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Pengaruh *chronotype* dan tingkat stres terhadap status gizi dengan mediator perilaku makan pada mahasiswa perkuliahan daring

The effect of chronotype and stress levels on nutritional status mediated by eating behavior in college students with online lecture

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ABSTRACT

Background: *College students are a group at risk of experiencing changes in stress levels, changes in eating behavior, and sleep quality. Unhealthy eating behavior, if done continuously, will lead to weight gain.* ***Objective:*** *This study aims to analyze the effect of chronotype and stress levels on nutritional status mediated by the eating behavior of college students with online lectures.* ***Methods:*** *Cross-sectional survey with multistage cluster random sampling on 220 respondents. Chronotype data used by Morningness - Eveningness Questionnaire (MEQ). Stress level data using by Perceived Stress Scale (PSS-10) questionnaire. Eating behavior data was used by Dutch Eating Behavior Questionnaire (DEBQ). Nutritional status data is measured according to body mass index (BMI) by measuring weight (kg) and height (m²). Data were analyzed using Partial Least Square-Structural Equation Model (PLS-SEM) analysis using SmartPLS software.* ***Results:*** *The results showed that there was a significant indirect effect between chronotype (x1) on nutritional status (y2) mediated by eating behavior (p=0.037) with an impact of 0.085 or 8.5%. In comparison, the magnitude of the direct effect without a mediator was 0.193 or 19.3%. Furthermore, there is a significant indirect effect between stress level (x2) on nutritional status (y2) mediated by eating behavior (p=0.017) with an impact of 0.074 or 7.4%. The direct effect without a mediator is 0.217 or 21.7%.* ***Conclusions:*** *There is a significant indirect effect between chronotype and stress level on nutritional status mediated by eating behavior in students with online lectures. During the COVID-19 pandemic, college students should continue to pay attention to healthy eating behavior by preventing emotional eating, setting bedtime earlier, and avoiding stress by increasing physical activity.*

KEYWORDS: *chronotype;* eating behavior; nutritional status; PLS-SEM; stress levels

ABSTRAK

Latar belakang: Mahasiswa merupakan kelompok yang berisiko mengalami perubahan tingkat stres, perubahan perilaku makan, dan kualitas tidur. Perilaku makan yang tidak sehat apabila dilakukan secara terus menerus dapat menyebabkan kenaikan berat badan. **Tujuan:** Penelitian ini bertujuan menganalisis pengaruh *chronotype* dan tingkat stres terhadap status gizi dengan mediator perilaku makan pada mahasiswa selama perkuliahan daring. **Metode:** Penelitian *cross-sectional* dengan *multistage cluster random sampling* pada 220 responden. Data *chronotype* diukur dengan kuesioner *Morningness - Eveningness Questionnaire* (MEQ). Data tingkat stres diukur dengan kuesioner *Perceived Stress Scale* (PSS-10). Data perilaku makan diukur menggunakan kuesioner *Dutch Eating Behavior Questionnaire* (DEBQ). Penentuan status gizi menurut indeks massa tubuh (IMT) dengan pengukuran berat badan (kg) dan tinggi badan (m²). Analisis data menggunakan analisis *Partial Least Square-Structural Equation Model* (PLS-SEM) dengan *software* SmartPLS. **Hasil:** Hasil penelitian menunjukkan adanya pengaruh tidak langsung signifikan antara *chronotype* (x1) terhadap status gizi (y2) yang dimediatori oleh perilaku makan (p=0,037) dengan pengaruh sebesar 0,085 atau 8,5% sedangkan besaran pengaruh langsung tanpa mediator sebesar 0,193 atau 19,3%. Pengaruh tidak langsung signifikan juga ditemukan antara tingkat stres (x2) terhadap status gizi (y2) yang dimediatori oleh perilaku makan (p=0,017) dengan pengaruh sebesar 0,074 atau 7,4% sedangkan besaran pengaruh langsung tanpa mediator sebesar 0,217 atau 21,7%. **Simpulan:** Pengaruh

tidak langsung secara signifikan ditemukan antara *chronotype* dan tingkat stres terhadap status gizi dengan mediator perilaku makan pada mahasiswa perkuliahan daring. Selama pandemi COVID-19, mahasiswa sebaiknya tetap memperhatikan perilaku makan sehat dengan mencegah perilaku *emotional eating*, mengatur waktu tidur dan waktu bangun tidur menjadi lebih awal, dan menghindari stres dengan cara meningkatkan aktivitas fisik.

KATA KUNCI: *chronotype;* perilaku makan; status gizi; PLS-SEM; tingkat stres

PENDAHULUAN

Mahasiswa merupakan kelompok umur yang berisiko mengalami perubahan tingkat stres, perubahan perilaku makan, kualitas tidur, dan asupan gizi sehingga berdampak pada status gizi dengan masalah gizi lebih [1]. Indikator status gizi merupakan salah satu indikator dalam menentukan derajat kesehatan individu. Hasil penelitian sebelumnya menunjukkan bahwa terdapat hubungan yang signifikan antara perilaku makan dengan status gizi pada remaja [2]. Prevalensi status gizi berdasarkan indeks massa tubuh (IMT) pada kelompok umur mahasiswa lebih dari 18 tahun di Jawa Barat masih menjadi perhatian, yaitu status gizi kurus (9,25%), berat badan lebih (13,66%), dan obesitas (23%). Lebih lanjut, prevalensi status gizi berdasarkan IMT kelompok umur lebih dari 18 tahun di Kota Cimahi memiliki prevalensi yang lebih tinggi dibandingkan dengan rerata prevalensi di Jawa Barat, yaitu status gizi kurus dan obesitas masing-masing sebesar 9,54% dan 24,87% [3].

Saat ini, Indonesia sedang mengalami masa pandemi *Corona Virus Disease* 2019 (COVID-19) sehingga pemerintah memutuskan kebijakan untuk melakukan pembatasan sosial berskala besar (PSBB) yaitu melakukan berbagai aktivitas dari rumah termasuk perkuliahan yang dilakukan secara daring [4]. Beberapa penelitian menunjukkan terjadinya perubahan perilaku selama masa pandemi COVID-19, seperti penurunan aktivitas fisik (38%) dan perubahan perilaku makan dengan mengonsumsi makanan tidak sehat [5]. Hasil penelitian lainnya menyebutkan bahwa sebanyak 22% dari subjek mengalami pertambahan berat badan sebesar 2,5–5 kg dalam kurun waktu 2 bulan selama pandemi COVID-19 [6].

Pola pembelajaran daring membuat mahasiswa dituntut untuk belajar menggunakan *smartphone,* tablet atau laptop. Mekanisme pancaran cahaya biru dari layar tersebut diketahui dapat menunda pelepasan melatonin sirkadian endogen yang menyebabkan kesulitan untuk tidur [7]. Hal ini sejalan dengan studi lain yang dilakukan

pada mahasiswa Akademi Keperawatan Dharma Wacana selama pandemi COVID-19 yang menunjukkan adanya gangguan pola tidur [4]. Individu yang diklasifikasikan sebagai *chronotype* malam berisiko menghasilkan IMT yang lebih tinggi dibandingkan tipe pagi [8,9].

Kualitas tidur yang buruk ditandai dengan status kesehatan kurang baik sepertinya timbulnya stres. Mayoritas mahasiswa dengan sistem pembelajaran daring memiliki kualitas tidur yang buruk (85%) [10]. Mahasiswa di bidang kesehatan mempunya tingkat stres yang lebih tinggi dan rentan terhadap stres jika dibandingkan dengan mahasiswa program lainnya [11]. Stres akan berpengaruh terhadap perilaku makan yang tidak sehat, yang apabila dilakukan secara terus menerus akan menyebabkan kenaikan berat badan sehingga individu menjadi *overweight* ataupun obesitas [12,13].

Penelitian sebelumnya telah menjelaskan hubungan antara *chronotype* dengan status gizi dan hubungan tingkat stres terhadap status gizi, maupun hubungan perilaku makan dengan status gizi [2,14,15]. Namun, studi tersebut belum meneliti seberapa besar pengaruh langsung dan tidak langsung dari setiap variabel dan besar pengaruh secara bersamaan variabel-variabel tersebut terhadap status gizi. Kebaruan dalam penelitian ini juga terdapat pada variabel perilaku makan sebagai variabel mediator dalam penentuan hubungan variabel *chronotype* dan tingkat stres terhadap status gizi individu. Perbedaan selanjutnya yaitu variabel penelitian tersebut belum diteliti secara bersamaan selama kondisi pandemi COVID-19. Tujuan penelitian ini adalah menganalisis pengaruh *chronotype* dan tingkat stres terhadap status gizi dengan mediator perilaku makan pada mahasiswa dengan perkuliahan daring.

BAHAN DAN METODE

Desain dan subjek

Penelitian ini merupakan penelitian observasional analitik dengan rancangan *cross-sectional* dan

dilaksanakan pada bulan Juli 2021. Penentuan sampel dilakukan dalam dua tahap. Tahap pertama, teknik pengambilan sampel dengan dengan cara *multistage cluster random sampling*, yaitu pertama-tama dengan menentukan kluster sekolah tinggi kesehatan yang berada di Jawa Barat sebanyak 20 kampus, kemudian dari 20 kampus di Jawa Barat dipilih unit kluster yang berada di Kota Cimahi sehingga diperoleh dua kampus. Selanjutnya, dari 2 kampus tersebut, dipilih secara acak dan terpilih kampus STIKES Jenderal A. Yani Cimahi kemudian mengambil empat jurusan yang memiliki strata pendidikan yang sama yaitu strata pendidikan D4 dan S1. Pengambilan sampel dengan teknik ini diperlukan karakteristik sampel yang homogen untuk menghindari terjadinya bias. Tahap kedua, pengambilan sampel di STIKES Jenderal A. Yani Cimahi dengan menggunakan teknik *purposive sampling* berdasarkan kriteria inklusi dan eksklusi. Kriteria inklusi penelitian ini yaitu mahasiswa yang berusia 18-24 tahun, sedang berlokasi di Cimahi, sedang menjalani perkuliahan daring, dan berstrata pendidikan S1 atau D4. Kriteria eksklusi adalah mahasiswa tingkat akhir dan sakit pada saat penelitian berlangsung.

Populasi penelitian ini adalah semua mahasiswa atau mahasiswi di STIKES Jenderal A. Yani Cimahi dengan strata pendidikan S1 dan D4 yang berjumlah 1.636 orang dengan besar sampel sebanyak 220 orang. Jumlah sampel ini diperoleh dengan menggunakan perhitungan sampel dalam analisis *Structural Equation Modelling* (SEM) yaitu: (jumlah paramater/indikator x 10 = jumlah sampel) [16]. Berdasarkan perhitungan tersebut, sampel minimal yang diperoleh sebanyak 220 mahasiswa. Penelitian ini telah dinyatakan layak etik oleh Komisi Etik Penelitian Kesehatan STIKES Jenderal A. Yani Cimahi dengan No. 01/KEPK/IV/2021.

Pengumpulan dan pengukuran data

Penelitian ini terdiri dari beberapa variabel laten yaitu *chronotype* (x1), tingkat stres (x2), perilaku makan (y1), dan status gizi (y2) yaitu variabel-variabel tersebut terdiri dari beberapa indikator yang digolongkan berdasarkan masing-masing kuesioner **(Tabel 1)**.

Chronotype. Variabel *chronotype* adalah pengukuran irama sirkadian setiap individu berupa siklus bangun, siklus tidur, dan waktu untuk memulai aktivitas di pagi hari yang diukur menggunakan kuesioner *Morningness-Eveningness Questionnaire* (MEQ).

Tingkat stres. Data tingkat stres diukur menggunakan kuesioner *Perceived Stress Scale* (PSS-10) yang dikategorikan menjadi perasaan tidak terprediksi, perasaan tidak terkontrol, dan perasaan tertekan.

Status gizi. Variabel status gizi berdasarkan IMT dengan melakukan pengukuran antropometri tinggi badan dan berat badan menggunakan alat mikrotoa (SECA) dan timbangan injak digital (CAMRY) yang sudah dikalibrasi dengan nomor sertifikat kalibrasi: 01777/MD/GQ1-Ser/05/21. Pengukuran berat badan dan tinggi badan dilakukan sebanyak dua kali pengukuran. Pada saat melakukan pengukuran antropometri, peneliti dan enumerator memastikan standar operasional prosedur pengukuran berat badan dan tinggi badan sudah dilakukan dengan benar.

Perilaku makan. Data perilaku makan diperoleh menggunakan kuesioner *Dutch Eating Behavior Questionnaire* (DEBQ) yang diklasifikasikan menjadi *emotional eating, external eating, dan restrained eating*.

Pengambilan data variabel laten tersebut diambil menggunakan *google form* setelah dilakukan pengukuran berat badan dan tinggi badan sehingga pada saat pengisian *google form* oleh responden dapat dipantau oleh peneliti. Pengambilan data dibantu oleh satu orang enumerator yang merupakan mahasiswa lulusan D4 Gizi. Seluruh subjek penelitian diminta persetujuannya untuk

Tabel 1. Variabel indikator analisis multivariat

Variabel laten	Variabel indikator	Kode	Ket
Chronotype (*x1*)	Aspek di pagi hari	(*x1*.1)	Skor
	Waktu tidur	(*x1*.2)	
	Waktu bangun tidur	(*x1*.3)	
	Perasaan di pagi hari	(*x1*.4)	
	Waktu aktivitas harian	(*x1*.5)	
	Puncak performa	(*x1*.6)	
	Perencanaan	(*x1*.7)	
Tingkat stres (*x2*)	Perasaan tidak terprediksi	(*x2*.1)	Skor
	Perasaan tidak terkontrol	(*x2*.2)	
	Perasaan tertekan	(*x2*.3)	
Perilaku makan (*y1*)	*Emotional eating*	(*y1*.1)	Skor
	External eating	(*y1*.2)	
	Restrained eating	(*y1*.3)	
Status gizi (*y2*)	Indeks massa tubuh (IMT)	(*y2*.1)	kg/m²

diikutsertakan dalam penelitian berupa *informed consent* secara tertulis. Sebelum memberikan persetujuan, calon subjek penelitian diberikan penjelasan tentang tujuan, manfaat, risiko, dan prosedur penelitian.

Analisis data

Analisis univariat disajikan dalam tabel distribusi frekuensi yaitu untuk menggambarkan masing-masing variabel penelitian. Analisis multivariat dianalisis menggunakan analisis *Partial Least Squaare-Structural Equation Model* (PLS-SEM) dengan *software* SmartPLS, analisis ini digunakan karena terdapat variabel perilaku makan sebagai mediator. Analisis PLS-SEM ini dilakukan untuk menguji variabel-variabel yang diuji dengan analisis *predictive model*. Analisis ini juga digunakan karena data dari variabel yang dihasilkan tidak terdistribusi normal [17].

