Prisma Sains: Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram
https://e-journal.undikma.ac.id/index.php/prismasains/index
e-mail: prismasains.pkpsm@gmail.com

July 2025. Vol. 13, No. 3
p-ISSN: 2338-4530
e-ISSN: 2540-7899
pp. 719-729

Correlation Between Nutritional Knowledge and Nutritional Status on Students' Academic Achievement

***Fatma Dhafir, Abd. Hakim Laenggen, Masriani, Lilies, Rafiqa, Saripa Husnul Qhatimah**
Biology Education Study Program, Faculty of Teacher Training and Education, Tadulako University, Jl. Soekarno Hatta Km. 9, Palu, Central Sulawesi, Indonesia. Postal code: 94119
*Corresponding Author e-mail: fatmahdhafir @gmail.com

Received: April 2025; Revised: July 2025; Published: July 2025

Abstract

This study investigates the relationship between nutritional knowledge, nutritional status, and academic achievement among junior high school students. Nutrition plays a vital role in cognitive performance, influencing concentration, memory, and energy levels. A cross-sectional correlational study was conducted at SMP Negeri 14 Palu, Central Sulawesi, involving 60 students across grades VII to IX. Data were collected using a structured questionnaire, anthropometric measurements, and academic performance records. Bivariate analysis using the Gamma correlation test revealed a statistically significant positive relationship between nutritional knowledge and academic achievement (Gamma = 0.515; p = 0.003). Conversely, a significant negative correlation was observed between nutritional status and academic performance (Gamma = –0.543; p = 0.040). These findings underscore the importance of structured nutrition education in supporting academic outcomes, while also highlighting the complex, non-linear relationship between physical health indicators and cognitive performance.

Keywords: Nutritional Knowledge, Nutritional Status, Academic Achievement, Gamma Correlation, Adolescents

How to Cite: Dhafir, F., Laenggen, A. H., Masriani, M., Tangge, L., Rafiqa, R., & Qhatimah, S. H. (2025). Correlation Between Nutritional Knowledge and Nutritional Status on Students' Academic Achievement. *Prisma Sains : Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, *13*(3), 719–729. https://doi.org/10.33394/j-ps.v13i3.15420

https://doi.org/10.33394/j-ps.v13i3.15420

INTRODUCTION

Adolescence represents a critical phase of human development, characterized by rapid physical, emotional, and cognitive changes. During this stage, the body's need for essential nutrients increases substantially. Adolescents require higher intakes of energy, protein, vitamins, and minerals compared to other life stages, except infancy (Erkan, 2011; Golden & Cotter, 2023; Parks et al., 2020). Adequate nutrition is not only vital for maintaining physical health but also plays a pivotal role in cognitive development, learning capacity, and academic performance (WHO et al., 2024). Nutritional deficiencies can result in fatigue, reduced concentration, impaired memory, and susceptibility to illness, factors that may disrupt a student's ability to learn effectively (Almatsier, 2015; Maryam & Muamar, 2014). Thus, meeting adolescents' nutritional needs is essential not only for supporting their physical growth but also for optimizing their academic potential during this formative stage.

Nutritional status refers to the physiological state of an individual as determined by the intake and utilization of nutrients, and it reflects long-term dietary patterns (Aulia, 2021; Dewi, 2014). In school-aged children and adolescents, poor nutritional status is commonly assessed through anthropometric indicators such as Body Mass Index (BMI), and often presents in forms like stunting, anemia, underweight, or overweight (Nur et al., 2023). According to Indonesia's 2018 Riskesdas data, 23.7% of children aged 5–12 years were stunted, 9.2% were underweight,

and 20.0% were classified as overweight or obese based on WHO BMI-for-age indicators (Kemenkes, 2019). These data highlight the urgent need for targeted nutritional interventions in these age groups.

Nutritional knowledge, on the other hand, involves an individual's understanding of dietary needs and nutritional science. It shapes food selection behavior and influences the ability to maintain a balanced diet. Without adequate knowledge, even individuals with strong purchasing power may struggle to meet their nutritional needs. Factors such as socioeconomic conditions, education, family environment, and peer influence further shape adolescents' nutritional knowledge (Florence, 2017; UNICEF et al., 2022). In essence, nutritional knowledge acts as a critical foundation for fostering sustainable and informed dietary habits among adolescents.

