

DIGITAL FOOD DELIVERY AND ULTRA-PROCESSED FOOD CONSUMPTION: ASSESSING THE NUTRITIONAL PROFILE OF UNIVERSITY STUDENTS IN PAREPARE CITY

Ade Triardana Damas Fardillah Mustari^{1*}, Haniarti¹, Fitriani Umar¹, Makhrajani Majid²

¹Nutrition Study Program, Universitas Muhammadiyah Parepare, Indonesia

²Public Health Study Program, Universitas Muhammadiyah Parepare, Indonesia

*Corresponding author email address: adetriardanadamasfardillah@gmail.com

Article History

Received 11 July 2026

Accepted 22 August 2026

Keyword

Adolescents
Energy Intake
Energy Adequacy
MBG
Nutritional Status

DOI

10.69632/jgkk.v4i01.114

Abstract

Background: Ultra-processed food (UPF) consumption among university students has risen alongside the widespread adoption of food delivery apps (FDA), yet its link to nutritional status remains inconsistent. **Objective:** This study aimed to assess the association between FDA usage intensity, UPF consumption, and nutritional status among university students in Parepare City. **Methods:** A cross-sectional study was conducted among 99 active students from four universities in Parepare City, selected through quota accidental sampling. FDA usage intensity and UPF consumption were assessed using a questionnaire and the FFQ-NOVA, nutritional status was determined from body mass index (BMI), and macronutrient adequacy was measured using a 2×24-hour food recall. Variables were analyzed using the Chi-Square/Fisher's Exact test. **Results:** Overweight and obesity together affected 26.3% of respondents, while underweight affected 20.2%; notably, all respondents (100%) had deficient energy and fiber intake. FDA usage intensity was significantly associated with UPF consumption ($p=0.002$), with 60.3% of FDA users falling into the frequent UPF consumption category. UPF consumption was not significantly associated with nutritional status ($p=0.689$), nor was FDA usage intensity associated with the adequacy of protein ($p=0.639$), fat ($p=0.466$), or carbohydrate ($p=0.364$) intake. **Conclusion:** FDA use is significantly associated with higher UPF exposure but is not significantly associated with nutritional status or macronutrient adequacy among students. The universal deficiency in energy and fiber intake highlights a critical nutritional concern independent of FDA use. Nutrition education, including guidance embedded within food delivery platforms, is recommended to encourage healthier food choices.



This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.

Introduction

Nutrition-related issues persist as a major public health concern among young adults within Indonesia, largely driven by the simultaneous prevalence of undernutrition

and overnutrition, a condition commonly referred to as the double burden of malnutrition (1). Information derived from the 2018 Basic Health Research (Riskesdas) demonstrated that the proportion of overnutrition (overweight and obesity combined) among adults aged ≥ 18 years reached 35.4%, while undernutrition stood at 8.7%. This upward trend in overnutrition continued in the 2023 Indonesian Health Survey (SKI), in which obesity alone a subset of the broader overnutrition category was reported at 23.4%, indicating a continuing shift in dietary patterns and lifestyle.

University students, as part of the young adult population, are vulnerable to nutritional problems due to lifestyle changes as they move from the family environment to independent living, with dietary patterns that tend to be irregular and dominated by foods high in energy but low in nutrients (2). One notable shift in eating habits is the rising intake of ultra-processed food (UPF) industrially manufactured products categorized under the NOVA classification system, generally characterized by high sugar, sodium, and fat content alongside low levels of dietary fiber and micronutrients (3). An umbrella review by Lane et al. (2024) which encompassed nearly 10 million participants, found that high UPF consumption was significantly linked to a greater likelihood of developing obesity, cardiovascular disease, and type 2 diabetes. An experimental investigation conducted by Hall et al. (2019) further demonstrated that a menu rich in UPF increased energy intake by approximately 500 kcal per day and triggered weight gain within a short period. In this context, digitalization particularly through food delivery platforms has increasingly served as an enabler that smooths students' everyday access to UPF, reshaping how eating habits are formed among this population.

