



Nutritional knowledge, diet quality and nutritional status of school-going adolescents in rural and urban areas in West Aceh

Pengetahuan gizi, kualitas diet dan status gizi remaja sekolah desa dan kota di Kabupaten Aceh Barat

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Abstract

The primary nutritional problem of adolescents is the triple burden of malnutrition. Factors that trigger nutritional problems in adolescents include poor eating habits, low nutritional and socioeconomic knowledge, and sedentary activities. This study aimed to analyze differences in nutrition knowledge, diet quality, and their relationship with nutritional status among rural and urban school adolescents in West Aceh. This study used a cross-sectional design, involving 312 adolescent schools in West Aceh in 2023. Data on nutritional knowledge were collected using a questionnaire filled out by the subjects themselves, intake data using 2x24-hour food recall, and anthropometric measurements such as BAZ and Percent Body Fat (PBF) using BIA scales and microtoice. Data were analyzed using Mann-Whitney and Spearman rank tests. There were significant differences in family characteristics, nutritional knowledge, and diet quality between the rural and urban school adolescents ($p < 0,05$). There was a significant positive relationship between nutritional knowledge and diet quality and BAZ and PBF ($p < 0,05$) only among rural school adolescents. In conclusion, family characteristics, nutritional knowledge, and diet quality differed significantly among the adolescents by region. In rural areas, nutritional knowledge and diet quality were significantly associated with BAZ and PBF. School adolescents' knowledge and diet quality remain low; therefore, nutrition education related to balanced nutrition guidelines is required.

Keywords: Adolescents, BAZ, diet quality, nutrition knowledge, PBF

Abstrak

Masalah gizi utama remaja adalah *triple burden of malnutrition*. Faktor pemicu masalah gizi remaja tersebut seperti kebiasaan makan yang buruk, rendahnya pengetahuan gizi dan sosial ekonomi serta aktivitas *sedentary* yang dominan. Penelitian bertujuan untuk menganalisis perbedaan pengetahuan gizi, kualitas diet dan hubungannya dengan status gizi pada remaja sekolah perdesaan dan perkotaan di Aceh Barat. Penelitian menggunakan desain *cross-sectional* melibatkan 312 remaja sekolah di Aceh Barat, tahun 2023. Data pengetahuan gizi dikumpulkan menggunakan kuesioner yang diisi sendiri oleh subjek, data asupan menggunakan *food recall* 2x24 jam, pengukuran antropometri seperti IMT/U, Persen Lemak Tubuh (PLT) menggunakan timbangan BIA dan *microtoice*. Data dianalisis menggunakan *Mann Whitney* dan *Spearman rank*. Terdapat perbedaan signifikan karakteristik keluarga, pengetahuan gizi dan kualitas diet pada remaja sekolah perdesaan dan perkotaan ($p < 0,05$). Terdapat hubungan signifikan positif antara pengetahuan gizi dan kualitas diet dengan IMT/U dan PLT ($p < 0,05$) hanya pada

remaja sekolah di perdesaan. Kesimpulan, karakteristik keluarga, pengetahuan gizi dan kualitas diet berbeda signifikan pada remaja sekolah berdasarkan wilayah. Di perdesaan, pengetahuan gizi dan kualitas diet berhubungan signifikan dengan IMT/U dan PLT. Pengetahuan dan kualitas diet remaja sekolah masih rendah sehingga sangat diperlukan edukasi gizi terkait pedoman gizi seimbang.

Kata Kunci: IMT/U, kualitas diet, pengetahuan gizi, PLT, remaja

Introduction

Adolescents are valuable assets for the nation in creating high-quality generations. Healthy, intelligent, growing, and optimally developing will contribute to improving the welfare of the country in the future. During adolescence, there is a second rapid growth period; therefore, adequate energy and nutrient intakes are needed. Nutritional problems that occur in adolescents, including the triple burden of malnutrition, include undernutrition, overnutrition and micronutrient deficiencies (Rah et al., 2021).