HASIL

Karakteristik subjek

Analisis deskriptif dalam penelitian ini (**Tabel 2**) menunjukkan bahwa subjek berada pada rentang umur 18-23 tahun, yaitu sebagian besar dari seluruh subjek penelitian (n=220) paling banyak berusia 20 tahun (39,5%) dan paling sedikit berusia 23 tahun (2,3%). Mayoritas subjek penelitian berjenis kelamin perempuan (81,8%). Hasil analisis univariat variabel laten *chronotype* (x1), indikator yang menunjukkan tipe *chronotype* individu adalah waktu tidur dan waktu bangun tidur. Indikator waktu tidur menunjukkan rerata skor sebesar 3,05 dan skor modus atau nilai yang paling sering muncul adalah 3. Sementara itu, indikator waktu bangun tidur menunjukkan rerata skor 3,70 dan skor modus 3. Variabel

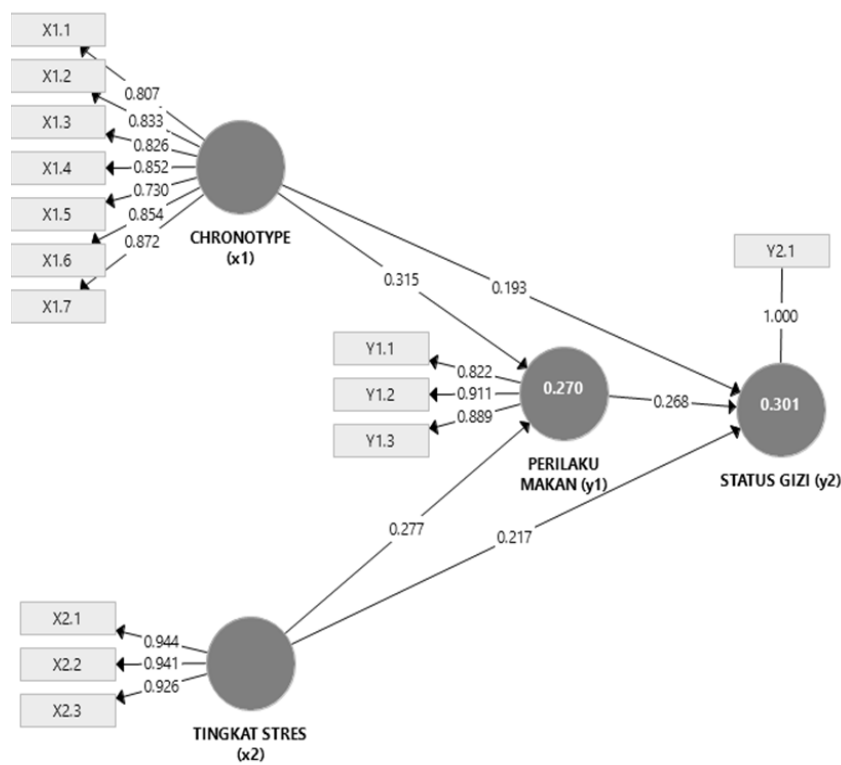**Tabel 2. Karakteristik subjek analisis univariat (n=220)**

Karakteristik	n	%	
Usia (tahun)			
18	24	10,9	
19	58	26,4	
20	87	39,5	
21	40	18,2	
22	6	2,7	
23	5	2,3	
Jenis kelamin			
Laki-laki	40	18,2	
Perempuan	180	81,8	
Variabel laten	**Rerata**	**Modus**	**Min-Maks**	**95% CI**
Chronotype (x1)				
Aspek di pagi hari (x1.1)	2,32	2	1,0-4,0	2,22-2,43
Waktu tidur (x1.2)	3,05	3	1,3-5,0	2,95-3,15
Waktu bangun tidur (x1.3)	3,70	3	1,0-5,0	3,55-3,85
Perasaan di pagi hari (x1.4)	2,53	2	1,3-3,7	2,46-2,59
Waktu aktivitas harian (x1.5)	2,90	3	1,5-4,0	2,90-3,04
Puncak performa (x1.6)	4,24	5	0,5-5,5	4,09-4,39
Perencanaan (x1.7)	2,74	2	1,0-4,7	2,65-2,84
Tingkat stres (x2)				
Perasaan tidak terprediksi (x2.1)	2,12	2	0,0-4,0	2,05-2,19
Perasaan tidak terkontrol (x2.2)	2,32	3	0,0-4,0	1,94-2,11
Perasaan tertekan (x2.3)	2,02	2	0,0-4,0	2,22-2,41
Perilaku makan (y1)				
Emotional eating (y1.1)	4,93	4	1,0-5,0	4,26-4,48
External eating (y1.2)	3,37	3	1,0-4,6	3,85-3,00
Restrained eating (y1.3)	3,70	3	1,0-4,9	3,59-2,80
Status gizi (y2)				
Indeks massa tubuh (y2.1)	24,53	26,0	15,1-34,9	23,99-25,10

laten tingkat stres (x2) indikator perasaan tidak terkontrol memiliki hasil analisis yang lebih tinggi dibandingkan dengan indikator lainnya dengan rerata skor sebesar 2,32 dan skor modus adalah 3. Variabel laten perilaku makan (y1) indikator *emotional eating* memiliki hasil analisis yang lebih tinggi dibandingkan dengan indikator lainnya dengan rerata skor sebesar 4,93 dan skor modus adalah 4. Variabel laten status gizi (y2) dengan indikator IMT menunjukkan rerata 24,53 kg/m², IMT terendah 15,1 kg/m², dan IMT tertinggi 34,9 kg/m². Berdasarkan estimasi interval disimpulkan bahwa 95% subjek dengan rerata IMT diantara 23,99-25,10 kg/m², hasil ini menunjukkan subjek memiliki kategori IMT *overweight* cenderung mengarah ke obesitas.

Hasil PLS algoritma pada **Gambar 1** menunjukkan bahwa nilai koefiesien jalur pada *chronotype* (x1) dan jalur pada tingkat stres (x2) terhadap perilaku makan (y1) masing-masing yaitu 0,315 dan 0,277 yang berarti terdapat pengaruh langsung yang positif. Demikian juga nilai koefiesien jalur pada perilaku makan (y1) terhadap status gizi (y2) yaitu 0,268 yang berarti terdapat pengaruh langsung yang positif.

Lebih lanjut, **Tabel 3** menunjukkan adanya pengaruh tidak langsung antara *chronotype* (x1) terhadap status gizi (y2) yang dimediatori oleh perilaku makan dengan nilai p=0,037. **Gambar 1** nilai koefisien *chronotype* terhadap status gizi adalah 0,193 sedangkan hasil penelitian dengan penambahan perilaku makan sebagai mediator maka nilai koefisien menjadi 0,085 (**Tabel 3**), yang dapat diartikan bahwa pengaruh langsung *chronotype* terhadap status gizi lebih besar dibandingkan pengaruh tidak langsung *chronotype* terhadap status gizi dengan mediator perilaku makan. Namun, meskipun pengaruhnya tidak lebih besar, mediator perilaku makan tetap memiliki peran dalam mempengaruhi status gizi (p<0,05). Dengan demikian, dapat diinterpretasikan bahwa semakin tinggi nilai *chronotype* (x1), maka nilai status gizi (y2) melalui perilaku makan (y1) akan semakin meningkat.

Selanjutnya, ditemukan pengaruh tidak langsung antara tingkat stres (x2) terhadap status gizi (y2) yang dimediatori oleh perilaku makan dengan nilai p=0,017. **Gambar 1** nilai koefisien tingkat stres terhadap status gizi adalah 0,217 sedangkan hasil penelitian dengan

Gambar 1. Analisis multivariat

Tabel 3. Analisis pengaruh *chronotype* terhadap status gizi yang dimediatori oleh perilaku makan dan pengaruh tingkat stres terhadap status gizi yang dimediatori oleh perilaku makan

Hubungan variabel	*Original sample* (O)	*Sample mean* (M)	*Standard deviation* (STDEV)	*T statistics* (|O/STDEV|)	*p-values*
Chronotype (x1)→ perilaku makan (y1)→ status gizi (y2)	0,085	0,087	0,040	2,090	0,037
Tingkat stres (x2)→ perilaku makan (y1)→ status gizi (y2)	0,074	0,071	0,031	2,399	0,017

penambahan perilaku makan sebagai mediator maka nilai koefisien menjadi 0,074 (**Tabel 3**), artinya bahwa pengaruh langsung tingkat stres terhadap status gizi lebih besar dibandingkan pengaruh tidak langsung tingkat stres terhadap status gizi dengan mediator perilaku makan. Namun, meskipun pengaruhnya tidak lebih besar, mediator perilaku makan tetap memiliki peran dalam mempengaruhi status gizi (p<0,05). Semakin tinggi nilai tingkat stres (x2) maka nilai status gizi (y2) melalui perilaku makan (y1) akan semakin meningkat.

Pengujian *inner model* dilakukan untuk melihat hubungan antara konstruk yaitu dengan melihat nilai signifikansi dan *R-square* dari model penelitian. Hasil koefisien determinasi *R-square* dari perilaku makan adalah 0,270 yang artinya bahwa pengaruh *chronotype* dan tingkat stres terhadap perilaku makan sebesar 27,0% dan 73,0% sisanya dipengaruhi oleh faktor lain. Sementara nilai koefisien determinasi (*R-square*) dari status gizi adalah 0,301. Nilai tersebut dapat diinterpretasikan bahwa pengaruh *chronotype*, tingkat stres, dan perilaku makan terhadap status gizi sebesar 30,1% dan 69,9% sisanya dipengaruhi oleh faktor lain.

BAHASAN

Pengaruh *chronotype* terhadap status gizi dengan mediator perilaku makan

Hasil penelitian menunjukkan adanya pengaruh tidak langsung positif yang signifikan antara *chronotype* terhadap status gizi yang dimediatori oleh perilaku makan (p=0,037). Jika *chronotype* meningkat maka status gizi dapat meningkat secara tidak langsung melalui perilaku makan sebesar 8,5% dan pengaruhnya bersifat positif. Penelitian sebelumnya belum pernah ada yang meneliti hubungan tidak langsung dari perilaku makan tersebut. Namun, berdasarkan hasil penelitian sebelumnya menyebutkan bahwa selama pandemi COVID-19 telah

menyebabkan perubahan yang signifikan pada perilaku makan mahasiswa, yaitu terjadi peningkatan konsumsi dibandingkan sebelumnya karena mereka lebih sering berada di dalam rumah [18]. Studi lain juga menunjukkan adanya pergeseran pola konsumsi pada mahasiswa selama pandemi COVID-19 menjadi lebih sering ngemil dan makan secara tidak terkontrol [19]. Penelitian sebelumnya menyebutkan adanya hubungan yang signifikan antara perilaku makan tidak sehat dengan status gizi *overweight* pada mahasiswa selama pandemi COVID-19 dengan persentase sebesar 15,3 % [20].

Berdasarkan analisis univariat variabel laten *chronotype*, indikator yang menunjukkan tipe *chronotype* individu adalah waktu tidur dan waktu bangun tidur. Hasil analisis indikator waktu tidur menunjukkan rerata skor 3,05 dan skor modus adalah 3. Skor ini menunjukkan bahwa sebagian besar responden menjawab waktu tidur pukul 22.15-00.45, waktu ini menunjukkan kondisi *chronotype* dengan tipe tengah. Sementara indikator waktu bangun tidur menunjukkan rerata skor 3,70 dan skor modus sebesar 3 yang menunjukkan bahwa sebagian besar responden menjawab waktu bangun tidur pukul 07.45-09.45, waktu ini merupakan kondisi chronotype tipe malam. Hasil penelitian ini menunjukkan *chronotype* tipe tengah menuju tipe malam lebih banyak dialami oleh mahasiswa selama perkuliahan daring saat pandemi COVID-19 dengan perilaku makan *emotional eating* dan status gizi *overweight* menuju obesitas. Sejalan dengan hasil penelitian sebelumnya yang menyebutkan bahwa *chronotype* tipe pagi memiliki pola kebiasaan konsumsi asupan energi dan lemak yang lebih rendah apabila dibandingkan dengan tipe malam [21]. Tipe *chronotype* malam secara signifikan memiliki penundaan waktu makan saat sarapan dan makan siang apabila dibandingkan tipe pagi sehingga *chronotype* tipe malam 1,7 kali lebih berisiko untuk melewati sarapan [22]. Individu yang diklasifikasikan sebagai *chronotype*

malam berisiko untuk memiliki IMT yang lebih tinggi dibandingkan tipe pagi [8,9].

Manusia memiliki variasi kendali tingkah laku berdasarkan mekanisme irama sirkadian yang terdiri dari waktu bangun, waktu tidur, dan waktu untuk beraktivitas yang disebut sebagai *chronotype* [23]. Mekanisme *chronotype* dipengaruhi oleh cahaya dan sinyal–sinyal eksterna dari lingkungan [24]. Gangguan pada jam sirkadian pada *chronotype* dapat meningkatkan risiko obesitas karena adanya gangguan mekanisme rasa kenyang melalui leptin dan ghrelin [25,26]. Pandemi COVID-19 membuat segala kegiatan dilakukan di rumah masing-masing termasuk kegiatan perkuliahan. Pada kondisi cahaya siang hari yang rendah karena hanya berada di dalam ruangan, maka pelepasan melatonin akan tertunda yang dapat menunda onset tidur dan menggeser fase tidur [27,28]. Hal ini sejalan dengan studi lain yang melaporkan bahwa sebagian besar para mahasiswa (82,7%) merasa bahwa perkuliahan daring menyebabkan peningkatan penggunaan teknologi digital sebesar 74,6% dan pemberian tugas dapat berpengaruh pada jadwal tidur mereka [29].

Cahaya biru yang dipancarkan dari layar selama proses perkuliahan daring dapat menekan atau menunda pelepasan melatonin sirkadian endogen sehingga dapat menyebabkan peningkatan kewaspadaan malam dan latensi tidur [7,30]. Temuan ini menunjukkan bahwa paparan cahaya buatan dari penggunaan layar tersebut dapat mengubah fase ritme sirkadian dan menghambat neuron yang mendorong tidur sehingga secara langsung mengganggu tidur dan menyebabkan kekurangan tidur kronis [7,31]. Selama pandemi COVID-19, sebagian besar individu akan menghabiskan waktu hari di dalam ruangan dan mengurangi paparan cahaya siang hari kemungkinan akan menunda dan mengurangi amplitudo pelepasan melatonin, yang pada akhirnya menunda permulaan tidur sehingga akan berpengaruh terhadap pergeseran ritme *chronotype* [28].

Pengaruh tingkat stres terhadap status gizi dengan mediator perilaku makan

Hasil penelitian menunjukkan adanya pengaruh tidak langsung positif yang signifikan antara tingkat stres terhadap status gizi yang dimediatori oleh perilaku makan (p=0,017). Jika tingkat stres meningkat maka status gizi dapat meningkat secara tidak langsung melalui perilaku makan sebesar 7,4% dan pengaruhnya bersifat positif. Perubahan gaya hidup pada mahasiswa juga akan mempengaruhi kebiasaan makan sehingga rentan terjadi masalah gizi [32]. Hasil penelitian lain juga menyebutkan bahwa pembelajaran daring mempengaruhi stres akademik [33]. Beban pembelajaran berbasis internet atau daring akan memberikan tugas yang berlebih dan waktu mengerjakan yang singkat sehingga dapat menyebabkan stres pada mahasiswa [4].

Berdasarkan hasil analisis univariat variabel laten tingkat stres, indikator perasaan tidak terkontrol memiliki hasil analisis yang lebih tinggi dibandingkan dengan indikator lainnya dengan rerata skor 2,32 dan skor modus adalah 3. Skor ini menunjukkan bahwa sebagaian besar responden sering merasakan perasaan tidak terkontrol seperti tidak mampu untuk mengontrol atau mengendalikan situasi dan perasaannya agar sesuai dengan apa yang diinginkan dan diharapkan. Dengan demikian, hasil penelitian ini menunjukkan tingkat stres dengan kondisi perasaan tidak terkontrol lebih banyak dialami oleh mahasiswa selama perkuliahan daring selama pandemi COVID-19 dengan memiliki perilaku makan *emotional eating* dan status gizi *overweight* menuju obesitas.

Salah satu metode koping dari stres adalah dengan melakukan kegiatan makan. Makan sebagai metode koping stres memiliki arti mengonsumsi makanan bukan karena merasa lapar, tetapi untuk memuaskan hasrat karena merasa tidak sanggup menahan beban yang terjadi disebut dengan *emotional eating* [34,35]. *Emotional eating* temasuk contoh perilaku makan tidak sehat karena pada saat mengalami *emotional eating*, seseorang cenderung memilih makanan yang tinggi energi dan lemak [12,36]. Hasil studi sebelumnya melaporkan hubungan yang positif antara stres dengan perilaku makan tidak sehat seperti konsumsi makanan ringan dan cepat saji pada mahasiswa [37]. Pada saat individu dalam keadaan stres, akan terjadi perubahan nafsu makan. Individu dengan status gizi lebih, cenderung melakukan pelarian dengan lebih banyak makan sedangkan individu dengan status gizi kurus akan cenderung mengurangi asupan makan [15,38]. Studi lain juga menyebutkan bahwa terdapat hubungan antara perilaku makan dengan status gizi [39].

Kebijakan *social distancing* mungkin berhasil memperlambat penyebaran virus infeksi dan meringankan sistem kesehatan masyarakat [40]. Di sisi lain, interaksi sosial yang kurang menyebabkan berkurangnya dukungan sosial dan berpotensi memengaruhi kesehatan mental pada siswa [41]. Penelitian menyebutkan bahwa ketika siswa lebih banyak hidup sendiri, kurang kontak atau interaksi langsung dengan teman dekat, dan kurang menerima dukungan sosial, maka dapat berpengaruh pada kesehatan mental seperti muncul gejala stres dan depresi [41]. Studi lain yang mendukung juga menunjukkan bahwa ada perubahan tingkat stres mahasiswa selama pandemi COVID-19 yaitu sebesar 0,9% ditemukan mengalami tingkat berat sedangkan 2,7% dan 21,3% mengalami stres tingkat ringan [42].

