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Nutrition transition and the risk of over-nutrition among female adolescents in Indonesia: analysis of Indonesian family life survey data 2007 and 2014

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ABSTRACT

Background: Global changes and urbanisation cause nutrition transition which holds a crucial factor to nutritional status. Nutrition transition manifests in increased access to unhealthy and highly processed food, as well as reduced physical activity that may lead to over-nutrition.

Objectives: This study aimed to measure the proportions of food consumption expenditure by food groups, identify nutrition transition by comparing the proportions of food expenditure namely modern, traditional, plant-based, meat-based, ready to eat and processed foods, and investigate association between nutrition transition and nutritional status of female adolescents in Indonesia.

Materials and Methods: This study used secondary data from the Indonesian Family Life Survey 4 (2007) and 5 (2014) that collected data on individual food consumption in the past week. Nutrition transition was measured by comparing proportions of food expenditure to estimate consumption. Height, weight, and age were calculated into Body Mass Index-for-age (BMI-for-age) to identify nutritional status. Data from 5,203 female adolescents aged 12-18 years were used. Multiple Logistic regression was performed to estimate the Odds Ratio (OR).

Results: Compared to 2007, there was an increase in the proportion of food expenditure for modern food and ready-to-eat food in households. On the other hand, the proportion of traditional food, plant-based food, and processed food consumption decreased in 2014 compared to 2007. Plant-based is a protective factor for over-nutrition (OR = 0.54; 95% CI: 0.31-0.95). Meanwhile, ready to eat food was a risk factor for over-nutrition (OR = 1.56; 95% CI: 0.95-2.57).

Conclusion: Plant-based is a protective factor; while ready-to-eat is a risk factor for over-nutrition among female adolescents.

***Keywords** : Female adolescents;nutrition transition; over-nutrition; plant-based; ready to eat meal*

BACKGROUND

Malnutrition is a prominent health issue in developing world. In India, a significant proportion of 43.3% adolescent girls experienced stunting.[1] Additionally, a considerable 20% of these adolescent girls were affected by anemia,[2] while 21.6% of adolescents were classified as overweight or obese.[3] Indonesia is also facing the triple burden of malnutrition, a condition in which the incidence of undernutrition, overnutrition, and micronutrient deficiency is found simultaneously in a region.[4, 5] In Indonesia, the prominent issue of undernutrition is stunting while micronutrient deficiency is anemia. Stunting and anemia among adolescents in Indonesia are still prevalent. National data in 2018 showed that 25.7% of adolescents aged 13-15 years and 26.7% of adolescents aged 16-18 years were stunted. In addition, 32% adolescents suffered from anemia.[6] Recent research in 2021 found the prevalence of anemia among pregnant adolescent girls aged 15-24 years in Indonesia were alarmingly high at 84.6%.[5] On the other hand, over-nutrition refers to overweight and obesity and there has been an increasing trend of obesity over the years. In the age group of 13-15 years, the prevalence increased from 10.3% in 2013 to 16% in 2018. The number slightly differ in the age group of 16-18 years where the increase was from 7.3% in 2013 to 13.3% in 2018.[6, 7]

Defining adolescence has been challenging since many loosely define adolescence as a developmental period ranging from age 10-19 years, [8] 10–24 years, [9] 13-18 years, [10] and ≤18 years.[11] Adolescence refers to the notion of a transition period between childhood and adulthood which includes biological growth and development. Almost 20% of total height growth and 45% of bone mass development occurred in the adolescent period. In addition, ponderal growth is at about the same rate as growth in infancy and childhood.[9, 12, 13]

Optimal growth and development for adolescent girls ensures better health outcomes in adulthood and future offspring. The physical development of adolescent girls is reflected in an increase in pelvic width (which

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plays a crucial role in preventing problems during labor), breast development, mammary tissue and uterus, and adipose tissue.[12-14] Adolescent girls around the ages of 12 and 13 years usually experiencing menarche or the start of menstrual periods which marked sexual maturation.[9]

Evidence suggests that adolescent nutritional status strongly influences nutritional status and health outcomes of the next generation, and must be considered as a continuum of risks. Adolescents girls with malnutrition were associated with adverse health, maternal, and neonatal outcomes at later life. Pregnant adolescents with anemia and/or protein/energy-deficient were at a higher risk of preterm births, stillbirths, neonatal mortality, and delivering low birth weight infants.[15] In addition, overweight and obesity increase the risk of adolescents experiencing sexual maturation disorders and non-communicable diseases in adulthood such as cardiovascular diseases, stroke, type 2 diabetes, musculoskeletal disorders such as osteoarthritis, and cancers (endometrial, breast, and colon).[16, 17]