The National Basic Health Research (Riskesmas) (Ministry of Health, 2018a) showed that the prevalence of 13-15 year-olds experiencing undernutrition (very thin and underweight) is 8,7%, while overnutrition (overweight and obese) has a prevalence that 2 times higher as that of those with poor nutritional status (16%). The prevalence of overnutrition in adolescents 16-18 years in 2018 was higher almost 2 times at 13,5% than in 2013 (7,3%). It has been reported that 32% of adolescents have anemia (Ministry of Health, 2018a); this figure has increased by almost half from the prevalence in 2013, which was 22,7% (Ministry of Health, 2013).

Aceh is one of Indonesia's provinces, ranking fifth, with the highest prevalence of stunted adolescents in Indonesia. The National Basic Health Research of Aceh Data (Ministry of Health 2018b) showed that the prevalence of undernutrition in adolescents 13-15 years was 8,3%, 36,9%, and 18,5 %, respectively. In adolescents 16-18 years old, the prevalence of undernutrition, stunting, and overnutrition is 14,9%, 36,4%, and 14,9%, respectively (Ministry of Health Republic of Indonesia, 2018b). The prevalence of adolescent anemia in Aceh has been reported to be 36,9% (Ministry of Health, 2017). The prevalence of stunted adolescents 13-18 years is greater in rural areas than in urban areas, and there are

more malnourished adolescents in urban areas than in rural areas (Ministry of Health, 2018b). In West Aceh District, the prevalence of adolescents aged 13-15 years was 18,9%, stunting was 52,1%, and overnutrition was 16,4%. Adolescents 16-18 years old, 7,3% were undernourished, 30,8% were stunted, and 18% were overnourished. West Aceh Regency has the highest prevalence of stunted adolescents aged 13-15 years in Aceh Province (Ministry of Health, 2018b).

The factors that trigger these problems are poor eating habits, low nutritional knowledge, low socioeconomic status, and sedentary activity. In addition, factors such as sex, age, environmental, psychological, and genetic factors influence health and nutritional status during adolescence (Intantiyana et al., 2018).

The nutritional knowledge of an individual indirectly influences the practice of selecting food, and eventually influences nutritional status. Nutritional knowledge is a fundamental factor in achieving a healthy diet. Dietary practices, food choices, and food quality may be influenced by nutritional knowledge (Grosso et al. 2013; Kwol et al. 2020; Haq et al. 2018).

Schools can have a beneficial effect on obesity among children and young adolescents and can be a place for students to learn and provide great opportunities to shape and change their behavior to be a desirable attitude. The availability of information on nutrition is important for improving students' nutritional behavior (Haryana et al., 2017; Wardhani et al., 2021).

Different regional settlements, such as those living in urban or rural areas, will also influence the lives of people living in those areas, not only the knowledge level, food access, policy, but also the eating habits of the community. Dali et al (2017) in their research found that the nutritional knowledge of overweight and obese children was higher in boys living in urban areas.

Prevention of nutritional problems requires socialization activities related to the application of basic balanced nutrition, assisted by Balanced Nutrition Guidelines (Ministry of Health Republic of Indonesia, 2014). Success is largely determined by the government's role at both the central and regional levels, along with community participation (Tambuwun et al., 2021).

West Aceh Regency has the highest prevalence of adolescent stunting in Aceh. Adolescents are vulnerable to nutritional problems caused by various factors, such as knowledge of nutrition and quality of diet in schools and homes. Based on these problems, this study will analyze the nutritional knowledge, diet quality, and nutritional status of school-going adolescents in West Aceh.

Methods

Design of the cross-sectional study. This study was conducted in the West Aceh Regency in two different areas: rural West Aceh and urban West Aceh. The term establishment for villages and cities was based on regulations from the Head of Central Statistical Agency Number 37 of 2010, which refers to the population and facilities available in an area (Central Statistics Agency of Indonesia, 2010). The research was conducted at four (4) state secondary schools in rural (district of Woyla) and urban (district of Johan Pahlawan) areas. The locations and schools for this research were selected using simple random sampling. This study was conducted between August 2023 and October 2023.

