Pusat Statistik terjadi peningkatan jumlah penduduk lansia di Indonesia, tahun 2020 persentase lansia sebesar 9,92 persen atau sekitar 26,82 juta orang, sedangkan tahun 2021 sebesar 10,82 persen atau sekitar 29,3 juta orang.[2,3] Peningkatan pada periode ini dapat berdampak positif, apabila lansia memiliki kualitas hidup yang baik yakni sehat, mandiri, aktif, dan produktif.

Masalah gizi pada lansia dapat berupa gizi kurang. Berdasarkan hasil Riset Kesehatan Dasar (Riskesdas) tahun 2013 bahwa prevalensi status gizi kurang pada kelompok dewasa (>18 tahun) menurut Indeks Massa Tubuh (IMT) di Indonesia sebesar 8,2 persen, sedangkan di tahun 2018 prevalensi meningkat menjadi sebesar 9,3 persen gizi kurang.[2,3] Prevalensi status gizi kurang tahun 2018 di provinsi DKI Jakarta sebesar 7,9 persen, sedangkan prevalensi di Jakarta Barat sebesar 9,3 persen gizi kurang.[4] Sementara itu, pada penelitian Vandewoude dkk (2019) di Belgia, Eropa Barat menunjukkan prevalensi lansia gizi kurang di panti jompo sebesar 63 persen, sedangkan di komunitas sebesar 36 persen ($p<0,001$).[5]

Masalah gizi kurang pada lansia dipengaruhi oleh perubahan anatomi dan fisiologi, yaitu adanya penurunan fungsi saluran pencernaan, penurunan fungsi sensorik terutama penciuman dan perasa, gangguan respon hormon, serta terkait dengan kesehatan gigi dan mulut.[6,7] Faktor-faktor tersebut dapat menyebabkan asupan makan berkurang sehingga meningkatkan risiko status gizi kurang pada lansia. Salah satu tanda status gizi kurang ialah penurunan berat badan, serta juga memperlihatkan massa lemak dan otot yang lebih rendah.[8] Selain itu komposisi tubuh mengalami perubahan seiring bertambahnya usia, dimana lemak tubuh meningkat dan massa otot menurun 0,5-1,0 persen per tahun.[9] Hal ini dapat meningkatkan risiko sarkopenia, kondisi yang ditandai dengan penurunan massa, kekuatan, dan fungsi otot.[10] Maka dari itu perlu optimalisasi asupan makanan untuk lansia, salah satunya dengan pemberian *Oral Nutritional Supplements* (ONS).

Kelebihan ONS, yaitu mengandung zat gizi makro (protein dan/atau energi) dan zat gizi mikro (vitamin dan mineral), serta mudah dalam konsumsinya.[11] Hasil penelitian Yeung dkk (2022) menunjukkan bahwa pemberian ONS sebanyak 2 porsi per hari (69 g bubuk per porsi) selama 12 minggu dapat meningkatkan berat badan sebesar 1,8 kg ($p<0,001$).[12] Selain berat badan, ditemukan pula peningkatan lingkar lengan atas sebesar 0,75 cm ($p<0,001$) dan lingkar betis sebesar 0,36 cm ($p=0,003$) sebagai penanda terjadi peningkatan massa otot. Penelitian Cramer dkk (2016) juga menunjukkan bahwa pemberian ONS 2 porsi per hari (220 ml per porsi) selama 12 minggu dapat meningkatkan berat badan sebesar 1,2 kg dan massa lemak tubuh sebesar 1,1 kg ($p<0,0001$).[13] Selanjutnya meta analisis yang dilakukan oleh Sanz-Paris dkk (2018) memperlihatkan hasil peningkatan rata-rata massa otot sebesar 0,352 kg sesudah pemberian ONS selama 12 minggu ($p=0,004$).[14]

ONS dapat dimodifikasi dalam berbagai bentuk, salah satunya dalam bentuk minuman Keloja. Minuman Keloja berbahan dasar daun kelor, kacang tolo, dan jagung. Daun kelor mengandung berbagai macam asam amino, dimana hal ini jarang terdapat pada sayuran. Selain asam amino, daun kelor juga mengandung antioksidan.[15] Sementara kacang tolo memiliki daya cerna protein dan pati yang tinggi. Kacang tolo dan jagung akan saling melengkapi dari sisi kandungan asam aminonya. Kacang-kacangan mengandung asam amino lisin dan leusin yang tinggi, tetapi rendah metionin.[16] Kombinasi dengan serealia berupa jagung dapat meningkatkan kandungan asam amino metionin.[17] Kandungan asam amino dalam bahan dasar tersebut berfungsi sebagai stimulator sintesis protein otot.

Pada penelitian Ngadiarti dkk (2018) telah dibuktikan bahwa dengan pemberian minuman Keloja sebanyak 250 ml per hari selama 1 bulan dapat meningkatkan status gizi anak usia 24-59 bulan, asupan energi, protein, lemak, karbohidrat, dan seng (Zn).[18] Selanjutnya Ngadiarti dan Muntikah (2021) melakukan modifikasi terhadap minuman Keloja dengan penambahan *whey* protein sesuai kebutuhan

lansia. Penelitian ini baru sampai pada tahap uji organoleptik dan analisis zat gizi. Kandungan zat gizi per sajian (30 g) berdasarkan hasil analisis, yaitu energi 120 kkal, protein 4,12 g, lemak 1,12 g, karbohidrat 23,25 g dan serat 3,49 g.[19] Tujuan penambahan *whey* protein ialah untuk meningkatkan asupan protein yang diharapkan dapat diaplikasikan pada lansia untuk meningkatkan berat badan, persen lemak tubuh, dan massa otot. Oleh karena itu, perlu dilakukan penelitian lanjutan mengenai pemberian minuman Keloja pada lansia gizi kurang, khususnya bagi lansia di panti jompo guna melihat perubahan berat badan, persen lemak tubuh, dan massa otot.

## METODE PENELITIAN

Penelitian ini merupakan penelitian pre-eksperiment dengan pendekatan *one-group pre test-post test* yang dilakukan pada bulan Juli sampai Agustus 2022 di Panti Werdha 2, Cengkareng, Jakarta Barat. Penelitian ini ialah bagian penelitian yang telah dilakukan oleh dosen jurusan Gizi dan Dietetika, yaitu Ibu Iskari Ngadiarti dan Ibu Muntikah. Bubuk minuman Keloja merupakan produk yang sudah dikembangkan dan disiapkan oleh Ngadiarti dan Muntikah (2021).[19]

Populasi penelitian ini adalah seluruh lansia mandiri yang memiliki status gizi kurang di Panti Werdha 2. Pengambilan sampel menggunakan teknik sampling jenuh. Menurut Sugiyono (2019) sampling jenuh adalah teknik pemilihan sampel apabila semua anggota populasi dijadikan sampel.20 Sampel dalam penelitian ini menggunakan seluruh jumlah populasi untuk digunakan sebagai responden sebanyak 13 lansia mandiri yang berstatus gizi kurang.

Sesuai dengan hasil dari penelitian sebelumnya, langkah-langkah pembuatan minuman Keloja berbahan dasar dari daun kelor, kacang tolo, dan jagung adalah sebagai berikut:[19]

### Alat dan Bahan

Alat yang digunakan dalam pembuatan minuman Keloja, yaitu *food processor*, baskom plastik, gelas ukur, pisau, kain kasa, panci, saringan stainless steel, timbangan digital, wajan, spatula, talenan, dandang, dan kompor. Bahan yang digunakan meliputi jagung manis (warna kuning dan sudah masak), kacang tolo, daun kelor (segar dan berwarna hijau tua), gula pasir, susu bubuk komersial, bubuk *whey* protein, jahe, kayu manis, dan air mineral.

### Prosedur Pembuatan Minuman Keloja

*Pembuatan Cairan Kacang Tolo*

Timbang sebanyak 75 g kacang tolo selama 24 jam. Setelah direndam, cuci bersih dan tiriskan kacang tolo, lalu rebus dengan api sedang hingga air menyusut atau habis. Setelah itu timbang kacang tolo dan hitung faktor konversi perubahan berat mentah ke matang. Selanjutnya giling kacang tolo yang sudah direbus dengan penambahan air matang (1:2) sebanyak 300 ml hingga halus, lalu saring dan ukur volume dengan gelas ukur.

*Pembuatan Cairan Jagung*

Sisir jagung manis hingga mendapat 75 g jagung pipil dan kukus jagung selama 10 menit. Kemudian giling jagung yang telah dikukus dengan perbandingan jagung dan air matang (1:2) sebanyak 200 ml hingga halus, lalu saring dan gabungkan dengan cairan kacang tolo. Setelah itu, ukur volume cairan keduanya.

*Pembuatan Cairan Daun Kelor*

Timbang daun kelor sebanyak 5 persen dari total volume minuman. Selanjutnya blancing daun kelor pada suhu 87°C selama 2 menit. Setelah itu, angkat, tiriskan, dan rendam pada air es selama 5 menit. Tiriskan hingga air habis dan press hingga air keluar. Kemudian giling daun kelor menggunakan 200 ml cairan, lalu saring dan gabungkan dengan campuran cairan kacang tolo dan jagung. Terakhir, ukur volume campuran tersebut dan sesuaikan cairan hingga mendapatkan volume cairan seperti semula (1000 ml).

*Pembuatan Minuman Keloja*

Panaskan cairan tersebut dan tambahkan 10 persen gula, 2,5 persen susu bubuk komersial, 0,2 persen bubuk *whey* protein, dan 3 persen bubuk jahe atau 0,75 persen kayu manis. Aduk hingga larut dan panaskan hingga mencapai suhu 70°C. Masukan formula yang sudah jadi ke dalam mesin *drum dryer* sampai keluar lembaran. Timbang formula bubuk yang sudah jadi, lalu dibuat konversi dari cair menjadi bubuk. Kemudian kalikan persen konversi dengan volume cairan per sajian (200 ml). Terakhir sajikan bubuk formula dengan 200 ml air hangat.

Intervensi berupa pemberian minuman Keloja dilakukan selama 4 minggu (30 hari). Lama Pemberian selama 4 minggu mengacu pada penelitian Ngadiarti dkk (2018).18 Minuman tersebut diberikan dalam bentuk bubuk dan disajikan dalam bentuk cair. Cara penyajian minuman Keloja merujuk pada penelitian Ngadiarti dan Muntikah (2021). Penelitian tersebut menjelaskan bahwa cara penyajian produk minuman Keloja ialah dengan melarutkan 30 g bubuk Keloja dalam 200 ml air hangat.19 Peneliti dibantu oleh enumerator dan perawat panti untuk melaksanakan intervensi. Enumerator sebanyak 4 orang dipilih dari lulusan tahun 2021, Diploma Gizi, Politeknik Kesehatan Kemenkes Jakarta II.

Alur pemberian minuman Keloja diawali dengan peneliti mengajukan perizinan dan koordinasi kepada pihak panti. Sebelum melakukan pengambilan data, peneliti melakukan skrinning awal untuk mengetahui status gizi lansia berdasarkan indeks massa tubuh (IMT). Setelah itu, peneliti memberikan penjelasan tujuan dan ruang lingkup penelitian, cara melakukan intervensi, pengisian kuesioner, pengawasan dan pelaksanaan intervensi, dan teknik wawancara kepada para perawat panti dan enumerator.

Cara penyajian atau menyeduh bubuk Keloja didemonstrasikan kepada perawat panti sebelum bubuk tersebut diberikan. Peneliti melakukan demonstrasi bersamaan dengan pengambilan data awal yang meliputi penimbangan berat badan, pengukuran persen lemak tubuh dan massa otot, dan wawancara asupan makan. Setiap responden mendapat 2 saset per hari. Penyeduhan bubuk Keloja dan pemantauan konsumsi minuman Keloja dilakukanoleh perawat panti. Peneliti dan enumerator melakukan kunjungan 2 minggu sekali kepada lansia sasaran. Kegiatan kunjungan yang dilakukan, yaitu wawancara asupan makan dengan metode *food recall* 1x24 jam, penimbangan berat badan, pengukuran persen lemak tubuh dan massa otot, serta pemberian minuman Keloja kepada perawat panti.

Data yang diambil dalam penelitian ini adalah informasi tentang karakteristik (jenis kelamin, usia, dan indeks massa tubuh (IMT)) subjek diperoleh dengan lembar kuesioner. Untuk IMT dilakukan penimbangan berat badan dan pengukuran tinggi lutut kepada lansia. Hasil pengukuran tinggi lutut dikonversi menjadi tinggi badan terlebih dahulu. IMT dikategorikan dalam 2 kategori, yaitu kurus (<17,0) dan sangat kurus (17,0 – < 18,5) yang mengacu pada Permenkes No. 41 tahun 2014.[21] Data berat badan, persen lemak tubuh, dan massa otot diperoleh dengan timbangan Tanita BC-601. Data asupan energi dan zat gizi diperoleh dengan form food recall 1x24 jam dengan berpedoman pada kandungan zat gizi yang terdapat dalam Panganku dan buku TKPI (Tabel Komposisi Pangan Indonesia) tahun 2017.[22] Data konsumsi minuman Keloja diperoleh dengan lembar observasi dikategorikan dalam 3 kategori berdasarkan jumlah konsumsi minuman Keloja, yaitu tidak diminum, kurang (< 2 sachet/hari), dan cukup (2 sachet/hari).

Pengolahan data dilakukan dengan editing, coding, entry data, dan cleaning. Data diolah dengan menggunakan program analisis data SPSS ver 24, yang didalamnya meliputi analisis univariat dan bivariat. Efek pemberian minuman Keloja terhadap berat badan, persen lemak tubuh, massa otot, dan asupan karbohidrat dianalisis menggunakan wilcoxon test, sedangkan efek pemberian minuman Keloja terhadap asupan energi dan zat gizi makro lainnya dianalisis menggunakan paired sample t-test. Penelitian ini telah memperoleh infomed consent dari responden dan telah lulus etik oleh Komisi Etik Penelitian Kesehatan (KEPK) dengan sertifikat etik nomor LB.02.01/I/KE/31/224/2021.

## HASIL

### Karakteristik Lansia

Berdasarkan data yang terkumpul, diperoleh data karakteristik responden meliputi jenis kelamin, usia, dan indeks massa tubuh. Data yang menggambarkan karakteristik responden dapat dilihat pada Tabel 1.

Berdasarkan Tabel 1, dari 13 responden sebagian besar responden berjenis kelamin laki-laki sebanyak 9 orang (69,2%). Pada penelitian ini responden paling banyak berusia >70 tahun sebanyak 9 orang (69,2%) dengan paling banyak memiliki status gizi sangat kurus sebanyak 7 orang (53,8%).

**Konsumsi Minuman Keloja, Asupan Energi dan Zat Gizi Makro**

Konsumsi minuman Keloja diberikan 2 saset per hari dengan kandungan energi 240 kkal, protein 8,24 g, lemak 2,24 g, dan karbohidrat 46,5 g. Berikut disajikan hasil mengenai distribusi lansia konsumsi minuman Keloja.

Berdasarkan Tabel 2, dari 13 responden yang mengonsumsi minuman Keloja sebagian besar responden termasuk dalam kategori kurang sebanyak 7 orang (53,8%) dan responden lainnya termasuk dalam kategori cukup.

Pada Tabel 3 terlihat rata-rata asupan energi Keloja yang dikonsumsi sebanyak 231,1 kkal, protein 7,9 g, lemak 2,2 g, dan karbohidrat 44,8 g.

Berdasarkan Tabel 4 dapat diketahui bahwa secara aktual rata-rata asupan energi dan karbohidrat terjadi peningkatan, yaitu berturut-turut sejumlah 10,6 kkal dan 19,6 g. Sementara rata-rata asupan protein dan lemak terjadi penurunan, yaitu berturut-turut sejumlah 1,9 g dan 5,8 g. Namun, secara statistik tidak terdapat perbedaan yang nyata pada rata-rata asupan energi dan zat gizi makro.

Tabel 1
Distribusi Frekuensi Karakteristik Lansia

| Karakteristik | n=13 | % |
|---|---|---|
| Jenis Kelamin | | |
| Laki-laki | 9 | 69,2 |
| Perempuan | 4 | 30,8 |
| Usia | | |
| 60-69 tahun | 4 | 30,8 |
| > 70 tahun | 9 | 69,2 |
| Indeks Massa Tubuh (IMT) | | |
| Kurus | 6 | 46,2 |
| Sangat kurus | 7 | 53,8 |

Tabel 2
Distribusi Lansia Konsumsi Minuman Keloja

| Konsumsi Minuman Keloja | n=13 | % |
|---|---|---|
| Kurang | 7 | 53,8 |
| Cukup | 6 | 46,2 |

Tabel 3
Distribusi Asupan Energi dan Zat Gizi Keloja pada Lansia

| Asupan Keloja | Min-Max | Rata-rata ± SD |
|---|---|---|
| Energi (kkal) | 204,0-240,0 | 231,1±11,7 |
| Protein (g) | 7,0-8,2 | 7,9±0,4 |
| Lemak (g) | 1,9-2,2 | 2,2±0,1 |
| Karbohidrat (g) | 39,5-46,5 | 44,8±2,3 |

Tabel 4
Perbedaan Asupan Energi dan Zat Gizi Sehari Lansia Sebelum dan Sesudah Intervensi

| Asupan Zat Gizi | Min | Max | Rata-rata ± SD | Δ rata-rata | *p* |
|---|---|---|---|---|---|
| Energi (kkal) | | | | | |
| Sebelum | 1081,0 | 2011,2 | 1639,3 ± 333,3 | 10,6 | 0,923[a] |
| Sesudah | 1323,2 | 1930,4 | 1649,9 ± 215,8 | | |
| Protein (g) | | | | | |
| Sebelum | 31,3 | 54,0 | 45,8 ± 6,8 | 1,9 | 0,527[a] |
| Sesudah | 27,6 | 52,5 | 43,9 ± 8,0 | | |
| Lemak (g) | | | | | |
| Sebelum | 28,3 | 62,7 | 49,0 ± 10,1 | 5,8 | 0,178[a] |
| Sesudah | 28,4 | 58,2 | 43,2 ± 8,0 | | |
| Karbohidrat (g) | | | | | |
| Sebelum | 159,9 | 372,7 | 274,2 ± 80,9 | 19,6 | 0,507[b] |
| Sesudah | 225,1 | 337,9 | 293,8 ± 43,1 | | |

[a]*Paired t-test*; [b]*Wilcoxon test*

Tabel 5

Perbedaan Berat Badan Lansia Sebelum dan Sesudah Intervensi

| Berat Badan (kg) | Min | Max | Rata-rata±SD | Δ rata-rata | *p*[b] |
|---|---|---|---|---|---|
| Sebelum | 32,7 | 48,1 | 39,2±5,2 | 0,6 | 0,182 |
| Sesudah | 32,8 | 49,6 | 39,9±6,4 | | |

[b]*Wilcoxon test*

Tabel 6

Perbedaan Persen Lemak Tubuh Lansia Sebelum dan Sesudah Intervensi

| Persen Lemak Tubuh (%) | Min | Max | Rata-rata ± SD | Δ rata-rata | *p*[b] |
|---|---|---|---|---|---|
| Sebelum | 10,4 | 27,0 | 18,9 ± 5,2 | 0,7 | 0,423 |
| Sesudah | 10,1 | 27,0 | 19,6 ± 5,0 | | |

[b]*Wilcoxon test*

**Berat Badan, Persen Lemak Tubuh, dan Massa Otot**

Setelah disajikan hasil dan pembahasan mengenai perbedaan asupan energi dan zat gizi makro, selanjutnya disajikan hasil mengenai perbedaan berat badan sebelum dan sesudah pemberian minuman Keloja. Pada Tabel 5 disajikan perbedaan berat badan sebelum dan sesudah diberikan minuman Keloja.

Berdasarkan Tabel 5, secara aktual rata-rata berat badan lansia terjadi peningkatan sebesar 0,6 kg dilihat dari rata-rata sebelum pemberian minuman Keloja sebesar 39,2 kg menjadi 39,9 kg. Namun, secara statistik tidak terdapat perbedaan rata-rata berat badan yang nyata sesudah pemberian minuman Keloja.

Berdasarkan Tabel 6, secara aktual terdapat peningkatan rata-rata persen lemak tubuh sebesar 0,7 persen dapat dilihat dari rata-rata sebelum pemberian minuman Keloja sebesar 18,9 persen menjadi 19,6 persen. Walaupun secara statistik tidak terdapat perbedaan rata-rata persen lemak tubuh yang nyata sesudah pemberian minuman Keloja.

Berdasarkan Tabel 7, secara aktual terjadi penurunan rata-rata massa otot sebesar 0,1 persen dapat dilihat dari rata-rata sebelum pemberian minuman Keloja sebesar 31,4 persen menjadi 31,3 persen. Secara statistik pun tidak terdapat perbedaan rata-rata massa otot yang nyata sesudah pemberian minuman Keloja

Tabel 7

Perbedaan Massa Otot Lansia Sebelum dan Sesudah Intervensi

| Massa Otot (%) | Min | Max | Rata-rata±SD | Δ rata-rata | *p*[b] |
|---|---|---|---|---|---|
| Sebelum | 28,0 | 35,5 | 31,4±2,6 | 0,1 | 0,754 |
| Sesudah | 27,0 | 37,2 | 31,3±3,2 | | |

[b]*Wilcoxon test*

## BAHASAN

### Karakterikstik Lansia

Hasil penelitian ini sesuai dengan hasil Riskesdas tahun 2018 di Jakarta Barat, dimana prevalensi status gizi kurang pada laki-laki sebesar 10,6 persen, sedangkan perempuan sebesar 7,9 persen.[4] Berbeda dengan penelitian Crichton dkk (2019) yang menyatakan bahwa lansia berjenis kelamin perempuan memiliki kemungkinan 45 persen lebih tinggi berisiko gizi kurang dibandingkan dengan laki-laki.[23] Hal yang diduga sebagai penyebab adanya masalah kesehatan gigi pada lansia berjenis kelamin laki-laki berdasarkan pengamatan peneliti saat melakukan wawancara.

Hasil penelitian ini juga selaras dengan penelitian Hua dkk (2022) yang dilakukan pada 125 responden dari 17 panti jompo, dimana responden gizi kurang paling banyak berusia >70 tahun sebanyak 113 orang (90,4%), sedangkan responden yang berusia 60-69 tahun sebanyak 12 orang (9,6%).[24] Seiring bertambahnya usia terjadi perubahan fisiologis seperti penurunan fungsi indra perasa dan penciuman, serta pengosongan lambung yang tertunda. Perubahan fisiologis tersebut menyebabkan penurunan nafsu makan dan peningkatan rasa cepat kenyang yang berakibat pada asupan makan tidak tercukupi sehingga meningkatkan risiko gizi kurang.[25]

### Konsumsi Minuman Keloja

Berdasarkan Tabel 7, sebagian besar responden termasuk dalam kategori kurang sebanyak 7 orang (53,8%). Hal tersebut dapat dikarenakan metode pemberian Keloja yang tanpa paksaan. Selain itu, saat penelitian dilakukan beberapa lansia ada yang mengalami pusing dan gangguan pencernaan seperti sakit perut dan diare sehingga konsumsi minuman Keloja dihentikan sementara.

Kandungan laktosa pada susu dalam minuman Keloja diduga menjadi penyebab terjadinya diare. Hal tersebut mungkin terjadi karena lansia mengalami intoleransi laktosa. Laktosa tidak dapat dipecah menjadi bentuk yang dapat diserap tubuh yang mengakibatkan meningkatnya tekanan osmotik pada lumen usus, sehingga menyebabkan diare.[26] Selain susu, osmolaritas pada makanan cair yang tinggi juga dapat menarik cairan ke dalam lumen usus dan menyebabkan diare.[27] Bersamaan dengan kedua hal tersebut, selama proses penuaan adanya penurunan fungsi fisiologi pada sistem saluran cerna dan kekebalan tubuh sehingga dapat meningkatkan risiko infeksi dan kejadian sakit. Cristina dan d'Alba (2021) menyatakan bahwa frekuensi infeksi oleh bakteri di saluran pencernaan pada lansia lebih tinggi dibandingkan yang usianya lebih muda.[28]

Rata-rata responden dapat menghabiskan minuman Keloja <2 saset per hari karena dalam 2 saset minuman Keloja mengandung energi 240 kkal, protein 8,2 g, lemak 2,24 g, dan karbohidrat 46,5 g. Maka rata-rata responden mendapat ±96,3 persen kandungan zat gizi dari minuman Keloja.

### Asupan Energi dan Zat Gizi Makro

Adanya peningkatan asupan energi dan karbohidrat aktual dapat dikarenakan kontribusi minuman Keloja. Apabila lansia mengonsumsi 2 saset per hari maka dapat mensuplai energi sebanyak 240 kkal dan karbohidrat 46,5 g. Faktor-faktor yang mempengaruhi asupan ONS menurut Lester dkk (2021), yaitu keterlibatan staff kesehatan, jenis ONS, dan sifat sensori seperti kekentalan, rasa, dan aroma.[29] Sama halnya dengan penelitian ini, yaitu saat pemberian minuman Keloja melibatkan perawat panti. Selain adanya keterlibatan perawat panti, minuman Keloja dalam sehari disajikan dengan 2 varian rasa, yaitu rasa jahe dan kayu manis

untuk meningkatkan selera konsumsi lansia terhadap minuman Keloja.

Penurunan asupan lemak dan protein aktual diperkirakan karena makanan yang dikonsumsi sebelum pemberian minuman Keloja diolah menggunakan santan (sayur lodeh dan abon sapi). Kemudian teknik pengolahan sayuran untuk satu kali makan utama dengan cara ditumis, juga adanya konsumsi kerupuk udang. Sementara jika dibandingkan dengan makanan yang dikonsumsi sesudah pemberian minuman keloja, teknik pengolahan sayuran untuk satu kali makan utama direbus dan tidak adanya penggunaan santan, serta konsumsi kerupuk udang. Hal tersebut yang mungkin menjadi penyebab asupan lemak dan protein sebelum pemberian Keloja lebih tinggi dibandingkan sesudahnya.

Namun, tidak terdapat perbedaan yang nyata secara statistik pada rata-rata asupan energi dan zat gizi makro (p>0,05). Hal tersebut dapat dikarenakan lama waktu pemberian minuman Keloja hanya 4 minggu. Hasil penelitian Xie dkk (2022) membuktikan adanya peningkatan yang nyata pada asupan energi, protein, dan karbohidrat sesudah pemberian ONS selama 12 minggu (p<0,01).[30] Meta analisis yang dilakukan oleh Li dkk (2021) juga membuktikan adanya peningkatan yang nyata pada asupan energi (p<0,001), protein (p=0,007), dan lemak (p<0,001) sesudah pemberian ONS selama 12 minggu.[31]

**Berat Badan**

Kenaikan berat badan aktual dapat disebabkan adanya peningkatan asupan energi, dimana pada Tabel 9 terlihat adanya peningkatan energi sejumlah 10,6 kkal. Selaras dengan penelitian Hall dkk (2019) menyatakan bahwa terdapat korelasi positif antara asupan energi dengan perubahan berat badan (r=0,8, p<0,0001).[32]

Zat gizi yang berfungsi sebagai sumber energi bagi tubuh, yaitu karbohidrat, protein, dan lemak. Apabila asupan energi kurang dari kebutuhan, tubuh akan menggunakan cadangan energi berupa glikogen dan lemak. Bila terjadi kekurangan energi berlangsung lama dan cadangan energi tidak mencukupi, maka protein yang digunakan sebagai sumber energi untuk menjalankan fungsi-fungsi vital dalam tubuh.

Minuman Keloja menjadi salah satu yang ikut mensuplai asupan energi. Rata-rata konsumsi minuman Keloja pada lansia sebanyak 231,1 kkal dapat dilihat pada Tabel 8 sehingga seharusnya dapat meningkatkan rata-rata berat badan sebesar 0,96 kg. Akan tetapi kenaikan rata-rata berat badan yang diperoleh sebesar 0,6 kg sehingga minuman Keloja hanya mensuplai energi sebanyak ±144 kkal/hari. Hal tersebut dapat disebabkan metode pemberian minuman Keloja yang tanpa paksaan dan terdapat lansia yang sakit selama penelitian dilakukan.

Namun, secara statistik tidak terdapat perbedaan berat badan yang nyata sesudah pemberian minuman Keloja. Hasil penelitian ini memiliki kesamaan dengan hasil penelitian Hébuterne dkk (2020), yaitu terdapat peningkatan rata-rata berat badan yang tidak nyata sebesar 0,6 kg sesudah pemberian ONS selama 4 minggu (p>0,05).[33] Hal tersebut dapat terjadi karena lama waktu pemberian minuman Keloja hanya 4 minggu. Hasil penelitian Malafarina dkk (2021) membuktikan ada peningkatan rata-rata berat badan yang nyata sebesar 2,6 kg sesudah pemberian ONS selama 12 minggu (p<0,01).[34]

**Persen Lemak Tubuh**

Persen lemak tubuh aktual yang meningkat mungkin terjadi karena asupan energi meningkat. Muhammad dkk (2021) sependapat dengan hal tersebut, dimana asupan energi secara nyata berkorelasi dengan perubahan persen lemak tubuh (p=0,030).[35] Sumber lemak dalam tubuh dapat pula berasal dari karbohidrat. Kelebihan glukosa akibat proses katabolisme disimpan dalam bentuk polimer kompleks yang kemudian diubah menjadi lemak (trigliserida) di sel adiposa (adiposit).[36]

Sehubungan dengan bertambahnya usia terdapat perubahan hormonal yang mungkin juga memengaruhi persen lemak tubuh. Menurut penelitian Pataky dkk (2021) menyatakan bahwa penurunan produksi hormon testosteron dapat meningkatkan lemak subkutan dan viseral. Perubahan hormonal lain seperti penurunan produksi hormon DHEA (*dehydroepiandrosterone*) berakibat pada peningkatan massa lemak tubuh dan penurunan sekresi hormon pertumbuhan (*growth hormon*) berpengaruh pada peningkatan jaringan adiposa viseral.[37]

Namun, secara statistik tidak terdapat perbedaan rata-rata persen lemak tubuh yang nyata sesudah pemberian minuman Keloja. Hal tersebut dapat dikarenakan lama waktu pemberian minuman Keloja hanya 4 minggu. Penelitian Han Zhang dkk (2021) memperlihatkan hasil peningkatan rata-rata persen lemak tubuh yang nyata sebesar 0,59% sesudah pemberian ONS selama 12 minggu (p=0,001).[38]

### Massa Otot

Massa otot turun diduga karena turunnya asupan protein sebesar 1,9 g dapat dilihat pada Tabel 9. Jika asupan protein yang dibutuhkan oleh tubuh tidak tercukupi, maka dapat menyebabkan terganggunya laju sintesis protein otot. Karena untuk meningkatkan massa otot diperlukan keseimbangan protein yang positif yakni sintesis protein otot lebih besar daripada pemecahan protein otot.

Selain turunnya asupan protein, penurunan massa otot diasumsikan terjadi karena perubahan hormonal yang terjadi secara progresif seiring bertambahnya usia. Hal tersebut dijelaskan oleh Pataky dkk (2021) bahwa penurunan hormon testosteron dan *growth hormon* berkontribusi dalam penurunan massa otot.[37]

Hal lain yang mungkin menjadi penyebab turunnya massa otot adalah kurangnya aktivitas fisik. Aktivitas fisik juga merupakan salah satu stimulus anabolik yang berfungsi merangsang sintesis protein otot. Hasil penelitian Jesadaporn dkk (2023) membuktikan bahwa terjadi peningkatan massa otot yang nyata sebesar 4,9 persen sesudah pemberian ONS yang dikombinasikan dengan latihan fisik berupa latihan ketahanan selama 12 minggu (p=0,004).[39]

Secara statistik pun tidak terdapat perbedaan rata-rata massa otot yang nyata sesudah pemberian minuman Keloja. Hasil penelitian ini sejalan dengan hasil penelitian Han Zhang dkk (2021) yang memperlihatkan penurunan rata-rata massa otot yang tidak nyata sebesar 0,18 persen sesudah pemberian ONS selama 12 minggu (p=0,07).[38]

Keterbatasan pada penelitian ini adalah jumlah minuman Keloja yang dapat dihabiskan tidak dicatat. Metode penilaian asupan energi dan zat gizi dengan menggunakan *food recall* 1x24 jam memiliki kelemahan tergantung daya ingat responden. Penelitian hanya dilakukan selama 4 minggu serta metode penelitian hanya menggunakan kelompok intervensi, tidak ada kelompok kontrol sebagai pembanding.

## SIMPULAN DAN SARAN

### Simpulan

Sesudah pemberian minuman Keloja sebanyak dua saset/hari secara aktual terdapat peningkatan berat badan dan persen lemak tubuh, tetapi tidak dengan massa otot. Demikian pula, terjadi peningkatan asupan energi dan karbohidrat, tetapi tidak dengan asupan protein dan lemak. Namun, secara statistik untuk semua variabel yang dianalisis tidak terdapat perbedaan sebelum dan sesudah pemberian minuman Keloja.

### Saran

Maka dari itu, perlu adanya penelitian lebih lanjut dengan mengganti komposisi minuman Keloja, yaitu susu dengan susu bebas laktosa dan melakukan uji osmolaritas terhadap formula Keloja terpilih. Selain itu perlu adanya penelitian lebih lanjut dengan mengombinasikan pemberian minuman Keloja dengan latihan fisik meliputi jenis, frekuensi, dan durasi, serta memperpanjang waktu pemberian minuman Keloja agar signifikan meningkatkan berat badan, persen lemak tubuh, dan massa otot.

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# EXPLORING MANAGEMENT ASPECTS OF MULTIPLE MICRONUTRIENT SUPPLEMENTATION PROGRAM FOR PREGNANT WOMEN IN SIDOARJO DISTRICT, EAST JAVA

*Eksplorasi Aspek Manajemen Program Suplementasi Multi Mikronutrien bagi Ibu Hamil di Kabupaten Sidoarjo, Jawa Timur*

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## ABSTRACT

**The most recent guidelines on antenatal care (ANC) issued by the World Health Organization in 2020 emphasize multi-micronutrient supplementation (MMS) to enhance maternal, infant, and child health. However, research exploring management aspects of MMS program implementation is still limited, particularly in Indonesia. This study aims to examine the management of the MMS program among pregnant women in Sidoarjo District. This qualitative research used a phenomenological approach conducted in Sidoarjo District involving 51 informants (stakeholders and beneficiaries) from April to May 2022. MMS tablets (Laduni) were distributed during ANC for free through an existing platform which is similar to the iron tablets distribution. Due to limited supply, the coverage of MMS tablets did not cover all pregnant women in Sidoarjo District. Therefore, they need to purchase the commercial MMS tablets by themselves. Management of the MMS program necessitated collaboration among various stakeholders, including civil society organizations for product supply, universities for quality control, and district health office and public health center for distribution. Monitoring and evaluation of the MMS program were integrated into an existing platform of the iron-folic acid program. Nevertheless, it should be strengthened by a coverage survey, as well as recording and reporting during the ANC.**

**Keywords: management, multiple micronutrient supplementation, pregnant women**

## ABSTRAK

**Pedoman terbaru tentang perawatan antenatal (ANC) yang dikeluarkan oleh Organisasi Kesehatan Dunia (WHO) pada tahun 2020 menekankan suplementasi multi-mikronutrien (MMS) untuk meningkatkan kesehatan ibu, bayi, dan anak. Namun, penelitian yang mengeksplorasi aspek manajemen dari implementasi program MMS masih terbatas, khususnya di Indonesia. Penelitian ini bertujuan untuk melihat manajemen program MMS pada ibu hamil di Kabupaten Sidoarjo. Penelitian kualitatif ini menggunakan pendekatan fenomenologi yang dilakukan di Kabupaten Sidoarjo dengan melibatkan 51 informan pada bulan April hingga Mei 2022. Tablet MMS (Laduni) didistribusikan pada saat ANC secara gratis melalui platform yang sama dengan distribusi tablet tambah darah (TTD). Karena keterbatasan pasokan, cakupan tablet MMS tidak mencakup semua ibu hamil di Kabupaten Sidoarjo. Oleh karena itu, mereka harus membeli tablet MMS komersial secara mandiri. Pengelolaan program MMS melibatkan berbagai pemangku kepentingan seperti organisasi masyarakat sipil untuk penyediaan produk, perguruan tinggi untuk pengawasan kualitas produk, dinas kesehatan kabupaten dan puskesmas untuk pendistribusian produk. Pemantauan dan evaluasi program MMS diintegrasikan ke dalam platform program TTD yang sudah ada. Namun demikian, hal ini perlu diperkuat dengan survei cakupan, serta pencatatan dan pelaporan selama ANC.**

**Kata kunci: ibu hamil, manajemen, suplementasi multi mikronutrien**

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## INTRODUCTION

Maternal and child undernutrition has emerged as a global concern due to its potential to yield both short-term and long-term consequences on various facets of human life across the life cycle. Concurrently, the nutritional status of mothers can significantly influence birth outcomes and contribute to early-life malnutrition, primarily stemming from chronic energy and micronutrient deficiencies in the mother.[1]

Referring to the Global Nutrition Report (GNR) 2020, it was reported that 613.2 million women of reproductive age experienced anaemia, with 35.3 million of them being pregnant women (data from 2016).[2] Furthermore, the global data on child undernutrition in 2020 indicated that 20.5 million newborns (14.6%) had low birth weight, 45.5 million children (6.7%) were wasted, and 149.2 million children (22.0%) were stunted.[3,4]

In Indonesia, maternal and child undernutrition has garnered national attention, with the prevalence of anaemia in pregnant women reaching 48.9 percent in 2018.[5] Furthermore, as of 2021, the prevalence of stunting, wasting, and underweight among children under five years was reported at 24.4 percent, 7.1 percent, and 17.0 percent, respectively.[6]

To address maternal, infant, and child health, the World Health Organization (WHO) has launched their updated recommendations on antenatal care (ANC) services with a special focus on multiple micronutrient supplements during pregnancy. These supplements, comprising 13 or 15 micronutrients, align with the UNIMMAP (United Nations International Multiple Micronutrient Antenatal Preparation) formulation, which encompasses 15 micronutrients.[7] The significance of multiple micronutrient supplementation (MMS) during pregnancy is underscored by its association with a reduction in maternal anemia, preterm birth, small for gestational age (SGA), and low birth weight (LBW).[7] Consequently, the maternal and infant outcomes, particularly in cases of preterm birth, SGA, and LBW, pose a heightened risk for infants to experience wasting, stunting, and underweight during subsequent stages of life.[8]

In low and middle-income countries, micronutrient deficiencies are prevalent, particularly among pregnant women who have increased energy and nutrient requirement, impacting their functioning, growth, and development.[9] Consequently, the adoption of MMS program during pregnancy has been proposed as a cost-effective strategy to yield multiple benefits.[9] A hypothetical replacement of iron-folic acid supplementation (IFAS) with MMS for pregnant women in studies conducted in Bangladesh and Burkina Faso demonstrated the effective prevention of mortality and preterm birth.[10] Similarly, in Vietnam, a study investigating the effectiveness of MMS during pregnancy revealed that regular MMS intake could enhance birthweight and height at 2 years of age compared to IFAS.[11]

In Indonesia, the implementation of MMS program has been initiated in a pilot phase limited to specific districts, while IFAS program remains a national program. The potential transition from IFAS to MMS arises from concerns about the low effectiveness of the IFAS program, including issue on monitoring and evaluation mechanisms to ensure delivery and consumption of IFAS tablet.[12] Similar challenge have been observed in countries like Nicaragua, Nepal, and Vietnam, where IFAS serves as a national program. These concerns include a lack of comprehensive data regarding the coverage and adherence to IFAS among pregnant women.[13]

Some pilot studies on MMS has been initiated in several districts in Indonesia, including Lombok Island[14], Probolinggo District[15], and Banggai District[16]. The outcomes of the MMS pilot study indicate its potential in reducing fetal loss, neonatal mortality, the risk of low birth weight, and Malondialdehyde levels.[14,16]

Despite the implementation of MMS program in several districts in Indonesia, including Sidoarjo District where the MMS program is integrated into the pre-marriage services *(Layanan Terpadu Pranikah*/Laduni) program, research on the management aspects of the program remains limited. Sidoarjo District has introduced the Laduni program as part of the MMS program initiative to accelerate nutrition improvement. According to the maternal and child nutrition profile in Sidoarjo District, the prevalence of stunting, wasting, and underweight among children under five years

was 14.8 percent, 5.4 percent, and 7.2 percent, respectively, in 2021.[6] Additionally, 12.2 percent of pregnant women of reproductive age in the district suffer from chronic energy deficiency.[5] Given the national priority on accelerating stunting reduction, Sidoarjo District has been designated as a priority location since 2020.[17] Therefore, it is imperative to conduct research on the management of MMS for pregnant women in Sidoarjo District, East Java, to prevent early-life malnutrition.

## METHODS

This study was a qualitative study using a phenomenological approach. The research focused on investigating the perceptions, experiences, and expectations of relevant stakeholders regarding the management of MMS program for pregnant womento prevent early-life malnutrition in Sidoarjo District, East Java.

The data collection for this study took place from April to May 2022 and involved in-depth interviews conducted through both online and face-to-face methods with a total of 23 informants. These informants represented government and non-government institutions at various levels, including national, provincial (East Java Province), district (Sidoarjo District), selected sub-districts (Jabon - rural, and Buduran - urban), and selected villages (Siwalan Panji and Dukuh Sari Village). The informants were selected based on their position in their respective institution relevant to MMS program. Data collection was done through face-to-face interviews with strict health protocols, except interviews with national and provincial governments, university, civil society organization (CSO), and industry, through online platforms using the Zoom Meeting application.