The term nutrition transition was first introduced in 1993 by Dr. Barry M. Popkin which concerns the broad changes in the pattern of human diet that have occurred over time.[18] Nutrition transition could be observed by measuring the proportion of animal food;[19, 20] plant-based food;[19, 21] food purchased from outside;[22] and processed food consumption.[19] In low- to middle-income countries such as Indonesia, nutrition transition describes shifts from traditional diets high in cereal and plant-based foods towards Western pattern diets high in sugars, fats, and animal foods. This causes a swift increase in the prevalence of overweight and obesity while undernutrition and micronutrient deficiencies remain public health issues.[18] Urbanisation, income growth, and global free-trade policy have increased food availability and affordability local food sector. The transition manifests in increased access to less healthy and highly processed foods, as well as a sedentary lifestyle.[23, 24]

Referring to the literature, nutrition transition may affect nutrition status of female adolescents. Therefore, understanding the concept of nutrition transition and malnutrition would be the first step in developing strategies to improve nutrition support for adolescent girls. Hence, this study aimed to: 1) measure the proportions of food consumption expenditure by food groups; 2) identify nutrition transition by comparing the proportions of food expenditure, namely modern, traditional, plant-based, meat-based, ready to eat and processed foods; and 3) investigate the relationship between nutrition transition and nutritional status of adolescents in Indonesia.

MATERIALS AND METHODS

This study used secondary data sources from the Indonesian Family Life Survey (IFLS).[25] The IFLS is a longitudinal survey representing around 83% of the Indonesian population. The survey has five waves of data collected in 1993, 1997, 2000, 2007–2008 and 2014–2015. The survey was conducted by the RAND Institute with the cooperation of local universities and research centers in Indonesia. Data were collected from questionnaire-based interviews and anthropometric measurement conducted by a nurse.

The first wave of the survey covered only 13 provinces, but the number was broadened to include more than 20 provinces in the last round to capture respondents' mobility to other provinces. Ethical clearances for the surveys were provided by institutional review boards (IRBs) in the United States and Gadjah Mada University (UGM) for IFLS waves 3, 4 and 5 and by the University of Indonesia for IFLS waves 1 and 2.

Our study focused on the two recent waves of IFLS—wave 4 (conducted between 2007 and 2008) and wave 5 (conducted between 2014 and 2015) due to availability of data on individual food consumption in the past week. Wave 4 and 5 were analyzed as repeated cross-sectional surveys. There were 13,500 households and 43,000 individuals interviewed in the fourth wave of the study (please refer to Figure 1). The number of respondents increased in the fifth wave to 15,900 households and more than 50,000 individuals. This study only covers adolescent girls aged 12-18 years. The dataset includes a total of 5,203 adolescent girls aged 12-18 years, with 2,409 in 2007 (IFLS 4) and 2,794 in 2014 (IFLS 5).

Nutrition Transition

This study used the IFLS Food Consumption Module for data collection. Subjects were asked if they consumed each food item in the past one month and how much money they spent to purchase it. In particular, we collected food expenditure data from the module and calculated the proportions of each food item expenditure then compared to the total food expenditure. Literature suggests food supply available for human consumption is a suitable proxy to capture the nutrition transition.[18, 26] Their study relied on household survey data to identify nutrition transition across households with different socioeconomic and areas.