The minimum number of participants was calculated based on the Lameshow sample size formula (Fauziyah, 2019) using the prevalence of adolescents age-16-18 years old who experienced malnutrition in Aceh Province. Based on the calculation results, a minimum sample size of 78 participants was obtained for each middle and high school in rural and urban areas, and the total number of participants was 312.

Data obtained in this study included family characteristics (parents' age, education, occupation, and income), nutritional knowledge, dietary quality, and nutritional status (BAZ and % body fat). Data on individual and family characteristics were collected using self-administered questionnaires. The list of nutrition knowledge questions was modified from Prasetya and Khomsan (2021) and tested for reliability, with a Cronbach's alpha value of

0,712. The nutritional knowledge scores were tabulated to determine the average value and categorized into (a) high category when the percentage of correct answers reached $\geq 80\%$, (b) moderate category when the percentage of correct answers reached 60–80%, and (c) low category when the percentage of correct answers reached $< 60\%$ (Khomsan, 2021).

Food consumption data were collected using the 2 × 24 h food recall method (weekdays and weekends). The quality of food consumption is processed and analyzed using the Diet Quality Index for Adolescents (DQI-A) (Vyncke et al., 2013). The category of DQI-A based on the four quartiles was quartile 1: $< 36,7\%$; quartile 2: $36,7\% - 51,0\%$; quartile 3: $51,1\% - 61,1\%$; and quartile 4: $> 61,2\%$. (Henriksson et al., 2017). Body height was measured using a microtome. Body weight and % total body fat were measured using Bioelectrical Impedance Analysis (BIA). Normality of data was tested using the Kolmogorov-Smirnov test. Bivariate analysis was performed to determine the relationships between variables using the Spearman's rank test. Differences were tested using the Mann-Whitney U test. The significance level was set at $P < 0,05$.

The respondents of this study signed the written consent form, and this research has passed an ethical review issued by the Ethics Commission of the Muhammadiyah University of Semarang (Number: No.221/KE/09/2023).

Result and Discussion

Characteristics of research responses

Three-quarters of school-going adolescents in rural and urban areas are aged 13-15 years, and the majority of school-going adolescents in rural and urban areas are female. The distribution of participants according to family characteristics in rural and urban areas is presented in Table 1.

The age of half of the fathers from rural and urban areas were ranging from to 45-60 years old while half of the mothers from rural area were 40-50 years old and mothers in urban areas were < 45 years old. Parents' ages in rural areas were significantly higher than those in urban areas ($p < 0,05$). Family income was higher in urban areas than in rural areas ($p > 0,05$). The results of this study are in line with those of Koricich et al. (2018), who reported that the education, income, and employment levels of non-rural parents were higher than those of parents in rural areas.

Table 1. Distribution of subjects according to family characteristics, nutritional knowledge, diet quality, nutritional status based on rural and urban areas

Variable	Rural		Urban		p-value ¹
	n	(%)	n	(%)	
Fathers' age (years)					
<45	40	26	58	37	0,001*
45-60	101	65	90	58	
>60	15	10	8	5	
Mean±SD	48,9±8,6		44,2±10,8		
Mothers' age (years)					
<45	58	37	85	54	0,001*
45-60	91	58	32	21	
>60	7	4	39	25	
Mean±SD	51,2±7,7		47,1±7,7		
Family income (Rp/percapita/month)					
< poverty line Rp.579.227	102	65	97	62	0,423
> poverty line Rp.579.227	54	35	59	38	
Mean±SD	Rp.544.744± Rp.661.339		Rp.590.377± Rp.669.812		
Father education					
Non-school	12	8	2	1	0,001*
Elementary school/equivalent	41	26	11	7	
Junior high school/equivalent	28	18	18	12	
Senior high school/equivalent	64	41	87	56	
University	11	7	38	24	
Mother education					
Non-school	27	17	5	3	0,001*
Elementary school/equivalent	19	12	15	10	
Junior high school/equivalent	35	22	25	16	
Senior high school/equivalent	66	42	74	47	
University	9	6	37	24	
Father occupation					
PNS/TNI/POLRI	12	8	32	21	0,003*
Labore/Farmer	122	78	52	33	
Self-employed	11	7	43	28	
Others	11	7	29	19	
Mother occupation					
PNS/TNI/POLRI	6	4	20	13	0,025*
Labore/Farmer	28	18	5	3	
Self-employed	12	8	5	3	
Housewife	108	69	115	74	
Others	2	1	10	6	
Nutrition Knowledge					
Low	106	68	84	54	0,001
Moderate	36	23	68	43	
High	14	9	4	3	
Mean±SD	53,65±13,57		63,24±14,60		
Diet Quality (DQI-A)					
Poor	20	13	12	8	0,005*
Less	68	44	50	32	
Sufficient	45	29	68	44	
Good	23	15	26	17	
Mean±SD	45,3±9,2		52,1±8,7		