Additionally, the study included focus group discussions (FGD) with 28 informants from the beneficiary groups, comprising 14 pregnant women and 14 mothers of children under 5 years. All FGD sessions with the beneficiaries were conducted face-to-face with strict health protocols. The selection of informants was guided by maximum variation purposive and snowball sampling methods based on data saturation. The variations include type of residence, type of MMS product consumed during pregnancy, compliance towards the MMS consumption where ≥180 tablets during pregnancy is good and <180 tablets during pregnancy is poor for mother under 5 five years old children. For pregnant women, the compliance referred to their current consumption in which everyday consumption is categorize as good compliance and not regular consumption is poor compliance.

Inclusion of different types of informants in this study is part of triangulation process to obtain insight from various perspective.

The data analysis for this study followed an iterative process which involves several cycle of refinement from transcription, coding, categorization, and theme determination. Content analysis was employed through hierarchical coding. Three pre-determined themes, adapted from the WHO logic model for micronutrients in public health (2016)[18] and Berti et al (2018)[13], were resources, management, and communities. However this paper will focus on management theme. Furthermore, within the management theme, the study used 5 pre-determined sub-themes namely (1) delivery mechanism, (2) accessibility, (3) coverage, (4) quality control, and (5) monitoring and evaluation.

This study received ethical approval from the Health Research Ethics Committee, Faculty of Medicine, Universitas Indonesia, granted on March 14th, 2022, with the approval number KET-250/UN2.F1/ETIK/PPM.00.02/2022.

## RESULTS

### Characteristic of The Informants

Majority of the stakeholders participated in this study were female (n = 18), within the age range of 46 to 55 years (n = 12). Eleven informants held a master's degree. While majority of the beneficiaries were aged between 26 to 32 years, had graduated from senior high school, were not employed, resided in rural areas, and demonstrated good adherence to MMS consumption. The total number of informants in this study was 51, as listed in Table 1 and Table 2.

### Sub-theme 1: Delivery Mechanism MMS Program

The delivery mechanism of the MMS program consisted of procurement and

distribution processes. These processes engaged District Health Office (DHO), university, Civil Society Organization (CSO), Public Health Center (PHC), and Ministry of Health (MoH).

MMS tablets in Sidoarjo District are supplied by the CSO with the name of the product called "Laduni" since it has been integrated into the district program "Laduni/*Layanan Terpadu Pranikah*" (Integrated Pre-marriage Services). Since the Laduni is imported product, there were some permit arrangements that should be completed. In this process, the DHO sent a request letter to the MoH to obtain a Special Access Scheme (SAS) number (*No. Ijin Kemenkes RI*). The SAS number (*No. Ijin Kemenkes RI*) must featured on the label or packaging of the Laduni product.

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Table 1

Characteristics of the Stakeholders

| Informants | Number (n = 23) |
|---|---|
| ***Characteristics*** | |
| Gender | |
| Female | 18 |
| Male | 5 |
| Age | |
| 26-35 | 4 |
| 36-45 | 5 |
| 46-55 | 12 |
| Above 55 | 2 |
| Education Level | |
| Senior High School | 5 |
| Diploma Degree | 3 |
| Bachelor Degree | 2 |
| Master Degree | 11 |
| Doctoral Degree | 2 |
| ***Institution*** | |
| National Level | |
| Ministry of Health (MoH) | 3 |
| Ministry of National Development Planning (Bappenas) | 2 |
| Provincial Level | |
| Provincial Health Office (PHO) | 1 |
| Province Development Planning Agency (Bappeda) | 2 |
| District Level | |
| District Health Office (DHO) | 1 |
| District Development Planning Agency (Bappekab) | 1 |
| Sub-district Level | |
| Public Health Center (PHC/Puskesmas) | 2 |
| Village Level | |
| Midwife | 2 |
| Cadre | 5 |
| Government Partners | |
| Academia/University | 2 |
| Civil Society Organization (CSO) | 1 |
| Business Sector/Industry | 1 |

Table 2

Characteristics of the Beneficiaries

| Characteristics | Mother of CU 5 (n = 14) | Pregnant Women (n = 14) |
|---|---|---|
| Age | | |
| 19-25 | 4 | 4 |
| 26-32 | 6 | 9 |
| 33-40 | 4 | 1 |
| Education Level | | |
| Elementary and Junior High School | 2 | 1 |
| Senior High School | 10 | 8 |
| Diploma and Bachelor Degree | 2 | 5 |
| Occupation | | |
| Working | 5 | 2 |
| Not Working | 9 | 12 |
| Residential Area | | |
| Urban | 5 | 5 |
| Rural | 9 | 9 |
| Child Age | | |
| 0-11 months | 9 | N/A |
| 12-23 months | 3 | N/A |
| 24-59 months | 2 | N/A |
| Number of Child | | |
| 1 | 5 | N/A |
| 2 | 3 | N/A |
| >2 | 6 | N/A |
| Gestational Age | | |
| 1st trimester | N/A | 5 |
| 2nd trimester | N/A | 3 |
| 3rd trimester | N/A | 6 |
| Anemia Status | | |
| Anemic | 2 | - |
| Non-Anemic | 12 | 14 |
| MMS Consumption | | |
| Laduni | 7 | 12 |
| Commercial product | 7 | 2 |
| Adherence of MMS Consumption | | |
| Poor | 3 | 3 |
| Good | 11 | 11 |

*"Given its non-commercial product and its intended use for a specific program, we were required to obtain a permit from the Ministry of Health through the Directorate General of Pharmaceuticals and Medical Tools to get the Special Access Scheme (SAS) number. To obtain the SAS number, a request letter from the district government was required." (Academia/University, IDI#13)*

After getting approval of the SAS permit from the MoH, the DHO initiated a collaboration with a university which in-charged to provide technical assistance to public health center (PHC) in implementing MMS program in Sidoarjo District. The collaboration was formalized in form of Memorandum of Understanding (MoU) between two parties. This collaborative agreement aimed to facilitate the distribution of the Laduni from CSO to DHO, enhancing packaging, and incorporating the necessary labeling for the Laduni product.

Additionally, the university has signed a MoU with the CSO as an integral component of the grants associated with the MMS program in Sidoarjo District. The university referred to the existing MoU with the DHO as the basis to propose grant to the CSO.

*"In response to a request from the DHO (to support MMS program in Sidoarjo District), the university submitted a formal request to XXX (the CSO)."(Academia/University, IDI#13)*

The CSO distributed the Laduni product to the university, to be further distributed to the DHO pharmacy warehouse. The Public Health Center (PHC) then obtained the Laduni product based on their estimated number of pregnant women in its PHC. Following this, nutritionists from the PHC distributed Laduni product to the beneficiaries during Antenatal Care (ANC) sessions, as part of the district government program.

*"It's important to note that the distribution of the Laduni to the PHC, was managed independently by the PHC. The distribution process initiated from the district pharmacy warehouse, where the university distributed the Laduni product to DHO. Subsequently, DHO stored it in the district pharmacy warehouse, and allocations were made for each PHC based on the number of beneficiaries." (District level, DHO, IDI#4)*

*"We receive the Laduni supply from DHO. (the number of Laduni is) based on our reports on estimaed number of pregnant and pre-marriage women for the present year. The data are compiled by DHO, and subsequently, Laduni is distributed to us (PHC)." "Regarding the coverage of MMS, we distribute the Laduni to pregnant women who attend pregnancy check at PHC, Posyandu, and village midwives." (Sub-district level, PHC, Rural, IDI#2)*

Stakeholders from the District Development Planning Agency (Bappekab) were not engaged in the procurement and distribution processes of the MMS/Laduni Program in Sidoarjo District, as their mandate primarily focuses on budgeting. Similarly, stakeholders from the Provincial Development Planning Agency (Bappeda), Provincial Health Office (PHO), and Ministry of National Development Planning (Bappenas) were not involved in these processes. This is attributed to the program being a district initiative, and the DHO holds the mandate for its implementation. Additionally, industry solely contribute to the production of premix as an ingredient for commercial MMS products.

**Sub-theme 2: Accessibility of MMS Product**

The accessibility of the MMS product in Sidoarjo District is facilitated through two channels: firstly, as a component of the district government program (Laduni product) provided by the DHO, and secondly, as a commercial product available for purchase in the marketplace. The Laduni product, integrated into the district program, is distributed to PHCs, which subsequently distribute it to beneficiaries through the ANC program. The Laduni product, being a part of the district program, is offered at no cost to beneficiaries in both rural and urban sub-districts. Therefore, pregnant women can receive Laduni product from the PHC.

*"We receive an adequate supply of MMS from DHO, and as a result, we do not need to purchase it. Pregnant women who visit our facility will be provided with MMS." (Sub-district level, PHC, Urban, IDI#3)*

*"I received Laduni from the PHC." (Mother of CU5, Rural, Laduni, Poor, FGD1#4)*

*"I received Laduni during the early stages of pregnancy, around 2 or 3 months, and obtained it from the PHC." (Pregnant Woman, Urban, Laduni, Good, FGD3#1)*

On the other hand, MMS from commercial sources are purchased by pregnant women in both rural and urban sub-districts based on prescriptions provided by obstetricians and gynecologists,

*"I did not receive Laduni product. I only received a prescription from the doctor. Yes, that is the product (commercial product)." (Mother of CU5, Rural, Commercial product, Good, FGD1#2)*

The PHC staff shared her interesting insight about practice of pregnant women towards MMS if they have to purchase the tablet themselves based on the prescription from the private midwife or obgyn. They more convinced the benefits of the commercial product since it was more expensive rather than Laduni product as describe in the following quotation.

*"If mothers receive additional prescriptions, such as other vitamins from the midwife or obstetrician, they tend to have more trust in those supplements." (Sub-district level, PHC, Rural, IDI#2)*

**Sub-theme 3: Coverage of MMS Program**

The MMS program in Sidoarjo District is designed to benefit both pregnant and pre-marriage women through the Laduni program. However, this present study focused on pregnant women.

In Sidoarjo District, the Laduni was distributed to pregnant women in all sub-districts. Nevertheless, due to limited quantities the DHO set criteria to prioritize pregnant women who get the Laduni.

*"Yes, the MMS coverage has been extended to all sub-districts. However, it has not allocated to all pregnant women in Sidoarjo." (Academia/University, IDI#13)*

*"The target is 100 percent for pregnant women and pre-marriage women. In 2021, MMS covered only 71.43 percent of pregnant women. Then, the priority target for MMS is pregnant women who suffer from anemia or chronic energy deficiency, as MMS cannot cover all pregnant women." (District level, DHO, IDI#4)*

**Sub-theme 4: Quality Control of MMS Product**

The quality control of Laduni product assessed in this study include formulation, packaging and labeling, as well as taste and aroma. The university acted as the primary responsibility for the quality control process.

*"Quality control of the product was the responsibility of the university as they were also involved in the labeling process. The university collaborated with the Food and Drugs Agency (BPOM). We were not involved. We received the (Laduni) product and checked the expiration date." (District level, DHO, IDI#4)*

The formulation of the Laduni product in Sidoarjo District adheres to the UNIMMAP (United Nations International Multiple Micronutrient Antenatal Preparation) formulation recommended by UNICEF and WHO since 1999. It is important to note that the commercial MMS product does not refer to the UNIMMAP formulation.

*"All MMS that we used to support the government since the 90s are based on the UNIMMAP formula. We do not have another formula. We follow the standard from WHO until now. Currently, the supply is from abroad, and there is no local production in Indonesia. There are many MMS products in Indonesia, but the formula is not the UNIMMAP formula. Therefore, we cannot buy from Indonesia." (CSO, IDI#14)*

*"There was no (commercial MMS) product with the UNIMMAP formula available in the marketplace." (Academia/University, IDI#13)*

A comparison between the UNIMMAP formulation, Laduni product, commercial product, and the Recommended Dietary Intake (RDI) of pregnant women in Indonesia is presented in Table 3. According to the table, Laduni product have less amount of calcium, vitamin K, biotin, DHA, and AHA compare with the commercial product. Conversely, the commercial product does not contain vitamin E, vitamin C, zinc, selenium, and iodine.

Regarding the packaging and labeling aspects, the DHO requested the university to create attractive packaging and labeling for the Laduni product. The orginal label was in English considering Laduni is an imported product. Given the Laduni is made for two different target groups, the university developed two distinct sets of packaging and labeling, each for pregnant women and pre-marriage women.

Table 3

Formulation of UNIMMAP Standard, Laduni Product, and Commercial Product

| Micro Nutrient | UNIMMAP Formula(19) | Laduni Product | Commercial Product | RDI (AKG 2019)(20) | | |
|---|---|---|---|---|---|---|
| | | | | T1 | T2 | T3 |
| Vitamin A | 800 µg | 800 RE | 10,000 IU | 900 RE | 900 RE | 900 RE |
| Vitamin D | 200 IU | 200 IU | 400 IU | 15 µg = 600 IU | 15 µg = 600 IU | 15 µg = 600 IU |
| Vitamin E | 10 mg | 10 mg | - | 15 µg | 15 µg | 15 µg |
| Vitamin C | 70 mg | 70 mg | - | 85 mg | 85 mg | 85 mg |
| Vitamin B1 | 14 mg | 1.4 mg | 3 mg | 1.4 mg | 1.4 mg | 1.4 mg |
| Vitamin B2 | 1.4 mg | 1.4 mg | 3.4 mg | 1.4 mg | 1.4 mg | 1.4 mg |
| Niacin | 18 mg | 18 mg | 20 mg | 18 mg | 18 mg | 18 mg |
| Vitamin B6 | 1.9 mg | 1.9 mg | 2 mg | 1.9 mg | 1.9 mg | 1.9 mg |
| Vitamin B12 | 2.6 µg | 2.6 µg | 4 µg | 4.5 µg | 4.5 µg | 4.5 µg |
| Folic Acid | 400 µg | 400 µg | 1 mg | 600 µg | 600 µg | 600 µg |
| Iron | 30 mg | 30 mg | 30 mg | 18-27 mg | 18-27 mg | 18-27 mg |
| Zinc | 15 mg | 15 mg | - | 10-12 mg | 10-12 mg | 10-12 |
| Copper | 2 mg | 2 mg | 0,1 mg | 1000 µg | 1000 µg | 1000 µg |
| Selenium | 65 µg | 65 µg | - | 29-30 µg | 29-30 µg | 29-30 µg |
| Iodine | 150 µg | 150 µg | - | 220 µg | 220 µg | 220 µg |
| Calcium: | - | - | - | 1200 mg | 1200 mg | 1200 mg |
| Calcium D-pantothenate | - | - | 7.5 mg | - | - | - |
| Calcium carbonate | - | - | 100 mg | - | - | - |
| Vitamin K1 | - | - | 50 µg | 55 µg | 55 µg | 55 µg |
| Biotin | - | - | 30 µg | 30 µg | 30 µg | 30 µg |
| DHA | - | - | 40 mg | - | - | - |
| AHA | - | - | 8 mg | - | - | - |

*Notes:
- RDI calculation based on the range RDI of two reproductive age group, 19-29 years and 30-49 years
- T = Trimester

*"The DHO requested to have more attractive packaging. We discussed and reached an agreement to create attractive packaging. For pre-marriage women, we chose a tosca color with images of brides and grooms. For pregnant women, we opted for a purple color with an image of a pregnant woman. Each photo on the packaging must include the SAS permit number." (Academia/University, IDI#13)*

The packaging and labeling of the MMS/Laduni product consisted of various elements, such as targeted beneficiaries, quantity of capsules, micro-nutrient content, producer/manufacturer, SAS number, expiration date, benefits of the product, consumption and storage guidelines, as well as partnership logos representing the CSO, university, and the Government of Sidoarjo District.

Meanwhile, the packaging and labeling of the commercial product differed from the Laduni product, especially on halal logo, additional ingredients (butylated hydroxyanisole, methyl paraben, edicol black PN, powder FD&C Red No.40, iron oxide red, titanium dioxide, gelatin (bovine), glycerin), and retail price. There were no SAS number and information about the benefits of MMS consumption on labeling of the commercial product.

Majority of beneficiaries, both urban and rural sub-districts, reported feeling better and have no complaints after consuming both Laduni and commercial products.

*"When I consume Laduni, I am feeling good. I don't have any complaints or issues at all." (Pregnant woman, Urban, Laduni, Good, FGD3#2)*

*"I didn't have any issues or complaints during the Laduni consumption." (Mother of CU5, Rural, Laduni, Good, FGD1#7)*

Nevertheless, some pregnant women have different perspectives about the taste, aroma, and shape of the Laduni and commercial products. Both Laduni and IFAS products are in tablet form, while MMS from commercial products is in capsule form. The nutritionists from PHC have reported that during pregnancy check in ANC, several beneficiaries raised their concerns about the taste and aroma of the

Laduni product, as it has been associated with inducing nausea.

*"Some mothers shared their experience on Laduni consumption, such as nausea." (Sub-district level, PHC, Rural, IDI#2)*

*"A pregnant woman mentioned about the smell of Laduni. She told me that it has unpleasant aroma." (Village level, Cadre, IDI#11)*

Some beneficiaries also complained about the size of Laduni, which was too large for their preference. Additionally, they reported that the taste and aroma of the commercial product were preferable compared to Laduni that has fishy aroma.

*"I received so many large-sized pills. I could not consume it if the pills had big size. Consequently, I had to grind the pills, but the taste was bitter." (Mother of CU5, Urban, Laduni, Poor, FGD4#4)*

*"The taste (of the commercial product) is slightly sweet, whereas Laduni, despite its small size, it has unpleasant aroma, like fish or iron. Consequently, Laduni induces nausea for me." …. "The size of XXX (commercial product) is not an issue as the tablet is sleek and easily consumable. XXX (commercial product) has a pleasant aroma. However, Laduni has a fishy smell, which is quite strong. Therefore, pregnant women with a history of nausea may find it more challenging." …. "The smell of Laduni is very strong, unlike IFAS, which only has a strong iron scent." (Mother of CU5, Urban, Commercial product, Good, FGD4#2)*

On the other hand, the nausea and vomiting experienced when consuming Laduni product during pregnancy may be associated with physiological changes inherent to the pregnancy itself.

*"In the early trimester, I experienced difficulties in consuming Laduni due to nausea and vomiting, mainly because of its unpleasant smell. However, in the second trimester, I was able to consume it as the nausea had subsided." (Pregnant woman, Rural, Laduni, Good, FGD2#9).*

**Sub-theme 5: Monitoring and Evaluation of MMS Program**

The monitoring of the MMS/Laduni program in Sidoarjo was integrated into an existing platform or reporting system, that aligned with the IFAS program. This includes written reports from PHC through the Maternal and Child Health (KIA) Book and online application "*Si Cantik*"(*Sidoarjo Cegah Angka Kematian Ibu dan Anak*/Sidoarjo Prevents Maternal and Child Mortality). Additionally, midwives and community health workers (cadres) conducted home visits to monitor the consumption of MMS.

This mechanism aligned with the statement from the national government, acknowledging that monitoring and evaluation for the MMS program has not been established at the national level, as MMS was introduced as an innovative program by district governments. Nevertheless, the monitoring and evaluation of the MMS program can follow an existing mechanism which is similar with the IFAS program.

*"Yes, there was no monitoring and evaluation mechanism established for the MMS program yet." (National level, MoH, IDI#21)*

*"Perhaps, the evaluation mechanism will be similar to IFAS." (National level, Bappenas, IDI#18)*

Nutritionists at PHC inputted the MMS consumption of the beneficiaries in the written report through KIA book and regular report of PHC when the beneficiaries come to PHC for pregnancy check-up.

*"We record data of MMS consumption (of the pregnant women). Whatever we provide to the pregnant women, including MMS, is documented in the KIA book. In addition to the KIA book, we also maintain our own notes." (Sub-district level, PHC, Urban, IDI#3)*

Subsequently, the PHC submitted the report, detailing the conditions in each village, to the DHO. The DHO then conducts an analysis of this report which must be presented/submitted to the Bappekab. The analysis consisted of the results of monitoring and evaluation, and its recommendations.These recommendations serve as considerations for

the budget allocation of the Laduni program in the subsequent period, overseen by Bappekab.

*"We solicit feedback from PHC as part of reporting process. The feedback reports from PHC described the conditions in each village. Subsequently, we analyzed these reports The results of the analysis were usually requested by Bappekab. Based on these results and recommendations, it serves as consideration when proposing the budget for the MMS program." (District level, DHO, IDI#4)*

The PHC has developed an online application called "*Si Cantik*," which stands for "*Sidoarjo Cegah Angka Kematian Ibu dan Anak*" (Sidoarjo Prevents Maternal and Child Mortality). This application is designed to monitor maternal and child health services, include the Laduni program. However, the current status indicates that the transition from written reports to online reporting is still in progress.

*"There are also reports through the 'Si Cantik' application, which includes data on pregnant women receiving Laduni. The application reports the number of pregnant women consuming Laduni. These data are available in the 'Si Cantik' application. However, not all data have been fully inputted. The system is currently in a transition process from semi-manual reporting to online reporting." (District level, DHO, IDI#4)*

At the village level, midwives and community health workers (cadres) actively participate in conducting home visits as part of the monitoring process for beneficiaries. Their role includes reminding beneficiaries to regularly consume Laduni. Subsequently, the midwives and cadres report the results of these home visits to the PHC.

*"In each citizen association (RW), we have cadres who assist pregnant women in each area. So, even if they cannot come to the PHC, we can reach out to the pregnant women. Each cadre is assigned to one RW. Then, the reports from the cadres are summarized at the village level and submitted to the PHC." (Village level, Midwife, Urban, IDI#9)*

Despite the establishment of the Laduni program in Sidoarjo District since 2017, a coverage survey is scheduled to be conducted in 2022. This survey is considered a component of the joint monitoring and evaluation efforts involving the DHO, university, and CSO.

*"A survey is scheduled for this year (2022). XXX (a civil society organization) has requested us to conduct the survey to monitor adherence to MMS consumption." (Academia/University, IDI#13)*

*"We will also support a coverage survey in Sidoarjo."(CSO, IDI#14)*

## DISCUSSION

The delivery mechanism of the MMS program in Sidoarjo District adopted the existing mechanism of the IFAS program through ANC services. An evidence-based study on MMS emphasizes the critical role of the delivery mechanism through the existing health system in effectively reaching pregnant women as beneficiaries of the MMS program.[13]

The procurement process for the Laduni product adhered to the official procedures from the MoH. This initiated with the official permit letter through the DHO to the Directorate General of Pharmaceuticals and Medical Tools of MoH, to obtain a Special Access Scheme (SAS) number for the Laduni product, as an import product. This procedure aligns with Minister of Health Regulation Number 51 of 2014 about the Importation of Medical Equipment through the Special Access Scheme.[21] The SAS is an official permit issued by the Government of Indonesia for essential products for the community through a special mechanism.[21] Products proposed to obtain SAS number should meet several requirements, including (1) providing optimal benefits for the community: (2) considering national needs and stocks; (3) meeting the standard on safety, benefit, and quality; (4) supporting government health policies; (5) originating from official sources; (6) having limited availability; (7) there is no similar product; (8) being incidental and not for regular purposes; and (9) not for commercial purposes.[21] Subsequently, the DHO proceeded to establish a MoU with the university. This MoU served as the basic agreement to implement the Laduni program in Sidoarjo District, complemented by an official

permit letter from the MoH. This was followed by a subsequent MoU between the university and the CSO.

Following the procurement process, the distribution of the Laduni product commenced with the CSO distributing the product to the university. Subsequently, the university distributed of the Laduni product to the DHO, and from the DHO to the PHC. At the community level, it became the responsibility of the nutritionists from the PHC to distribute the MMS product to the pregnant women during ANC sessions, in collaboration with the midwives. Existing delivery system for the IFAS program is already in place and can be potentially utilized for the distribution of MMS to the beneficiaries.[22] Leveraging the established delivery system for IFAS can reduce the distribution costs. Furthermore, high coverage of MMS program will be achieved if the delivery mechanism at the community level is put in place and the supply of MMS product is secured.[22]

In addition to the Laduni product provided for free by the district government, pregnant women also have access to commercial products available in the marketplace. The Laduni program in Sidoarjo District, as a district government initiative, is specifically targeted for pregnant women and pre-marriage women to prevent micronutrient deficiencies and mitigate their impact on pregnancy outcomes.

The coverage of the Laduni program in Sidoarjo District has gradually expanded from two sub-districts to all sub-districts. However, due to the limited quantity of the Laduni product, it has not yet reached all the targeted beneficiaries. Consequently, the DHO distributes the Laduni product selectively to a prioritized number of beneficiaries, based on proposed data from PHC. Pregnant women and pre-marriage women who are not covered by the district distribution can still access MMS by purchasing commercial products available in the marketplace.

Ensuring the quality of the MMS product is crucial, with particular focus on formulation, packaging, and labeling aspects. The formulation of Laduni product aligns with the UNIMMAP formula. In contrast, the formulation of the commercial product differs from the UNIMMAP formula, in terms of vitamin E, vitamin C, zinc, selenium, iodine, calcium, vitamin K, biotin, DHA, and AHA. This finding is similar with a situational analysis conducted in 12 lower and upper middle-income countries, including Brazil, Colombia, Guatemala, Mexico, Peru, Bangladesh, India, Vietnam, Ghana, Kenya, Nigeria, and South Africa, where the formulation of MMS product did not match with the UNIMMAP formulation.[23]

The packaging of the Laduni product becomes an attractive feature and its labeling functions as an informational source for the beneficiaries, while also as part of product regulatory.[23] Laduni product has packaging with two different colors for two different target beneficiaries, and its labeling consists of information on the number of capsules, micro-nutrient content, producer/manufacturer, SAS number, expiry date, benefits of the product, consumption and storage guidelines, and partnership logos. In contrast, the commercial product has a single color and features different components on its labeling, such as a halal logo, additional ingredients, and retail price. A situational analysis conducted in 12 countries across Asia, Africa, and Latin America found that MMS product labeling, at a minimum, includes a list of ingredients, expiry date, and manufacturer information.[23]

The beneficiaries expressed varied perspectives on the MMS products they consumed during pregnancy. Majority of the beneficiaries had no complaints about Laduni product. While some beneficiaries complained about the size and aroma of Laduni product which was too big and a bit fishy that can lead to nausea. In contrast, a few beneficiaries who consumed the commercial product found that the commercial product was slightly sweet and sleek which was easier to swallow and did not induce nausea. These different perspectives on Laduni and commercial products were influenced by the form of the product. Laduni product is a tablet which potentially difficult to swallow and leading to nausea, even though tablets have a longer shelf life than capsules.[24] A study in Mexico similarly identified that some beneficiaries found it challenging to swallow and detected a smell from the micronutrient tablet.[25] Conversely, the commercial product is a capsule coated with an outer shell that is more tasteless and easier to swallow.[24] However, capsules are more expensive than tablets, and

the outer shell contains gelatin, requiring assurance of halal certification.[24]

Laduni program in Sidoarjo District, as an innovative program by the DHO, has an existing monitoring platforms similar to the IFAS program. These platforms include written reports from PHC or KIA book, online application "*Si Cantik*" from PHC, and home visits conducted by midwives and cadres. However, a comprehensive coverage survey has not been conducted yet by the DHO, university, or CSO. The initiation of the coverage survey in 2022 indicates that the monitoring and evaluation of the Laduni program in Sidoarjo District is still unestablished. In the development of the monitoring and evaluation system for MMS, it is crucial to formulate a set of indicators consist of the program's cycle, covering inputs, activities, outputs, and outcomes.[26] These indicators can be adapted from existing IFAS program indicators, supplemented with specific indicators relevant to MMS.[26] At least, these indicators should consist of policy and supply availability, coverage, as well as adherence of the MMS consumption.[26]

## CONCLUSION AND RECOMMENDATION

### Conclusion

The MMS/Laduni product, implemented as part of the DHO program, was distributed to pregnant women through the existing delivery mechanism of IFAS program during ANC services. Despite being distributed in all sub-districts, the distribution of Laduni product has not reached all pregnant women in Sidoarjo District due to the limited quantity of Laduni product. Consequently, some pregnant women purchased MMS product from the commercial market.

The quality control of the Laduni product, based on the UNIMMAP formula, is overseen by the university and supervised by the DHO, particularly on product packaging and labeling. However, the quality of the MMS product should be improved, as some beneficiaries expressed their concerns about its taste and aroma, describing it as somewhat fishy. Additionally, feedback indicated that the hardness of the tablet posed challenges for swallowing compared to the commercial product.

Monitoring of the Laduni program involved manual reporting, and there is an ongoing transition towards implementing an online reporting system through a mobile application. However, the monitoring and evaluation systems have not been fully established, as the coverage and compliance survey has not been conducted yet. Consequently, the current data about the adherence of the Laduni consumption is unavailable.

### Recommendation

The quality of the Laduni product should be improved based on the concerns raised by several beneficiaries about the taste, aroma, and size of the Laduni product compared to the commercial product. Additionally, there is a need to improve the monitoring and evaluation systems by formulating comprehensive coverage and compliance surveys, as well as strengthening the recording and reporting during ANC. This approach ensures the MMS program effectively targets and reaches its beneficiaries.

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# KEPUASAN PASIEN TERHADAP PENYAJIAN DIET DI RUMAH SAKIT BERDASARKAN KARAKTERISTIK INDIVIDU

*Patient Satisfaction Towards Hospital Diet Serving According to Individual Characteristics*

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## ABSTRACT

**Patient satisfaction surveys can be a valuable tool for hospitals to identify areas for improvement in service based on patient characteristics. This study examined patient satisfaction with hospital diet serving and identified the individual characteristics of a patient satisfaction indicator that had the highest dissatisfaction rate. The study surveyed 96 adult inpatients at two District General Hospitals in Jogjakarta province, using a quantitative analytical method and a cross-sectional design. Patients were given an individual characteristic questionnaire and a modified version of the Acute Care Hospital Foodservice Patient Satisfaction Questionnaire (ACHFPSQ). Data analysis included chi-square tests, Fisher's exact and Kolmogorov-Smirnov alternatives, and gamma and Spearman correlation tests. The study found that the overall satisfaction rate for hospital diet serving was high, at 96.9 percent (98% and 95.7% at Yogyakarta and Bantul General Hospital respectively). However, patients expressed the highest dissatisfaction rate of 11.4 percent in the indicator of food quality, specifically taste and flavor. Patient satisfaction levels with food quality differed significantly based on hospital wards (p=0.012), appetites (p=0.011), and diet textures (p=0.048). While overall patient satisfaction with diet serving is high, there is room for improvement in enhancing patients' appetite as well as improving food quality including the appearance of diet food in the hospital.**

**Keywords: patient satisfaction, diet serving, food quality, individual characteristics**

## ABSTRAK

**Melalui survei kepuasan pasien, rumah sakit dapat mengidentifikasi kelompok pasien yang memerlukan perbaikan pelayanan sesuai dengan karakteristik individunya. Penelitian ini bertujuan untuk mengetahui tingkat kepuasan pasien terhadap penyajian diet rumah sakit dan karakteristik individu pasien pada indikator kepuasan penyajian diet yang memiliki persentase ketidakpuasan tertinggi. Penelitian kuantitatif analitik observasional dengan rancangan potong lintang dilakukan di dua Rumah Sakit Umum Daerah (RSUD) di Daerah Istimewa Yogyakarta (DIY). Subyek penelitian yaitu 96 orang pasien rawat inap dewasa yang ditentukan secara *purposive*. Pengumpulan data menggunakan kuesioner karakteristik individu dan modifikasi *Acute Care Hospital Foodservice Patient Satisfaction Questionnaire* (ACHFPSQ) yang telah divalidasi. Analisis data menggunakan uji chi-square dengan alternatif *Fisher's exact* dan *Kolmogorov-Smirnov* serta uji korelasi gamma dan Spearman. Tingkat kepuasan pasien pada penyajian diet rumah sakit sebesar 96,9 persen (98% di RSUD Kota Yogyakarta dan 95,7% di RSUD Bantul). Indikator yang memiliki tingkat "kurang puas" tertinggi (sebesar 11,4%) yaitu cita rasa (rasa dan aroma). Tingkat kepuasan pasien terhadap cita rasa makanan berbeda berdasarkan bangsal perawatan (p=0,012), nafsu makan (p=0,011) dan tekstur diet/bentuk makanan (p=0,048). Tingkat kepuasan pasien pada penyajian diet rumah sakit tergolong tinggi tetapi tetap diperlukan intervensi yang dapat meningkatkan nafsu makan pasien serta memperbaiki cita rasa termasuk penampilan makanan diet di rumah sakit.**

**Kata kunci: kepuasan pasien, penyajian diet, cita rasa makanan, karakteristik individu**

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## PENDAHULUAN

Pelayanan gizi dan dietetik merupakan bagian integral dari pelayanan rumah sakit yang dilakukan oleh tenaga gizi dan prosesnya terdiri dari pelayanan asuhan gizi dan dietetik serta asuhan penyelenggaraan makanan.[1] Penyelenggaraan makanan rumah sakit bertujuan untuk menyediakan makanan bergizi bagi pasien rawat inap yang bermanfaat bagi kesembuhan dan kesehatannya, serta memberikan contoh makanan sehat dengan menu yang disesuaikan dengan kondisi kesehatan pasien secara spesifik.[2] Pelayanan gizi rumah sakit yang berkualitas dapat mempercepat proses penyembuhan pasien dan memperpendek waktu rawat inap sehingga biaya perawatan menjadi hemat.[3]

Pelayanan rumah sakit yang berkualitas akan meningkatkan kepuasan pasien.[4,5] Pelayanan yang diberikan di instalasi gizi juga akan memengaruhi kepuasan secara keseluruhan selama pasien dirawat di rumah sakit sehingga dapat dijadikan sebagai suatu alat untuk mengevaluasi kualitas pelayanan kesehatan.[3,6] Kepuasan pasien adalah harapan pasien yang timbul atas tindakan tenaga kesehatan sebagai akibat dari kinerja layanan kesehatan selama proses berinteraksi dalam upaya memberikan pelayanan.[7] Pengukuran tingkat kepuasan pasien diperlukan agar dapat mengetahui sejauh mana pemenuhan harapan pasien terhadap dimensi-dimensi mutu pelayanan sudah diselenggarakan.

Keberhasilan pelayanan gizi dikaitkan dengan daya terima pasien terhadap makanan yang disajikan.[8] Makanan yang disajikan harus diinginkan oleh konsumen; jika tidak maka akan ada sisa makanan pasien rawat inap dalam jumlah yang relatif banyak dan menimbulkan konsekuensi anggaran penyelenggaraan makanan.[9] Namun, makanan sebagai *output* penyelenggaraan makanan rumah sakit sering kali tidak memberikan kepuasan kepada pasien.[10] Hasil penelitian di Rumah Sakit (RS) Panti Rapih Yogyakarta menunjukkan tingkat kepuasan pasien VIP terhadap penyelenggaraan makanan sebesar 56 persen dan rata-rata sisa makanan di piring pasien 24,62 persen.[11] Penelitian di RS Condong Catur Yogyakarta juga mendapati pasien belum puas terhadap penyajian makanan dan tingkat kepuasan rendah pada aspek suhu makanan, keramahan pramusaji, serta alat dan waktu penyajian.[12] Di salah satu Rumah Sakit Umum Daerah (RSUD) tipe B di DIY yang menjadi lokasi penelitian, data Instalasi Gizi pada Januari 2018 menunjukkan rata-rata sisa makanan pasien 30 persen atau melebihi standar minimal yakni < 20 persen.

Konsumsi makanan pasien rawat inap berhubungan dengan status gizi dan kepuasan terhadap penyelenggaraan makanan, serta faktor lain seperti status kesehatan, kondisi medis, nafsu makan, dan gigi geligi.[2] Faktor personal dan sosial budaya juga diidentifikasi sebagai faktor utama dalam daya terima dan memprediksi asupan makanan.[2] Beberapa faktor sama-sama memengaruhi kepuasan dan sisa makanan pasien.[13] Kepuasan pelanggan terhadap penyelenggaraan makanan rumah sakit bersifat multifaktor dan sulit untuk dinilai.[14] Sebuah studi *literature review* menyebutkan dua hal yang paling menentukan kepuasan pasien terhadap penyelenggaraan makanan di rumah sakit yaitu kualitas makanan (rasa, tektstur, penampilan, dan variasi makanan) serta kualitas pelayanan makanan (sistem pemesanan makanan, alat makan, sikap dan kinerja petugas).[15] Kualitas penyelenggaraan makanan berorientasi pada kepuasan pasien dengan memperhatikan berbagai hal, antara lain penampilan makanan, cita rasa makanan, kebutuhan alat, ketepatan waktu dalam menghidangkan makanan serta sikap dan perilaku petugas dalam menghidangkan makanan yang secara langsung atau tidak langsung dapat memengaruhi selera makanan pasien.[16]

Kualitas makanan diikuti oleh kualitas layanan merupakan prediktor paling penting terhadap kepuasan pelanggan.[17] Sebuah penelitian kepuasan pasien di Malaysia yang menggunakan *The Acute Care Hospital Foodservice Patient Satisfaction Questionnaire* (ACHFPSQ) menunjukkan dimensi kualitas makanan mendapat skor terendah dibandingkan dengan dimensi lainnya yaitu kualitas pelayanan makanan, staf, dan lingkungan fisik. Pasien tidak puas secara spesifik dengan kualitas makanan karena variasi menu yang kurang, pengulangan menu, rasa, aroma, serta cara memasak daging dan sayuran.[13] Hasil penelitian di RSUD Mamuju Sulawesi Barat menunjukkan bahwa pasien rawat inap kelas I, II dan III tidak puas terhadap penampilan makanan yang meliputi bentuk,

warna, porsi makan pagi dan malam, serta terhadap atribut rasa yaitu suhu makanan.[18] Modifikasi diet dapat menyebabkan makanan kurang menarik[2], tetapi penelitian di rumah sakit pemerintah di India mendapati hampir semua pasien puas terhadap jenis diet yang diterima, baik berupa makanan biasa, diet diabetes melitus, diet tinggi protein, maupun diet rendah protein rendah garam.[19]

Karakteristik individu merupakan salah satu faktor yang banyak dipelajari dalam menentukan kepuasan pasien. Melalui survei kepuasan pasien, rumah sakit terbantu dalam proses identifikasi kelompok pasien yang memerlukan perbaikan pelayanan dalam upaya peningkatan kualitas pelayanan kesehatan.[20] Beberapa faktor individu yang memengaruhi kepuasan pasien antara lain jenis kelamin, kelompok umur, tingkat pendidikan, status perkawinan, asuransi kesehatan dan status kesehatan.[21] Berbagai penelitian telah melihat hubungan kepuasan pasien terhadap pelayanan gizi/makanan rumah sakit dengan karakteristik individu pasien yang meliputi usia[13,22–25], jenis kelamin[13,22–25], pendidikan[13,22–25], pekerjaan[22], etnis[25], lama dirawat[13,22,25], kelas perawatan[23], jenis penyakit[22], selera makan[23] dan jenis diit[23], tetapi hasilnya tidak konsisten. Penelitian ini bertujuan untuk mengetahui tingkat kepuasan pasien terhadap penyajian diet di dua RSUD di DIY dan karakteristik individu pasien pada indikator kepuasan penyajian diet yang memiliki persentase ketidakpuasan tertinggi.

## METODE PENELITIAN

### Desain Penelitian

Penelitian ini menggunakan metode kuantitatif analitik dengan jenis observasional dan rancangan potong lintang (*cross sectional*). Penelitian dilakukan pada bulan Juni 2018 dan berlokasi di dua Rumah Sakit Umum Daerah (RSUD) tipe B di provinsi DIY, yaitu RS Jogja (RSUD Kota Yogyakarta) dan RSUD Panembahan Senopati Bantul (RSUD Bantul). Pemilihan lokasi penelitian di RSUD tipe B berdasarkan alasan penyelenggaraan makanan rumah sakit yang menggunakan sistem swakelola dan merupakan rumah sakit rujukan di wilayah pedesaan dan perkotaan DIY yang memiliki karakteristik pasien dan jenis penyakit yang lebih beragam. Selain itu, dua RSUD yang menjadi lokasi penelitian belum memiliki data mengenai kepuasan pasien pada penyajian diet. Penelitian ini telah mendapatkan surat izin kelayakan etik dari Komite Etik Fakultas Kedokteran, Kesehatan Masyarakat dan Keperawatan Universitas Gadjah Mada dengan nomor KE/FK/0532/EC/2018 dan KE/FK/0542/EC/2018.

### Populasi dan Sampel

Populasi penelitian ini yaitu pasien rawat inap di rumah sakit yang menjadi tempat penelitian. Sampel penelitian adalah pasien rawat inap yang memenuhi kriteria inklusi, yaitu berusia 18 tahun – 70 tahun, telah menerima diet makanan padat dan lunak yang disajikan minimal 3 kali waktu makan, dapat berkomunikasi dengan baik, dan bersedia menjadi responden penelitian dengan pengisian *informed consent*. Kriteria eksklusi sampel meliputi pasien dalam kondisi tidak sadar, dirawat di bangsal ICU (*Intensive Care Unit)* atau ICCU (*Intensive Cardiac Care Unit)*, memperoleh diet cair, sedang atau akan menjalani puasa saat pengambilan data, dan tidak mengisi kuesioner dengan lengkap. Sampel diperoleh sebanyak 96 pasien menggunakan teknik *purposive sampling*, dengan rincian 50 orang berasal dari RSUD Kota Yogyakarta dan 46 orang dari RSUD Bantul.

