Poltekita: Jurnal Ilmu Kesehatan
http://jurnal.poltekkespalu.ac.id/index.php/JIK

Vol.17 No.3 November 2023: Hal. 564-571
p-ISSN: 1907-459X e-ISSN: 2527-7170

Original Article

Healthy Food Education Affects Underweight Adolescent's Knowledge and Intakes of Energy, Macro and Micro Nutrients

Annasari Mustafa[1]*, Endang Sutjiati[2], Sheily Inge Agustin[2]

[1] Dietitian Professional Education Study Program, Politeknik Kesehatan Kementerian Kesehatan Malang, Malang, East Java Province, Indonesia
[2] Bachelor of Applied Nutrition and Dietetics Study Program, Politeknik Kesehatan Kementerian Kesehatan Malang, Malang, East Java Province, Indonesia

(Correspondence author email, annasary@yahoo.com)

ABSTRACT

One of the causes of underweight is an imbalance between nutritional intake and needs. The condition often occurs in teenagers and in Indonesia there are 8.1%. This study aims to investigate the impact of healthy diet education delivered by peers on the level of knowledge; energy, macro and micro nutrients intake among underweight adolescents at state Senior High School 1 in Singosari, Malang Regency. This study conducted on 33 undeweight adolescent's girls selected based on inclusion criteria. Data collection was carried out before and after the intervention. Adolescents' nutritional knowledge was collected by asking questions using Google forms and food consumption data collection was carried out by direct interviews using a 24-hour food recall form. The intervention took the form of education and guidance from peer tutors when the subjects consumed snacks and lunch at school, which was carried out 14 times, 2 times a week during 8 weeks. The effect of providing education on the level of knowledge; Energy, carbohydrate, protein, fat and zinc intake were analyzed using the paired sample t test, while vitamin C and iron intake used the Wilcoxon test (95% CI; α = 0.05). The results showed significant improvements in the level of knowledge intake of Energy, Protein, Fat, Carbohydrates as well as Iron and Zinc (p-value <0.05), while the increase in vitamin C intake was not significantly different (p-value >0.05). These findings demonstrated the potential of providing healthy diet education by peers to increase knowledge, energy, macro and micro nutrient intake among underweight adolescent girls.

Keywords: *Education, Healthy Diet, Nutrients Intake, Peer Tutor*

https://doi.org/10.33860/jik.v17i3.2980

INTRODUCTION

According to the World Health Organization, adolescence occurs between the ages of 10 and 19 years[1]. Several nutritional problems in adolescents arise due to an imbalance between energy and nutrient intake with adequacy recommended nutritient[2].

The problems of nutritrions in Indonesia generally caused by several factor among them in sufficient food availability, low levels public knowledge about nutritions, and imbalance eating patterns[3]. Underweight is condition caused by imbalance between food

intake and nutritional needs. According to data from the Ministry of Health in (2018) there were 8,7% teenagers aged 13-15 years and 8,1% teenagers aged 16-18 years with condition thin and very skinny. Malnutrition can increase susceptibility to diseases caused by a poor immune system, and has an impact on the risk of stunting at a young age[1]. If this problem continues into adulthood until marriage, there will be a risk of affecting the health of the fetus during pregnancy[4]. Lack of food consumption will cause disease. Adolescents' food consumption will determine the amount of nutrients they obtain for their gramsowth and development. If this intake is insufficient or excessive, it will have an impact on their gramsowth and development as well as their achievements Arisman M., (2010), states that one of the causes of nutritional problems is a lack of knowledge about nutrition which can later lead to mistakes in choosing food[5]. Nurcahyani, (2020) states that nutritional education among adolescensts can change attitudes and actions toward awareness of being able to meet nutritional needs. Good knowledge will create a good attitude so that good behavior will emerge[6]. This is proven by Asmarudin's research, (2018) that there is an influence of providing nutrition education on the energy and nutrient intake of research subjectsts. Education uses the peer tutoring method which is provided in the form of a peer gramsoup, as an effort to change health behavior[7]. This is supported by research conducted by Nuryani, et al (2018), namely that there was a significant increase in knowledge, attitude and behavior scores after nutrition education interventions were carried out[8].

