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Inadequate Dietary Diversity among Female Students in Southeast Sulawesi, Indonesia: Influences of Parental Education and Food Budget

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Abstract

Background: Young people in Indonesia persistently grapple with nutritional challenges. Regrettably, there has been insufficient research addressing their distinct nutritional requirements.

Objective: This study aims to describe the dietary diversity of female students in Southeast Sulawesi and investigate the associated factors.

Methods: A cross-sectional study was conducted among female students in the Public Health Faculty of Halu Oleo University. Using random sampling, 280 participants were selected from five different departments within the faculty. Minimum dietary diversity for women (MDD-W) was assessed using a single 24-hour recall. A cut-off value of 5 was used to determine whether the recommendation was met. Multiple logistic regression was performed to examine the association between independent variables and MDD-W.

Results: The mean (±SD) dietary diversity score of the participants was 3.6±1.1, with only 33.3% meeting the minimum recommendation for dietary diversity. In the multivariate analysis, higher maternal education (AOR: 4.4; 95% CI: 2.0, 9.6), higher paternal education (AOR: 3.2; 95% CI: 1.2, 8.2), and monthly food budget (AOR: 1.9; 95% CI: 1.0, 3.7) were significantly associated with achieving adequate dietary diversity.

Conclusion: The lack of dietary diversity not only poses risks of malnutrition but also exacerbates prevalent health concerns like anemia and obesity among young people in the region. The significant role of parental education and economic dependency on dietary habits highlights the need for comprehensive interventions.

Keywords: Dietary diversity; nutritional status; female student; Indonesia

Background

The World Health Organization (WHO) defines age groups from 10 to 19 as "adolescents" and from 15 to 24 as "youth," while encompassing "young people" from ages 10 to 24 (World Health Organization, 2020). In Indonesia, this demographic constitutes 24% of the total population of 270 million (Indonesian

Central Bureau of Statistics, 2020), emphasizing the urgent need to prioritize their nutritional and health needs to avert future health crises.

Despite being a significant demographic, Indonesian young people grapple with persistent nutritional challenges, as underscored by data from the 2018 Basic Health Research report. This report reveals alarming statistics, including 27% of adolescents aged 16 to 18 classified as underweight, 13.5% as overweight or obese, and 22.7% of adolescent girls afflicted with anemia (Kementerian Kesehatan RI, 2018a). Furthermore, infectious diseases stand out as the leading cause of death among young females (Ning Sulistiyowati & Felly P Senewe, 2014), underscoring the severity of health risks associated with inadequate nutrition. Despite these alarming statistics, young female nutrition remains a neglected area in public health discourse, resulting in a noticeable gap in research addressing their specific nutritional requirements.

The dietary behaviors of young people significantly influence their nutritional status. Studies conducted across various regions of Java Island shed light on prevalent suboptimal dietary practices among Indonesian adolescents. For instance, a cross-sectional study among adolescents from low socioeconomic backgrounds in Jakarta revealed that less than 30% consumed fruits and fewer than 20% included milk in their diets across nine assessed food groups (Rachmalina et al., 2019). Similarly, in West Java, a mere 5.7% of adolescents exhibited a high level of dietary diversity, indicating a lack of balanced nutrition within this demographic (Agustina et al., 2020).

In Southeast Sulawesi (SE Sulawesi), where stunting prevalence among toddlers reaches 30% and dietary diversity rates remain low at 52.5% (Kementerian Kesehatan RI, 2018b), addressing the nutritional needs of young females becomes paramount. Stunting, often an intergenerational issue, persists due to undernourished mothers, accentuating the crucial role of young females in breaking this cycle. However, the scarcity of nutritional data for this demographic in SE Sulawesi presents a significant challenge. Thus, this study aims to investigate the dietary diversity of female adolescents in SE Sulawesi and explore associated factors to inform evidence-based interventions.

Methods

Study design and participants

During the odd semester from March to April 2021, a cross-sectional study was conducted among female students at the Public Health faculty of Halu Oleo University, situated in Kendari City, the capital of Southeast Sulawesi Province. The selection of this university was based on its significance within the province, hosting a substantial student population and serving as the primary choice for young individuals across various regions in Southeast Sulawesi seeking higher education. The sample size was determined using a single population proportion method (Pourhoseingholi et al., 2013). The prevalence of minimum dietary diversity among adult women, sourced from a prior study in eastern Indonesia, was considered at 76% (Gibson, Stacey, Sunderland, & Adhuri, 2020), a 95% confidence interval and a 5% margin of error were also taken into account. Participants were randomly selected from five different departments within the public health faculty, and all provided informed consent. The study protocol received ethical approval from the Research Ethics Committee of the Public Health Association under clearance Number 96/KEPK-IAKMI/IX/2022.