Kelebihan dari penelitian ini yaitu dapat melihat hubungan secara tidak langsung variabel perilaku makan terhadap status gizi mahasiswa dengan nilai koefisien jalur 0,268. Hasil koefisien determinasi *R-square* pada status gizi dari penelitian ini masih rendah yaitu 30,1%, yang berarti masih ada sebesar 69,9% faktor lain yang mempengaruhi status gizi. Penelitian selanjutnya dapat dilakukan untuk mengetahui asupan zat gizi mahasiswa selama pandemi COVID-19 karena penelitian ini hanya menggambarkan aspek dari perilaku makan.

SIMPULAN DAN SARAN

Penelitian ini menemukan bahwa *chronotype* dan tingkat stres berpengaruh terhadap status gizi yang dimediatori oleh perilaku makan pada mahasiswa dengan perkuliahan daring. Hasil uji multivariat berdasarkan hasil koefisien jalur diperoleh kekuatan hubungan tidak langsung *chronotype* yang lebih tinggi dibandingkan tingkat stres yaitu sebesar 8,5% dapat meningkatkan status gizi melalui mediator perilaku makan. Sementara kekuatan hubungan langsung paling kuat dalam meningkatkan status gizi adalah tingkat stres yaitu sebesar 21,7%. Secara keseluruhan aspek *chronotype*, tingkat stres, dan mediator perilaku makan berpengaruh terhadap status gizi sebesar 30,1% sedangkan sebanyak 69,9% dipengaruhi oleh faktor lain. Selama pandemi COVID-19, mahasiswa sebaiknya tetap memperhatikan perilaku makan yang sehat dengan mencegah perilaku *emotional eating*, mengatur waktu tidur dan waktu bangun tidur menjadi lebih awal, dan mengatur tingkat stres dengan cara meningkatkan aktivitas fisik seperti olahraga dari rumah sehingga dapat mencapai status gizi normal.

Pernyataan konflik kepentingan

Penulis menyatakan tidak ada konflik kepentingan dalam penelitian ini.

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Asupan protein, zink, dan defisiensi zink pada santriwati *underweight*

Protein intake, zinc intake, and zinc deficiency in underweight female students attending Islamic Boarding School in Indonesia

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ABSTRACT

Background: One of the nutritional issues in Indonesia is underweight. Groups of teenage girls tend to have underweight especially female students (santriwati) who live far from their parents. It happens due to a lack of macronutrients and micronutrients, zinc deficiency. Zinc deficiency impacts are reproductive disorders, stunted growth, fatigue, and loss of appetite. Objective: Analyzing the differences in zinc levels, protein, and zinc intakes between female students with underweight and normal nutritional status. Methods: An analytical observational study with a cross-sectional design in Askhabul Kahfi Islamic Boarding School with 24 underweight female students selected by consecutive sampling and 24 normal nutritional status female students were selected by matching techniques based on age. Data included nutritional status assessed by BMI for age z-score, protein and zinc intakes assessed by Semi-Quantitative Food Frequency Questionnaire, and zinc levels were tested using Atomic Absorption Spectrophotometry. The data analyses used Mann-Whitney test. Results: Underweight female students had lower average protein intake than normal nutritional status female students (52.20±25.06 and 75.52±23.19 grams) as well as zinc intake (4.63±1.22 and 7.51±1.94 grams). Protein and zinc intake were significantly different, but the two groups did not differ in zinc levels. All subjects had a normal zinc level of 100%. Conclusions: There was a difference in protein and zinc intake between underweight and normal nutritional female students (p<0.001), while the zinc levels were not found any differences (p=0.773).

KEYWORDS: *female students; protein intake; santriwati; underweight; zinc deficiency; zinc intake*

ABSTRAK

Latar belakang: Masalah gizi yang terjadi di Indonesia salah satunya ialah *underweight*. Kelompok yang rentan *underweight* adalah remaja putri, khususnya remaja yang tinggal jauh dari orang tua yaitu santriwati. *Underweight* terjadi karena kekurangan zat gizi makro dan zat gizi mikro, salah satunya ialah defisiensi zink. Dampak dari defisiensi zink ialah gangguan reproduksi, pertumbuhan terhambat, penurunan daya tahan tubuh dan penurunan nafsu makan. **Tujuan:** Penelitian ini bertujuan menganalisis perbedaan asupan protein, asupan zink, dan kadar zink antara santriwati dengan status gizi normal dan *underweight*. **Metode:** Penelitian observasional analitik dengan desain *cross-sectional* di Pondok Pesantren Askhabul Kahfi Kecamatan Mijen, Kota Semarang dengan 24 santriwati *underweight* dipilih secara *consecutive sampling* dan 24 santriwati status gizi normal dipilih dengan teknik *matching* berdasarkan usia. Data meliputi status gizi dinilai dengan Z-*score* IMT/U, asupan protein dan zink menggunakan *Semi Quantitative Food Frequency Questionnaire* (SQ-FFQ) serta kadar zink diuji menggunakan metode *Atomic Absorption Spectrophotometry* (AAS). Analisis data menggunakan uji *Mann-Whitney*. **Hasil:** Defisiensi zink tidak ditemukan pada santriwati karena 100% memiliki kadar zink normal, tetapi rerata asupan protein lebih rendah pada santriwati *underweight* daripada santriwati dengan status gizi normal (52,20±25,06 g dan 75,52±23,19 g) begitu juga dengan asupan zink (4,63±1,22 g dan 7,51±1,94 g. Asupan protein dan zink berbeda signifikan (*p*<0,001) antara santri underweight dan normal, tetapi kadar zink pada kedua kelompok tersebut tidak terdapat perbedaan (*p*=0,773). **Simpulan:** Asupan protein dan zink pada santriwati *underweight* dan santriwati status gizi normal menunjukkan perbedaan tetapi tidak demikian dengan kadar zink.

KATA KUNCI: *remaja putri; asupan protein; santri; underweight; defisiensi zink; asupan zink*

PENDAHULUAN

Masalah gizi menjadi suatu masalah yang banyak dihadapi oleh negara berkembang termasuk Indonesia. Masalah gizi yang dialami masyarakat Indonesia salah satunya ialah *underweight*. *Underweight* adalah kondisi berat badan rendah yang dapat disebabkan asupan zat gizi kurang dari yang seharusnya sehingga tidak dapat memenuhi kebutuhan tubuh dan dapat disebabkan oleh infeksi berulang [1]. Penentuan status gizi pada remaja di bawah 19 tahun menggunakan indikator indeks massa tubuh menurut umur (IMT/U) yang dikategorikan *underweight* jika hasil perhitungan IMT/U dengan z-score $\geq$ -3 s/d < -2 [2]. Berdasarkan hasil Riskesdas 2018, provinsi Jawa Tengah termasuk dalam 10 provinsi dengan prevalensi status gizi kurus pada remaja usia 13-18 tahun. Prevalensi yang mengalami *underweight* (menurut *z-score* IMT/U) pada remaja umur 13-15 tahun yaitu kurus sebesar 10,1% (2,7% sangat kurus dan 7,4% kurus) pada tahun 2010 dan meningkat menjadi 11,1% (3,3% sangat kurus dan 7,8% kurus) pada tahun 2013 [3].

Kelompok remaja yang rentan atau berisiko *underweight* adalah remaja di pondok pesantren (santri) [4]. Sebagian besar remaja tidak memperhatikan asupan bergizi dan pola makan, terutama dengan kelompok santri yang berjauhan dengan orang tua dalam jangka waktu lama, maka pengawasan tentang asupan bergizi tidak termonitor secara menyeluruh seperti ketika di rumah [5]. Asupan akan mempengaruhi status gizi remaja. Santri yang *underweight* dapat menyebabkan pertumbuhan tidak optimal, produktivitas rendah, terhambatnya organ reproduksi, dan rentan terhadap penyakit. Selain itu, santriwati juga dapat mengalami anemia dan gangguan menstruasi [1,6]. Penelitian yang dilakukan di Pondok Pesantren Darul Ulum Peterongan Jombang sebanyak 175 santriwati berusia rata-rata 13 tahun menunjukkan 18,9% *underweight* dan 57,5% anemia [7]. *Underweight* yang terjadi pada kelompok santri tidak hanya berkaitan dengan kurangnya zat gizi makro saja tetapi juga zat gizi mikro, salah satunya ialah defisiensi zink [8].

Zink merupakan mineral mikro yang memegang peranan penting dalam banyak fungsi tubuh [9,10]. Zink berfungsi mengaktifkan sintesis hormon pertumbuhan dengan meningkatkan *insulin-like growth factor-1* (IGF-1) yang merupakan mediator hormon pertumbuhan dan pembentukan *antibody* oleh sel B dalam sistem imun [11]. Pada pertumbuhan awal kehidupan, janin dalam proses pematangan sel membutuhkan zink sehingga zink sangat penting pada masa konsepsi yang akan berpengaruh pada daur hidup selanjutnya [12]. Masa konsepsi adalah masa sebelum terjadinya kehamilan. Santriwati sangat penting untuk mempersiapkan diri dari segi kecukupan gizi agar melahirkan generasi yang sehat dengan memperhatikan kesehatan reproduksi sehingga dapat menurunkan risiko kesakitan pada bayi dan kejadian berat bayi lahir rendah (BBLR) yang rentan terhadap penyakit [13]. Bayi yang lahir dengan kondisi kurang gizi akan berisiko kekurangan gizi saat dewasa sehingga perbaikan status gizi pada masa konsepsi sangat penting agar siklus malnutrisi intergenerasi ini terputus [14].

Defisiensi zink dapat terjadi karena kandungan zink yang rendah dalam makanan yang dikonsumsi. Bioavailabilitas zink yang rendah dapat terjadi karena pemilihan makanan yang tidak beragam dan adanya zat penghambat penyerapan zink seperti fitat, tanin, dan serat. Dampak dari defisiensi zink ialah gangguan reproduksi, pertumbuhan terhambat, gangguan kulit atau dermatitis, penyembuhan luka terganggu, dan penurunan daya tahan tubuh sehingga rentan terhadap penyakit infeksi [14]. Defisiensi zink memiliki keterkaitan dengan kejadian *underweight*. Seseorang yang mengalami defisiensi zink akan kehilangan indera pengecap sehingga terjadi penurunan nafsu makan hingga anorexia [15]. Sebaliknya, keadaan gizi kurang atau *underweight* akan mempengaruhi status zink di dalam tubuh [16]. Kondisi gizi kurang menyebabkan kadar albumin di dalam tubuh menurun karena terjadi penurunan sintesis protein dan peningkatan pemecahan protein. Albumin merupakan protein cadangan yang diproduksi oleh organ hati dan berperan sebagai transportasi utama zink sehingga jika albumin darah menurun maka absorbsi zink juga menurun [17]. Penelitian yang dilakukan di Yayasan Pondok Pesantren Hidayatullah Makassar dengan sampel 100 orang menunjukkan bahwa 34% sampel memiliki asupan protein kurang dan 100% sampel tergolong asupan zink kurang [18]. Namun demikian, studi di Indonesia yang menganalisis kadar zink pada santriwati dengan perbedaan status gizi masih sangat

terbatas. Dengan demikian, penelitian ini bertujuan untuk mengetahui perbedaan asupan protein, zink, dan kadar zink antara santri dengan status gizi normal dan *underweight.*

BAHAN DAN METODE

Desain dan subjek

Penelitian ini merupakan penelitian observasional analitik dengan desain *cross-sectional* yang dilakukan pada bulan September hingga Oktober 2020. Penelitian ini dilakukan di Pondok Pesantren Askhabul Kahfi, Kecamatan Mijen, Kota Semarang. Pelaksanaan penelitian ini telah memperoleh persetujuan Komisi Bioetika Penelitian Kedokteran/Kesehatan, Fakultas Kedokteran Universitas Islam Sultan Agung Semarang No.243/VII/2020/Komisi Bioetik.

Populasi target pada penelitian ini adalah seluruh santriwati Pondok Pesantren di Jawa Tengah dengan populasi terjangkau santriwati di Pondok Pesantren Askhabul Kahfi, Kecamatan Mijen, Kota Semarang. Berdasarkan perhitungan rumus besar sampel penelitian observasional dua populasi [19] dengan Zα deviat baku alfa (Zα) = 1,96; deviat baku beta (Zβ) = 0,84; dan koreksi *drop out* 10% diperoleh jumlah sampel minimal masing-masing kelompok adalah 22 sampel. Dengan demikian, kelompok santriwati dengan status gizi normal sebanyak 22 subjek dan kelompok santriwati dengan status gizi *underweight* sebanyak 22 subjek. Skrining dengan pengukuran antropometri dilakukan pada 770 santriwati. Selama proses penelitian, terdapat 1 subjek pada kelompok santriwati *underweight* yang *drop out* karena data tidak lengkap sehingga diperoleh jumlah sampel sebanyak 24 santriwati *underweight* dan 24 santriwati status gizi normal yang diambil secara *consecutive sampling.* Subjek dalam penelitian ini terdiri dari jenjang pendidikan SMP, MTS, MA, dan SMA. Kriteria inklusi pada subjek penelitin ini yaitu santriwati usia 12 – 18 tahun di Pondok Pesantren Askhabul Kahfi, status gizi normal (Z-*score* ≥-2,0 s/d ≤1,0) dan *underweight* (Z-score ≥-3,0 s/d <- 2), tidak merokok dan mengonsumsi alkohol, tidak menderita penyakit infeksi (diare, malaria, TBC, pneumonia, dll), serta bersedia menjadi responden dan mengisi *informed consent.*

Pengumpulan dan pengukuran data

Status gizi. Data status gizi dinilai berdasarkan *z-score* IMT/U yang merupakan indikator penentu status gizi untuk remaja dengan usia kurang dari 18 tahun. Variabel status gizi dalam penelitian ini dikategorikan menjadi kelompok santriwati normal (z-*score* ≥-2,0 s/d ≤1,0) dan santriwati *underweight* (z-score ≥-3,0 s/d <-2) [2]. Data berat badan (BB) dan tinggi badan (TB) diperoleh melalui pengukuran langsung menggunakan timbangan injak digital merk GEA dengan ketelitian 0,1 kg dan *microtoise* dengan ketelitian 0,1 cm. Data *z-score* IMT/U diperoleh dengan *software* WHO antroplus.

Kadar zink. Kadar zink adalah kandungan zink di dalam serum darah yang merupakan suatu indikator untuk menilai risiko defisiensi zink atau status zink pada populasi. Jika terdapat lebih dari 20% populasi memiliki kadar zink serum di bawah batas normal maka seluruh populasi berisiko defisiensi zink. Sampel darah diambil dari darah vena yang dilakukan oleh analis pada pagi hari dalam keadaan subjek tidak berpuasa. Batas bawah atau *lower cut off* kadar zink yaitu 66 µg/dL [20]. Penentuan kadar zink dilakukan dengan metode *atomic absorption spectrophotometry* (AAS) yang dilakukan di Laboratorium GAKI, Fakultas Kedokteran Universitas Diponegoro.

Asupan protein dan zink. Variabel perancu meliputi asupan protein dan asupan zink untuk mengetahui rerata asupan protein dan zink yang berasal dari makanan sehari-hari termasuk vitamin dan suplemen. Data asupan protein dan zink diperoleh melalui wawancara langsung kepada subjek menggunakan kuesioner *semi quantitative food frequency questionnaire* (SQ-FFQ) yang dibantu dengan media foto makanan kemudian dihitung menggunakan *Nutrisurvey.* Asupan protein dan zink akan dibandingkan dengan angka kecukupan gizi (AKG) kemudian dihitung dalam persentase [21]. Tingkat kecukupan asupan protein dikategorikan menjadi kurang (<80%), cukup (80 – 120%), dan lebih (>120%) sedangkan tingkat kecukupan zink dibedakan menjadi kurang (<77%) dan cukup (≥77%) [22].

Analisis data

Analisis data univariat digunakan untuk mendeskripsikan karakteristik masing-masing variabel

dan melihat distribusi. Uji normalitas data dalam penelitian ini menggunakan uji *Shapiro Wilk* (subjek<50). Analisis data bivariat menggunakan uji *Mann-Whitney* karena data berdistribusi tidak normal dengan tingkat signifikasi (*α*) sebesar 0,05 dan tingkat kepercayaan sebesar 95%. Tujuan analisis bivariat adalah untuk melihat perbedaan asupan protein, asupan zink, dan kadar zink antara santriwati yang memiliki status gizi normal dengan santriwati *underweight*.