The relevance of nutrition to academic achievement is supported by theoretical frameworks from educational psychology. Jean Piaget's theory posits that adolescents in the formal operational stage (ages 11 and up) develop the ability for abstract thinking, but this cognitive growth depends on biological readiness, including adequate nutrition (Ginsburg & Opper, 1988; Piaget, 1970). Likewise, Bloom's Taxonomy of Educational Objectives identifies a hierarchy of learning—ranging from basic recall to higher-order thinking such as analysis and evaluation—which requires not only intellectual stimuli but also physical well-being to support sustained concentration and mental processing (Anderson & Krathwohl, 2001; Bloom, 1986). These theoretical perspectives underscore the intrinsic link between physical nourishment and the capacity for advanced learning

Academic achievement itself encompasses outcomes across cognitive, affective, and psychomotor domains (Nur et al., 2023; Salsabila & Puspitasari, 2020). It is shaped by multiple factors, both internal—such as nutrition, health, motivation, and external, such as family support, school environment, and socioeconomic background. Nutrition is a crucial determinant of academic achievement. Balanced diets, regular meal consumption, and school feeding programs positively influence cognitive functions and academic performance (Alayne et al., 2017). Addressing unhealthy eating habits and promoting nutritional education can significantly enhance students' academic success (Asigbee et al., 2018; Burrows et al., 2017; Pesantez Jara, 2025; Verulava & Devnozashvili, 2021). Therefore, improving students' nutritional practices through education and supportive interventions is a strategic pathway to strengthening academic outcomes across all domains of learning.

Although many studies report a positive correlation between nutritional knowledge or status and academic achievement (Putri Yuniarsih, 2021), other studies suggest that this relationship is not always linear. Winarni (2012) and Grantham-McGregor et al., (2007) highlight the influence of confounding factors such as mental health, family income, and lifestyle habits that may distort the nutrition-performance relationship. Thus, further investigation is required, especially within specific local and cultural contexts.

This study aims to analyze the correlation between nutritional knowledge and nutritional status with academic achievement among junior high school students at SMP Negeri 14 Palu. Given the limited research conducted in this regional context, the study is expected to provide empirical insights that can support targeted interventions in school-based nutrition education and contribute to improving adolescent academic outcomes.

METHOD

Research Design

This study employed a quantitative approach with a descriptive-correlational design. This design was chosen to examine the relationship between two or more variables without manipulating the independent variable, making it highly suitable for assessing the strength and direction of associations among variables (Creswell, 2012). The research was conducted at SMP Negeri 14 Palu, Central Sulawesi.

The population in this study consisted of all students in grades VII, VIII, and IX at SMP Negeri 14 Palu. A purposive sampling technique was used, selecting participants based on specific criteria relevant to the research objectives (Memon et al., 2024). A total of 60 students were selected, consisting of: 19 students from Grade VII; 23 students from Grade VIII; and18 students from Grade IX.The sample was composed of 41.7% male and 58.3% female students. The inclusion criteria were students who were actively attending school, had complete academic records, and had available anthropometric data. Students with chronic illnesses or medical conditions affecting nutritional status or cognitive functioning were excluded from the sample.

Nutritional knowledge was measured using a 27-item multiple-choice questionnaire adapted from the Indonesian Balanced Nutrition Guidelines (Permenkes Nomor 41, 2014). Each correct answer received a score of 1, and incorrect answers received a score of 0. The maximum score was 27. The categorization is presents in Table 1.

Table 1. Nutritional Knowledge Category

Category	Score Range	Criteria Description
Good	≥ 21 (≥ 75%)	High level of knowledge
Sufficient	14–20 (50–74%)	Moderate knowledge
Poor	< 14 (< 50%)	Low level of knowledge

Reliability testing using Cronbach's Alpha produced a value of 0.78, indicating acceptable internal consistency (Fraenkel & Wallen, 2009). Nutritional status was determined using the Body Mass Index-for-Age (BMI/A) based on body weight and height measurements, classified according to the 2007 WHO Growth Reference (Turck et al., 2013) as presents in Table 2.

Table 2. Nutritional Status Category

Category	BMI/A Z-Score	Description
Underweight	< –2 SD	Below normal BMI
Normal	–2 SD to +1 SD	Normal BMI range
Overweight	> +1 SD	Above normal BMI

Weight was measured using a digital scale, and height was measured using a stadiometer. All measurements were conducted by trained personnel following standard procedures. Academic achievement was assessed based on the students' report card scores in core subjects (Mathematics, Science, and Bahasa Indonesia) from the most recent semester. The average scores were classified by using Table 3.

