DIET QUALITY DURING PREGNANCY IS A RISK FACTOR FOR STUNTING BIRTH IN TRIMULYO PUBLIC HEALTH CENTER, PESAWARAN DISTRICT

Antun Rahmadi[1*], Arie Nugroho[2], Bertalina[3], Abdullah[4]
[1,2,3]Poltekkes Kemenkes Tanjungkarang (INDONESIA)
[4]Universitas Aisyah Pringsewu (INDONESIA)

[*]Corresponding author: antunrahmadi@poltekkes-tjk.ac.id

Abstract

Maternal nutritional intake during pregnancy is related to the birth of stunted babies. The relationship between maternal diet quality and stunting incidence is still poorly understood. This study aims to determine the differences in maternal diet quality during pregnancy between mothers who give birth to stunted and non-stunted babies. A case-control study was conducted on 31 pairs of mothers with a history of giving birth to stunted and non-stunted babies. Maternal diet assessment during pregnancy was carried out using FFQ-SQ and diet quality was evaluated using the Diet Quality Index-International (DQI-I). Determination of stunting cases used birth records in the KIA Book. The DQI-I score of subjects in the control group was greater than that of the case group, namely 67.81 and 56.55. The difference was statistically significant so that it can be concluded that maternal diet quality during pregnancy is a risk factor for the birth of stunted babies. Overall, the DQI-I score of subjects in the control group was already in the good category (>60%), however, more efforts are needed to increase the scores in both groups.

Keywords: *Maternal, quality diet, stunting, pregnancy*

1. INTRODUCTION

Stunting is still a public health problem in several countries in the world, including Indonesia [1]. The results of the 2023 Indonesian Health Survey (SKI), the prevalence of stunting in under five children in Indonesia is still high, namely 21.5% [2]. Stunting is a short or very short stature based on length/height according to age of less than -2 Standard Deviations (SD) on the 2006 WHO growth curve, caused by chronic malnutrition associated with low socioeconomic status, poor maternal nutritional intake and health, history of recurrent illness and inappropriate feeding practices for infants and children. Stunting causes obstacles in achieving children's physical and cognitive potential [3].

The World Health Organization states that around 20% of stunting cases occur since the child is in the womb. One important factor that contributes to stunting is the nutritional status of the mother during pregnancy. Poor nutritional status of the mother before and during pregnancy is at risk of giving birth to a baby with low birth weight [4], [5]. This condition then has an impact on the growth of the baby after birth which can cause stunting.

The results of Fitriani's research (2020), maternal nutritional status during pregnancy is significantly related to the incidence of stunting in children. Poor maternal nutritional status causes the prevalence of stunting in toddlers during pregnancy to be 85%. The results of the study also showed that children born to mothers with poor nutritional status during pregnancy are 13 times more likely to experience stunting than children born to mothers with good nutritional status [6].

In Indonesia, the prevalence of pregnant women experiencing Chronic Energy Deficiency (CED) is 17.3% and pregnant women experiencing anemia is 48.9%. In addition, the prevalence of pregnant women with short stature (height <145 cm) is still high, which is 29.9% [7]. This condition shows that the nutritional status of pregnant women in Indonesia is still low, which needs serious attention.

The low nutritional status of pregnant women in Indonesia is partly caused by poor consumption patterns. Most pregnant women have intakes of protein, iron, zinc, vitamin A, and folic acid that do not meet the recommended nutritional adequacy [8]. This has an impact on fetal growth disorders in the womb which triggers the risk of giving birth to short babies [9]. In addition to consumption patterns, another factor that causes nutritional problems in pregnant women is infection [10]. Pregnant women who suffer from chronic infections tend to experience impaired absorption of nutrients needed for fetal growth. In addition, pregnant women who are often sick also tend to have a decreased appetite which has an impact on nutritional intake. Therefore, handling infections and complete immunization in pregnant women is also important to prevent shortness.

Studies to determine the quality of diet are important to be conducted in order to determine the causes of malnutrition, not only in mothers but also in children for the rest of their lives. Based on previous studies aimed at determining the quality of diet in pregnant women in Indonesia, the results showed that the quality of diet in pregnant women in several regions in Indonesia is still poor and there needs to be an improvement in the quality of diet [11], [12], [13]. In Indonesia, research related to the quality of diet in pregnant women is still limited. This study aims to assess the quality of the mother's diet during pregnancy in relation to the nutritional status of the baby born.