This study aims to investigate the impact of healthy diet education delivered by peers on the level of knowledge; energy, macro and micro nutrients intake among underweight adolescents at state Senior High School 1 in Singosari, Malang Regency.

METHOD

This type of study is quantitative with pre-experiment methods with used a pre and post test one group design. The research target was 33 female students who met the inclusion criteria (female students with a BMI and/or upper arm circumference less than normal and willing to participate in research activities from start until finish and 16-18 years old) . The research was carried out in May-June 2023 underweight adolescents at state Senior High School 1 in Singosari, Malang Regency. Data collection on nutritional knowledge and food consumption was carried out before and after the intervention. Nutritional knowledge was collected by asking 30 questions using a Google form, while food consumption data was collected by direct interviews using a 24-hour food recall form. There are 30 questions given with a score of 3 for the correct answer and 0 for the wrong answer. The intervention carried out was in the form of education and guidance from peer tutors when the subject's consumed snacks and lunch at school which was carried out 14 times, 2 times a week for 8 weeks. The intervention provided is in the form of educational material on healthy diet for adolescents which is given for approximately 45 minutes.

Knowledge score data is categorized into insufficient (score < 56), sufficient (score 56-75) and good (score 76-100) categories. Food consumption data was analyzed using nutrisurvey to obtain Energy and nutrient intakes are then compared with requirements to obtain levels of energy consumption, macronutrients and micronutrients.

Data were analyzed using SPSS 25. Subject characteristics data were presented in the form of descriptive frequency tables and descriptive analysis was carried out. while data on knowledge levels and energy and nutritional intake were carried out. Descriptive analysis and continued with statistical analysis. The effect of education on data normally distributed using the Paired Sample T-Test (knowledge, energy intake, Carbohydrates, Protein, Fat and Zinc) while data that is not normally distributed (Vitamin C and iron) uses the Wilcoxon Test. The confidence level used is 95% or $\alpha = 0.05$. This research was carried out after receiving ethical approval from the Health Research Ethics Commission of the Health Polytechnic, Ministry of Health, Malang with No. Reg. 80/V/KEPK POLKESMA/2023 which was published on 24 May 2023.

RESULTS

The characteristics of the research subjects include age and nutritional status. The distribution of research subjects based on

characteristics can be seen in the following table:

Table 1. Distribution of research subjects based on characteristics

Characteristics of research subjects	Category	n	%
Age	16 years old	33	100
Nutritional Status	Very thin BMI, skinny and LiLA not enough	25	75.8
	BMI is thin and very thin	2	6,1
	LiLA not enough	6	18,2
	Amount	33	100

Source : Primary data, 2023

Table 1 shows that all research subjects were 16 years old and the majority (75.8%) were in the BMI categories of thin, very thin and insufficient Middle Upper Arm Circumference (MUAC).

Table 2. Distribution of Research Subjects Based on Knowledge Level Categories Before and After Healthy Diet Education

Category	Before		After	
	n	%	n	%
Good	3	9	14	42.4
Sufficient	18	54.5	17	51.5
Insufficient	12	36.5	2	6 .1
Amount	33	100	33	100

Source : Primary data, 2023

Table 2 shows that before being given education, the majority (54.5%) of research subjects had a level of knowledge in the sufficient (enough) category, and there were still 36.5% of subjects with a level of knowledge in the insufficient (not enough) category. After being given education, research subjects who were in the sufficient level of knowledge category became 51.5% and those in the good category became 42.4%. Research subjects with a low level (not enough) of knowledge category remaining 6.1%.