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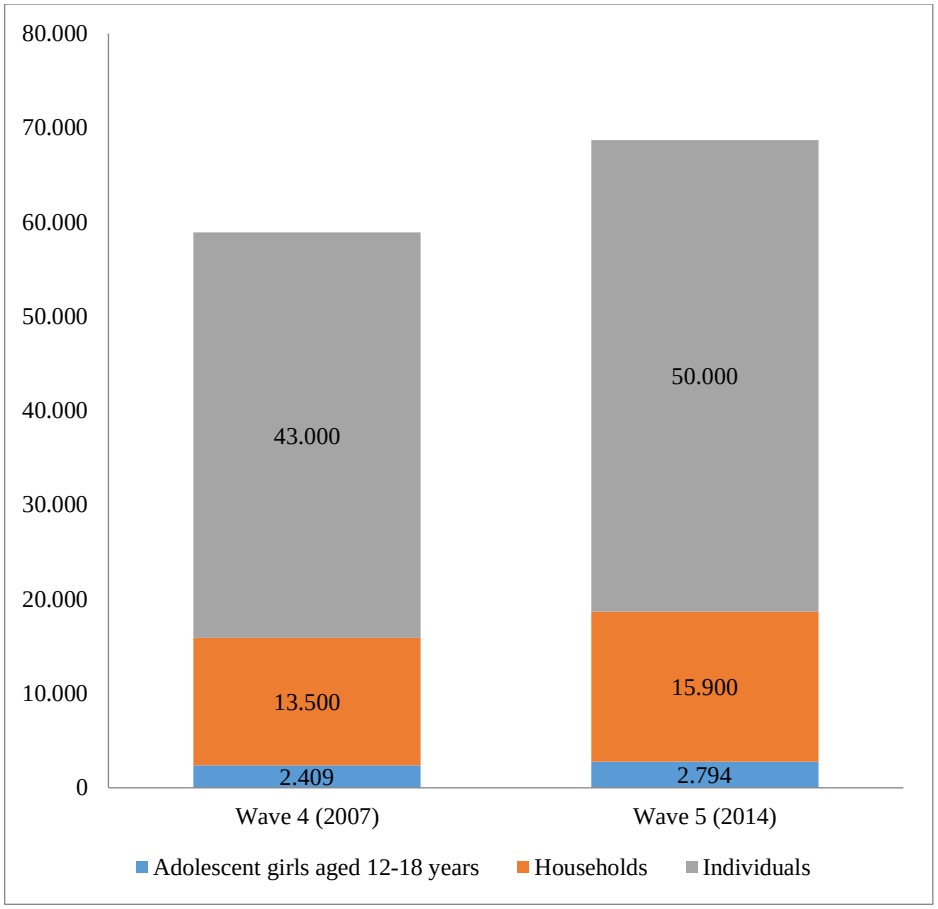

Figure 1. Observation number of IFLS 4 and 5

Food items were then grouped referring to previous studies. In this study we classified food items into six food groups, namely: 1) Modern food consists of instant noodle, soda, eggs, sweet, fast food, meat, fried food, dairy, and sauce; 2) Traditional food consists of rice, banana, green leaf vegetable, papaya, carrot, tubers, fish, and mango;[27] 3) Plant-based food consists of rice, corn, tubers, vegetables, fruits, nuts, herbs, plant protein; 4) Meat-based food consists of meat, chicken, fish, salted fish, processed meat, and eggs;[19-21] 5) Ready to eat food refers to food purchased from outside and consists of soup, porridge, fried and cooked rice and noodles; 6) Processed food consists of soft drink, alcohol, tobacco, instant noodles, processed meat, ketchup, shrimp paste, and sauce.[21, 22]

Nutrition transition was measured by comparing the proportions of food expenditure of adolescents aged 12-18 years of modern vs traditional food and plant based vs meat based food in 2007 and 2014. In addition, we identified nutrition transition by examining the increased proportions of ready to eat and processed food expenditure between 2007 and 2014.

Adolescents Nutritional Status

Anthropometric measurements including weight and height were collected from IFLS Book US. Adolescents nutritional status in this study were classified using Body Mass Index-for-age (BMI for-age) for 5-18 years. BMI is the ratio between body weight (in kilograms) to height (in meters) and then raised to the power of two. BMI-for-age is calculated by dividing the BMI value by the age of the adolescents and then classified based on the Indonesian Child Anthropometric cut-off values. Adolescent girls with z-score >+2 SD were classified as obese; z-score between +1 to +2 SD were overweight; z-score between -2 to +1 SD were considered normal; z-score between -3 to -2 SD were classified as thinnes; and z-score < -3 SD were classified as severely thinnes.[11]

Statistical analysis

Multiple logistic regression analysis performed with STATA version 17.0 (StataCorp) was used to examine the associations between nutrition transition and nutritional status of adolescents. Model 1 focused

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on predicting the role of increased consumption of modern vs traditional food on the risk of over-nutrition. Model 2 captured the association of increased consumption of plant vs meat-based food on the risk of over-nutrition. Model 3 explored the association of increased consumption of ready-to-eat vs processed food on the risk of over-nutrition. In addition, we included year dummy 2014 to capture the difference of average risk of over-nutrition among female adolescents in 2007 and 2014. The estimation result were significant at a two-tailed type 1 (i.e. α) error rate of 5 % ($P< 0{\cdot}05$). Dummy variables of BMI to categorize nutritional status: 1 for obese and overweight; 0 for normal, thin, and severely thin. The association were measured by Odds Ratios (OR) for these factors.