### Pengumpulan Data

Variabel bebas dalam penelitian ini adalah karakteristik individu pasien yang terdiri dari jenis kelamin, usia, tingkat pendidikan, pekerjaan, cara pembayaran biaya rumah sakit, status pernikahan, nafsu makan, lama rawat inap, alasan masuk rumah sakit, tekstur diet dan jenis intervensi diet yang diterima. Sementara itu, variabel terikat adalah kepuasan pasien rawat inap terhadap mutu makanan dan pelayanan dalam penyajian diet di rumah sakit yang terbagi menjadi 9 indikator (cita rasa, penilaian menu secara umum, kesesuaian cara pengolahan menu dengan selera pasien, porsi makanan, suhu makanan, perilaku pramusaji, jadwal distribusi makanan, lingkungan fisik bangsal dan peralatan makan). Indikator cita rasa menggambarkan penilaian pasien terhadap rasa dan aroma makanan yang disajikan. Indikator penilaian menu secara umum meliputi penilaian kepuasan pasien terhadap menu masakan yang disediakan oleh

rumah sakit, yakni variasi menu dan kesesuaian seluruh makanan yang disajikan dengan harapan pasien. Indikator kesesuaian cara pengolahan menu dengan selera pasien menunjukkan penilaian pasien terhadap pengolahan menu makanan pokok, sayuran dan lauk nabati. Indikator kepuasan pasien terhadap lingkungan fisik bangsal menunjukkan penilaian pasien saat melihat pramusaji membawa nampan berisi alat makan yang kotor dan pembuangan sisa makanan. Indikator peralatan makan menggambarkan penilaian pasien terhadap kondisi peralatan yang tidak baik (retak, rusak, berkarat, kotor, dan bau) serta tidak lengkap.

Instrumen penelitian menggunakan kuesioner karakteristik individu dan ACHFPSQ untuk mengukur kepuasan pasien pada panyajian diet. Kuesioner ACHPSQ dimodifikasi dari penelitian sebelumnya yang dilakukan di berbagai institusi penyelenggara makanan termasuk rumah sakit[13] dan asrama angkatan udara[26] serta diterjemahkan ke dalam Bahasa Indonesia. Modifikasi yang dilakukan terhadap isi kuesioner yaitu *item* cita rasa makanan disesuaikan dengan menu makanan masyarakat Indonesia. Hal ini meliputi penambahan butir pernyataan tentang pengolahan makanan pokok (berupa nasi, nasi tim, dan bubur nasi) dan lauk nabati (tahu dan tempe) serta eliminasi pernyataan mengenai suhu makanan dingin, suhu minuman dingin, dan tekstur daging sapi, dengan alasan kemunculan jenis-jenis menu tersebut jarang di rumah sakit tempat penelitian. Kuesioner ini telah diuji validitas dan reliabilitasnya pada 30 orang pasien rawat inap yang memiliki karakteristik sama seperti subyek penelitian dan mendapatkan nilai *Cronbach's alpha* 0,866 (reliabilitas baik)[27]. Butir-butir pernyataan dalam kuesioner ACHFPSQ juga terbukti memiliki kesesuaian dengan kuesioner ServQual yang digunakan untuk mengukur dimensi kualitas pelayanan (*service quality*) yang meliputi *tangible* (penampilan fisik), *reliability* (kehandalan), *responsiveness* (daya tanggap), *assurance* (jaminan), dan empati pramusaji pada saat memberikan pelayanan makanan. Hal ini ditunjukkan dengan korelasi yang bermakna dari nilai jawaban 56 subyek dari RSUD Kota Yogyakarta terhadap kedua kuesioner tersebut berdasarkan uji Rank-Spearman (r=+0,517; p=0,000).

Kuesioner ACHFPSQ dalam penelitian ini terdiri dari 16 butir pertanyaan yang menunjukkan penilaian pasien terhadap pengalaman saat pelayanan oleh pramusaji dan mengonsumsi diet. Skala penilaian pada kuesioner ACHFPSQ awal yang menggunakan skala *likert* 5 pilihan dimodifikasi menjadi 4 pilihan berdasarkan hasil uji validasi kuesioner. Sistem penilaian untuk butir pernyataan positif (*favorable)* menggunakan skor Sangat Setuju (SS)=4, Setuju (S)=3, Tidak Setuju (TS)=2, dan Sangat Tidak Setuju (STS)=1, sedangkan untuk butir pernyataan negatif (*unfavorable)* skor SS=1, S=2, TS=3, dan STS=4. Hasil penilaian tingkat kepuasan pasien rawat inap terhadap penyajian diet rumah sakit dan indikatornya terbagi atas 3 kategori menggunakan rumus klasifikasi data yang tidak terdistribusi normal[28], yakni "Kurang Puas", "Cukup Puas", dan "Puas". Kepuasan pasien terhadap penyajian diet rumah sakit tergolong kurang puas jika skor yang diperoleh dari jawaban semua pernyataan dalam kuesioner ≤ 39,21; cukup puas jika total skor 39,22-40,79; dan puas jika total skor > 40,8. Data sekunder yang dikumpulkan meliputi jumlah pasien rawat inap dan gambaran umum lokasi penelitian yang diperoleh dari laman resmi RSUD maupun arsip data administrasi rumah sakit dan Instalasi Gizi.

**Analisis Data**

Hipotesis penelitian ini yaitu ada perbedaan karakteristik individu pasien pada indikator kepuasan penyajian diet yang memiliki ketidakpuasan tertinggi. Analisis statistik untuk membuktikan hipotesis ini menggunakan uji *chi-square* pada variabel kategorik dan uji Kruskal Wallis pada 3 kelompok (pasien yang kurang puas, cukup puas dan puas) karena distribusi data tidak normal. Analisis univariat karakteristik individu dan kepuasan pasien terhadap penyajian diet serta indikatornya menggunakan nilai absolut dan persentase total dari masing-masing rumah sakit dan seluruh rumah sakit. Perbedaan karakteristik individu antara subyek yang berasal dari 2 rumah sakit diidentifikasi dengan menggunakan uji *chi-square* pada variabel kategorik dengan alternatif *Fisher's exact* dan Kolmogorov-Smirnov pada data yang memiliki nilai *expected* <5 serta uji Mann-Whitney pada variabel numerik karena distribusi data tidak normal. Seluruh analisis statistik dilakukan pada tingkat signifikansi (p)=0,05.

Tabel 1

Karakteristik Individu Pasien

| Karakteristik Individu | RSUD Kota Yogyakarta (n) | RSUD Bantul (n) | p | Total (n, %) |
|---|---|---|---|---|
| Jenis kelamin | | | 0,018 | |
| Laki-laki | 23 | 10 | | 33 (34,4%) |
| Perempuan | 27 | 36 | | 63 (65,6%) |
| Usia (tahun)[1] | 42,2±14,0 | 44,7±13,7 | 0,385 | 43,40±13,86 |
| Tingkat pendidikan | | | 0,001 | |
| Rendah (tidak bersekolah, tamat SD/ SMP/ sederajat) | 16 | 31 | | 47 (49%) |
| Sedang (tamat SMA/ SMK/ sederajat) | 24 | 13 | | 37 (38,5%) |
| Tinggi (diploma, sarjana, pascasarjana) | 10 | 2 | | 12 (12,5%) |
| Status bekerja | | | 0,012 | |
| Tidak bekerja | 14 | 25 | | 39 (40,6%) |
| Bekerja | 36 | 21 | | 57 (59,4%) |
| Status perkawinan | | | 0,160 | |
| Tidak menikah[2] | 5 | 10 | | 15 (15,6%) |
| Menikah | 45 | 36 | | 81 (84,4%) |
| Bangsal perawatan | | | 0,076 | |
| Bedah | 13 | 8 | | 23 (24%) |
| Kebidanan | 17 | 9 | | 26 (27%) |
| Penyakit Dalam | 20 | 27 | | 47 (49%) |
| Kelas perawatan | | | 0,000 | |
| Kelas I | 10 | 0 | | 10 (10,4%) |
| Kelas II | 10 | 0 | | 10 (10,4%) |
| Kelas III | 30 | 46 | | 76 (79,2%) |
| Lama rawat inap (hari)[1] | 3,1±2,0 | 3,1±2,0 | 0,279 | 3,3±2,2 |
| Alasan memilih rumah sakit | | | 0,088 | |
| Darurat/ rujukan | 28 | 34 | | 62 (64,6%) |
| Pilihan sendiri | 22 | 12 | | 34 (35,4%) |
| Cara pembayaran biaya RS | | | 0,113 | |
| Biaya pribadi | 6 | 1 | | 7 (7,3%) |
| Asuransi | 44 | 45 | | 89 (92,7%) |
| Nafsu makan[3] | | | 0,188 | |
| Buruk (berkurang/tidak nafsu makan sama sekali) | 12 | 17 | | 29 (30,2%) |
| Baik (tetap/ meningkat) | 38 | 29 | | 67 (69,8%) |
| Tekstur diet/ bentuk makanan | | | 0,152 | |
| Nasi | 30 | 20 | | 50 (52,1%) |
| Lunak (tim dan bubur nasi) | 20 | 26 | | 46 (47,9%) |
| Jenis intervensi diet | | | 0,000 | |
| Makanan biasa non-diet | 13 | 30 | | 43 (44,8%) |
| Diet khusus[4] / diet TKTP/ diet DM | 37/ 32/ 4 | 16/ 2/ 10 | | 53 (55,2%) |

Sumber: Data Primer Terolah

Keterangan:

[1] disajikan dalam ukuran rata-rata ± standar deviasi (*Mean* ± SD)

[2] meliputi status belum menikah dan cerai hidup/mati, dengan rincian 4 orang berusia 18-21 tahun, 3 orang usia 22-30 tahun, 1 orang usia 31-40 tahun, 4 orang usia 41-50 tahun, 1 orang usia 51-60 tahun, dan 2 orang usia 61-70 tahun

[3] dibandingkan dengan saat berada di rumah

[4] Diet Tinggi Kalori Tinggi Protein (TKTP), Diabetes Mellitus (DM), diet Jantung (DJ), Rendah Garam (RG), Diet Lambung (DL), Rendah Kalium (RK), RS (Rendah Serat), Rendah Lemak (RL)

## HASIL

### Karakteristik Individu

Karakteristik individu pasien yang menjadi subyek penelitian disajikan dalam Tabel 1. Sebagian besar subyek penelitian berjenis kelamin perempuan (65,6%), tingkat pendidikan rendah (49%), tidak bekerja (59,4%), berstatus menikah (84,4%), berasal dari bangsal perawatan penyakit dalam (49%), berada di kelas perawatan III (79,2%), memiliki nafsu makan baik (tetap atau meningkat) dibanding saat berada di rumah (69,8%), dan melakukan pembayaran melalui sistem asuransi (92,7%). Rata-rata usia subyek adalah 43,40 tahun dan dirawat inap lebih dari 3 hari. Sebanyak 21 pasien (21,88% dari total subyek atau 72,42% dari 29 pasien yang memiliki nafsu makan buruk) dirawat di bangsal penyakit dalam. Subyek lain yang memiliki nafsu makan buruk dirawat di bangsal bedah (6 pasien) dan kebidanan (3 pasien).

Subyek penelitian dari RSUD Kota Yogyakarta dan RSUD Bantul memiliki karakteristik individu yang berbeda ($p<0,05$) dalam hal demografi yaitu jenis kelamin, tingkat pendidikan, dan status bekerja. Lebih banyak pasien laki-laki yang berpartisipasi dalam penelitian ini di RSUD Kota Yogyakarta dibandingkan RSUD Bantul. RSUD Kota Yogyakarta yang berada di perkotaan juga memiliki lebih banyak subyek yang bekerja dan dengan tingkat pendidikan tinggi dibandingkan subyek dari RSUD Bantul. Semua subyek di RSUD Bantul diperoleh dari kelas perawatan III, sedangkan di RSUD Kota Yogyakarta sebanyak 60 persen (30 orang) subyek berasal dari pasien kelas III. Subyek di RSUD Bantul lebih banyak menerima makanan non-diet (30 orang) daripada diet khusus (16 orang). Sebaliknya, subyek di RSUD Kota Yogyakarta lebih banyak yang mendapatkan makanan diet khusus (37 orang) dibandingkan makanan non-diet (13 orang). Hal ini menunjukkan diet yang diterima subyek di kedua rumah sakit berbeda secara bermakna ($p=0,000$).

Tabel 2
Kepuasan Pasien terhadap Penyajian Diet di Rumah Sakit

| Indikator | Kurang puas | | | Cukup puas | | | Puas | | |
|---|---|---|---|---|---|---|---|---|---|
| | RSUD Kota Yogyakarta (n) | RSUD Bantul (n) | Total RS (n, %) | RSUD Kota Yogyakarta (n) | RSUD Bantul (n) | Total RS (n, %) | RSUD Kota Yogyakarta (n) | RSUD Bantul (n) | Total RS (n, %) |
| Cita rasa makanan (rasa, aroma) | 6 | 5 | 11 (11,4%) | 9 | 12 | 21 (21,9%) | 35 | 29 | 64 (66,7%) |
| Kesesuaian cara pengolahan dengan selera pasien | 5 | 2 | 7 (7,3%) | 11 | 14 | 25 (26,0%) | 34 | 31 | 64 (66,7%) |
| Lingkungan fisik bangsal | 2 | 4 | 6 (6,3%) | 45 | 40 | 85 (88,5%) | 3 | 2 | 5 (5,2%) |
| Porsi makanan | 2 | 2 | 4 (4,2%) | 47 | 42 | 89 (92,7%) | 1 | 2 | 3 (3,1%) |
| Jadwal distribusi makanan | 3 | 1 | 4 (4,2%) | 42 | 42 | 84 (87,5%) | 5 | 3 | 8 (8,3%) |
| Penilaian menu secara umum | 3 | 0 | 3 (3,1%) | 3 | 6 | 9 (9,4%) | 44 | 40 | 84 (87,5%) |
| Peralatan makan | 1 | 1 | 2 (2,0%) | 2 | 2 | 4 (4,2%) | 47 | 43 | 90 (93,8%) |
| Suhu makanan | 0 | 0 | 0 | 48 | 38 | 86 (89,6%) | 2 | 8 | 10 (10,4%) |
| Perilaku pramusaji | 0 | 0 | 0 | 0 | 1 | 1 (1,0%) | 50 | 45 | 95 (99,0%) |
| Tingkat kepuasan pasien terhadap penyajian diet RS | 1 (2%) | 2 (4,3%) | 3 (3,1%) | 0 | 0 | 0 | 49 (98%) | 44 (95,7%) | 93 (96,9%)* |

Sumber: Ningrum (2018)[27]
Keterangan:
*Perbedaan tingkat kepuasan penyajian diet di kedua rumah sakit (p)=0,606 berdasarkan uji *chi-square*

Tabel 3

Kepuasan Penyajian Diet pada Indikator Cita Rasa Makanan berdasarkan Karakteristik Individu

| Karakteristik Individu | Tingkat kepuasan pada indikator cita rasa makanan (n, %) | | | | | | | | p |
|---|---|---|---|---|---|---|---|---|---|
| | Kurang puas | | Cukup puas | | Puas | | Total (n=96) | | |
| Jenis kelamin | | | | | | | | | 0,829[a] |
| Laki-laki | 3 | 9,1 | 8 | 24,2 | 22 | 66,7 | 33 | 34,4 | |
| Perempuan | 8 | 12,7 | 13 | 20,6 | 42 | 66,7 | 63 | 65,6 | |
| Usia (tahun) | 37,7±15,1 | | 42,1±12,8 | | 44,8±13,9 | | 43,40±13,86 | | 0,260[b] |
| Tingkat pendidikan | | | | | | | | | 0,822[a] |
| Rendah | 5 | 10,6 | 9 | 19,1 | 33 | 70,2 | 47 | 49 | |
| Sedang | 5 | 13,5 | 10 | 27,0 | 22 | 59,5 | 37 | 38,5 | |
| Tinggi | 1 | 8,3 | 2 | 16,7 | 9 | 75 | 12 | 12,5 | |
| Status bekerja | | | | | | | | | 0,230[a] |
| Tidak bekerja | 7 | 17,9 | 7 | 17,9 | 25 | 64,1 | 39 | 40,6 | |
| Bekerja | 4 | 7,0 | 14 | 24,6 | 39 | 68,4 | 57 | 59,4 | |
| Status perkawinan | | | | | | | | | 0,408[a] |
| Tidak menikah | 3 | 20 | 4 | 26,7 | 8 | 53,3 | 15 | 15,6 | |
| Menikah | 8 | 9,9 | 17 | 21,0 | 56 | 69,1 | 81 | 84,4 | |
| Bangsal perawatan | | | | | | | | | 0,012[a] |
| Bedah | 1 | 4,8 | 1 | 4,8 | 19 | 90,5 | 21 | 21,9 | |
| Kebidanan | 3 | 11,5 | 3 | 11,5 | 20 | 76,9 | 26 | 27,1 | |
| Penyakit Dalam | 7 | 14,3 | 17 | 34,7 | 25 | 51 | 49 | 51 | |
| Kelas perawatan | | | | | | | | | 0,589[a] |
| Kelas I | 0 | 0 | 2 | 20 | 8 | 80 | 10 | 10,4 | |
| Kelas II | 2 | 20 | 3 | 30 | 5 | 50 | 10 | 10,4 | |
| Kelas III | 9 | 11,8 | 16 | 21,1 | 51 | 67,1 | 76 | 79,2 | |
| Lama rawat inap (hari) | 4,1±3,9 | | 3,2±2,3 | | 3,2±1,8 | | 3,3±2,2 | | 0,871[b] |
| Alasan memilih rumah sakit | | | | | | | | | 0,758[a] |
| Darurat/ rujukan | 6 | 9,7 | 14 | 22,6 | 42 | 67,7 | 62 | 64,6 | |
| Pilihan sendiri | 5 | 14,7 | 7 | 20,6 | 22 | 64,7 | 34 | 35,4 | |
| Cara pembayaran biaya RS | | | | | | | | | 0,478[a] |
| Biaya pribadi | 0 | 0,0 | 1 | 14,3 | 6 | 85,7 | 7 | 7,3 | |
| Asuransi | 11 | 12,4 | 20 | 22,5 | 58 | 65,2 | 89 | 92,7 | |
| Nafsu makan | | | | | | | | | 0,011[a] |
| Buruk | 5 | 17,2 | 11 | 37,9 | 13 | 44,8 | 29 | 30,2 | |
| Baik | 6 | 9,0 | 10 | 14,9 | 51 | 76,1 | 67 | 69,8 | |
| Tekstur diet/ bentuk makanan | | | | | | | | | 0,048[a] |
| Nasi | 7 | 14,0 | 6 | 12,0 | 37 | 74,0 | 50 | 52,1 | |
| Lunak | 4 | 8,7 | 15 | 32,6 | 27 | 58,7 | 46 | 47,9 | |
| Jenis intervensi diet | | | | | | | | | 0,795[a] |
| Makanan biasa non-diet | 4 | 9,3 | 9 | 20,9 | 30 | 69,8 | 43 | 44,8 | |
| Diet khusus | 7 | 13,2 | 12 | 22,6 | 34 | 64,2 | 53 | 55,2 | |

Sumber: Data Primer Terolah

Keterangan:

[a] Uji *chi-square* [b] Uji Kruskal-wallis

**Kepuasan Pasien terhadap Penyajian Diet Rumah Sakit**

Tingkat kepuasan pasien terhadap penyajian diet rumah sakit adalah 96,9 persen dan lebih besar daripada tingkat ketidakpuasannya (Tabel 2). Tingkat kepuasan pasien di kedua rumah sakit hampir sama, yaitu 98 persen di RSUD Kota Yogyakarta dan 95,7 persen di RSUD Bantul. Angka tersebut tidak berbeda secara statistik berdasarkan uji *chi-square* (p=0,606). Kedua RSUD ini merupakan rumah sakit tipe B dengan penyelenggaraan makanan swakelola dan sama-sama memiliki skor Indeks Kepuasan Masyarakat (IKM) dengan kategori baik sehingga keduanya

sebanding. Subyek penelitian di RSUD Yogyakarta yang dirawat inap di kelas I dan II menunjukkan tingkat kepuasan terhadap penyajian diet RS masing-masing sebesar 100 persen, sedangkan tingkat kepuasan terhadap penyajian diet RS bagi subyek di kelas rawat inap III sebesar 96,7 persen.

Tingkat kepuasan pasien terhadap setiap indikator penyajian diet juga menunjukkan nilai yang tidak jauh berbeda antara kedua rumah sakit. Indikator kepuasan penyajian diet dengan persentase "puas" tertinggi ditunjukkan pada indikator perilaku pramusaji (99%), diikuti peralatan makan (93,8%) dan penilaian menu secara umum (87,5%). Pada kategori "cukup puas", persentase terbesar dimiliki indikator porsi (92,7%), suhu makanan (89,6%), lingkungan fisik bangsal (88,5%), dan ketepatan waktu (87,5%), secara berturut-turut. Tidak ada subyek yang termasuk ke dalam kategori "kurang puas" pada indikator suhu makanan dan perilaku pramusaji. Indikator cita rasa memiliki persentase tertinggi pada kategori "kurang puas" (11,4%) dibandingkan indikator kepuasan penyajian diet lainnya.

### Karakteristik Individu Pasien pada Indikator Kepuasan Penyajian Diet yang Memiliki Persentase Ketidakpuasan Tertinggi

Indikator kepuasan penyajian diet yang memiliki tingkat "kurang puas" tertinggi yaitu cita rasa makanan. Tingkat kepuasan cita rasa makanan berdasarkan karakteristik individu pasien disajikan pada Tabel 3. Terdapat perbedaan tingkat kepuasan cita rasa makanan berdasarkan bangsal perawatan pasien ($p=0,012$). Pasien yang dirawat di bangsal penyakit dalam memiliki tingkat "kurang puas" yang tertinggi terhadap cita rasa makanan (14,3%), sedangkan pasien di bangsal bedah memiliki tingkat kurang puas yang terendah (4,8%). Karakteristik individu yang meliputi jenis kelamin, usia, tingkat pendidikan, status bekerja, status perkawinan, kelas perawatan, lama rawat inap, alasan memilih rumah sakit, cara pembayaran biaya RS, dan jenis diet tidak berbeda secara bermakna ($p>0,05$) antara subyek yang kurang puas, cukup puas, dan puas terhadap cita rasa makanan. Sementara itu, karakteristik individu berupa nafsu makan ($p=0,011$) dan tekstur diet/ bentuk makanan yang diterima ($p=0,048$) berbeda secara bermakna ($p<0,05$) antara subyek yang kurang puas, cukup puas, dan puas terhadap cita rasa makanan.

## BAHASAN

Sebanyak 96,9 persen pasien rawat inap dalam penelitian ini puas terhadap penyajian diet di rumah sakit. Tingkat kepuasan pasien dalam penelitian ini lebih tinggi daripada penelitian di salah satu rumah sakit pemerintah di Yogyakarta yang memperoleh hasil persentase kepuasan pasien terhadap pelayanan makanan sebesar 80,5 persen.[29] Penelitian ini dilakukan di dua RSUD tipe B yang memiliki nilai Indeks Kepuasan Masyarakat dengan mutu pelayanan B (kinerja unit pelayanan Baik), yakni 79 persen pada semester I tahun 2016 untuk RSUD Bantul dan 77,6 persen pada tahun 2017 untuk RSUD Kota Yogyakarta. Tingginya proporsi subyek pada kategori "puas" sejalan dengan hasil penelitian *systematic review* tentang kepuasan pasien terhadap penyelenggaraan makanan rumah sakit yang menyatakan bahwa kepuasan sebagian besar berkaitan dengan harapan[14], sehingga jika harapan terhadap kualitas penyelenggaraan makanan rendah maka kepuasan mungkin mendapat nilai yang tinggi.[30]

Selain itu, hasil tersebut dapat dipengaruhi oleh subyek penelitian yang sebagian besar (79,2%) dirawat di ruang perawatan kelas III dan menggunakan asuransi pemerintah sebagai cara pembayaran biaya RS. Berdasarkan hasil observasi dalam penelitian ini, beberapa subyek yang memberikan penilaian puas dalam kuesioner menyebutkan bahwa mereka menerima pelayanan apa adanya karena termasuk dalam kelompok pasien BPJS (Badan Penyelenggara Jaminan Sosial) dengan kategori PBI (Penerima Bantuan Iuran) sehingga dapat dikatakan iuran BPJS dibayarkan oleh pemerintah. Hasil penelitian di Wuhan Tiongkok menunjukkan terdapat perbedaan kepuasan pasien yang signifikan secara statistik berdasarkan kelompok jenis asuransi kesehatan, rasio penggantian biaya pengobatan, dan alasan memilih rumah sakit.[31] Pengeluaran pemerintah di bidang kesehatan mempunyai dampak yang besar terhadap kepuasan pasien karena pelayanan kesehatan dipersepsikan semestinya diberikan secara gratis oleh negara.[32]

Cita rasa makanan memiliki persentase tertinggi pada kategori "kurang puas" dibandingkan indikator kepuasan lain (Tabel 2). Temuan ini sejalan dengan penelitian di Malaysia yang menunjukkan cita rasa memiliki skor terendah dibandingkan dengan dimensi kepuasan penyajian diet lainnya berdasarkan isian kuesioner ACHFPSQ.[13] Hasil penelitian ini mengenai perbedaan kepuasan terhadap cita rasa makanan berdasarkan karakteristik individu (Tabel 3) juga sesuai dengan beberapa penelitian sebelumnya yang menunjukkan kepuasan pasien terhadap pelayanan makanan tidak berhubungan dengan usia[22], jenis kelamin[22,23], pendidikan[22,23], pekerjaan[23], lama rawat inap[22], kelas perawatan[23], dan jenis diet[23].

Namun, penelitian ini mendapati adanya perbedaan karakteristik individu berupa bangsal perawatan dan tekstur diet/bentuk makanan antara subyek yang kurang puas, cukup puas, dan puas terhadap cita rasa makanan yang disajikan (Tabel 3). Pasien di bangsal penyakit dalam memiliki tingkat kepuasan cita rasa makanan terendah, sedangkan pasien di bangsal bedah memiliki tingkat kepuasan tertinggi. Analisis lanjutan menunjukkan hubungan antara variabel bangsal perawatan dengan tekstur diet/bentuk makanan (p=0,000). Pasien yang dirawat di bangsal penyakit dalam pada penelitian ini lebih banyak mendapatkan bentuk makanan lunak berupa nasi tim atau bubur nasi (77,6%) dibandingkan pasien di bangsal bedah (38,1%). Makanan dengan tekstur yang lebih lunak cenderung memiliki kadar air yang lebih tinggi sehingga volumenya pun lebih besar dan bumbu menjadi lebih hambar.

Selain itu, dalam penelitian ini terdapat perbedaan karakteristik individu berupa nafsu makan antara subyek yang kurang puas, cukup puas, dan puas terhadap cita rasa makanan yang disajikan (Tabel 3). Hasil penelitian menunjukkan bahwa subyek yang memiliki nafsu makan buruk lebih banyak yang kurang puas terhadap cita rasa makanan (17,2%) dibandingkan yang memiliki nafsu makan baik (9%). Subyek yang memiliki nafsu makan baik lebih banyak yang puas terhadap cita rasa makanan (76,1%) dibandingkan subyek dengan nafsu makan buruk (44,8%). Semakin baik nafsu makan pasien maka kepuasan terhadap cita rasa makanan juga semakin tinggi. Hasil penelitian berbeda dengan penelitian di RS Dr. H. Abdul Moeleok Lampung yang menunjukkan tidak adanya hubungan antara selera makan dengan kepuasan pasien terhadap mutu pelayanan gizi.[22] Perbedaan ini dapat dipengaruhi oleh jenis penyakit dan diet yang diterima pasien. Sebanyak 55,2% subyek pada penelitian ini mendapat diet khusus sedangkan pada penelitian di RS Dr. H. Abdul Moeleok Lampung hanya 37,1 persen subyek mendapat makanan diet khusus, kemungkinan karena pasien yang dirawat tidak terlalu parah sakitnya. Penyakit yang diderita saat ini dan pengobatan yang diterima pasien dapat memengaruhi nafsu makan dan selera atau kemampuan merasakan makanan.[25]

Analisis lanjutan menggunakan uji *Mann-Whitney* menunjukkan adanya perbedaan tingkat kepuasan suhu makanan dan peralatan makan pada subyek yang memiliki nafsu makan baik dan buruk, dengan nilai signifikansi masing-masing sebesar p=0,003 dan p=0,036. Tidak ada subyek yang kurang puas terhadap suhu makanan dan hanya 1 orang subyek yang kurang puas terhadap indikator peralatan makan dalam penelitian ini (Tabel 2). Hasil penelitian di RSUD Kabupaten Aceh Tamiang menyebutkan bahwa alat makan berpengaruh terhadap nafsu makan pasien[33]. Meskipun RSUD Kota Yogyakarta dan RSUD Bantul tidak menggunakan troli dengan fasilitas penghangat makanan, mayoritas subyek menilai bahwa suhu makanan masih hangat sesampainya di meja pasien. Hal ini didukung oleh data capaian Standar Pelayanan Minimal (SPM) mengenai tingkat ketepatan waktu pemberian makanan di kedua rumah sakit yang mencapai 100 persen.

Tidak adanya subyek yang kurang puas terhadap suhu makanan juga dapat dipengaruhi oleh makanan di rumah sakit yang cenderung bertekstur lunak dan tidak kering. Sebuah penelitian menyatakan bahwa makanan yang basah atau kental seperti sup atau *puree* mampu mempertahankan panas lebih lama atau lebih lambat dalam proses pendinginan.[34] Penelitian di RS Roemani Muhammadiyah Kota Semarang menemukan bahwa terdapat korelasi bermakna antara suhu dan sisa makanan pada menu makanan pokok dan sayur, yaitu semakin tinggi suhu makanan maka semakin sedikit sisa makanan.[35]

Hasil penelitian menunjukkan 30,2 persen pasien merasa kurang nafsu makan atau sama sekali tidak memiliki nafsu makan dibandingkan

dengan sebelum mereka dirawat di rumah sakit. Hasil penelitian di RS Holistik Purwakarta menyebutkan bahwa pengolahan diet khusus untuk pasien rumah sakit yang menggunakan rempah dan bumbu alami belum mampu meningkatkan keinginan dan selera makan.[36] Berdasarkan hasil observasi di RSUD Bantul, makanan dengan diet khusus misalnya bubur diberikan penambahan garam dan pasien dengan diet rendah garam menggunakan bumbu garam lososa atau garam rendah natrium untuk menambah cita rasa. Permasalahan nafsu makan yang buruk pada subyek ditengarai bukan disebabkan oleh kurangnya penggunaan garam dan bumbu pada masakan, melainkan dipengaruhi oleh penyakit pasien. Sebanyak 21 orang subyek (21,9% dari total subyek atau 72,42 persen dari 29 pasien yang memiliki nafsu makan buruk) dalam penelitian ini dirawat di bangsal penyakit dalam.

Penurunan nafsu makan pada pasien tidak hanya terkait dengan kualitas pelayanan makanan rumah sakit tetapi dapat juga berhubungan dengan diagnosis, derajat rasa sakit, lingkungan, serta jenis dan jumlah pengobatan yang dijalani pasien. Strategi pemberian stimulan penambah nafsu makan dalam bentuk intervensi medis dan diet/makanan serta peningkatan kualitas atau cita rasa dan penampilan makanan dapat dipertimbangkan untuk mengurangi sisa makanan karena permasalahan klinis, menu, lingkungan dan pelayanan.[37] Hasil penelitian di RS Advent Medan menunjukkan bahwa faktor yang paling dominan memengaruhi kepuasan pasien dalam pelayanan makanan adalah waktu makan dan penampilan makanan.[38] Penelitian di sebuah RS pendidikan di Sri Lanka juga menemukan bahwa perbaikan penyajian makanan dapat meningkatkan konsumsi makanan dan kepuasan pasien serta menurunkan biaya makanan dan tingkat readmisi rawat inap.[39] Garnis dan penyajian makanan yang menarik akan mendorong pasien untuk mencoba makanan meskipun nafsu makannya rendah setelah perawatan.[40]

Karakteristik individu lain yaitu jenis kelamin, usia, tingkat pendidikan, status bekerja, kelas perawatan, lama rawat inap, alasan memilih rumah sakit, cara pembayaran, dan jenis intervensi diet yang diterima tidak berbeda secara bermakna pada subyek dengan tingkat kepuasan cita rasa makanan yang berbeda (p>0,05). Hal ini dapat dipengaruhi oleh adanya ketentuan hari rawat inap di suatu fasilitas pelayanan kesehatan pada pasien yang menggunakan BPJS untuk pembiayaan pengobatannya, termasuk pada pasien kelas III. Lama rawat inap pasien di rumah sakit dalam penelitian ini tidak terlalu panjang dengan rerata 3,4 hari atau kurang dari 4 hari. Oleh sebab itu, pasien memiliki penilaian kepuasan pada jenis menu yang terbatas selama ia dirawat dibandingkan dengan keseluruhan siklus menu yang dimiliki rumah sakit. Hasil penelitian ini sesuai dengan penelitian di Malaysia yang menunjukkan lama rawat inap tidak memengaruhi kepuasan pasien karena sebagian besar subjek (60,8%) dirawat inap tidak lebih dari seminggu (4-7 hari), sedangkan pengulangan menu yang berkontribusi terhadap ketidakpuasan terjadi setelah kurun waktu seminggu.[13]

Kedua lokasi penelitian telah memenuhi Standar Akreditasi Rumah Sakit versi SNARS di mana predikat akreditasi paripurna diperolah RSUD Bantul pada tahun 2018 dan RSUD Kota Yogyakarta pada tahun 2019. Namun, pelaksanaan penelitian ini di RSUD Bantul hanya melibatkan pasien rawat inap kelas III terkait izin pengambilan sampel yang diperbolehkan oleh rumah sakit, sehingga terdapat sebaran sampel penelitian yang tidak merata dari berbagai kelas perawatan dengan pengambilan sampel secara *non-random*. Hal tersebut dapat memengaruhi hasil penelitian terkait faktor karakteristik individu dan kepuasan pasien serta merupakan keterbatasan penelitian ini. Keterbatasan lainnya yaitu peneliti tidak berfokus pada *outcome* terapi medis dan asuhan gizi tetapi pada aspek penyelenggaraan makanan rumah sakit yaitu penyajian makanan. Oleh karena itu, faktor diagnosis penyakit dan terapi obat yang dapat memengaruhi nafsu makan pasien tidak dianalisis dalam penelitian ini.

## SIMPULAN DAN SARAN

### Simpulan

Tingkat kepuasan pasien pada penyajian diet rumah sakit di RSUD Bantul dan RSUD Kota Yogyakarta tergolong tinggi. Indikator "kepuasan terhadap cita rasa" memiliki persentase "kurang puas" yang tertinggi. Tingkat kepuasan pasien terhadap cita rasa

makanan berbeda signifikan berdasarkan karakteristik individu yaitu bangsal perawatan, nafsu makan dan tekstur diet/ bentuk makanan.

**Saran**

Cita rasa makanan merupakan indikator penyajian diet rumah sakit dengan tingkat ketidakpuasan yang tertinggi. Guna meningkatkan kepuasan pasien pada aspek tersebut, diperlukan intervensi yang dapat meningkatkan nafsu makan pasien serta memperbaiki cita rasa termasuk penampilan makanan diet. Rumah sakit juga disarankan melakukan survei kepuasan pasien terhadap penyajian diet secara berkala untuk mengukur dampak perbaikan penyelenggaraan makanan, salah satunya dapat menggunakan kuesioner ACHFPSQ yang telah diterapkan dalam penelitian ini. Penelitian selanjutnya disarankan untuk dilakukan pada sampel pasien dengan sebaran yang merata dari berbagai kelas perawatan dan tidak hanya di rumah sakit tipe B untuk mengetahui faktor-faktor yang memengaruhi tingkat kepuasan pasien secara komprehensif.

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# ANALISIS KANDUNGAN GIZI, TOTAL FENOL, DAN SIFAT ORGANOLEPTIK TEMPE DENGAN SUBSTITUSI BIJI LAMTORO (LEUCAENA LEUCOCEPHALA)

*Analysis of Nutrient, Total Phenolic Content, and Organoleptic Properties of Tempe with Lamtoro Seed (Leucaena Leucocephala) Substitution*

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**ABSTRACT**

**Tempe is a traditional food from Indonesia. The purpose of this study was to analyze the effect of the substitution of lamtoro seeds on the nutritional content, total phenol, and organoleptic properties of soybean tempe and determine the selected formula. The research method used was experimental with a one-factor Completely Randomized Design (CRD) with two repetitions. There were four treatment levels with different ratios of lamtoro seeds and soybeans, namely F0 (0:100), F1 (40:60), F2 (50:50), and F3 (60:40). Analysis of water content using the gravimetric method. Analysis of ash content using dry ashing method. Analysis of protein content using the Kjeldahl method. Analysis of fat content using the Soxhlet method. Analysis of crude fiber content using the gravimetric method. Analysis of carbohydrate content using the by-difference method. Analysis of total phenol using the Folin-Ciocalteu method. The ANOVA results showed that the substitution of lamtoro seeds had a significant effect on the water, protein, fat, carbohydrates, ash, and phenol content in tempeh ($p<0.05$). The results of the organoleptic analysis showed that the substitution of lamtoro seeds had a significant effect on the panelists' preference for color and texture parameters ($p<0.05$). F3 became the chosen formula with 66.17 percent water content, 12.16 percent protein, 5.85 percent fat, 13.7 percent carbohydrates, 1.36 percent ash, 2.23 percent crude fiber, and 0.77 mg phenol. Further research is needed to see the effect of the length of fermentation in the manufacture of tempe on the nutritional content.**

**Keywords: lamtoro seeds, nutrient, tempe, total phenolic compound**

**ABSTRAK**

**Tempe merupakan makanan tradisional khas masyarakat Indonesia. Tujuan penelitian ini adalah menganalisis pengaruh substitusi biji lamtoro terhadap kandungan gizi, total fenol dan sifat organoleptik tempe kedelai serta menentukan formula terpilihnya. Metode penelitian yang digunakan yaitu eksperimental dengan desain Rancangan Acak Lengkap (RAL) satu faktor dengan dua kali pengulangan. Terdapat empat taraf perlakuan dengan perbandingan biji lamtoro dan kedelai yang berbeda yaitu F0 (0:100), F1 (40:60), F2 (50:50), dan F3 (60:40). Analisis kandungan air menggunakan metode gravimetri. Analisis kandungan abu menggunakan metode pengabuan kering. Analisis kandungan protein menggunakan metode kjeldahl. Analisis kandungan lemak menggunakan metode soxhlet. Analisis kandungan serat kasar menggunakan metode gravimetri. Analisis kandungan karbohidrat menggunakan metode *by difference*. Analisis total fenol menggunakan metode folin-ciocalteu. Hasil ANOVA menunjukkan bahwa substitusi biji lamtoro berpengaruh nyata terhadap kadar air, protein, lemak, karbohidrat, abu, dan fenol pada tempe ($p<0,05$). Hasil analisis organoleptik menunjukkan bahwa substitusi biji lamtoro berpengaruh nyata terhadap tingkat kesukaan panelis pada parameter warna dan tekstur ($p<0,05$). F3 menjadi formula terpilih dengan kandungan air 66,17 persen, protein 12,16 persen, lemak 5,85 persen, karbohidrat 13,7 persen, abu 1,36 persen, serat kasar 2,23 persen dan fenol 0,77 mg. Penelitian lanjutan diperlukan untuk melihat pengaruh lama fermentasi dalam pembuatan tempe terhadap kandungan gizi.**

**Kata kunci: biji lamtoro, tempe, kandungan gizi, total fenol**

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## PENDAHULUAN

Tempe merupakan makanan tradisional khas masyarakat Indonesia. Umumnya tempe terbuat dari fermentasi biji kedelai. Akan tetapi produksi biji kedelai tidak dapat memenuhi kebutuhan kedelai Indonesia, sehingga diperlukan impor kedelai dari luar negeri. Untuk mengurangi penggunaan kedelai dalam pembuatan tempe maka diperlukan inovasi dalam pembuatan tempe yaitu dengan substitusi biji kedelai. Saat ini sudah banyak yang mengembangkan produk tempe selain tempe dari kedelai, salah satunya yaitu tempe dapat terbuat dari bahan leguminosa non kedelai seperti tempe dari kacang hijau, kacang merah, koro, kecipir, kedelai hitam, dan biji lamtoro.[1]

Biji lamtoro merupakan tumbuhan yang banyak dijumpai di Indonesia. Biji lamtoro yang muda biasa dikonsumsi sebagai lalapan dan diolah menjadi makanan yang disebut botok. Biji lamtoro telah digunakan untuk berbagai tujuan seperti pengobatan penyakit perut dan pengobatan diabetes.[2] Ekstrak biji lamtoro juga terbukti dapat menghambat peningkatan kadar glukosa darah dan lipid.[3] Hal tersebut dikarenakan biji lamtoro merupakan salah satu sumber fenol. Senyawa fenol sendiri merupakan salah satu zat antioksidan yang dapat memblokir produksi radikal bebas intraseluler atau mencegah radikal bebas untuk mencegah stress oksidatif.[4] Penelitian ini bertujuan untuk mengetahui pengaruh substitusi biji kedelai dengan biji lamtoro terhadap kandungan gizi, total fenol dan sifat organoleptik pada tempe.

## METODE PENELITIAN

### Desain Penelitian

Penelitian ini menggunakan desain studi eksperimental dengan metode Rancangan Acak Lengkap (RAL) satu faktor dengan dua kali pengulangan terdiri dari empat taraf perlakuan, dengan perbandingan biji lamtoro dan biji kedelai yaitu F0 (0:100), F1 (60:40), F2 (50:50), dan F3 (60:40). Data kandungan proksimat, serat kasar dan total fenol dianalisis menggunakan ANOVA (*Analysis of Variance*) dengan uji lanjut Duncan, sementara untuk data sifat organoleptik dianalisis menggunakan uji Kruskal Wallis dengan uji lanjut Mann-Whitney. Penentuan formula terpilih menggunakan Metode Perbandingan Eksponensial (MPE) dengan mempertimbangkan hasil analisis kandungan proksimat, total fenol dan hasil uji organoleptik. Penelitian ini dilakukan setelah mendapatkan surat izin ethical clearance dari Komisi Etik Penelitian Kesehatan (KEPK) Universitas Pembangunan Nasional Veteran Jakarta Nomor 98/IV/2022/KEPK.