Table 3. Academic Achievement Category

Category	Score Range	Description
Good	≥ 80	High academic performance
Sufficient	65–79	Average performance
Poor	< 65	Below average performance

Grade data were obtained from official school records. Data were collected over a two-week period during the second semester of the academic year. The data collection process included the following steps: 1) Obtaining permission from the school principal and informed consent from parents/guardians; 2) Distributing and completing the nutritional knowledge questionnaire; 3) Measuring students' height and weight according to WHO protocols; and 4) Collecting academic achievement data from homeroom teachers.

Data were analyzed using SPSS version 23. The analysis included: 1) Univariate analysis to describe frequency distributions; and 2) Bivariate analysis using the Gamma correlation test to assess relationships between ordinal variables. The Gamma test was selected due to its appropriateness for analyzing associations between ordinal categorical data and its ability to indicate both the strength and direction of the relationship. The significance level was set at $p < 0.05$ (Field, 2013).

RESULTS AND DISCUSSION

Results

This section presents the findings from descriptive and bivariate analyses involving 60 students from SMP Negeri 14 Palu. The analysis includes the distribution of nutritional knowledge, nutritional status, and academic achievement, as well as the results of Gamma correlation tests between the variables.

Nutritional Knowledge

The level of nutritional knowledge of the respondents was evaluated through 27 questions from the distributed questionnaire. The percentage of students' nutritional knowledge can be found in Table 4.

Table 4. Distribution of Students' Nutritional Knowledge

Level of Nutritional Knowledge	N	%
Good	15	25.0
Sufficient	23	38.3
Poor	22	36.7
Total	60	100.0

The data shows that there are still some adolescents who have insufficient nutritional knowledge, so the group of adolescents with poor nutritional knowledge may be influenced by or have a limited understanding of nutrition.

Nutrition Status

Body mass index measurement is conducted by measuring the height and weight of the students, and the results of the measurements are presented in Table 5.

Tabel 5. Frequency Distribution of Students' Nutritional Status

Nutrition Status	N	%
Underweigh	19	31.7
Normal	37	61.7
Overweigh	4	6.7
Total	60	100.0

The measurmen from 60 samples showed that 19 students (31,7%) were underweigth, 37 students (61,7%) had normal weigth, and 4 students (6,7%) were overweigth. This showed that the majority of the respondens have normal nutrition compare to poor nutrition However there are still some groups of teenagers who are undernowrished and overweigth.

Academic Achievement

The frequency distribution data on students' academic achievement is presented in Table 6 that shows the distribution of respondents according to students' academic achievement, with 36 students (60.0%) in the good category, 17 students (28.3%) in the sufficient category, and 7 students (11.7%) in the poor category. It can be concluded that the most common academic achievement category is the good grade category.

Tabel 6. Academic achievement frequency distributions

Academic Achievement	N	%
Good	36	60.0
Sufficient	17	28.3
Poor	7	11.7
Total	60	100.0

Bivariate Analysis Results

Correlation between Nutritional Knowledge Level and Academic Achievement of Students at SMP Negeri 14 Palu

To analyze the correlation between nutritional knowledge and academic achievement among junior high school students at SMP Negeri 14 Palu, a bivariate ordinal correlation test was performed using IBM SPSS Statistics version 27. The statistical tools employed were the Gamma correlation coefficient is suitable for two ordinal variables and a Chi-Square test of independence to confirm the categorical association. The data can be seen in Table 7.

Table 7. Crosstabulation of the Relationship Between Nutritional Knowledge Level and Academic Achievement of Students at SMP Negeri 14 Palu

Nutritional Knowledge	Nutritional Knowledge			Total
	Good	Sufficient	Poor	
Good	12	3	0	15
Sufficient	17	5	1	23
Poor	7	9	6	22
Total	36	17	7	60

The Gamma test was selected due to the ordinal nature of both variables: 1) Nutritional knowledge: Good, Sufficient, Poor; and 2) Academic achievement: Good, Sufficient, Poor. After inputting data into SPSS and conducting the crosstab analysis with, the following output was generated: Gamma coefficient (γ): 0.515; Significance value (p-value): 0.003; and 95% Confidence Interval (CI): 0.229 to 0.742.

The Gamma coefficient of 0.515 indicates a moderate positive correlation, implying that students with higher nutritional knowledge tend to demonstrate better academic performance. The p-value (0.003) is statistically significant at the conventional alpha level (0.05), and the 95% confidence interval does not cross zero, confirming the strength and direction of the relationship.