Table 3. Average Knowledge Score of Research Subjects Before and After education

Variable	N	Mean±SD	*p*- value
Before	33	55.94±10.994	0.000
After		67.45±9.223	

Source : Primary data, 2023

Table 3 shows that the average knowledge score of research subjects before being given education was 55.94, and afterwards it increased to 67.5. The increase in knowledge scores is significantly different (p-value <0.05)

Providing education, which had an impact on increasing the knowledge of research subjects, also turned out to have an influence on increasing the average energy and nutrient intake. Providing education, apart from increasing the knowledge of research subjects, also has an influence on increasing the average intake of energy and nutrients. The average energy intake of respondents while attending education can be seen in Figure 1. In this figure, respondents' intake decreased in the second, third, and fourth weeks, but on average increased. Even though it has increased several times, energy intake still does not meet the needs of adolescent girls aged 16-18 years based on the RDA 2019 and is still in the severe deficit consumption level category.

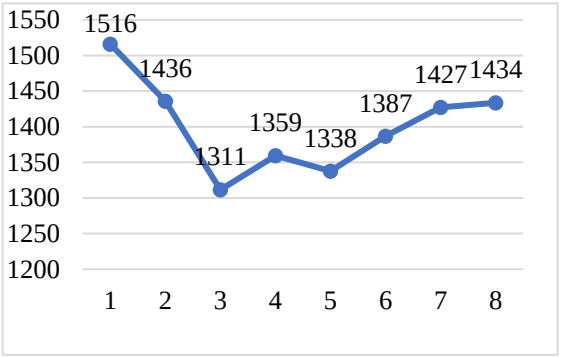

Figure 1. Average Energy Intake of Research Subjects During Education

Table 4. Energy Intake of Research Subjects Before and After Providing Education

Variable	N	Mean±SD	*p-value*
intake Energy Before Education (g)	33	1282.1752±3 50.99197	0.005
intake Energy After Education (g)		1533.2258±3 94.79126	

Source : Primary data, 2023

Table 4 shows the energy intake of research subjects before being given healthy diet education was 1282 kcal. After being given education, it increased by 251 kcal to 1533 kcal. This increase in energy intake is significant (p-value <0.05).

Average Macronutrient Intake of Research Subjects (Protein, Fat and Carbohydrates) During Education.

Figure 2 shows that the average protein intake increased during the education. While fat intake decreased in the second and third weeks,

in the fourth week protein, fat and carbohydrate intake increased by 2 grams, 5 grams and 7 grams respectively. Then in the fifth week only protein intake increased, while fat and carbohydrates decreased, although only by 1 gram. However, in the following week, Protein, Fat and Carbohydrate intake increased until the last week. Even though the research subjects' intake has increased, it is still below the nutritional requirements according to the RDA 2019 and still in the severe deficit consumption level category.

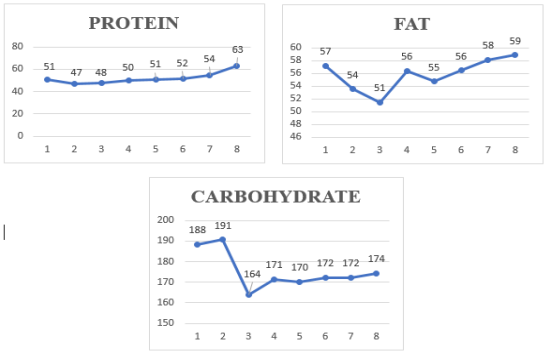

Figure 2. Average Macronutrients Intake Research subjectt During Education

Research subjects' macronutrient intake before and after healthy food education is proven by the normality test and the data results are normally distributed. The results of the analysis can be seen in the table below.

Table 5. Macronutrient Intake of Research Subjects Before and After Providing Education

Variable	N	Mean±SD	*p-Value*
Intake Protein Before Education	33	48.3788±17.23051	0.009
Intake Protein After Education		57.9279±20.32707	
Intake Fat Before Education		43.08±18.93	0.023
Intake Fat After Education		53.92±2.63	
intake Carbohydrate Before Education		167.5879±52.85	0.009
Intake Carbohydrates After Education		203.35±61.3685	

Source. Primary Data (2023)

Table 5 shows that the macronutrient intake of research subjects before and after being given education increased. Protein intake increased by 9.55 grams; Fat 10.4 grams and carbohydrates 35.77 grams. This shows that providing education can increase macronutrient intake.