The advancement of digital-based technology has further driven alterations in student eating habits. This is largely triggered by the widespread adoption of Food Delivery Applications (FDA), hereafter used interchangeably with the term "food delivery services," such as GoFood, GrabFood, ShopeeFood, and MaximFood. The ease and swiftness in obtaining meals, combined with various attractive promotions like discounts and free shipping fees, can encourage impulsive buying tendencies toward food items dominated by fast food and sugary beverages classified as UPF (6). The convenience of FDA platforms may also inadvertently reduce students' exposure to fresh, varied food options, as menu selections are often dominated by processed and ready-to-eat items; this pattern could plausibly contribute to inadequate intake of dietary fiber and other essential nutrients among frequent users. Beyond compositional shifts, reliance on FDA may also encourage irregular eating behaviors such as skipping meals or ordering disproportionately small portions for convenience, patterns that could plausibly underlie the undernutrition side of the double burden and align with the low energy adequacy and underweight prevalence observed among students in this study. Nevertheless, research findings concerning the correlation between the intensity of FDA usage and UPF dietary

patterns alongside nutritional status continue to show discrepancies. Keeble et al. (2020) found that individuals who frequently utilize food delivery services tend to have less healthy dietary patterns, while Li et al. (2020) recorded an elevation in energy intake among users of these platforms. In contrast, Stephens et al. (2020) identified no meaningful relationship between how often someone uses FDA and their nutritional status. These conflicting findings indicate the need for further investigation, particularly among the student population.

As a medium-sized satellite city and emerging educational hub in South Sulawesi undergoing rapid digital transition, Parepare City is home to several universities whose students as digital natives embedded in an urban lifestyle actively use digital technology, including food delivery apps, in their daily lives. To date, limited research has examined how FDA use, UPF consumption, and nutritional status intersect among students in secondary cities such as Parepare, despite the rapid growth of FDA platforms in such areas. Considering the background outlined previously, this study focuses on investigating the correlation between FDA usage intensity, UPF consumption, nutritional status, coupled with the adequacy of macronutrient consumption among college attendees within Parepare City. This study hypothesizes that higher FDA usage intensity is associated with increased UPF consumption and poorer nutritional profiles among students.

Materials and Methods

This research utilized a quantitative framework featuring an analytical observational design adopting a cross-sectional approach, intended to investigate associations among research parameters without implementing follow-up procedures. The investigation took place spanning the period from May to July 2026 at four universities in Parepare City, South Sulawesi, namely Universitas Muhammadiyah Parepare (UMPAR), the State Islamic Institute (IAIN) Parepare, the Bacharuddin Jusuf Habibie Institute of Technology (ITH), and STIKES Fatima Parepare. The study locations were selected based on the consideration that the four institutions are located in different sub-districts of Parepare City, allowing them to represent student characteristics from various areas, and that food delivery app services were accessible at all four locations.

The research population encompassed the entirety of active undergraduate students enrolled across the four institutions during the 2025/2026 academic year, with a total population of 9,675 students (UMPAR 1,908; IAIN Parepare 5,822; ITH 1,740; and STIKES Fatima Parepare 205). To determine the minimum sample requirement, researchers applied the Slovin formula incorporating a 10% margin of error, which resulted in a total count of 99 participants distributed proportionally across the four institutions using a quota accidental sampling technique. A quota was predetermined for

each institution prior to data collection based on its proportional share of the total student population (UMPAR: 19; IAIN Parepare: 60; ITH: 18; STIKES Fatima Parepare: 2 participants), after which respondents meeting the inclusion criteria within each institution were recruited accidentally until the corresponding quota was fulfilled.

