SciencePlus
Vol. 2 Nomor 2 Oktober 2026
ISSN. 3090-3564
https://journal.barkahpublishing.com/index.php/sp

KNOWING IS NOT DOING: NUTRITION KNOWLEDGE, EATING BEHAVIOUR, AND NUTRITIONAL STATUS AMONG UNIVERSITY STUDENTS

Amaliah Amriani Amran Saru*, **Oriny Tri Ananda****, **Dian Aswita*****, **Muh. Syaiful Akbar******, dan **Erona Wafaretta*******
**Department of Biology, Universitas Negeri Makassar, Makassar, amaliah.amriani@unm.ac.id
**Department of Biology, Universitas Negeri Makassar, Makassar, orinytriananda@unm.ac.id
***Department of Biology, Universitas Negeri Makassar, Makassar, dian.aswita@unm.ac.id
****Department of Biology, Universitas Negeri Makassar, Makassar, Syaiful.akbar@unm.ac.id
*****Department of Biology, Universitas Negeri Makassar, Makassar, erona.wafaretta@unm.ac.id

Abstract

Pre-service biology teachers are expected to deliver nutrition education in schools, yet it remains unclear whether the nutrition knowledge they acquire during their studies is reflected in their own eating behaviour and nutritional status. This study aimed to examine the association of nutrition knowledge with eating behaviour and nutritional status among university students and to explore which eating behaviours are most closely related to knowledge. A cross-sectional study was conducted among 87 third-semester biology education students at a public university in Makassar, Indonesia. Nutrition knowledge was measured with a written test administered at the end of a nutrition and health course, eating behaviour with a ten-item questionnaire based on the Indonesian balanced nutrition guidelines, and nutritional status with body mass index. Data were analysed using rank correlation and exact tests. Two thirds of the students had good nutrition knowledge, yet the mean eating behaviour score was only 39.8 out of 100, none showed good eating behaviour, 87.4% rated their own diet as unbalanced, and 46.0% were underweight. Knowledge was associated neither with overall eating behaviour nor with body mass index. In exploratory analysis, the proportion of students consuming sugar-sweetened beverages every day fell from 83.3% among those with poor knowledge to 31.0% among those with good knowledge. These findings indicate that knowing does not translate into doing, and that nutrition courses for future teachers should move beyond conceptual mastery towards practice-based learning, beginning with simple behaviours such as reducing sweetened drinks.

Keywords: nutrition knowledge, eating behaviour, sugar-sweetened beverages, nutritional status, pre-service teachers.

INTRODUCTION

Indonesia faces a double burden of malnutrition among adults. The 2023 Indonesian Health Survey reported that 23.4% of adults aged over 18 years were obese and 14.4% were overweight, up from 21.8% and 13.6%, respectively, in 2018(Badan Kebijakan Pembangunan Kesehatan, 2023). The same survey found that 47.5% of the population consumed sweetened beverages at least once a day, whereas the World Health Organization recommends limiting free sugars to less than 10% of total energy intake (World Health Organization, 2015). Sugar-sweetened beverages are a well-established contributor to weight gain and cardiometabolic disease, and the global prevalence of overweight and obesity continues to rise (GBD 2021 Adult BMI Collaborators, 2025; Malik et al., 2013; Malik & Hu, 2022; World Health Organization, 2021).

ISSN. 3090-3564
https://journal.barkahpublishing.com/index.php/sp

University life is a vulnerable transition period for dietary habits. Students typically begin living away from their families, manage their own finances, and face demanding academic schedules. A meta-analysis showed that 60.9% of first-year students gain weight, with a pooled mean gain of 1.36 kg, and a prospective study found that intake of most food groups declined during the transition from secondary school to higher education (Deforche et al., 2015; Vadeboncoeur et al., 2015). Students' food choices are shaped by limited time, cost, food availability on campus, peers, and stress (Deliens et al., 2014; Hilger-Kolb & Diehl, 2019; Kabir et al., 2018; Sogari et al., 2018), and taste and dietary identity often outweigh health considerations (Aboueldahab et al., 2026). Both ends of the malnutrition spectrum are present among university students: underweight affected 17.6% of female and 10.8% of male students across 22 countries(Peltzer et al., 2014), while 34.7% of first-year health sciences students in Indonesia had excess body weight (Vidiawati et al., 2025).