Average Intake of Micronutrients (Vitamin C, Iron, Zinc) of Research Subjects During Education

The average micronutrient intake of research subjects during education tends to be unstable. There are ups and downs every week. In the second week, intake increases. However, in the third week Vitamin C and Iron decreased simultaneously, while Zinc intake increased. Even though there have been several increases, the intake of vitamin C, iron and zinc is still below the 2019 AKG figure. The results of the average intake of micronutrients can be seen in Figure 3 below.

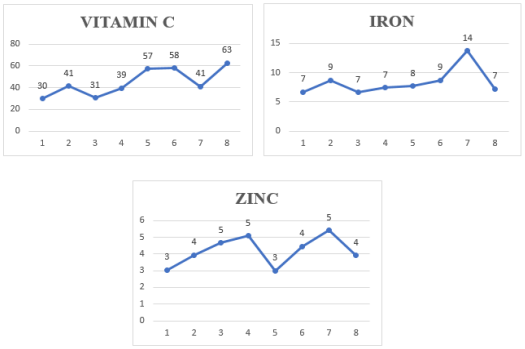

Figure 3. Average Micronutrient Intake of Research Subjects During Education

Research subjects' macronutrient intake before and after healthy food education is proven by the normality test and the data results are normally distributed. The results of the analysis can be seen in the Table 6.

Table 6. Average Vitamin C and Iron Intake of Research Subjects Before and After Providing Education

Variable		n	Means	Sum of Rank	*p-value*
Pre test Vit C *Post test* Vit C-	(-) ranks	8[a]	12.59	101.50	0.21
	(+) ranks	20[b]	15.23	304.50	
	ties	5[c]			
	Total	33			
Pre test substance iron *Post test* Substance Iron -	(-) ranks	9[a]	13.50	121.50	0.038
	(+) ranks	20[b]	15.68	313.50	
	Ties	4[c]			
	Total	33			

Source : Primary data, 2023

Table 6. There is an increase in vitamin C and iron intake. Vitamin C intake increased from 12.59 grams to 15.23 grams. Likewise, iron intake increased from 13.50 grams to 15.68 grams. This shows that providing education can increase intake of vitamin C and iron.

Table 7. Zinc Intake of Research Subjects Before and After Providing Education

Variable	n	Mean±SD	*p-value*
Iron intake before providing education	33	3.5518±2.127	0.004
Iron intake after providing education		4.8721 ± 2.590	

Source: Primary data, 2023

The table above shows the average Zinc intake of research subjects before and after providing education. It is known that there has been an increase in zinc intake, from 3.55 grams to 4.87 grams. This shows that education can increase zinc intake.

DISCUSSION

The Effect of Healthy Diet Education on The Level of Knowledge among Underweight Adolescents

Providing education has been proven to increase the knowledge of research subjects (table 2). Only 6.1% of research subjects were categorized as low level of knowledge (insufficient). The average knowledge score of research subjects before being given education was 55.4, increasing to 67.5 (table 3). The increase in knowledge scores is significantly different (p-value <0.05). Education is a form of effort that can influence a person's knowledge, attitudes, and behavior as a result of learning or knowledge that has been obtained[7].

The research subjects were general students who had never received nutritional information about healthy eating patterns for teenagers, and this information was delivered by peer tutors. This makes students less reluctant to express the conditions they feel and are free to ask questions. So that they can receive the explanation well. Studying together with peer tutor is competency-based learning, because students will become more active with interaction and communication. This can be seen from the increasing participation of students with their peers. This is also in accordance with Nuryani (2018), sometimes students/adolescents find it easier to accept information provided by their peers and do not feel reluctant to ask questions[8]. The increase in knowledge after being given education is in line with research by Asmarudin (2018)7 which states that there is an influence of education on the level of knowledge of research subjects[7]. The results of the research that has been carried out prove that healthy diet education can significantly increase (*p-value*<0.005) the knowledge of underweight female students.