To strengthen the categorical association analysis, a Chi-Square test of independence was also conducted using the same cross-tabulated dataset with the result as follow: Chi-Square statistic (χ^2): 14.32; Degrees of Freedom (df): 4; and p-value: 0.006. The p-value < 0.05 indicates a statistically significant association between the levels of nutritional knowledge and academic achievement. This confirms that academic outcomes differ significantly across the levels of students' nutritional knowledge.

A statistically significant positive correlation was found between nutritional knowledge and academic achievement ($\gamma = 0.515$; $p = 0.003$; 95% CI: 0.229–0.742). This suggests that higher nutritional literacy contributes to improved school performance. Additionally, the Chi-Square test ($p = 0.006$) confirms a strong categorical association between these two variables. These results support the importance of integrating nutrition education into school curricula as a pathway to enhance cognitive and academic development among adolescents.

Correlation between Nutritional Status and Academic Achievement of Students at SMP Negeri 14 Palu

To investigate the correlation between students' nutritional status and their academic achievement, a bivariate statistical analysis was performed using IBM SPSS Statistics version 27. The data were analyzed through a Gamma correlation test, which is appropriate for examining the strength and direction of association between two ordinal variables. Additionally, a Chi-Square test of independence was used to verify the association between these categorical variables. The crosstabulation results are presented in Table 8.

Table 8. Crosstabulation of the Relationship Between Nutritional Status and Academic Achievement of Students at SMP Negeri 14 Palu

Nutrition Status	Academic Achievement			Total
	Good	Sufficient	Poor	
Underweight	6	5	5	19
Normal	28	8	1	37
Overweight	2	1	1	4
Total	36	7	17	60

After inputting data into SPSS and conducting the crosstab analysis with Gamma, the following output was generated: Gamma coefficient (γ): –0.543; Significance (p-value): 0.040; and 95% Confidence Interval (CI): –0.798 to –0.135. The Gamma value of –0.543 reflects a moderate negative correlation between nutritional status and academic performance. This suggests that students with abnormal nutritional status (either underweight or overweight) were more likely to exhibit lower academic achievement. The significance level of $p = 0.040$ (< 0.05) confirms that this relationship is statistically significant, and the 95% CI that does not include zero validates the direction and strength of the correlation.

To support the findings from the Gamma analysis, a Chi-Square test of independence was conducted: Chi-Square statistic (χ^2): 12.485; Degrees of Freedom (df): 4; and p-value: 0.014. The p-value below 0.05 indicates that the association between nutritional status and academic achievement is statistically significant, affirming that academic outcomes vary depending on students' nutritional categories.

The statistical findings confirm a negative and significant correlation between students' nutritional status and their academic achievement. The Gamma correlation ($\gamma = –0.543$; $p = 0.040$; 95% CI: –0.798 to –0.135) indicates that students with normal nutritional status tend to perform better academically than those who are underweight or overweight. The Chi-Square test ($p = 0.014$) further supports a significant association between these variables. These results underscore the importance of monitoring and supporting adolescent nutrition as part of efforts to improve educational outcomes.

Discussion

Respondent Characteristics

Of the 60 students, 41.7% are male and 58.3% are female, and the age distribution results show a significant variation. The majority of respondents are within the age range of 13 to 15 years, with the highest proportion at age 14, which is 28.3%. The lowest proportion is at age 17, with 1.1%. This indicates that the sample has a varied age range, although there is a dominance in the 14-year-old group. Therefore, the age distribution of the respondents is crucial to consider in a study to ensure the representativeness and generalizability of the findings.

Correlation between Nutritional Knowledge and Academic Achievement

The Gamma correlation analysis conducted between nutritional knowledge and academic achievement aims to reveal the relationship between these two variables. The analysis results

show that the Gamma correlation coefficient is 0.515, indicating a positive relationship between nutritional knowledge and students' academic achievement, as well as a significant correlation. This assumption highlights the importance of nutritional knowledge in influencing students' academic performance in school. With a coefficient value of 0.515, it can be concluded that the relationship between nutritional knowledge and academic achievement has a moderate strength. This indicates that the better the nutritional knowledge students have, the higher their academic performance, and vice versa. A previous study by Putri Yuniarsih in 2021 revealed that students with poor nutritional knowledge are 5.1 times more likely to achieve lower academic performance. A good understanding of nutrition can be a key factor in improving students' academic performance at SMP Negeri 14 Palu and may encourage more attention to nutrition education within schools.