Data collection

The study required respondents to fill out an online questionnaire that was distributed via email. Clear instructions were provided prior to the distribution of the questionnaire. The questionnaire was divided into two sections: demographic information and nutrition knowledge. Demographic questions covered a range of topics such as major of study, age, religion, ethnicity, parent's education, parent's occupation, family size, cost of monthly food expenses, and ownership.

To gather dietary information, we used a 24-hour food recall method. All participants were asked to detail the foods and drinks they consumed within the past day, including their composition (DeBiasse et al., 2018). We assessed the minimum dietary diversity for women (MDD-W) based on ten food groups, which included staple foods (grains, white roots, tubers, and plantains), pulses (beans, peas, and lentils), nuts and seeds, milk and milk products, flesh foods (meat, poultry, and fish), eggs, dark green leafy vegetables, vitamin A-rich fruits and vegetables, other vegetables, and other fruits. Each food group was counted only once, resulting in a score of 0 to 10. To achieve adequate dietary diversity, the participant had to consume at least five food groups within the last 24 hours, with anything less considered poor dietary diversity (FAO, 2021).

A highly trained research assistant in the nutrition laboratory carried out anthropometric assessments and hemoglobin measurements. The participant's height was accurately measured using a stadiometer and recorded to the nearest 0.1 cm. Body weight and BMI were precisely measured using the Karada scan 375 after entering the participant's height, age, and gender into the machine. BMI was categorized into four groups: underweight (BMI <18.5), normal weight (18.5 to 23), overweight (>23 to 27.5), and obese (>=27.5) (World Health Organization, 2004). Mid-upper-arm circumference (MUAC) was meticulously measured using non-stretch tape and recorded to the nearest 0.1 cm. Participants with MUAC below 23 were identified as having an energy chronic deficiency. All anthropometric measurements were duplicated, adhering strictly to WHO's standard procedure (Cashin & Oot, 2018).

The level of hemoglobin in the blood was determined using the Easy Touch GCHb, a reliable and non-invasive digital device that has been validated through research. A small capillary blood was obtained by pricking the finger with a lancet and collected in a micro cuvette for analysis. The classification of hemoglobin levels complied with the World Health Organization's recommended guidelines, with normal levels being at or above 12 g/dl, mild being between 10-11.9 g/dl, moderate being between 7.0-9.9 g/dl, and severe being less than 7 g/dl.

Data quality control and statistical analysis

The principal author conducted daily checks to ensure the accuracy and completeness of the collected data. Subsequently, the data were inputted into MS Excel and underwent a process of cleaning, coding, and analysis using SPSS version 18. Descriptive statistics including number as percent and mean ± SD were calculated, as appropriate. Logistic regression analysis was performed to determine the odds ratio (OR) and 95% CI. Only the strongest predictor variables with $p< 0.25$ from the univariate analyses were included. Variables entered in the model include age group, father's occupation, mother's occupation, breakfast practice, dieting, nutritional knowledge, food purchasing behaviors, and monthly food budget. A p-value of < 0.05 indicated statistical significance.

RESULT

Socio-demographic, eating behavior, anthropometric and biochemical characteristics of female university students

The study initially included 280 female students. However, those with incomplete data, those currently menstruating, or those with known chronic diseases were excluded, resulting in a final sample size of 246 students.

Table 1 details the socio-demographic characteristics of the study participants. The mean age of the respondents was 19.3±0.79 years, with 64.2% falling within the 18-19 year age group. The majority (95.5%) of the students were Muslim, 31.7% were of the Muna ethnic group, 47.2% came from families with 5 to 6 members, and 59.3% of mothers and 70.3% of fathers had higher education levels. Most students relied on their parents for financial support, with over 40% of respondents spending IDR 500.000 to 750.000 per month on food.

Table 2 presents the eating behaviors and nutritional status of the students. Over one-third of the respondents reported skipping breakfast, and more than half never took supplements (86.2%). At the time of the survey, about 14.6% of students were on a weight loss plan. Nutritional knowledge assessment revealed that 65.4% of respondents had sufficient knowledge, with the internet being the primary source of information. The percentage of underweight, overweight/obesity, and low MUAC among the respondents was 26.4%, 24.4%, and 35.4%, respectively. Additionally, 27.3% of respondents were anemic, with a mean Hb concentration of 12.6 g/dl.