### Pembuatan Tempe

Pembuatan tempe pada penelitian kali ini dilakukan berdasarkan penelitian terdahulu lalu dimodifikasi.[5,6] Modifikasi yang dilakukan adalah penggantian bahan baku, pemilihan proporsi pada formulasi dan proses pembuatan. Langkah-langkah dalam pembuatan tempe dimulai dari memilah biji kedelai dan biji lamtoro guna menghilangkan kotoran yang terdapat pada bahan. Langkah selanjutnya, kedua bahan ditimbang sesuai dengan berat yang dibutuhkan. Tahap selanjutnya yaitu mencuci semua bahan dasar pembuatan tempe dengan menggunakan air bersih hingga tiga kali penggantian air. Setelah itu, rendam kedelai selama 2 jam dan biji lamtoro selama 12 jam. Selanjutnya kedelai dan biji lamtoro direbus selama masing-masing 1 jam dan 2 jam dengan suhu 100$^{o}$C hingga mendidih. Setelah itu, kedelai dan biji lamtoro dikupas dan dicuci kembali. Kemudian, kedelai dan biji lamtoro direndam selama 24 jam dalam dua wadah yang terpisah dengan perbandingan bahan dan air sebanyak 1:4 dan ditambahkan cairan Palape (pengawet alami tempe). Perendaman bertujuan untuk pengasaman dan hidrasi biji kedelai maupun biji lamtoro. Cairan palape ditambahkan untuk menghemat waktu pembuatan tempe dan untuk membuat tempe lebih tahan lama. Setiap 1 liter air perendaman ditambahkan 20 ml palape. Setelah itu, cuci bersih kedelai dan biji lamtoro untuk menghilangkan lendir. Langkah selanjutnya, biji kedelai dan biji lamtoro dikukus di dandang selama 30 menit setelah dandang mendidih. Tahap selanjutnya adalah pendinginan dilakukan selama 15 menit di wadah yang terbuka. Ketika semua bahan sudah dingin, tahap selanjutnya adalah menakar bahan sesuai dengan proporsi yang telah ditentukan. Kemudian dilakukan peragian, yaitu mencampur biji kedelai dan biji lamtoro menggunakan ragi dengan perbandingan 1 gr ragi setiap 100 gram

berat bahan. Kemudian adonan tempe dibungkus dengan plastik dan dilubangi di bagian depan dan belakang supaya oksigen dapat masuk. Langkah yang terakhir yaitu pemeraman tempe yang dilakukan selama 32 jam.

### Analisis Kandungan Gizi

Analisis kandungan air menggunakan metode gravimetri. Analisis kandungan abu menggunakan metode pengabuan kering. Analisis kandungan protein menggunakan metode kjeldahl. Analisis kandungan lemak menggunakan metode soxhlet. Analisis kandungan serat kasar menggunakan metode gravimetri.[7] Analisis kandungan karbohidrat menggunakan metode *by difference*.[8] Analisis total fenol menggunakan metode folin-ciocalteu.[9]

### Uji Organoleptik

Uji organoleptik dilakukan oleh panelis semi terlatih sejumlah 30 orang. Pengujian ini bertujuan untuk mengetahui tingkat kesukaan panelis dari produk yang diteliti. Parameter yang dinilai oleh panelis adalah warna, aroma, rasa dan tekstur. Penilaian menggunakan skala 1-5. Penilaian komponen dimulai dari angka 1 (Sangat Tidak Suka), 2 (Tidak Suka), 3 (Biasa), 4 (Suka) dan 5 (Sangat Suka).

## HASIL

Hasil ANOVA menunjukkan bahwa substitusi biji lamtoro pada tempe kedelai terdapat pengaruh nyata terhadap peningkatan kadar air pada perlakuan F0, F1, F2, dan F3 dengan nilai p=0,01. Berdasarkan hal tersebut, perlu dilakukan uji lanjut Duncan untuk mengetahui perbedaan pada masing-masing perlakuan. Hasil dari uji Duncan menunjukkan bahwa kadar air F0 memiliki perbedaan yang nyata dengan kadar air F1, F2 dan F3, sedangkan kadar air pada perlakuan F1 tidak memiliki perbedaan nyata dengan kadar air pada perlakuan F2 dan F3. Pada Tabel 1 dapat dilihat kadar air pada tempe berkisar antara 60,86-66,17 persen. Kadar air pada F0, F1, F2, dan F3 secara berturut-turut yaitu 60,86 persen, 64,56 persen, 65,4 persen, dan 66,17 persen. Kadar air tertinggi terdapat pada perlakuan F3 dengan 66,17 persen, sedangkan kadar air terendah terdapat pada perlakuan F0 (60,86%).

Hasil ANOVA menunjukkan bahwa substitusi biji lamtoro pada tempe kedelai terdapat pengaruh nyata terhadap penurunan kadar protein pada perlakuan F0, F1, F2, dan F3 dengan nilai p=0,043. Berdasarkan hal tersebut, perlu dilakukan uji lanjut Duncan untuk mengetahui perbedaan pada masing-masing perlakuan. Berdasarkan uji Duncan, Kadar protein pada perlakuan F0 memiliki perbedaan yang nyata dengan kadar protein pada perlakuan F2 dan F3, sedangkan kadar protein pada perlakuan F1 tidak memiliki perbedaan yang nyata dengan kadar protein pada perlakuan F0, F2 maupun F3. Pada Tabel 2 dapat dilihat kadar protein tempe kedelai dengan substitusi biji lamtoro berkisar antara 12,16-14,74 persen. Kadar protein F0, F1, F2, dan F3 secara berurutan yaitu 14,74 persen, 13,74 persen, 12,71 persen, dan 12,16 persen. Perlakuan F0 memiliki kadar protein tertinggi dengan 14,74 persen, sedangkan perlakuan F3 memiliki kadar protein terendah dengan 12,16 persen.

Hasil ANOVA menunjukkan bahwa substitusi biji lamtoro pada tempe kedelai terdapat pengaruh nyata terhadap penurunan kadar lemak pada perlakuan F0, F1, F2, dan F3 dengan nilai p=0,005. Berdasarkan hal tersebut, perlu dilakukan uji lanjut Duncan supaya dapat mengetahui perbedaan pada masing-masing perlakuan. Hasil dari uji Duncan menunjukkan bahwa kadar lemak pada perlakuan F0 memiliki perbedaan yang nyata dengan perlakuan F1, F2 dan F3, sedangkan kadar lemak pada perlakuan F1 tidak berbeda nyata dengan perlakuan F2 dan F3. Pada Tabel 3 dapat dilihat kadar lemak tempe kedelai dengan substitusi biji lamtoro berkisar antara 5,85-8,92 persen. Kadar lemak F0, F1, F2, dan F3 secara berurutan yaitu 8,92 persen, 6,78 persen, 6,24 persen, 5,85 persen. Perlakuan F0 memiliki kadar lemak tertinggi dengan 8,92 persen, sedangkan perlakuan F3 memiliki kadar lemak terendah dengan 5,85 persen.

Tabel 1

Uji Organoleptik Tempe Kedelai dengan Substitusi Biji Lamtoro

| Parameter | Sampel | | | |
|---|---|---|---|---|
| | F0 | F1 | F2 | F3 |
| Kadar Air (%) | 60,86±0,933[a] | 64,56±1,1[b] | 65,4±0,12[b] | 66,17±0,76[b] |
| Protein (%) | 14,74±0,24[a] | 13,79±1,17[ab] | 12,71±0,12[b] | 12,16±0,14[b] |
| Lemak (%) | 8,92±0,59[a] | 6,78±0,46[b] | 6,24±0,32[b] | 5,85±0,08[b] |
| Karbohidrat (%) | 15,11±0,15[a] | 14,59±0,1[b] | 14,41±0,16[b] | 13,7±0,25[c] |
| Abu (%) | 0,77±0,04[a] | 0,87±0,04[a] | 0,99±0,01[b] | 1,36±0,05[c] |
| Serat (%) | 2,57±0,18[a] | 3,24±0,19[b] | 3,9±0,01[c] | 4,45±0,29[c] |
| Fenol (mg) | 0,615±0,007[a] | 0,655±0,007[b] | 0,720±0,014[c] | 0,770±0,000[d] |

Keterangan : [a,b,c] = notasi huruf berbeda berarti terdapat perbedaan nyata pada Uji Duncan (p<0,05)

Hasil ANOVA menunjukkan bahwa substitusi biji lamtoro pada tempe kedelai berpengaruh nyata terhadap penurunan kadar karbohidrat pada perlakuan F0, F1, F2, dan F3 dengan nilai p=0,006. Berdasarkan hal tersebut, perlu dilakukan uji lanjut Duncan supaya dapat mengetahui perbedaan pada masing-masing perlakuan. Hasil dari uji Duncan menunjukkan bahwa kadar karbohidrat pada perlakuan F0 berbeda nyata dengan kadar karbohidrat perlakuan F1, F2 dan F3, sedangkan kadar karbohidrat pada perlakuan F1 memiliki perbedaan yang nyata perlakuan F3 tetapi tidak dengan F2. Pada Tabel 4 dapat dilihat kadar karbohidrat tempe kedelai dengan substitusi biji lamtoro berkisar antara 13,7-15,11 persen. Kadar karbohidrat perlakuan F0, F1, F2, dan F3 secara berurutan yaitu 15,11 persen, 14,59 persen, 14,41 persen, 13,7 persen. Perlakuan F0 memiliki kadar karbohidrat tertinggi dengan 15,11 persen, sedangkan perlakuan F3 memiliki kadar karbohidrat terendah dengan 13,7 persen.

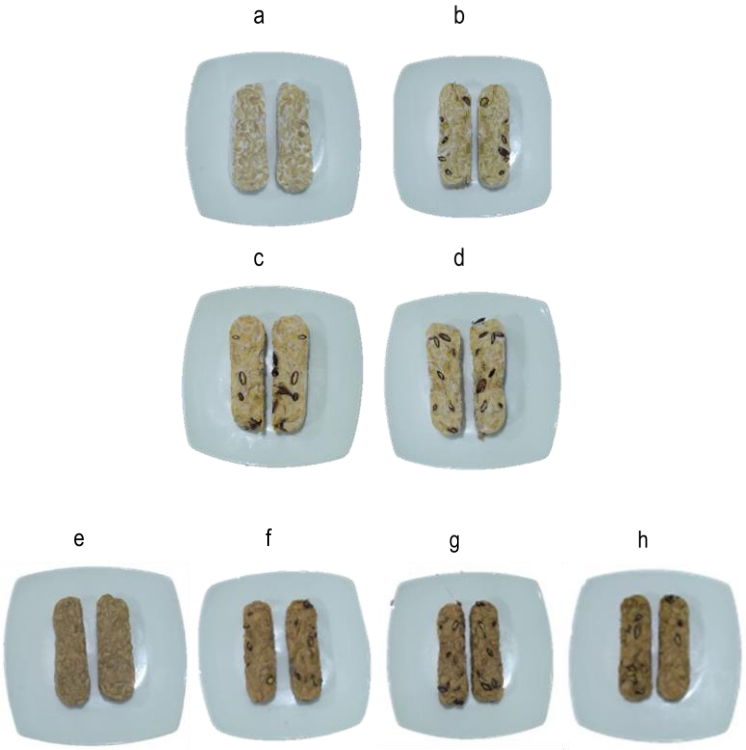
Hasil ANOVA menunjukkan bahwa substitusi biji lamtoro pada tempe kedelai berpengaruh nyata terhadap peningkatan kadar abu pada perlakuan F0, F1, F2, dan F3 dengan nilai p=0,001. Berdasarkan hal tersebut, perlu dilakukan uji lanjut Duncan untuk dapat mengetahui perbedaan pada masing-masing perlakuan. Hasil dari uji Duncan menunjukkan bahwa kadar abu pada perlakuan F0 berbeda nyata dengan kadar abu pada perlakuan F2 dan F3 tetapi tidak dengan perlakuan F1, lalu kadar abu pada perlakuan F2 terdapat perbedaan yang nyata dengan perlakuan F1 dan F3. Pada Tabel 5 dapat dilihat hasil analisis kadar abu tempe kedelai dengan substitusi biji lamtoro berkisar antara 0,77-1,36 persen. Kadar abu pada perlakuan F0, F1, F2, dan F3 secara berturut-turut yaitu 0,77 persen, 0,87 persen, 0,99 persen, 1,36 persen. Perlakuan F3 memiliki kadar abu tertinggi dengan 1,36, sedangkan perlakuan F0 memiliki kadar abu terendah dengan 0,77 persen.

Hasil ANOVA menunjukkan bahwa substitusi biji lamtoro pada tempe kedelai berpengaruh nyata terhadap peningkatan kadar serat kasar pada perlakuan F0, F1, F2, dan F3 dengan nilai p=0,004. Berdasarkan hal tersebut, perlu dilakukan uji lanjut Duncan untuk dapat mengetahui perbedaan pada masing-masing perlakuan. Hasil dari uji Duncan menunjukkan bahwa kadar serat kasar pada perlakuan F0 memiliki perbedaan yang nyata dengan perlakuan F1, F2 dan F3, sedangkan kadar serat kasar pada perlakuan F2 tidak memiliki perbedaan yang nyata dengan perlakuan F3. Pada Tabel 6 dapat dilihat hasil analisis kadar serat tempe kedelai dengan substitusi biji lamtoro berkisar antara 2,57-4,45 persen. Kadar serat kasar pada perlakuan F0, F1, F2, dan F3 secara berurutan yaitu 2,57 persen, 3,24 persen, 3,9 persen, 4,45 persen. Perlakuan F3 memiliki kadar serat kasar tertinggi dengan 4,45 persen, sedangkan perlakuan F0 memiliki kadar serat kasar terendah dengan 2,57 persen .

Berdasarkan hasil analisis bahan baku biji lamtoro dan biji kedelai diperoleh kandungan total fenol biji lamtoro sebesar 1,3 mg/100 gr

dan kandungan total fenol pada biji kedelai sebesar 0,2 mg/100 gr. Hasil ANOVA menunjukkan bahwa substitusi biji lamtoro pada tempe kedelai memiliki pengaruh yang nyata terhadap peningkatan kadar fenol pada perlakuan F0, F1, F2, dan F3 dengan nilai p=0,00. Berdasarkan hal tersebut, perlu dilakukan uji lanjut Duncan untuk dapat mengetahui perbedaan pada masing-masing perlakuan. Hasil dari uji Duncan menunjukkan bahwa kadar fenol pada perlakuan F0, F1, F2, dan F3 berbeda nyata satu sama lain. Pada Tabel 7 dapat dilihat hasil analisis total fenol tempe kedelai dengan substitusi biji lamtoro berkisar antara 0,62-0,77 mg. Kadar fenol pada perlakuan F0, F1, F2, dan F3 secara berurutan yaitu 0,62 mg, 0,66 mg 0,72 mg, 0,77 mg. Perlakuan F3 memiliki kandungan total fenol tertinggi sebesar 0,77 mg, sedangkan perlakuan F0 memiliki kandungan total fenol terendah yakni 0,62 mg.

Hasil analisis menunjukkan bahwa substitusi biji lamtoro pada tempe kedelai berpengaruh nyata terhadap warna pada perlakuan F0, F1, F2, dan F3 dengan nilai p=0,002. Berdasarkan hal tersebut, perlu dilakukan uji lanjut *Mann-Whitney* untuk melihat perlakuan yang berbeda. Hasil analisis *Mann-Whitney* menunjukkan bahwa tingkat kesukaan tekstur tempe kedelai dengan substitusi biji lamtoro berbeda nyata pada perlakuan F0 dengan F1 (p=0,043), lalu pada perlakuan F0 dengan F2 juga berbeda nyata (p=0,001), begitu pula dengan perlakuan F0 dengan F3 yang juga berbeda nyata (p = 0,001) sedangkan pada perlakuan F1 dengan F2, perlakuan F1 dengan F3 serta perlakuan F2 dengan F3 tidak memiliki perbedaan yang nyata (p>0,05). Penampakan warna tempe kedelai dengan substitusi biji lamtoro dapat dilihat pada Gambar 1.




Keterangan : a (F0 mentah), b (F1 mentah), c (F2 mentah), d (F3 mentah), e (F0 goreng), f (F1 goreng), g (F2 goreng), f (F3 goreng)

Gambar 1

Hasil Tempe Dengan Substitusi Biji Lamtoro

Hasil analisis menunjukkan bahwa substitusi biji lamtoro pada tempe kedelai berpengaruh nyata terhadap tekstur pada perlakuan F0, F1, F2, dan F3 dengan nilai p=0,003. Berdasarkan hal tersebut, perlu dilakukan uji lanjut *Mann-Whitney* untuk mengetahui perlakuan yang berbeda. Hasil analisis Mann-Whitney menunjukkan bahwa tingkat kesukaan tekstur tempe kedelai dengan substitusi biji lamtoro berbeda nyata pada F0 dengan F1 (p=0,002), lalu pada F0 dengan F2 juga berbeda nyata (p=0,008), begitu pula dengan F0 dengan F3 yang juga berbeda nyata (p=0,001) sedangkan pada perlakuan F1 dengan F2, perlakuan F1 dengan F3 serta perlakuan F2 dengan F3 tidak memiliki perbedaan nyata (p>0,05). Hasil analisis menunjukkan bahwa substitusi biji lamtoro pada tempe kedelai tidak memiliki pengaruh yang nyata terhadap aroma (p=0,385) dan rasa (p=0,236) pada perlakuan F0, F1, F2, dan F3.

## BAHASAN

Peningkatan kadar air pada tempe seiring dengan peningkatan komposisi substitusi biji lamtoro berkaitan dengan kadar air biji lamtoro (14,31%) lebih tinggi jika dibandingkan dengan kedelai (6,49%). Perbedaan tersebut memiliki angka yang cukup jauh. Kadar air biji kedelai 2,2 kali lipat lebih tinggi dibandingkan kadar air biji lamtoro.[10] Peningkatan kadar air pada tempe selaras dengan penurunan karbohidrat. Proses pemecahan karbohidrat selama fermentasi akan menghasilkan air.[11] Hal ini diperkuat dari data penurunan karbohidrat seiring dengan peningkatan substitusi biji lamtoro pada Tabel 4. Biji kedelai dan biji lamtoro sama-sama mengalami proses hidrasi selama proses perendaman dan perebusan. Hal tersebut menyebabkan kadar air meningkat karena air mengalami difusi ke bahan baku.[12]

Penurunan kadar protein dapat dilihat pada Tabel 1. Hal tersebut sejalan dengan penelitian terdahulu, bahwa semakin tinggi substitusi biji lamtoro pada tempe kedelai maka kadar protein semakin menurun.[5] Kadar protein tempe dipengaruhi oleh kadar protein bahan baku. Penurunan kadar protein seiring dengan peningkatan komposisi substitusi biji lamtoro berkaitan dengan kadar protein biji lamtoro (19,75%) lebih rendah jika dibandingkan dengan kedelai (36,17%). Perbedaan tersebut memiliki angka yang cukup jauh. Protein biji kedelai 1,8 kali lipat lebih tinggi dibandingkan protein biji lamtoro.[10] Penurunan kadar protein disebabkan oleh proses pemanasan. Proses pemanasan membuat protein menjadi rusak karena mengalami denaturasi.[13]

Penurunan kadar lemak seiring dengan peningkatan komposisi substitusi biji lamtoro dikarenakan kadar lemak pada biji lamtoro lebih rendah daripada kadar lemak pada biji kedelai, kadar lemak pada biji lamtoro 5,58 persen sedangkan kadar lemak pada biji kedelai 19,45 persen.[10] Lemak dapat menguap dan mencair selama proses perebusan karena lemak memiliki sifat tidak tahan panas.[14] Penurunan kadar karbohidrat pada tempe selaras dengan peningkatan kadar air. Proses pemecahan karbohidrat selama fermentasi akan menghasilkan air.[11] Hal ini diperkuat dari data penurunan karbohidrat seiring dengan peningkatan substitusi biji lamtoro

Semakin tinggi substitusi biji lamtoro maka kadar abu tempe akan semakin meningkat. Peningkatan kadar abu seiring dengan meningkatnya komposisi substitusi biji lamtoro disebabkan tingginya kadar abu biji lamtoro (4,4%) jika dibandingkan dengan kedelai (4,1%).[15] Hal tersebut sama seperti dengan penelitian sebelumnya, yakni semakin tinggi substitusi biji lamtoro maka kadar abu akan semakin tinggi. Kadar abu pada biji lamtoro 1,1 kali lipat lebih tinggi dari biji kedelai.[10]

Peningkatan kadar serat seiring dengan meningkatnya komposisi substitusi biji lamtoro disebabkan tingginya kadar serat biji lamtoro (32,5%) jika dibandingkan dengan kedelai (30,1%).[15] Peningkatan kadar serat kasar disebabkan oleh proses fermentasi selama pembuatan tempe. Selama proses pembuatan tempe, kapang *Rhizopus sp*. membentuk miselium pada permukaan biji. Miselium terdiri dari hifa yang semakin lama fermentasi maka akan menjadi lebih tebal, lebih padat dan menghasilkan bentuk tempe yang lebih kompak. Miselium terdiri dari hifa yang mengandung protoplasma dan dilapisi dengan dinding sel. Kitin dan selulosa merupakan komponen dari dinding sel pada miselia. Selulosa merupakan salah satu penyusun serat kasar.

Semakin tinggi substitusi biji lamtoro maka kandungan total fenol tempe semakin

meningkat. Kandungan total fenol pada biji lamtoro mempengaruhi peningkatan kadar total fenol pada tempe. Hal tersebut dikarenakan kandungan fenol pada biji lamtoro (1,3 g/100 g) lebih tinggi jika dibandingkan dengan kandungan fenol kedelai (0,2 g/100 g). Perbedaan tersebut memiliki angka yang cukup jauh. Fenol biji lamtoro 6,5 kali lipat lebih tinggi dibandingkan fenol kedelai. Peningkatan kadar fenol terjadi karena adanya aktivitas mikrobia yang menghasilkan senyawa fenol.[16] Enzim β-glukosidase pada kapang melepaskan aglikon dari substrat biji-bijian sehingga senyawa fenol meningkat.[17] Senyawa fenol memiliki sifat yang rentan terhadap cahaya, oksigen, dan panas. Fenol bersifat asam, mudah teroksidasi, serta mudah menguap.[18]

Warna tempe kedelai dengan substitusi biji lamtoro dipengaruhi oleh komposisi tempe. Semakin banyak jumlah lamtoro pada tempe maka akan semakin banyak warna coklat, semakin banyak jumlah biji kedelai pada tempe lebih banyak maka akan memberikan warna yang lebih putih. Hal tersebut sama seperti dengan penelitian sebelumnya, yakni semakin tinggi substitusi biji lamtoro yang digunakan maka miselium kapang yang tumbuh pada permukaan tempe akan berkurang ketebalannya sehingga warna dan penampakan tempe menjadi kurang putih dibandingkan dengan tempe kedelai.[5]

Aktivitas kapang yang dapat memecah komponen dalam tempe mempengaruhi aroma pada tempe dengan memberikan aroma khas pada tempe. Aroma yang unik terbentuk karena pemecahan komponen-komponen tempe selama proses fermentasi.[5] Kapang Rhizophus mensintesis pati dari biji-bijian menjadi monosakarida, mengubahnya menjadi asam organik sehingga menghasilkan tempe dengan aroma yang khas. Tempe dengan substitusi biji lamtoro menghasilkan aroma yang lebih wangi karena biji lamtoro mengandung kandungan fenol yang lebih tinggi dibanding kedelai, hal tersebut dikarenakan fenol yang merupakan senyawa aromatik.[19]

Rasa tempe kedelai dengan substitusi biji lamtoro dipengaruhi oleh komposisi biji lamtoro, semakin tinggi substitusi biji lamtoro maka rasa tempe akan terasa asam. Kapang Rhizopus yang tumbuh pada tempe menghasilkan enzim protease yang berfungsi memecah protein menjadi asam amino bebas dan memberikan cita rasa gurih.[5] Tempe yang digoreng dapat menambah rasa lezat dan gurih pada tempe. Bahan makanan yang digoreng memiliki cita rasa yang lebih gurih.[20]

## SIMPULAN DAN SARAN

### Simpulan

Substitusi biji lamtoro menunjukkan adanya pengaruh yang nyata terhadap kadar air (p=0,01), kadar protein (p=0,04), kadar lemak (p=0,005), kadar karbohidrat (p=0,006), kadar abu (p=0,001), kadar serat kasar (p=0,004) dan kadar total fenol pada tempe kedelai (p=0,00). Hasil uji organoleptik parameter warna (p=0,002) dan tekstur (p=0,003) tempe kedelai dengan substitusi biji lamtoro menunjukkan adanya pengaruh nyata, sedangkan pada parameter aroma (p=0,385) dan rasa (p=0,236) didapatkan pengaruh yang tidak nyata. F3 menjadi formula terpilih dengan kandungan air 66,17 persen, protein 12,16 persen, lemak 5,85 persen, karbohidrat 13,7 persen, abu 1,36 persen, serat kasar 2,23 persen dan fenol 0,77 mg.

### Saran

Penelitian lanjutan diperlukan untuk melihat pengaruh lama fermentasi dalam pembuatan tempe terhadap kandungan gizi, kadar total fenol dan sifat organoleptik tempe. Penelitian indeks glikemik tempe dengan substitusi biji lamtoro juga diperlukan untuk mengetahui efeknya terhadap glukosa darah.

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# NUTRITION SECURITY AMONG UNIVERSITY STUDENTS DURING COVID-19 COMMUNITY ACTIVITY RESTRICTION: A CROSS-SECTIONAL STUDY IN SEMARANG, INDONESIA

*Ketahanan Gizi Mahasiswa Selama Pembatasan Aktivitas Masyarakat COVID-19: Studi Cross-Sectional di Semarang, Indonesia*

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## ABSTRACT

**The COVID-19 pandemic has had a significant impact on various aspects of human life, including health. In Indonesia, many students in Semarang have had to adapt to online learning and make significant changes to their lifestyles due to community activity restrictions. This adjustment to their lifestyle may have affected their nutritional adequacy and jeopardized their nutrition security. This study aims to determine the nutrition security status of university students during the COVID-19 pandemic's community activity restriction. The research employs a cross-sectional design, and the Modified Semi-Food Frequency Questionnaire (Semi-FFQ) is used as the research tool. Data analysis was conducted using univariate analysis (frequency distribution) and bivariate analysis (Spearman's rank correlation test). The study found that 81.12 percent of respondents had adequate food supplies during community activity restriction, and 39.2 percent of students relied on contemporary or traditional markets as their primary food source. Furthermore, 76 percent of students preferred consuming fried foods. The data analysis showed a weak negative correlation between community activity restriction and nutrition security proxies such as food storage availability (p=-0.071), appetite (p=-0.026), and food hygiene adherence (p=-0.018). However, all p-values were greater than 0.05, indicating no statistically significant link. The study concluded that there was no significant association between community activity restriction and nutrition security among university students in Semarang. Interventions are needed to enhance university students' nutrition and food choices, even amid community activity restrictions. This study's implications could be far-reaching in enhancing nutrition security among university students.**

**Keywords: nutrition security, university students, community activity restriction, COVID-19**

## ABSTRAK

**Pandemi COVID-19 telah memberikan dampak yang signifikan terhadap berbagai aspek kehidupan manusia, termasuk kesehatan. Situasi pandemi memaksa banyak pelajar di Indonesia, termasuk di kota Semarang, untuk melakukan kegiatan belajar daring dan mengubah gaya hidup secara signifikan, Perubahan gaya hidup ini dapat mempengaruhi kecukupan asupan gizi siswa dan menurunkan ketahanan gizinya. Penelitian ini bertujuan untuk untuk mengetahui pola konsumsi makanan mahasiswa pada masa pandemi COVID-19. Metode penelitian ini menggunakan desain penelitian cross sectional. Instrumen penelitian yang digunakan yaitu Modified Semi *Food Frequency Questionnaire* (Semi-FFQ). Analisis data menggunakan analisis univariat (distribusi frekuensi), dan analisis bivariat (uji korelasi rank Spearman).Hasil penelitian ini diketahui bahwa selama pembatasan aktivitas masyarakat: 81,12 persen responden memiliki persediaan makanan yang cukup, 39,2 persen mahasiswa mengandalkan pasar modern atau tradisional sebagai sumber makanan utama, 76 persen mahasiswa menyukai pemanfaatan makanan dengan metode pengolahan digoreng. Keanekaragaman pola konsumsi mahasiswa mayoritas mengonsumsi daging ayam (74%), telur ayam (73%), wortel (70%), tempe (67%), dan tahu (66%). Hasil analisis data dihasilkan pembatasan aktivitas masyarakat memiliki korelasi negatif yang lemah dengan ketersediaan penyimpanan makanan (p=-0,071), nafsu makan (p=-0,026), dan kepatuhan terhadap kebersihan makanan (p=0,018). Namun, tidak ada korelasi yang signifikan secara statistik, karena semua nilai p lebih besar dari 0,05. Kesimpulan penelitian ini tidak terdapat hubungan yang siginifikan antara pembatasan aktivitas masyarakat dengan ketersediaan penyimpanan makanan, nafsu makan, dan kepatuhan terhadap kebersihan makanan. Dalam penelitian ini berpotensi memiliki implikasi yang signifikan untuk mempromosikan ketahanan gizi di kalangan mahasiswa.**

**Kata kunci: ketahanan gizi, mahasiswa, pembatasan aktivitas masyarakat, COVID-19**

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## INTRODUCTION

University students are a prone to malnutrition due to their transitional period from adolescence to adulthood and their need for high mental activity, such as pursuing higher education. They require a sufficient amount of nutrients to meet the demands of their academic and personal lives. Therefore, it is crucial to evaluate their food intake to identify any potential nutrient deficiencies or imbalances. This condition makes students more susceptible to various health problems, including malnutrition. Malnutrition in students can affect their health, including decreasing their immune system and increasing the risk of various infectious diseases, including COVID-19.[1]

The COVID-19 pandemic has had a significant impact on various aspects of human life, including health. The pandemic situation has forced many students in Indonesia, including in the city of Semarang, to engage in online learning activities and significantly alter their lifestyles. The government's implementation of community activity restrictions to slow down the spread of the virus has made life for students even more challenging.[2] Most students have returned to their hometown, but some students have been unable to return home due to government restrictions and are trapped in their boarding houses. Additionally, the closure of some food stalls has made it difficult for these students to access food, which is affecting their nutrition security.[3,4]

The Semarang City Government has enacted Mayor Regulation No. 28 of 2020 concerning Guidelines for Implementing Community Activity Restrictions in the Acceleration of Handling Corona Virus Disease 2019 (COVID-19) in Semarang City on April 24, 2020. This policy has forced many students to change their lifestyles and engage in online learning activities. This change in lifestyle can affect students' adequate intake of nutrients and decrease their nutritional resilience. Therefore, research is needed to determine the extent to which community activity restrictions affect students' nutrient intake adequacy in Semarang City.

This study can provide better insights into the nutritional status of students during the COVID-19 pandemic and the impact of community activity restrictions on their nutrient intake adequacy. Furthermore, the results of this study can serve as a basis for relevant parties, such as universities and the government, in designing appropriate and effective nutritional intervention programs to address malnutrition problems in students post-COVID-19. Thus, this research can provide significant benefits for the health and well-being of students and the general public by understanding the effect of pandemic on nutrition security.

### Food Security during the COVID-19 Pandemic

In an effort to develop quality human resources, one of the basic components that must be fulfilled is food. Food is the most basic human need, and its fulfillment is regulated by law. Based on Law Number 18 of 2012, "food" is defined as something that originates from sources of agricultural products, plantations, fisheries, animal husbandry, forestry, and waters that can be processed or cannot be processed and used as food or drinks for human consumption, including food additives, food raw materials, and other materials used in the process of preparation for food and beverage processing.

Food security is the condition of sufficient food availability for every individual at any time. Based on Government Regulation Number 17 of 2015, food security is the condition of fulfilling the availability of food in sufficient quantities that is of good quality, safe, nutritious, equitable, and affordable and does not conflict with people's beliefs and culture to live a healthy, active, and productive life in a sustainable manner. [5]

The existence of the COVID-19 pandemic has had a large-scale impact on food security and individual food crises, one of which is in Indonesia. Especially when the PSBB (Large-Scale Social Restrictions) policy was implemented in several areas, people were asked to reduce physical contact and carry out all activities mostly online and in limited ways. In this condition, food security will be stable when food availability is adequate (quantity, quality, safety, and socio-cultural acceptability) and can be used and accessed by everyone to live a healthy and happy life.[6]

Food security during COVID-19 Pandemics play an important role in promoting public health. In achieving food security, there are three important aspects with indicators in them that need to be considered in order to achieve more stable food security, including: [7]

1. Aspects of Food Availability by considering the indicator of the ratio of normative consumption per capita to food production
2. Access to Food Accessibility by considering indicators of the percentage of people living below the poverty line who have access to food, the percentage of households with a proportion of food expenditure >65 percent of total expenditure, and the percentage of households without access to electricity.
3. Utilization and consumption of food, taking into account the indicators of the average length of schooling for girls >15 years; the percentage of households without access to clean water; the ratio of population per health worker to the density level; the percentage of toddlers with below-standard height (stunting); and the sickness rate.

The aspect of food availability in food security is directed at increasing domestic products with commodities such as rice, corn, meat, and soybeans. Food utilization can be seen in the quantity and quality that must be met in order for each individual to live a healthier and more productive life[8]. According to Suryana, the aspect of food utilization is a subsystem of food security that is influenced by purchasing power, tastes, knowledge and awareness of community nutrition, and the availability of food itself. so that in this case, the aspect of food utilization is no less important than the two previous aspects.[9]

In their research entitled "Impact of COVID-19 on Food Security in the Caribbean," they explained that the COVID-19 pandemic had an impact on food availability in the Caribbean, such as decreased purchases of meat, fish, fruit, chicken, and vegetables, while consumption of rice and eggs increased. Although many of these dietary changes have been driven by changes in price and availability, the nutritional implications are still important. Reducing food intake from animals is a concern for the body's intake of animal protein. In addition, a decrease in consumption of vegetables and fruit, if prolonged, will cause a source of supplying antioxidants from food in the effort to recover from COVID-19 to be hampered.[10]

There are several proposed strategies and resolutions related to food security during the COVID-19 pandemic to fulfill nutrition in the community so that it can increase, which are detailed as follows:[11]

1. Availability of food: construction of food barns to be used as reserves for food stocks; diversification of food within the scope of fulfilling carbohydrates; increasing the quantity of food through imported and domestic supplies.
2. Access to food: massively increasing the food supply chain and reducing food prices so that they are affordable for people with middle-to-lower incomes.
3. Utilization of food: increasing the utilization of agricultural land in supporting food availability and guaranteeing the quality of food circulating in the community, including aspects of safety, hygiene, and nutritional content.

**The Interrelationship between Nutrition security and Food Security**

Nutrition security and food security are two distinct but interconnected concepts. In this case, nutrition security is a condition in which everyone can consume food in sufficient quantity and quality at any time, with a variety, taking into account the nutritional content and safety of adequate environmental sanitation to meet food needs in support of an active and healthy life, as well as adequate nutritional status.[12]

According to the Food Agricultural Organization (FAO) there has been a refinement of the concept of food security into food security and nutrition. The definition of food security and nutrition is an embodiment of food security that is not only oriented towards providing food in sufficient quantity and quality for the community but also accompanied by the effectiveness of food utilization to create a good nutritional status for each individual. This scope also pays attention to optimizing the use of food supported by environmental sanitation and good hygiene so that people are protected from infectious diseases that can interfere with growth, development, and health.[13]

When talking about nutrition, the quantity and quality of food consumed determine a

person's nutrition security, while the absorption of nutrients in each person's body is different and is influenced by a person's physical condition.

Therefore, in order to achieve optimal nutrition security while supporting a healthy, active, and productive life, it is necessary to fulfill a variety of food consumption patterns that are nutritionally balanced and safe (B2SA).[14]

### The Impact of a Pandemic on Student Food Consumption

Students are one of the groups affected by COVID-19 since the rules for studying from home were enforced following the work-from-home rules, or, in other words, the learning system is implemented online. Sociologically, psychologically, and physiologically, this change in the learning system is prone to stressing students and can change their eating behavior. This is similar to the decrease in consumption due to the habit of buying food, drinks, and snacks outside the home directly due to limited access to food during the COVID-19 period, so that new habits make cooking at home more frequent.[15]

Based on research conducted by Ashari, there were significant differences in student food security during the CO-19 pandemic. This was explained by saying that in the consumption of vegetables and fruit during the pandemic, students had sufficient or good availability of vegetables and fruit, so that this affected the consumption of vegetables and fruit every day. The availability of vegetables and fruit at home has a major influence on student vegetable and fruit consumption because many students say that if vegetables and fruit are not available at home, they do not consume them.[16]

## METHODS

The study was conducted in May 2020, during the period of social distancing in Semarang City, with a sample size of 197 university students who resided in the city. The purpose of this study was to determine the food consumption patterns of university students during the COVID-19 pandemic using a Modified Semi Food Frequency Questionnaire (Semi-FFQ) administered through Google Form. A cross-sectional food consumption survey method was employed to assess the adequacy of food intake and nutrient intake at the group, household, and individual levels.

The Semi-FFQ is a qualitative online method of measuring food frequency that describes the frequency of consumption per day, week, or month[17]. The questionnaire included aspects of food availability, food accessibility, and food utilization[18]. The food availability questions were designed to determine changes in the students' food storage. The food intake questions asked the students to choose among the types of carbohydrates, animal protein, plant protein, vegetables, and fruits, and their respective eating frequencies (daily, weekly, monthly, and yearly/ never). The food utilization questions were used to determine how the students mostly prepared their food (e.g., fried, boiled, baked, grilled, and steamed), any changes in their appetite, and their adherence to food hygiene practices. The questionnaire comprised a total of 38 items. The researchers also inquired about changes in food availability that occurred during the COVID-19 pandemic.

In this research, the data analysis involved two types of statistical analysis: univariate analysis and bivariate analysis. Univariate analysis is a statistical method used to describe the characteristics of the variables included in the study, such as frequency, mean, standard deviation, and minimum and maximum values. Bivariate analysis, on the other hand, is a statistical method that examines the relationship between two variables. In this study, the bivariate analysis was conducted using the Spearman rank correlation test.[19]

The Spearman rank correlation test is a non-parametric statistical method used to measure the strength and direction of the relationship between two variables. It is used to determine whether there is a significant association between two variables that are not normally distributed or where the relationship is not linear. The Spearman rank correlation test involves assigning ranks to the variables and then calculating the correlation coefficient based on the ranks. The resulting coefficient ranges from -1 to +1, where a coefficient of -1 indicates a perfect negative correlation, a coefficient of +1 indicates a perfect positive correlation, and a coefficient of 0 indicates no correlation between the variables. The significance of the correlation

coefficient is tested using a p-value, where a p-than 0.05 indicates a significant correlation between the variables.[19,20]

The results of the food consumption survey using Semi-FFQ provided preliminary information regarding the possibility of nutritional deficiencies among students and the factors influencing food consumption during the early phase of social distancing measures.[21] Specifically, the researcher assessed three aspects of food security: food availability, food accessibility, and food utilization.[22] The findings of this study can serve as a basis for future research on food security among university students during the COVID-19 pandemic.

## RESULT

### Demographic Characteristic

Table 1 presents the demographic characteristics of the university students who participated in this study. The majority of the participants were female, accounting for 87.82 percent (n=173) of the total sample, while male students only accounted for 11.73 percent (n=23). All participants were enrolled in undergraduate programs, and no students from vocational programs were included. Among the universities, 65.31 percent (n=129) of the students came from Islamic universities, while 34.69 percent (n=68) came from regular universities. Regarding the stage of studies, most of the participants were sophomores (39.80%, n=78) and juniors (29.08%, n=57), while the remaining participants were freshmen (26.53%, n=52) and seniors (4.59%, n=9). The majority of the participants, accounting for 91.84 percent (n=180) of the total sample, were staying in their hometowns during the restriction. Only a small number of participants, 8.16 percent (n=16), were staying in boarding houses.

### Food Availability of The University Students

In this study, food storage availability is used as a proxy for food availability. Food storage availability is defined as the availability of a variety of foods stored at home or in other places that are easily accessible for consumption. The importance of Table 4 is that it provides information on the change in food storage availability during the community activity restrictions.The table shows that 81.12 percent value of less of the participants reported that they had enough food stored during the restrictions, indicating a high level of food storage availability.

### Food Accessibility of The University Students

Table 3 presents the daily food acquisition methods used by university students during the community activity restriction period. The most of the students, 39.29 percent (n=77) obtained their food from the modern or traditional market. The second most popular method was buying from mobile vendors, accounting for 32.65 percent (n=64) of the total sample. Homegrown produce, such as vegetables grown in the students' own gardens, accounted for 15.31 percent (n=30) of food acquisition methods, while only 6.63 percent (n=13) of students purchased food from small food stalls around their homes. Additionally, only 5.61 percent (n=11) of students acquired their food from online marketplaces. It is indicating that many of the students relied on modern or traditional market as their primary source of food during the community activity restriction. This suggests that students had relatively good access to food in terms of food accessibility.

### Food Utilization of The University Students

Table 4 provides information on the favorite food processing methods utilized by university students during community activity restrictions, categorized by food type. The table displays the percentage of students who preferred different food processing methods such as frying, boiling, baking, grilling, steaming, stir-frying, eating raw, and other methods.

The food categories are divided into carbohydrates, animal protein, plant protein, vegetables, and fruits. For each food category, the table shows the percentage of students who preferred each food processing method. For carbohydrates, the most preferred food processing method was frying (41%), followed by steaming (28%), boiling (20%), baking (8%), and others (0%). For animal protein, most students preferred fried food (76%), while a small percentage preferred other method such as boiled, baked, grilled, or steamed. Similarly, for plant protein, the most preferred method was

frying (74%), followed by stir-frying (6%), and other methods. For vegetables, the most preferred food processing method was boiling (41%), followed by stir-frying (39%), and other methods. For fruits, the most popular food processing method was eating raw (77%), followed by other methods (15%), while only a small percentage of students preferred fried or boiled fruits.