RESULTS

Table 1 shows that compared to 2007 the proportion of modern food, meat-based food, and ready to eat food consumption increased for adolescents in 2014. On average, the proportion of modern food consumption was 27.1% in 2007 and 30.2% in 2014. The proportion of meat-based consumption was 15.4% in 2007 and 15.9% in 2014. The proportion of ready to eat food consumption was 10.2% in 2007 and 13.5% in 2014.

On the other hand, the proportion of traditional food, plant-based food, and processed food consumption decreased in 2014 compared to 2007. On average, the proportion of traditional food consumption was 35.2% in 2007 and 33.5% in 2014. The proportion of plant-based consumption was 35.1% in 2007 and 32.9% in 2014. The proportion of processed food consumption was 30.1% in 2007 and 27.1% in 2014.

Table 1. Nutrition Transition of Adolescent Girls Aged 12-18 Years in Indonesia

Variable	2007					2014				
	Obs.*	Mean	Std. Dev	Min	Max	Obs.	Mean	Std. Dev	Min	Max
Modern Food	2,476	27.1%	18.9%	0	1.0%	2,803	30.2%	20.8%	0	1
Traditional Food	2,476	35.2%	16.6%	0	98.3%	2,803	33.5%	16.0%	0	89.0%
Plant-Based	2,476	35.1%	16.8%	0	95.4%	2,803	32.9%	16.1%	0	93.0%
Meat-Based	2,476	15.4%	10.8%	0	72.2%	2,803	15.9%	10.6%	0	76.3%
Ready to Eat	2,476	10.2%	16.0%	0	1.0%	2,803	13.5%	18.7%	0	1
Processed food	2,476	30.1%	13.7%	0	93.7%	2,803	27.1%	13.5%	0	82.7%
BMI	2,409	1954.6	324.3	1114.4	3806.9	2,794	1994.3	362.6	1138.2	3790.2
BMI-for-age	2,409	-32.1	103.2	-356.0	487.4	2,794	-16.9	116.3	-342.6	474.3

*Obs: number of observation

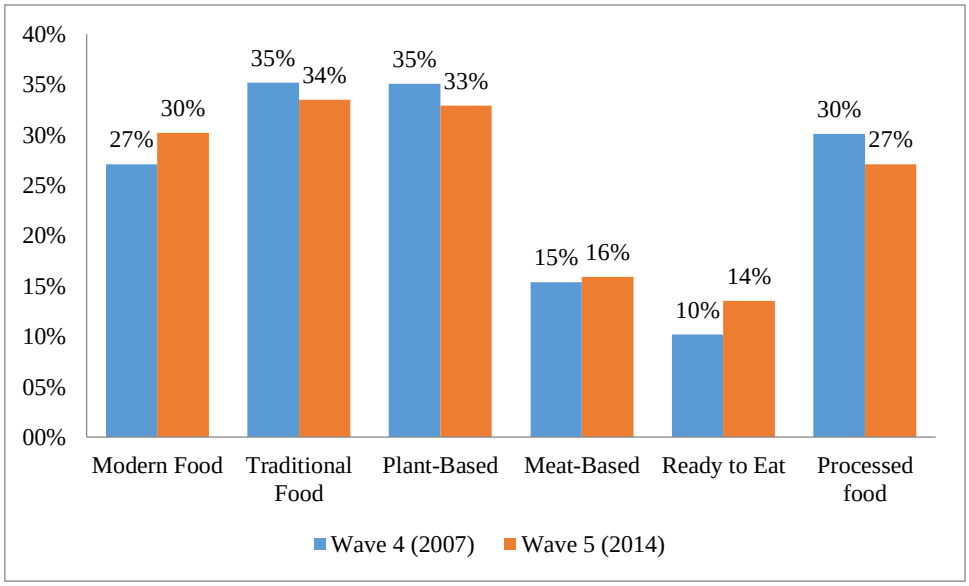

Figure 2. Nutrition Transition of Adolescent Girls Aged 12-18 Years in Indonesia (Wave 4 and 5)

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Table 2 describes the changes in nutritional status of adolescents from 2007 to 2014. The data indicates that the proportions of adolescents who are overweight increase from 6.19% in 2007 to 8.02% in 2014, and the proportions of obese adolescents increase from 2.32% in 2007 to 4.76% in 2014.