The frequency of FDA utilization was evaluated utilizing a structured questionnaire adapted from Shovianti et al. (2024) and categorized into frequent (≥ 3 times/week), infrequent (< 3 times/week), and never (0 times/week) (10). The intake level of UPF was quantified through a Food Frequency Questionnaire based on the NOVA classification (FFQ-NOVA) covering the previous month, with frequent and infrequent categories determined based on the mean total score, following a normality test that confirmed a normally distributed dataset. The evaluation of nutritional condition was established relying upon Body Mass Index (BMI) derived from direct anthropometric measurements of body weight, obtained using a calibrated digital body weight scale, and height, obtained using a calibrated microtoise stadiometer, both instruments having been calibrated prior to data collection, categorized as underweight, normal, overweight, and obese (11).

The sufficiency levels regarding energy, protein, fat, carbohydrate, and dietary fiber consumption were examined employing a 2×24-hour food recall conducted on two non-consecutive days, comprising one weekday and one weekend day to better capture variation in students' eating patterns, evaluated against the 2019 Recommended Dietary Allowance (RDA) and the national Pedoman Gizi Seimbang (Permenkes No. 41/2014), with categories of deficient ($< 80\%$ RDA), adequate (80-110% RDA), and excessive ($> 110\%$ RDA). To minimize recall bias during FFQ-NOVA and food recall data collection, enumerators provided verbal explanations and household-based portion-size aids to help respondents estimate their household serving sizes (URT) as accurately as possible.

Data were analyzed univariately to describe respondent characteristics and variable distributions, and bivariately using the Chi-Square or Fisher's Exact test in SPSS to examine associations between variables, with a significance level of $\alpha = 0.05$. For the bivariate analyses (Tables 4 and 6), the "frequent" and "infrequent" FDA usage categories were combined into a single "frequent+infrequent" group and compared against the "never" group, as the expected cell counts within the original three-category structure did not meet the minimum requirement for a valid Chi-Square test. This study received ethical approval from the Health Research Ethics Committee (KEPK) of Institut Nani Hasanuddin, No. 236/INSTITUT-NH/KEPK/VII/2026.

Results

Table 1 Respondent characteristics by sex and age

Characteristic	n	%
Sex		
Male	35	35.4
Female	64	64.6
Age (years)		
19 – 20	41	41.4
21 – 22	51	51.5
>22	7	7.1
Nutritional Status		
Underweight	20	20.2
Normal	53	53.5
Overweight	9	9.1
Obese	17	17.2
FDA Usage Intensity		
Frequent + Infrequent	63	63.6
Never	36	36.4
UPF Consumption		
Infrequent	51	51.5
Frequent	48	48.5
Total	99	100.0

Table 1 shows that the study respondents were predominantly female (64 students, 64.6%), while male respondents accounted for 35 students (35.4%). Most respondents were aged 20 and 21 years (27.3% each), followed by those aged 22 years (24.2%) and 19 years (14.1%), while respondents older than 22 years accounted for a relatively small proportion (7.1%). Respondents had a normal nutritional status (53.5%), while obesity was found in 17.2% of respondents, underweight in 20.2%, and overweight in 9.1%. Based on FDA usage intensity, the majority of respondents (63.6%) were classified as FDA users (either frequent or infrequent). The distribution of UPF consumption showed a relatively balanced proportion between the infrequent (51.5%) and frequent (48.5%) categories.

Table 2 shows that all respondents (100%) fell into the deficient category for energy and fiber intake, while deficient intake also dominated for protein, fat, and carbohydrate, indicating that overall nutrient intake adequacy among respondents remained low across all macronutrients. As this finding relies on a self-reported 2×24-

hour food recall, the universally low energy and fiber adequacy should be interpreted with some caution given the method's susceptibility to recall inaccuracy and under-reporting; this reliability consideration is examined further in the discussion.