Individual achievement is influenced by two main categories: internal factors and external factors. Internal factors include physical conditions (such as vision, hearing, and body structure), psychological aspects (comprising intellectual and non-intellectual factors), and maturity both physically and mentally (Putri Yuniarsih, 2021). On the other hand, external factors include social influences (such as family, school, community, and peer groups), cultural elements (including traditions, knowledge, technology, and art), as well as physical environmental factors (such as housing facilities, learning resources, and climatic conditions). Understanding these two types of factors is crucial in helping individuals achieve maximum performance because achievement is the result of complex interactions between various factors, both internal and external.

Consistent with these findings, Doustmohammadian et al., (2022), employing a structural equation modeling approach, demonstrated that Food and Nutrition Literacy (FNLIT) directly influences both healthy eating behaviors and academic achievement among students aged 10–12 years in Iran. Nutritional knowledge, in this context, encompasses skill-based components such as food label literacy and food choice literacy, which play a critical role in shaping dietary behaviors and learning outcomes. The study also emphasized that FNLIT mediates the impact of socioeconomic status on academic performance, suggesting its potential as a tool for reducing educational disparities linked to social inequality.

A similar pattern was observed by Lwin et al., (2025) in Thailand, where positive attitudes toward nutrition and mindfulness were found to be positively associated with academic achievement. In their study, students who exhibited more favorable attitudes toward nutrition and engaged in healthier eating practices achieved significantly higher academic performance (AOR = 1.543, p = 0.044). These findings underscore that nutritional knowledge, students' awareness and attitudes toward nutrition play a vital role in their academic success.

The results of studies conducted by (Heartanya et al. (2024) and Nova & Yanti (2018) can be concluded that there is a correlation between students' understanding of balanced nutrition and academic achievement at MTsN 3 Agam, where good or balanced nutritional knowledge is related to better learning outcomes. However, the researcher also noted that good academic performance can still occur even if students' nutritional knowledge is unbalanced, and vice versa, because other factors, such as students' age, also influence their nutritional knowledge and academic success (Heartanya et al., 2024). Therefore, this study aims to provide a deeper understanding of the relationship between nutritional knowledge and academic achievement at SMP Negeri 14 Palu.

Correlation between Nutritional Status and Academic Achievement

The correlation analysis between nutritional status and academic achievement in this study revealed a statistically significant negative relationship, with a Gamma coefficient of –0.543 and a significance level of p = 0.040. This indicates that the probability of this correlation occurring by chance is only 4%, suggesting a true negative association between the two variables.

This finding is consistent with prior studies, such as Juwita et al., (2023) and Winarni (2012), who also reported significant negative correlations between students' nutritional status and their academic achievement. In Winarni's study, although the correlation was weaker ($r = –0.172$, $p = 0.026$), it similarly suggested that improved nutritional status did not automatically translate into improved academic performance.

In the present study, students with underweight or overweight status were more likely to perform poorly compared to students with normal nutritional status. However, it's essential to interpret this cautiously. A negative correlation does not necessarily imply a causal inverse relationship. It is more likely that academic performance is influenced by a complex interplay of factors—not only physiological (like nutritional status), but also psychological (motivation, self-esteem, cognitive load), and socio-environmental factors (peer pressure, parental support, socioeconomic status) as suggested by Abdullah & Norfai (2019) and Lestari (2020).

International literature supports this complexity. For example, Haile et al. (2016) in Ethiopia found that height-for-age Z scores (a proxy for chronic undernutrition) significantly predicted students' academic performance, particularly in mathematics. A one-unit increase in height-for-age was associated with a 2.11-point increase in math scores. This implies that long-term nutritional status may indirectly influence cognitive development, especially when combined with socioeconomic factors and cognitive stimulation.

Similarly, Al Maghaireh (2019), in a study of over 450 primary school students in Jordan, found a significant negative correlation between undernutrition indicators (wasting, stunting, and thinness) and academic achievement. The study showed that BMI had a positive correlation ($r = 0.21$, $p < 0.001$) with academic success. Importantly, the authors concluded that nutritional problems affected students' ability to benefit from learning opportunities, with 67.1% of students facing nutrition-related academic challenges.

In Indonesia, Rahmatillah and Mulyono (2019) also confirmed a significant relationship ($p = 0.03$) between nutritional status and academic performance. Although most students in their study had normal nutritional status, nearly half had low academic achievement, highlighting that adequate nutrition alone does not guarantee academic success. The study emphasizes the need for complementary health education and school-based nutrition programs.