Table 2. Nutritional Status of Adolescent Girls Aged 12-18 Years in Indonesia

BMI-for-age	Year		Total n (%)
	2007 n (%)	2014 n (%)	
1: Severely Thinnes	8 (0.33)	4 (0.14)	12 (0.23)
2: Thinnes	93 (3.86)	84 (3.01)	177 (3.40)
3: Normal	2,103 (87.30)	2,349 (84.07)	4,452 (85.57)
4: Overweight	149 (6.19)	224 (8.02)	373 (7.17)
5: Obese	56 (2.32)	133 (4.76)	189 (3.63)
Total	2,409 (100)	2,794 (100)	5,203 (100)

In table 3 we examine the association between nutrition transition and nutritional status of adolescents from 2007 to 2014. The Odds Ratio for consumption of plant based food is 0.54. This implies that adolescents with higher intake of plant-based food are 46% less likely to be overweight and obese. Meanwhile, the Odds Ratio for consumption of ready to eat food is 1.56. This implies that a higher consumption of ready to eat food increase the risk of overweight and obesity by 1.56 times. Last, adolescents surveyed in 2014 has higher risk of developing overweight and obesity by approximately 1.5 times.

Table 3. Nutrition Transition and Risk of Obesity/ Overweight

Risk Of Overweight & Obesity	Odds Ratio (95% CI)		
	Model 1	Model 2	Model 3
Year 2014	1.55 (1.29-1.86)	1.55 (1.29-1.86)	1.55 (1.28-1.86)
Constant	0.09 (0.06-0.14)	0.11 (0.09-0.15)	0.09 (0.07-0.12)
Modern Food	1.28 (0.73-2.26)		
Traditional Food	0.72 (0.35-1.50)		
Plant-Based		0.54 (0.31-0.95)	
Meat-Based		1.09 (0.48-2.47)	
Ready to Eat			1.56 (0.95-2.57)
Processed food			0.92 (0.46-1.86)
Log likelihood	-1766.523	-1766.289	-1766.827
LR chi2	29.39	29.85	28.78
Prob > chi2	0.000	0.000	0.000
Pseudo R2	0.008	0.008	0.008
Observation	5,203	5,203	5,203

Note:
Model 1: the effect of modern food and traditional food on the risk of overweight & obesity
Model 2: the effect of plant based food and meat based food on the risk of overweight & obesity
Model 3: the effect of prepared food and processed food on the risk of overweight & obesity
An odds ratio is statistically significant at 5 percent of the confidence intervals

DISCUSSION

Our study found evidence of nutrition transition among female adolescents from 2007 to 2014. The proportions of modern food, meat-based food, and ready to eat food consumption increased while the proportion of traditional food, plant-based food, and processed food consumption decreased. This was consistent with previous study which described that younger generation in Indonesia often preferred western-type foods over traditional dishes.[22] Western-type food is primarily characterized by red meat and other animal products, fast food or junk food, and pre-packaged or ready to eat meal; [22, 28] thus are similar to modern and meat-based food in our study. Moreover, time constraint with more women in the work force cause a failing practice to cook meals at home and increase favour in ready to eat food.[22]

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This study also found supporting evidence that nutrition transition was associated with nutritional status of female adolescents in Indonesia. Those with higher intake of plant-based food are less likely to be overweight and obese. Meanwhile, a higher consumption of ready to eat food is a risk factor of overweight and obesity. Our result was in agreement with previous longitudinal cohorts which found that plant-based diet had a protective association with weight gain and fat mass,[29, 30] and inversely associated with the risk of obesity.[31] Fruits and vegetables in plant-based diet are rich in antioxidants, therefore this diet promotes lower oxidative stress and inflammation that contributes to the development of obesity.[32] Conversely, ready to eat meals were associated with increased risk of obesity. Ready to eat meals were linked to higher energy intake above the national nutritional recommendations, and thus increase the risk of fat deposition and subsequently, obesity.[33]

Based on our findings, Indonesia is currently at stage IV of nutrition transition according to Popkin theory. Popkin described the concept of nutrition transition in five patterns: (i) collecting food: diets rich in plants and high in protein from lean wild animals; (ii) famine: diets rich in agriculture products, i.e. cereals; (iii) receding famine: diets characterized by fewer carbohydrates and more fruits, vegetables, animal protein; (iv) degenerative diseases: high-calorie foods, more fats, animal products, sugars, processed food and less fibres; (v) behavioural change toward a healthy and balanced diet: less fats and processed foods, increased carbohydrate, fruits, and vegetables.[18]