The Effect of Healthy Diet Education on The Level of Energy Consumption Among Underweight Adolescents

The results showed that the average weekly energy intake of research subjects continued to increase. Even though there appears to be an increase, the consumption level of research subjects is still below the 2019 adequate (RDA). Based on the 2019 RDA, teenage girls aged 16-18 years need 2100 kcal of energy. An increase occurred in the research subjects' energy intake (figure 1), although the research subjects' energy intake still did not meet the recommended adequacy figures. Research subjects rarely consumed high-energy foods such as staple foods. This data was obtained from the results of a 24-hour food recall carried out. This shows that the research subjects still have not implemented the balanced nutrition message conveyed during education so they have not been able to change their eating behavior. Education still needs to be carried out so that the subject's energy sufficiency can be achieved. Even though they understood the education that had been provided, the students still could not accept the change in their eating patterns, especially in the third week there was a drastic decrease because the average frequency of eating for research subjects was 2 times a day. as well as the lack of food variety in research subjects, such as rarely consuming snacks, vegetables and fruit. Female students admit that they rarely eat breakfast because they are afraid of being late for school. Anna (2012) said that someone with a high level of knowledge may not necessarily be able to eat breakfast every day[10].

Another factor is that they lose motivation to change their eating behavior. This

assumption was proven in the following weeks, there was an increase in energy intake after being given education and motivation again by the peer tutor on duty. Rotua (2017) states that health education provides a person's motivation to receive information in order to understand better[11].

The results of research that have been conducted prove that healthy food education can significantly increase the energy intake of underweight female students (*p-value* <0.05). The increase in energy intake after being given education is in line with research by Asmarudin (2018) which states that there is an influence of education on the energy intake of research subjects[7].

The Effect of Healthy Diet Education on The Level of Macronutrients Consumption Among Underweight Adolescents

The average intake of macronutrients during education tends to increase, although it still has not reached the recommended adequacy figure according to the RDA 2019 (figure 2). The results of the 24-hour food recall showed that the research subjects consumed less varied foods and lacked motivation in weeks 2 and 3, and it appeared that their intake of Fat and Carbohydrates decreased. The research subjects admitted to skipping breakfast several times for the same reason, namely because they were afraid of being late for school and this often happens to students[10].

Adolescent who needs high concentration in their studies and for good physical growth really need adequate protein intake. Angramseani (2018) stated that one of the causes of skinny teenagers is that they rarely consume foods that contain high protein such as meat, fish and nuts, thus resulting in less protein intake in the body[12]. According to Supriasa (2016), protein intake is recommended from food sources of protein with high biological value[13]. If protein intake does not meet needs, it will result in weight loss, delayed sexual maturity, and decreased accumulation of lean body mass[14]. The results of statistical analysis (table 5) show that there was an increase in the average intake of Protein, Fat and Carbohydrates in research subjects after being given education. This is the same as Asmarudin's research (2018) which states that there is an influence of education on the protein intake of research subjects[7]. Adequate intake of Protein, Carbohydrates and Fat during adolescence is very necessary, to avoid the emergence of several problems in adolescents. This is supported by Sirajuddin, (2012) who said that lack of fat consumption can also have an impact on health such as physical disorders, increased risk of chronic disease, physiological dysfunction[15]. Intake of these macronutrients increased significantly (*p-value* <0.05), which means providing education about healthy diet for tunderweight adolescents can increase protein, fat and carbohydrate intake.

The Effect of Healthy Food Education on The Level of Micronutrients Consumption Among Underweight Adolescents.