The knowledge–attitude–behaviour model positions nutrition knowledge as the foundation of healthy eating (Contento, 2016). Some studies support this view: nutrition knowledge was associated with healthier food intake in British adults (Wardle et al., 2000), and higher knowledge was linked to lower saturated fat and cholesterol intake among college students (Yahia et al., 2016). Other evidence, however, reveals a wide gap between knowing and doing. A systematic review of 29 studies found that associations between nutrition knowledge and dietary intake were mostly positive but weak ($r < 0.5$) (Spronk et al., 2014), and only about 40% of Italian adults showed concordance between their knowledge and eating habits (Scalvedi et al., 2021). Knowledge is therefore necessary but not sufficient to change eating behaviour (Worsley, 2002). The behaviour change wheel framework explains this gap by positing that behaviour requires capability, opportunity, and motivation, of which knowledge is only one component of capability (Michie et al., 2011).

Findings among students in Indonesia and elsewhere are similarly mixed. Nutrition knowledge was not associated with nutritional status among biology students in Manado (Adimin et al., 2022), physical education students in Sumenep (Kusuma et al., 2025), or university students in Lahore (Aslam et al., 2023), whereas a positive association was reported among working students of an open university (Marhamah et al., 2023). For sugar-sweetened beverages specifically, no association between knowledge and consumption was found among British university students or between knowledge and nutritional status among Indonesian adolescents (A'la et al., 2025; Warner & Ha, 2017). In contrast, low nutrition knowledge was associated with high consumption among Indonesians aged 19–22 years (Ahmad & Maulida, 2025), and excessive consumption was considerably more common among school and university students with poor knowledge in Semarang (Handayani et al., 2026).

This study addresses two gaps. First, most previous studies measured knowledge with brief, one-off questionnaires. The present study used a standardised nutrition knowledge test administered after students had completed a full semester of nutrition coursework, which better reflects their actual mastery of the subject. Second, the participants were pre-service biology teachers, a group of particular interest because they will later be responsible for teaching nutrition in schools. Evidence from pre-service health and physical education teachers suggests that inaccuracies in nutrition knowledge can persist until graduation (Werkhoven et al., 2014), but little is known about whether pre-service teachers apply what they learn to their own diets. This study therefore aimed to examine the association of nutrition knowledge with eating behaviour and nutritional status among university students, and to explore which components of eating behaviour are most closely related to knowledge.

ISSN. 3090-3564
https://journal.barkahpublishing.com/index.php/sp

METHODS

Study design and participants. This cross-sectional study involved third-semester students of the Biology Education Study Program at Universitas Negeri Makassar (N = 118). All students were invited to complete an online questionnaire between 22 and 28 October 2025, and 88 students participated (response rate 74.6%). One respondent was excluded for not taking the knowledge test, leaving an analytical sample of 87 students. With n = 87, the study had 81% power to detect a moderate correlation ($\rho = 0.30$) at $\alpha = 0.05$.

Nutrition knowledge. Nutrition knowledge was measured using a written test administered at the end of the Nutrition and Health course. The test covered all nutrition topics taught during the semester and was scored by the course lecturer on a 0–100 scale. Because the test was completed as part of the regular course assessment rather than for research purposes, it provides a more objective measure of knowledge than self-administered knowledge questionnaires and is not influenced by respondents' wish to give socially desirable answers. Scores were obtained from the official grade records and classified as good (≥ 76), fair (56–75), or poor (< 56) (Arikunto, 2013).