Nutritional status (BAZ)					
Underweight	6	4	10	6	
Normal	121	78	113	72	
Overweight	35	22	33	21	0,941
Mean±SD	0,1±1,3		0,3±1,4		
% Body Fat					
Normal	96	62	108	69	
Obesity	60	38	48	31	0,428
Mean±SD	23,1±8,28		21,2±8,75		

Note: ¹⁾ Mann-Whitney test, *significant $p < 0,05$

Almost half of the parents in rural and urban areas had an educational background until SMA/MA/equivalent. Parents' education in urban areas was significantly higher than that in rural areas ($p < 0,05$). Three-quarters of fathers in rural areas and one-third of fathers in urban areas work as laborers or farmers, whereas almost all mothers in rural and urban areas work as housewives. There was a significant difference in parents' occupations between the rural and urban areas ($p < 0,05$). The difference between parents' occupations in rural and urban areas can be attributed to the availability of more job opportunities in urban areas than in rural ones.

Nutritional Knowledge of School-going Adolescents in Rural and Urban Areas

Knowledge related to nutrition influences individual practices based on the Indonesian Dietary Guidelines (IDG). The guidelines are a reference for someone to consume nutrients according to their body's needs, so they can prevent various nutritional problems (Ministry of Health Republic of Indonesia, 2014).

The questions in the table in this study were limited to six questions on diet quality: 1) food sources of vitamins and minerals, 2) food sources of vegetable protein, 3) food sources of carbohydrates and fiber, 4) recommendations for daily sugar consumption, 5) the function of vitamins in metabolic processes, and 6) the function of carbohydrates, proteins, and fat, based on one of the four pillars of IDG. Table 1 shows that the average nutritional knowledge score of adolescents in urban areas was significantly higher than that in rural areas ($p < 0,05$). This difference was due to more

adolescents answering correctly on the first, second, and sixth topics of dietary quality than those in rural areas. This finding is in line with a study conducted by Faradila et al. (2020) in Jakarta and Tangerang on adolescents, which stated that there were significant differences in nutritional knowledge between urban and regency areas. Adolescents in urban areas are easier to access and are more exposed to nutrition-related information than those in rural areas.

Diet Quality of School-going Adolescents in Rural and Urban Areas.

Diet quality was measured using the DQI-A score, which was adjusted to the IDG (Ministry of Health Republic of Indonesia, 2014). The average food consumption of rural and urban subjects and their compliance with the guidelines are presented in Table 2. It is evident that the two groups of recommended foods (carbohydrate and animal-based protein sources) met the minimum portion set in the IDG. One group of non-recommended foods, namely sweet drinks and fruit juice, exceeded the recommended amount (< 300 mL). The average water consumption of the subjects was considered low, similar to the consumption of plant-based protein sources, vegetables, fruit, oil, and fat in the low category. This finding is in line with that of Dewi et al. (2023), with adolescents aged 15–17 years in Palu Indonesia, reporting that the adolescents' food intake was less than the recommended daily portions. Low consumption of fruits and vegetables and high consumption of fast food can worsen the quality of adolescents' nutritional status in the future (Kumara & Putra, 2022).