HASIL

Karakteristik subjek penelitian

Subjek pada penelitian ini berjumlah 48 santriwati di Pondok Pesantren Askhabul Kahfi, Kecamatan Mijen, Kota Semarang, Jawa Tengah. Santriwati dikelompokkan menjadi dua berdasarkan status gizi normal dan *underweight* masing- masing sebanyak 24 orang. Usia subjek berkisar 11-17 tahun. Kelompok *underweight* menunjukkan sebagian besar subjek tergolong remaja awal yaitu sebanyak 20 orang (83,3%) sedangkan kelompok status gizi normal sebagian besar subjek tergolong remaja pertengahan sebanyak 13

orang (54,2%). Mayoritas tingkat asupan protein dan zink pada santriwati *underweight* tergolong kurang yaitu masing-masing sebanyak 11 orang (45,8%) dan 22 orang (91,7%) sedangkan pada santriwati status gizi normal tingkat asupan protein dan zink cenderung cukup yaitu sebanyak 13 orang (54,2%). Kadar zink pada dua kelompok tersebut secara keseluruhan normal (100%). Rerata tinggi badan pada kelompok *underweight* adalah 145,3 cm sedangkan pada kelompok status gizi normal sebesar 153,6 cm (**Tabel 1**).

Perbedaan asupan protein, asupan zink, dan kadar zink antara santriwati status gizi normal dan *underweight*

Tabel 2 menunjukkan rerata asupan protein pada santriwati *underweight* lebih rendah yaitu 52,20±25,06 g jika dibandingkan dengan santriwati normal yaitu 75,52±23,19 g sehingga terdapat perbedaan yang signifikan antara kedua kelompok (*p*<0,001). Demikian juga dengan asupan zink yang berbeda signifikan antara kedua kelompok tersebut (*p*<0,001). Rerata asupan zink tergolong lebih rendah pada santriwati *underweight* (4,63±1,22 g) dibandingkan santriwati dengan status gizi normal (7,51±1,94 g). Kadar zink pada santriwati dengan status gizi normal tidak ditemukan perbedaan dengan kadar zink santriwati *underweight* (*p*=0,773).

BAHASAN

Sebagian besar kelompok santriwati *underweight* tergolong remaja (83,3%) sedangkan santriwati dengan status gizi normal tergolong remaja pertengahan (54,2%). Mayoritas remaja awal di kelompok santriwati *underweight* belum menstruasi (75%). Hormon esterogen mempengaruhi siklus menstruasi dan produksi hormon tersebut dipengaruhi oleh lemak tubuh individu. Oleh

Tabel 1. Gambaran kategori asupan protein, asupan zink, dan kadar zink pada santriwati yang memiliki status gizi normal dan *underweight*

Variabel	n (%)	
	Underweight	Normal
Asupan protein (g)		
Kurang	11 (45,8)	0 (0)
Cukup	10 (41,7)	13 (54,2)
Lebih	3 (12,5)	11 (45,8)
Asupan zink (g)		
Kurang	22 (91,7)	11 (45,8)
Cukup	2 (8,3)	13 (54,2)
Kadar zink (µg/dL)		
Normal	24 (100)	24 (100)

Tabel 2. Perbedaan asupan protein, asupan zink, dan kadar zink antara santriwati berstatus gizi normal dan *underweight*

Variabel	*Underweight*			Normal			*p-value*
	Min[1]	Max[2]	Rerata±SD	Min	Max	Rerata±SD	
Asupan protein (g)	23,60	131,80	52,20±25,06	47,10	135,90	75,52±23,19	<0,001*
Asupan zink (g)	2,60	7,20	4,63±1,22	4,50	12,1	7,51±1,94	<0,001*
Kadar zink (µg/dL)	88,50	158,80	120,20±20,87	84,10	166,3	121,40±22,70	0,773

[1]minimum (min); [2]maximum (max); *signifikansi p<0,05

karena itu, pada kelompok *underweight* lebih banyak ditemukan remaja yang belum menstruasi karena lemak tubuh yang masih belum cukup [23,24]. Masalah gizi rentan terjadi pada usia tersebut karena perubahan secara psikologis, fisiologis, dan biologis [5]. Pada masa remaja awal terjadi peningkatan pematangan dan pertumbuhan fisik yang cepat sebagaimana remaja pertengahan yang juga ditandai pertumbuhan pubertas yang hampir lengkap. Salah satu penyebab yang berperan besar pada masalah gizi remaja adalah kecukupan asupan zat gizi makro maupun mikro [4].

Santriwati di pondok pesantren ini mendapatkan makan tiga kali sehari. Menu sarapan pagi terdiri dari nasi dan sayur kemudian siang dan malam terdiri dari nasi, sayur, dan lauk nabati. Lauk hewani diberikan satu kali dalam satu minggu sedangkan buah-buahan tidak diberikan oleh pondok pesantren. Sayur yang sering dimasak yaitu sayur sop, labu siam, kangkung, terong, dan sawi. Sumber protein dari lauk nabati yang tersedia adalah tempe dan tahu sedangkan lauk hewani yaitu ikan, telur, dan ayam. Lauk hewani seperti daging sapi hanya diberikan saat ada perayaan tertentu seperti lebaran. Pembagian makanan dilakukan dengan cara santriwati mengantre sambil membawa peralatan makan masing-masing kemudian nasi bisa mengambil sendiri sedangkan menu lain diporsi per individu yaitu lauk nabati satu potong dan sayur satu centong. Pondok pesantren menyediakan kantin dan toko yang menjual segala kebutuhan santri termasuk berbagai macam snack ringan dan juga jajanan seperti gorengan, sosis goreng, bakso bakar, mi ayam karena para santri tidak boleh keluar dari pondok pesantren.

Hasil penelitian ini menunjukkan rerata kadar zink pada santriwati *underweight* lebih rendah tetapi memiliki nilai yang relatif sama dengan santriwati status gizi normal sehingga tidak menunjukkan perbedaan yang signifikan. Seluruh santriwati memiliki kadar zink yang normal. Hasil ini sesuai dengan penelitian pada subjek berusia 9-12 tahun yang menunjukkan bahwa mayoritas subjek dengan *z-score* IMT/U normal (62%) memiliki kadar zink yang normal sedangkan seluruh subjek *underweight* (12%) memiliki kadar zink yang normal [25]. Penelitian tersebut membedakan subjek berdasarkan status gizi untuk melihat tingkat defisiensi

zink karena orang yang defisiensi zink berisiko malnutrisi [25]. Namun demikian, kadar zink di dalam plasma dipengaruhi oleh banyak faktor, tidak hanya asupan zat gizi tetapi juga adanya infeksi, stres akut, dan status gizi. Di samping itu, seseorang yang mengalami penurunan berat badan atau pada kondisi katabolik juga dapat mempengaruhi kadar zink plasma [26,27].

Selain itu, kadar albumin juga memengaruhi kadar zink. Albumin merupakan protein cadangan yang diproduksi oleh organ hati dengan waktu paruh 14-20 hari sehingga asupan protein dalam sehari tidak berpengaruh pada tingkat albumin. Keadaan malnutrisi, defisiensi zink yang parah, dan kondisi peradangan atau fase akut seperti keadaan pasca operasi, gagal hati, luka bakar, sepsis, dan kanker dapat menurunkan kadar abumin [28,29]. Albumin memiliki peran penting dalam penyerapan dan transportasi zink, 80% zink plasma diikat oleh albumin sehingga ketika albumin menurun maka akan berpengaruh pada konsentrasi zink [16,30]. Albumin, kadar zink serum, dan status gizi memiliki keterkaitan yang dibuktikan dengan peningkatan status gizi signifikan setelah pemberian suplementasi zink 30 mg/hari pada anak-anak dan remaja yang malnutrisi kronik dengan hipoalbumin [31]. Para santriwati dalam penelitian ini belum sampai ke malnutrisi yang menyebabkan penurunan albumin sehingga tidak terjadi defisiensi. Meskipun tidak ada perbedaan kadar zink serum antara santriwati berstatus gizi normal dan *underweight,* tetapi hal ini dapat menjadi indikator dini bahwa subjek pada kelompok *underweight* pertumbuhannya terganggu. Rerata tinggi badan santriwati pada kelompok *underweight* lebih rendah (145,3 cm) dibandingkan tinggi badan kelompok status gizi normal (153,6 cm). Selain itu, pada kelompok *underweight* juga ditemukan asupan zink dan protein yang rendah.

Zink adalah mineral yang sangat penting bagi tubuh [32]. Zink merupakan bagian dari kegiatan pada lebih dari dua ratus enzim sehingga berpengaruh banyak terhadap jaringan tubuh. Selain itu, zink juga berkaitan dengan metabolisme sel dengan melakukan degradasi dan sintesis pada protein, lipid, asam nukleat, dan protein [9]. Zink berkaitan dengan pertumbuhan yang berfungsi mengaktifkan sintesis hormon pertumbuhan, sistem imun, reproduksi laki-laki, dan nafsu makan [33]. Dampak dari

defisiensi zink adalah gangguan reproduksi, pertumbuhan terhambat, gangguan kulit atau dermatitis, penyembuhan luka terganggu, penurunan daya tahan tubuh sehingga rentan terhadap penyakit infeksi, dan penurunan nafsu makan yang berisiko malnutrisi [34,35]. Kondisi fisiologis seperti kehamilan, proses hemolisis, pemakaian kontrasepsi oral, penyakit kronik, inflamasi, infeksi akut, dan asupan zink dapat berdampak pada status zink. Di samping itu, keberadaan zat-zat lain seperti kalsium, fitat, tembaga dan besi dapat mempengaruhi absorbsi zink [36]. Hasil studi eksperimental menunjukkan bukti yang kuat tentang hubungan asupan zink dengan kadar zink yaitu remaja dengan status gizi normal dapat memiliki kadar zink yang rendah dalam beberapa hari atau berminggu-minggu akibat pembatasan asupan zink yang sangat ketat. Namun, kadar zink akan kembali seperti semula kadar awal zink setelah mengonsumsi asupan yang kaya akan zink dalam periode 9-35 hari [37].

Hasil penelitian ini menunjukkan bahwa sebagian besar tingkat asupan zink santriwati tergolong kurang dan paling banyak ditemukan pada kelompok *underweight* (91,7%). Berdasarkan data asupan makan, santriwati lebih banyak mengonsumsi sumber bahan makanan lauk nabati seperti tahu dan tempe dan sebaliknya sangat jarang mengonsumsi lauk hewani. Bahan makanan sumber nabati memiliki bioavaibilitas yang rendah karena mengandung zat penghambat penyerapan salah satunya adalah fitat [38]. Faktor lain yang memengaruhi penyerapan zink adalah besi, kalsium, dan tembaga. Sumber zink dari makanan hewani seperti daging, kerang, ikan, dan hati memiliki bioavaibilitas lebih tinggi dibandingkan sumber protein nabati [39].

Saat asupan zink rendah, maka tubuh akan menunjukkan keadaan homeostasis untuk mengontrol atau menjaga kadar zink di dalam plasma [40]. Asupan zink yang rendah dapat memicu penyerapan zink karena terjadi peningkatan transfer zink yang cepat oleh pembawa melewati membran mukosa. Absorbsi zink terjadi di duodenum (usus halus bagian atas). Zink dari makanan diangkut oleh albumin dan transferin ke aliran darah menuju hati. Zink yang berlebih disimpan dalam bentuk metalotionein di dalam hati sedangkan yang lainnya dibawa darah dalam albumin ke pankreas dan jaringan tubuh lain seperti kulit, retina, rambut, tulang,

organ reproduksi laki-laki, dan kuku. Setelah itu, akan terjadi sirkulasi enteropankreatik yang merupakan sirkulasi zink dari pankreas ke saluran cerna dan kembali ke pankreas lagi. Zink akan digunakan untuk membentuk enzim pencernaan di pankreas dan mengeluarkannya ke dalam saluran cerna pada waktu makan [10,41]. Pertukaran zink dari plasma ke dalam jaringan secara cepat berguna agar kadar zink dalam serum relatif konstan [40,42].

Lebih lanjut, metalotionein yang dibuat di dalam sel dinding usus halus berperan dalam mengatur kadar zink. Jika konsumsi zink tinggi, maka penyerapan zink akan berkurang karena akan disimpan dalam bentuk metalotionein di dalam sel dinding saluran cerna yang kemudian akan dibuang dalam waktu 2-5 hari bersama sel-sel dinding usus halus. Metalotionein yang disimpan di dalam hati akan terus mengikat zink sampai saat dibutuhkan tubuh dan organ hati berperan penting dalam hal redistribusi [10,12].

Zat gizi lain yang berhubungan dengan zink adalah protein. Protein terdiri dari rantai-rantai asam amino yang sangat dibutuhkan oleh tubuh [21]. Protein berfungsi untuk memelihara sel-sel tubuh dan jaringan, pembentukan antibodi, mengangkut zat- zat gizi, dan sebagai sumber energi jika sumber energi dari karbohidrat dan lemak tidak terpenuhi. Protein juga berperan dalam penyerapan dan metabolisme zink [43]. Transportasi utama zink di membran enterosit yaitu *Zrt- and Irt-like protein* (ZIP), metalotionein yang merupakan protein khusus pengatur penyerapan zink, serta asam amino seperti histidin, glisin, dan lisin berperan sebagai pengikat dalam proses penyerapan zink dan mempertahankan kelarutan zink di dalam saluran pencernaan [44]. Sumber protein ada yang berasal dari hewani seperti telur, susu, daging, unggas, kerang, ikan, daging, dan berasal dari nabati (tumbuh-tumbuhan) yaitu kacang-kacangan, tempe, dan tahu [8]. Protein yang bermutu tinggi terdapat pada sumber bahan makanan hewani. Kebutuhan protein meningkat pada masa remaja yang berguna untuk proses tumbuh kembang [45].

Asupan protein pada sebagian besar santriwati dengan status gizi normal tergolong cukup (54,2%) sedangkan santriwati *underweight* tergolong kurang (45,8%). Rerata asupan zink dan *protein* pada santriwati *underweight* ($p<0,001$) lebih rendah secara signifikan

dibandingkan santriwati yang berstatus gizi normal. Hasil ini sejalan dengan studi di Pondok Pesantren Hidayatullah Makassar yang menunjukkan perbedaan asupan protein dan zink pada santriwati yang memiliki status gizi normal dan santri *underweight* (*p*<0,05) [18]. Berdasarkan hasil wawancara menggunakan form SQ-FFQ, asupan makan santriwati *underweight* tergolong kurang dalam jumlah dan variasi sedangkan asupan pada santriwati berstatus gizi normal lebih banyak dan bervariasi. Frekuensi makan pada santriwati *underweight* tidak teratur, terkadang makan dua kali dalam sehari dengan alasan malas makan, tidak selera makan, dan tidak sempat sarapan. Selain itu, frekuensi konsumsi makanan selingan juga lebih sedikit dibandingkan santriwati normal. Santriwati dengan status gizi normal lebih banyak mengonsumsi makanan dari kantin atau jajanan yang mengandung sumber protein seperti susu dan jajanan seperti sosis, nuget, telur gulung, dan bakso. Sementara itu, santriwati *underweight* tidak banyak mengonsumsi makanan sumber protein selain dari yang disediakan pondok pesantren. Makanan selingan yang sering dikonsumsi santriwati *underweight* yaitu roti isi selai, susu kental manis, minuman berasa, dan kue-kue manis.

Pondok pesantren diharapkan dapat meningkatkan perhatian terhadap status gizi santriwati dengan cara menyediakan makanan sesuai prinsip gizi seimbang dan kebutuhan santriwati, termasuk perlu memperhatikan variasi menu makanan dalam siklus menu. Di samping itu, perlu memberikan informasi atau pengetahuan gizi kepada pengelola pondok pesantren agar menyediakan asupan yang mengandung zat gizi makro (karbohidrat, protein, lemak), mineral, dan vitamin serta meningkatkan frekuensi penyediaan makanan sumber protein hewani. Kebutuhan protein meningkat pada masa remaja terutama remaja putri yang mengalami tahap pertumbuhan dan perkembangan yang lebih cepat dibandingkan laki-laki. Selain itu, zink juga dibutuhkan untuk kematangan seksual dan pertumbuhan [1]. Pemenuhan asupan protein dan zink tidak hanya bermanfaat untuk masa remaja, tetapi juga untuk daur hidup selanjutnya. Para santriwati perlu mempersiapkan diri dari segi kecukupan gizi agar melahirkan generasi yang sehat. Bayi yang lahir dengan kondisi kurang gizi akan berisiko kekurangan gizi hingga dewasa sehingga pemenuhan zat gizi pada masa konsepsi sangat penting untuk memutus siklus malnutrisi

antar generasi [12]. Pemeriksaan kesehatan seperti penimbangan berat badan dan pengukuran tinggi badan secara berkala juga perlu dilakukan untuk memonitor status gizi santriwati. Pada penelitian ini belum dilakukan pemeriksaan albumin untuk mengetahui lebih jelas kondisi status gizi subjek dan pengaruhnya terhadap kadar zink. Tanda-tanda malnutrisi diantaranya adalah *underweight* dan hipoalbuminemia [30,46]. Saran untuk penelitian selanjutnya, sebaiknya dilakukan pemeriksaan albumin. Studi sebelumnya menunjukkan bahwa terdapat hubungan kadar albumin dengan kadar zink [47,48].