Eating behaviour. Eating behaviour was assessed using a ten-item questionnaire developed from the Indonesian Balanced Nutrition Guidelines and the *Isi Piringku* (My Plate) guideline (Kementerian Kesehatan Republik Indonesia, 2014). The items covered the frequency of consuming vegetables, fruit, protein-rich side dishes, carbohydrates, milk and dairy products, fast food, and sugar-sweetened beverages; the habits of limiting fat and salt; and a self-assessment of dietary balance. Each item was scored from 0 to 3, with fast food and sugar-sweetened beverage items reverse-scored so that higher scores consistently indicated healthier behaviour. The total score (0–30) was converted to a 0–100 scale and classified using the same cut-offs as knowledge. Internal consistency was Cronbach's $\alpha = 0.59$. Alpha depends on the number of items and the homogeneity of the construct, and is expected to be lower for short scales covering heterogeneous behaviours (Tavakol & Dennick, 2011); the conventional threshold of 0.70 is not an absolute criterion of acceptability (Taber, 2018).

Nutritional status. Nutritional status was determined by body mass index (BMI), calculated from self-reported body weight and height provided in the questionnaire. BMI was classified as underweight (< 18.5 kg/m²), normal (18.5–25.0 kg/m²), or overweight (> 25.0 kg/m²) according to the Indonesian Ministry of Health criteria (Kementerian Kesehatan Republik Indonesia, 2014).

Statistical analysis. Categorical variables were presented as frequencies and percentages, and continuous variables as mean, standard deviation (SD), minimum, and maximum. BMI and knowledge scores were not normally distributed (Shapiro–Wilk, $p < 0.001$), whereas the eating behaviour score was ($p = 0.322$). Because each pair of variables included at least one non-normally distributed variable, non-parametric tests were used. Correlations were assessed with Spearman's rank correlation, with 95% confidence intervals (CI) estimated by bootstrapping (5,000 replicates). Differences in scores across nutritional status categories were tested with the Kruskal–Wallis test. Associations between categorical variables were tested with the Fisher–Freeman–Halton exact test (Monte Carlo, 100,000 samples), as some cells had expected frequencies below five. In exploratory analysis, the knowledge score was correlated with each eating behaviour item; items showing an association were further analysed with the Cochran–Armitage trend test and Fisher's exact test. Because the exploratory analysis involved ten tests, its results were interpreted as preliminary. Sensitivity analyses used the mid-semester test score (available for 75 students) and excluded respondents with poor knowledge. Statistical significance was set at $p < 0.05$.

ISSN. 3090-3564
https://journal.barkahpublishing.com/index.php/sp

RESULTS AND DISCUSSION

Characteristics of Respondents

Two thirds of the students had good nutrition knowledge, yet most did not meet dietary recommendations and almost half were underweight (Table 1). Eating behaviour scores ranged from 13.3 to 70.0, and no respondent reached the threshold of 76, meaning that none of the students had eating behaviour classified as good (Table 2).

Table 1. Frequency Distribution of Respondent Characteristics (n = 87)

Variable	Category	n	%
Nutritional status (BMI)	Underweight	40	46.0
	Normal	42	48.3
	Overweight	5	5.7
Nutrition knowledge	Poor	6	6.9
	Fair	23	26.4
	Good	58	66.7
Eating behaviour	Poor	79	90.8
	Fair	8	9.2
	Good	0	0.0
Daily sugar-sweetened beverage consumption	Yes	35	40.2
	No	52	59.8

Source: Primary data, 2025.

Table 2. Descriptive Statistics of Study Variables (n = 87)

Variable	N	Minimum	Maximum	Mean	SD
Body weight (kg)	87	36.00	90.20	47.35	9.02
Height (cm)	87	130.00	170.00	154.37	6.17
BMI (kg/m²)	87	15.06	36.13	19.88	3.69
Nutrition knowledge score	87	28.00	90.00	75.10	10.99
Eating behaviour score	87	13.33	70.00	39.81	12.43

Note: SD = standard deviation. Knowledge and eating behaviour scores range from 0 to 100.
Source: Primary data, 2025.

Eating Behaviour Profile

Only 3 students (3.4%) ate vegetables three or more times a day, and almost one third never ate fruit (Table 3). More than half consumed fast food at least three times a week, and four in ten drank sugar-sweetened beverages every day. The students were aware of this situation: 87.4% rated their diet as unbalanced or not entirely balanced, and the proportion was almost identical among those with good knowledge (86.2%; 50 of 58).