2. METHODOLOGY

The method used in this study is a case-control study with a retrospective design. This study has received ethical approval from the Ethics Committee of Poltekkes Tanjungkarang number 413 / KEPK-TJK / V / 2024 which is valid until May 16, 2025. The population is mothers who have babies aged 0 to 12 months. The case group sample was selected from the population purposively with the criteria of having a history of giving birth to stunted babies, having a KIA book, and being willing to be a research subject as evidenced by filling out the Informed Consent form. which is 31 people. The selection of control group samples was carried out purposively with a ratio of one to one so that the sample from both groups totaled 62 people.

The dependent variable in this study was diet quality processed from data on respondents' consumption patterns collected using the Semi Quantitative-Food Frequency Questionnaire (SQ-FFQ) method. Diet quality analysis was carried out using the Diet Quality Index-International (DQI-I) method. DQI-I is a composite indicator of diet quality at the individual level. Created in 2003, this indicator is the first indicator of a healthy diet designed to allow comparison of diet quality across cultures [14]. DQI-I was developed from existing indicators, such as the Healthy Eating Index (HEI) and the Diet Quality Index (DQI), but was formulated by combining many aspects of diet that contribute to quality, including diversity, adequacy, moderation, and balance. Scores in DQI-I range from 0 to 100, which are determined by summing the scores of the various components, namely 0-20 for variety, 0-40 for adequacy, 0-30 for moderation, and 0-10 for overall balance. If the total score is > 60% of the highest score, the diet quality is considered good and a score < 60% indicates poor diet quality [15].

The independent variable in this study is the nutritional status of the baby born. This variable is collected through the record of the baby's length at birth contained in the KIA Book. The nutritional status of the baby is determined based on the Body Length Index for Age with the category of stunting if the z-score is less than -2 SD (Standard Deviation) while it is categorized as not stunting if the z-score is equal to or more than -2 SD on the WHO 2006 standard curve [16].

Data processing and analysis were performed using computer software including univariate analysis to describe the characteristics of each variable and presented in the form of a distribution table. Univariate analysis was performed on data on age, height, education, occupation and economic status. To test the difference in average diet quality scores between the case and control groups, the Independent sample T test was performed.

3. RESULTS

Previous studies have found that the variables of age, height, education, occupation and income are related to the incidence of stunting in toddlers [17-21] so that they can interfere with uncontrolled analysis. The results of the cross-tabulation analysis between subject characteristics according to case and control groups presented in Table 1 show that age, height, education, occupation and income of subjects are not statistically different between the case and control groups.

Table 1: *Characteristics of Research Subjects in Case and Control Groups*

Characteristics	Case	Control	Sig
Age	29,4 ± 1,006	28,7 ± 1,113	0,638*
Height	152,2 ± 4,5	153,5 ± 3,6	0,202*
Education:			
Primary	4 (66,7%)	2 (33,3%)	0,642**
Secondary	25 (49,0%)	26 (51,0%)	
University	2 (40,0%)	3 (60,0%)	
Occupation:			
Employed	6 (46,2)	7 (53,8%)	0,755**
Not employed	25 (51,0)	24 (49,0%)	
Income:			
≥ UMK (district minimum wage)	15 (45,5%)	18 (54,5%)	0,445**
< UMK	16 (55,2%)	13 (44,8%)	

* Independent sample T test
** Chi-Squared test

The description of maternal diet quality assessed by the DQI-I method is presented in Table 2. Based on the assessment of the four components of diet quality, the total diet quality score was 56.65 in the subjects in the case group and 67.81 in the control group. The independent sample T test used to test the difference showed that there was a significant difference between the case group and the control group. The results of the average difference test of the scores of the 4 components of diet quality showed that there were 3 components, namely variation, adequacy, and balance, which were significantly different and only the moderation component did not differ between the case group and the control group. The total diet quality index score in the case group was 56.55 or below 60% of the highest DQI-I score (100). This shows that the diet quality of the subjects in the case group is included in the poor category. On the other hand, the total diet quality index score in the control group was above 60% or included in the good category [15]. However, efforts are needed to improve both groups to achieve higher scores.