Nutrition transition in stage IV was associated with an increased risk of adolescent obesity and overweight, and eventually led to nutrition related non-communicable diseases such as type 2 diabetes, heart disease, stroke, and cancer.[16-18] This was in line with our findings that there was an increase proportions of overweight and obesity among female adolescents from 2007 to 2014. If this nutrition transition pattern persisted, there should be concern to address unhealthy consumption among female adolescents, considering that adolescence period is eminent for the second window of opportunity. This means the lack of nutritional intake in childhood can be compensated during adolescence by optimizing nutrient intake to maximize growth.[5]

Moreover, nutrition transition stage IV was characterized by lower consumption of fibres which may increase the risk of micronutrient deficiencies in female adolescents. Female adolescents experience increased nutritional needs to support the transformation of puberty into the adult phase. [13] A study indicated that pregnant adolescents with anemia were at a higher risk of preterm births, stillbirths, neonatal mortality, and delivering low birth weight infants.[15]

Since micronutrient deficiencies could coexist with overweight and obesity during adolescents period, this issue needs further attention. Referring to the findings of this study, there are proposed policy recommendation such as school based interventions by enhancing nutrition education and implementing healthy food environment in the school canteen.[34] Home based interventions could also be implemented by weekly nutrition session by trained nutrition educator and food subsidy.[35]

However, the decreased processed food consumption from 2007 to 2014 in current study contradicts with Popkin theory which defines stage IV with higher processed food.[18] These inconsistencies could be attributed to factors associated with diet changes in modern era. Income growth, increased number of working women, and increased working hours have caused a high demand for ready to eat food.[23, 36-38] Ready to eat food refers to food purchased from outside and suitable for eating with no further preparation. They could also be described as food partially cooked in advance, with no further cooking or preparation required before being eaten. These type of food are convenient and time-saving.[37, 38] The trend aligned with evidence of increased ready to eat food consumption found in our study.

The strength of the present study was the use of IFLS data which represented around 83% of the Indonesian population. In addition, this was one of the first known study to examine nutrition transition from 2007 to 2014 and its association with nutritional status of female adolescents.

However, this study also has some limitations. First, this study used household food expenditure data to measure nutrition transition. For future research, we suggest using food diary consumption to better identify nutrition transition. Second, the cross-sectional data only allowed us to estimate association between nutrition transition and nutritional status. To infer causation, the longitudinal data is more preferable.

CONCLUSIONS

Compare to 2007, the proportions of modern food, meat-based food, and ready to eat food consumption increased in 2014; while the proportion of traditional food, plant-based food, and processed food consumption

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decreased. Plant based is a protective factor for over-nutrition with Odds Ratio of 0.54*;* while ready-to-eat is a risk factor for over-nutrition with Odds Ratio of 1.56.