Table 2. Average of food consumption portion of rural and urban subjects and compliance with recommendations with balanced nutrition

Food Group	Recommended consumption (Portion)	Rural Average of consumption	Conformity	Urban Average of consumption	Conformity
Water (mL)	2000-2100	1346,5±702,7	Not conform	1256,3±646,8	Not conform
Carbohydrate source	4,5-6,5	5,7±2,7	Conform	5,8±2,2	Conform
Animal-based protein sources	3	4,5±2,3	Conform	4,3±1,3	Conform
Plant-based protein sources	3	1,1±1,2	Not conform	1,1±0,9	Not conform
Vegetable	3	0,4±0,7	Not conform	0,5±0,6	Not conform
Fruit	4	0,5±0,4	Not conform	0,5±0,3	Not conform
Oil and fat	5-6	3,0±2,2	Not conform	5,2±2,9	Conform
Snack, sugar and candy (gr)	<50	80,1±58,7	Not conform	98,0±63,0	Not conform
Sweet drink and fruit juice (mL)	<300	80,2±74,6	Conform	142,9±119,9	Conform

According to the results, the knowledge and diet quality of adolescents in rural and urban areas included sufficient knowledge related to vegetable protein food sources based on answers to nutritional knowledge. The consumption of plant-based protein sources as a food source is still low and is not in accordance with the portion size. In addition, knowledge of adolescents in rural and urban areas regarding recommendations for daily sugar consumption is still quite low, supported by the consumption of snacks, sweets, and sugar, which is still higher than the recommended recommendation.

DQI-A scores were calculated according to three components: Dietary Quality (DQ), Dietary Diversity (DD), and Dietary Equilibrium (DE). The average DQI scores according to components and regions are presented in Table 3. The average DQ and DD scores of adolescents in urban areas were significantly higher than those in rural areas ($p < 0,05$). The average DE score of adolescents in urban areas was higher than that of adolescents in rural areas, but the difference was not significant ($p > 0,05$).

Table 3. Average of DQI score according to the component and region

DQI-A (%)	Rural Mean±SD	Urban Mean±SD	p-value
DQ	48,9 ±24,7	54,9 ±21,2	0,042*
DD	47,8 ±12,4	52,3 ±12,6	0,002*
DE	48,1 ±8,6	50,1 ±9,5	0,067
DQI-A	45,3±9,2	52,1±8,7	0,005*

A higher DD value indicates a more diverse type of food consumption, and the better the DE value, the better the fulfillment of the recommended number of food portions consumed by adolescents (Dewi et al., 2023). This indicates that adolescents in urban areas tend to be better at choosing the type of food they consume than those in rural areas. The distribution of participants according to the diet quality category and region is presented in Table 1. The average DQI-A scores of adolescents in urban areas were significantly higher than those of adolescents in rural areas ($p < 0,05$). One-third of adolescents in rural areas have lower diet quality. Almost half of adolescents in urban areas have a sufficient proportion of diet quality.

Nutritional Status of School-going Adolescents in Rural and Urban Areas

Nutritional status can be measured using several indicators such as BAZ and PBF. The distribution of participants according to their nutritional status and region is shown in Table 1. The proportion of school-going adolescents who were overnutrition in rural areas was higher than that in urban areas based on Z-score and percent body fat, but there was no significant difference ($p > 0,05$). This result inversely proportional to Riskesdas (2018) showed that adolescents aged 13-18 years who overnutrition based on BAZ are higher in urban areas than in rural areas in West Aceh Regency.

Relationship between Nutritional Knowledge and Diet Quality

Nutritional status is also influenced by several factors. The relationships between knowledge, diet quality, and nutritional status are shown in Table 4. The table shows that BAZ had a significant positive relationship with nutritional knowledge of school-going adolescents in rural areas ($p < 0,05$). Diet quality also had a significant positive relationship with nutritional status (BAZ) ($p < 0,05$). This research is also in line with the research conducted by Miguel-Etayo et al. (2018) with adolescents in Spain, who found

that the higher the DQI-I value, the lower was the BMI value. Moreover, Chatterjee et al. (2020), in their literature review of risk factors associated with obesity and being overweight, stated that one of the risk factors identified and related to the incidence of obesity is the consumption of sweet drinks. Changes in diet, consumption of refined sugar, easily accessible fat and grains, and greater food security and purchasing power can trigger overweight and obesity as well as the risk of non-communicable diseases for women in rural areas (Walton et al., 2020).