SIMPULAN

Defisiensi zink tidak ditemukan pada santriwati, karena seluruh santriwati memiliki kadar zink kategori normal, namun rerata asupan protein dan zink pada santriwati *underweight* lebih rendah dan berbeda signifikan jika dibandingkan dengan santriwati status gizi normal sedangkan kadar zink tidak ditemukan adanya perbedaan pada kedua kelompok. Penelitian selanjutnya sebaiknya dilakukan pemeriksaan albumin pada subjek penelitian.

UCAPAN TERIMA KASIH

Pernyataan konflik kepentingan
Penulis menyatakan tidak ada konflik kepentingan dalam penelitian ini.

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The effect of Korean wave on body image and eating disorders among female adolescent in Yogyakarta, Indonesia*

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ABSTRACT

Background: Currently, Indonesia is one of the countries affected by the Korean "fever", which is due to the globalization of the Korean wave through the media. Through the content of K-pop which displayed model characteristics that identical to a slender body, tall, and attractive can lead to the adolescent body image perception. The problem most often experienced by adolescents is physical appearance. The negative body image in adolescence could encourage the emergence of eating behavior disorders known as eating disorders. Objective: To analyze the relation between Korean wave exposure through media information with body image and eating disorders risk on female high school students in Yogyakarta. Methods: This research used the cross-sectional method with a quantitative approach. The research population was a female first-grade high school student in Yogyakarta. The subjects of 109 female students who are qualified with the inclusion criteria: enrolled student in the selected schools, physical healthy, and willing to take part in the research; are requested to fill out the Korean wave exposure questionnaire to measure the type and frequency of exposure, the Contour Drawing Rating Scale questionnaire to measure the body image, and the Eating Attitude Test 26 to determine the eating disorders risk. Data analyzed with the Chi-Square test and logistic regression test. Results: Univariate analysis shown that 11% of the subject was exposed to Korean wave with various type of exposure, 88.1% of the subject was dissatisfied with their body and developed negative body image, and 47.7% of the subject was at risk of eating disorders; 53% of them tend to developed diet behavior, 21.04% bulimia, and 25.96% was in oral intake restriction. Multivariate analysis result showed that Korean wave exposure (RP=1.6; 95%CI=0.7-10.04) has significant correlation with negative body image perception. Eating disorders risk significantly affected by Korean wave exposure (RP=2.1; 95%CI=0.97-4.63) and body image (RP=2.93; 95%CI=1.25-5.49). Chi-Square analysis showed body image has significant correlation with eating disorders risk (RP=6.2; 95%CI=1.25-5.94). Conclusions: Exposure to Korean waves affected negative body image in female adolescents. On the other hand, Korean wave exposure and body image also affected eating disorders behavior among female adolescents.

KEYWORDS: *body image; eating behavior; eating disorder; female adolescent; Korean wave; k-pop; k-drama*

INTRODUCTION

The Korean wave is a form of South Korean culture that is packaged in such a way, is a plan by the Korean government to improve the image of Korea in the eyes of other countries, also proves the strength of this country in transmitting culture and art to other countries to reach all parts of the world. The outbreak of the Korean wave or

in Korean is referred as *hallyu* began in 1997. Currently, Indonesia is one of the countries affected by the Korean "fever", which is due to the globalization of the Korean wave through the media of information [1]. Television programs, pop music, various books and magazines are forms of media that have a major effect on the regulation of information with international content, especially in

Indonesia [2]. Based on research [3] regarding race and ethnicity among K-pop fans, it is known that social media is the most popular type of media in the consumption and distribution of K-pop around the world, reaching 91%. This is because online information regulation is considered faster than off-line media.

The Korean wave phenomenon that appears through the information media is known to have influenced all groups, especially teenagers [1]. Even adolescents in Indonesia constitute 40.55% of access to internet (social media) around the world [4], this is an important factor in the spread of Korean waves among teenagers in Indonesia. Audience acceptance and preference for content in information media can influence and impact changes in life, as well as what happens to adolescents [5]. Based on a qualitative study in the District of Solo for junior high school students, high school students, and college students; it is known that the most Korean wave fans are high school students (teenagers) [6].

Adolescence is a dynamic development phase in an individual's life. This is a period of transition from childhood to adulthood marked by the speed of growth and development of physical, mental, emotional, and social, starting at the age of 9-10 years and ending at the age of 18 years [7]. The immense influence brought by the Korean wave can instill the imagination of Korean wave stars' physical appearance, namely beautiful appearance, energetic, and attractive physical form. The problem most often experienced by adolescents is physical appearance. Various studies on the influence of the media always indicate the results of negative body image assessments, related to the ideal body image provided by the media [8-10]. Teenagers do not have sufficient knowledge of the ideal body shape, while the information they receive in Korean wave content sets the ideal standard at the underweight range even more severely.

According to research results [11], the perception of a wrong body image will lead to dissatisfaction with physical appearance, so that adolescents tend to make various efforts to control their weight and body shape. Teenagers will usually go on a diet so that they can meet expectations of an ideal body image according to him. The diet that is done is usually not correct so that it can be the beginning of the development of eating disorders. The American Psychological Association explains that deviant eating behavior can cause health problems, including anemia, palpitations, loss of bone and hair mass, tooth decay, esophagitis, and menstrual cycle disorders until menstruation stops.

Based on this background, it can be concluded that the Korean wave in the form of music, drama, film, and other entertainment products showed the characteristics of hallyu stars (Korean celebrities) that are synonymous with slim, tall, and attractive bodies can lead to negative body image perceptions in adolescents. Negative body image in young women can lead to eating disorders. The results of Wijayanti's research show that Yogyakarta as a student city has the potential for teenagers who behave fanatically towards Korean culture, shown by the formation of a Korean wave fan community [12]. Thus, researchers are interested in examining the effects of exposure to Korean waves on body image and eating disorders in young women in Yogyakarta, Indonesia.

METHODS

Study design and participants

This research is non-experimental type. The research was conducted with a quantitative method to measure Korean waves exposure, body image, and the risk of eating disorders. The design of this study was cross sectional to determine the effect of Korean wave exposure on body image and eating disorders. Data retrieval in the study was carried out once at the same time.

The research was conducted in the city of Yogyakarta, namely at a public high school located in an urban area. The reason for choosing such locations is that senior high schools located in urban areas in Yogyakarta City have easier access to information. Determining the research location using simple random sampling method, found SMA Negeri 2 Yogyakarta and SMA Negeri 6 Yogyakarta as research locations. The research was conducted in March - May 2014. The study population was female adolescent who are currently studying at state senior high school in Yogyakarta City. This criterion was chosen as a population with the consideration that high school students are assumed to be aged 15-18 years,

which is a vulnerable group of adolescents and is the peak of emotional development. Even until recently, the phenomenon of Korean wave remain high and this study could suggest that since 2014 the impact of the exposure was not only as entertainment aspect but also on the quality of health, especially on negative body image and development of eating disorders risk.

Determination of research subjects by simple random sampling adjusted to the inclusion criteria, namely active students at the research location and in good health. While the exclusion criteria for subjects were undergoing symptom healing therapy or eating disorders. The sample number in this study was 109 students, plus 10% of the estimated sample drop out, so that it became 120 students. This research has received permission from the Ethics Committee of Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada with number KE/FK/513/EC.

Measures

Korean wave exposure. The measurement used a questionnaire that consists of two parts, namely the introduction of the Korean wave and the type and frequency of exposure. The questionnaire was tested for validity and reliability before being used as a data collection instrument.

Body image. The assessment of adolescents' perception of their body shape used the The Contour Drawing Rating Scale (CDRS) instrument, which is a scale consisting of nine body contour images whose size and weight have increased from severe underweight (1) to very overweight (9).

Eating disorders. Feeding behavior was measured using the Eating Attitude Test questionnaire (EAT-26) which consists of 26 statements about eating behavior associated with the risk of anorexia or bulimia.

Body mass index (BMI). Nutritional status is determined by calculating the body mass index according to age, which consists of the measurement results of body weight (BW) and height (TB) which are entered in the BMI / U graph from World Health Organization (WHO). The tools used for data collection were microtose with an accuracy of 0.1 cm for measuring height, a digital scale with a capacity of 200 kg with an accuracy level of 0.01

kg for measuring body weight. Measurement of height and weight was carried out to determine anthropometric data which could then be used to interpret the nutritional status of the research subjects.

The research implementation was divided into 3 (three) stages, starting with the preparation stage, namely preparing permission, data collection instruments, and technical preparation for data collection. Then proceed with the implementation stage, namely data collection by measuring nutritional status and filling out a questionnaire, done once at the beginning of the data collection process followed by a follow-up confirmation if the data received is incomplete. The last stage is the completion stage, namely the processing and analysis of research data.

Data analysis

The data collected were checked for completeness first, then the coding is carried out to simplify the data entry process. After the data is entered, cleaning is necessary to find out the missing data as some of the subjects did not complete the questionnaire (11 subjects). At the beginning of data collection, purposely more than the needed number of subject was choosen that sufficient number of sample (109) was able to analyzed in the study. Univariate analysis was carried out to determine the frequency distribution and proportion of the characteristics of the research subjects, anthropometric data, Korean wave (Hallyu) exposure data, body image data, and eating behavior data. Bivariate analysis using the Chi-Square test to determine the relationship between two research variables. Bivariate analysis with a significance level of $p < 0.05$. The p-value is used to see the statistical significance of the correlation, if the p-value < 0.05, the relationship between variables is statistically significant. Multivariate analysis was carried out to determine the relationship between independent variable (Korean wave exposure), intermediate variable (nutritional status), and the dependent variable together. The variables to be tested in the multivariate analysis are those in the bivariate test results that show a significant level of $p < 0.25$. The statistical test used was logistic regression analysis with a significance level of $p < 0.05$ with a 95% confidence interval.

RESULTS

The characteristics of research subjects

Based on the data in **Table 1**, it is known that the mean age of the research subjects was 16.23 years. The area of origin of research subjects is almost entirely from the province of Daerah Istimewa Yogyakarta (DIY). Subjects who come from outside DIY currently lives in the province of DIY.

The description of research variables

Of the 57 research subjects exposed to the Korean wave, 11% were exposed to audiovisual only; 33% were exposed to a mix of audio, visual, and audiovisual types; 7.3% were exposed to audio and audiovisual types; and 0.9% are exposed to visual and audiovisual types. Thus, the exposure to the Korean wave received by the research subjects was varied. The main sources of exposure that are accessed include television, internet, print media, radio, friends or family, as well as events or festivals. Research subjects do not only get exposure from one source. As many as 45% of research subjects admitted to being exposed to more than one type of source.

The average frequency of exposure based on statistical calculations was 16.48 hours/week, with the lowest exposure frequency of 0 hours/week and the highest exposure frequency of 399 hours/week. Not all subjects are exposed to the Korean wave because some research subjects do not know the development of the Korean wave. As many as 22% of subjects did not know the development of the Korean wave, and 55% of subjects did not enjoy the Korean wave. Body image or body perception of research subjects is mostly negative. A total of 96 study subjects (88.1%) were dissatisfied with their current body.

Subjects who are at risk of experiencing food behavior deviations as much as 53% have a tendency to diet behavior, bulimia 21.04%, and control behavior of oral intake 25.96%. The mean score of EAT-26 according to the results of statistical calculations was 10.28 with the lowest score of 0 and the highest score of 27. The nutritional status of research subjects based on **Table 2** was dominated by normal nutritional status. Anthropometric data of research subjects showed the average BMI of research subjects was 21.62 kg/m^2.

Table 1. The characteristic of subject (n=109)

Variable	n (%)
Age (years)	
15	7 (6.4)
16	70 (64.2)
17	32 (29.4)
Origin (city/district)	
Yogyakarta city	45 (41.3)
Bantul	15 (13.8)
Sleman	45 (41.3)
Kulon Progo	1 (0.9)
Outside of Yogyakarta	3 (2.8)
Residency (city/district)	
Yogyakarta city	47 (43.1)
Bantul	15 (13.8)
Sleman	46 (42.2)
Kulon Progo	1 (0.9)
Outside of Yogyakarta	-

Table 2. The frequency distribution of research variable

Variable	n (%)
Korean wave exposure	
Exposed	57 (52.3)
Not exposed	52 (47.7)
Frequency of exposure	
Low (< 7 hours/week)	76 (69.7)
Moderate (7 – 21 hours/week)	13 (11.9)
High (> 21 hours/week)	20 (18.3)
Body image	
Negative	96 (88.1)
Positive	13 (11.9)
Eating disorders risk	
At risk	52 (47.7)
Not at risk	57 (52.3)
Nutritional status	
Underweight	7 (6.4)
Normal	84 (77.1)
Overweight/obesity	18 (16.5)

The result of multivariate analysis

Multivariate analysis was used to see the relationship between research variables that gave a p-value <0.25 in the bivariate analysis. In the first multivariate analysis, the variables that can be tested are exposure to Korean waves, frequency of exposure to Korean waves, nutritional status, and social support from peer satisfaction aspects (SSQS) with body image. Meanwhile, in the multivariate analysis, the two variables

that can be tested are exposure to Korean waves and body image with the risk of eating disorders.

The test used was logistic regression analysis, with a significance level of p <0.05 and a confidence interval of 95% CI. In the multivariate test, several models were produced to see the influencing variables. The method used in logistic regression analysis is the backward method so that the analysis of each model is carried out automatically by a computer program. Multivariate analysis will automatically stop at the most ideal modeling, namely by looking at the contribution and influence of research variables on the dependent variable.

Using multivariate analysis, all the possible variables was analyzed together to found which model suggested to has relationship with the subject. In contrast to bivariate analysis which only looks at the relationship of one variable, multivariate analysis can describe the relationship of more than two variables at the same time and provide information on the significance of the relationship between each variable. Based on the analysis results in this analysis, model 3 is the best modeling (**Table 3**). In model 3, it is known that the Korean wave exposure variable statistically have a significant relationship with body image (p<0.05). This model shows that the variable Korean wave exposure contributed 18.4% to the emergence of a negative body image in young girls. Meanwhile, there are 81.6% of other factors that were not examined in this study could influence the emergence of a negative body image in young women.

Based on **Table 4**, it is known that in the multivariate test of research variables with the risk of eating disorders, only one model is produced. In this modeling, it is known that the variable exposure to Korean wave and body image has a significant relationship with the risk of eating disorders so that further modeling analysis is not required. This model shows that the variable exposure to Korean wave and body image contributes 44.1% to the emergence of eating disorders risk in adolescent girls. Meanwhile, there are 55.9% other factors that were not examined in this study that could affect the risk of eating disorders in young women.

DISCUSSION

The relationship between Korean wave exposure and body image

In this study, exposure to the Korean wave is viewed from two aspects, namely: exposure to the Korean wave and frequency of exposure to the Korean wave. According to the analysis, 36.7% of young women received exposure to the Korean wave for the first time through mass media including television, 35.8% through friends or family, 22.9% through events or festivals, and 4.6% through other sources. This is possible because television, as a medium that provides audiovisual information, is the main source

Table 3. The result of logistic regression analysis between the relationship of Korean Wave exposure, and nutritional status with body image

	Variabel	Coefisien	p	OR (95% CI)
Model 1	Korean wave exposure	1.932	0.046	1.20 (0.79-18.13)
	Frequency of exposure	-0.565	0.534	0.57 (0.95-3.38)
	Nutritional status	1.022	0.440	2.78 (0.21-37.31)
	Consanta	1.533	0.325	4.63
Model 2	Korean wave exposure	1.968	0.019	2.2 (0.47-10.04)
	Nutritional status	1.022	0.440	0.31 (0.02-3.79)
	Constanta	1.501	0.324	4.48

Table 4. The result of logistic regression analysis between the relationship of Korean Wave exposure, nutritional status, and peer group support with body image

	Variabel	Coefisien	p	OR (95% CI)
Model 1	Korean wave exposure	0.717	0.025	2.12 (0.97-4.63)
	Body image	0.752	0.012	2.93 (1.25-5.49)
	Constanta	-0.012	0.066	1.00

of media exposure accessed by the public. Information broadcast on television also varies, for example news, entertainment, and sports coverage. Exposure to the Korean wave, either in the form of entertainment or other information, is also broadcast on television, so that young women who watch television can get exposure to the Korean wave. This result is supported by previous research regarding the fanatical behavior of teenagers in Yogyakarta towards South Korean culture or known as the Korean wave, that the first exposure to the Korean wave in Indonesia was through television media [12].