Table 2 Distribution of respondents by nutrient adequacy level

Nutrient	Deficient		Adequate		Excessive		Total	
	n	%	n	%	n	%	n	%
Energy	99	100.0	0	0.0	0	0.0	99	100.0
Protein	60	60.6	17	17.2	22	22.2	99	100.0
Fat	58	58.6	27	27.3	14	14.1	99	100.0
Carbohydrate	98	99.0	1	1.0	0	0.0	99	100.0
Fiber	99	100.0	0	0.0	0	0.0	99	100.0

Note: Based on 2×24-hour food recall compared with the 2019 Recommended Dietary Allowance (RDA).

The association between Food Delivery Application (FDA) usage intensity and Ultra Processed Food (UPF) consumption among respondents (N = 99) is summarized in Table 3. Bivariate analysis revealed a statistically significant relationship between the intensity of FDA usage and the frequency of UPF consumption ($p = 0.002$). Respondents who used FDAs (combining the frequent and infrequent categories) demonstrated a higher proportion of frequent UPF consumption (60.3%; $n = 38$) compared to those categorized as infrequent UPF consumers (39.7%; $n = 25$). Conversely, among respondents who never used FDAs, the majority reported infrequent UPF consumption (72.2%; $n = 26$), with only 27.8% ($n = 10$) engaging in frequent UPF consumption. Overall, 48.5% ($n = 48$) of the total sample were frequent UPF consumers, while 51.5% ($n = 51$) consumed UPFs infrequently. These results indicate that the utilization of food delivery applications is significantly associated with an increased likelihood of consuming ultra-processed foods.

Table 3 Association between Food Delivery Application (FDA) Usage Intensity and Ultra Processed Food (UPF) Consumption

FDA Usage Intensity	UPF Consumption						p value
	Frequent		Infrequent		Total		
	n	%	n	%	N	%	
Frequent + Infrequent	38	60.3	25	39.7	63	100.0	0.002
Never	10	27.8	26	72.2	36	100.0	
Total	48	48.5	51	51.5	99	100.0	

*Fisher's Exact test; **Chi-Square test, used according to the expected cell count in each analysis.

Table 4 Association between Food Delivery Application (FDA) Usage Intensity and Protein Intake Adequacy

FDA Usage Intensity	Adequate		Deficient		Excessive		p value
	n	%	n	%	n	%	
Intake Adequacy (Protein)							
Frequent + Infrequent	12	19.0	36	57.1	15	23.8	0.639**
Never	5	13.9	24	66.7	7	19.4	
Total	17	17.2	60	60.6	22	22.2	
Intake Adequacy (Fat)							
Frequent + Infrequent	19	30.2	34	54.0	10	15.9	0.466**
Never	8	22.2	24	66.7	4	11.1	
Total	27	27.3	58	58.6	14	14.1	
Intake Adequacy (Carbohydrate)							
Frequent + Infrequent	0	0.0	63	100.0	63	100.0	0.364*
Never	1	2.8	35	97.2	36	100.0	
Total	1	1.0	98	99.0	99	100.0	

Based on the bivariate analysis in Table 4 (N = 99), there was no statistically significant association between Food Delivery Application (FDA) usage intensity and the intake adequacy of any macronutrient, including protein (p = 0.639), fat (p = 0.466), and carbohydrates (p = 0.364). Regarding protein adequacy, the FDA user group (*Frequent + Infrequent*) comprised 19.0% (n = 12) respondents with adequate intake, 57.1% (n = 36) with deficient intake, and 23.8% (n = 15) with excessive intake, which was proportionally similar to the non-user group (*Never*) where 13.9% (n = 5) were adequate, 66.7% (n = 24) were deficient, and 19.4% (n = 7) were excessive. A homogeneous pattern was also observed in fat adequacy, where 30.2% (n = 19) of FDA users had adequate intake, 54.0% (n = 34) were deficient, and 15.9% (n = 10) were excessive, compared to the non-user group which recorded 22.2% (n = 8) adequate intake, 66.7% (n = 24) deficient intake, and 11.1% (n = 4) excessive intake. Meanwhile, carbohydrate intake adequacy demonstrated a dominant deficit pattern across the entire sample, where all FDA users (100.0%; n = 63) experienced a carbohydrate deficiency, and among non-users, only 2.8% (n = 1) achieved adequate intake while the remaining 97.2% (n = 35) were categorized as deficient.