Table 3. Distribution of Eating Behaviour Items (n = 87)

Behaviour	Category	n	%
Vegetable consumption	≤ 2 times/day	84	96.6
	Never	12	13.8
Fruit consumption	≤ 1 time/day	72	82.8
	Never	27	31.0
Healthy protein side dishes	Every day	34	39.1
Balanced carbohydrate portions	Regularly at every meal	31	35.6
Milk, yoghurt, or cheese	Never	20	23.0

ISSN. 3090-3564
https://journal.barkahpublishing.com/index.php/sp

Behaviour	Category	n	%
Fast food	≥ 3 times/week	49	56.3
Sugar-sweetened beverages	Every day	35	40.2
	≥ 2 times/day	11	12.6
Limiting high-fat foods	Often or always	12	13.8
Attention to salt use	Never	25	28.7
Self-rated balanced diet	Balanced or fairly balanced	11	12.6

Source: Primary data, 2025.

Association of Nutrition Knowledge with Eating Behaviour and Nutritional Status

Nutrition knowledge was not associated with eating behaviour (Table 4) or with nutritional status (Table 5), and eating behaviour was not associated with nutritional status (Table 6). Even among students with good knowledge, 43.1% were underweight.

Table 4. Association between Nutrition Knowledge and Eating Behaviour

Nutrition knowledge	Poor behaviour n (%)	Fair behaviour n (%)	Total n (%)	p-value
Poor	5 (83.3)	1 (16.7)	6 (100.0)	0.448[a]
Fair	22 (95.7)	1 (4.3)	23 (100.0)	
Good	52 (89.7)	6 (10.3)	58 (100.0)	
Total	79 (90.8)	8 (9.2)	87 (100.0)	

Note: [a] Fisher–Freeman–Halton exact test. No respondent had good eating behaviour.
Source: Primary data, 2025.

Table 5. Association between Nutrition Knowledge and Nutritional Status

Nutrition knowledge	Underweight n (%)	Normal n (%)	Overweight n (%)	Total n (%)	p-value
Poor	4 (66.7)	2 (33.3)	0 (0.0)	6 (100.0)	0.768[a]
Fair	11 (47.8)	10 (43.5)	2 (8.7)	23 (100.0)	
Good	25 (43.1)	30 (51.7)	3 (5.2)	58 (100.0)	
Total	40 (46.0)	42 (48.3)	5 (5.7)	87 (100.0)	

Note: [a] Fisher–Freeman–Halton exact test.
Source: Primary data, 2025.

Table 6. Association between Eating Behaviour and Nutritional Status

Eating behaviour	Underweight n (%)	Normal n (%)	Overweight n (%)	Total n (%)	p-value
Poor	37 (46.8)	37 (46.8)	5 (6.3)	79 (100.0)	0.824[a]
Fair	3 (37.5)	5 (62.5)	0 (0.0)	8 (100.0)	
Total	40 (46.0)	42 (48.3)	5 (5.7)	87 (100.0)	

Note: [a] Fisher–Freeman–Halton exact test.
Source: Primary data, 2025.

The correlation analysis confirmed these results (Table 7). The upper bound of the confidence interval for the correlation between knowledge and eating behaviour was 0.330, indicating that the data do not support an association stronger than moderate. Eating behaviour scores increased slightly from the poor knowledge group (33.9 ± 16.7) to the fair (38.0 ± 12.2) and good (41.1 ± 12.0) groups, but the difference was not significant (Kruskal–Wallis, $p = 0.370$). Knowledge scores did not differ between underweight (median 78.0), normal (77.0), and overweight (82.0) students ($p = 0.842$), nor did eating behaviour scores differ across nutritional status categories ($p = 0.827$).