Based on the research results, there was an increase in intake of vitamin C and iron. Vitamin C intake increased from 12.59 grams to 15.23 grams. Likewise, iron intake increased from 13.50 grams to 15.68 grams. This shows that providing education can increase intake of vitamin C and iron. It can be seen that the average intake of Vitamin C from the first week to the last week has increased and decreased, and no one has met the requirements according to the RDA 2019, that is 75 mg. It is known from the results of 24-hour food records that the research subjects rarely consumed vegetables and fruit so they were unable to increase their Vitamin C intake according to the RDA 2019. Vitamin C and iron intake is very important for young women, these two nutrients are always related, if at all. With vitamin C, the absorption of iron in non-heme form increases fourfold. The role of Vitamin C is to move iron from transferrin in plasma to liver ferritin. Therefore, iron which plays a role in the formation of hemoglobin also requires the role of Vitamin C, so that young women will avoid anemia[16].

Likewise for iron, the results of the study showed that the average iron intake of the research subjects had increased and decreased. Even though there has been a significant increase, it is still below the recommended nutritional adequacy rate (RDA 2019). This is because research subjects rarely consume vegetable food, so it can be concluded that research subjects do not apply the knowledge gained from previous education. Another factor that might occur is that the research subjects did not convey the nutritional knowledge they had acquired to their parents so that it could not be applied at home. This is in line with research by

Fitriyani and Sefrina (2022) which states that nutrition education is considered less effective in changing fruit and vegetable consumption behavior in children and adolescents[17]. Regarding zinc intake, the research results showed that the average zinc intake of study subjects increased and decreased over time. This shows that the research subjects were not ready to change their eating habits, so the research subjects' zinc consumption did not meet or was below the 2019 RDA, that is 9 mg. The best sources of zinc are animal protein sources, especially meat, liver, shellfish and eggs. Cereals and legumes are also good but have low biological value[18]. Meanwhile, zinc intake is also needed by adolescents as they grow. This is supported by Ilmi (2021) which shows that zinc levels in thin female students are lower but the values are relatively the same as female students with normal nutritional status. Even so, this could be an early indicator that underweight research subjects experience growth disorders[19].

The results of the p-value analysis for iron and zinc were <0.05, which means that there was a significant effect of healthy food education on iron and zinc, while increasing Vitamin C intake had no significant effect (p-value > 0.05). This research is in line with research conducted by Nento (2022), namely that nutrition education via WhatsApp media cannot increase intake of iron, protein and Vitamin C[20].

CONCLUSION

The research conclusion proves that providing healthy diet education to underweight adolescent girls can significantly increase knowledge, energy intake and macronutrients (protein, fat and carbohydrates) and micronutrients (iron and zinc) in underweight adolescent girls at state Senior High School 1 Singosari. However, there was an increase in Vitamin C but there was no significant effect.

Healthy food education using peer tutors can be used as an alternative to increase knowledge and consumption in adolescents with underweight.