Table 5 shows that the distribution of nutritional status was relatively similar between the infrequent and frequent UPF consumption groups. The Chi-Square test showed a p-value of 0.689 (p>0.05), indicating no statistically significant association

between UPF consumption and nutritional status among university students in Parepare City. This null result should be interpreted with caution, as grouping nutritional status into three categories particularly the combined Overweight+Obese group required to meet Chi-Square assumptions may have reduced sensitivity to detect an association that could be more apparent when BMI is analyzed as a continuous variable, a possibility discussed further below.

Table 5 Association between Ultra-Processed Food Consumption and Nutritional Status

UPF Consumption	Nutritional Status								p value
	Underweight		Normal		Overweight+Obese		Total		
	n	%	n	%	n	%	n	%	
Infrequent	9	17.6	27	52.9	15	29.4	51	100.0	0.689
Frequent	11	22.9	26	54.2	11	22.9	48	100.0	
Total	20	20.2	53	53.5	26	26.3	99	100.0	

Note: Overweight and Obese categories were combined into "Overweight+Obese" to meet the minimum expected cell count assumption of the Chi-Square test.

Discussion

This study found a significant association between FDA usage intensity and UPF consumption, while no significant association was observed between UPF consumption and nutritional status, nor between FDA usage intensity and macronutrient adequacy. Respondents were predominantly female (64.6%), consistent with the general pattern in health and nutrition fields, which tend to attract more female students. In terms of age, respondents ranged from 19 to 26 years and were concentrated in the 20-21-year age group (27.3% each), indicating that most respondents fell into the young adult category, as is typical among active undergraduate students. This demographic profile young, largely female, and digitally engaged represents a key target segment for FDA platforms, underscoring the relevance of examining their food-related digital behavior.

Association between FDA Usage Intensity and Ultra-Processed Food Consumption

The results showed an association between FDA usage intensity and UPF consumption. A notable pattern was observed among respondents who used FDA (either frequently or infrequently), of whom 60.3% had frequent UPF consumption. This condition indicates that frequent UPF consumption was found not only among students who used FDA regularly, but also among those who used FDA infrequently. Meanwhile, among respondents who never used FDA, the majority (72.2%) had infrequent UPF consumption. This condition illustrates that the absence of FDA use was associated with

lower exposure to food obtained through delivery services. Based on interview results, respondents who did not use FDA obtained most of their food through direct purchase. However, direct purchase does not always lead to high UPF consumption, since the food choices obtained by respondents may come from various food types, not all of which fall under the UPF category. This may help explain why most respondents who never used FDA fell into the infrequent UPF consumption category.

Among respondents who used FDA infrequently, high UPF consumption may be related to their FDA usage characteristics. Based on the questionnaire results, GrabFood/GrabMart was the most widely used application, with orders mostly placed in the evening to obtain food or snacks. Promotions or discounts, as well as convenience, were also commonly cited reasons for using FDA. Meanwhile, the types of UPF consumed by respondents included packaged snacks or chips, packaged biscuits or wafers, contemporary coffee or tea beverages, and fried chicken. This condition indicates that the ease of obtaining food through FDA can facilitate access to various food products classified as UPF. These outcomes align with the research conducted by Eu along with Sameeha (2021), which demonstrated that leveraging food delivery services connects to the food choices available on the platform, including fast food and sweetened beverages (12). In addition, Kaur et al. (2021) explained that perceived price value and convenience are factors related to FDA use (13). This parallels what was discovered in current research, wherein promotions or discounts and convenience were the reasons most frequently cited by respondents for using FDA.