ISSN. 3090-3564
https://journal.barkahpublishing.com/index.php/sp

Table 7. Spearman Correlation between Nutrition Knowledge, Eating Behaviour, and BMI (n = 87)

Variables	n	r	95% CI	p-value
Nutrition knowledge – eating behaviour	87	0.117	−0.109 to 0.330	0.280
Nutrition knowledge – BMI	87	0.033	−0.190 to 0.252	0.761
Eating behaviour – BMI	87	−0.100	−0.298 to 0.105	0.354

Note: r = Spearman's rank correlation coefficient; CI = confidence interval (bootstrap, 5,000 replicates).
Source: Primary data, 2025.

These findings reveal a clear paradox among pre-service biology teachers: they know, but they do not yet act on what they know. The results are consistent with the systematic review by Spronk et al. (2014), in which associations between nutrition knowledge and dietary intake were generally weak. The correlation observed here (ρ = 0.117) falls within that range and is in the expected positive direction. With 81% power to detect a moderate correlation and an upper confidence bound of 0.330, any true association is likely to be small and insufficient to explain students' eating behaviour. The findings also mirror those among biology students in Manado and students in Sumenep, but differ from the positive association reported among working students, which may reflect differences in age, living arrangements, and income (Adimin et al., 2022; Kusuma et al., 2025; Marhamah et al., 2023).

Three explanations are plausible. First, knowledge is necessary but not sufficient (Contento, 2016; Worsley, 2002). Within the behaviour change wheel, knowledge strengthens psychological capability but does not provide the physical opportunity or the motivation required for behaviour change (Michie et al., 2011). Students' eating behaviour is determined largely by time, price, food availability around campus, peers, and academic stress and the food environment exerts a strong influence beyond individual knowledge (Deliens et al., 2014; Hilger-Kolb & Diehl, 2019; Kabir et al., 2018; Sogari et al., 2018; Story et al., 2008). Second, a knowledge test measures conceptual understanding rather than practical skills such as planning meals on a limited budget or choosing food in the campus canteen identified cooking ability as a key determinant of students' diets (Kabir et al., 2018). Third, the students themselves recognise the gap: 86.2% of those with good knowledge rated their diet as unbalanced. The problem, therefore, is not a lack of knowledge but difficulty in applying what is already known.

Exploratory Analysis: Sugar-Sweetened Beverages

Of the ten eating behaviour items, only sugar-sweetened beverage consumption was associated with the knowledge score (ρ = 0.245; 95% CI 0.038–0.436; p = 0.022): the higher the knowledge score, the less frequently students consumed sugar-sweetened beverages. The proportion of students consuming them daily fell from 83.3% in the poor knowledge group to 31.0% in the good knowledge group (Table 8). Students with good knowledge had 68% lower odds of daily consumption than other students (OR = 0.32; 95% CI 0.11–0.88; Fisher's exact test, p = 0.020), and the mean knowledge score decreased from students who rarely consumed sugar-sweetened beverages (79.3) to those who consumed them at least twice a day (67.7).

Table 8. Daily Sugar-Sweetened Beverage Consumption by Level of Nutrition Knowledge

Nutrition knowledge	Daily n (%)	Not daily n (%)	Total n (%)	p-value
Poor	5 (83.3)	1 (16.7)	6 (100.0)	0.019[a]
Fair	12 (52.2)	11 (47.8)	23 (100.0)	
Good	18 (31.0)	40 (69.0)	58 (100.0)	
Total	35 (40.2)	52 (59.8)	87 (100.0)	

ISSN. 3090-3564
https://journal.barkahpublishing.com/index.php/sp

Note: [a] Fisher–Freeman–Halton exact test. Cochran–Armitage trend test: z = −2.815; p = 0.005.
Source: Primary data, 2025.

This pattern closely mirrors the findings of Handayani et al. (2026) in Semarang, where excessive consumption was 74.8% among those with poor knowledge and 27.8% among those with good knowledge, and is consistent with the association between low knowledge and high consumption among Indonesians aged 19–22 years (Ahmad & Maulida, 2025). Why should sugar-sweetened beverages differ from other behaviours? One possibility is that reducing sweetened drinks is a simple and immediate decision, such as choosing water instead of sweet tea. Unlike eating vegetables and fruit, this decision requires no cooking time, additional cost, or access to particular foods, which are the main barriers to healthy eating among students (Deliens et al., 2014; Sogari et al., 2018). Messages about the harms of sugar are also concrete and well publicised (Malik & Hu, 2022; World Health Organization, 2015).