Meanwhile, in the variable frequency of exposure to the Korean wave, it was found that in general the research subjects were exposed to Korean waves in low frequencies (69.7%). In the analysis, it was found that the lowest exposure frequency in the study subjects was 0 hours/week or not exposed, and the highest frequency was 399 hours/week. Research subjects who claimed not to be exposed were possible because of them has no interest and tendency to try to access exposure to the Korean wave. Meanwhile, the high frequency of exposure or being extreme can be caused by the behavior of young women who tend to be fanatical in accessing Korean wave exposure. This fanatical behavior will appear especially in young women who enjoy Korean wave products so that they consider various forms of exposure to the Korean wave as part of their lifestyle.

The results of the multivariate analysis show that exposure to the Korean wave is one of the variables associated with the emergence of negative body image in young girls. Girls who are exposed to the Korean wave are 2.2 times more likely to have a negative body image than girls who are not exposed to the Korean wave. This is possible because the exposure to the Korean wave presents a model that is small, thin, visually attractive, and attractive. According to Eunbi [13], Female K-pop idol only 8.8% has normal body mass index (BMI) considered as healthy weight and nutritional status, meanwhile 82% were underweight (BMI 16-18.5), 8% severely underweight (BMI 15-16), and 1.2% were very severely underweight (BMI <15). Models in the information media tend to appear in the form of small and thin bodies which will form the perception that the ideal body is small and thin.

Relationship between nutritional status and body image

In the bivariate analysis between nutritional status and body image, it is known that there is no significant relationship between the two. This is possible because a negative body image appears not only in adolescent girls who are malnourished. Based on the research findings, it is known that negative body image is dominated by subjects who have normal nutritional status (66.1%). Veggi [14] explained that women with underweight and overweight nutritional status have a more accurate body perception than women with normal nutritional status. In general, women who overestimate their body weight have the wrong perception of their body.

According to Botta [15], the problem of body image in young women is the perception of the level of body thinness that is not appropriate, so they tend to expect a body that is thinner than it should be. In general, young women worry if their bodies are too fat or too tall [16]. Salim [17] explains that the peak growth and increase in body fat that occurs at puberty are predisposing factors for concern about body weight and cause body dissatisfaction in adolescents.

Relationship of Korean wave exposure with eating disorders

The resuts of the multivariate analysis, it is known that exposure to Korean waves is one of the variables associated with the emergence of eating disorders risk in adolescent girls. Girls who are exposed to the Korean wave are 2.1 times more likely to have eating disorders than girls who are not exposed to the Korean wave. Deviant eating behavior may develops as a result of efforts to achieve the body shape desired by young women. This body image emerged because of the depiction of the ideal body shape through the media of information, in this case the model depicted in the Korean wave product content. According to Becker [9], the mechanism for the emergence of eating disorders risk due to media exposure is through a character model that is presented on television, which raises the imagination and perception of the ideal body shape in young women. This then conditions the young women to socially compare

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their body size and shape with each other, especially in conditions of active social change. The other factors that influence the development of eating disorders, organic disorders (e.a. hypertiroidisme, diabetes mellitus, and other chronic infections) and psychiatric disorders (e.a. depression, obsessive-compulsive disorder, and schizophrenia) [18].

Relationship of body image with risk eating disorders

The multivariate analysis of body image and the risk of eating disorders show a significant relationship. This can be possible because adolescents are synonymous with periods of instability in mental conditions so the perception of an irrational ideal body shape around them will make adolescents have a negative body image. Based on the mental development of adolescence, they are in the phase of searching for self-identity and starting to recognize the formation of body perceptions. The existence of a measure of physical appearance as a value or measure of superiority makes adolescents follow the surrounding standards in shaping body perceptions [11,19]. Besides, physical growth and development can make adolescents feel that their body mass growth is not following under the desired ideal body shape. Adolescence is a period of development when the individual has an interest in physical appearance and the greatest concern and center of their activity is body weight [20].

Dissatisfaction with body shape and size among young women makes them make various efforts to achieve the ideal body shape and size according to them. Efforts to achieve the ideal weight and body shape tend to be in unhealthy ways and will interfere with normal eating behavior, so that young women are at risk of developing eating disorders. However, the emergence of eating disorders risk in young women is not only influenced by body image. Jung [21] explained that the population from South Korea is more at risk of developing eating disorders related to body image compared to the population from the United States. This is due to social changes that tend to be more active in South Korea, as well as differences in cognitive aspects between the two countries. Thus the emergence of eating disorders risk can also be caused by socio-cultural conditions, race, and other individual factors.

CONCLUSIONS

Exposure to Korean waves is related to body image, namely the prevalence of negative body image in adolescent girls exposed to the Korean wave is greater than girls who are not exposed to Korean waves. Exposure to Korean waves and body images are related to the risk of eating disorders, namely the prevalence of risk of eating disorders in adolescent girls exposed to the Korean wave is greater than girls who are not exposed to the Korean wave. For young women who have a negative or inappropriate body image, it is necessary to have a correct understanding that the wrong body image can play an active role in the risk of eating disorders, which will also have negative consequences for physical and mental health. Further data mining and research is needed regarding the influence of the Korean wave on a more global situation today. Especially studies in different age groups and genders.

Declaration of conflict interests

All authors declare no conflict of interest related to this study. They have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Factors associated with food choice motives of adolescents in Yogyakarta Special District*

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ABSTRACT

Background: Adolescents begin to have eating autonomy which causes changes in behavior and habits related to food selection. Various factors are considered to be able to influence food choice motives. Objective: The study aimed to determine factors related to adolescents' food choice motives. Methods: A cross-sectional study involving 121 students who studied at two state Junior High School in Yogyakarta Special District (YSD) from April to May 2020. The independent variables are gender, perception of body image, nutritional knowledge, peer influence, school location, amount of pocket money, family income, parental education, and media influence. The dependent variables are nine food choice motives. Data collection was used online questionnaires via an online form. The data were analyzed by using multiple linear regression. Results: Most respondents had health motive as their primary motive in food choice, followed by natural content, price, and ethical concern. This research also found that there was a relationship between nutritional knowledge with a natural content motive; media influence, nutritional knowledge, and amount of pocket money with ethical concern motive; parental education with price motive; perception of body image, media influence, amount of pocket money, and nutritional knowledge with weight control motive (p<0,05). Conclusions: Perception of body image, nutritional knowledge, media influence, amount of pocket money, and parental education were related to food choice motives of adolescents. Future intervention strategies related to healthy eating behavior in adolescents can be designed based on these factors.

KEYWORDS: *adolescents; dietary behavior; food choice; food selection; nutrition knowledge*

INTRODUCTION

In the adolescent period, adequate nutritional intake is needed for the growth process. One of the things that affect nutritional intake is the pattern of food choice. The wrong food choice pattern will have a bad impact on the body [1]. Adolescent girls tend to pay attention to health and weight control in food choice [2]. Adolescents with low nutritional knowledge pay less attention to nutritional aspects in food choice [3]. Adolescents's perceptions of body image can also influence their diet and food choices [4]. Peers have a strong influence on adolescents's food choices associated with the desire to be accepted and become popular [5]. Adolescents

are also easily influenced by food advertisements displayed in the media [6]. Location differences are also related to differences in the types of food that are frequently accessed. Someone who lives or has a lot of activities in rural areas will find it difficult to access fast food than someone in urban areas [7]. The amount of pocket money is also associated with freedom in choosing food [8]. Family socio-economic aspects such as family income and parental education are also related to food choice based on price motives [9].

Until now, there has been no program related to choose healthy foods for adolescents. However, there was a program for elementary school students (or equivalent) called the School Child Nutrition Program (Program Gizi

Anak Sekolah/ProGAS). This program aims to improve hygiene and healthy living behavior, nutritional intake, and student learning abilities [10]. If a program like this is also applied to adolescents, this program is deemed ineffective because the nutritional knowledge obtained by students cannot be applied if it is not balanced with the availability of healthy food in the school environment.

Research on high school students in Padang showed that factors related to food choice were allergies, gender, and food aroma [11]. Other research related to food choice among high school students in Yogyakarta and concluded that factors related to food choice were the family's role and the level of knowledge [12]. Recent research on junior high school students in East Jakarta concluded that factors related to food choice motives were gender and family income [13].

The conceptual framework in this was rooted in the socio-ecological model. This model explains that various levels and layers of life can influence individual behavior. In this model, the factor level starts from within the individual itself, then intrapersonal and interpersonal factors, then it is also influenced by factors outside the individual, such as environmental, physical, social/cultural, economic, and informational factors. Factors from a larger level include influenced by smaller levels. Thus that the resulting interaction between factors that can relate to the food choice motives [14].

Recent research had examined the relationship between food choice motives with gender, parent's education, parent's occupation, household socio-economic status, BMI, and knowledge about nutrition for junior high school students in Jakarta [13]. However, there has been no similar research in Yogyakarta Special District (YSD) with other variables such as perception of body image, peer influence, school location, amount of pocket money, family income, and media influence. Therefore, we performed this study with the aim to investigate the food preferences of high school students and the factors associated with the choices.

METHODS

Study design and participants

This was an observational study with a cross-sectional research design conducted from April to May 2020 in YSD. The study population was adolescents and schools in YSD. The research subjects were adolescents aged 12-15 years old in Yogyakarta Junior High School with the inclusion criteria that received approval from their parents and were willing to become research subjects by filling in the informed consent; have been enrolled in the participating schools for at least one year; and adolescent students who are willing to follow the course of the research. The exclusion criteria were chronic disease patients; pregnant; and persons with disabilities.

The sample size is calculated using the sample size formula for a cross-sectional study of the proportion of two populations with a confidence level of 80% and a significance value of 10%. Obtained a minimum sample size of 49 people for each population. Then add 10% to 54 people per population. So the minimum total sample required in this study is 108 people.

The selection of research locations using purposive sampling based on rural and urban categories according to the Regulation of the Head of BPS (The Central Bureau of Statistics) No. 37 of 2010. It was obtained Junior High School 2 Yogyakarta for the urban population and Junior High School 1 Imogiri for the rural population. The school used purposive sampling to select research subjects by selecting three study groups from class VIII to become research subjects. This research has obtained ethical permission from the Ethics Commission of the Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada with the number: KE/FK/0320/EC/2020.

Measures

The independent variables in this study were gender, nutritional knowledge, perception of body image, peer influence, school location (rural or urban), amount of pocket money, family income (differentiated into < or ≥YSD provincial minimum wage), parental education (divided into graduated from Elementary School to Graduate Degree), and the media influence. This study's dependent variables were nine food choice motives that are health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity, and ethical concern. Data collection was used online questionnaires via an online form.

Before the research was carried out, we conducted a questionnaires validity and reliability test first. The questionnaires was tested on respondents who have the same characteristics as the research respondents. The selection of the location for the questionnaire trial was based on locations that had lower health literacy. This was done to ensure that the questionnaires used were easily understood and answered by respondents from various locations. Therefore, the researchers conducted a questionnaire trial in junior high schools located in rural areas.

The trial of this questionnaires was carried out in April 2020. The number of samples used was 30 students of class VIII. Samples were taken from students who did not become research respondents. The validity test used the Biserial Point formula and Pearson Product Moment correlation. The reliability test used the KR (Kuder Richardson) 20 test and Cronbach's Alpha. The results show that the questionnaires used is valid and reliable.

Nutritional knowledge. The measurement used a nutritional knowledge questionnaire in the form of 14 true or false questions. These results were divided into three categories: good (answered> 75% of statements correctly), moderate (answered 61 - 75% of statements correctly), and poor (answered ≤ 60% of statements correctly) [15]. The questionnaire's material was taken from the subject of natural science class VI and class VII and VIII Biology subject. This questionnaire has been tested for validity (0.358 - 0.573) and reliability (0.719) in YSD.

Perception of body image. Measurements used a modified Body Shape Questionnaire by Evans and Dolan (1993) which consists of 8 questions and translated into Indonesian. This questionnaire uses a 6-point Likert scale with the response "never" has a value of 1 to "always" has a value of 6. The overall score is the total value of the 8 items. In the body image perception, a person was ignored body shape if the score was <19. Someone was said to pay attention/conscious to body shape if the score was >19 [16]. This questionnaire has been tested for validity (0.647 - 0.853) and reliability (0.897) in YSD.

Peer influence. The measurement used a peer influence questionnaire with a dichotomous type of answer (yes or no) consisting of 8 questions. Peer influence was categorized into strong and weak with

the average as a cut of point. This questionnaire is a modification of Saifah's (2011) thesis to approach the research conducted [17]. This questionnaire has been tested for validity (0.372 - 0.721) and reliability (0.708) in YSD.

Media influence. The measurement used a dichotomy (yes or no) media influence questionnaire consisting of 17 statements. The media's influence was categorized as strong and weak with the average as a cut of point. This questionnaire is a modification of Saifah's (2011) thesis to approach the research conducted [17]. This questionnaire has been tested for validity (0.376 - 0.720) and reliability (0.850) in YSD.

Food choice motive. The measurement used the Food Choice Questionnaire (FCQ), which has been translated into Indonesian. The assessment uses a 4-point Likert scale with the response "not important at all" with a value of 1, "rather important" with a value of 2, "quite important" with a value of 3, and "very important" with a value of 4. The Likert scale results could be categorized as the average motive of selecting food [18]. This questionnaire has been tested for validity (0.446 - 0.926) and reliability (0.967) in YSD.

Data analysis

The data analysis used was univariate and bivariate analysis. Univariate analysis is performed to describe the characteristics of the subject, and the variables studied. The bivariate analysis carried out was multiple linear regression on each dependent variable. The stepwise method is chosen to obtain the most suitable model for the study results. Before the bivariate analysis is applied, the researcher carried out the classical assumption test first in the form of linearity test, residual normality test, multicollinearity test, and heteroscedasticity test. All assumptions are met so that regression testing can be done. Data analysis was performed using statistics software.

RESULTS

Respondent characteristics

The results of the analysis based on the characteristics of the respondents (**Table 1**) showed that

of the 121 respondents, most of the respondents were female (58.68%), go to school in urban areas (50.41%), had family income less than YSD Provincial Minimum Wage (51.24%), and parents with a high school education level/equivalent (37.19%). The pocket money/day was categorized into high and low with the average as the cut of point. As a result, most respondents had a low amount of pocket money/day (70.25%).

The nutritional knowledge score showed the number of respondents who answered correctly on the

Table 1. Characteristics of the respondents (n=121)

Characteristics	n (%)
Gender	
Male	50 (41.32)
Female	71 (58.68)
School location	
Rural	60 (49.59)
Urban	61 (50.41)
Family income (Rp)	
<YSD provincial minimum wage (<Rp1,700,000)	62 (51.24)
≥YSD provincial minimum wage (≥Rp1,700,000)	59 (48.76)
Parental education	
Elementary school	11 (9.09)
Junior high school	35 (28.93)
Senior high school	45 (37.19)
Diploma	16 (13.22)
Bachelor degree	12 (9.92)
Master degree	2 (1.65)
Characteristics	**Mean (SD)**
Amount of pocket money/day (Rp)	10,921.49 (5,569.26)
Nutritional knowledge score	7.74 (1.94)
Perception of body image score	19.78 (8.71)
Peer influence score	4.07 (2.17)
Media influence score	9.35 (3.07)

Table 2. Distribution of food choice motives

Food choice motives	n	%
Natural content	29	23.97
Health	55	45.45
Ethical concern	7	5.79
Price	17	14.05
Mood	2	1.65
Sensory appeal	4	3.31
Convenience	5	4.13
Weight control	2	1.65
Familiarity	0	0
Total	121	100

nutritional knowledge questionnaire. As a result, most of the respondents had insufficient knowledge of nutrition (69.42%). Only 9.09% of the respondents had good nutrition knowledge. In the body image perception, someone was said to pay attention to body shape if the score was >19 [16]. The result, most respondents ignored body shape (52.89%), had weak peer influence (56.20%), and had weak media influence (52.07%).