Table 1

Demographic Characteristic of The University Students

| | n (196) | % |
|---|---|---|
| Sex | | |
| Male | 23 | 11.73% |
| Female | 173 | 88.27% |
| Study Levels | | |
| Vocational Program | 0 | 0% |
| Undergraduate Program | 196 | 100% |
| University Type | | |
| Islamic Universities | 128 | 65.31% |
| Regular Universities | 68 | 34.69% |
| Stages of the Studies | | |
| Freshman | 52 | 26.53% |
| Sophomores | 78 | 39.80% |
| Juniors | 57 | 29.08% |
| Seniors | 9 | 4.59% |
| Location during Community Activity Restriction | | |
| Hometown | 180 | 91,84% |
| Boarding Houses | 16 | 8,16% |

Credits: Research Data

Table 2

Food storage availability of the university students during community activity restrictions

| | n | % |
|---|---|---|
| Adequate | 159 | 81,12% |
| Inadequate | 35 | 17,86% |
| Excessive | 2 | 1,02% |
| Total | 196 | 100% |

Credits: Research Data

Table 3

Daily food acquisition methods of the university students during community activity restrictions

| | n (196) | % |
|---|---|---|
| Homegrown produce | 30 | 15.31 |
| Buying from mobile carts | 64 | 32.65 |
| Given by Neighbor | 1 | 0.51 |
| Buying from modern or traditional market | 77 | 39.29 |
| Buying from online marketplace | 11 | 5.61 |
| Buying from small food stall around the house | 13 | 6.63 |

Credits: Research Data

Table 4

Favorite food processing methods of the university students during community activity restriction

| | Fried | Boiled | Baked | Grilled | Steamed | Stir Fried | Raw | Other |
|---|---|---|---|---|---|---|---|---|
| | n (%) | n (%) | n (%) | n (%) | n (%) | n (%) | n (%) | n (%) |
| Carbohydrates | 80 (41%) | 39 (20%) | 16 (8%) | 6 (3%) | 55 (28%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Animal Protein | 148 (76%) | 7 (4%) | 8 (4%) | 4 (2%) | 18 (9%) | 11 (6%) | 0 (0%) | 0 (0%) |
| Plant Protein | 146 (74%) | 12 (6%) | 9 (5%) | 5 (3%) | 12 (6%) | 12 (6%) | 0 (0%) | 0 (0%) |
| Vegetable | 17 (9%) | 81 (41%) | 0 (0%) | 0 (0%) | 6 (3%) | 77 (39%) | 4 (2%) | 11 (6%) |
| Fruit | 11 (6%) | 2 (1%) | 0 (0%) | 0 (0%) | 3 (2%) | 0 (0%) | 150 (77%) | 30 (15%) |

Credits: Research Data

**Dietary Diversity of The University Students**

Table 5 shows the frequency of food intake among university students categorized into daily, weekly, monthly, and yearly/never consumed. The table presents ten of the most frequently consumed food items among university students, consisting of only ten top choices for each category out of a total of 107 food options. The most frequently consumed food on a daily basis was rice (89%), followed by tempeh (28%), tea (24%), tofu (21%), and chicken eggs (17%). On a weekly basis, the most consumed foods are chicken meat (74%), chicken eggs (73%), carrot (70%), tempeh (67%), and tofu (66%). On a monthly basis, the most consumed foods were instant noodles (42%), beans (42%), beef (41%), squid (41%), and potato (39%). The foods that were rarely consumed or never consumed are pork (99%), beef kidney (97%), ham (96%), brain (94%), cow intestines (94%), beef liver (90%), cassava leaves (89%), eel (87%), brown rice (87%), and dried fruits (85%).

**Correlation of the Community Activity Restriction and Nutrition Security**

Table 6 presents the results of Spearman's correlation coefficient analysis to assess the relationship between community activity restriction and food storage availability, appetite, and adherence to food hygiene among university students. The table shows the correlation coefficients for each pair of variables, where a negative correlation indicates an inverse relationship between the variables. The findings indicate that community activity restriction has a weak negative correlation with food storage availability (-0.071), appetite (-0.026), and adherence to food hygiene (-0.018). However, none of the correlations are statistically significant, as all of the p-values are greater than 0.05.

Table 5

The frequency of food intake among university students categorized as daily, weekly, monthly, yearlyor never consumed.

| Daily | | Weekly | | Monthly | | Yearly/ Never | |
|---|---|---|---|---|---|---|---|
| | n (%) | | n (%) | | n (%) | | n (%) |
| Rice | 175 (89%) | Chicken meat | 145 (74%) | Instant noodles | 83 (42%) | Pork | 194 (99%) |
| Tempeh | 54 (28%) | Chicken eggs | 144 (73%) | Beans | 82 (42%) | Beef Kidney | 190 (97%) |
| Tea | 48 (24%) | Carrot | 137 (70%) | Beef | 80 (41%) | Ham | 189 (96%) |
| Tofu | 41 (21%) | Tempeh | 131 (67%) | Squid | 80 (41%) | Brain | 185 (94%) |
| Chicken eggs | 33 (17%) | Tofu | 129 (66%) | Potato | 76 (39%) | Cow intestines | 184 (94%) |
| Dates | 28 (14%) | Banana | 125 (64%) | Apple | 76 (39%) | Beef liver | 177 (90%) |
| Chicken meat | 25 (13%) | Spinach | 120 (61%) | Corn | 74 (38%) | Cassava leaves | 174 (89%) |
| Tomato | 19 (10%) | Chicken skin | 113 (58%) | Rice noodles | 73 (37%) | Eel | 170 (87%) |
| Carrot | 18 (9%) | Meatball | 110 (56%) | Dry salted fish | 72 (37%) | Brown rice | 170 (87%) |
| Chicken egg Yolk | 16 (8%) | Tomato | 109 (56%) | Peanuts | 71 (36%) | Dried fruits | 166 (85%) |

n = number of university students
%= percentage of university students
Credits: Research Data

Table 6

Spearman's correlation coefficient for assessing relation between community activity restriction and food storage availability, appetite, and adherence to food hygiene

| | Food Storage Availability | Appetite | Adherence to Food Hygiene |
|---|---|---|---|
| Community Activity Restriction | -0.071 (p = 0.807) | -0.026 (p = 0.716) | -0.018 (p = 0.322) |

Statistically significant if $p < 0.05$
Credits: Research Data

## DISCUSSION

### Demographic Characteristic

The demographic characteristics of the university students in this study were collected to provide a comprehensive overview of the sample. The participants in this study consisted of both male and female students, who were all enrolled in undergraduate programs at universities in Semarang City. The sample included students from both Islamic universities and regular universities. In terms of academic year, the sample was composed of students from different stages of their undergraduate studies, including freshmen, sophomores, juniors, and seniors. This information provides insight into the living arrangements of participants and can aid in understanding the potential impact of the community activity restriction on their access to food and nutrition security. Overall, these demographic characteristics are essential to understanding the study sample and evaluating nutrition security among university students. In this study, there is information provides insight into the living arrangements of participants and can aid in understanding the potential impact of the community activity restriction on their access to food and nutrition security. Overall, these demographic characteristics are essential to understanding the study sample and evaluating nutrition security among university students.[23]

**Food Availability of The University Students**

Food availability is an essential component of nutrition security. It refers to the sufficient supply and access to various types of foods that meet the dietary needs of individuals or households. Food availability is an important indicator of nutrition security as it directly affects the ability of individuals or households to obtain and consume adequate and nutritious food [(24)]. The table 2 shows that 81.12% of the participants reported that they had enough food stored during the restrictions, indicating a high level of food storage availability**.** This information is crucial in understanding the food availability situation during the community activity restrictions and the potential impact on nutrition security. A high level of food storage availability suggests that participants were able to access and store enough food to meet their dietary needs during the restrictions. On the other hand, a low level of food storage availability could indicate a potential food shortage or difficulty in accessing food, which may negatively affect nutrition security.[25]

**Food Accessibility of The University Students**

Food accessibility refers to the physical and economic access that people have to sufficient, safe, and nutritious food to meet their dietary needs and preferences for an active and healthy life. It is a component of nutrition security, which also includes food availability, food utilization, and dietary variability. Food accessibility is influenced by various factors such as geographic location, income, transportation, market availability, and food prices. People with limited access to food may experience food insecurity, which can lead to malnutrition and negative health outcomes.[26] Food acquisition, which refers to the means by which individuals or households obtain their food, is often used as a proxy measure of food accessibility.[27] Understanding food acquisition patterns and sources can provide insights into the availability and accessibility of food, as well as potential barriers to access that may affect food security.[28]

Food acquisition can be influenced by various factors such as income, food prices, and accessibility of food outlets. In some cases, individuals or households may have limited access to food due to factors such as geographic isolation or lack of transportation. This can result in inadequate food acquisition and, ultimately, food insecurity. Table 3 explains on how university students obtain their food. This information can be used to identify gaps in food access and inform policies and programs aimed at improving food availability and access for communities and populations at risk of food insecurity.

**Food Utilization of The University Students**

Food utilization is a crucial aspect of nutrition security as it impacts the accessibility, availability, and quality of food. Adequate food utilization involves the consumption of safe, nutritious, and culturally appropriate foods that meet the dietary requirements of individuals.[28] However, during community activity restrictions, individuals may face challenges in accessing diverse and fresh foods, leading to a reliance on processed and convenience foods. To gain insights into the food utilization practices of university students during those times, this study explored their favorite food processing methods. By examining the methods used to prepare food such as frying, boiling, baking, grilling, or steaming, the study aimed to understand how students were utilizing the available food.

The results from Table 4 provide insights into the food utilization practices of university students during community activity restrictions. The preference for fried food among the students is concerning as excessive consumption of fried food can lead to health problems such as obesity, high blood pressure, and heart disease.[29] It is encouraging, however, to see that a considerable percentage of students preferred steaming and boiling methods for carbohydrates. These methods are known to retain the nutritional value of the food and can contribute to a healthy and balanced diet.

The high preference for fried food among students is consistent across animal and plant protein categories, highlighting the need for interventions aimed at promoting healthier food choices. The low percentage of students who preferred grilling or baking as food processing methods for animal and plant protein is concerning as these methods are generally healthier compared to frying. In contrast, the preference for stir-frying and boiling methods among students for vegetables is encouraging, as they are known to retain the nutritional value of vegetables. The preference for eating raw fruits among students is also positive, as this

method can help retain the nutritional value of fruits.

Overall, the results from Table 4 underscore the importance of promoting healthier food processing methods among university students. Interventions that encourage the use of healthy food processing methods such as steaming, boiling, and grilling, along with education on the health benefits of a balanced diet, could be helpful in promoting healthier food choices and improving the nutrition security of students.

**Dietary Diversity of The University Students**

Dietary diversity is an important aspect of nutrition security as it ensures that an individual is consuming a wide range of foods from different food groups to meet their daily nutrient requirements. It is a well-known fact that a balanced and varied diet is essential for maintaining good health and preventing the risk of chronic diseases. Table 5 shows the frequency of food eaten by university students.

Using food frequency as a proxy to assess dietary diversity is an efficient and practical method as it enables the collection of dietary information from a large number of participants in a short period. By assessing dietary diversity, the researcher can identify any gaps in the participants' diets and design appropriate interventions to improve their nutrition security.[18]

Dietary diversity plays a significant role in ensuring adequate nutrition security, which is essential for maintaining good health and preventing the risk of chronic diseases. As university students are at a critical stage of their lives, it is crucial to assess their dietary habits and food intake to identify any potential nutrient deficiencies or imbalances. By using food frequency as a proxy to evaluate dietary diversity, researchers can obtain a comprehensive understanding of the types and amounts of foods consumed by university students. This information can be used to develop targeted interventions to promote healthy eating habits and improve nutrition security among this population.

Furthermore, the importance of dietary diversity goes beyond just meeting daily nutrient requirements. It also provides benefits such as improving gut microbiota diversity, reducing the risk of food intolerances and allergies, and enhancing overall well-being. Therefore, assessing the dietary diversity of university students is crucial for promoting their health and preventing the onset of chronic diseases. Evaluating the dietary diversity of university students using food frequency as a proxy is essential for assessing nutrition security and promoting healthy eating habits. The results of such assessments can inform the development of targeted interventions to address potential nutrient deficiencies and imbalances and enhance overall well-being.

**Correlation of the Community Activity Restriction and Nutrition Security**

In assessing the impact of community activity restrictions on nutrition security among university students, it is essential to investigate various aspects of food security. This study explored the relationship between community activity restrictions and food storage availability, appetite, and adherence to food hygiene among university students. Spearman's correlation coefficient was used to analyze the relationship between these variables. This statistical method measures the strength and direction of the association between two variables. The results of this analysis can provide insights into the potential impact of community activity restrictions on food security among university students. Table 6 shows the Spearman's correlation coefficients between community activity restrictions and food storage availability, appetite, and adherence to food hygiene. In this study, The findings indicate that community activity restriction has a weak negative correlation with food storage availability (-0.071), appetite (-0.026), and adherence to food hygiene (-0.018). However, none of the correlations are statistically significant, as all of the p-values are greater than 0.05.

This finding implies that as the level of community activity restriction increased, the food storage availability, appetite, and adherence to food hygiene decreased slightly, but not to a statistically significant extent. These findings are important as they provide insight into the potential impact of community activity restrictions on the food security and nutrition of university students. The weak negative correlation between community activity restriction and food storage availability suggests that as restrictions increase, students may have more difficulty storing food, potentially resulting in food waste or reduced access to food.[30,31] The weak negative

correlation between community activity restriction and appetite suggests that as restrictions increase, students may experience decreased appetite, which could lead to reduced food intake and potential malnutrition.[32] Lastly, the weak negative correlation between community activity restriction and adherence to food hygiene suggests that as restrictions increase, students may have more difficulty maintaining proper food hygiene practices, potentially resulting in increased risk of foodborne illness.[33] Overall, these findings highlight the importance of considering the potential impact of community activity restrictions on the food security and nutrition of university students.

## CONCLUSION AND RECOMMENDATION

### Conclusion

This research findings could potentially have significant implications for promoting nutrition security among university students. The COVID-19 pandemic has brought about significant changes in the learning system, with university students being among the groups affected. The shift to online learning has led to stress among students, potentially affecting their eating behavior. This study highlights the need for interventions to encourage healthy food choices and improve food utilization among university students. Understanding the challenges faced by students in accessing nutritious and culturally appropriate foods could also inform the development of policies and strategies to enhance the food security of university communities.

### Recommendation

This research underscores the importance of promoting nutrition security among university students and calls for further studies to inform effective policy and intervention development.

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# NUTRITION SECURITY AMONG UNIVERSITY STUDENTS DURING COVID-19 COMMUNITY ACTIVITY RESTRICTION: A CROSS-SECTIONAL STUDY IN SEMARANG, INDONESIA

*Ketahanan Gizi Mahasiswa Selama Pembatasan Aktivitas Masyarakat COVID-19: Studi Cross-Sectional di Semarang, Indonesia*

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## ABSTRACT

**The COVID-19 pandemic has had a significant impact on various aspects of human life, including health. In Indonesia, many students in Semarang have had to adapt to online learning and make significant changes to their lifestyles due to community activity restrictions. This adjustment to their lifestyle may have affected their nutritional adequacy and jeopardized their nutrition security. This study aims to determine the nutrition security status of university students during the COVID-19 pandemic's community activity restriction. The research employs a cross-sectional design, and the Modified Semi-Food Frequency Questionnaire (Semi-FFQ) is used as the research tool. Data analysis was conducted using univariate analysis (frequency distribution) and bivariate analysis (Spearman's rank correlation test). The study found that 81.12 percent of respondents had adequate food supplies during community activity restriction, and 39.2 percent of students relied on contemporary or traditional markets as their primary food source. Furthermore, 76 percent of students preferred consuming fried foods. The data analysis showed a weak negative correlation between community activity restriction and nutrition security proxies such as food storage availability (p=-0.071), appetite (p=-0.026), and food hygiene adherence (p=-0.018). However, all p-values were greater than 0.05, indicating no statistically significant link. The study concluded that there was no significant association between community activity restriction and nutrition security among university students in Semarang. Interventions are needed to enhance university students' nutrition and food choices, even amid community activity restrictions. This study's implications could be far-reaching in enhancing nutrition security among university students.**

**Keywords: nutrition security, university students, community activity restriction, COVID-19**

## ABSTRAK

**Pandemi COVID-19 telah memberikan dampak yang signifikan terhadap berbagai aspek kehidupan manusia, termasuk kesehatan. Situasi pandemi memaksa banyak pelajar di Indonesia, termasuk di kota Semarang, untuk melakukan kegiatan belajar daring dan mengubah gaya hidup secara signifikan, Perubahan gaya hidup ini dapat mempengaruhi kecukupan asupan gizi siswa dan menurunkan ketahanan gizinya. Penelitian ini bertujuan untuk untuk mengetahui pola konsumsi makanan mahasiswa pada masa pandemi COVID-19. Metode penelitian ini menggunakan desain penelitian cross sectional. Instrumen penelitian yang digunakan yaitu Modified Semi *Food Frequency Questionnaire* (Semi-FFQ). Analisis data menggunakan analisis univariat (distribusi frekuensi), dan analisis bivariat (uji korelasi rank Spearman).Hasil penelitian ini diketahui bahwa selama pembatasan aktivitas masyarakat: 81,12 persen responden memiliki persediaan makanan yang cukup, 39,2 persen mahasiswa mengandalkan pasar modern atau tradisional sebagai sumber makanan utama, 76 persen mahasiswa menyukai pemanfaatan makanan dengan metode pengolahan digoreng. Keanekaragaman pola konsumsi mahasiswa mayoritas mengonsumsi daging ayam (74%), telur ayam (73%), wortel (70%), tempe (67%), dan tahu (66%). Hasil analisis data dihasilkan pembatasan aktivitas masyarakat memiliki korelasi negatif yang lemah dengan ketersediaan penyimpanan makanan (p=-0,071), nafsu makan (p=-0,026), dan kepatuhan terhadap kebersihan makanan (p=0,018). Namun, tidak ada korelasi yang signifikan secara statistik, karena semua nilai p lebih besar dari 0,05. Kesimpulan penelitian ini tidak terdapat hubungan yang siginifikan antara pembatasan aktivitas masyarakat dengan ketersediaan penyimpanan makanan, nafsu makan, dan kepatuhan terhadap kebersihan makanan. Dalam penelitian ini berpotensi memiliki implikasi yang signifikan untuk mempromosikan ketahanan gizi di kalangan mahasiswa.**

**Kata kunci: ketahanan gizi, mahasiswa, pembatasan aktivitas masyarakat, COVID-19**

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## INTRODUCTION

University students are a prone to malnutrition due to their transitional period from adolescence to adulthood and their need for high mental activity, such as pursuing higher education. They require a sufficient amount of nutrients to meet the demands of their academic and personal lives. Therefore, it is crucial to evaluate their food intake to identify any potential nutrient deficiencies or imbalances. This condition makes students more susceptible to various health problems, including malnutrition. Malnutrition in students can affect their health, including decreasing their immune system and increasing the risk of various infectious diseases, including COVID-19.[1]

The COVID-19 pandemic has had a significant impact on various aspects of human life, including health. The pandemic situation has forced many students in Indonesia, including in the city of Semarang, to engage in online learning activities and significantly alter their lifestyles. The government's implementation of community activity restrictions to slow down the spread of the virus has made life for students even more challenging.[2] Most students have returned to their hometown, but some students have been unable to return home due to government restrictions and are trapped in their boarding houses. Additionally, the closure of some food stalls has made it difficult for these students to access food, which is affecting their nutrition security.[3,4]

The Semarang City Government has enacted Mayor Regulation No. 28 of 2020 concerning Guidelines for Implementing Community Activity Restrictions in the Acceleration of Handling Corona Virus Disease 2019 (COVID-19) in Semarang City on April 24, 2020. This policy has forced many students to change their lifestyles and engage in online learning activities. This change in lifestyle can affect students' adequate intake of nutrients and decrease their nutritional resilience. Therefore, research is needed to determine the extent to which community activity restrictions affect students' nutrient intake adequacy in Semarang City.

This study can provide better insights into the nutritional status of students during the COVID-19 pandemic and the impact of community activity restrictions on their nutrient intake adequacy. Furthermore, the results of this study can serve as a basis for relevant parties, such as universities and the government, in designing appropriate and effective nutritional intervention programs to address malnutrition problems in students post-COVID-19. Thus, this research can provide significant benefits for the health and well-being of students and the general public by understanding the effect of pandemic on nutrition security.

### Food Security during the COVID-19 Pandemic

In an effort to develop quality human resources, one of the basic components that must be fulfilled is food. Food is the most basic human need, and its fulfillment is regulated by law. Based on Law Number 18 of 2012, "food" is defined as something that originates from sources of agricultural products, plantations, fisheries, animal husbandry, forestry, and waters that can be processed or cannot be processed and used as food or drinks for human consumption, including food additives, food raw materials, and other materials used in the process of preparation for food and beverage processing.

Food security is the condition of sufficient food availability for every individual at any time. Based on Government Regulation Number 17 of 2015, food security is the condition of fulfilling the availability of food in sufficient quantities that is of good quality, safe, nutritious, equitable, and affordable and does not conflict with people's beliefs and culture to live a healthy, active, and productive life in a sustainable manner. [5]

The existence of the COVID-19 pandemic has had a large-scale impact on food security and individual food crises, one of which is in Indonesia. Especially when the PSBB (Large-Scale Social Restrictions) policy was implemented in several areas, people were asked to reduce physical contact and carry out all activities mostly online and in limited ways. In this condition, food security will be stable when food availability is adequate (quantity, quality, safety, and socio-cultural acceptability) and can be used and accessed by everyone to live a healthy and happy life.[6]

Food security during COVID-19 Pandemics play an important role in promoting public health. In achieving food security, there are three important aspects with indicators in them that need to be considered in order to achieve more stable food security, including: [7]

1. Aspects of Food Availability by considering the indicator of the ratio of normative consumption per capita to food production
2. Access to Food Accessibility by considering indicators of the percentage of people living below the poverty line who have access to food, the percentage of households with a proportion of food expenditure >65 percent of total expenditure, and the percentage of households without access to electricity.
3. Utilization and consumption of food, taking into account the indicators of the average length of schooling for girls >15 years; the percentage of households without access to clean water; the ratio of population per health worker to the density level; the percentage of toddlers with below-standard height (stunting); and the sickness rate.

The aspect of food availability in food security is directed at increasing domestic products with commodities such as rice, corn, meat, and soybeans. Food utilization can be seen in the quantity and quality that must be met in order for each individual to live a healthier and more productive life[8]. According to Suryana, the aspect of food utilization is a subsystem of food security that is influenced by purchasing power, tastes, knowledge and awareness of community nutrition, and the availability of food itself. so that in this case, the aspect of food utilization is no less important than the two previous aspects.[9]

In their research entitled "Impact of COVID-19 on Food Security in the Caribbean," they explained that the COVID-19 pandemic had an impact on food availability in the Caribbean, such as decreased purchases of meat, fish, fruit, chicken, and vegetables, while consumption of rice and eggs increased. Although many of these dietary changes have been driven by changes in price and availability, the nutritional implications are still important. Reducing food intake from animals is a concern for the body's intake of animal protein. In addition, a decrease in consumption of vegetables and fruit, if prolonged, will cause a source of supplying antioxidants from food in the effort to recover from COVID-19 to be hampered.[10]

There are several proposed strategies and resolutions related to food security during the COVID-19 pandemic to fulfill nutrition in the community so that it can increase, which are detailed as follows:[11]

1. Availability of food: construction of food barns to be used as reserves for food stocks; diversification of food within the scope of fulfilling carbohydrates; increasing the quantity of food through imported and domestic supplies.
2. Access to food: massively increasing the food supply chain and reducing food prices so that they are affordable for people with middle-to-lower incomes.
3. Utilization of food: increasing the utilization of agricultural land in supporting food availability and guaranteeing the quality of food circulating in the community, including aspects of safety, hygiene, and nutritional content.

**The Interrelationship between Nutrition security and Food Security**

Nutrition security and food security are two distinct but interconnected concepts. In this case, nutrition security is a condition in which everyone can consume food in sufficient quantity and quality at any time, with a variety, taking into account the nutritional content and safety of adequate environmental sanitation to meet food needs in support of an active and healthy life, as well as adequate nutritional status.[12]

According to the Food Agricultural Organization (FAO) there has been a refinement of the concept of food security into food security and nutrition. The definition of food security and nutrition is an embodiment of food security that is not only oriented towards providing food in sufficient quantity and quality for the community but also accompanied by the effectiveness of food utilization to create a good nutritional status for each individual. This scope also pays attention to optimizing the use of food supported by environmental sanitation and good hygiene so that people are protected from infectious diseases that can interfere with growth, development, and health.[13]

When talking about nutrition, the quantity and quality of food consumed determine a

person's nutrition security, while the absorption of nutrients in each person's body is different and is influenced by a person's physical condition.

Therefore, in order to achieve optimal nutrition security while supporting a healthy, active, and productive life, it is necessary to fulfill a variety of food consumption patterns that are nutritionally balanced and safe (B2SA).[14]

### The Impact of a Pandemic on Student Food Consumption

Students are one of the groups affected by COVID-19 since the rules for studying from home were enforced following the work-from-home rules, or, in other words, the learning system is implemented online. Sociologically, psychologically, and physiologically, this change in the learning system is prone to stressing students and can change their eating behavior. This is similar to the decrease in consumption due to the habit of buying food, drinks, and snacks outside the home directly due to limited access to food during the COVID-19 period, so that new habits make cooking at home more frequent.[15]

Based on research conducted by Ashari, there were significant differences in student food security during the CO-19 pandemic. This was explained by saying that in the consumption of vegetables and fruit during the pandemic, students had sufficient or good availability of vegetables and fruit, so that this affected the consumption of vegetables and fruit every day. The availability of vegetables and fruit at home has a major influence on student vegetable and fruit consumption because many students say that if vegetables and fruit are not available at home, they do not consume them.[16]

## METHODS

The study was conducted in May 2020, during the period of social distancing in Semarang City, with a sample size of 197 university students who resided in the city. The purpose of this study was to determine the food consumption patterns of university students during the COVID-19 pandemic using a Modified Semi Food Frequency Questionnaire (Semi-FFQ) administered through Google Form. A cross-sectional food consumption survey method was employed to assess the adequacy of food intake and nutrient intake at the group, household, and individual levels.

The Semi-FFQ is a qualitative online method of measuring food frequency that describes the frequency of consumption per day, week, or month[17]. The questionnaire included aspects of food availability, food accessibility, and food utilization[18]. The food availability questions were designed to determine changes in the students' food storage. The food intake questions asked the students to choose among the types of carbohydrates, animal protein, plant protein, vegetables, and fruits, and their respective eating frequencies (daily, weekly, monthly, and yearly/ never). The food utilization questions were used to determine how the students mostly prepared their food (e.g., fried, boiled, baked, grilled, and steamed), any changes in their appetite, and their adherence to food hygiene practices. The questionnaire comprised a total of 38 items. The researchers also inquired about changes in food availability that occurred during the COVID-19 pandemic.

In this research, the data analysis involved two types of statistical analysis: univariate analysis and bivariate analysis. Univariate analysis is a statistical method used to describe the characteristics of the variables included in the study, such as frequency, mean, standard deviation, and minimum and maximum values. Bivariate analysis, on the other hand, is a statistical method that examines the relationship between two variables. In this study, the bivariate analysis was conducted using the Spearman rank correlation test.[19]

The Spearman rank correlation test is a non-parametric statistical method used to measure the strength and direction of the relationship between two variables. It is used to determine whether there is a significant association between two variables that are not normally distributed or where the relationship is not linear. The Spearman rank correlation test involves assigning ranks to the variables and then calculating the correlation coefficient based on the ranks. The resulting coefficient ranges from -1 to +1, where a coefficient of -1 indicates a perfect negative correlation, a coefficient of +1 indicates a perfect positive correlation, and a coefficient of 0 indicates no correlation between the variables. The significance of the correlation

coefficient is tested using a p-value, where a p-than 0.05 indicates a significant correlation between the variables.[19,20]

The results of the food consumption survey using Semi-FFQ provided preliminary information regarding the possibility of nutritional deficiencies among students and the factors influencing food consumption during the early phase of social distancing measures.[21] Specifically, the researcher assessed three aspects of food security: food availability, food accessibility, and food utilization.[22] The findings of this study can serve as a basis for future research on food security among university students during the COVID-19 pandemic.

## RESULT

### Demographic Characteristic

Table 1 presents the demographic characteristics of the university students who participated in this study. The majority of the participants were female, accounting for 87.82 percent (n=173) of the total sample, while male students only accounted for 11.73 percent (n=23). All participants were enrolled in undergraduate programs, and no students from vocational programs were included. Among the universities, 65.31 percent (n=129) of the students came from Islamic universities, while 34.69 percent (n=68) came from regular universities. Regarding the stage of studies, most of the participants were sophomores (39.80%, n=78) and juniors (29.08%, n=57), while the remaining participants were freshmen (26.53%, n=52) and seniors (4.59%, n=9). The majority of the participants, accounting for 91.84 percent (n=180) of the total sample, were staying in their hometowns during the restriction. Only a small number of participants, 8.16 percent (n=16), were staying in boarding houses.

### Food Availability of The University Students

In this study, food storage availability is used as a proxy for food availability. Food storage availability is defined as the availability of a variety of foods stored at home or in other places that are easily accessible for consumption. The importance of Table 4 is that it provides information on the change in food storage availability during the community activity restrictions.The table shows that 81.12 percent value of less of the participants reported that they had enough food stored during the restrictions, indicating a high level of food storage availability.

### Food Accessibility of The University Students

Table 3 presents the daily food acquisition methods used by university students during the community activity restriction period. The most of the students, 39.29 percent (n=77) obtained their food from the modern or traditional market. The second most popular method was buying from mobile vendors, accounting for 32.65 percent (n=64) of the total sample. Homegrown produce, such as vegetables grown in the students' own gardens, accounted for 15.31 percent (n=30) of food acquisition methods, while only 6.63 percent (n=13) of students purchased food from small food stalls around their homes. Additionally, only 5.61 percent (n=11) of students acquired their food from online marketplaces. It is indicating that many of the students relied on modern or traditional market as their primary source of food during the community activity restriction. This suggests that students had relatively good access to food in terms of food accessibility.

### Food Utilization of The University Students

Table 4 provides information on the favorite food processing methods utilized by university students during community activity restrictions, categorized by food type. The table displays the percentage of students who preferred different food processing methods such as frying, boiling, baking, grilling, steaming, stir-frying, eating raw, and other methods.

The food categories are divided into carbohydrates, animal protein, plant protein, vegetables, and fruits. For each food category, the table shows the percentage of students who preferred each food processing method. For carbohydrates, the most preferred food processing method was frying (41%), followed by steaming (28%), boiling (20%), baking (8%), and others (0%). For animal protein, most students preferred fried food (76%), while a small percentage preferred other method such as boiled, baked, grilled, or steamed. Similarly, for plant protein, the most preferred method was

frying (74%), followed by stir-frying (6%), and other methods. For vegetables, the most preferred food processing method was boiling (41%), followed by stir-frying (39%), and other methods. For fruits, the most popular food processing method was eating raw (77%), followed by other methods (15%), while only a small percentage of students preferred fried or boiled fruits.

Table 1

Demographic Characteristic of The University Students

| | n (196) | % |
|---|---|---|
| Sex | | |
| Male | 23 | 11.73% |
| Female | 173 | 88.27% |
| Study Levels | | |
| Vocational Program | 0 | 0% |
| Undergraduate Program | 196 | 100% |
| University Type | | |
| Islamic Universities | 128 | 65.31% |
| Regular Universities | 68 | 34.69% |
| Stages of the Studies | | |
| Freshman | 52 | 26.53% |
| Sophomores | 78 | 39.80% |
| Juniors | 57 | 29.08% |
| Seniors | 9 | 4.59% |
| Location during Community Activity Restriction | | |
| Hometown | 180 | 91,84% |
| Boarding Houses | 16 | 8,16% |

Credits: Research Data

Table 2

Food storage availability of the university students during community activity restrictions

| | n | % |
|---|---|---|
| Adequate | 159 | 81,12% |
| Inadequate | 35 | 17,86% |
| Excessive | 2 | 1,02% |
| Total | 196 | 100% |

Credits: Research Data

Table 3

Daily food acquisition methods of the university students during community activity restrictions

| | n (196) | % |
|---|---|---|
| Homegrown produce | 30 | 15.31 |
| Buying from mobile carts | 64 | 32.65 |
| Given by Neighbor | 1 | 0.51 |
| Buying from modern or traditional market | 77 | 39.29 |
| Buying from online marketplace | 11 | 5.61 |
| Buying from small food stall around the house | 13 | 6.63 |

Credits: Research Data

Table 4

Favorite food processing methods of the university students during community activity restriction

| | Fried | Boiled | Baked | Grilled | Steamed | Stir Fried | Raw | Other |
|---|---|---|---|---|---|---|---|---|
| | n (%) | n (%) | n (%) | n (%) | n (%) | n (%) | n (%) | n (%) |
| Carbohydrates | 80 (41%) | 39 (20%) | 16 (8%) | 6 (3%) | 55 (28%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Animal Protein | 148 (76%) | 7 (4%) | 8 (4%) | 4 (2%) | 18 (9%) | 11 (6%) | 0 (0%) | 0 (0%) |
| Plant Protein | 146 (74%) | 12 (6%) | 9 (5%) | 5 (3%) | 12 (6%) | 12 (6%) | 0 (0%) | 0 (0%) |
| Vegetable | 17 (9%) | 81 (41%) | 0 (0%) | 0 (0%) | 6 (3%) | 77 (39%) | 4 (2%) | 11 (6%) |
| Fruit | 11 (6%) | 2 (1%) | 0 (0%) | 0 (0%) | 3 (2%) | 0 (0%) | 150 (77%) | 30 (15%) |

Credits: Research Data

**Dietary Diversity of The University Students**

Table 5 shows the frequency of food intake among university students categorized into daily, weekly, monthly, and yearly/never consumed. The table presents ten of the most frequently consumed food items among university students, consisting of only ten top choices for each category out of a total of 107 food options. The most frequently consumed food on a daily basis was rice (89%), followed by tempeh (28%), tea (24%), tofu (21%), and chicken eggs (17%). On a weekly basis, the most consumed foods are chicken meat (74%), chicken eggs (73%), carrot (70%), tempeh (67%), and tofu (66%). On a monthly basis, the most consumed foods were instant noodles (42%), beans (42%), beef (41%), squid (41%), and potato (39%). The foods that were rarely consumed or never consumed are pork (99%), beef kidney (97%), ham (96%), brain (94%), cow intestines (94%), beef liver (90%), cassava leaves (89%), eel (87%), brown rice (87%), and dried fruits (85%).

**Correlation of the Community Activity Restriction and Nutrition Security**

Table 6 presents the results of Spearman's correlation coefficient analysis to assess the relationship between community activity restriction and food storage availability, appetite, and adherence to food hygiene among university students. The table shows the correlation coefficients for each pair of variables, where a negative correlation indicates an inverse relationship between the variables. The findings indicate that community activity restriction has a weak negative correlation with food storage availability (-0.071), appetite (-0.026), and adherence to food hygiene (-0.018). However, none of the correlations are statistically significant, as all of the p-values are greater than 0.05.

Table 5

The frequency of food intake among university students categorized as daily, weekly, monthly, yearlyor never consumed.

| Daily | | Weekly | | Monthly | | Yearly/ Never | |
|---|---|---|---|---|---|---|---|
| | n (%) | | n (%) | | n (%) | | n (%) |
| Rice | 175 (89%) | Chicken meat | 145 (74%) | Instant noodles | 83 (42%) | Pork | 194 (99%) |
| Tempeh | 54 (28%) | Chicken eggs | 144 (73%) | Beans | 82 (42%) | Beef Kidney | 190 (97%) |
| Tea | 48 (24%) | Carrot | 137 (70%) | Beef | 80 (41%) | Ham | 189 (96%) |
| Tofu | 41 (21%) | Tempeh | 131 (67%) | Squid | 80 (41%) | Brain | 185 (94%) |
| Chicken eggs | 33 (17%) | Tofu | 129 (66%) | Potato | 76 (39%) | Cow intestines | 184 (94%) |
| Dates | 28 (14%) | Banana | 125 (64%) | Apple | 76 (39%) | Beef liver | 177 (90%) |
| Chicken meat | 25 (13%) | Spinach | 120 (61%) | Corn | 74 (38%) | Cassava leaves | 174 (89%) |
| Tomato | 19 (10%) | Chicken skin | 113 (58%) | Rice noodles | 73 (37%) | Eel | 170 (87%) |
| Carrot | 18 (9%) | Meatball | 110 (56%) | Dry salted fish | 72 (37%) | Brown rice | 170 (87%) |
| Chicken egg Yolk | 16 (8%) | Tomato | 109 (56%) | Peanuts | 71 (36%) | Dried fruits | 166 (85%) |

n = number of university students
%= percentage of university students
Credits: Research Data

Table 6

Spearman's correlation coefficient for assessing relation between community activity restriction and food storage availability, appetite, and adherence to food hygiene

| | Food Storage Availability | Appetite | Adherence to Food Hygiene |
|---|---|---|---|
| Community Activity Restriction | -0.071 (p = 0.807) | -0.026 (p = 0.716) | -0.018 (p = 0.322) |

Statistically significant if $p < 0.05$
Credits: Research Data

## DISCUSSION

### Demographic Characteristic

The demographic characteristics of the university students in this study were collected to provide a comprehensive overview of the sample. The participants in this study consisted of both male and female students, who were all enrolled in undergraduate programs at universities in Semarang City. The sample included students from both Islamic universities and regular universities. In terms of academic year, the sample was composed of students from different stages of their undergraduate studies, including freshmen, sophomores, juniors, and seniors. This information provides insight into the living arrangements of participants and can aid in understanding the potential impact of the community activity restriction on their access to food and nutrition security. Overall, these demographic characteristics are essential to understanding the study sample and evaluating nutrition security among university students. In this study, there is information provides insight into the living arrangements of participants and can aid in understanding the potential impact of the community activity restriction on their access to food and nutrition security. Overall, these demographic characteristics are essential to understanding the study sample and evaluating nutrition security among university students.[23]

**Food Availability of The University Students**

Food availability is an essential component of nutrition security. It refers to the sufficient supply and access to various types of foods that meet the dietary needs of individuals or households. Food availability is an important indicator of nutrition security as it directly affects the ability of individuals or households to obtain and consume adequate and nutritious food [(24)]. The table 2 shows that 81.12% of the participants reported that they had enough food stored during the restrictions, indicating a high level of food storage availability**.** This information is crucial in understanding the food availability situation during the community activity restrictions and the potential impact on nutrition security. A high level of food storage availability suggests that participants were able to access and store enough food to meet their dietary needs during the restrictions. On the other hand, a low level of food storage availability could indicate a potential food shortage or difficulty in accessing food, which may negatively affect nutrition security.[25]

**Food Accessibility of The University Students**

Food accessibility refers to the physical and economic access that people have to sufficient, safe, and nutritious food to meet their dietary needs and preferences for an active and healthy life. It is a component of nutrition security, which also includes food availability, food utilization, and dietary variability. Food accessibility is influenced by various factors such as geographic location, income, transportation, market availability, and food prices. People with limited access to food may experience food insecurity, which can lead to malnutrition and negative health outcomes.[26] Food acquisition, which refers to the means by which individuals or households obtain their food, is often used as a proxy measure of food accessibility.[27] Understanding food acquisition patterns and sources can provide insights into the availability and accessibility of food, as well as potential barriers to access that may affect food security.[28]

Food acquisition can be influenced by various factors such as income, food prices, and accessibility of food outlets. In some cases, individuals or households may have limited access to food due to factors such as geographic isolation or lack of transportation. This can result in inadequate food acquisition and, ultimately, food insecurity. Table 3 explains on how university students obtain their food. This information can be used to identify gaps in food access and inform policies and programs aimed at improving food availability and access for communities and populations at risk of food insecurity.

**Food Utilization of The University Students**

Food utilization is a crucial aspect of nutrition security as it impacts the accessibility, availability, and quality of food. Adequate food utilization involves the consumption of safe, nutritious, and culturally appropriate foods that meet the dietary requirements of individuals.[28] However, during community activity restrictions, individuals may face challenges in accessing diverse and fresh foods, leading to a reliance on processed and convenience foods. To gain insights into the food utilization practices of university students during those times, this study explored their favorite food processing methods. By examining the methods used to prepare food such as frying, boiling, baking, grilling, or steaming, the study aimed to understand how students were utilizing the available food.

The results from Table 4 provide insights into the food utilization practices of university students during community activity restrictions. The preference for fried food among the students is concerning as excessive consumption of fried food can lead to health problems such as obesity, high blood pressure, and heart disease.[29] It is encouraging, however, to see that a considerable percentage of students preferred steaming and boiling methods for carbohydrates. These methods are known to retain the nutritional value of the food and can contribute to a healthy and balanced diet.

The high preference for fried food among students is consistent across animal and plant protein categories, highlighting the need for interventions aimed at promoting healthier food choices. The low percentage of students who preferred grilling or baking as food processing methods for animal and plant protein is concerning as these methods are generally healthier compared to frying. In contrast, the preference for stir-frying and boiling methods among students for vegetables is encouraging, as they are known to retain the nutritional value of vegetables. The preference for eating raw fruits among students is also positive, as this

method can help retain the nutritional value of fruits.

Overall, the results from Table 4 underscore the importance of promoting healthier food processing methods among university students. Interventions that encourage the use of healthy food processing methods such as steaming, boiling, and grilling, along with education on the health benefits of a balanced diet, could be helpful in promoting healthier food choices and improving the nutrition security of students.