REFERENCES

1. Jaleel A, Arlappa N, Ramakrishna KS, Sunu PV, Jayalakshmi G, Neeraja G, et al. Examining the Triple Burden of Malnutrition: Insights from a Community-Based Comprehensive Nutrition Survey among Indigenous Tribal Children (0-19 Years) in the Western Ghats Hills of India. Nutrients. 2023;15(18). DOI: 10.3390/nu15183995.
2. Chauhan S, Kumar P, Marbaniang SP, Srivastava S, Patel R. Prevalence and predictors of anaemia among adolescents in Bihar and Uttar Pradesh, India. Sci Rep. 2022;12(1):8197. DOI: 10.1038/s41598-022-12258-6.
3. Nitika N. Discriminatory ability of mid-upper arm circumference in identifying overweight and obese adolescents: Findings from the comprehensive national nutrition survey, India. Indian J Public Health. 2021;65(3):269-74. DOI: 10.4103/ijph.IJPH_54_21.
4. Rah JH, Melse-Boonstra A, Agustina R, van Zutphen KG, Kraemer K. The Triple Burden of Malnutrition Among Adolescents in Indonesia. Food Nutr Bull. 2021;42(1_suppl):S4-S8. DOI: 10.1177/03795721211007114.
5. Sparrow R, Agustina R, Bras H, Sheila G, Rieger M, Yumna A, et al. Adolescent Nutrition-Developing a Research Agenda for the Second Window of Opportunity in Indonesia. Food Nutr Bull. 2021;42(1_suppl):S9-S20. DOI: 10.1177/0379572120983668.
6. Kemenkes. Laporan Nasional Riskesdas 2018. Jakarta; 2018. Available from: https://repository.badankebijakan.kemkes.go.id/id/eprint/3514/1/Laporan%20Riskesdas%202018%20Nasional.pdf
7. Kemenkes. Laporan Nasional Riskesdas 2013. Jakarta; 2013. Available from: https://repository.badankebijakan.kemkes.go.id/id/eprint/4467/1/Laporan_riskesdas_2013_final.pdf
8. WHO. Adolescent health Geneva: WHO. 2023. Available from: https://www.who.int/health-topics/adolescent-health#tab=tab_1.
9. Sawyer SM, Azzopardi PS, Wickremarathne D, Patton GC. The age of adolescence. Lancet Child Adolesc Health. 2018;2(3):223-8. DOI: 10.1016/S2352-4642(18)30022-1.
10. Hurlock E. Developmental Psychology. India: McGraw-Hill Education; 2001.
11. Kemenkes. PMK RI No 2 Tahun 2020 tentang Standar Antropometri Anak. Jakarta; 2020. Available from: http://hukor.kemkes.go.id/uploads/produk_hukum/PMK_No__2_Th_2020_ttg_Standar_Antropometri_Anak.pdf
12. Patton GC, Sawyer SM, Santelli JS, Ross DA, Afifi R, Allen NB, et al. Our future: a Lancet commission on adolescent health and wellbeing. Lancet. 2016;387(10036):2423-78. DOI: 10.1016/S0140-6736(16)00579-1.
13. Hughes IA, Kumanan M. A wider perspective on puberty. Mol Cell Endocrinol. 2006;254-255:1-7. DOI: 10.1016/j.mce.2006.04.014.
14. Tanner J. Fetus into Man: Physical Growth from Conception to Maturity, Revised Edition: Harvard University Press; 1990.
15. Bhutta ZA, Lassi ZS, Bergeron G, Koletzko B, Salam R, Diaz A, et al. Delivering an action agenda for nutrition interventions addressing adolescent girls and young women: priorities for implementation and research. Ann N Y Acad Sci. 2017;1393(1):61-71. DOI: 10.1111/nyas.13352.
16. Jebeile H, Kelly AS, O'Malley G, Baur LA. Obesity in children and adolescents: epidemiology, causes, assessment, and management. Lancet Diabetes Endocrinol. 2022;10(5):351-65. DOI: 10.1016/S2213-8587(22)00047-X.
17. Reinehr T, Roth CL. Is there a causal relationship between obesity and puberty? Lancet Child Adolesc Health. 2019;3(1):44-54. DOI: 10.1016/S2352-4642(18)30306-7.
18. Popkin B. Nutritional Patterns and Transitions. Population and Development Review. 1993;19(1):20. DOI: 10.2307/2938388.
19. Huang L, Wang Z, Wang H, Zhao L, Jiang H, Zhang B, et al. Nutrition transition and related health challenges over decades in China. Eur J Clin Nutr. 2021;75(2):247-52. DOI: 10.1038/s41430-020-0674-8.