Nevertheless, this finding is exploratory. The association was no longer significant after excluding the six students with poor knowledge (ρ = 0.145; p = 0.196), and it was not observed when knowledge was measured using the mid-semester test score (ρ = 0.078; p = 0.504; n = 75). Daily sugar-sweetened beverage consumption was also not associated with nutritional status (p = 0.608). Studies among British university students and Indonesian adolescents likewise found no association between knowledge and consumption or nutritional status (A'la et al., 2025; Warner & Ha, 2017). The finding should therefore be regarded as a hypothesis to be tested in larger samples.

Hidden Undernutrition

The proportion of underweight students (46.0%) far exceeded that of overweight students (5.7%). This pattern contrasts with the national trend, which is dominated by overnutrition (Badan Kebijakan Pembangunan Kesehatan, 2023), and with the 34.7% prevalence of excess body weight among first-year health sciences students in Indonesia (Vidiawati et al., 2025). It is also considerably higher than the underweight prevalence reported among university students across 22 countries (Peltzer et al., 2014). The eating behaviours recorded here, such as infrequent consumption of fruit, dairy, and protein-rich foods, are consistent with inadequate intake and with the decline in food group intake observed during the transition to higher education (Deforche et al., 2015). However, eating behaviour was not statistically associated with BMI, suggesting that other factors, such as physical activity, sleep patterns, and economic conditions, may play a role.

Limitations

The cross-sectional design precludes causal inference. The eating behaviour questionnaire had moderate internal consistency and has not been validated against quantitative intake methods such as 24-hour dietary recall. Body weight and height were self-reported, which tends to underestimate weight and BMI (Connor Gorber et al., 2007). The sample was drawn from a single study programme, with few students in the poor knowledge (n = 6) and overweight (n = 5) groups. In addition, physical activity, economic conditions, and sex were not recorded.

CONCLUSION

The conclusion is the final part of a scientific paper obtained from the essence of the study's findings and discussion (analysis). The conclusion doesn't mean rewriting the finding and discussion chapter or summarizing, but rather delivering brief answers to the objectives or research questions previously asked. We need to write a conclusion in

ISSN. 3090-3564
https://journal.barkahpublishing.com/index.php/sp

complete, clear, and concise sentences. The specific conclusion comes from the finding and discussion analysis, while the general conclusion comes from generalization or correlation with similar phenomena in other studies as referred to in previous publications. In this case, research problems, research objectives, and research findings all must be considered to check and recheck when writing a conclusion.

In addition, suggestions are needed in academic recommendations, along with a feasible follow-up or policy implications for the findings obtained. The recommendations should be written in brief and concise sentences.

BIBLIOGRAPHY

A'la, N., Nurdin, A., Fitria, U., Khairuman, K., & Rahayu, D. (2025). Hubungan pengetahuan konsumsi minuman berpemanis dengan status gizi remaja. *Public Health Journal*, *2*(1). https://doi.org/10.62710/vjcw4f81

Aboueldahab, A., Vanutelli, M. E., D'Addario, M., & Steca, P. (2026). Understanding food choices among university students: Dietary identity, decision-making motives, and contextual influences. *Nutrients*, *18*(2), 228. https://doi.org/10.3390/nu18020228

Adimin, A. N., Arrijani, & Tengker, A. C. C. (2022). Hubungan pengetahuan gizi dan pola konsumsi dengan status gizi pada mahasiswa Biologi Universitas Negeri Manado. *JSPB Bioedusains*, *3*(1), 27–34. https://ejurnal.unima.ac.id/index.php/bioedusains/article/view/4945