Food Group Consumption and Dietary Diversity

Table 3 shows the distribution of respondents based on their food consumption over the preceding 24-hour period. The mean dietary diversity score was 3.6±1.1, with an average food group consumption of 2.9 for those with inadequate dietary diversity and 5.0 for those with adequate dietary diversity. Only 33.3% of participants met the minimum recommendation for dietary diversity.

According to the 24-hour recall, consumption of nuts and seeds (3.3%) and milk-based products (8.5%) was notably low among the participants. Eggs (26.8%), vitamin A-rich vegetables and fruits (21.5%), and other fruits (14.6%) were also infrequently consumed. The most commonly consumed food group was flesh foods (76.8%), with fish (56.1%) being the most preferred. More than half of the

participants consumed dark green leafy vegetables, and nearly all consumed rice as their staple food (95.5%).

Graph 1 illustrates the levels of dietary diversity among participants with anemia, low mid-upper arm circumference (MUAC), overweight, and obesity. Among the anemic participants, 93.3% exhibited low dietary diversity. Similarly, 64.3% of those with low MUAC had low dietary diversity. Additionally, 71.6% of overweight participants and 9.8% of obese participants demonstrated low dietary diversity. These findings underscore the critical link between low dietary diversity and various health issues.

Determinant of dietary diversity

Tables 4 and 5 present the bivariate and multivariate analyses. In the bivariate analysis, maternal education, paternal education, paternal occupation, maternal occupation, monthly food budget, and nutritional knowledge were significantly associated with dietary diversity. In the multivariate logistic regression analysis, three factors-maternal education, paternal education, and monthly food budget-were found to significantly predict the likelihood of female students achieving the minimum dietary diversity.

The adjusted odds of meeting the minimum dietary diversity for female students with mothers having secondary or higher education levels were significantly higher (AOR: 4.4; 95% CI: 2.0, 9.6) compared to those with mothers with primary education levels. Similarly, female students with fathers having secondary or higher education levels had higher odds (AOR: 3.2; 95% CI: 1.2, 8.2) of achieving minimum dietary diversity compared to those with fathers with primary education levels. The monthly food budget was also a crucial factor; students with a higher budget for food had significantly higher odds of meeting the minimum dietary diversity (AOR: 1.9; 95% CI:1.0-3.7).

Table 1 Demographic and socio-economic characteristics

Variables	Frequency	Percentage (%)
Age		
18-19	158	64.2
20-21	88	35.8
Religion		
Islam	235	95.5
Christianity	10	4.1
Hinduism	1	0.4
Maternal education		
Primary education	52	21.1
Secondary education	48	19.5
Higher education	146	59.3
Paternal education		
Primary education	43	17.5
Secondary education	30	12.2
Higher education	173	70.3
Father occupation		
None	17	6.9
Formal sector	78	31.7
Informal sector	151	61.4
Mother's occupation		
Housewife	169	68.7
Working outside	77	31.3
Family size		
≤ 4	17	6.9
5 - 6	116	47.2
> 6	113	45.9
Monthly food budget		
< IDR 500.000	94	38.2
≥ IDR 500.000 – 750.000	102	41.5
> IDR 750.000	50	20.3
Vehicle ownership (motorcycle, car)		
No	144	58.5
Yes	102	41.5
Nutritional knowledge		
Low	42	17.1
Moderate	172	69.9
high	32	13.0
Exercise		

No	153	62.2
Yes	93	37.8
Ethnicity		
Muna	78	31.7
Bugis/Makassar	41	16.7
Buton	26	10.6
Tolaki	22	8.9
Others	79	32.1
Residential status		
Parents' house	96	39.0
Rent	107	43.5
Living with relative	43	17.5
Main source of living cost		
Parents	231	93.9
Scholarship	13	5.3
Others	2	0.8