The tendency of respondents to order snacks and beverages such as contemporary coffee or tea, packaged snacks, and fried chicken in the evening also points to a broader pattern consistent with hedonic eating food consumption driven by psychological factors such as academic stress, late-night study sessions, or peer influence rather than purely homeostatic energy needs. Evening promotions and discounts offered by FDA platforms may further stimulate impulsive purchasing during this period. This pattern reflects what has been described in the literature as a digital obesogenic food environment, in which algorithm-driven marketing and round-the-clock accessibility make it easier for students to obtain energy-dense, nutrient-poor foods outside regular mealtimes, potentially reinforcing patterns associated with night eating behavior and circadian disruption of metabolism.

Association between Ultra-Processed Food Consumption and Nutritional Status

The results showed no significant association between UPF consumption and nutritional status among university students in Parepare City. The pattern observed in both UPF consumption groups showed that normal nutritional status was the most common category, both among respondents with infrequent and frequent UPF

consumption, with relatively similar proportions in both groups, indicating that differences in UPF consumption frequency did not clearly correspond to differences in nutritional status. This condition suggests that the frequency of UPF consumption does not directly determine respondents' nutritional status. Although frequent UPF consumption was found among some respondents, normal nutritional status remained the dominant category. This may occur because nutritional status is not only influenced by UPF consumption, but is also related to overall dietary patterns and the balance between energy intake and the body's needs. Thus, frequent UPF consumption is not always followed by excess nutritional status.

This particular outcome aligns closely with the investigation carried out by Mutawakillah et al. (2025) among Public Health students at UIN Jakarta, which found no significant association linking UPF consumption coupled with nutritional condition measured relying on body mass index ($p=0.160$) (14). This finding indicates that high UPF consumption is not always followed by increased overnutrition, so UPF consumption should be viewed as only one part of respondents' overall dietary pattern. Beyond multifactorial dietary influences, the absence of a significant association between UPF consumption and nutritional status in this study may also be explained by the age profile of respondents, who were predominantly young adults with a potentially higher basal metabolic rate and variable levels of unmeasured campus-based physical activity, both of which could buffer short-term excess energy intake. This metabolic buffering mechanism is highly consistent with the findings of Afranissa et al. (2026), who studied adolescents in East Jakarta and Bekasi and suggested that high adolescent metabolic rates (BMR) temporarily mask the acute impacts of high UPF consumption, leading to no immediate significant association with nutritional status ($p=0.955$).

In addition, because this study employed a cross-sectional design, it captures only a single point in time, whereas measurable changes in body mass index resulting from sustained UPF exposure typically accumulate over a longer period. The lack of a significant association observed here should therefore not be interpreted as an absence of risk, but rather as a limitation of the study's temporal scope in detecting a relationship that may only become apparent through longitudinal observation. Future studies may also consider analyzing BMI as a continuous variable rather than a categorical one, as categorization can sometimes obscure associations that are present at a finer level of measurement.

Association between FDA Usage Intensity and Macronutrient Intake Adequacy

The results showed that FDA usage intensity was not significantly associated with the adequacy of protein, fat, or carbohydrate intake among university students in Parepare City. The consumption pattern showed that the deficient category remained dominant among respondents who used FDA infrequently or never used it. For protein

adequacy, the proportion of respondents in the deficient category reached 57.1% among FDA users and 66.7% among those who never used FDA. An even stronger pattern was observed for carbohydrate adequacy, where all respondents who used FDA infrequently fell into the deficient category (100%), while 97.2% of those who never used FDA fell into the same category.

The dominance of the deficient category in both FDA usage groups indicates that low macronutrient intake adequacy is not solely related to FDA use. Based on the 2×24-hour food recall and interview results, this condition may be linked to respondents' irregular dietary patterns, including low meal frequency and relatively small portion sizes. Respondents also tended to prioritize simply having a meal over paying attention to nutrient balance at each meal. Under these conditions, both FDA users and non-users may have protein, fat, and carbohydrate intakes that do not meet their daily requirements. This raises the question of whether students' definition of feeling 'full' has shifted toward smaller, more convenient portions, or whether economic constraints limit the food volume they can afford to order both of which merit further exploration in future studies.