In a study focusing on adolescents in North Sumatra, Sinurat et al. (2018) found a significant moderate positive correlation ($r = 0.541$, $p = 0.020$) between overweight status and academic achievement in mathematics, while normal nutritional status also correlated significantly with better report card results ($p = 0.003$). This further complicates the assumption that only undernutrition is problematic—overnutrition may also influence performance, potentially through mechanisms such as metabolic dysfunction, self-perception, or peer-related stress.

Taken together, these findings support the notion that the relationship between nutritional status and academic achievement is neither linear nor uniform. While normal nutritional status tends to be associated with better academic outcomes, extreme deviations—both under- and overnutrition—can disrupt cognitive performance and concentration. These effects may be mediated by other variables such as intelligence, psychological resilience, social environment, and mindfulness (Lwin et al., 2025).

Thus, the negative correlation observed in the current study should be interpreted as a warning signal that nutrition-related imbalances—regardless of direction—can impair students' learning capacity. Therefore, interventions should not only aim to improve physical health through nutrition but also address mental well-being, dietary behavior, and social factors to support holistic academic development.

CONCLUSION

Based on the study conducted at SMP Negeri 14 Palu, the results indicate a significant association between students' nutritional knowledge and their academic achievement: students

with higher nutritional knowledge tend to achieve better, plausibly because this knowledge supports healthier food choices. The study also notes that good nutritional status contributes to stamina and physical health, which supports participation in learning activities. Correspondingly, the analysis reports a positive correlation coefficient between nutritional knowledge and academic achievement, whereas nutritional status shows a negative correlation coefficient with academic achievement.

RECOMMENDATION

The results of this study suggest that in order to improve students' comprehension of balanced diets and the role that nutrition plays in cognitive development, schools should improve the way that structured nutrition education is incorporated into their curricula. Academic performance may benefit from this. To confirm the findings and improve generalizability, future studies should include a larger and more varied sample population from different geographical areas. For a more thorough understanding of the connection between nutrition and academic outcomes, it would also be advantageous to take into account other factors like dietary practices, levels of physical activity, and socioeconomic background. Additionally, schools are urged to work with parents and medical professionals to address issues related to undernutrition or overnutrition and to establish routine monitoring of students' nutritional status through school health programs. Future studies should try to account for these factors in order to provide more accurate insights, as this study also recognizes the impact of a variety of internal and external factors on academic achievement, including learning environments, family support, and psychological conditions. To ensure that students consistently have access to wholesome food and health education to support their academic and physical development, policymakers are also urged to support the implementation of school-based nutrition and wellness programs through funding and regulation.

REFERENCES

Abdullah, A., & Norfai, N. (2019). Nutritional Analisis Status Gizi Dengan Prestasi Belajar Pada Siswa Di SDN Mawar 8 Kota Banjarmasin. *Jurnal Kesehatan Indonesia*, *9*(2), Article 2.

Al Maghaireh, D. F. (2019). The impact of malnutrition on the academic achievement among jordanian students in the primary schools. *Gazi Medical Journal*, *30*(2), 130–135. Scopus. https://doi.org/10.12996/gmj.2019.34

Alayne, M. A., Rushdia, A., Mahbub Latif, A. H. M., Sabrina, R., Sumon, K. D., Enamul, H., Fahmida, D. F., Farzana, F., Shahnawaz, A., & Asg, F. (2017). Impact of fortified biscuits on micronutrient deficiencies among primary school children in Bangladesh. *PLoS ONE*, *12*(4). Scopus. https://doi.org/10.1371/journal.pone.0174673

Almatsier, S. (2015). *Prinsip Dasar Ilmu Gizi* (9th ed.). Gramedia Pustaka Utama. https://gpu.id/book/77801/prinsip-dasar-ilmu-gizi

Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives* (Complete ed). Longman.

Asigbee, F. M., Whitney, S. D., & Peterson, C. E. (2018). The Link Between Nutrition and Physical Activity in Increasing Academic Achievement. *Journal of School Health*, *88*(6), 407–415. Scopus. https://doi.org/10.1111/josh.12625

Aulia, N. R. (2021). Peran Pengetahuan Gizi Terhadap Asupan Energi, Status Gizi Dan Sikap Tentang Gizi Remaja. *Jurnal Ilmiah Gizi Dan Kesehatan (JIGK)*, *2*(02), 31–35. https://doi.org/10.46772/jigk.v2i02.454

Bloom, B. S. (1986). *Taxonomy of Educational Objectives: Handbook 1, Cognitive Domain* (29. print). Longman.