Table 2. Eating behavior and nutritional status information

Variable	Frequency (n)	Percentage (%)
Skipping breakfast		
Yes	89	36.2
No	157	63.8
Source of food		
Food purchasing	57	23.1
cooking	189	76.9
Taking supplement		
No	212	86.2
Yes	34	13.8
Doing the weight loss plan/dieting		
No	210	85.4
Yes	36	14.6
Source of nutrition information		
Internet	215	87.4
Others (Television Newspaper/magazine)	31	12.6
Nutritional knowledge		
Low	85	34.6
good	161	65.4
BMI classification		
Underweight	65	26.4
Normal	121	49.2
Overweight	35	14.2
Obese	25	10.2
Mid-upper arm circumference		
< 23	87	35.4
≥ 23	159	64.6
Anemia (n=110)		
Yes	30	27.3
No	80	72.7

Table 3. Food group consumption and dietary diversity status

Characteristics	Number (n)	Percentage (%)
Food Group Consumption		
Staple food	235	95.5
Pulses	90	36.7
Nuts and seeds	8	3.3
Milk and milk product	21	8.5
Flesh food	189	76.8
Meat	2	0.8
Poultry	83	33.7
Fish/seafood	138	56.1
Eggs	66	26.8
Dark green leafy vegetables	134	54.5

Vitamin A-rich vegetables and fruit	53	21.5
Vitamin A-rich vegetables	45	18.3
Vitamin A-rich fruit	9	3.7
Other vegetables	74	30.1
Other fruits	36	14.6
Dietary diversity		
Dietary diversity scores (Mean ±SD)	3.6	1.1
Minimum dietary diversity for women (MDD-W)		
Achieving minimum dietary diversity	82	33.3
Not achieving minimum dietary diversity	164	66.7

Table 4. Bivariate analysis of socio-demographic characteristics, meal behaviors, and dietary diversity among female university students, Kendari City, Southeast Sulawesi, Indonesia

Variables	Minimum Dietary Diversity (MDD)		p-Value
	Inadequate	Adequate	
Age			0.132
18-19	100 (63.3)	58 (36.7)	
20-21	64 (40.7)	24 (23.6)	
Paternal education			<0.001
Primary education (<= 9 years)	66(90.4)	7(9.6)	
Secondary or above (> 9 years)	98 (56.6)	75 (43.4)	
Maternal education			<0.001
Primary education (<= 9 years)	89 (89.0)	11 (11.0)	
Secondary or above (> 9 years)	75 (51.3)	71 (48.6)	
Father occupation			0.026
None	11 (64.7)	6 (35.3)	
Formal sector	43 (55.1)	35 (44.9)	
Informal sector	110 (72.8)	41 (27.2)	
Mother's occupation			<0.001
Housewife	126 (74.6)	43 (25.4)	
Working outside	38 (49.4)	39 (50.6)	
Source of food			0.521
Food purchasing	40 (70.2)	17 (29.8)	
Food brought from home	124 (65.6)	65 (34.4)	
Monthly food budget			0.007
≤ IDR 500.000	82 (77.4)	24 (22.6)	
> IDR 500.000 – 750.000	71 (59.7)	48 (40.3)	
> IDR 750.000	11 (52.4)	10 (47.6)	
Skipping Breakfast			0.851
Yes	60 (67.4)	29 (32.6)	
No	104 (66.2)	53 (33.8)	
Doing the weight loss plan/dieting			0.444
Yes	26 (72.2)	10 (27.8)	
No	138 (65.7)	72 (34.3)	
Nutritional knowledge			0.008
Low	66 (77.6)	19 (22.4)	
good	98 (60.9)	63 (39.1)	

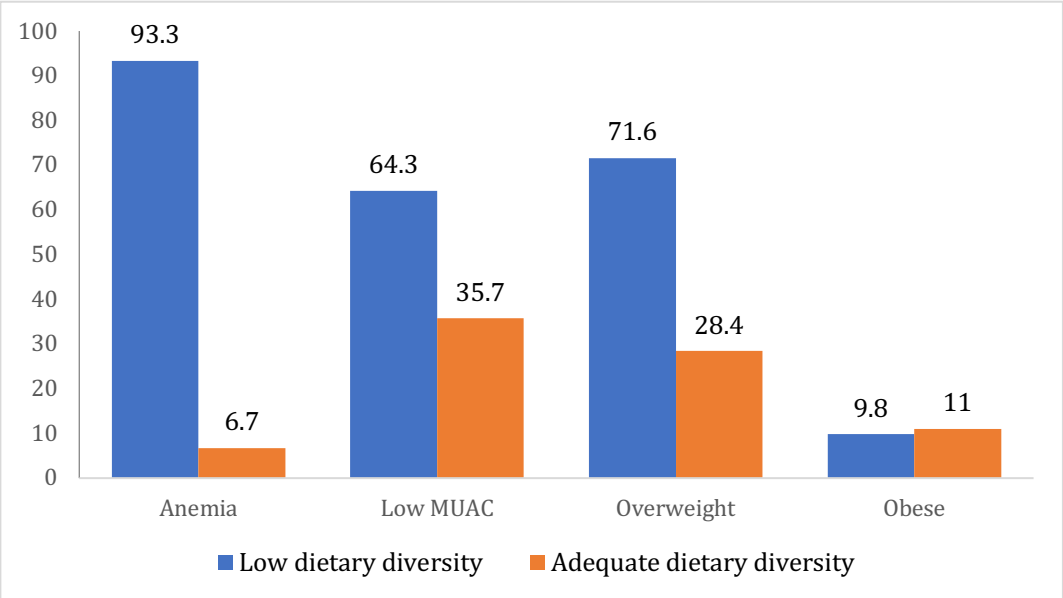
Data are presented as frequency (percentage), Chi-squared test