Food choice motive

The results of the analysis based on the distribution of food choice motives (**Table 2**) showed that the main food choice motives of most respondents was health (45.45%), followed by natural content motives (23.97%), price (14.05%), and ethical concern (5.79%).

Factors related to food choice motives

Table 3 showed the regression model of the four food choice motives; natural content, ethical concern, price, and weight control. In the regression model of natural content motive, there was a nutritional knowledge variable maintained in the model. The p value = 0.013 indicates that the nutritional knowledge as an independent variable had a significant relationship with the dependent variable, that was the natural content motive. Then, the coefficient of determination (Adjusted R^2) showed a value of 0.042. This means that nutritional knowledge had a significant correlation of 4.2% with natural content motive, while the rest was related to other variables outside the independent variables analyzed in the study. Then, the relationship between nutritional knowledge and natural content motive was positive (t = 2.513). This means that the better the nutritional knowledge, the more adolescents will give more importance to natural content motive in choosing food. Based on this study, the equation of the multiple linear regression model for the dependent variable natural content motive is:

Y_Natural content motive = 2.256 + 0.100 × *x2*

There were variables of media influence, nutritional knowledge, and the amount of pocket money retained in the ethical concern motive regression model. The

Table 3. Multiple linear regression model of factors related to food choice motives

Variable	*b*	SE	β	*t*	*p*
Natural content motive					
Constant	2.256	0.316		7.132	0.000
Nutritional knowledge	0.100	0.040	0.224	2.513	0.013
Adjusted R² = 0.042; F = 6.314; p = 0.013*					
Ethical concern motive					
Constant	1.928	0.407		4.738	0.000
Media influence	0.065	0.023	0.244	2.771	0.007
Nutritional knowledge	0.087	0.037	0.208	2.381	0.019
Amount of pocket money	-0.000029	0.000	-0.201	-2.304	0.023
Adjusted R² = 0.101; F = 5.473; p = 0.001*					
Price motive					
Constant	1.935	0.350		5.524	0.000
Parental education	0.067	0.029	0.207	2.307	0.023
Adjusted R² =0.035; F = 5.321; p = 0.023*					
Weight control motive					
Constant	1.041	0.459		2.268	0.025
Perception of body image	0.026	0.008	0.265	3.115	0.002
Media influence	0.065	0.024	0.232	2.694	0.008
Amount of pocket money	-0.000030	0.000	-0.197	-2.309	0.023
Nutritional knowledge	0.076	0.038	0.173	2.018	0.046
Adjusted R² = 0.137; F = 5.781; p = 0.000*					

*significant (p<0.05) by multiple linear regression test

p value = 0.001 indicates that the three independent variables had a significant relationship with the dependent variable, ethical concern motive. Then, the coefficient of determination (adjusted R^2) showed a value of 0.101. This means that the effect of media, nutritional knowledge, and the amount of pocket money simultaneously had a significant correlation of 10.1% with ethical concern motive, while the rest was related to other variables outside the independent variables analyzed in the study. Then, the relationship between the influence of media and nutritional knowledge with ethical concern motive was positive (t = 2.771 and 2.381) while the amount of pocket money was negative (t = -2.304). This means that the stronger the media's influence and better nutrition knowledge, the more adolescents will be concerned with ethical concern motive. In contrast, the higher the amount of pocket money, the adolescents will be less concerned with ethical concern motive in food choice. Based on this study, the equation of the multiple linear regression model for the dependent variable ethical concern motive is:

$$Y\_Ethical\ concern\ motive = 1.928 + 0.065 \times x9 + 0.087 \times x2 - 0.000029 \times x6$$

In the price motive regression model, there was parental education variable that are maintained in the model. The p value (0.023) indicates that parental education as the independent variable had a significant relationship with the the price motive. Then, the coefficient of determination (adjusted R^2) showed a value of 0.035. That was, parental education had a significant correlation of 3.5% with price motive, while the rest was related to other variables outside the independent variables analyzed in the study. Then, the relationship between parental education and price motive was positive (t = 2.307). This means that the higher the level of education of parents, the more adolescents will be concerned with the price motive in choosing food. Based on this study, the equation of the multiple linear regression model for the dependent variable price motive is:

$$\boxed{\text{Y\_Price motive} = 1.935 + 0.067 \times x8}$$

There was variables of body image's perception, media influence, amount of pocket money, and nutritional knowledge retained in the regression model of weight control motive. The p value = 0.000 indicates that the four independent variables had a significant relationship with the dependent variable, that was weight control motive. Then, the coefficient of determination (adjusted R^2) showed a value of 0.137. This means that the perception of body image, the influence of the media, the amount of pocket money, and nutritional knowledge simultaneously had a significant relationship with 13.7% of weight control motive, while the rest was related to other variables outside the independent variables analyzed in the study. Then, the relationship between body image perception, media influence, and nutritional knowledge with weight control motives were positive (t = 3.115; 2.694; and 2.018). This means that the more adolescents pay attention to body shape, the stronger the media's influence, and the better the knowledge of nutrition, the more the adolescents will give more importance to weight control motive in food choice. However, the higher the owned pocket money, the adolescents will be less concerned with the motive for controlling weight in food choice. Based on this study, the equation of the multiple linear regression model for the dependent variable weight control motive is:

$$\boxed{\begin{array}{c}\text{Y\_Weight control motive} = 1.041 + 0.026 \times x3 + \\ 0.065 \times x9 - 0.000030 \times x6 + 0.076 \times x2\end{array}}$$

Description of indepent variables: *x1*: gender; *x2*: nutritional knowledge; *x3*: perception of body image; *x4*: peer influence; *x5*: school location; *x6*: amount of pocket money; *x7*: family income; *x8*: parental education ; *x9*: media influence

DISCUSSION

Respondent characteristics

Most of the respondents had a low amount of pocket money and parents had an income < YSD provincial minimum wage. This is because family income is reflected in the pocket money that children receive. Generally, the higher the family income, the more pocket money the children get. Vice versa, the less family income, the less pocket money is obtained [19]. Most of the respondents's knowledge of nutrition was still low. This result is similar to a study conducted by Nurmasyita et al. (2015) which showed that adolescents nutritional knowledge tends to be low with the average scores of the two groups studied being 52.69 and 53.84 [20]. Insufficient nutritional knowledge can be caused by lack of information, indifference and disinterest in nutrition, time, culture, family, finance, and low nutrition education [21]. In the perception of body image variable, most respondents pay attention to body shape. This result is in line with a study conducted by Voelker et al. (2015) that 70% of adolescent girls pay attention to body shape, so they want to lose weight because they feel less slim [22].

Food choice motives

Based on Steptoe's Food Choice Questionnaire (FCQ), food choice motives are divided into nine motives or subscales; health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity, and ethical concern motives. Health motive are related to nutritional content such as fiber, vitamins, minerals, and protein. Mood motive are related to the effect of the food to restoring a good mood. The motive for convenience is related to the ease of obtaining the product and the preparation process. The motive for sensory appeal is related to taste, aroma, texture, and food appearance. The natural content motive is related to addictive substances, natural/non-manufactured ingredients, and hazardous materials. The price motive is related to affordability and purchase ability. Weight control motive is linked to low calorie and fat content. Familiar motive related to foods that are often eaten. Meanwhile, ethical concern motive is related to the effects on humans and the environment [18].

The results showed that most respondents had health motive as the most important motive when choosing food, followed by natural content, price, and ethical concern motive. Most research states that health and price motives are the most important motives in

food choice. For example in the research conducted by Maulida et al. (2016) at junior high schools in East Jakarta, which showed that the most important motives for adolescents in choosing food were health, comfort (mood and sensory appeal) and convenience and price (average = 2.92; 2.30; and 3.78) [13]. Setyaningsih's research (2016) also showed that health motive was the most important motive in choosing food for families and children (average = 3.56) [23]. Research by Roos et al. (2012) also showed that the price motive was the most important motive in choosing school children's meals, followed by sensory appeal and health [24].

However, natural content and ethical concern motives can also be important motives in food choice for certain consumer groups. For example, a study conducted by Pearcey & Zhan's (2018) showed that adolescent respondents with Asian culture had dominant natural content and ethical concern motives in food choice [25]. Ethical concern motive have evolved from focusing solely on environmental issues to encompassing issues of animal welfare, national origin, fair trade, health, etc [26]. Health-related ethical concern motive include consumer consideration of nutritional information labels and composition in a food product [27]. This development makes ethical concern motive related to natural content motive. These two motives are starting to be considered in food choice because of the many food safety incidents, for example, in over-the-counter herbal diet pills that claim to lose weight naturally. These products are mostly sold over the counter without meeting food safety regulations [28]. Price motive also have a major influence on food choice decisions by consumers in general. Most consumers, including adolescents, will look for products at affordable prices to save money, time, and effort [29].

Factors related to food choice motives

Based on the results of multiple linear regression tests on the nine dependent variables, there were four models with the dependent variables (natural content motive, ethical concern, price, and weight control) which had a significant relationship with the independent variables simultaneously. In the dependent variable, health, mood, convenience, sensory appeal, and familiarity motive, no proper regression model was found.

This showed that there were no independent variables in the study that significantly predict the dependent variable. This can occur because the food choice motives are related to the biological and physiological responses of individuals to food, whereas most of the independent variables in this study are related to socioeconomic conditions [13].

Natural content motive. Based on the research results, the factor with a significant relationship with natural content motive was nutritional knowledge. The results of this study are in line with the research of Sun et al. (2008). Food choice motives influence attitudes regarding food choice. Meanwhile, food choice motives are influenced by nutritional knowledge and health care. In this study, nutritional knowledge and concern for the emergence of food-related diseases were the strongest food choice causes based on health motives, natural content, and ethical concern [30].

Natural content motive is related to food safety. There are food products that are harmful to health on the market. Incorrect information regarding these products can mislead consumers into choosing these products. However, consumers with exposure to the same product information do not necessarily have similar product choices. The role of nutritional knowledge is thought to help consumers evaluate these products's information and quality [28]. Good nutritional knowledge is related to choosing the right food (safe and nutritious) while a lack of nutritional knowledge is related to choosing the wrong food [12].

Ethical motive. Based on the research results, factors that had a significant relationship with ethical motives were nutritional knowledge, media influence, and the amount of pocket money. This result is in line with the research conducted by Sun et al. (2008) which showed that nutritional knowledge and concern for the emergence of food-related diseases were the strongest causes in choosing food based on health motive, natural content, and ethical concern (p<0.001) [30]. This result is also in line with Aulia and Yuliati (2018) research, which showed that exposure to information from the media had a significant effect on food choice [31]. Some of the information that adolescents get through the media is information about food, nutrition and health. Therefore,

adolescents with strong media exposure and influence are thought to have strong nutritional knowledge as well. Individuals with nutritional knowledge will pay more attention to ethical concern motive in food choice. In this case, the ethical motive in question is related to consumer consideration of information on nutritional value and natural content written on the product, whether it is in line with existing moral norms [27].

Adolescents who have a high pocket money will tend not to pay attention to ethical concern motive in food choice. Adolescents with high pocket money have high purchasing power as well. They can be freer in choosing the type and amount of food to be consumed [12]. Foods often purchased by adolescents with high pocket money are fast food and sweet foods [8,32]. In fact, both types of food are high-calorie foods that can have a negative effect on health. This indicates that adolescents with high pocket money do not pay attention to health-related ethical motives in food choice.

Price motive. Based on the research results, the factor with a significant relationship with price motive was parental education. The relationship was unidirectional or positive. This result is different from the research conducted by Fernandez-Alvira et al. (2013). The study showed that parental education was negatively related to price motives. In the study, low parental education levels were associated with children's high-sugar, high-fat intake of foods such as french fries, desserts, and sweetened drinks. Meanwhile, a high level of parental education is associated with children's food intake that is low in sugar and low in fat, such as vegetables, fruit, and whole grains [32]. Low sugar and low-fat diets are associated with high costs. Whereas diets high in sugar and high in fat are associated with lower costs [25].

The difference in this study results is that the parents of respondents with a higher education level still emphasize the price motive related to the feasibility of the product to be purchased. One of the price motive points is "good value for money" or having a price that is comparable to the quality of the food. Parents who teach economic and nutrition education to their children will instill their children's attitude to choose food based on price but still pay attention to the quality of the food. Individuals with high knowledge will tend to choose

foods that are cheap but have high nutritional value and are easily found in the surrounding environment [33].

Weight control motive. Based on the research results, the factors that had a significant relationship with the motive for controlling weight were perception of body image, media influence, the amount of pocket money, and nutritional knowledge. This result is in line with the research conducted by Kusuma & Krianto (2018) which showed that body image had a significant influence on eating behavior ($\beta = 0.19$; $p < 0.01$) [34]. During puberty, feelings of attraction to the opposite sex begin to arise so that adolescents will try to look as attractive as possible. Adolescents will also try to adapt to their peer environment standards to get acceptance, one of which is related to body shape standards. This causes many adolescents to have a negative body image perception [35]. Body image perception is one of the factors that cause concern regarding weight among adolescents so that adolescents begin to pay attention to the motives of controlling weight in food choice [36].

Media influence also had a positive relationship with weight control motive. One of the media influences received by adolescents is related to the stigma of an ideal body in society. The media are one channel that forms the idea that physical attractiveness is important. Overweight individuals are underrepresented on television shows. They are often seen as less attractive and popular than the thinner characters. The effect that emerges is that adolescent girls' audience has a stigma that body shape satisfaction is obtained if they have an ideal body like the figures that appear in advertisements [37]. Boys also experience the same thing. Adolescents who view music video clips featuring muscular figures have lower body satisfaction [38]. This can lead to changes in eating behavior to get the desired body shape. One of the things that are done is choosing foods based on weight control motive.

Nutritional knowledge also had a positive relationship with weight control motives. Adolescents with sufficient nutritional knowledge will practice proper weight control. Weight control strategies for adolescents with good nutritional knowledge include healthy lifestyles such as increasing consumption of vegetables and fruit, reducing sweetened drinks, and

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increasing physical activity. Meanwhile, adolescents with insufficient nutritional knowledge tend to practice incorrect weight control. For example, skipping meals and taking diet pills [39].

The relationship between the amount of pocket money and the motive for controlling weight was negative. This result is in line with Punitha et al. (2014) research, which showed that the amount of pocket money affects BMI status. Most adolescents with high pocket moneys have BMI status overweight and obesity [8]. Foods that are often consumed by adolescents with high pocket moneys are fast food and sugary foods that can cause weight gain. This shows that adolescents with high pocket moneys ignore weight control in food choice.

The results of this study can become a reference for stakeholders (schools, education offices, health offices, etc.) to make more segmented and targeted policies related to food choice in the school environment so that interventions resulting from these policies have a higher success rate. This study has a limitation, using the cross-sectional method, which can only observe the respondents's characteristics at one time so that the researcher cannot see the respondents's consistency in different time periods. Besides, this study uses multiple linear regression statistical tests so that it cannot describe the relationship between variables other than a linear relationship and can only find association and not causation.

CONCLUSIONS

Based on the research results, perception of body image, nutritional knowledge, media influence, amount of pocket money, and parental education were factors related to food choice motives of adolescents in Yogyakarta Special District. In the future, various stakeholders such as health practitioners, media, healthy food industry, and policy makers can design intervention strategies related to healthy eating behavior in adolescents based on these factors. Further research is also needed regarding other factors that may play a role in adolescents's food choices, especially biological, physiological, or psychological factors.

Declaration of conflict interests
The author declare that there is no conflict of interest in this study.