Burrows, T., Goldman, S., Pursey, K., & Lim, R. (2017). Is there an association between dietary intake and academic achievement: A systematic review. *Journal of Human Nutrition and Dietetics*, *30*(2), 117–140. Scopus. https://doi.org/10.1111/jhn.12407

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed). Pearson.

Dewi, S. R. (2014). *Buku Ajar Keperawatan Gerontik*. Deepublish. https://balaiyanpus.jogjaprov.go.id/opac/detail-opac?id=296052

Doustmohammadian, A., Omidvar, N., Keshavarz-Mohammadi, N., Eini-Zinab, H., Amini, M., & Abdollahi, M. (2022). The association and mediation role of Food and Nutrition Literacy (FNLIT) with eating behaviors, academic achievement and overweight in 10–12 years old students: A structural equation modeling. *Nutrition Journal*, *21*(1). Scopus. https://doi.org/10.1186/s12937-022-00796-8

Erkan, T. (2011). Adolescent nutrition. *Türk Pediatri Arşivi*, *46*(1), 49–53. https://doi.org/10.4274/tpa.46.34

Florence, A. G. (2017). *Hubungan Pengetahuan Gizi dan Pola Konsumsi dengan Status Gizi Pada Mahasiswa Tpb Sekolah Bisnis dan Manajemen Institut Teknologi Bandung* [Thesis, Universitas Panca Bhakti]. http://repository.unpas.ac.id/29841/

Ginsburg, H. P., & Opper, S. (1988). *Piaget's theory of intellectual development, 3rd ed* (pp. viii, 264). Prentice-Hall, Inc.

Golden, N. H., & Cotter, E. M. (2023). Adolescent nutrition. In *Encyclopedia of Child and Adolescent Health* (pp. 780–789). Elsevier. https://doi.org/10.1016/B978-0-12-818872-9.00001-7

Grantham-McGregor, S., Cheung, Y. B., Cueto, S., Glewwe, P., Richter, L., Strupp, B., & International Child Development Steering Group. (2007). Developmental potential in the first 5 years for children in developing countries. *Lancet (London, England)*, *369*(9555), 60–70. https://doi.org/10.1016/S0140-6736(07)60032-4

Heartanya, D., Febria, C., & Nugrahmi, M. A. (2024). Hubungan Pengetahuan Siswa Tentang Gizi Seimbang dengan Prestasi Belajar Pada Siswa MTsN 3 Agam Tahun 2023. *Innovative: Journal Of Social Science Research*, *4*(1), Article 1. https://doi.org/10.31004/innovative.v4i1.8129

Juwita, L., Sari, N. N., & Pangestika, Y. (2023). Faktor-Faktor Karakteristik Demografi Yang Mempengaruhi Tingkat Kecemasan Primigravida Trimester III. *JURNAL NERS LENTERA*, *11*(1), 1–10.

Kemenkes, R. (2019). *Laporan Nasional Riskesdas 2018* (p. 674). Kementerian Kesehatan Republik Indonesia.

Lestari, P. (2020). Hubungan Pengetahuan Gizi, Asupan Makanan dengan Status Gizi Siswi Mts Darul Ulum. *Sport and Nutrition Journal*, *2*(2), Article 2. https://doi.org/10.15294/spnj.v2i2.39761

Lwin, E. Z., Watthanakulpanich, D., Phetrak, A., Soonthornworasiri, N., & Prangthip, P. (2025). Factors influencing secondary school students' nutrition, mindfulness, and academic performance in Nan Province, Thailand. *PLoS ONE*, *20*(1). Scopus. https://doi.org/10.1371/journal.pone.0308882

Maryam, S., & Muamar, M. R. (2014). Hubungan Status Gizi Terhadap Prestasi Belajar Siswa Kelas IV SD Negeri 1 Pandrah Kecamatan Pandrah Kabupaten Bireuen—Neliti. *JESBIO*, *III*(4).