Table 2: *Overview of Diet Quality Scores in Case and Control Groups*

Component	Group	n	Mean	SD	Sig*
Variety	Case	31	7.97	3.420	0,001
	Control	31	10.65	2.537	
Adequacy	Case	31	16.84	3.934	0,002
	Control	31	22.32	8.162	
Moderation	Case	31	18.39	1.498	0,808
	Control	31	18.29	1.616	
Overall Balance	Case	31	5.81	1.887	0,002
	Control	31	7.16	1.344	
Total	Case	31	56.55	9.959	0,000
	Control	31	67.81	10.313	

*Independent sample T test

Table 3 illustrates the components of the Variation of food groups and protein sources. Food groups in the variation component include 5 types, namely 1) meat/poultry/fish/eggs. 2) milk/nuts, 3) grains, 4) fruits, and 5) vegetables. The variation of protein sources consists of 6 types, namely 1) meat, 2) poultry, 3) fish, 4) milk, 5) nuts, and 6) eggs. In table 3 it can be seen that most subjects consume 2 types of food groups every day. Most of the subjects' diets are grains and animal or vegetable foods. The protein sources used by subjects in the case group were mostly only 1 source of protein per day while in the control group 2 sources of protein per day. Likewise with the use of protein sources, most subjects in the case group only used 1 source of protein such as nuts. Most subjects in the control group used 2 sources of protein. Generally, nuts and animal sources such as eggs and fish. This shows that in general the food consumed by the subjects is still not very varied because according to the Ministry of Health, adults are recommended to consume 4 types of food groups [22].

Table 3: Description of Food Variety in Case and Control Groups

Variation	Case		Control	
	n	%	n	%
Overall food group variety:				
≥1 serving from each food group/d	6	19.4	1	3.2
Any 1 food group missing/d	18	58.1	16	51.6
Any 2 food groups missing/d	6	19.4	12	38.7
Any 3 food groups missing/d	1	3.2	2	6.5
Total	31	100.0	31	100.0
Within-group variety for protein source				
≥3 different sources/d	16	51.6	2	6.5
2 different sources/d	12	38.7	24	77.4
From 1 source/d	3	9.7	5	16.1

Total	31	100.0	31	100.0

Table 4 illustrates the components of the adequacy of food groups of vegetables, fruits, grains, fiber, protein, iron, and calcium. The adequacy of vegetables, fruits, and grains is differentiated according to the portion of consumption. The results of the analysis showed that most subjects consumed 1-2 servings of vegetables and less than 1 serving of fruit per day. Thus, the adequacy of vegetables and fruits is still lacking because according to WHO recommendations, the consumption of vegetables and fruits for a healthy life is 250 g of vegetables and 150 g of fruit per person per day or equivalent to 2.5 servings and 1.5 servings [23]. The adequacy of fiber and protein in most subjects is still lacking. Based on the 2019 Nutritional Adequacy Rate (AKG), the fiber requirement for women aged 30-49 years is 30 grams per day. According to the Ministry of Health, the protein requirement is 10-15% of the total calorie requirement. Table 4 shows that some subjects in the case group, more than half of their protein intake is still less than 10% of the total calorie requirement. Protein intake during pregnancy is a risk factor for stunting in infants [24]. The adequacy of iron, calcium, and vitamin C in most subjects was below 100% AKG. This indicates a lack of conditions because according to the Ministry of Health, all nutrients must always be met 100% or more every day [25].

Table 4: Overview of Food Group Adequacy in Case and Control Groups

Food Group Adequacy	Case		Control	
	n	%	n	%
Vegetable group				
1–2 servings/d	27	87.1	26	83.9
≥3–5 servings/d	4	12.9	5	16.1
Total	31	100.0	31	100.0
Fruit group				
<1 servings/d	21	67.7	13	41.9
≥1–2 servings/d	10	32.3	13	41.9
Total	31	100.0	5	16.1
Grain group				
< 1 servings/d	2	6.5	24	77.4
≥1–5 servings/d	29	93.5	7	22.6
Total	31	100.0	31	100.0
Fiber				
<20 g/d	28	90.3	20	64.5
≥20–30 g/d	3	9.7	11	35.5
Total	31	100.0	31	100.0
Protein				
<10% of energy/d	16	51.6	7	22.6
≥10% of energy/d	15	48.4	24	77.4
Total	31	100.0	31	100.0
Iron				
< 100% RDA (AI)/d	20	64.5	11	35.5
≥100% RDA (AI)/d	11	35.5	20	64.5
Total	31	100.0	31	100.0
Calcium				
< 100% RDA (AI)/d	29	93.5	21	67.7