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Macronutrient, nutritional status, and anemia incidence in adolescents at Islamic boarding school*

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ABSTRACT

Background: Anemia occurs due to the body's loss of red blood cells and decreased iron absorption. Globally, it is known that the prevalence of anemia is 1.62 billion, with the majority of anemia sufferers being a group of women who are not pregnant, as many as 468.4 million people. In addition, the highest prevalence of anemia in the group of school-age girls is 47.4%, while in men, only 12.7%. Objective: This study aims to determine the correlation between macronutrients and nutritional status with the anemia accident in adolescents at Islamic Boarding schools. Methods: This study used a case-control design with matching criteria aged 15-19 years, not menstruating, not fasting. Sampling with quota sampling of late adolescents with a population of 15-19 years 1,359 people, anemic case sample of 46 people and control without anemia 46 people, intake questionnaire using the SQ-FFQ, statistical test with Chi-Square. Results: There was a significant relationship between macronutrient intake [energy p=0.048; OR=3.3 (CI 0.965-11.28), protein p=0.036; OR=3.98 (CI 1.018-15.57)] and nutritional status [p=0.024; OR=5.35 (CI 1.088-26.32)] with anemia incidence. Less energy intake has a risk of 3.3 times anemia, lack of protein intake has a risk of 3.98 times, and malnutrition has a risk of anemia of 5.35 times. Conclusions: There was a significant correlation between energy, protein intake, and nutritional status with anemia incidents. Nutritional status has the strongest association with anemia.

KEYWORDS: *anemia; energy intake; nutritional status; protein intake*

INTRODUCTION

Anemia is a health problem causes chronic illnes that has a major impact on health, economy, and social. According to World Health Organization (WHO) 2013, the prevalence of anemia in the world is 40-88% with the highest incidence of anemia in adolescent girls, especially in developing countries at 53.7% [1]. Based on to Indonesian Ministry of Health 2018, the prevalence of anemia in Indonesia is 48.9% in pregnant women and 84.6% in pregnant women aged 15-24 years, adolescents are the age with the most anemia. Anemia is a less of

hemoglobin levels, erythrocyte, and hematocrit counts so that the number of erythrocytes and / or circulating hemoglobin levels cannot fulfill their function of delivered oxygen to body tissues [2]. Anemia is characterized by hemoglobin levels less than 13.5 g/dl in adult men and less than 11.5 g/dl in adult women [3].

According to WHO, 40% maternal mortality in developing countries associated with anemia in pregnancy and most of due to iron deficiency. Previous research, result that childbirth in pregnant women who suffer from anemia iron deficiency is found 12-28%

fetal death, 30% perinatal mortality, and 7-10% neonatal mortality rate [3]. In pregnancy, anemia occurs relatively because the blood of pregnant woman is hemodiluted with an increase volume 30-40% which peaks with age gestation 32-34 weeks. Increases the number of red blood cells 18-30%, haemoglobin about 19%. If the mothers haemoglobin befor pregnancy is around 11%, the occurrence of hemodilution will result physiological pregnant anemia, and maternal haemoglobin at risk decreased to 9,5-10%. After childbirth, the placenta is detached and the mother is at risk of experiencing iron loss of about 900 mg. During breastfeeding, mothers still need optimal physical health in order to prepare breast milk for the growth and development of their babies. In anemia, breastfeeding may not be possible well executed [4].

Anemia occurs due to several factors including bleeding from an accident or menstruation, worms or infections disease, and lack of nutrient intake, especially iron and other substances that can increase absorption of iron such as vitamin C and protein. Lack of this nutrient can increase risk of anemia. Anemia caused by malnutrition usually experienced by young women who influenced by the availability of food and the food habbit [5]. Adolescents tend to want an ideal body shape while less nutritional knowledge. They deliberately reduce food intake till less than needed [6]. Anemia due to lack of nutrient intake is characterized by hemoglobin synthesis disorder. The nutrients concerned are protein, pyridoxine (vitamin B6) which has a role as a catalyst in the synthesis of heme in the hemoglobin molecule, besides iron (Fe) is also a one of the nutritional components in the formation of haemoglobin [7].

Pondok Modern Darussalam Gontor Campus 1 is a large Islamic Boarding School in the city of Ngawi which uses a boarding school system so that it has food management to meet the nutritional needs of students. Every day, the kitchen prepares 3 meals with a system of taking staple foods and vegetables that the students can take themselves and the side dishes are proportioned by the kitchen staff. The santri snack can be obtained from buying in canteens and supermarkets in boarding school. This is related to the diet, portion and nutritional adequacy of the santri which affect the health status of the santri. Research related to nutrition in Islamic Boarding School has been widely carried out, but those specifically assessing nutrient intake and nutritional status associated with anemia are still rare.

METHOD

Study design and participants

This type of research is analytic observational with a case-control research design. This research was conducted at Pondok Modern Darussalam Gontor Campus 1 from March to October 2020. The population in this study were all female adolescents 15-18 years, totaling 1359 people. The calculation of the sample size was used hypothesis test for an odds ratio with the formula: P_1 = probability of case group (0,70); P_2 = probability of control group (0,40); $Z_{1-\alpha}$ = level of significance (95%); and $Z_{1-\beta}$ = power of signifiance (80%); 95% significance level and 80% power [8]. Based on this formulas, obtained a total sample of 84 people with the case group 42 people and the control group was 42 people. To anticipate drop out, add 10% to 46 people in each group. The sampling technique was quota sampling who met the inclusion criteria [9]. Inclusion criteria was 15-18 years of age, already menstruating, not menstruating, no pain, and not fasting when checking hemoglobin, do not have a history of blood disorders, do not have a history of malaria, worms and diabetes, are willing to be respondents and follow the research until it is finished. This research has graduated from the Ethics Commission for public health research with number of ethics 2930 / B.2 / KEPK-FKUMS / III / 2020 which was endorsed by the Muhammadiyah University Surakarta.

Measures

The variables examined in this study were protein intake, energy intake, nutritional status, and anemia status. The tools used are weight measurement with digital scales with the CAMRY mode brand: EB9003, height measurement using a microtoice. Hb measurement using the easytouch GCHB type ET-321 made in Taiwan, blood lancet, test chip, pen lancing device, alcohol swab, and hemoglobin strips. Before taking data, the researcher

carried out permission to take secondary data at the female Gontor 1 data center, then sorted secondary data for students aged 15-18 years, then carried out weight measurements, Hb checks, and SQ-FFQ data on students, then processed data according to the inclusion criteria.

Nutritional status. The category of nutritional status based on body mass index for age (BMI / U) refers to the z-score set by the Indonesian Ministry of Health [10]. The nutritional status category based on the z-score consists of malnutrition (-3 SD to ≤-2 SD), normal (-2 SD to ≤1 SD), overweight (1 SD to ≤2 SD), and obesity (> 2 SD) [11]. Blood pressure variables, both systolic and diastolic, were classified into hypotension (<90/60 mm Hg), normal (90 / 60-119 / 79 mm Hg), prehypertension (120 / 80-139 / 89 mm Hg), and hypertension (≥140 / 90 mm Hg) [12].

Anemia. Hb levels as an indicator of anemia were categorized into non-anemia (≥12 g/dL), mild anemia (11-11.9 mg/dL), moderate anemia (8-10.9 mg/dL), and severe anemia (<8 g/dL) [13]. The Hb measuring instrument used was the Easy Touch GCHb type ET-321 made in Taiwan, blood lancet, test chip, pen lancing device, alcohol swab, and hemoglobin strips. The procedure for using it, the fingertip to be shot with the needle is cleaned with an alcohol swab, the needle is shot and pressed so that blood comes out. The blood is touched on the side edge of the strip then after the blood has soaked up to the end of the strip and there is a beep sound, the results can be seen for a few seconds on the screen.

Macronutrient. Energy and nutrient intake data were assessed using a semi quantitative food frequency questionnaire (SQ-FFQ) for the last 3 months during the intervention period. The nutrients assessed are protein. The level of energy and nutrient adequacy is calculated by comparing the intake data with the 2019 nutritional adequacy rate [14].

Data analysis

To analyze the relationship between macronutrient (energy and protein) intake and nutritional status with the incidence of anemia in female students, it was used Chi-Square statistical test and used SPSS 16 program.

RESULTS

Pondok Modern Darussalam Gontor Campus 1 is one of the schools with a boarding system, this boarding school located in the Mantingan area, more precisely located in the Sambirejo Mantingan Ngawi area, which has a land area of 25 hectares m². Modern Darussalam Gontor for girls 1st is one of the schools that is quite well known among the community, Modern Darussalam Gontor for girls 1st has 29 buildings, while for classes there are 10 buildings [15]. The number of santri aged 15-18 years is 1,359 people, for the intake of respondents has been provided by the kitchen section with a menu cycle of 7 days, the activities carried out by the respondents are school until noon. The subjects in this study were 92 late adolescents aged 15-18 years old who lived in Islamic boarding schools. Mean of haemoglobin in the case group was 13.99±1.28 g/dl with min, max was 12.2 g/dl and 17 g/dl, whereas mean of haemoglobin in the control group was 11.05±0.98 g/dl with min, max was 8.1 g/dl, 12 g/dl.

According to **Table 1,** it can be seen that the majority of students were 16 years old (47.8%); who have normal nutritional status was 71.7% in anemia group

Table 1. Characteristic of student age 15-18 years old

Variable	Anemia (n=46)		Non anemia (n=46)	
	n	**%**	**n**	**%**
Age (years)				
15th	1	2.2	1	2.2
16th	22	47.8	22	47.8
17th	17	37	17	37
18th	6	13	6	13
Nutritional status				
Malnutrition	9	28.3	2	10.9
Normal	37	71.7	44	89.1
Diastole				
Abnormal	34	73.9	37	80.4
Normal	12	26.1	9	19.6
Systole				
Abnormal	41	89.1	43	93.5
Normal	5	10.9	3	6.5
Energy intake				
Less	42	91.3	35	76.1
Enough	4	8.7	11	23.9
Protein intake				
Less	43	93.5	36	78.3
Enough	3	6.5	10	21.7

Table 2. Correlation between macronutrient and nutritional status with anemia

Variabel	Anemia		Non anemia		OR (95% CI)	*p-value*
	n	**%**	**n**	**%**		
Energi						
Less	42	91.3	35	76.1	3.30 (0.965 – 11.28)	0.048
Enough	4	8.7	11	23.9		
Protein						
Less	43	93.5	36	78.3	3.98 (1.018 – 15.57)	0.036
Enough	3	6.5	10	21.7		
Nutritional status						
Underweight	9	28.3	2	10.9	5.35 (1.088 – 26.32)	0.024
Normal	37	71.7	44	89.1		

and 89.1% in non anemia group; abnormal diastole was 73.9% in anemia group and 80.4% in non anemia group; have normal tidal systole was 89.1% in anemia group and 93.5% in non anemia group, Majority of energy and protein intake of female students was inadequate. According to **Table 2** it can be seen that there was a significant relationship between macronutrient intake (energy and protein) and nutritional status with the incidence of anemia in adolescents (*p*= 0.048, *p*= 0.036, *p*= 0.024).

DISCUSSION

There is a significant relationship between energy and the incidence of anemia in the pesantren (*p*=0.048; OR=3.3; CI 0.96 – 11.28). If it is adjusted to the energy needs according to the recommended dietary allowances (RDA), the energy intake of the students is less than the need due to several factors, including the respondents often skip the meal schedule because the food menu is not in accordance with the respondent's taste and is accompanied by the activities of the students who are so dense that the energy intake is not in accordance with their supposed needs. The OR value shows that respondents with energy intake less than their needs are 8 times more at risk of anemia than respondents with sufficient energy intake. The results of this study are in line with Agustina's research, which states that there was a significant correlation between energy adequacy and anemia (*p*= 0.047) due to the habit of adolescents skipping breakfast [16]. In the Aritonang and Albiner study, also stated that there was a significant relationship between

energy intake and the incidence of anemia (*p*<0.005) and 65.4% of respondents have adequate energy intake [17].

Energy intake is very important for adolescents for growth, either. Energy is formed from macronutrients and micronutrients. Both are very important for adolescent growth because with the balance of substances consumed by adolescents, adolescents will get enough energy for everyday life. An unbalanced energy intake can lead to obesity or thinness because in malnutrition, you are more at risk of developing anemia [18]. Sugar, especially fructose and sorbitol is one of the nutrients that can increase iron absorption. Fructose and sorbitol function as ligands so that they can prevent the binding of non-heme iron to the inhibitory component and increase its availability [19]. Intake of complex carbohydrates has been reported to enhance the bioavailability of iron. Consumption of iron supplements together with galactooligosaccharides (GOS) can increase the diffusion solubility of ferrous fumarate. The absorption of iron in women who were given ferrous fumarate and GOS supplements was higher than those who were only given iron supplements. Consumption of GOS can reduce serum ferritin so that it can increase iron bioavailability [20]. In contrast to carbohydrate consumption, a high-fat diet is thought to increase the risk of anemia due to the breakdown of red blood cells. In non-HDL cholesterol can cause hemolysis in erythrocytes, while an increase in HDL can increase the size and number of erythrocytes and platelets [21].

In the protein variable, it was also found that there was a significant relationship between protein intake and the incidence of anemia in adolescents (*p*=0.036;

OR=3,98; CI 1,018 – 15,57). The protein intake of respondent's was low and less than the RDA requirement. According to the results of the interview, this was due to the fact that the menu available in the dormitory was more vegetable protein than animal protein. The OR value shows that respondents with less protein intake are 6 times more risk to have anemia than respondents with sufficient protein intake. This study was also in line with Sholihah's research, which said that there was a significant relationship between protein and the incidence of anemia in adolescents (p=0.001; OR=30.333; CI 3.433-26.7988), as evidenced by the level of protein consumption of adolescents who are not anemia higher than adolescents with anemia [22]. Protein plays an important role in adolescence because in adolescence the need for protein increases for a faster growth process [23].

One of the nutrients that has an important role is protein. Protein is useful as a building and regulatory agent, besides protein also regulates human health by providing molecular precursors of amino acids and also functions as a component in body cells, protein also has a role in the transportation of iron to the spinal cord for the formation of red blood cells. Protein intake, especially animal protein helps increase iron absorption, therefore low protein intake can affect Hb levels to be less, so it can lead to anemia [24].

The nutritional status variable also showed that there was a significant relationship between nutritional status and the incidence of anemia in Islamic boarding schools (p<0.000; OR=5.35; CI 1,088 – 26,32). Even though most respondents have normal nutritional status, respondents are still at risk of developing anemia because the intake they consume has not met their needs according to the RDA, especially for protein, energy, and iron. The result showed that respondents with malnutrition status are 1.1 times more at risk of anemia than respondents with normal nutritional status.

Angraini and Sofwan's research stated that there was a significant relationship between chronic energy deficiency and the incidence of anemia in adolescents (p= 0.020), respondents in this study met nutritional intake standards, had sufficient and even high energy or macronutrient intake, foods that are consumed contain more carbohydrates and fats, but, 95.6% of responden

had a low iron intake. This condition perhaps cause of risk of anemia, especially iron-deficiency anemia [25].

This result of this study is different from research conducted by Gasong. According to Gasong research, said that there was no significant relationship between nutritional status and the incidence of anemia among adolescent girls in Kupang (p=0.004). The results showed a correlation between nutritional status and the occurrence of weak and insignificant anemia. The correlation test results showed a relationship (2-tailed) between nutritional status and anemia incidence of 0.916 (>0.05), meaning that there was no significant relationship between nutritional status variables with the incidence of anemia [26]. The results of this study are different from research conducted by Jho which said that there was no significant relationship between nutritional status and the incidence of anemia in adolescents who are in dormitories (p=0.205), because the intake consumed by students in the dormitory has met the appropriate needs with RDA [27]. The condition in the research conducted by Jho was different from this study, because food management system in this study was taken food by student themself. This cause different of intake every person. In the Indartanti study, said that there was no significant relationship between nutritional status and the incidence of anemia in adolescent girls (p=0.289), because most of the subjects had normal nutritional status with adequate intake of macro nutrient [28].

It is hoped that this research can provide knowledge about anemia and anemia prevention, so that young women can be motivated to change their lifestyle and eating habits as well as increase the awareness of young women about health and the future. As with other case control studies, this research also has a hemoglobin check that does not use laboratory checks with ferritin checking. Checking hemoglobin using a ferritin check will have more accurate results. This research has advantages in the questionnaire used, namely the SQ-FFQ questionnaire, the SQ-FFQ questionnaire is a questionnaire that can be used as daily intake data and can also be used as dietary data. It is hoped that the next researchers will add several other factors related to the incidence of anemia. Relevant institutions are expected to pay more attention to the intake of students by moving the part in charge of the

dormitory to monitor their schedules, and provide a more diverse menu so that the protein obtained is not only more vegetable protein but balanced with animal protein intake. Attention is given so that the anemia group is reduced and even there is no anemia group.

CONCLUSIONS

There was significant correlation energy, protein intake, and nutritional status with anemia incidents. Nutritional status has a strongest association with anemia (OR=5,35).

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Declaration of conflicting interests
The authors declare that they have no competing interests.

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