Memon, M. A., Thurasamy, R., Ting, H., & Cheah, J.-H. (2024). Purposive Sampling: A Review And Guidelines For Quantitative Research. *Journal of Applied Structural Equation Modeling*, *9*(1), 1–23. https://doi.org/10.47263/JASEM.9(1)01

Nova, M., & Yanti, R. (2018). Hubungan Asupan Zat Gizi Makro dan Pengetahuan Gizi dengan Status Gizi Pada Siswa Mts.S An-Nurkota Padang. *JURNAL KESEHATAN*

PERINTIS (Perintis's Health Journal), *5*(2), 169–175. https://doi.org/10.33653/jkp.v5i2.145

Nur, A. A. W., Mokhtar, S., Nurmadilla, N., Bamahry, A. B., & Jafar, M. A. (2023). Hubungan Antara Status Gizi Dengan Prestasi Belajar Anak Pada Usia 9 – 12 Tahun. *Wal'afiat Hospital Journal*, *4*(1), 23–30. https://doi.org/10.33096/whj.v4i1.99

Parks, E. P., Mascarenhas, M. R., & Goh, V. (2020). Nutrient needs and requirements during growth. In *Present Knowledge in Nutrition* (pp. 23–44). Elsevier. https://doi.org/10.1016/B978-0-12-818460-8.00002-2

Permenkes Nomor 41, Pub. L. No. 41 (2014).

Pesantez Jara, N. C. (2025). Impact of diet on academic performance. *Retos*, *67*, 1321–1331. Scopus. https://doi.org/10.47197/retos.v67.114570

Piaget, J. (1970). Science of education and the psychology of the child. Trans. D. Coltman. *Science of Education and the Psychology of the Child. Trans. D. Coltman.*, 186–186.

Putri Yuniarsih, D. (2021). Hubungan Pengetahuan Gizi dan Kebiasaan Sarapan terhadap Prestasi Belajar Siswa di SMA Negeri 12 Kota Bekasi. *Jurnal Health Sains*, *2*(11), 1448–1459. https://doi.org/10.46799/jhs.v2i11.261

Rahmatillah, S. U., & Mulyono, S. (2019). The Relationship between the Nutritional Status of School-Age Children and Their Academic Achievement and Physical Fitness Levels. *Comprehensive Child and Adolescent Nursing*, *42*(sup1), 147–153. Scopus. https://doi.org/10.1080/24694193.2019.1578435

Salsabila, A., & Puspitasari, P. (2020). Faktor-faktor yang Mempengaruhi Prestasi Belajar Siswa Sekolah Dasar. *PANDAWA*, *2*(2), 278–288. https://doi.org/10.36088/pandawa.v2i2.800

Sinurat, R. S., Sembiring, T., Azlin, E., Faranita, T., & Pratita, W. (2018). Correlation of nutritional status with academic achievement in adolescents. In Wijaya L., Widodo D., Manosuthi W., Baird J.K., Eyanoer P.C., de Jong M., & Zein U. (Eds.), *IOP Conf. Ser. Earth Environ. Sci.* (Vol. 125, Issue 1). Institute of Physics Publishing; Scopus. https://doi.org/10.1088/1755-1315/125/1/012226

Turck, D., Michaelsen, K. F., Shamir, R., Braegger, C., Campoy, C., Colomb, V., Decsi, T., Domellöf, M., Fewtrell, M., Kolacek, S., Mihatsch, W., Moreno, L. A., & Van Goudoever, J. (2013). World Health Organization 2006 Child Growth Standards and 2007 Growth Reference Charts: A Discussion Paper by the Committee on Nutrition of the European Society for Pediatric Gastroenterology, Hepatology, and Nutrition. *Journal of Pediatric Gastroenterology and Nutrition*, *57*(2), 258–264. https://doi.org/10.1097/MPG.0b013e318298003f

UNICEF, IFAD, FAO, WFP, & WHO. (2022). *The State of Food Security and Nutrition in the World 2022. Repurposing food and agricultural policies to make healthy diets more affordable*. FAO. https://doi.org/10.4060/cc0639en

Verulava, T., & Devnozashvili, R. (2021). Nutrition and academic performance among adolescences. *Romanian Journal of Diabetes, Nutrition and Metabolic Diseases*, *28*(3), 275–283. Scopus. https://doi.org/10.46389/rjd-2021-1041

WHO, UNICEF, & World Bank. (2024). *The UNICEF-WHO-World Bank Joint Child Malnutrition Estimates (JME) standard methodology*.

Winarni, W. (2012). Hubungan Antara Status Gizi Dengan Prestasi Belajar Pada Siswa Kelas VIII SMP Negeri 1 Jaten Karanganyar. *Gaster*, *9*(1). https://doi.org/10.30787/gaster.v9i1.107