Ahmad, Z., & Maulida, N. R. (2025). Pengetahuan gizi, aksesibilitas, dan persepsi regulasi sebagai indikator perilaku konsumsi minuman berpemanis usia 19–22 tahun. *Jurnal Kebijakan Kesehatan Indonesia*, *14*(3). https://doi.org/10.22146/jkki.108161

Aslam, M., Azam, M. B., Latif, F., Jaffar, M., & Haseeb, I. (2023). An exploratory research to assess total nutritional knowledge of students at the University of Lahore, Pakistan. *Health Scope*, *12*(1), e130511. https://doi.org/10.5812/jhealthscope-130511

Badan Kebijakan Pembangunan Kesehatan. (2023). *Survei Kesehatan Indonesia (SKI) 2023 dalam angka*.

Connor Gorber, S., Tremblay, M., Moher, D., & Gorber, B. (2007). A comparison of direct vs. self-report measures for assessing height, weight and body mass index: A systematic review. *Obesity Reviews*, *8*(4), 307–326. https://doi.org/10.1111/j.1467-789X.2007.00347.x

Contento, I. R. (2016). *Nutrition education: Linking research, theory, and practice* (Third). Jones \& Bartlett Learning.

Deforche, B., Van Dyck, D., Deliens, T., & De Bourdeaudhuij, I. (2015). Changes in weight, physical activity, sedentary behaviour and dietary intake during the transition to higher education: A prospective study. *International Journal of Behavioral Nutrition and Physical Activity*, *12*, 16. https://doi.org/10.1186/s12966-015-0173-9

Deliens, T., Clarys, P., De Bourdeaudhuij, I., & Deforche, B. (2014). Determinants of eating behaviour in university students: A qualitative study using focus group discussions. *BMC Public Health*, *14*, 53. https://doi.org/10.1186/1471-2458-14-53

GBD 2021 Adult BMI Collaborators. (2025). Global, regional, and national prevalence of adult overweight and obesity, 1990–2021, with forecasts to 2050: A forecasting study for the Global Burden of Disease Study 2021. *The Lancet*, *405*(10481), 813–838. https://doi.org/10.1016/S0140-6736(25)00355-1

Handayani, O. W. K., Budiono, I., Ediyarsari, P., Setyawati, V. A. V, Rimawati, E., Nasir, S., & Rambing, D. R. (2026). Educational level differences in knowledge and perceptions of sugar-sweetened beverages in Central Semarang. *KEMAS: Jurnal Kesehatan Masyarakat*, *21*(3), 549–554. https://doi.org/10.15294/kemas.v21i3.32654

Hilger-Kolb, J., & Diehl, K. (2019). "Oh God, I have to eat something, but where can I get something quickly?"—A qualitative interview study on barriers to healthy eating among university students in Germany. *Nutrients*, *11*(10), 2440. https://doi.org/10.3390/nu11102440

Kabir, A., Miah, S., & Islam, A. (2018). Factors influencing eating behavior and dietary intake among resident students in a public university in Bangladesh: A qualitative study. *PLOS ONE*, *13*(6), e0198801. https://doi.org/10.1371/journal.pone.0198801

ISSN. 3090-3564
https://journal.barkahpublishing.com/index.php/sp

Kusuma, R., Rahman, T., & Riqzal Firdauz, N. W. (2025). Description of nutritional knowledge and body mass index of college students in Sumenep. *Altius: Jurnal Ilmu Olahraga Dan Kesehatan*, *14*(1), 12–21. https://doi.org/10.36706/altius.v14i1.104

Malik, V. S., & Hu, F. B. (2022). The role of sugar-sweetened beverages in the global epidemics of obesity and chronic diseases. *Nature Reviews Endocrinology*, *18*(4), 205–218. https://doi.org/10.1038/s41574-021-00627-6

Malik, V. S., Pan, A., Willett, W. C., & Hu, F. B. (2013). Sugar-sweetened beverages and weight gain in children and adults: A systematic review and meta-analysis. *The American Journal of Clinical Nutrition*, *98*(4), 1084–1102. https://doi.org/10.3945/ajcn.113.058362