**Dietary Diversity of The University Students**

Dietary diversity is an important aspect of nutrition security as it ensures that an individual is consuming a wide range of foods from different food groups to meet their daily nutrient requirements. It is a well-known fact that a balanced and varied diet is essential for maintaining good health and preventing the risk of chronic diseases. Table 5 shows the frequency of food eaten by university students.

Using food frequency as a proxy to assess dietary diversity is an efficient and practical method as it enables the collection of dietary information from a large number of participants in a short period. By assessing dietary diversity, the researcher can identify any gaps in the participants' diets and design appropriate interventions to improve their nutrition security.[18]

Dietary diversity plays a significant role in ensuring adequate nutrition security, which is essential for maintaining good health and preventing the risk of chronic diseases. As university students are at a critical stage of their lives, it is crucial to assess their dietary habits and food intake to identify any potential nutrient deficiencies or imbalances. By using food frequency as a proxy to evaluate dietary diversity, researchers can obtain a comprehensive understanding of the types and amounts of foods consumed by university students. This information can be used to develop targeted interventions to promote healthy eating habits and improve nutrition security among this population.

Furthermore, the importance of dietary diversity goes beyond just meeting daily nutrient requirements. It also provides benefits such as improving gut microbiota diversity, reducing the risk of food intolerances and allergies, and enhancing overall well-being. Therefore, assessing the dietary diversity of university students is crucial for promoting their health and preventing the onset of chronic diseases. Evaluating the dietary diversity of university students using food frequency as a proxy is essential for assessing nutrition security and promoting healthy eating habits. The results of such assessments can inform the development of targeted interventions to address potential nutrient deficiencies and imbalances and enhance overall well-being.

**Correlation of the Community Activity Restriction and Nutrition Security**

In assessing the impact of community activity restrictions on nutrition security among university students, it is essential to investigate various aspects of food security. This study explored the relationship between community activity restrictions and food storage availability, appetite, and adherence to food hygiene among university students. Spearman's correlation coefficient was used to analyze the relationship between these variables. This statistical method measures the strength and direction of the association between two variables. The results of this analysis can provide insights into the potential impact of community activity restrictions on food security among university students. Table 6 shows the Spearman's correlation coefficients between community activity restrictions and food storage availability, appetite, and adherence to food hygiene. In this study, The findings indicate that community activity restriction has a weak negative correlation with food storage availability (-0.071), appetite (-0.026), and adherence to food hygiene (-0.018). However, none of the correlations are statistically significant, as all of the p-values are greater than 0.05.

This finding implies that as the level of community activity restriction increased, the food storage availability, appetite, and adherence to food hygiene decreased slightly, but not to a statistically significant extent. These findings are important as they provide insight into the potential impact of community activity restrictions on the food security and nutrition of university students. The weak negative correlation between community activity restriction and food storage availability suggests that as restrictions increase, students may have more difficulty storing food, potentially resulting in food waste or reduced access to food.[30,31] The weak negative

correlation between community activity restriction and appetite suggests that as restrictions increase, students may experience decreased appetite, which could lead to reduced food intake and potential malnutrition.[32] Lastly, the weak negative correlation between community activity restriction and adherence to food hygiene suggests that as restrictions increase, students may have more difficulty maintaining proper food hygiene practices, potentially resulting in increased risk of foodborne illness.[33] Overall, these findings highlight the importance of considering the potential impact of community activity restrictions on the food security and nutrition of university students.

## CONCLUSION AND RECOMMENDATION

### Conclusion

This research findings could potentially have significant implications for promoting nutrition security among university students. The COVID-19 pandemic has brought about significant changes in the learning system, with university students being among the groups affected. The shift to online learning has led to stress among students, potentially affecting their eating behavior. This study highlights the need for interventions to encourage healthy food choices and improve food utilization among university students. Understanding the challenges faced by students in accessing nutritious and culturally appropriate foods could also inform the development of policies and strategies to enhance the food security of university communities.

### Recommendation

This research underscores the importance of promoting nutrition security among university students and calls for further studies to inform effective policy and intervention development.

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# HUBUNGAN ANTARA USIA IBU DAN KEBIASAAN KONSUMSI FAST FOOD (MAKANAN CEPAT SAJI) DENGAN KEJADIAN HIPERTENSI KEHAMILAN PADA IBU HAMIL DI PUSKESMAS KOTA SEMARANG

*Correlation between Maternal Age and Fast Food Consumption Habits with the Incidence of Pregnancy Hypertension in Pregnant Women at the Public Health Center in Semarang City*

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**ABSTRACT**

**Pregnancy is a critical period that affects the health of both mother and child. Data from the Semarang City Health Office shows that the incidence of maternal deaths due to hypertension tends to increase, with 35 percent of mothers dying from hypertension. This study aims to analyze the relationship between maternal age and the habit of consuming fast food as risk factors for hypertension in pregnant women. This community nutrition study utilized a cross-sectional design. The study involved 80 pregnant women with overweight status at Semarang Public Health Centers. Data collection was conducted through direct interviews using a questionnaire. Body weight was measured directly through anthropometry. Blood pressure was assessed using the Maternal and Child Health (MCH) book. Results: Maternal age was not associated with the occurrence of hypertension in pregnancy (HDP) (p=0.749). The frequency of fast food consumption did not increase the risk of HDP (p=0.058). A history of HDP increased the risk of HDP in the current pregnancy by 4.75 times (p=0.02). In conclusion, maternal age is not associated with the occurrence of hypertension in pregnant women, while fast food consumption does not increase the risk of hypertension in pregnant women because in this study pregnant women tend to limit their intake of fast food. It is recommended that pregnant women maintain blood pressure within the normal recommended range. Pregnant women, whether with or without a history/diagnosis of HDP, are advised to be more selective in their food choices.**

**Keywords: pregnancy, gestational hypertension, fast food,overweight**

**ABSTRAK**

**Kehamilan merupakan masa kritis yang mempengaruhi kesehatan ibu dan anak. Data Dinkes Kota Semarang menunjukkan penyebab kematian ibu karena hipertensi cenderung meningkat, dimana sebanyak 35 persen ibu meninggal karena hipertensi. Tujuan penelitian ini untuk menganalisis hubungan usia ibu dan kebiasaan konsumsi makanan cepat saji sebagai faktor risiko terjadinya hipertensi pada ibu hamil. Penelitian gizi masyarakat dengan desain cross sectional. Jumlah subjek 80 ibu hamil dengan status gizi lebih di Puskesmas Semarang. Pengambilan data dilakukan dengan wawancara langsung menggunakan kuesioner. Berat badan diukur langsung melalui antropometri. Tekanan darah dilihat dari buku KIA. Hasil: Usia ibu hamil tidak berhubungan dengan kejadian hipertensi dalam kehamilan (HDK) (p=0,749). Frekuensi konsumsi makanan cepat saji tidak meningkatkan risiko HDK (p=0,058). Riwayat HDK yang meningkatkan risiko kejadian HDK pada kehamilan saat ini 4,75 kali lebih besar (p=0,02). Kesimpulannya usia tidak berhubungan dengan kejadian hipertensi pada ibu hamil, sedangkan makanan cepat saji tidak meningkatkan risiko hipertensi pada ibu hamil karena pada penelitian ini ibu hamil cenderung membatasi asupan makanan cepat saji. Diharapkan ibu hamil menjaga kondisi tekanan darah dalam ambang batas normal yang dianjurkan. Ibu hamil dengan maupun tidak memiliki riwayat/diagnosis HDK, dianjurkan lebih selektif dalam pemilihan asupan.**

**Kata kunci: kehamilan, hipertensi kehamilan, makanan cepat saji, *overweight***

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## PENDAHULUAN

Angka Kematian Ibu (AKI) merupakan salah satu indikator kesuksesan pembangunan suatu negara karena peningkatan kualitas hidup perempuan merupakan salah satu syarat pembangunan Sumber Daya Manusia (SDM). AKI menjadi salah satu target *Sustainable Development Goals* (SDGs) yaitu menjamin kehidupan yang sehat dan mendorong kesejahteraan bagi semua orang di segala usia.[1] Tingginya AKI menandakan masih rendahnya tingkat kesejahteraan penduduk dan secara tidak langsung mencerminkan kegagalan pemerintah dan masyarakat untuk mengurangi risiko kematian ibu dan anak. Menurut *World Health Organization* (WHO), kematian ibu adalah kematian perempuan selama masa kehamilan atau dalam 42 hari setelah persalinan, terlepas dari lama dan letak kehamilan, dari setiap penyebab yang berhubungan dengan atau diperburuk oleh kehamilan atau penanganannya tetapi bukan karena kecelakaan.[2] WHO memaparkan tingginya AKI yang disebabkan karena hipertensi mencapai 14 persen dari keseluruhan kasus kematian ibu hamil.[3] Data Dinas Kesehatan Kota Semarang sendiri menunjukkan terjadinya peningkatan AKI dari 15 ibu di tahun 2018 menjadi 17 ibu di tahun 2019.[4] Penyebab kematian ibu karena hipertensi juga cenderung meningkat dalam 3 tahun terakhir, sebanyak 35 persen ibu meninggal karena hipertensi. Penyebab lainnya karena perdarahan 17 persen, infeksi 8 persen dan lain-lain sebanyak 40 persen.[5]

Kehamilan merupakan kondisi dimana seorang wanita memiliki janin yang sedang tumbuh di dalam tubuhnya. Kehamilan merupakan masa kritis di mana gizi ibu yang baik adalah faktor penting yang mempengaruhi kesehatan ibu dan anak. Risiko komplikasi selama kehamilan atau kelahiran rendah bila pertambahan berat badan sebelum melahirkan memadai.[6,7] Tekanan darah dinyatakan normal bila 120/80 mmHg atau kurang. *American Heart Association* (AHA) menetapkan ambang batas diagnosis hipertensi 130/80 mmHg untuk hipertensi stadium 1 dan 140/90 mmHg atau lebih untuk hipertensi stadium 2. Sementara itu, untuk pasien hamil, ambang batas yang ditetapkan secara internasional oleh *American College of Obstericians and Gynecologists* (ACOG) adalah 140/90 mmHg.[7,8] Hipertensi kehamilan sendiri meliputi hipertensi kronis, hipertensi gestasional, pre-eklamsia, dan eklamsia.[9]

Hipertensi pada ibu hamil dapat dipengaruhi oleh beberapa faktor, baik yang tidak dapat dimodifikasi seperti usia ibu, paritas ibu, riwayat hipertensi sebelum kehamilan, tingkat pendidikan dan sosio ekonomi, serta beberapa kondisi medis tertentu, sedangkan faktor yang dapat dimodifikasi, seperti asupan ibu, pola hidup ibu, tingkat stres, aktvitas fisik, dan berat badan berlebih.[7,10–12]

Subjek yang digunakan dalam penelitian sendiri adalah ibu hamil dengan berat badan berlebih, karena pada penelitian sebelumnya ditemukan adanya hubungan antara obesitas dengan kejadian hipertensi pada ibu hamil. Dipaparkan bahwa, ibu hamil yang obesitas berpeluang 5,1 kali menderita hipertensi dibandingkan dengan ibu hamil yang tidak obesitas.[1] Orang yang obesitas berisiko menderita hipertensi pada saat hamil, disebabkan pada orang yang obesitas terjadi peningkatan kerja pada jantung untuk memompa darah. Berat badan berlebihan menyebabkan bertambahnya volume darah dan perluasan sistem sirkulasi. Makin besar massa tubuh, makin banyak pula suplai darah yang dibutuhkan untuk memasok oksigen dan zat gizi ke jaringan tubuh. Hal ini mengakibatkan volume darah yang beredar melalui pembuluh darah akan meningkat sehingga tekanan pada dinding arteri menjadi lebih besar.[1]

Usia ibu yang merupakan salah satu faktor risiko ibu untuk terjadinya hipertensi kehamilan adalah ibu hamil yang berusia lebih dari 35 tahun.[1,13] Wanita yang berada pada akhir usia reproduksi, dianggap rentan mengalami komplikasi kehamilan karena cenderung didapatkan penyakit lain dalam tubuh ibu, salah satunya hipertensi.[13] Penelitian sebelumnya yang dilakukan di Poli Rawat Jalan Spesialis Obstetri dan Ginekologi RSUD Tugurejo Semarang pada tahun 2013, menunjukkan bahwa usia ibu saat hamil berisiko tinggi terhadap hipertensi kehamilan dengan nilai OR: 2,774 kali.[14] Dengan nilai tersebut, usia menjadi faktor risiko yang paling dominan terhadap kejadian hipertensi kehamilan.

Penelitian lainnya memaparkan bahwa asupan, utamanya kebiasaan konsumsi *fast food* memiliki hubungan yang tinggi terhadap

kejadian hipertensi ibu hamil, dimana konsumsi *fast food* juga meningkatkan risiko kejadian hipertensi pada orang tidak hamil dengan nilai OR mencapai 1,49 kali.[15,16]

Penelitian ini perlu dilakukan karena ingin melihat secara langsung hubungan kedua variabel tersebut dengan kejadian hipertensi pada ibu hamil yang kelebihan berat badan di wilayah kerja Puskesmas di kota Semarang. Penelitian yang sebelumnya telah dilakukan di Semarang belum ada yang secara khusus membahas usia dan konsumsi makanan cepat saji. Selain itu, juga masih sedikitnya penelitian mengenai hubungan kedua variabel tersebut dengan hipertensi pada ibu hamil yang kelebihan berat badan. Penelitian ini bertujuan untuk mengkaji hubungan usia ibu dan kebiasaan konsumsi makanan cepat saji sebagai faktor risiko terjadinya hipertensi pada ibu hamil.

## METODE PENELITIAN

Penelitian ini merupakan penelitian di bidang gizi masyarakat yang tergolong penelitian *observasional analitik* dengan desain penelitian *cross sectional survey* yang menggunakan teknik *non-probability sampling* dengan metode *purposive sampling*, sampel yang digunakan akan didasarkan pada pertimbangan peneliti yang diharapkan dapat mewakili (menjadi representasi) suatu populasi. Penelitian ini dilakukan pada bulan Juni hingga Desember 2022. Pelaksanaan penelitian ini telah memperoleh persetujuan dari Komisi Etik Penelitian Kesehatan (KEPK) Fakultas Kedokteran Universitas Diponegoro / Rumah Sakit Umum Pusat dr. Kariadi No. 105/EC/KEPK/FK-UNDIP/IV/2022.

Penelitian ini dilakukan di beberapa wilayah Puskesmas yang terdiri dari Puskesmas Srondol, Ngesrep, dan Padangsari di kota Semarang. Populasi target pada penelitian ini adalah ibu hamil yang *overweight* dan obesitas. Besar subjek yang digunakan dalam penelitian ini merujuk pada rumus untuk populasi proporsi dari *Lameshow* [17] dan didapatkan subjek yang dibutuhkan sebesar 80, dengan kriteria inklusi antara lain: ibu hamil bersedia menjadi responden, ibu hamil memiliki status gizi *overweight* / obesitas, usia kehamilan berada di TM II (14-26 minggu) dan TM III (27-40 minggu), ibu hamil dalam keadaan sehat jasmani dan rohani, dan ibu hamil memiliki kemampuan komunikasi dan baca tulis yang baik, sedangkan untuk kriteria eksklusinya antara lain: ibu hamil memilih mengundurkan diri saat dilakukan penggalian data dan ibu hamil melahirkan.

Data yang dikumpulkan pada penelitian ini berupa gabungan data primer dan data sekunder. Data primer pada penelitian ini meliputi data asupan makan, tingkat pendidikan, tingkat sosio ekonomi, tingkat stres, paritas dan aktivitas fisik ibu hamil. Data tersebut akan diperoleh dengan menggunakan teknik wawancara menggunakan kuesioner kepada responden. Kuesioner yang digunakan terdiri dari identitas diri, *Food Frequency Questionnaire* (FFQ) untuk melihat asupan makanan cepat saji dengan daftar bahan makanan cepat saji yang melihat dari penelitian terdahulu,[18,19] *Depression Anxiety Stres Scale* (DASS 21) untuk melihat tingkat stres ibu hamil,[20] dan *Global Physical Activity Questionnaire* (GPAQ) untuk menilai aktivitas fisik ibu hamil[21]. Data sekunder penelitian ini meliputi data berat badan, tinggi badan, serta data pemeriksaan tekanan darah rutin ibu hamil akan diambil dari buku Kesehatan Ibu dan Anak (KIA) ibu hamil.

Penentuan hipertensi diambil dari *American Heart Association* (AHA)/*American College of Cardiology* (ACC) *guidelines*. Seseorang dikatakan hipertensi jika tekanan darah sistolik ≥130 mmHg dan tekanan darah diastolik ≥80 mmHg.[22] Menurut penelitian sebelumnya yang dilakukan di Semarang, hipertensi pada masa kehamilan akan semakin meningkat pada ibu hamil berusia 35 tahun.[14] Konsumsi makanan cepat saji dikatakan sering apabila ≥ 25 kali per bulan dan dikatakan jarang apabila konsumsi makanan cepat saji antara 0 sampai 24 kali per bulan.[23] Ibu hamil yang baru pertama kali melahirkan (primipara) meningkatkan risiko kejadian hipertensi dalam kehamilan 6 sampai 8 kali dibandingkan ibu yang sudah beberapa kali melahirkan (multipara).[12] Ibu dikatakan memiliki pendidikan tinggi apabila lulus SMA / sederajat dan di atasnya.[24,25] Status sosial ekonomi ibu dikatakan sejahtera jika lebih dari atau sama dengan UMR di Kota Semarang, yakni sebesar Rp 2.835.021,29.[25] Aktivitas fisik ibu dikatakan tinggi jika skor dari kuesioner GPAQ ≥360 METs.[26] Berdasarkan acuan kuesioner DASS

21, ibu dikatakan stres jika skor DASS nya ≥15.[20]

Setelah semua data terkumpul, data diolah melalui beberapa tahap, yaitu penyuntingan (*editing*), pengkodean (*coding*), dan entri data menggunakan *software Microsoft Office Excel*. Kemudian data diolah dan dianalisis baik secara univariat, bivariat, maupun multivariat menggunakan *software Statistical Program for Social Science* (SPSS) Versi 25. Data akan disajikan dalam bentuk tabel. Hubungan usia dan konsumsi makanan cepat saji terhadap kejadian hipertensi ibu hamil, masing-masing dianalisis menggunakan *software* SPSS dengan uji statistik parametrik *uji chi square*. Jika data berdistribusi tidak normal, akan dilakukan uji non-parametrik *Fisher*. Tingkat signifikansi ditetapkan pada *p-value* <0,05. Untuk analisis multivariat menggunakan uji regresi logistik.[27].

.

## HASIL

Berdasarkan penelitian yang telah dilakukan diperoleh data mengenai karakteristik responden seperti pada tabel 1.

Tabel 1.

Karakteristik Subjek

| Variabel | n | % |
|---|---|---|
| Kejadian hipertensi pada ibu hamil | | |
| Tidak hipertensi | 65 | 81,25 |
| Hipertensi | 15 | 18,75 |
| Usia ibu hamil[2] | | |
| Tidak berisiko (18 – 34 tahun) | 58 | 72,5 |
| Berisiko (≥35 tahun) | 22 | 27,5 |
| Frekuensi Makanan Cepat Saji[23] | | |
| Jarang (0 – 24x / bulan) | 14 | 17,5 |
| Sering (≥25x/ bulan) | 66 | 82,5 |
| Paritas ibu hamil[25] | | |
| Tidak berisiko (multipara) | 21 | 26,2 |
| Berisiko (nullipara - primipara) | 59 | 73,8 |
| Pendidikan ibu hamil[25] | | |
| Tinggi (SMA, S1, S2) | 69 | 86,25 |
| Rendah(tidak sekolah, SD, SMP) | 11 | 13,75 |
| Sosial ekonomi ibu hamil[25] | | |
| Sejahtera (≥ Rp 2.835.021,29) | 63 | 78,75 |
| Kurang sejahtera (< Rp 2.835.021,29) | 17 | 21,25 |
| Aktivitas fisik ibu hamil[28] | | |
| Kurang (<360 METs) | 44 | 55 |
| Baik (≥360 METs) | 36 | 45 |
| Tingkat stres ibu hamil[20] | | |
| Normal (0 – 14) | 64 | 80 |
| Stres (≥ 15) | 16 | 20 |
| Riwayat hipertensi ibu hamil[25] | | |
| Tidak ada riwayat hipertensi | 76 | 95 |
| Ada riwayat hipertensi | 4 | 5 |

Tabel 2

Jenis Makanan Cepat Saji

| Jenis Makanan Cepat Saji yang Banyak Dikonsumsi | n | % |
|---|---|---|
| Es Krim | 45 | 25 |
| Gorengan | 44 | 25 |
| *Fried chicken* | 22 | 12 |
| Kripik | 14 | 8 |
| Donat | 13 | 7 |
| Mie instan | 11 | 6 |
| *Nugget* | 10 | 6 |
| Mie ayam | 10 | 6 |
| Es campur | 8 | 5 |

Tabel 1 menunjukkan bahwa dari 80 responden ibu hamil dengan status gizi lebih, 19 persen ibu hamil mengalami hipertensi kehamilan. Dari keseluruhan responden, 4 diantaranya memiliki riwayat hipertensi (hipertensi kronis / preeklamsi –eklamsi dari kehamilan sebelumnya). Sebanyak 27,5 persen ibu hamil yang berada pada rentang usia berisiko. Berdasarkan frekuensi konsumsi makanan cepat saji, sebanyak 82,5 persen ibu hamil sering mengonsumsi makanan cepat saji. Ibu hamil yang masuk ke kategori paritas berisiko (nullipara/primipara) sebanyak 33 orang (41,25%). 86,25 persen ibu hamil memiliki tingkat pendidikan yang tinggi. Sebanyak 63 ibu hamil memiki tingkat sosial ekonomi yang tergolong sejahtera. Ibu hamil dengan tingkat stres tinggi sebanyak 13 orang. Dari segi aktivitas fisik, ibu hamil dengan aktivitas fisik baik sebanyak 45 persen.

Penentuan jenis makanan cepat saji yang paling banyak dikonsumsi dilihat dari kuesioner FFQ. Hasilnya, dari masing-masing responden diambil tiga makanan cepat saji yang dikonsumsi masing – masing ibu hamil dengan frekuensi terbanyak. Pada tabel 2, diketahui bahwa jenis makanan cepat saji yang paling banyak diminati oleh ibu hamil adalah es krim dan gorengan yang masing-masing dikonsumsi oleh 25 persen ibu hamil. Makanan cepat saji lainnya yang banyak diminati ibu hamil yaitu *fried chicken* yang dikonsumsi oleh 12 persen ibu hamil. Selanjutnya ada kripik, donat, mie instan, *nugget*, mie ayam, dan nasi goreng sebagai makanan cepat saji lainnya yang banyak diminati oleh ibu hamil bagi sebagai camilan maupun sebagai pilihan makanan utama.

Tabel 3 menunjukkan hasil analisis bivariat antara usia ibu hamil dengan kejadian hipertensi ibu hamil dengan berat badan berlebih. Hasil uji statistik dengan *chi-square* didapatkan p=0,749 (p>0,05), maka dapat disimpulkan bahwa secara statistik tidak terdapat hubungan antara umur ibu hamil dengan kejadian hipertensi. Untuk hasil uji bivariat variabel frekuensi konsumsi makanan cepat saji didapatkan p=0,003 (p≤0,05),sehingga disimpulkan bahwa terdapat hubungan yang bermakna antara frekuensi konsumsi makanan cepat saji dengan kejadian hipertensi ibu hamil. Dalam penelitian ini, ibu yang sudah memiliki riwayat / diagnosis hipertensi kehamilan cenderung mengurangi frekuensi konsumsi makanan cepat saji, sehingga tidak meningkatkan risiko hipertensi kehamilan.

Tabel 3
Hasil Analisis Bivariat Variabel Bebas

| Variabel | Kejadian Hipertensi pada Ibu Hamil | | | | *p value* | PR (95% CI) |
|---|---|---|---|---|---|---|
| | Hipertensi | | Tidak hipertensi | | | |
| | n | % | n | % | | |
| Usia ibu hamil | | | | | | |
| Berisiko | 5 | 22,7 | 17 | 77,3 | 0,749 | 1,318 |
| Tidak berisiko | 10 | 17,2 | 48 | 82,8 | | |
| Frekuensi Konsumsi Makanan Cepat Saji | | | | | | |
| Sering | 8 | 12,1 | 58 | 87,9 | 0,003 | 0,242 |
| Jarang | 7 | 50 | 7 | 50 | | |

Tabel 4
Hasil Analisis Bivariat Variabel Perancu

| Variabel | Kejadian Hipertensi pada Ibu Hamil | | | | *p value* | PR (95% CI) |
|---|---|---|---|---|---|---|
| | Hipertensi | | Tidak hipertensi | | | |
| | n | % | n | % | | |
| Paritas ibu hamil | | | | | | |
| Berisiko | 12 | 20,3 | 47 | 79,7 | 0,748 | 1,424 |
| Tidak berisiko | 3 | 14,3 | 18 | 85,7 | | |
| Pendidikan ibu hamil | | | | | | |
| Rendah | 2 | 18,2 | 9 | 81,8 | 1,000 | 0,965 |
| Tinggi | 13 | 18,8 | 56 | 81,2 | | |
| Sosial ekonomi ibu hamil | | | | | | |
| Tidak sejahtera | 4 | 23,5 | 13 | 76,5 | 0,727 | 0,926 |
| Sejahtera | 11 | 17,5 | 52 | 82,5 | | |
| Aktivitas fisik ibu hamil | | | | | | |
| Kurang | 8 | 18,2 | 36 | 81,8 | 1,000 | 0,935 |
| Baik | 7 | 19,4 | 29 | 80,6 | | |
| Tingkat stres ibu hamil | | | | | | |
| Stres | 3 | 18,8 | 13 | 81,2 | 1,000 | 1,000 |
| Normal | 12 | 18,8 | 52 | 81,2 | | |
| Riwayat hipertensi ibu hamil | | | | | | |
| Ada riwayat | 3 | 75 | 1 | 25 | 0,020 | 4,750 |
| Tidak ada riwayat | 12 | 15,8 | 64 | 84,2 | | |

Tabel 5
Analisis Multivariat Faktor yang Memengaruhi Kejadian Hipertensi Ibu Hamil

| Variabel | *Crude Odd Ratio*[1] | | *Adjusted Odd Ratio*[2] | |
|---|---|---|---|---|
| | PR (95% IK) | *p* | PR (95% IK) | *p* |
| Frekuensi Konsumsi Makanan Cepat Saji<br>Jarang<br>Sering | 1<br>0,208 | 0,011 | 1<br>0,283 | 0,058 |

[1]Multivariat tanpa variabel perancu, [2]Multivariat dengan variabel perancu : riwayat hipertensi ibu hamil

Tabel 4 menunjukkan uji bivariat untuk variabel perancu yang dikontrol melalui analisis dengan uji *chi square*. Untuk variabel perancu yang memiliki hubungan bermakna dengan kejadian hipertensi pada ibu hamil dengan berat badan berlebih adalah riwayat hipertensi ibu hamil dengan p=0,020 (p≤0,05). Riwayat hipertensi pada ibu hamil meningkatkan risiko terjadinya hipertensi dalam kehamilan sebesar 4,75 kali dibandingkan dengan ibu yang tidak memiliki riwayat hipertensi. Pada variabel paritas, tingkat pendidikan, tingkat sosial ekonomi, aktivitas fisik, dan tingkat stres ibu hamil tidak memiliki hubungan yang bermakna dengan kejadian hipertensi pada ibu hamil dengan berat badan berlebih karena memiliki nilai p>0,05.

Tabel 5 menunjukkan hasil uji multivariat untuk variabel yang sebelumnya memiliki hubungan bermakna terhadap kejadian hipertensi ibu hamil. Uji multivariat dilakukan dengan uji regresi logistik pada *software* SPSS. Hasilnya jika terdapat riwayat hipertensi ibu hamil dan peningkatan frekuensi konsumsi makanan cepat saji tidak memiliki hubungan dengan kejadian hipertensi ibu hamil dengan berat badan berlebih, karena nilai p=0,058 (p>0,05).

## BAHASAN

Penelitian ini meneliti kejadian Hipertensi dalam Kehamilan (HDK) pada ibu hamil dengan berat badan berlebih (*overweight* / obesitas). Penelitian sebelumnya di California Utara menunjukkan adanya peningkatan risiko hipertensi sebesar 90% pada ibu hamil dengan berat badan berlebih. Penelitian serupa yang dilakukan di Padang, Indonesia menunjukkan bahwa asupan tinggi energi dan karbohidrat meningkatkan risiko terjadinya preeklamsia.[29] Namun, risiko hipertensi ini dapat dikontrol dengan menjaga kenaikan berat badan selama hamil.[30] Berdasarkan penelitian yang telah dilakukan, menunjukkan hasil yang sejalan dengan penelitian tersebut. Dari 80 subjek ibu hamil dengan berat badan berlebih, hanya terdapat 18,75 persen ibu yang mengalami hipertensi. Hal ini dapat dipengaruhi karena anjuran dari dokter/bidan di Puskesmas yang dikunjungi untuk menjaga asupan dan mengontrol berat badan selama kehamilan agar tidak terjadi komplikasi kehamilan.

Usia ibu saat hamil menjadi salah satu faktor risiko terjadinya hipertensi dalam kehamilan. Ibu dengan usia risiko tinggi yaitu ≥35 tahun 2,774 kali berisiko mengalami HDK dibandingkan dengan ibu yang memiliki usia risiko rendah.[14] Berdasarkan hasil analisis bivariat dari penelitian yang telah dilakukan, untuk usia ibu hamil dengan kejadian HDK, menunjukkan tidak ada hubungan signifikan (p=0,749). Hal ini sejalan dengan penelitian sebelumnya yang dilakukan di Puskesmas Kramat Jati Jakarta.[1] Namun, hasil ini bertentangan dengan penelitian yang dilakukan di RS Tugurejo Semarang pada tahun 2013.[14] Hal ini mungkin dapat terjadi karena perbedaan kriteria dan jumlah subjek. Menurut peneliti walaupun tidak adanya hubungan secara statistik antara umur dengan kejadian hipertensi pada ibu hamil, umur masih

merupakan faktor risiko kejadian hipertensi pada ibu hamil. Hal ini didukung dengan data dari penelitian ini yang menunjukkan 82% bahwa ibu hamil yang tidak berada pada rentang usia berisiko tidak mengalami hipertensi kehamilan.

Frekuensi konsumsi makanan cepat saji dalam penelitian ini memiliki hubungan yang signifikan dengan kejadian HDK (p=0,003). Hal ini sejalan dengan penelitian – penelitian yang telah dilakukan di Rumah Sakit Hikmah Makassar maupun di Puskesmas Kedung Mundu Semarang dimana ada hubungan yang bermakna antara konsumsi makanan cepat saji dengan kejadian HDK.[11,25] Namun, dalam penelitian yang saya lakukan ini makanan cepat saji tidak meningkatkan risiko dari kejadian HDK karena justru memiliki nilai PR 0,242 kali. Hal ini terjadi karena dalam penelitian ibu hamil dengan riwayat maupun diagnosis HDK cenderung mengurangi atau membatasi asupan natrium dengan tidak mengonsumsi makanan tinggi sodium, mengandung *monosodium glutamate* (MSG), dan makanan awetan, karena telah mendapatkan anjuran dari tenaga kesehatan juga.[31] Selain itu, dari penelitian sebelumnya yang dilakukan pada skala nasional di Indonesia terbukti pola konsumsi makanan cepat saji bukan merupakan faktor utama terjadinya hipertensi.[32]

Pada penelitian ini, makanan cepat saji hanya dilihat dengan kuesioner *Food Frequency Questionnaire* (FFQ), sehingga untuk hasil yang didapatkan hanya dalam bentuk jenis makanan cepat saji yang sering dikonsumsi.[33,34] Hasilnya gorengan, es krim, dan *fried chicken* menempati urutan 3 teratas untuk makanan cepat saji yang kerap dikonsumsi ibu hamil. Berdasarkan hasil wawancara, ibu hamil memaparkan untuk konsumsi gorengan cukup tinggi karena mudah didapat dan harganya cukup murah. Untuk konsumsi es krim, karena ibu hamil yang masih merasakan mual, merasa cukup teratasi dengan konsumsi es krim. Sedangkan, pada *fried chicken*, biasanya karena ibu hamil yang sebelumnya telah memiliki anak, mengikuti kemauan anaknya untuk memilih *fried chicken* sebagai menu makanan. Hal ini sejalan dengan penelitian sebelumnya yang dilakukan di Kuningan, dimana ibu hamil trimester II dan III cenderung memilih makanan cepat saji sebagai makanan utama dengan alasan karena keinginan bayi dalam kandungannya "*mengidam"*. Namun justru menjadi berlebihan karena hal ini seolah-olah sebagai "balas dendam" karena pada trimester I ibu hamil cenderung susah makan karena mual muntah yang dialami.[35]

Variabel yang dikontrol melalui analisis yang pertama adalah paritas. Penelitian sebelumnya yang dilakukan di Puskesmas Kedung Mundu Semarang menunjukkan hasil wanita dengan status primipara meningkatkan risiko terjadinya HDK 9 kali lebih besar dibandingkan dengan wanita dengan status multipara.[25] Pada ibu primipara, HLA-G (*human leukocyte antigen G*) akan menghasilkan antibodi pemblokiran antigen plasenta yang belum sepenuhnya terbentuk, dan akan mengganggu proses implantasi trofoblas ke dalam jaringan desidua ibu. Hal ini akan berakibat pada tingginya tekanan darah.[36] Namun, hasil ini bertentangan dengan penelitian yang telah dilakukan, untuk paritas ibu hamil dengan kejadian hipertensi ibu hamil, menunjukkan tidak ada hubungan signifikan (p=0,748). Penelitian ini sejalan dengan penelitian yang dilakukan di Poli KIA RSU Anutapura Palu, Puskesmas Kassi – Kassi, dan Puskesmas Dahlia di Sulawesi. Hal ini mungkin terjadi karena paritas bukan merupakan faktor langsung dalam kejadian HDK, selain itu jarak kehamilan juga berpengaruh dalam kejadian HDK.[36,37]

Pada penelitian yang telah dilakukan, pendidikan tidak berhubungan secara signifikan dengan kejadian HDK (p=1,000). Namun, dari data penelitian yang telah diambil menunjukkan bahwa 81,2% ibu hamil dengan tingkat pendidikan tinggi tidak mengalami hipertensi kehamilan. Hal ini bertentangan dengan penelitian sebelumnya di Puskesmas Kedung Mundu Semarang.[25] Tetapi, sejalan dengan penelitian terdahulu yang dilakukan di RSUP Dr. Mohammad Hoesin Palembang. Pendidikan yang tinggi belum tentu menjamin ibu terhindar dari HDK karena perilaku ibu juga dipengaruhi oleh dukungan dari lingkungan sekitar dalam penerapannya.[38]

Sosial ekonomi keluarga dilihat dari jumlah pendapatan keluarga per bulan. Berdasarkan penelitian yang telah dilakukan, sosial ekonomi tidak memiliki hubungan signifikan dengan kejadian HDK (p=0,727). Dari data penelitian

diketahui bahwa 82,5% ibu hamil dengan pendapatan tergolong sejahtera tidak mengalami hipertensi kehamilan. Hasil penelitian ini sejalan dengan penelitian sebelumnya yang dilakukan di Puskesmas Nunpene pada tahun 2018. Namun bertentangan dengan penelitian sebelumnya di Puskesmas Kedung Mundu Semarang.[25] Hal ini mungkin karena sosial ekonomi yang kurang sejahtera berakibat pada kemampuan daya beli asupan berkurang, sedangkan ibu dengan sosial ekonomi yang tergolong sejahtera dapat lebih variatif dalam memenuhi asupannya.[39]

Aktivitas fisik sehari hari dari penelitian ini tidak berhubungan secara signifikan dengan kejadian HDK (p=0,506). Hasil ini sejalan dengan penelitian sebelumnya yang dilakukan di Kabupaten Semarang.[40] Hal ini bertentangan dengan penelitian sebelumnya yang dilakukan di Puskesmas Kedung Mundu Semarang, dalam penelitian tersebut dinyatakan bahwa ibu hamil dengan status aktivitas fisik yang banyak atau melakukan pekerjaan yang mengharuskan berdiri lama akan berisiko meningkatkan kejadian HDK hingga 20 – 60%.[25] Namun, dalam penelitian yang telah saya lakukan, sebanyak 55% ibu hamil memiliki status aktivitas fisik yang kurang (<360METs). Selain itu melalui wawancara diketahui bahwa sekiranya ada ibu dengan status bekerja, sebagian besar pekerjaannya dilakukan dengan duduk, dan tidak banyak melakukan aktivitas fisik yang terlalu berat. Untuk ibu rumah tangga, memaparkan bahwa walaupun banyak hal yang dikerjakan, namun saat mengerjakan sebenarnya banyak dibantu suami / orang tua / mertua dan sekiranya lelah, ibu hamil juga akan beristirahat dahulu.

Dari data penelitian yang telah dilakukan, didapatkan hasil bahwa tingkat stres tidak memiliki hubungan yang signifikan dengan kejadian HDK (p=1,000). Hal ini bertentangan dengan penelitian sebelumnya yang dilakukan di Makassar dimana stres berpengaruh terhadap kejadian HDK karena kondisi stres meningkatkan saraf simpatis yang kemudian meningkatkan tekanan darah secara bertahap, akibatnya semakin berat kondisi stres semakin tinggi pula tekanan darahnya.[41] Menurut peneliti walaupun tidak adanya hubungan secara statistik antara tingkat stres dengan kejadian hipertensi pada ibu hamil, stres masih berpengaruh terhadap kejadian hipertensi pada ibu hamil. Hal ini juga didukung dari hasil penelitian ini yang menunjukkan bahwa mayoritas ibu yang tidak stres, tidak mengalami hipertensi kehamilan.

Penelitian yang telah dilakukan terkait riwayat hipertensi kehamilan sebelumnya memiliki hubungan signifikan terhadap kejadian HDK (p=0,020). Ibu hamil dengan riwayat hipertensi kehamilan sebelumnya meningkatkan kejadian HDK 4,75 kali lebih besar dibandingkan dengan ibu hamil yang tidak memiliki riwayat hipertensi kehamilan. Hal ini sejalan dengan penelitian yang dilakukan di Puskesmas Kedung Mundu, Puskesmas Nunpene, dan Poli Obs-Gin RSJ Ratumbuysang di Kota Manado.[12,25,39] Ibu yang memiliki riwayat HDK pada kehamilan pertama cenderung meningkatkan kejadian preeklamsia pada kehamilan kedua. Kejadian ini biasanya diminimalisir dengan pemberian penyuluhan dari dokter / bidan yang menangani agar bisa lebih memperhatikan kondisinya.

Kelebihan penelitian yaitu penelitian ini mengembangkan penelitian sebelumnya, dengan melihat hubungan dari faktor-faktor risiko kejadian HDK pada ibu hamil di Kota Semarang dengan berat badan berlebih. Keterbatasan dari penelitian ini adalah data tekanan darah yang tidak diambil secara langsung, hanya melalui data sekunder dari buku KIA.

## SIMPULAN DAN SARAN

### Simpulan

Usia ibu hamil tidak berhubungan dengan kejadian HDK. Riwayat hipertensi ibu hamil memiliki hubungan yang bermakna dengan kejadian Hipetensi dalam Kehamilan (HDK). Oleh karena ibu dengan riwayat / diagnosis HDK sudah mendapat anjuran dan membatasi asupan makanan cepat saji, maka pada penelitian ini makanan cepat saji tidak berhubungan dan tidak meningkatkan risiko kejadian HDK.

### Saran

Ibu hamil perlu menjaga kondisi tekanan darah dalam ambang batas normal yang dianjurkan. Ibu hamil dengan maupun tidak memiliki riwayat / diagnosis HDK, dianjurkan

lebih selektif dalam pemilihan asupan. Makanan cepat saji pada penelitian ini tidak meningkatkan risiko karena adanya pembatasan konsumsi dari ibu hamil yang diteliti, maka untuk para ibu hamil juga dianjurkan untuk melakukan pembatasan konsumsi makanan cepat saji agar tidak meningkatkan risiko hipertensi dalam kehamilan. Untuk peneliti selanjutnya, perlu dilakukan pengukuran tekanan darah secara langung untuk mengurangi bias akibat penggunaan data sekunder. Dapat dilakukan desain studi yang berbeda juga untuk melihat batasan frekuensi dan porsi makanan cepat saji aman dikonsumsi bagi ibu hamil.