An apparent paradox emerges when comparing the universal deficiency in energy and fiber intake with the comparatively high UPF consumption observed among respondents, since UPF is typically energy-dense. This discrepancy may indicate a degree of under-reporting bias, a phenomenon commonly encountered in self-reported dietary assessment methods such as the food recall, wherein respondents particularly those who are overweight or obese may under-report actual intake or misestimate household serving sizes (URT), whether unintentionally or due to social desirability bias; this possibility should be acknowledged as a limitation affecting the interpretation of the deficient intake findings. Separately, the underweight group, which comprised 20.2% of respondents a higher proportion than obesity (17.2%) warrants specific attention. It remains unclear whether FDA use and UPF consumption among underweight student function as an accessible means of meeting energy needs despite continued inadequacy, or conversely, as a substitute for more balanced home-prepared meals; this question merits further investigation in future research.

FDA use itself is more related to convenience in obtaining food than to ensuring nutrient adequacy. This is consistent with Kaur et al. (2021), who explained that perceived convenience and price are key considerations in FDA use, meaning that the decision to use delivery services is based more on convenience and perceived benefit than on considerations of nutritional adequacy (13). Therefore, FDA use does not necessarily result in better nutrient adequacy, as intake adequacy remains influenced by the type, amount, and overall dietary pattern of the respondents.

Conclusion

This study of 99 students from four universities in Parepare City found that FDA usage intensity was significantly associated with ultra-processed food (UPF) consumption, but not with nutritional status or the adequacy of protein, fat, and carbohydrate intake. Notably, all respondents showed deficient energy and fiber intake, and underweight prevalence (20.2%) exceeded obesity prevalence (17.2%) findings that warrant urgent attention regardless of FDA usage. These results suggest that the quality and diversity of food choices matter more than the frequency of FDA use itself, and that nutritional interventions among students should address both overnutrition and undernutrition. Collaborative measures such as nutritional labeling on FDA platforms, "healthier choice" filters, and nutrition education targeting late-night snacking are recommended. This study is limited by its cross-sectional design, reliance on self-reported dietary data, accidental sampling across only four universities, and a relatively small sample size (n=99), which may have reduced statistical power to detect true associations.

Acknowledgements

The authors would like to thank the Health Research Ethics Committee (KEPK) of Institut Nani Hasanuddin, Universitas Muhammadiyah Parepare (UMPAR), the State Islamic Institute (IAIN) Parepare, the Bacharuddin Jusuf Habibie Institute of Technology (ITH), and STIKES Fatima Parepare, all students who participated as respondents, and the research supervisors for their guidance and direction throughout this study.

References

1. Muharram FR, Tjandra S, Madani NJ, Rokx C, Abdullah A. Trends in the double burden of malnutrition among Indonesian adults, 2007 to 2023. *Sci Rep.* 2025 Oct 7;15:34883. doi:10.1038/s41598-025-17348-9 PubMed PMID: 41057404; PubMed Central PMCID: PMC12504651.
2. Wisnuwardani RW, Noviasy R, Saputri A, Kurniawati ER. Changes of Physical Activity and Ultra-Processed Food Consumption in College students during Covid-19 Pandemic: An Observational Study: *Media Gizi Indones.* 2022 Sep 30;17(3):293–301. doi:10.20473/mgi.v17i3.293-301
3. Monteiro CA, Cannon G, Levy RB, Moubarac JC, Louzada ML, Rauber F, et al. Ultra-processed foods: what they are and how to identify them. *Public Health Nutr.* 2019 Apr;22(5):936–41. doi:10.1017/S1368980018003762
4. Lane MM, Gamage E, Du S, Ashtree DN, McGuinness AJ, Gauci S, et al. Ultra-processed food exposure and adverse health outcomes: umbrella review of epidemiological meta-analyses. *BMJ.* 2024 Feb 28;e077310. doi:10.1136/bmj-2023-077310
5. Hall KD, Ayuketah A, Brychta R, Cai H, Cassimatis T, Chen KY, et al. Ultra-Processed Diets Cause Excess Calorie Intake and Weight Gain: An Inpatient Randomized