≥100% RDA (AI)/d	2	6.5	10	32.3
Total	31	100.0	31	100.0
Vitamin C				
< 100% RDA (AI)/d	24	77.4	16	51.6
≥100% RDA (AI)/d	7	22.6	15	48.4
Total	31	100.0	31	100.0

The moderation component describes nutrients or foods whose consumption is limited. The moderation component includes total fat, saturated fat, cholesterol, sodium, and non-calorie foods. Table 5 shows that the intake of total fat and saturated fat of most subjects is still within the tolerance limit. WHO emphasizes that adults should limit total fat intake to 30% of total daily energy intake. Fat consumed by everyone aged 2 years and over should be unsaturated fatty acids, with no more than 10% of total energy intake coming from saturated fatty acids and no more than 1% of total energy intake coming from trans fatty acids [26]. The cholesterol intake of most subjects was at 300-400 mg per day. This shows that the cholesterol intake of the subjects was still within the recommended limits. The 9th Dietary Guidelines for Americans recommends no more than 300 mg/day of cholesterol for a healthy population [27]. Almost all subjects' sodium intake ranged from 2400-3400 mg per day. This is high because the recommended sodium intake for adults according to WHO is 2000 mg per day [28].

Table 5: Overview of Moderacy Components in Case and Control Groups

Moderacy	**Case**		**Control**	
	n	**%**	**n**	**%**
Total fat				
>20% - 30% of total energy/d	29	93.5	27	87.1
≤20% of total energy/d	2	6.5	4	12.9
Total	31	100.0	31	100.0
Saturated fat				
>7% of total energy/d	29	93.5	27	87.1
≤7% of total energy/d	2	6.5	4	12.9
Total	31	100.0	31	100.0
Cholesterol				
>400 mg/d			2	6.5
>300 s.d 400 mg/d	31	100.0	29	93.5
Total	31	100.0	31	100.0
Sodium				
>3400 mg/d			1	3.2
>2400 - 3400 mg/d	31	100	30	96.8
Total	31	100.0	31	100.0
Empty calorie foods				
>3% of total energy/d			2	6.5
≤3% of total energy/d	31	100	29	93.5
Total	31	100.0	31	100.0

Table 6 describes the balance components including macronutrient ratio and fatty acid ratio. Macronutrient ratio describes the comparison of carbohydrates, proteins, and fats. Most of which are in the sufficient and good categories. Fatty acid ratio describes the comparison between Poly Unsaturated Fatty Acid (PUFA), Mono Unsaturated Fatty Acid (MUFA), and Saturated Fatty Acid (SFA) which are mostly in the sufficient and good categories.

Table 6: Overview of Overall Balance

Overall balance	Case		Control	
	n	%	n	%
Macronutrient ratio (carbohydrate : protein : fat)				
50 ~ 70:8 ~ 17:12 ~ 30	16	51.6	7	22.6
52 ~ 68:9 ~ 16:13 ~ 27	14	45.2	21	67.7
55 ~ 65:10 ~ 15:15 ~ 25	1	3.2	3	9.7
Total	31	100.0	31	100.0
Fatty acid ratio (PUFA : MUFA : SFA)				
Else if P/S = 0.8 ~ 1.7 and M/S = 0.8 ~ 1.7	19	61.3	9	29.0
P/S = 1 ~ 1.5 and M/S	12	38.7	22	71.0
Total	31	100.0	31	100.0

4. CONCLUSIONS

Dietary Quality Index International (DQI-I) score can be used as an indicator of individual diet quality. The results showed that the average DQI-I score of subjects in the control group was greater than in the case group, namely 67.81 and 56.55. The difference was statistically significant so that it can be concluded that the quality of the mother's diet during pregnancy is a risk factor for the birth of stunted babies. Overall, the DQI-I score of subjects in the control group was already in the good category (> 60%), however, more efforts are needed to increase the scores in both groups.