e-ISSN : 2338-3119, p-ISSN: 1858-4942

20. Khusun H, Februhartanty J, Anggraini R, Mognard E, Alem Y, Noor MI, et al. Animal and Plant Protein Food Sources in Indonesia Differ Across Socio-Demographic Groups: Socio-Cultural Research in Protein Transition in Indonesia and Malaysia. Front Nutr. 2022;9:762459. DOI: 10.3389/fnut.2022.762459.
21. Jayawardena R, Ranasinghe P, Wijayabandara M, Hills AP, Misra A. Nutrition Transition and Obesity Among Teenagers and Young Adults in South Asia. Curr Diabetes Rev. 2017;13(5):444-51. DOI: 10.2174/1573399812666160808100211.
22. Anyanwu OA, Naumova EN, Chomitz VR, Zhang FF, Chui K, Kartasurya MI, et al. The Socio-Ecological Context of the Nutrition Transition in Indonesia: A Qualitative Investigation of Perspectives from Multi-Disciplinary Stakeholders. Nutrients. 2022;15(1). DOI: 10.3390/nu15010025.
23. Popkin BM, Corvalan C, Grummer-Strawn LM. Dynamics of the double burden of malnutrition and the changing nutrition reality. Lancet. 2020;395(10217):65-74. DOI: 10.1016/S0140-6736(19)32497-3.
24. Popkin BM, Adair LS, Ng SW. Global nutrition transition and the pandemic of obesity in developing countries. Nutr Rev. 2012;70(1):3-21. DOI: 10.1111/j.1753-4887.2011.00456.x.
25. Strauss J, Witoelar F, Sikoki B. User's Guide for the Indonesia Family Life Survey, Wave 5: Volume 2. Santa Monica, CA: RAND Corporation; 2016.
26. Popkin BM. An overview on the nutrition transition and its health implications: the Bellagio meeting. Public Health Nutr. 2002;5(1a):93-103. DOI: 10.1079/phn2001280.
27. Anyanwu OA, Folta SC, Zhang FF, Chui K, Chomitz VR, Kartasurya MI, et al. A Cross-Sectional Assessment of Dietary Patterns and Their Relationship to Hypertension and Obesity in Indonesia. Curr Dev Nutr. 2022;6(6):nzac091. DOI: 10.1093/cdn/nzac091.
28. Clemente-Suárez VJ, Beltrán-Velasco AI, Redondo-Flórez L, Martín-Rodríguez A, Tornero-Aguilera JF. Global Impacts of Western Diet and Its Effects on Metabolism and Health: A Narrative Review. Nutrients. 2023;15(12). DOI: 10.3390/nu15122749.
29. Jarvis SE, Nguyen M, Malik VS. Association between adherence to plant-based dietary patterns and obesity risk: a systematic review of prospective cohort studies. Applied Physiology, Nutrition, and Metabolism. 2022;47(12):1115-33. DOI: 10.1139/apnm-2022-0059 %M 35985038.
30. Satija A, Malik V, Rimm EB, Sacks F, Willett W, Hu FB. Changes in intake of plant-based diets and weight change: results from 3 prospective cohort studies. Am J Clin Nutr. 2019;110(3):574-82. DOI: 10.1093/ajcn/nqz049.
31. Wang YB, Shivappa N, Hébert JR, Page AJ, Gill TK, Melaku YA. Association between Dietary Inflammatory Index, Dietary Patterns, Plant-Based Dietary Index and the Risk of Obesity. Nutrients. 2021;13(5). DOI: 10.3390/nu13051536.
32. García-Montero C, Fraile-Martínez O, Gómez-Lahoz AM, Pekarek L, Castellanos AJ, Noguerales-Fraguas F, et al. Nutritional Components in Western Diet Versus Mediterranean Diet at the Gut Microbiota-Immune System Interplay. Implications for Health and Disease. Nutrients. 2021;13(2). DOI: 10.3390/nu13020699.
33. Alkerwi A, Crichton GE, Hébert JR. Consumption of ready-made meals and increased risk of obesity: findings from the Observation of Cardiovascular Risk Factors in Luxembourg (ORISCAV-LUX) study. Br J Nutr. 2015;113(2):270-7. DOI: 10.1017/s0007114514003468.
34. Teo CH, Chin YS, Lim PY, Masrom SAH, Shariff ZM. School-based intervention that integrates nutrition education and supportive healthy school food environment among Malaysian primary school children: a study protocol. BMC Public Health. 2019;19(1):1427. DOI: 10.1186/s12889-019-7708-y.
35. Davis J, Ventura E, Alexander K, Salguero L, Weigesberg M, Crespo N, et al. Feasibility of a home-based versus classroom-based nutrition intervention to reduce obesity and type 2 diabetes in Latino youth. International Journal of Pediatric Obesity. 2009;2(1). DOI: 10.1080/17477160601133077.
36. Novta N, Wong J. Women at work in Latin America and the Caribbean. IMF; 2017. Available from: https://www.imf.org/en/Publications/WP/Issues/2017/02/14/Women-at-Work-in-Latin-America-and-the-Caribbean-44662
37. Mankani R, Tata K. A Study on Consumer Behaviour of Ready-to-Eat Food with Special Reference to Women in Mumbai. Journal of Positive School Psychology. 2022;6(4):13. DOI: 10.2139/ssrn.2141192.
38. Rathee R, Rajain P, Kuchhal A. Ready-to-Eat Products: Perspective of Working Women. International Journal of Management ,Technology, and Engineering. 2018;8(XII):16.