Table 4. Relationship between knowledge and diet quality with nutritional status

Variable	Rural		Urban	
	r	p-value ¹	r	p-value ¹
Nutritional status (BAZ)				
Nutrition Knowledge	0,276	0,001*	-0,020	0,802
Diet Quality	0,246	0,002*	-0,107	0,183
Nutritional status (PBF)				
Nutrition Knowledge	0,186	0,020*	-0,043	0,598
Diet Quality	0,214	0,007*	-0,075	0,355

Note: ¹Spearman test, * $p < 0,05$; r = coefficient of correlation.

Body fat is an indicator of nutritional status. Body fat measurements are important for the prevention of nutritional problems. Table 4 shows that nutritional knowledge and diet quality had a significant positive relationship with percent body fat in school-going adolescents from rural areas ($p < 0,05$) but were not related to school-going adolescents in urban areas ($p > 0,05$). This finding is in line with research by Jagim et al. (2021) in the USA with collegiate athletes, who reported that nutritional knowledge is related to certain body compositions, where those who have higher nutritional knowledge have a lower body fat percentage value. This research is also in line with the research conducted by Nurwanti et al. (2019) with adolescent in Indonesia, who found that the daily consumption of grilled and salty foods was significantly associated with obesity in rural areas, but not in urban areas. This finding is also in line with the research by Taillie et al. (2015) in Mexico with child aged 2-13 years, who reported that snacks that tend to be salty are associated with a greater increase in children's daily energy. Food and eating quality are associated with a better and healthier fat distribution (Xu et al., 2020).

Nutritional knowledge is not a direct factor influencing the nutritional status of an individual, as there are other factors that can influence nutritional status, such as infectious diseases and environmental factors (Ilham et al., 2019).

Conclusion

According to the research results, it can be concluded that there are significant differences in family characteristics (parents' age, education, and occupation), nutritional knowledge, and diet quality among school-going adolescents in rural and urban areas. Nutritional status (BAZ and PBF) had a significant positive relationship with the nutritional knowledge and diet quality of school-going adolescents from rural areas.

The level of nutritional knowledge and diet quality of school-going adolescents is still lacking, and the quality of school-going adolescents' food consumption is still not in accordance with the guidelines; therefore, education regarding the application and nutritional balance of school-going adolescents is needed, especially on topics related to recommendations for sugar

consumption and recommendations for protein food source consumption students by conforming to the Indonesian Dietary Guidelines. Thus, it can improve the nutritional status of school-going adolescents living in the urban and rural areas of the West Aceh Regency.