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# FLAVONOID AS A FUNCTIONAL INGREDIENT IN THE NUTRITION MANAGEMENT OF ENDOMETRIOSIS: A REVIEW

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## ABSTRACT

**Endometriosis is a chronic gynecological disease that often causes chronic pain, dysmenorrhea, and infertility. Hormonal treatment as definitive therapy for endometriosis can disrupt and lead to recurrent pain. Flavonoids are natural bioactive compounds found in various fruits, vegetables, and bee products, and their function as antioxidants to suppress the proliferation of pathological cells, which can also contribute to the improvement of clinical signs and symptoms. The aim of this literature review is to investigate the potential of flavonoids as a functional ingredients in nutrition management of endometriosis. The review was conducted using search engines including PubMed, ScienceDirect, and Cochrane. The inclusion criteria were: (1) The study design could be a randomized clinical trial (RCT), a case-control study, or an in vivo study, (2) the literature has to be published in the last ten years from 2013 to 2023, (3) using English or Indonesian subjects, and (4) literature can be accessed online. The exclusion criteria were irrelevant articles and incomplete texts, such as only abstracts. The triggering factors for the development of endometriosis are still unknown, but oxidative stress is one of the factors that has been strongly associated with endometriosis. The administration of natural antioxidants is a promising adjuvant nutritional therapy option to support primary endometriosis treatment. Flavonoids are bioactive compounds that possess strong antioxidant activity. They are abundantly found in vegetables, fruits, bee products, and have been shown to have anti-inflammatory and anti-proliferative effects on endometriosis, both at the cellular and clinical levels.**

**Keywords: flavonoids, endometriosis, antioxidants**

## ABSTRAK

**Endometriosis merupakan penyakit ginekologi kronis yang sering menyebabkan nyeri kronis, dismenore dan infertilitas. Pengobatan hormonal sebagai terapi definitif endometriosis dapat mengganggu dan dapat menyebabkan nyeri berulang. Flavonoid merupakan bahan bioaktif alami yang terdapat pada berbagai jenis buah, sayuran, dan produk lebah serta berfungsi sebagai antioksidan untuk menekan proliferasi sel patologis yang juga akan berpengaruh pada perbaikan tanda dan gejala klinis. Studi literatur ini bertujuan untuk memberikan ulasan mengenai flavonoid sebagai zat fungsional yang berpotensi memberikan dampak dalam manajemen gizi pada endometriosis. Tinjauan dilakukan dengan menggunakan mesin pencari yang terdiri dari PubMed, ScienceDirect, dan Cochrane dengan kriteria inklusi berupa: (1) desain studi yaitu uji klinis acak, studi case-*control* atau studi *in-vivo* (2) literatur harus diterbitkan dalam sepuluh tahun terakhir dari tahun 2013 hingga 2023, (3) menggunakan bahasa Inggris atau bahasa Indonesia, dan (4) literatur dapat diakses secara online. Kriteria eksklusi adalah artikel tidak relevan dan teks tidak lengkap; hanya abstrak. Faktor pencetus timbulnya endometriosis masih belum diketahui, stres oksidatif merupakan salah satu faktor yang banyak terbukti berhubungan dengan endometriosis. Pemberian antioksidan alami merupakan salah satu pilihan terapi nutrisi tambahan yang menjanjikan untuk mendukung terapi utama endometriosis. Flavonoid merupakan salah satu senyawa bioaktif yang memiliki aktivitas antioksidan kuat dan banyak terkandung dalam sayuran, buah-buahan dan produk lebah dan memiliki efek anti-inflamasi serta anti proliferasi terhadap kondisi endometriosis secara seluler maupun tanda klinis.**

**Kata kunci: flavonoid, endometriosis, antioksidan**

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## INTRODUCTION

Endometriosis is the growth of endometrial tissue outside the uterus, specifically in the peritoneal cavity. It is a benign condition that often causes dysmenorrhea and infertility in women.[1] Approximately 10 percent of the female population, including adolescent girls, worldwide are at risk of developing endometriosis.[2] Previous studies have found that endometriosis is present in 30-50 percent of women with infertility.[2] The Indonesian Association of Obstetrics and Gynecology states that dysmenorrhea can still recur even after operative therapy for endometriosis.[3] However, the exact triggering factors for endometriosis are still unknown, although oxidative stress is now recognized as a risk factor for the development of endometriotic lesions.[4,5] Endometriosis not only affects physiological function but also the quality of life for women. Women with symptomatic endometriosis are prone to experience depression, anxiety, and other mood disorders that impact their daily activities, due to hormonal imbalance, especially estrogen.[6] The signs and symptoms are not specific and may include menstrual pain (dysmenorrhea), pain during intercourse (dyspareunia), pain during urination (dysuria), and deep pelvic pain during bowel movements (dyschezia). Additionally, infertility can occur due to the infiltration of endometriotic lesions in specific areas, which is a concern for scientists regarding these ectopic endometriotic lesions.[8] Not all cases of endometriosis are accompanied by symptoms, but according to the Indonesian Society of Obstetrics and Gynecology (ISOG) consensus in 2017, 62 percent of endometriosis patients experience menstrual pain (dysmenorrhea) and chronic pelvic pain. The nature and frequency of the perceived pain are subjective to each individual with endometriosis.[3]

The mechanisms involved in endometriosis are still theoretical, as the underlying inflammation is not yet fully understood and may be caused by genetic and epigenetic factors resulting in an increased imbalance of estrogen compared to progesterone. Hormonal imbalance leads to pain occurring outside the menstrual cycle as well as fertility disorders. Anatomic factors, estrogen hormonal dysregulation, and exogenous factors such as immune status and hormonal imbalances, especially increased estrogen, may also contribute to endometriosis[7]. These factors result in prolonged oxidation without a proper balance of antioxidants and pro-oxidants. As a result, oxidative stress occurs, leading to inflammatory reactions and compensatory responses from other organs, ultimately leading to the development of hyperproliferative lesions and impacting the physiological function.[8] The goals of managing endometriosis are to reduce clinical symptoms, prevent fertility disorders, minimize surgical interventions, and prevent postoperative recurrence. Endometriosis therapy involves the use of pain-relieving medications such as NSAIDs and continuous hormonal therapy with regular monthly evaluations.[3]

Flavonoids are a group of phenolic compounds that have been extensively studied for their competence as antioxidants. They are abundantly found in natural food sources such as green leafy vegetables, grapes, olives, apples, and bee products, which have been identified to have higher flavonoid content compared to other food sources.[9] Several studies on flavonoids have demonstrated their antioxidant effects in reducing oxidative processes through intracellular pathways, such as the natural factor kappa beta (NF-κβ) pathway, and by binding circulating reactive oxygen species (ROS) both extracellularly and intracellularly.[10,11,12]

Flavonoids are also known as phytoestrogen which were synthesized by plants through UV radiation. The estrogens naturally formed by various types of plants that can bind to estrogen receptors 1 and 2 (ESR1 and ESR2) in human's body.[11] It predominantly works on ESR2 in the endometrium, while acting as antagonists to ESR1, reducing estrogen activation by ESR1 which is located in almost all organs but dominantly in brain and adipose tissue.[11,12] Flavonoids also stimulate the production of incretin hormones, such as glucose-dependent insulinotropic polypeptide (GIP), which increases insulin secretion and glucose uptake into cells, resulting in decreased plasma blood sugar levels. Glucagon-like

peptide (GLP-1) is a hormone activated by flavonoids during the digestion process in the small intestine. GLP-1 prolongs gastric emptying time, reduces gastric acid secretion, improves absorption processes, and reduces appetite.[13,14] The role of flavonoid has been shown can help regulate metabolism under conditions of oxidative stress, especially in chronic diseases. The role of flavonoids in endometriosis has been systematically explained by previous studies. A review article by Bartiromo,et al.,[15] demonstrates the potential of flavonoids as phytoestrogens that can improve endometriosis lesions based on animal studies conducted in several studies. Although not all groups of flavonoids show significant changes in endometriosis lesions compared to the control group, certain flavonoids, such as resveratrol found in berries, chrysin found in bee products, and daidzein found in soybeans and their derivatives, have shown promising effects. In line with the review article by Wardani et al.,[16] which provides an overview of the role of flavonoids in modulating TNF-alpha levels in endometriosis conditions in animal and in vivo studies, this article comprehensively examines the role of flavonoids in endometriosis. The emphasis is placed on studies involving human subjects rather than animal or in vivo studies, providing a more direct understanding of the potential improvement of endometriosis's symptoms through flavonoid administration. The development of targeted nutritional interventions and further research in this area are needed to better understand the potential benefits of antioxidants and flavonoids in managing endometriosis. The aim of this study is to investigate the potential of flavonoids as a functional ingredients in nutrition management of endometriosis.

## METHOD

This study used a literature study or literature review using three databases, PubMed, Cochrane, and Science Direct with the keywords "Flavonoids", "endometriosis" and "antioxidant". The inclusion criteria in this literature study were: (1) The study design could be a randomized clinical trial (RCT), a case-control study, or an in vivo study, (2) the literature has to be published in the last ten years from 2013 to 2023, (3) using English or Indonesian subjects, and (4) literature can be accessed online.The exclusion criteria are irrelevant articles and incomplete texts, such as only abstracts.

Literature search was conducted using Boolean Search techniques with the keywords: Flavonoid OR phytoestrogen AND Endometriosis OR Endometriosis-related pain. The identified references will be reviewed first and used if they can address several research questions, such as "what is flavonoid?," "how can flavonoids affect endometriosis improvement?," and "what are the outcomes of orally administered flavonoid-rich foods in endometriosis?". Articles with plant subjects and in vitro designs are considered irrelevant and excluded. Additionally, articles that do not specifically focus on inflammation and the improvement of endometriosis cells are also included in the exclusion criteria due to different outcomes. The PRISMA diagram of literature search process is presented in Figure 1.

## RESULTS

In this literature, there are 9 articles consisting of 6 clinical studies articles while 3 other are laboratory experimental studies. Many animal and in-vitro studies investigating the role of flavonoids in improving endometriosis have been designs, demonstrating the antioxidant effects of flavonoids in supporting clinical and cellular improvements in endometriosis. Meanwhile, human studies regarding this issue are still limited. A summary of this literature search results for this study is shown in table 1.

## DISCUSSION

Based on the results of literature search, eight articles met the inclusion criteria: two articles discussed flavonoid compound on improving pain scale, five articles discussed about improving lesion and inflammation[7,18,21,22,26,27,], and one article discussed flavonoid reduce the risk of endometriosis.[21]

**The Effect Flavonoid on Endometriosis Lesion**

Five articles were reviewed and indicated the positive effect of flavonoid compound on endometriosis lesion. The emergence of clinical symptoms in endometriosis is based on the proliferation of abnormal endometrial layers as a consequence of inflammation due to oxidative stress in the uterus. Tumor necrotizing factor alpha (TNFα) levels increase in chronic inflammation, providing a proliferation signal to cells through the nuclear factor kappa beta (NF-kβ) pathway, which is one of the pathways involved in tumorigenesis by triggering the production of vascular endothelial growth factor (VEGF) and aromatase enzyme production by the Golgi apparatus.[17] Clinical study conducted by Mirzaei et al.[18] on female subjects with endometriosis using silymarin (a group of flavonoids) compared with placebo-showed a significant reduction in endometriotic lesion size by 25 $mm^3$ in the silymarin group. Silymarin is one of the active ingredients found in milk thistle (*Silybum marianum*), which is known as a class of flavonoids.[19]

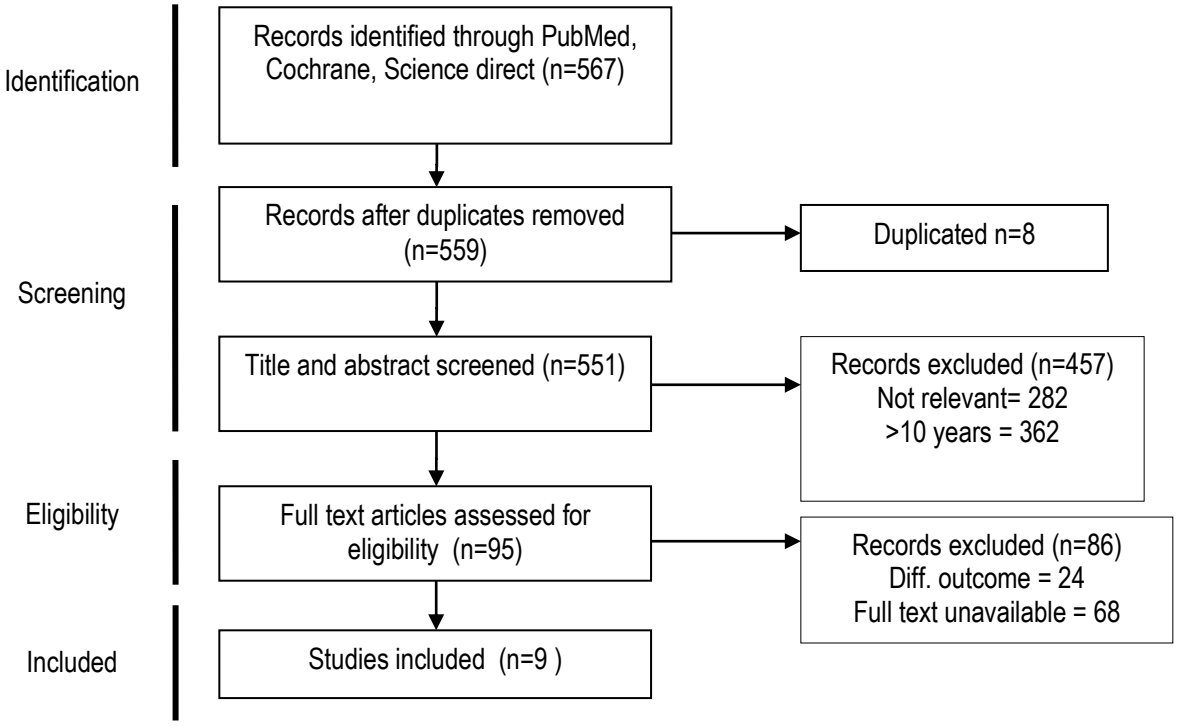


**Figure 1.**

**Literature search proces**

Table 1

Summary of articles findings

| Author | Subject | Title | Design | Dosage of flavonoid | Duration | Results |
|---|---|---|---|---|---|---|
| Giannini et al, 2015 | 30 women with endometriosis | Effects of Preoperative and Perioperative administration of Wobenzym Vital, an enzyme-flavonoids combination supplement with antiinflammatory activity, as supportive treatment on Minimal-Mild stage of Endometriosis | Randomized-controlled trial | Each tablet of Wobenzym contains 9 mg chymotrypsin (flavonoid compound), two times a day | 60 days | Wobenzym group has lower visual analogue scale (VAS) scores before surgery and perioperatively,in compare with placebo group. Inflammatory and several growth factors were higher than intervention group in perioperative period, significantly (P<0.05) |
| Da Silva et al, 2017 | 44 women with endometriosis | The use of Resveratrol as an adjuvant treatment of pain in endometriosis: A randomized clinical trial | Randomized-controlled trial | each resveratrol capsule contains 40 mg resveratrol, 2 times a day | 42 days | After treatment, pain values were decreased in both group. Pain values of resveratrol group was lower than placebo group (P<0,005) |
| Mirzaei et al, 2020 | 70 women with endometriosis | A randomized trial assessing the eficacy of Silymarin on endometrioma‐related manifestations | Randomized-controlled trial | 140 mg of silymarin (flavonoid compound), 2 times a day | 12 weeks | The volume of endometrioma in right ovary was reduced significantly (p=0,04) after 12 weeks in silymarin group and IL-6 level in silymarin group was reduced significantly as well (p=0,002). (The Quality of Life (QoL) and female sexual function did not improve substantially in the two groups. |

| Author | Origin | Title | Design | Subject | Results |
|---|---|---|---|---|---|
| Hendarto et al, 2018 | Indonesia | Curcumin improves growth factors expression of bovine cumulus-oocyte complexes cultured in peritoneal fluid of women with endometriosis | In vitro study | 21 peritoneal fluid from infertile women with endometriosis | Growth Differentiation Factor 9 (GDF-9) produced by oocyte, which is useful for granulosa cell proliferation and differentiation, and Kit Ligand (KitL) secreted by granulosa cells, which induces oocyte maturation were increased significantly (p<0,001) in samples with curcumin, meanwhile TNFα expression in peritoneal fluids added curcumin were reduced compared to those cultured without curcumin (p<0,001) |
| Youseflu et al, 2020 | Iran | Dietary Phytoestrogen Intake and The Risk of Endometriosis in Iranian Women: A Case-Control Study | Case-control study | 78 women with laparoscopically confirmed endometriosis and 78 normal pelvis women | Among food groups, intake of total isoflavones, one of flavonoid compound was higher (P-tren=0,002) than others. It was related to reduced endometriosis risk. (OR=0,38) |
| Jehanara et al, 2018 | Indonesia | Effect of Genistein on Decreased Levels of Vascular Endothelial Growth Factor-A in Endometriosis Cell Culture | In-Vitro study | Human endometriosis cell | Concentration of VEGF-A between the control group and genistein group were significantly different at the $24^{th}$ and $48^{th}$ hour of incubation period. The lowest VEGF-A concentration was found at the genistein group of 50µm/L with 48 hours of incubation ($p < 0.05$). |

| Author | Subject | Title | Design | Dosage of Flavonoid | Duration | Results |
|---|---|---|---|---|---|---|
| Jouhari et al, 2018 | Rats | Effects of silymarin, cabergoline and letrozole on rat model of Endometriosis | In-vivo study | 100 mg/kgBW/day of silymarin | 3 weeks | Volume of the endometriosis implants decreased significantly in silymarin, letrozole, and cabergoline compared to the control. |
| Maharani et al, 2019 | Rats | Phytochemical characteristics from *Phaleria macrocarpa* and its activity on the peritoneal damage of endometriosis | In-vivo study | 3,75 mg, 7,5 mg, 11,25 mg of flavonoid isolates from P.*macrocarpa* extract | 14 days | There was an increase in granulomas, proliferation, and apoptosis in the peritoneal tissues of the endometriosis model (EMT) |
| Ilhan et al, 2020 | Rats | The regression of endometriosis with glycosylated flavonoids isolated from *Melilotus officinalis*(L.) Pall. in an endometriosis rat model | In-Vivo study | 100 mg/kgBW/day of glycosylated flavonoid fractions from *Melilotus officinalis*(L.) Pall MeOH extract | 4 weeks | The application of the MeOH extract on the top of endometriotic implant significantly decreased the volumes from 81.9 to 54.4 $mm^3$ |

This is consistent with the concept of increased inflammatory mediators as activators of cell proliferation leading to hyperplasia and the formation of endometriotic lesions.[20] Endometriotic lesions undergo thickening of the endometrial lining, triggering increased aromatase enzyme production. Aromatase enzyme is required for the catalysis process of androstenedione into estrogen. Increased estrogen levels without a balance in progesterone production can cause vasodilation of blood vessels and angiogenesis in the endometrium, leading to pain as one of the signs of ongoing inflammation. Furthermore, impaired maturation of ovarian eggs and increased mucus production can interfere with the penetration of sperm during fertilization.

Comparisons between flavonoid, lignans, and other phytoestrogen compound were also studied by Youseflu et al.[21] on women with confirmed endometriosis and those with a normal pelvis. By observing the intake of phytoestrogens, specifically flavonoids, lignans, and other flavonoids / coumestrol, showed that a high intake of flavonoids is significantly associated with a lower risk of endometriosis (OR: 0.38; 95% CI: 0.33-0.83; P-trend=0.002). Some studies discussed about the role of flavonoids in the growth factor signaling pathway. Genistein, one of the flavonoid compounds found in soy, is known to inhibit the activity of tyrosine kinase enzymes.[22] Tyrosine kinases are known to be involved in cell proliferation. Inhibiting tyrosine kinase enzymes in cancer conditions can be beneficial in reducing cancer cell proliferation.[24]

**Anti-inflammatory Activity**

The inflammation that occur in endometriosis lead to sensitization of the endometrium to increased estrogen levels, leading to myometrial contractions and arteriolar vasoconstriction, resulting in ischemia. Ischemia causes an inflammatory response, including the release of prostaglandins that stimulate afferent nerves and result in pain. Several human studies have shown that flavonoids play a role in reducing pain in endometriosis.[25,27]

A study by Da Silva et al.[25] on 44 women confirmed with endometriosis who received combination oral contraceptive therapy divided the participants into an intervention group and a placebo group. The intervention group received oral resveratrol, a group of flavonoids found in many dietary sources such as grapes, wine, peanuts, soy and berries.[26] 40 mg of resveratrol has given to subject in resveratrol group, twice daily for 42 days. Pain measured using visual analogue scale (VAS), during menstruation (dysmenorrhea) and/or pelvic pain was assessed. The results of this study showed pain improvement in both groups within 42 days, with a better VAS score in the intervention group (mean baseline score: 5.4, mean final score: 3.2) compared to the placebo group (mean baseline score: 5.7, mean final score: 3.9). Although no significant difference was found between resveratrol and placebo group, the pain improvement observed in the resveratrol group suggesting the need for further investigation in larger populations or with higher doses.

In vitro study conducted by Hendarto et al.[27] which used peritoneal fluid from 44 infertile women with endometriosis. 0.2 ml of dissolved curcuminwas added on 21 peritoneal fluid and 21 other samples were not given curcumin. Curcumin, a plant-derived polyphenolic compound, naturally present in turmeric (*Curcuma longa*).[27] Growth Differentiation Factor 9 (GDF-9) produced by oocyte, which is useful for granulosa cell proliferation and differentiation, and Kit Ligand (KitL) secreted by granulosa cells, which induces oocyte maturation were increased significantly ($p<0,001$) in samples with curcumin, meanwhile TNFα expression in peritoneal fluids with curcumin were reduced compared to those cultured without curcumin ($p<0,001$). This indicates the presence of other flavonoid compounds, including curcumin, which has a significant positive impact on the improvement of endometriosis compared to the control group. The decrease in TNF-alpha and the increase in growth differentiation factor 9 (GDF9) in peritoneal fluid treated with curcumin suggest the role of curcumin as an anti-inflammatory agent and its ability to improve the regulation of oocyte maturation. Consistent with previous studies, two important points can be highlighted regarding the improvement of endometriosis. First, the significant role of aromatase enzyme

in the proliferation of lesions, as the administration of aromatase inhibitors leads to a reduction in the size of endometriotic lesions. Second, antioxidants have an anti-proliferative effect, such as aromatase inhibitors, and increase the levels of antioxidants involved in inhibiting NF-kβ signaling, thus reducing the formation of tumor-initiating inflammatory mediators such as TNFα.

Consistent with animal study conducted by Jouhari et al.[28] divided 32 female rats induced with endometriosis into four groups: (1) letrozole group, a non-steroidal aromatase inhibitor at a dose of 0.18 mg/kg body weight/day; (2) cabergoline group, a dopamine agonist involved in VEGF receptor endocytosis, resulting in a reduction in VEGF-receptor binding. Cabergoline was administered at a dose of 0.5 mg/kg body weight/day; (3) silymarin group, at a dose of 100 mg/kg body weight/day; and (4) control group, receiving no intervention. The three intervention groups received subcutaneous injections for 21 days. The results of the study showed that the letrozole group had a greater reduction in endometriotic lesion mass by 4.35 $mm^3$ compared to the other two intervention groups. Additionally, the silymarin group showed significantly higher antioxidant capacity compared to the control group. The higher antioxidant value in the silymarin group is also consistent with a significant decrease in TNFα levels compared to the control group. The improvement in levels of pro-inflammatory mediator such as TNFα and growth factors affects the perceived quality of pain, leading to a better experience. The antioxidant effects of flavonoids also work effectively on several neurotransmitter receptors associated with neuropathic pain.[29]

### Potential application of flavonoid in the management of endometriosis

Globally, the use of supplementary nutrition therapy in the management of endometriosis has not been determined. Based on a study by Hujis et al.[30], the intake of fatty acids, antioxidants, and a combination of vitamins and minerals has been found to help improve endometriosis, particularly the clinical symptoms experienced. Vegetables and fruits are among the recommended nutritious ingredients in supplementary nutrition therapy for endometriosis patients. The effective dosage range of flavonoids has not yet been determined, but based on a study by Ortiz-Andrade et al.[31] in animal experiments, an intake of more than 2000 mg of flavonoids per day may pose a risk of liver disorders because flavonoids have the potential to weakly inhibit the metabolism of metabolites through the CYP450 pathway. Several studies have reported that the average flavonoid consumption in Asian populations ranges from 50-200 mg/day, while in European populations, it ranges from 200-500 mg/day, with tea being one of the most frequently consumed food items. Tea is a rich source of flavonoids, followed by oranges and grapes. In Indonesia, the median flavonoid intake, according to a study by Sefrina et al.[32], is approximately 25.02 mg/day. Recommendations to increase the consumption of vegetables, fruits, and bee products can be applied as a supportive therapy.

## CONCLUSION

In this review, we discuss potential of flavonoids in improving endometriotic lesions and clinical symptoms. Flavonoids have been shown to reduce inflammation, which is a cause of pain and abnormal lesion growth, by inhibiting the signaling of the NF-kB pathway, which is a key pathway involved in tumorigenesis, as well as through the activation of antioxidant enzymes. Flavonoids, as a group of phytonutrients, hold promise as an additional nutritional therapy for conditions involving chronic pain and abnormal lesion growth, such as endometriosis. Food sources rich in flavonoids can be a favorable option as supplementary nutrition for endometriosis patients, both with or without medical therapy. Flavonoids are abundantly found in natural food sources that are easily accessible and can be consumed in daily life. A limitation of our study is that some of our references were studies conducted on animals. The dosage of drugs or supplements used in animal testing is often higher, making it inappropriate to directly reference those dosages for human use. Furthermore, due to the limited number of

articles reviewed in this study, a definitive conclusion regarding the role of flavonoids in endometriosis cannot be drawn. Evidently, there are still many gaps to explore potential of flavonoids in human's health and also metabolic dysfunction. Further clinical trials, particularly involving human subjects with endometriosis or even other chronic diseases , are needed to validate these positive findings from previous studies as well as to detect possible adverse effects that may arise when administered in the form of supplementation.

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# IRON INTAKE, HEMOGLOBIN LEVEL AND ITS ASSOCIATION WITH KARNOFSKY SCORE: A CROSS SECTIONAL STUDY IN PULMONARY TUBERCULOSIS PATIENTS OF RSUP PERSAHABATAN

*Asupan Zat Besi, Kadar Hemoglobin, dan Hubungannya dengan Skor Karnofsky: Studi Potong Lintang pada Pasien Tuberkulosis Paru di RSUP Persahabatan*

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## ABSTRACT

**Tuberculosis (TB) is a major public health concern globally, with high prevalence in Indonesia. The functional status of TB patients is commonly assessed using Karnofsky Score. However, the correlations between iron intake, hemoglobin levels, and Karnofsky Score in pulmonary TB patients at RSUP Persahabatan have not been investigated. This study aimed to examine iron intake and hemoglobin levels and their possible correlations with the Karnofsky Score in pulmonary TB patients at RSUP Persahabatan. A total of 108 outpatient TB patients were included in the study. Data on iron intake, hemoglobin levels, and Karnofsky Score were collected through interviews, dietary assessments, and anthropometric measurements. Statistical analyses involved univariate and bivariate correlation tests. The majority of subjects had insufficient iron intake (74.1%), normal hemoglobin levels (56.5%), and Karnofsky Score of 80 percent (30.6%). However, this study did not identify significant relationships between iron intake, hemoglobin levels, and Karnofsky Score in pulmonary TB patients at RSUP Persahabatan. These findings suggest that other factors may influence the functional status of TB patients, highlighting the need for further research. Understanding the characteristics and nutritional requirements of TB patients is crucial for effective management and control strategies.**

**Keywords: iron intake, hemoglobin, karnofsky score, tuberculosis**

## ABSTRAK

**Tuberkulosis (TB) adalah masalah kesehatan yang mengancam masyarakat secara global, dengan prevalensi yang tinggi di negara Indonesia. Status fungsional pasien TB umum dinilai menggunakan Skor Karnofsky. Namun penelitian mengenai hubungan antara asupan zat besi, kadar hemoglobin, dan Skor Karnofsky pada pasien TB paru di RSUP Persahabatan belum dilakukan. Penelitian ini bertujuan untuk mengkaji asupan zat besi, kadar hemoglobin, dan hubungannya dengan Skor Karnofsky pada pasien TB paru di RSUP Persahabatan. Sebanyak 108 pasien TB rawat jalan menjadi subjek penelitian. Data mengenai asupan zat besi, kadar hemoglobin, dan Skor Karnofsky dikumpulkan melalui wawancara, penilaian pola makan, dan pengukuran antropometri. Analisis statistik meliputi uji korelasi univariat dan bivariat. Sebagian besar subjek memiliki asupan zat besi yang tidak cukup (74,1%), kadar hemoglobin normal (56,5%), dan Skor Karnofsky 80 persen (30,6%). Namun, tidak ditemukan hubungan signifikan antara asupan zat besi dan kadar hemoglobin dengan Skor Karnofsky. Penelitian ini tidak menemukan hubungan signifikan antara asupan zat besi, kadar hemoglobin, dan Skor Karnofsky pada pasien TB paru di RSUP Persahabatan. Temuan ini menunjukkan bahwa faktor lain mungkin memengaruhi status fungsional pasien TB, sehingga diperlukan penelitian lebih lanjut. Memahami karakteristik dan kebutuhan nutrisi pasien TB sangat penting untuk strategi manajemen dan pengendalian yang efektif.**

**Kata kunci: asupan zat besi, hemoglobin, skor karnofsky, tuberkulosis**

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## INTRODUCTION

Tuberculosis (TB) is one of the leading infectious causes of death and a global public health threat. In 2020, there were 10 million people who suffered from TB, and 1.5 million deaths were attributed to the disease. Southeast Asia, particularly, is the region that had the highest number of TB cases, accounting for 43 percent of the total cases in 2020. According to the World Health Organization (WHO), Indonesia ranks third among countries with the highest prevalence of TB, following India and China. As of May 2018, Indonesia Ministry of Health had reported 420,994 new cases of TB.[1,2]

The Karnofsky Score is a commonly used clinical prediction rule for TB patients. It is a simple and rapid method to assess the functional status of patients and has been used for over 60 years. The score is widely used as an indicator of disease severity, treatment response, quality of life assessment, mortality prediction, evaluation of different therapeutic approaches, and prognosis assessment for individual patients. The score ranges from 0 to 100 percent, with assessments based on an individual's ability to perform daily activities, work, the need for assistance, and the presence of disease-related symptoms. A lower Karnofsky score indicates poorer functional status.[3–6] Pakasi et al used the Karnofsky score to categorize the severity of TB patients with a score of <80 being severe TB and >80 being mild TB. They found 47 percent of patients with severe TB in East Nusa Tenggara.[7]

In the context of TB patients, decreased appetite and metabolic needs can lead to malnutrition, including iron intake disorders. A study conducted in China in 2019 found that the majority (97.9%) of female TB patients had iron intake below the country's Dietary Reference Intakes (DRI) guidelines.[8] Insufficient iron intake is associated with impaired immune function, but excessive iron intake is also linked to increased active TB and TB-related mortality.[9] World Health Organization has not yet determined iron intake recommendations for active TB patients, and recommendations for iron supplementation are still unclear.[10]

During the diagnosis of TB, low hemoglobin levels are commonly found. Studies have reported a higher prevalence of anemia among TB patients compared to healthy control groups. The prevalence of anemia among TB patients has been reported as 72.7 percent in India[11] and 86 percent in Tanzania [12]. A systematic literature review and meta-analysis of 16,671 TB patients conducted by Barzegari et al. showed a prevalence of anemia of 61.53 percent.[11] In Indonesia, a study conducted in Tanjung Raja Community Health Center found that 81 percent of pulmonary TB patients suffered from anemia.[13]

Study by Mendonca et al. have suggested that anemia can indicate the severity of tuberculosis. Anemia due to iron deficiency has been associated with the Karnofsky score.[14] Isanaka et al found that the hematological status of TB patients with iron deficiency anemia was related to the Karnofsky score (p<0,001).[15] In Indonesia, a study found a significant association between hemoglobin levels and the Karnofsky score, with patients in the severe category (Karnofsky score <80) having lower hemoglobin levels.[7]

Indonesia is the third highest country with the incidence of tuberculosis and RSUP Persahabatan is a national respiratory referral hospital as well as a referral center for lung infection cases including TB. Currently there are no studies linking iron intake and hemoglobin levels with the Karnofsky score in pulmonary tuberculosis patients at RSUP Persahabatan using SQFFQ method. This research is expected to provide an overview of nutritional aspects in TB patients. Thus, the aim of this study was to investigate iron intake and hemoglobin level and to assess for possible correlations with the Karnofsky score in pulmonary TB patients of RSUP Persahabatan.

## RESEARCH METHOD

### Study Participant

We recruited 108 outpatient TB patients with a Karnofsky score ≥50 percent, diagnosed with pulmonary TB by the attending physician, aged between 18-60 years, and patients with hemoglobin test results. The exclusion criteria are pregnant or breastfeeding, have history of blood transfusion in the past 4 months, diagnosed with kidney failure and liver disease, experiencing moderate to severe bleeding, including menorrhagia, hemoptysis, injury, and moderate to severe surgery, and have

psychiatric disorders. Subjects were patients who were visited RSUP Persahabatan during January-February 2023 and were recruited consecutively. This study has been approved by the Medical Ethics Committee of RSUP Persahabatan No. 03.A.1/KEPK-RSUPP/01/2023.

**Data Collection**

The study procedures include interviews, assessment of food intake and anthropometric measurements. All procedures are completed while adhering to disease prevention safety protocols. A semi-quantitative Food Frequency Questionnaire (FFQ) was used to collect dietary iron intake. The semi-quantitative FFQ iron database was obtained from the Mutmainnah study in 2016.[16] Subjects were asked to remember the frequency and amount of foods listed in the questionnaire during the last month. Subjects who have problems remembering meal portions or need help eating, the family or caregiver will be asked about the frequency, type and amount of food. Food recording is carried out using household measurements. Body mass index was collected by measuring body weight and body height. The body height measurement was performed with a height measuring board (ShorrBoard, Olney, USA). Weight measurement was performed using SECA 876 for body weight. Measurements were made twice and the average value was taken. An interview regarding the Karnofsky score was conducted using the Karnofsky score form. The researcher inquired about the subject's level of severity. After the subject answers the questions, the researcher record and assign a score based on the subject's responses. The Karnofsky score ranges from 0 percent to 100 percent, with higher scores indicating better patient performance.

**Data Analysis**

Interviews with research subjects were carried out using a structured questionnaire to obtain characteristic data. Characteristic data includes age, gender, education level, income, treatment phase, bacterial type, comorbidities, and smoking history. The anthropometric examination carried out is measuring height and weight to calculate BMI. Measurements were carried out twice and the average was taken. BMI is obtained from calculating body weight in kilograms divided by height in meters squared. The results of anthropometric measurements are recorded on form. Food recording is carried out using household measurements. The data is then converted into grams using food ingredient analysis data and exchange food ingredient lists. Analysis was carried out using NutriSurvey 2007 (Germany). We used SPSS software (version 25.0, is developed from IBM) to conduct the data analysis). Normality of the distribution was tested using the Kolmogorov-Smirnov test. Mean and standard deviation (SD) were presented in normally distributed data, while median and minimum-maximum were presented in non-parametric data. The Spearman correlation test was applied to evaluate the relationship between correlation between iron intake, hemoglobin levels, and Karnofsky score. If $p< 0.05$, the association was considered significant. Characteristics of subjects were analyzed using the T-test or Mann-Whitney U test for two categories and, ANOVA or Kruskal-Walls test for more than two categories.

**RESULTS**

The characteristics of subjects are summarized in Table 1. There were 108 subjects aged 19-59 years, most subjects were male, had medium level of education, insufficient income, nutritional status of underweight, on continued treatment phase, drug sensitive bacterial type, no comorbidity, never smoking, normal hemoglobin level, inadequate protein intake, inadequate iron intake and had Karnofsky score of 80 percent. There was no statistical difference between subjects in terms of age, education level, nutritional status, treatment phase, comorbidity, comorbid diseases and hemoglobin level.

Iron intake, hemoglobin level, and Karnofsky score can be seen in Table 2. The median of iron intake was 5.5 mg/day, the median level of hemoglobin level was 12.9 g/dL, and the median of Karnofsky score was 80 percent.

To examine the correlation between iron intake and hemoglobin level with the Karnofsky score, a Spearman test was conducted. Table 3 showed no statistically significant correlations between iron intake and hemoglobin level with the Karnofsky score in pulmonary tuberculosis patients at Persahabatan General Hospital

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Table 1

Sociodemographic Characteristics of Subjects

| Characteristics | n (%) | p |
|---|---|---|
| Age (years)^ | 40 (19-59)^ | 0.44 |
| Gender | | |
| Female | 44 (40,7) | 0.03* |
| Male | 64 (59,3) | |
| Education level | | |
| Low | 29 (26,9) | |
| Medium | 61 (56,5) | 0.07 |
| High | 18 (16,7) | |
| Income | | |
| Insufficient (< Rp4,641,854/month) | 84 (77,8) | 0.03* |
| Sufficient (> Rp4,641,854/month) | 24 (22,2) | |
| Nutritional status | | |
| Underweight (<18.5 kg/m$^2$) | 46 (42,6) | |
| Normal (18.5-22.9 kg/m$^2$) | 43 (39,8) | |
| Overweight (23-24.9 kg/m$^2$) | 8 (7,4) | 0.29 |
| Obese I (25-29.9 kg/m$^2$) | 7 (6,5) | |
| Obese II (>30 kg/m$^2$) | 4 (3,7) | |
| Treatment phase | | |
| Intensive | 43 (39,8) | 0.12 |
| Continued | 65 (60,2) | |
| Bacterial type | | |
| Drug-sensitive | 76 (70,4) | 0.02* |
| Drug-resistant | 32 (29,6) | |
| Comorbidity | | |
| No | 56 (51,9) | 0.21 |
| Yes | 52 (48,1) | |
| Comorbid diseases | | |
| Arthritis | 27 (25) | |
| Cardiovascular | 3 (2,8) | 0.06 |
| Hypertension | 11 (10,2) | |
| Cancer | 4 (3,7) | |
| Diabetes | 25 (23,1) | |
| Smoking history | | |
| Never (<1 Brinkman index) | 62 (57,4) | |
| Light (1-199 Brinkman index) | 18 (16,7) | 0.02* |
| Moderate (200-599 Brinkman index) | 24 (22,2) | |
| Heavy (>600 Brinkman index) | 4 (3,7) | |
| Hemoglobin level | | |
| Normal (>13 g/dL) | 61 (56,5) | 0.07 |
| Anemia (<13 g/dL) | 47 (43,5) | |
| Protein intake | | |
| Inadequate (<RDA) | 81 (75) | 0.01* |
| Adequate (>RDA) | 27 (25) | |
| Iron intake | | |
| Inadequate (<RDA) | 80 (74,1) | 0.02* |
| Adequate (>RDA) | 28 (25,9) | |
| Karnofsky score | | |
| 50% | 2 (1, 9) | |
| 60% | 12 (11,1) | |
| 70% | 23 (21,3) | 0.01* |
| 80% | 33 (30,6) | |
| 90% | 28 (25,9) | |
| 100% | 10 (9,3) | |

^Median (min-max) *p<0.05 Significant

Abbreviations used: RDA, Recommended Dietary Allowance.

Table 2

Distribution of Iron Intake, Hemoglobin Level, and Karnofsky Score

| Parameter | Median (Min-Max) |
|---|---|
| Iron intake (mg/day) | 5,5 (1,1-68,3) |
| Hemoglobin level (g/dL) | 12,9 (9,4-16,5) |
| Karnofsky Score (%) | 80 (50-100) |

Table 1

Correlations Between Iron Intake and Hemoglobin Level With Karnofsky Score

| Variable | Karnofsky Score | |
|---|---|---|
| | r | p |
| Iron intake | -0,051 | 0,601 |
| Hemoglobin level | 0,073 | 0,455 |

**Spearman test*

## DISCUSSION

Our study found no statistical difference between subjects in terms of age, education level, nutritional status, treatment phase, comorbidity, comorbid diseases and hemoglobin level. Majority of the subjects in this study were male (59.3%), which is consistent with global trends showing higher TB prevalence among males.[17] In 2022, Valencia-Aguirre found that the average mortality rate for TB disease is mostly experienced by men with a male-to-female ASMR (Age Related Mortality Rate) ratio of 7.1:2.7.[18] Marçôa in 2018 conducted research in Portugal with the result that men have a higher average prevalence after two decades of life in suffering from TB.[19] Factors contributing to this gender disparity in TB include biological differences, differences in disease presentation, and differential access to healthcare services.[19] The study subjects had an average age of 40 years, reflecting the higher incidence of TB in productive age groups.[1] Meanwhile the Indonesia Ministry of Health in 2021 found that most TB cases are found in the age group 45-54 years with a proportion of 17.5 percent of the total national cases. Based on the 2013 Riskesdas survey, the prevalence of suffering from TB will be higher with increasing age. This is due to the possibility of TB reactivation and the longer duration of TB exposure in the older age group compared to the lower age group.[2]

The majority of the subjects had a moderate level of education (completed high school or equivalent), which can influence TB occurrence due to limited knowledge about transmission and risks.[20] Imam et al in 2021 found that TB patients with higher education suffer fewer TB side effects than those with lower levels of education.[21] Low income was prevalent among the subjects, which is associated with higher TB incidence and poorer treatment outcomes.[22] In 2020 WHO found that there was a strong relationship between the incidence rate of TB and average income as measured in gross domestic product (GDP) per capita.[1] This is in line with Fuady's research in 2020 which found that most subjects (61%) had low incomes.[22] Malnutrition was also common among the subjects, with a significant proportion experiencing underweight. A cross-sectional study conducted in Ethiopia also reported the same thing, namely 57.17% of adult TB patients were malnourished.[23] According to Feleke, the relationship between TB and malnutrition consists of two interactions, namely the effect of malnutrition on clinical manifestations of TB and the effect of TB on nutritional status as a result of immune system disorders.[23] Nutritional support is crucial for individuals with TB. Most of the subjects were in the continued phase of treatment, indicating improvement in symptoms during this phase. A study with similar results

was also obtained by Lee who found that 53 percent of the subjects in his study were in the continuation phase. [24] This could be due to the fact that this study involved pulmonary TB patients with a Karnofsky score >50 percent where symptom improvement mostly occurred in the continuation phase.