REFERENCE

1. Octavia ZF. Frekuensi Dan Kontribusi Energi Dari Sarapan Meningkatkan Status Gizi Remaja Putri. Jurnal Riset Gizi. 2020 May 31;8(1):32-6.
2. Sulistiyoningsih, H. Gizi Untuk Kesehatan Ibu dan Anak. Yogyakarta: Graha Ilmu; 2011.
3. Almatsier, S. Prinsip Dasar Ilmu Gizi. Jakarta: PT.Gramedia Pustaka; 2015.
4. Kementerian Kesehatan Republik Indonesia. Gizi saat Remaja Tentukan Kualitas Keturunan. Kementerian Kesehatan Republik Indonesia; 2021. Retrieved from https://sehatnegeriku.kemkes.go.id/baca/umum/20200124/0232834/gizi-saat-remaja-tentukan-kualitas-keturunan/
5. Arisman, M. Gizi Dalam Daur Kehidupan. Jakarta: EGC; 2010.
6. Nurcahyani ID, Suaib F, Istejo I. Pengaruh Edukasi Gizi terhadap Peningkatan Asupan Energi dan Protein pada Remaja Putri SMP Al-Ishlah Maros. Ghidza: Jurnal Gizi Dan Kesehatan. 2020 Jul 30;4(1):100-6.
7. Pakhri A, Sukmawati S, Nurhasanah N. Pengaruh Edukasi Gizi terhadap Pengetahuan Gizi dan Asupan Energi, Protein dan Besi Pada Remaja. Media Kesehatan Politeknik Kesehatan Makassar. 2018 Jun 30;13(1):39-43.
8. Nuryani N, Paramata Y. Intervensi Pendidik Sebaya Meningkatkan Pengetahuan, Sikap, dan Perilaku Gizi Seimbang pada Remaja di MTsN Model Limboto. Indonesian Journal of Human Nutrition. 2018 Dec 31;5(2):96-112.
9. Suharsimi A. Pengelolaan Kelas dan Siswa. Jakarta: Rajawali; 2002.
10. Sari AF, Briawan D, Dwiriani CM. Kebiasaan Dan Kualitas Sarapan Pada Siswi Remaja Di Kabupaten Bogor. Jurnal Gizi dan Pangan. 2012;7(2):97-102.
11. Rotua M. Efektifitas Edukasi Gizi Terhadap Perbaikan Asupan Zat Besi, Protein, Dan Kadar Hemoglobin Pada Siswai Sma Negeri 14 Palembang. JPP (Jurnal Kesehatan Poltekkes Palembang). 2017;12(2):161-8.
12. Angreani, F. A. (2018). Hubungan Asupan Energi Protein Wasting Remaja Mts 2 Pontianak. Sarjana Thesis. UM Pontianak

13. Supariasa, H. Ilmu Gizi Teori dan Aplikasi. Jakarta: EGC; 2016.
14. Fikawati, Gizi Anak dan Remaja. Depok: Rajawali pers; 2017.
15. Sirajuddin, Bahan Ajar Survei Konsumsi Makanan Makasar. Politeknik Kesehatan Republik Indonesia; 2012.
16. Padayatty SJ, Katz A, Wang Y, Eck P, Kwon O, Lee JH, Chen S, Corpe C, Dutta A, Dutta SK, Levine M. Vitamin C as an antioxidant: evaluation of its role in disease prevention. Journal of the American college of Nutrition. 2003 Feb 1;22(1):18-35.
17. Blogkod FR. Analisis Pola Makan, Asupan dan Status Gizi Mahasiswa Universitas Bina Mandiri Gorontalo pada Masa Pandemi: Analysis of Dieting, Intake and Nutritional Status of Bina Mandiri Gorontalo University Students During Pandemic. Jurnal Gizi Dan Kesehatan. 2022 Jul 15;14(2):177-90.
18. Almatsier, S. Prinsip Dasar Ilmu Gizi. Jakarta: PT Gramedia Pustaka Utama; 2010.
19. Ilmi VY, Maharani N, Dieny FF, Fitranti DY. Asupan protein, zink, dan defisiensi zink pada santriwati underweight. Jurnal Gizi Klinik Indonesia. 2021 Oct;18(2):69-77.
20. Nento PR, Indriasari R, Syam A, Virani D, Riskiytanti S. The Effect of Education Through Whatsapp on Intakes of Adolescent Students Faculty of Agriculture Hasanuddin University. Jurnal Gizi Masyarakat Indonesia (The Journal of Indonesian Community Nutrition). 2022 Jun 27;11(1).
21. Marfuah DM, Kusudaryati DP. Pengaruh Edukasi Gizi Terhadap Pengetahuan Gizi dan Asupan Zat Besi Pada Remaja Putri: Pengaruh Edukasi Gizi Terhadap Pengetahuan Gizi dan Asupan Zat Besi Pada Remaja Putri. PROFESI (Profesional Islam): Media Publikasi Penelitian. 2020;18(2):116-23.