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References

- Central Statistics Agency of Indonesia. (2010). Urban and Rural Classification in Indonesia. In *Central Statistics Agency of Indonesia*.
- Chatterjee, A., Gerdes, M. W., & Martinez, S. G. (2020). Identification of risk factors associated with obesity and overweight - a machine learning overview. *Sensors*, *20*(9). <https://doi.org/10.3390/s20092734>
- Dali, W. P. E. W., Mohamed, H. J. J., & Yusoff, H. (2017). Nutrition knowledge, attitude and practices (NKAP) and health-related quality of life (HRQOL) status among overweight and obese children: an analysis of baseline data from the interactive multimedia-based nutrition education package (IMNEP) study. *Malaysian Journal of Nutrition*, *23*(1), 17–29.
- Faradila, O. E., Kuswari, M., & Gifari, N. (2020). Differences in food choices and related factors among adolescent girls in city and district high schools. *Nutri-Sains: Jurnal Gizi, Pangan Dan Aplikasinya*, *3*(2), 103. <https://doi.org/10.21580/ns.2019.3.2.3406>
- Fauziyah, N. (2019). *Sampling and Sample Size in Public Health and Clinical Sectors*. Politeknik Kesehatan Kemenkes Bandung.
- Grosso, G., Mistretta, A., Turconi, G., Cena, H., Roggi, C., & Galvano, F. (2013). Nutrition knowledge and other determinants of food intake and lifestyle habits in children and young adolescents living in a rural area of Sicily, South Italy. *Public Health Nutrition*, *16*(10), 1827–1836. <https://doi.org/10.1017/S1368980012003965>
- Haq, U. I., Mariyam, Z., Li, M., Huang, X., Jiang, P., Zeb, F., Wu, X., Feng, Q., & Zhou, M. (2018). A comparative study of nutritional status, knowledge attitude and practices (KAP) and dietary intake between international and Chinese students in Nanjing, China. *International Journal of Environmental Research and Public Health*, *15*(9), 1–11. <https://doi.org/10.3390/ijerph15091910>
- Haryana, N. R., Kustiyah, L., & Madanijah, S. (2017). The effect of multicomponent nutritional interventions for teachers, parents and elementary school students on knowledge, attitudes and availability of fruit and vegetables at home. *Media Gizi Indonesia*. *2019*, *14*(1), 44–55. <https://doi.org/10.204736/mgi.v14i1.44-55>
- Henriksson, P., Cuenca-García, M., Labayen, I., Esteban-Cornejo, I., Henriksson, H., Kersting, M., Vanhelst, J., Widhalm, K., Gottrand, F., Moreno, L. A., & Ortega, F. B. (2017). Diet quality and attention capacity in European adolescents: the healthy lifestyle in Europe by nutrition in adolescence (HELENA) study. *British Journal of Nutrition*, *117*(11), 1587–1595. <https://doi.org/10.1017/S0007114517001441>
- Ilham, D., Harleni, H., & Miranda, S. R. (2019). The relationship between nutritional status, nutritional intake and family history with the incidence of hypertension in the elderly at the Lubuk Buaya Padang health center. *Prosiding Seminar Kesehatan Perintis*, *2*(1), 1–7. <https://jurnal.stikesperintis.ac.id/index.php/PSKP/article/view/334/196>
- Intantiyana, M., Widajanti, L., & Rahfiludin, M. Z. (2018). The relationship between body image, physical activity and knowledge of balanced nutrition with the incidence of obesity in overnourished adolescent girls at SMA Negeri 9 Semarang City. *Jurnal*