Table 5. Determinant of dietary diversity among female students in Kendari City, Southeast Sulawesi, Indonesia

Variables	COR (95%CI)	p-Value	AOR (95%CI)	p-Value
Maternal education				
Primary education	1	<0.001	1	
Secondary or higher education	7.2(3.1-16.6)		4.4(2.0-9.6)	**<0.001****
Paternal education				
Primary education	1	<0.001	1	
Secondary or higher education	7.6(3.7-15.5)		3.2(1.2-8.2)	**0.013***
Monthly food budget				
<= IDR < 500.000	1		1	
> IDR 500.000-750.000	2.3 (1.2-4.1)	0.005	1.9(1.0-3.7)	**0.034***
> IDR > 750.000	3.1 (1.1-8.1)	0.022	2.0(0.7-5.8)	0.171

Analysis using logistic regression, backward LR. Variables entered into the model included age group, father's occupation, mother's occupation, breakfast habits, dieting, nutritional knowledge, food purchasing behavior, and monthly food budget;
COR: Crude Odds Ratio; AOR: Adjusted Odds Ratio

Graph 1. Level of dietary diversity in anemic, low mid-upper arm circumferences (MUAC), overweight, and obese female students.



DISCUSSION

This cross-sectional study underscored a critical issue of inadequate dietary diversity among female students, with an average dietary diversity score of only 3.6, significantly below the WHO's recommended minimum of five out of ten food groups. Our findings revealed that the majority of participants adhered to a repetitive dietary pattern, predominantly comprising two to four food categories, echoing similar research in Indonesia by Rachmalina et al., which indicated a prevalent reliance on rice and limited intake of other food groups among adolescents (Rachmalina et al., 2019).

Furthermore, the study identified a predominant reliance on fish as the primary source of animal protein, over other sources such as poultry, ruminants, and dairy. Due to the coastal setting of the study area, fish hold a central position in the daily diet of the community. Even during periods of scarcity, fish remains a cost-effective option, contrasting with the higher prices of alternative protein sources such as meat and poultry. Additional protein sources like legumes and eggs are present in the local market at more economical rates, yet their consumption is comparatively lower, possibly influenced by dietary preferences or cultural practices. This is consistent with findings from other parts of Indonesia, where fish consumption is influenced by cultural preferences and economic factors (Gibson et al., 2020). This pattern is also observed internationally, as evidenced by studies in coastal regions of Bangladesh and Ghana, where fish serves as a primary protein source due to its availability and affordability, contributing to lower consumption of alternative protein sources like poultry and ruminant meat (Onumah et al., 2020; Thilsted et al., 2010).

Moreover, a significant deficiency in vegetable and fruit consumption was noted among the participants, with green leafy vegetables being the exception. This observation resonates with research in West Java, which reported a limited variety of vegetables consumed by adolescent girls, indicating potential micronutrient deficiencies (Agustina et al., 2020). Similar issues with vegetable and fruit consumption among young people have been documented globally, highlighting inadequate intake and its implications for nutritional outcomes (Beal et al., 2019; Peltzer & Pengpid, 2012; Pengpid et al., 2019).