- Controlled Trial of Ad Libitum Food Intake. *Cell Metab.* 2019 Jul;30(1):67-77.e3. doi:10.1016/j.cmet.2019.05.008
6. Vashtianada A, Setiarini A, Sartika RAD. The Difference of Ultra-Processed Food Consumption based on Individual Characteristics and Other Factors among Non-Health Undergraduate Students in Universitas Indonesia in 2023. *Indones J Public Health Nutr.* 2023;4(1). doi:10.7454/ijphn.v4i1.7393
 7. Keeble M, Adams J, Sacks G, Vanderlee L, White CM, Hammond D, et al. Use of Online Food Delivery Services to Order Food Prepared Away-From-Home and Associated Sociodemographic Characteristics: A Cross-Sectional, Multi-Country Analysis. *Int J Environ Res Public Health.* 2020;17(14):5190. doi:10.3390/ijerph17145190
 8. Li C, Miroso M, Bremer P. Review of Online Food Delivery Platforms and their Impacts on Sustainability. *Sustainability.* 2020;12(14):5528. doi:10.3390/su12145528
 9. Stephens J, Miller H, Militello L. Food Delivery Apps and the Negative Health Impacts for Americans. *Front Nutr.* 2020;7:14. doi:10.3389/fnut.2020.00014
 10. Shovianti N, Simanjuntak BY, Okfrianti Y. Frekuensi menggunakan aplikasi delivery food dan indeks massa tubuh (IMT) pada mahasiswa Poltekkes Bengkulu. *J SAGO Gizi Dan Kesehat.* 2024;5(3B):1063. doi:10.30867/gikes.v5i3B.2033
 11. Novianti A, Widodo ZN, Shidiqah RS. Edukasi Gizi Efektif terkait Gizi Seimbang melalui Media Permainan dan Talkshow #Nasihatsehat untuk Warga Jakarta pada Kegiatan Jakarta Future Festival (JFF) 2025. *J Abdimas Indones.* 2026 Mar 31;6(1):631-6. doi:10.34697/jai.v6i1.2831
 12. Eu EZR, Sameeha MJ. Consumers' Perceptions of Healthy Food Availability in Online Food Delivery Applications (OFD Apps) and Its Association with Food Choices Among Public University Students in Malaysia. *Front Nutr.* 2021 Aug 23;8:674427. doi:10.3389/fnut.2021.674427
 13. Kaur P, Dhir A, Talwar S, Ghuman K. The value proposition of food delivery apps from the perspective of theory of consumption value. *Int J Contemp Hosp Manag.* 2021;33(4):1129-59. doi:10.1108/IJCHM-05-2020-0477
 14. Mutawakillah H, Sari R, Afiva N, Thahara A, Nurchalizah R, Rosidati C, et al. The Relationship between Ultra-Processed Food Consumption and Nutritional Status: A Cross-Sectional Study on Public Health Students at UIN Jakarta. *J Ilmu Gizi Dan Diet.* 2025;4(1):9-14. doi:10.25182/jigd.2025.4.1.9-14
 15. Firdausiyah A, Rahmawati LA, Irawan AMA. The Relationship Between Ultra-Processed Food and Beverage Consumption Patterns, Blood Glucose Levels, and Nutritional Status Among Adolescents. *J Gizi Dan Kesehat Kel.* 2026 Jan 31;3(2):75-81. doi:10.69632/jgkk.v3i2.77