- Kesehatan Masyarakat*, 6(5), 404–412.
- Jagim, A. R., Fields, J. B., Magee, M., Kerksick, C., Luedke, J., Erickson, J., & Jones, M. T. (2021). The influence of sport nutrition knowledge on body composition and perceptions of dietary requirements in collegiate athletes. *Nutrients*, 13(7), 1–11. <https://doi.org/10.3390/nu13072239>
- Khomsan, A. (2021). *Techniques for Measuring Nutritional Knowledge*. IPB Press.
- Koricich, A. X. C. R. P. H. (2018). Understanding the effects of rurality and socioeconomic status on college attendance and institutional choice in the united states. *The Review of Higher Education*, 41(2), 281–305.
- Kumara, K. D. M., & Putra, I. W. G. A. E. (2022). Diet patterns, physical activity and nutritional status of students at SMA Negeri 1 Singaraja during the Covid-19 pandemic. *Archive of Community Health*, 9(1), 97. <https://doi.org/10.24843/ach.2022.v09.i01.p07>
- Kwol, Victoria Stephen, Kayode Kolawole Eluwole, Turgay Avci, T. T. L. (2020). Another look into the knowledge attitude practice (KAP) model for food control: an investigation of the mediating role of food handlers' attitudes. *Food Control*, 110(1). <https://doi.org/https://doi.org/10.1016/j.foodcont.2019.107025>
- Miguel-Etayo, P. De, Moreno, L. A., Javier, S., Miguel, M.-M., Maria, Julian, C. A.-S., Amelia, M. del M., Campoy, C., Marcos, A., & Garagorri, J. M. (2018). Diet quality index as a predictor of treatment efficacy in overweight and obese adolescents: the Evasyon study group. *Clinical Nutrition*, 1(1), 1–9. <https://doi.org/https://doi.org/10.1016/j.clnu.2018.02.032>
- Ministry of Health Republic of Indonesia. (2013). Main Results of National Basic Health Research 2013. In *Kementrian Kesehatan RI*. <https://doi.org/10.1126/science.127.3309.1275>
- Ministry of Health Republic of Indonesia. (2014). Regulation of the Minister of Health of the Republic of Indonesia. In *Kemenkes RI*.
- Ministry of Health Republic of Indonesia. (2017). *Indonesian Demographic and Health Survey: Adolescent Reproductive Health*. Ministry of Health Republic of Indonesia.
- Ministry of Health Republic of Indonesia. (2018a). Main Results of National Basic Health Research 2018. In *Kementrian Kesehatan RI*.
- Ministry of Health Republic of Indonesia. (2018b). *Main Results of National Basic Health Research of Aceh 2018*.
- Nurwanti, E., Hadi, H., Chang, J.-S., Paramashati, B. A., & Gittelsohn, J. (2019). Rural-urban differences in dietary behavior and obesity: result of the Riskesdas study in 10-18 year old Indonesian children and adolescent. *Nutrients*, 11(2813), 1–14. www.mdpi.com/journal/nutrients
- Prasetya, G., & Khomsan, A. (2021). The knowledge, attitude and practice of mothers and children on the Indonesian Dietary Guidelines and the relationship with children's nutritional status. *J. Gizi Pangan*, 16(28), 55–64.
- Rah, J. H., Melse-Boonstra, A., Agustina, R., van Zutphen, K. G., & Kraemer, K. (2021). The triple burden of malnutrition among adolescents in Indonesia. *Food and Nutrition Bulletin*, 42(IS), S4–S8. <https://doi.org/10.1177/03795721211007114>
- Taillie, L. S., Afeiche, M. C., Eldridge, A. L., & Popkin, B. M. (2015). Increased snacking and eating occasions are associated with higher energy intake among Mexican children aged 2-13 years. *Journal of Nutrition*, 145(11), 2570–2577. <https://doi.org/10.3945/jn.115.213165>
- Tambuwun, C. Y., Malonda, N. S. H., & Punuh, M. I. (2021). Description of the application of the principles of balanced nutrition to youth in Pinasungkulan Village, Modinding District, South Minahasa Regency during the Covid-19 pandemic. *Kesmas*, 10(1), 194–202.
- Dewi, N. U., Khomsan, A., Dwiriani, C. M., Riyadi, H., Ekayanti, I., Hartini, D. A., & Fadrijah, R. N. (2023). Factors associated with diet quality among adolescents in a post-disaster area: a cross-sectional study in Indonesia. *Nutrients*, 15(15), 1–20. <https://doi.org/10.3390/nu15051101>
- Vyncke, K., Fernandez, E. C., Fajó-Pascual, M.,

- Cuenca-García, M., De Keyzer, W., Gonzalez-Gross, M., Moreno, L. A., Beghin, L., Breidenassel, C., & Kersting, M. (2013). Validation of the diet quality index for adolescents by comparison with biomarkers, nutrient and food intakes: The HELENA study. *British Journal of Nutrition*, *109*(11), 2067–2078. <https://doi.org/10.1017/S000711451200414X>
- Walton, C., Taylor, J., Ogada, I., Agon, N., & Raynor, L. (2020). Associations among food security, BMI, diet diversity and food consumption patterns of women in rural Kenya. *Afr. J. Food Agric. Nutr. Dev*, *20*(5), 16290–16308.
- Wardhani, D. A., Nissa, C., & Setyaningrum, Y. I. (2021). Increasing knowledge of young women through nutrition education using WhatsApp group media. *Jurnal Unimus*, *10*(1), 31–37.
- Xu, F., Greene, G. W., Earp, J. E., Adami, A., Delmonico, M. J., Lofgren, I. E., & Greaney, M. L. (2020). Relationships of physical activity and diet quality with body composition and fat distribution in US adults. *Obesity*, *28*(12), 2431–2440. <https://doi.org/10.1002/oby.23018>