Marhamah, M., Emilia, E., Yusrafiddin, Y., Pakpahan, S., & Rassy, R. (2023). Relationship between employment status and knowledge of balanced nutrition with nutritional status students. *Sport and Nutrition Journal*, *5*(2), 78–86. https://doi.org/10.15294/spnj.v5i2.73484

Michie, S., van Stralen, M. M., & West, R. (2011). The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science*, *6*, 42. https://doi.org/10.1186/1748-5908-6-42

Peltzer, K., Pengpid, S., Samuels, T. A., Özcan, N. K., Mantilla, C., Rahamefy, O. H., Wong, M. L., & Gasparishvili, A. (2014). Prevalence of overweight/obesity and its associated factors among university students from 22 countries. *International Journal of Environmental Research and Public Health*, *11*(7), 7425–7441. https://doi.org/10.3390/ijerph110707425

Scalvedi, M. L., Gennaro, L., Saba, A., & Rossi, L. (2021). Relationship between nutrition knowledge and dietary intake: An assessment among a sample of Italian adults. *Frontiers in Nutrition*, *8*, 714493. https://doi.org/10.3389/fnut.2021.714493

Sogari, G., Velez-Argumedo, C., Gómez, M. I., & Mora, C. (2018). College students and eating habits: A study using an ecological model for healthy behavior. *Nutrients*, *10*(12), 1823. https://doi.org/10.3390/nu10121823

Spronk, I., Kullen, C., Burdon, C., & O'Connor, H. (2014). Relationship between nutrition knowledge and dietary intake. *British Journal of Nutrition*, *111*(10), 1713–1726. https://doi.org/10.1017/S0007114514000087

Story, M., Kaphingst, K. M., Robinson-O'Brien, R., & Glanz, K. (2008). Creating healthy food and eating environments: Policy and environmental approaches. *Annual Review of Public Health*, *29*, 253–272. https://doi.org/10.1146/annurev.publhealth.29.020907.090926

Vadeboncoeur, C., Townsend, N., & Foster, C. (2015). A meta-analysis of weight gain in first year university students: Is freshman 15 a myth? *BMC Obesity*, *2*, 22. https://doi.org/10.1186/s40608-015-0051-7

Vidiawati, D., Werdhani, R. A., Sahar, J., Ekawati, F. M., Dewanti, L., Lestari, P., Surjaningrum, E. R., Sulistiawati, S., & Widyahening, I. S. (2025). Excess body weight and its associated factors among first-year health sciences university students in Indonesia. *PLOS ONE*, *20*(5), e0322773. https://doi.org/10.1371/journal.pone.0322773

Wardle, J., Parmenter, K., & Waller, J. (2000). Nutrition knowledge and food intake. *Appetite*, *34*(3), 269–275. https://doi.org/10.1006/appe.1999.0311

Warner, R. S., & Ha, M.-A. (2017). University students' knowledge, consumption patterns and health perceptions of sugar sweetened beverages (SSB). *EC Nutrition*, *11*(6), 223–232. https://arro.anglia.ac.uk/id/eprint/702433

Werkhoven, T., Cotton, W., & Russell, K. (2014). Pre-service health and physical education teachers' obesity-related nutrition knowledge and food habits. *Journal of the Home Economics Institute of Australia*, *21*(3), 2–11. https://ueaeprints.uea.ac.uk/id/eprint/59560/

World Health Organization. (2015). *Guideline: Sugars intake for adults and children*.

World Health Organization. (2021). *Obesity and overweight*. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

Worsley, A. (2002). Nutrition knowledge and food consumption: Can nutrition knowledge change food behaviour? *Asia Pacific Journal of Clinical Nutrition*, *11*(Suppl. 3), S579--S585. https://pubmed.ncbi.nlm.nih.gov/12492651/

Yahia, N., Brown, C. A., Rapley, M., & Chung, M. (2016). Level of nutrition knowledge and its association with fat consumption among college students. *BMC Public Health*, *16*, 1047. https://doi.org/10.1186/s12889-016-3728-z