The majority of the subjects did not have chronic comorbidities, although some had arthritis, which can be induced by certain TB medications such as pirazinamide and etambutol.[25] Similar results were also obtained by Widowati in 2021 in Surakarta who found that the majority of TB patients did not have comorbid chronic diseases.[26] However, Salihi in 2020, who conducted a study on 1160 TB patients of productive age, obtained different results, namely the majority of TB patients had comorbid chronic diseases.[27] According to Padrão, this can be attributed to a reverse causality bias, namely by considering that the individual adopts a healthy lifestyle because the individual has a chronic disease.[28] Smoking was not prevalent among the subjects, but it is a strong individual-level risk factor for TB.[29] Research with similar results was also obtained by Lee who found that 77.5 percent of the subjects in his study did not smoke.[24] The role of cigarette smoke in the pathogenesis of tuberculosis is associated with ciliary dysfunction, decreased immune response, and defects in macrophage immune responses, with or without a decrease in CD4 cell count thereby increasing susceptibility to Mycobacterium tuberculosis infection.[29]

Inadequate protein intake was common among the subjects, which is important to address as recommended protein intake is higher for individuals with TB. The same results were also obtained by Ren in China in 2019 who found that 90.8 percent of male subjects and 58.4 percent of female subjects consumed insufficient protein.[8] In Indonesia, a study conducted by Pakasi et al found that outpatients pulmonary TB patients in NTT consume an average of 26.4 g of protein, which is a value below Indonesia recommendation dietary allowance.[7] Recall bias and overestimation or underestimation of food intake are potential limitations of assessing protein intake through food recall. Overall, understanding the characteristics of TB patients, such as gender, age, education, income, nutritional status, comorbidities, smoking, and protein intake, is crucial for effective TB management and control strategies.

The majority of subjects in the study (74.1%) had iron intake below Indonesia recommendation dietary allowance. The median intake of iron among the subjects was 5.5 mg/day. Previous research by in China has shown that the majority (97.9%) of female TB patients consumed iron below the recommended levels. Iron is essential for the growth of MTB within macrophages.[8] Excessive iron consumption is associated with increased active TB and TB-related deaths, while iron deficiency is associated with impaired immune function.[15,30] Low iron intake in TB patients is linked to decreased appetite due to inflammation process, which can worsen the disease or slow down the healing process through immune suppression. The mechanism behind the decreased appetite is based on the increased production of Tumor Necrosis Factor-alpha (TNF-α). TNF-α not only helps fight infections in the body but also affects homeostasis and has an anorexigenic effect in the hypothalamus. TNF-α impacts appetite within the arcuate nucleus of the hypothalamus, which serves as the central hub for regulating energy homeostasis.It triggers the synthesis of α-melanocyte-stimulating hormone (α-MSH) and cocaine and amphetamine-regulated transcript (CART) in proopiomelanocortin (POMC) neurons.This stimulation results in a 35-42 percent decrease in the production of orexigenic signals originating from agouti-related protein (AgRP) and NPY-expressing AgRP neurons.The aforementioned signaling molecules are then transported to the lateral hypothalamus and paraventricular nucleus. Ultimately, this process leads to a reduction in appetite and body weight.[30,31]

The majority of subjects in the study (56.5%) had normal hemoglobin levels. The median hemoglobin level among the subjects was 12.9 g/dL. Similar results were found in a study in China in 2022, which reported that the majority of pulmonary TB patients did not have anemia (78.8%).[32] However, different results were observed in studies conducted in India and Tanzania, reporting anemia prevalence rates of 72.7 percent[11] and 86 percent[12], respectively. Although there is a strong association between tuberculosis and anemia, the exact mechanisms

underlying this association are not yet fully understood[11]. Three main mechanisms have been proposed: pathological dysregulation of iron homeostasis, erythropoiesis abnormalities, and decreased response to erythropoietin. In pathological dysregulation of iron homeostasis, there is increased iron retention in the reticuloendothelial system. This process involves inflammation caused by TB bacteria and their ligands, leading to increased production of the cytokine TNF-alpha, which stimulates macrophages for erythrophagocytosis. This results in accelerated aging and destruction of old red blood cells. Additionally, IL-6 produced by monocytes and lipopolysaccharides from TB bacteria increases hepcidin production in hepatic cells, thereby reducing iron absorption in the duodenum and increasing iron retention in macrophages. Another mechanism is erythropoiesis abnormalities, where there is a decrease in the proliferation and differentiation of erythroid progenitor cells. There is also a decrease in the expression of erythropoietin receptors on CFU. The response of erythroid progenitor cells to erythropoiesis is inversely related to the severity and duration of TB infection, resulting in a lower erythroid response with prolonged TB progression.[33,34]

The biggest proportion of patients in the study had a Karnofsky score of 80 percent, with a minimum score of 50 percent and a maximum score of 100 percent. Patients with Karnofsky score of 80 percent has can do normal activity with effort which means the patient restricted in physically strenuous activity but ambulatory and able to carry out work of a light or sedentary nature, e.g., light house work, office work. Similar findings have been reported in studies conducted in various countries, where most pulmonary TB patients had Karnofsky scores of 90 or 100. Karyadi et al. used the Karnofsky Score as an outcome measure in a clinical trial to assess the health status of TB patients.[35] The Karnofsky Performance Status (KPS) is also commonly used to assess the quality of life of patients, particularly those with tumors. In TB patients, the Karnofsky score is often used as a clinical prediction rule, helping doctors make decisions in conditions of uncertainty and improving diagnostic, prognostic, and therapeutic accuracy to enhance the quality of patient care.

This study found no correlation between iron intake and Karnofsky score in pulmonary tuberculosis (TB) patients at RSUP Persahabatan. Previous research has not directly linked iron intake with the Karnofsky score in pulmonary TB patients. A study conducted in Africa showed an increase in iron consumption due to high iron intake from traditional fermented food. The study included 98 TB patients and 98 control subjects in Zimbabwe. Iron intake, hemoglobin, ferritin, and transferrin saturation were examined at the beginning of the study and after 9 months. The results showed that iron consumption increased in the population due to high iron intake from traditional fermented beer. Laboratory results showed low mean hemoglobin (9.4+2.1), high ferritin, and transferrin saturation in TB patients at the beginning of the study. Over time, there was a decrease in serum ferritin and an increase in hemoglobin levels. The analysis showed that increased iron intake was associated with a 3.5 times higher risk of TB and a 1.3 times higher risk of mortality.[36] In a published case study, intravenous iron administration was found to promote the activation of tuberculosis. Iron overload, as indicated by splenic iron levels, has been previously correlated with tuberculosis mortality, as discussed earlier.[37] The authors concluded that excessive iron intake led to iron overload, resulting in iron deposition in macrophages and parenchymal cells. This impairs the ability of macrophages to suppress microbial invasion and leads to increased growth of *Mycobacterium tuberculosis* (MTB). Increased MTB growth prolongs the duration of TB infection and worsens symptoms in patients, resulting in decreased activity and performance as reflected by the Karnofsky score.

The bivariate analysis using Spearman's test in this study showed no correlation between hemoglobin levels and Karnofsky score in pulmonary TB patients at RSUP Persahabatan. However, different results were found in other studies. Isanaka et al., in a randomized controlled trial (RCT) with 887 pulmonary TB patients, found that most patients with low Karnofsky scores (<70%) had iron-deficiency anemia.[15] Bivariate analysis showed a significant association between anemia status and Karnofsky score ($p<0.001$). Another study by Pakasi et al. in outpatient pulmonary TB

patients in East Nusa Tenggara Province found a significant correlation between hemoglobin levels and Karnofsky score. Patients with severe TB (Karnofsky score <80) had lower hemoglobin levels.[7] Low hemoglobin levels in TB patients are associated with the severity of the disease. It is suggested that hemoglobin levels examination is important to do in tuberculosis cases and it can serve as a biomarker for TB severity.[7] The exact mechanisms underlying the decrease in hemoglobin levels in TB patients are not fully understood, but it is believed to involve excessive cytokine production, disturbances in iron metabolism, increased erythrocyte destruction, and shortened erythrocyte lifespan. As the duration of TB increases, the symptoms worsen, leading to a longer period of hemoglobin decrease in TB patients.

This study has several limitations. First, this research utilized interview data obtained from subjective sources, which inherently carries the risk of reducing the objectivity of the study outcomes. However, we took proactive steps to mitigate this risk by conducting interviews administered by trained healthcare professionals. Second, the collection of hemoglobin data relied on secondary sources, potentially failing to accurately capture the current hemoglobin status. Third, we did not have data on several predictors of iron status, factors associated with its bioavailability, or genetic polymorphisms. Thus, we cannot rule out the contribution of confounding to the observed associations. This limitation in data collection methodology could have contributed to the absence of a significant relationship in the findings.

## CONCLUSION

The majority of subjects had iron intake below Indonesia recommendation dietary allowance, normal hemoglobin levels and a Karnofsky score of 80 percent. In conclusion, iron intake and hemoglobin level appear not to be associated with Karnofsky score among pulmonary TB patients at RSUP Persahabatan.

## RECOMMENDATION

A further study through a prospective cohort analysis is necessary to evaluate the iron requirements in TB patients as well as the significant impact of iron intake and hemoglobin levels linked to the severity of pulmonary TB patients. Moreover, it is essential to enhance socialization and education among individuals diagnosed with pulmonary TB regarding the intake of iron and protein-rich food items, while also meeting the necessary criteria for other vital nutrients, including both macronutrients and micronutrients.

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# PERBANDINGAN ALAT SKRINING GIZI *SCREENING TOOL FOR RISK DAN ON NUTRITIONAL STATUS AND GROWTH* (STRONGKIDS) DAN *PAEDIATRIC YORKHILL MALNUTRITION SCORE* (PYMS) DALAM MENDETEKSI RISIKO MALNUTRISI PADA PASIEN KANKER ANAK DI RUMAH SAKIT DR. SARDJITO

*Comparison of Nutritional Screening Tools Screening Tool for Risk on Nutritional Status and Growth (STRONGkids) and Paediatric Yorkhill Malnutrition Score (PYMS) In Detecting the Risk of Malnutrition in Paediatric Cancer Patients at Dr. Sardjito Hospital*

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**ABSTRACT**

**Intensive therapy in children with cancer in developing countries often leads to digestive disturbances, malnutrition, and other adverse effects such as decreased tolerance to chemotherapy, treatment delays, increased infection risk, and reduced quality of life. This diagnostic study involved 54 male and female patients aged 1-16 years with cancer treated at Dr. Sardjito General Hospital. Each subject was evaluated using the STRONGkids, PYMS, and SCAN screening tools. Statistical analysis was conducted to calculate the sensitivity, specificity, and AUC of each screening tool in detecting malnutrition risk compared to SCAN as the gold standard. Overall, 61.1 percent of patients had a diagnosis of Acute Lymphoblastic Leukemia. Screening with STRONGkids revealed that 44.4 percent of subjects were at moderate risk of malnutrition, and 55.6 percent were at high risk. Meanwhile, PYMS indicated that 35.2 percent were at low risk and 64.8 percent were at high risk. Both screening tools showed moderate and substantial agreement levels with SCAN. PYMS exhibited higher sensitivity, specificity, and AUC compared to STRONGkids (89.1%, 88.2%, 0.925 (0.885-0.996) respectively). In this study, 31.5 percent of patients were not at risk of malnutrition, and 68.5 percent were at risk based on SCAN as the gold standard. In conclusion, the results from PYMS had higher sensitivity, specificity, and AUC in detecting malnutrition risk in pediatric cancer patients. However, both STRONGkids and PYMS demonstrated good specificity and AUC compared to SCAN.**

**Keywords: malnutrition, pediatric, cancer, STRONGkids, PYMS, SCAN**

**ABSTRAK**

**Terapi intensif pada anak dengan kanker di negara berkembang seringkali menyebabkan gangguan pencernaan, malnutrisi, dan dampak buruk lainnya seperti penurunan toleransi terhadap kemoterapi, keterlambatan pengobatan, dan peningkatan risiko infeksi, serta menurunkan kualitas hidup. Studi diagnostik ini melibatkan 54 pasien laki-laki dan Perempuan dengan kanker berusia 1-16 tahun yang dirawat di Rumah Sakit Umum Pusat Dr. Sardjito. Setiap subjek dilakukan evaluasi menggunakan alat skrining STRONGkids, PYMS dan SCAN. Analisis statistik dilakukan untuk menghitung sensitivitas, spesifisitas dan AUC dari masing-masing alat skrining dalam mendeteksi risiko malnutrisi terhadap SCAN sebagai baku emas. Secara keseluruhan, 61,1 persen pasien memiliki diagnosis *Acute Lymphoblastic Leukemia*. Hasil skrining dengan STRONGkids menunjukkan 44,4 persen subjek berisiko sedang malnutrisi, dan 55,6 persen berisiko tinggi. Sementara PYMS menunjukkan 35,2 persen berisiko rendah, dan 64,8 persen berisiko tinggi. Kedua alat skrining menunjukkan tingkat kesepakatan yang moderat dan substansial dengan SCAN. PYMS memiliki sensitivitas, spesifisitas, dan AUC yang lebih tinggi daripada STRONGkids (89,1%, 88,2%, 0,925 (0,885-0,996) secara berurutan). Dalam penelitian ini, 31,5 persen pasien tidak berisiko malnutrisi, dan 68,5% berisiko berdasarkan SCAN sebagai baku emas. Kesimpulannya hasil dari PYMS memiliki nilai sensitivitas, spesifisitas dan AUC yang lebih tinggi dalam mendeteksi risiko malnutrisi pada pasien anak dengan kanker. Namun baik keduanya STRONGkids dan PYMS memiliki spesifisitas dan AUC yang baik terhadap SCAN.**

**Kata kunci: malnutrisi, pediatri, kanker, STRONGkids, PYMS, SCAN**

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## PENDAHULUAN

Kanker menjadi salah satu penyebab kematian utama di seluruh dunia, dimana menurut WHO jumlah kasus per tahun 2018 mencapai 18,1 juta.[1] Sementara di Indonesia prevalensi kanker mencapai 1,49 persen dengan prevalensi kanker anak berusia <1 tahun sebesar 0,3 persen; usia 1-4 tahun sebesar 0,08 persen; usia 5-14 tahun sebesar 0,47 persen; serta usia 15-24 tahun sebesar 0,47 persen.[2] Terapi intensif yang dijalani oleh pasien kanker seperti kemoterapi, operasi, radiasi serta transplantasi sumsum tulang belakang sering dikaitkan dengan masalah utama yang mempengaruhi status gizi seperti mual, muntah, mucositis, anoreksia, dan penurunan berat badan. Hal ini disebabkan oleh penurunan asupan akibat efek terapi serta adanya peningkatan kebutuhan selama pengobatan akibat stress metabolik yang terjadi. Akibatnya adalah kebutuhan gizi menjadi tidak terpenuhi selama pengobatan. Terapi intensif mampu meningkatkan tingkat kelangsungan hidup pasien, namun efek samping dari terapi tersebut mampu meningkatkan risiko serta kejadian malnutrisi.[3–5].

Risiko malnutrisi yang tidak diatasi dengan cepat akan memicu keterlambatan pertumbuhan seperti stunting, gangguan perkembangan kognitif otak yang pada akhirnya menurunkan kualitas hidup pasien anak dengan kanker.[6] Studi yang dilakukan oleh Song *et al*., (2019) menunjukan 58 persen pasien kanker mengalami malnutrisi sedang hingga berat, namun hanya 29 persen pasien yang mendapatkan asuhan gizi.[7] Penelitian lain mengatakan prevalensi malnutrisi pada pasien anak dengan kanker mencapai 8-43 persen di negara berkembang.[5] Deteksi risiko malnutrisi penting dilakukan untuk dapat diberikan intervensi gizi sedini mungkin dan diharapkan dapat mencegah terjadinya gejala serta komplikasi malnutrisi yang lebih berat.[8,9] Untuk mendeteksi risiko malnutrisi dapat dilakukan skrining gizi., dengan menggunakan beberapa instrumen yang sesuai.

Skrining gizi menjadi salah satu cara dalam mengatasi malnutrisi pada pasien kanker anak karena mampu memprediksi kemungkinan outcome yang akan terjadi berkaitan dengan faktor gizi ataupun intervensi yang telah dilakukan.[10] Alat skrining *Screening Tool for Risk on Nutritional Status and Growth* (STRONGkids) merupakan ringkasan komprehensif dari pertanyaan-pertanyaan umum mengenai masalah gizi yang dikombinasikan dengan penilaian fisik klinis terkait gizi pada pasien anak.[11] Sementara dalam alat skrining *Paediatric Yorkhill Malnutrition Score* (PYMS) terdapat empat prediktor risiko malnutrisi seperti indeks massa tubuh, riwayat penurunan berat badan secara tidak disengaja, perubahan asupan makan dan kemungkinan efek dari kondisi medis terhadap status gizi.[12] Kedua alat skrining tersebut tidak secara khusus dikembangkan bagi populasi pasien kanker anak.

*Nutrition Screening Tool for Childhood Cancer* (SCAN) secara khusus dikembangkan sebagai alat skrining pada pasien anak kanker baik untuk rawat inap maupun rawat jalan. Studi pendahuluan telah dilakukan untuk mengevaluasi validitas SCAN sebagai alat skrining pada pasien kanker anak di *Queensland Children's Cancer Centre* terhadap *Subjective Global Nutritional Assessment* (SGNA), dengan hasil SCAN memiliki akurasi yang sangat baik.[13] Penelitian lain dilakukan pada pasien kanker anak di RSUP Dr. Sardjito dengan hasil skrining berisiko malnutrisi berdasarkan SCAN secara signifikan memiliki asupan energi dan protein kurang, perubahan berat badan lebih dari 2 persen, status gizi kurang berdasarkan Indeks Massa Tubuh menurut Umur (IMT/U) serta lama rawat inap yang lebih panjang.[14] Tujuan dari studi ini untuk membandingkan STRONGkids dan PYMS terhadap SCAN sebagai baku emas dalam mendeteksi risiko malnutrisi pada pasien anak rawat inap dengan kanker di RSUP Dr. Sardjito.

## METODE PENELITIAN

Penelitian merupakan studi observasional dengan rancangan *cross-sectional* yang dilakukan di RSUP Dr. Sardjito pada bulan Agustus-September 2022. Penelitian dilaksanakan setelah mendapat persetujuan dari Komisi Etik Fakultas Kedokteran,

Kesehatan Masyarakat, dan Keperawatan UGM dengan nomer persetujuan etik KE/FK/0452/EC/2022. *Informed Consent* diberikan oleh keluarga terdekat yaitu orang tua kandung. Subjek penelitian adalah pasien anak dengan diagnosis kanker yang berusia 1 hingga 16 tahun dengan total 54 pasien (33 laki-laki dan 21 perempuan), dan baru masuk di bangsal perawatan yaitu Indraprasta 3, Padmanaba Timur, Kartika 1 dan Kartika 2; Kriteria inklusi , yaitu pasien dalam kondisi sadar, dan bersedia mengikuti penelitian serta mendapat persetujuan dari orang tua. Kriteria eksklusi penelitian ini, yaitu pasien yang tidak memungkinkan untuk dilakukan pengukuran antropometri. Teknik pengambilan sampel menggunakan metode *consecutive sampling.*

Seluruh subjek penelitian akan dilakukan skrining gizi menggunakan kuesioner alat skrining STRONGkids, PYMS dan SCAN. SCAN merupakan skrining gizi yang sederhana dan cepat untuk mengidentifikasi risiko malnutrisi khusus pada pasien anak dengan kanker. Alat skrining ini terdiri dari 6 pertanyaan dengan masing-masing skor 1 hingga 2 yang mencakup tipe kanker yang diderita, tahap pengobatan dan gejala yang muncul akibat pengobatan kanker berhubungan dengan saluran cerna. Hasil skrining menggunakan SCAN akan dibagi menjadi dua kelompok, yaitu kelompok berisiko malnutrisi dan tidak berisiko malnutrisi.[15] Dalam penelitian ini SCAN digunakan sebagai baku emas. STRONGkids terdiri dari 4 pertanyaan dengan alokasi skor 1 hingga 2 poin untuk setiap pertanyaan yang terdiri dari evaluasi klinis secara subjektif, evaluasi risiko penyakit, asupan dan kehilangan nutrisi, serta perubahan berat badan. Seluruh skor akan ditotal dan kemudian diklasifikasikan menjadi tiga kategori: skor 0, berisiko rendah malnutrisi; skor 1 hingga 3, berisiko sedang malnutrisi; skor 4 hingga 5, berisiko tinggi malnutrisi. Namun dalam penelitian ini hasil skrining akan dibagi menjadi dua kelompok, yakni: skor 0 hingga 3 maka berisiko rendah malnutrisi dan skor 4 hingga 5 maka berisiko tinggi malnutrisi.[11] PYMS terdiri dari 4 elemen pertanyaan dengan masing-masing skor 0 hingga 2 yang terdiri dari BMI, penurunan berat badan, asupan nutrisi, dan prediksi efek kondisi medis sekarang terhadap status gizi. Hasil skor akan dibagi menjadi tiga kelompok: skor 0, perlu dilakukan evaluasi dalam 3 hari; skor 1, perlu dilakukan evaluasi dalam 3 hari; dan skor ≥2, perlu dilakukan pemeriksaan gizi lebih lanjut oleh *dietitian.* Dalam penelitian ini hasil skrining akan dibagi menjadi dua kelompok, yakni: skor 0 hingga 1 diklasifikasikan sebagai risiko rendah malnutrisi dan skor ≥2 diklasifikasikan sebagai risiko tinggi malnutrisi.[16]

Setelah diperoleh data isian kuesioner skrining, selanjutnya dilakukan rekapitulasi, *coding* dan pengolahan data dengan analisis 103iagnosti menggunakan software IBM SPSS *Statistic* 25. Data hasil analisis univariat dipresentasikan dalam 103iagn distribusi yang memuat informasi mengenai frekuensi dan persentase dari masing-masing 103iagnost. Nilai validitas masing-masing alat skrining terhadap SCAN dilakukan melalui uji diagnostic (sensitivitas, spesifisitas dan *Area Under Curve*). *Area Under the Curve* atau luas area bawah kurva merupakan cara yang efektif dalam meringkas akurasi diagnostic keseluruhan tes. Nilai AUC berkisar antara 0 hingga 1,0 dengan nilai 0 menunjukan tes sangat tidak akurat dan 1 menunjukan tes sangat akurat. Dimana nilai 0,5 menunjukan tidak ada diskriminasi atau alat skrining tidak mampu membedakan subjek yang berisiko dan tidak berisiko; 0,7-0,8 diskriminasi sedang atau dapat diterima; 0,8-0,9 sangat baik; dan lebih dari 0,9 merupakan diskriminasi tertinggi untuk membedakan subjek berisiko dengan tidak berisiko.[17]

Konsistensi antara alat skrining dan baku emas (SCAN) dievaluasi melalui koefisien Cohen's Kappa. Normalitas data diperiksa dengan uji Kolmogorov Smirnov untuk mengetahui distribusi data apakah normal atau tidak. Normalitas data diperiksa dengan uji *Kolmogorov Smirnov* untuk mengetahui distribusi data apakah normal atau tidak. Setelah itu, uji *Chi-square* digunakan untuk memeriksa hubungan antara STRONGkids dan PYMS dengan baku emas SCAN. Signifikansi data ditetapkan pada $p < 0,05$.

## HASIL

### Karakteristik Subjek Penelitian

Penelitian ini memperoleh responden berusia 1 hingga 16 tahun dengan total 54

pasien dengan 61.1 persen yang berjenis kelamin laki-laki dan 38,9 persen berjenis kelamin perempuan (Tabel 1). Kelompok usia pasien dibagi menjadi tiga kelompok, yaitu anak balita (1-5 tahun), anak-anak (6-11 tahun), dan remaja (12-18 tahun).

Berdasarkan kelompok usia tersebut, terdapat 53,7 persen pasien anak balita, 33,3 persen pasien anak-anak dan 13 persen pasien remaja. Berdasarkan jenis kanker yang dialami, sebanyak 61,1 persen pasien anak memiliki *Acute Lymphoblastic Leukemia* dimana hampir semua pasien atau sebanyak 92,6 persen sedang menjalani kemoterapi. Berdasarkan Tabel 2, terdapat kelompok pasien berisiko malnutrisi berdasarkan SCAN sebagai baku emas sebanyak 37 orang (68.5%) dan kelompok tidak berisiko malnutrisi sebanyak 17 orang (31.5%). Sementara kelompok berisiko sedang malnutrisi berdasarkan STRONGkids 24 orang (44,4%) dan PYMS 19 orang (35.2%). Sedangkan kelompok berisiko tinggi malnutrisi menurut STRONGkids 30 orang (55.6%) dan PYMS 35 orang (64.8%). Selanjutnya, dapat dilihat hubungan kedua alat skrining jika dibandingkan dengan SCAN sebagai baku emas melalui analisis tabel kontingensi (Tabel 3).

Tabel 1

Karakteristik Subjek Penelitian

| Variabel | n | % |
|---|---|---|
| Jenis Kelamin | | |
| Laki-laki | 33 | 61.1 |
| Perempuan | 21 | 38.9 |
| Usia (tahun) | | |
| Anak Balita[1] | 29 | 53.7 |
| Anak-anak[2] | 18 | 33.3 |
| Remaja[3] | 7 | 13 |
| Jenis Kanker | | |
| ALL[a] | 33 | 61.1 |
| AML[b] | 1 | 1.85 |
| ERMS[c] | 3 | 5.56 |
| Limfoma Burkitt | 1 | 1.85 |
| Limfoma Hodgkin | 1 | 1.85 |
| Nefroblastoma | 1 | 1.85 |
| Neuroblastoma | 2 | 3.70 |
| Pancreatoblastoma | 1 | 1.85 |
| Retinoblastoma | 8 | 14.81 |
| Teratoma | 1 | 1.85 |
| Tumor Sel Germinal | 2 | 3.70 |
| Jenis Perawatan | | |
| Kemoterapi | 50 | 92.6 |
| Pemeriksaan Lebih Lanjut | 2 | 3.7 |
| Perawatan Lainnya | 2 | 3.7 |

[1]Anak Balita = 1-5 tahun; [2]Anak-anak = 6-11 tahun; [3]Remaja = 12-18 tahun; [a]ALL = Acute Lymphoblastic Leukemia; [b]AML = Acute Myeloblastic Leukemia; [c]ERMS = Embryonal Rhabdomyosarcoma

Tabel 2

Tabel Hasil Skrining Gizi

| Variabel | n | % |
|---|---|---|
| SCAN | | |
| Skor 0 – 2 (Tidak berisiko malnutrisi) | 17 | 31.5 |
| Skor ≥3 (Berisiko malnutrisi) | 37 | 68.5 |
| STRONGkids | | |
| Skor 1 – 3 (Berisiko sedang malnutrisi) | 24 | 44.4 |
| Skor 4 – 5 (Berisiko tinggi malnutrisi) | 30 | 55.6 |
| PYMS | | |
| Skor 1 (Berisiko sedang malnutrisi) | 19 | 35.2 |
| Skor ≥2 (Berisiko tinggi malnutrisi) | 35 | 64.8 |

Keterangan:
PYMS: Paediatric Yorkhill Malnutrition Score | STRONGkids: Screening Tool for Risk on Nutritional Status and Growth | SCAN: Nutrition Screening Tool for Childhood Cancer

Tabel 3

Hubungan Alat Skrining Gizi STRONGkids dan PYMS dengan SCAN

| Skrining Gizi | SCAN | | | | Total | | *p-value* | Kappa |
|---|---|---|---|---|---|---|---|---|
| | Berisiko Malnutrisi | | Tidak Berisiko Malnutrisi | | | | | |
| | n | % | n | % | n | % | | |
| STRONGkids | | | | | | | | |
| Berisiko Tinggi | 27 | 90.0 | 3 | 10 | 30 | 100 | <0.001* | 0.498** |
| Berisiko Rendah | 20 | 41.7 | 14 | 58.3 | 24 | 100 | | |
| PYMS | | | | | | | | |
| Berisiko Tinggi | 33 | 94.3 | 2 | 5.7 | 35 | 100 | <0.001* | 0.750** |
| Berisiko Rendah | 4 | 21.1 | 15 | 78.9 | 19 | 100 | | |

Keterangan:
PYMS: Paediatric Yorkhill Malnutrition Score | STRONGkids: Screening Tool for Risk on Nutritional Status and Growth | SCAN: Nutrition Screening Tool for Childhood Cancer
*Nilai signifikansi data ditetapkan pada *p-value* <0,05 dengan tingkat kepercayaan 95 persen
**Tingkat kesepakatan cukup (kappa= 0,41-0,60); dan baik (kappa= 0,61-0,80)

**Hubungan Alat Skrining Gizi STRONGkids dan PYMS dengan SCAN**

Pada **Tabel 3** ditunjukkan hasil uji *chi-square* untuk melihat hubungan antara STRONGkids dan PYMS dengan SCAN. Hasil uji chi-square menunjukan bahwa terdapat hubungan yang bermakna antara kedua alat skrining dengan SCAN pada tingkat kepercayaan 95%, dengan nilai *p-value* <*0,001*. Selain itu, dilakukan juga evaluasi tingkat kesepakatan antara kedua alat skrining dengan menggunakan koefisien *Cohen's Kappa.* Hasil evaluasi menunjukan bahwa alat skrining PYMS memiliki tingkat kesepakatan yang cukup baik, sementara alat skrining STRONGkids memiliki tingkat kesepakatan yang cukup dengan alat skrining SCAN.

Tabel 4

Validitas Skrining Gizi terhadap Baku Emas SCAN

| Alat Skrining | Se[1](%) | Sp[2](%) | AUC[3] |
|---|---|---|---|
| STRONGkids | 72.9 | 82.4 | 0.893(0.789-1.00) |
| PYMS | 89.1 | 88.2 | 0.925(0.885-0.996) |

Keterangan:
PYMS: Paediatric Yorkhill Malnutrition Score | STRONGkids: Screening Tool for Risk on Nutritional Status and Growth | SCAN: Nutrition Screening Tool for Childhood Cancer
[1]Se = Sensitivitas; [2]Sp = Spesifisitas; [3]AUC = *Area Under Curve*

Pada Tabel 4 diketahui nilai sensitivitas (Se) dan spesifisitas (Sp). STRONGkids memiliki Se 72.9 persen dan Sp 82.4 persen PYMS memiliki nilai Se 89.1 persen dan Sp 88.2 persen. Selain itu juga dilakukan analisis luas dibawah kurva atau AUC berdasarkan kurva ROC. PYMS memiliki luas area dibawah kurva yang lebih besar dibandingkan STRONGkids.

## DISKUSI

Hasil penelitian ini menunjukkan beberapa temuan penting. Pertama, distribusi usia dan jenis kelamin responden cukup merata, dengan mayoritas pasien berada dalam kelompok usia balita dan berjenis kelamin laki-laki. Kedua, mayoritas pasien anak memiliki *Acute Lymphoblastic Leukemia* dan sedang menjalani kemoterapi. Dalam penelitian ini, ditemukan bahwa prevalensi pasien kanker anak yang berisiko malnutrisi berbeda menurut ketiga alat skrining yang digunakan. SCAN menunjukkan prevalensi sebesar 68.5 persen, sedangkan STRONGkids dan PYMS masing-masing menunjukkan prevalensi sebesar 55.6 persen dan 64.8 persen. Malnutrisi selama terapi dan pengobatan kanker memiliki kaitan yang erat dengan penurunan toleransi terhadap pengobatan, peningkatan kerentanan infeksi hingga penurunan kelangsungan hidup secara keseluruhan.[3,5] Maka dari itu, deteksi dini risiko malnutrisi menjadi penting sehingga memungkinkan adanya intervensi nutrisi sedini mungkin serta mencegah terjadinya komplikasi malnutrisi yang lebih berat. Penilaian risiko malnutrisi dapat dilakukan melalui skrining gizi.[13,18]

Analisis yang dilakukan menunjukkan adanya korelasi signifikan antara hasil skrining gizi menggunakan STRONGkids dan SCAN sebagai standar (p<0,001). Ini berarti hasil skrining gizi dengan STRONGkids konsisten dengan hasil skrining menggunakan SCAN. Selain itu, evaluasi tingkat kesepakatan antara alat skrining STRONGkids dan SCAN melalui koefisien Cohen's Kappa menunjukkan tingkat kesepakatan yang moderat dengan nilai kappa 0,498 (Tabel 3).

Belum ada penelitian yang membandingkan antara STRONGkids dengan SCAN, sehingga penelitian ini belum dapat dibandingkan dengan penelitian lain. Namun, ada penelitian oleh Sidiartha dan Pratiwi, (2018) yang membandingkan alat skrining STRONGkids dengan indeks antropometri menurut WHO sebagai standar dan menemukan bahwa pasien anak dengan Indeks Berat Badan menurut Tinggi Badan (BB/TB) < 3 atau 2 SD saat masuk rumah sakit memiliki risiko tinggi malnutrisi berdasarkan klasifikasi skor STRONGkids.[1] Hasil serupa juga ditemukan dalam penelitian di Rumah Sakit Dr. Hasan Sadikin, Bandung, dimana STRONGkids berhubungan dengan standar yaitu Indeks Berat Badan menurut Tinggi Badan (BB/TB) dan Tinggi Badan menurut Usia (TB/U).[18] Penelitian lain oleh Khajavi et al., (2020) pada pasien anak rawat jalan dengan kanker di Turki menunjukkan adanya korelasi antara STRONGkids dengan Indeks Berat Badan menurut Usia (BB/U) sebagai standar. STRONGkids juga memiliki tingkat kesepakatan yang moderat (nilai kappa=0,56) dengan hasil penilaian antropometri.[5,19] Secara signifikan, hasil penelitian-penelitian tersebut sejalan

dengan penelitian ini bahwa STRONGkids berhubungan dan memiliki tingkat kesepakatan yang cukup dengan standar.

Sementara itu, hasil skrining PYMS juga menunjukkan adanya korelasi signifikan dengan SCAN sebagai standar (p<0,001). Ini berarti hasil skrining gizi menggunakan PYMS konsisten dengan hasil skrining gizi menggunakan SCAN. Selain itu, tingkat kesepakatan antara alat skrining PYMS dan SCAN menunjukkan kesepakatan yang cukup baik dengan nilai kappa 0,750 (Tabel 3). Belum ada penelitian yang membandingkan antara PYMS dengan SCAN, sehingga penelitian ini belum dapat dibandingkan dengan penelitian lain. Namun, ada penelitian yang membandingkan PYMS dengan indeks antropometri, dan menemukan bahwa PYMS memiliki korelasi dengan hasil Indeks Tinggi Badan menurut Usia (TB/U). Penelitian tersebut juga menunjukkan bahwa PYMS memiliki tingkat kesepakatan yang baik dengan *Subjective Global Nutritional Assessment* (SGNA).[18] Hasil signifikan dari studi tersebut sejalan dengan penelitian ini, yang menunjukkan adanya korelasi antara PYMS dengan standar atau baku emas.

Menurut van Bokhorst-de van der Schuerenet al. validitas alat skrining yang baik memiliki sensitivitas (Se) dan spesifisitas (Sp) >80 persen.[20] Dalam studi ini didapatkan PYMS memiliki nilai validitas yang lebih tinggi daripada STRONGkids dilihat dari nilai sensitivitas (89.1%), spesifisitas (88.2%) dan AUC (0.925 [0.885-0.996]) Meskipun begitu alat skrining STRONGkids memiliki nilai sensitivitas cukup baik, spesifisitas serta AUC yang baik. Hal ini menunjukan bahwa kedua alat skrining mampu mendeteksi pasien anak dengan kanker yang berisiko dan tidak berisiko malnutrisi dengan baik. Hasil ini sejalan dengan penelitian sebelumnya pada 170 pasien anak dengan kanker di Turkey dengan SGNA sebagai baku emas. Didapatkan PYMS memiliki nilai validitas yang lebih baik dibandingkan dengan STRONGkids dengan nilai sensitivitas 92,6 persen dan spesifisitas 37,98 persen. Dalam penelitian tersebut nilai spesifisitas rendah akibat sebagian besar subjek penelitian didominasi oleh pasien dengan tumor padat. Sedangkan alat skrining PYMS memerlukan data berat badan sehingga data tersebut menjadi tidak valid akibat massa tumor yang dapat mencapai lebih dari 10 persen berat badan total pasien. Hal ini menjadi salah satu kelemahan dari alat skrining PYMS.[12,21] Dua penelitian lain juga dilakukan dalam membandingkan alat skrining STRONGkids dan PYMS terhadap SGNA sebagai baku emas, dan diketahui alat skrining PYMS memiliki nilai sensitivitas dan spesifisitas yang lebih baik dibandingkan dengan STRONGkids.[18,22] Alat skrining yang sensitif secara klinis sangat penting dalam mendeteksi kondisi serius namun dapat diobati seperti malnutrisi. Dimana tujuan utama dari alat skrining gizi ialah meminimalkan subjek berisiko malnutrisi yang tidak terdeteksi sehingga mampu dilakukan intervensi sedini mungkin dan mengurangi risiko komplikasi gizi yang lebih serius di kemudian hari.[13]

Penelitian ini memiliki kekuatan diantaranya belum adanya penelitian yang membandingkan antara alat skrining gizi STRONGkids dan PYMS dengan SCAN pada pasien anak dengan kanker. Sementara keterbatasan penelitian ini adanya sampel yang digunakan hanya terbatas pada pasien anak dengan kanker yang dirawat di RSUP Dr. Sardjito sehingga memungkinkan adanya variasi jika dilakukan pada rumah sakit yang berbeda. Selain itu, meskipun hasil penelitian ini menunjukkan keunggulan PYMS dibandingkan STRONGkids, masih diperlukan penelitian lebih lanjut untuk memvalidasi temuan ini dan mengevaluasi implementasi alat skrining ini dalam praktek klinis.

## SIMPULAN DAN SARAN

### Simpulan

Studi ini menyimpulkan alat skrining PYMS memiliki nilai sensitivitas, spesifisitas dan AUC yang lebih tinggi dalam mendeteksi risiko malnutrisi pada pasien anak dengan kanker.

### Saran

PYMS dan STRONGkids dapat digunakan sebagai alat skrining dalam mendeteksi risiko malnutrisi pada pasien anak dengan kanker.

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# PEDOMAN PENULISAN NASKAH

**Majalah GIZI INDONESIA** – disingkat Gizi Indon-menerima naskah tentang gizi, baik berupa hasil penelitian kajian masalah, maupun telaah pustaka, yang bermanfaat bagi kemajuan pergizian dan upaya perbaikan gizi di Indonesia. Naskah belum pernah dimuat, atau sedang diajukan untuk dimuat dalam media komunikasi tertulis lainnya. Naskah yang dikirim belum tentu dimuat, tergantung pada pertimbangan dewan redaksi.

Naskah dikirim/diserahkan ke redaksi dengan ketentuan sebagai berikut:

1. Naskah berupa file elektronik (*softcopy*) dan diharapkan juga menyampaikan naskah hasil cetakan (*hardcopy*).
2. Naskah diketik menggunakan Program MS Word, *font Arial* 11, satu setengah spasi, tepi kiri 4 cm, tepi kanan 3 cm, atas 3 cm, bawah 3 cm, orientasi portrait.
3. Tebal naskah 10-15 halaman.
4. Judul naskah seluruhnya ditulis memakai huruf besar dengan *font size* maksimal 12; singkat tetapi jelas dan sesuai dengan isi tulisan. Di bawah judul naskah ditulis nama (para) penulis. Di bawah nama penulis dicantumkan abstrak; dalam bahasa Inggris dan bahasa Indonesia. Abstrak ditulis tanpa alinea (paragraf). Jumlah kata dalam abstrak antara 200 – 250 kata.
5. Sistematika penulisan naskah asli (hasil penelitian) terdiri atas: Pendahuluan, Bahan dan Cara, Hasil, Bahasan, dan Rujukan. Kata rujukan digunakan untuk daftar acuan (sitasi) atau kutipan langsung. Penulisan Rujukan menurut **Sistem Vancouver**. Tanda rujukan pada naskah ditulis dengan angka Arab setelah nama dan diurut menurut nomor pemunculan serta ditulis *superkrip.* Penulisan rujukan harus taat asas (konsisten) dan berpedoman pada Sistem Vancouver seperti contoh berikut.

**Majalah/Terbitan Berseri:**

***Pengarang tunggal:***

Karyadi, Darwin. Pengaruh perbaikan kesehatan terhadap produktivitas kerja. Gizi Indonesia 1985;10(1): 1-13.

***Pengarang ganda:***

Slamet L, Komari. Perubahan fisik dan kimiawi selama proses pematangan pisang raja sereh (Musa Parasiaca Linn) dengan kalsium karbid secara rumah tangga. Gizi Indonesia 1985; 10(1): 70-74.

Keterangan: Nama penulis ditulis terbalik. Jika penulis sampai dengan enam orang, semua nama dicantumkan, kalau penulis lebih dari enam orang, penulis enam pertama dicantumkan diikuti "dkk." atau "et al." (naskah dalam bahasa Inggris).

**Buku/Monograf:**

Gibson RS. Principles of Nutritional Assessment. 2nd edition. New York: Oxford University Press, 2005.

Tanner JM. Growth and physique in different population of mankind In: Baker PT, and Weiner JS (eds). The Biology of Human Adaptability. Oxford Clarendon Press, 1996.

**Prosiding/Pertemuan Ilmiah:**

Soewondo S, Husaini MA, Piliang WG, and Pollitt E. Recent studies of the functional consequences of iron deficiency anemia cognitive performance to iron status. Fourth Asian Congress of Nutrition Bangkok, November 1-4, 1983.

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Setiap tabel, grafik dan gambar atau bagan ditulis pada lembar terpisah, diberi nomor urut. Judul tabel ditulis pada bagian atas, sementara judul grafik, gambar atau bagan pada bagian bawah. Lambang dan singkatan, kecuali satuan ukuran yang sudah baku, hanya digunakan dalam tabel dengan mencantumkan keterangannya pada bagian bawah. Lambang atau singkatan di dalam naskah boleh digunakan hanya sesudah ada penjelasan atau kepanjangannya.

Tanpa ijin penulis, redaksi berhak mengubah isi naskah sepanjang tidak bertentangan dengan pokok tulisan. Naskah hendaknya ditulis dalam bahasa Indonesia yang baik dan benar, serta baku. Jika terpaksa menggunakan bahasa "asing" atau bahasa "daerah" harus ditulis dalam tanda "petik", (….) atau denga huruf italic, atau pakai garis bawah.

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