The lack of dietary diversity not only poses risks of micronutrient deficiencies but also exacerbates prevalent health concerns like anemia, as evidenced by our finding that over 27% of female adolescents were anemic. Moreover, more than 70% of overweight teenagers and 63 % of low MUAC teenagers also exhibited low dietary diversity, suggesting a multifaceted challenge in addressing dietary habits and nutritional status among young people in this area. Similarly, a study in West Java reported that 45% of surveyed adolescents aged 12-19 years were anemic and 17% were obese or overweight, with overall low dietary diversity and diet quality (Agustina et al., 2020). Combining the results from these two studies highlights a significant issue among young people in Indonesia: inadequate dietary diversity is contributing to both micronutrient deficiencies and an increased prevalence of anemia and obesity. Poor health in this age group can lead to increased absenteeism from school and reduced educational attainment, which can limit future income-earning potential and perpetuate cycles of poverty and poor health.

Our research unearthed a significant association between parental education and the adoption of a diverse diet among female students. Higher parental education often correlates with better access to resources, including higher household income and greater financial stability, which can enhance the ability to purchase a variety of nutritious foods. Parents with higher education levels are more likely to be informed about the nutritional value of different foods and the importance of a balanced diet, thereby making more informed food choices and encouraging healthier eating habits in their children. Higher parental education levels were linked to healthier dietary habits, a finding supported by research in various socio-economic contexts globally (Béghin et al., 2014; Finger et al., 2015; Ghosh et al., 2021; Glozah & Pevalin, 2015; Tur et al., 2004).

Moreover, the monthly food budget emerges as another critical determinant of dietary habits among female students in our study. Given that nearly all participants in this study were still economically dependent on their parents, the amount of money they received for food was closely tied to their parents' income levels. Adolescents from lower socioeconomic backgrounds face significant obstacles in maintaining a healthy diet due to the high cost of nutritious foods. This financial limitation is a key factor influencing dietary choices and overall nutrition (Angeles-Agdeppa et al., 2019; Baxter et al., 2022; Leroy et al., 2018; Vakili et al., 2013). Studies have consistently demonstrated that the consumption of fruits, vegetables, and animal-source foods increases with higher household incomes (Ayele et al., 2023; Maulida et al., 2016). This financial barrier is not merely a matter of choice but a structural issue that necessitates policy interventions aimed at improving economic conditions and food accessibility.

To promote dietary diversity and improve nutritional outcomes among adolescents, holistic interventions addressing both socioeconomic factors and individual-level determinants are needed (Fahira Nur et al., 2023). Comprehensive nutritional education programs should be implemented in schools to highlight the benefits of a varied diet. Local governments and health organizations must collaborate to make alternative protein sources like legumes and eggs more accessible and affordable. Initiatives to increase the availability and consumption of a wider variety of vegetables and fruits are crucial to prevent micronutrient deficiencies. Policies aimed at improving household income and parental awareness about nutrition could significantly impact adolescent health. Addressing these issues will help mitigate the dual burden of malnutrition and obesity, improving the overall health and well-being of young people in this area.

This study has several limitations that should be acknowledged. Firstly, the cross-sectional design limits the ability to infer causality between dietary diversity and the associated factors. Secondly, the use of a single 24-hour dietary recall may not accurately capture the usual intake and might be subject to recall bias. Additionally, the study was conducted in a specific geographical area (Southeast Sulawesi) and among female students of a single university, which may limit the generalizability of the findings to other regions or populations in Indonesia. The sample size, although adequate, may not fully represent the broader adolescent population. Furthermore, the study did not account for other potential confounding variables such as physical activity levels, cultural dietary practices, and access to food, which could influence dietary diversity. Future research should employ longitudinal designs, include male adolescents to provide a comprehensive understanding of dietary diversity issues, and use qualitative methods to explore the barriers and facilitators of achieving adequate dietary diversity among adolescents.

CONCLUSION

This cross-sectional study highlights the pressing issue of inadequate dietary diversity among female students. The lack of dietary diversity not only poses risks of malnutrition but also exacerbates prevalent

health concerns like anemia and obesity among young people in the region. The significant role of parental education and economic dependency on dietary habits highlights the need for comprehensive interventions. These should include nutritional education, economic support for healthier food options, and policy changes to enhance food diversity and accessibility. By addressing these factors, it is possible to improve the nutritional status and overall health outcomes of young people in Southeast Sulawesi and similar socio-economic contexts.

Conflict of interests
The authors declare that there are no conflicts of interest.

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Author Contributions
DSE, FM, and HB designed the research. DSE and YN performed the research, analyzed the data, and wrote the manuscript. ND and FN contributed to statistical analysis. All authors read and approved the final manuscript.

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