5. ACKNOWLEDGEMENTS

This article is written based on the results of the study "Dietary history of mothers of stunted babies at Trimulyo Pesawaran Health Center. A case control study" funded by Poltekkes Kemenkes Tanjungkarang through the Research Grant Program for the Inter-University Collaborative Research (PKPT) scheme in 2024. The author would like to thank the Director of Poltekkes Kemenkes Tanjungkarang and all members of the research team who have contributed to the research and writing of the article.

6. REFERENCES

[1] de Onis M, Borghi E, Arimond M, Webb P, Croft T, Saha K, De-Regil LM, Thuita F, Heidkamp R, Krasevec J, Hayashi C, Flores-Ayala R. (2019). Prevalence thresholds for wasting, overweight and stunting in children under 5 years. Public Health Nutr. 2019 Jan;22(1):175-179. doi: 10.1017/S1368980018002434. Epub 2018 Oct 9. PMID: 30296964; PMCID: PMC6390397

[2] Ministry of Health (2023). Indonesian Health Survey (SKI) 2023 in Figures. Health Development Policy Agency, Ministry of Health of the Republic of Indonesia.

[3] Winasandis BF, Tamtomo D, Anantanyu S (2020). Associations between Maternal Nutritional Status, Carbohydrate, Fat, and Protein Intakes, and Low Birth Weight in Jember, East Java. J Matern Child Health. 5(1): 1-11. https://doi.org/10.26911/thejmch.2020.05.01.01 Journal of Maternal and Child Health is licensed under a Creative Commons Attribution-Non Commercial-Share Alike 4.0 International License.

[4] Lassi, Z. S., Kedzior, S. G., Tariq, W., Jadoon, Y., Das, J. K., & Bhutta, Z. A. (2020). Effects of preconception care and periconception interventions on maternal nutritional status and birth outcomes in low-and middle-income countries: a systematic review. *Nutrients*, *12*(3), 606.

[5] Fitriani, Hemi, Achmad Setya R, and Popy Nurdiana. "Risk factors of maternal nutrition status during pregnancy to stunting in toddlers Aged 12–59 Months." (2020).

[6] Ministry of Health (2018). Main Results of Riskesdas 2018. Accessed from https://www.kemkes.go.id/resources/download/info-terkini/hasil-riskesdas-2018.pdf..

[7] Septyasih, A. R. N., Widajanti, L., & Nugraheni, S. A. (2016). Relationship between intake of iron, folic acid, vitamin B12 and vitamin C with hemoglobin levels of students at SMP Negeri 2 Tawangharjo, Grobogan Regency. Journal of Public Health, 4(4), 521-528.

[8] Reyes-López, M. A., González-Leyva, C. P., Rodríguez-Cano, A. M., Rodríguez-Hernández, C., Colin-Ramírez, E., Estrada-Gutierrez, G., ... & Perichart-Perera, O. (2021). Diet quality is associated with a high newborn size and reduction in the risk of low birth weight and small for gestational age in a group of Mexican pregnant women: an observational study. *Nutrients*, *13*(6), 1853.

[9] Gaspersz, E., Picauly, I., & Sinaga, M. (2020). The relationship between consumption pattern factors, history of infectious diseases, and personal hygiene with the nutritional status of pregnant women in the stunting locus area, North Central East Regency. Journal of Food Nutrition and Health, 9(2), 1081-1090.

[10] Dewi R.K., Khomsan A., Riyadi H., Diana R. (2019) Dietary Quality and Nutritional Status of Pregnant Women in Sumenep Regency, Madura, Indonesia. Pakistan Journal of Nutrition, 17 (11): 530-534

[11] Siregar D.A.S., Rianda, D., Irwinda, R., Dwi Utami, A., Hanifa, H., Shankar, A. H., & Agustina, R. (2020) Associations between diet quality, blood pressure, and glucose levels among pregnant women in the Asian megacity of Jakarta. PloS one, 15(11)

[12] Chia, A.R.; Chen, L.W.; Lai, J.S.; Wong, C.H.; Neelakantan, N.; van Dam, R.M.; Chong, M.F. (2019) Maternal Dietary Patterns and Birth Outcomes: A Systematic Review and Meta-Analysis. Adv. Nutr, 10, 685–695

[13] Kim, S., Haines, P. S., Siega-Riz, A. M., & Popkin, B. M. (2003). The Diet Quality Index-International (DQI-I) provides an effective tool for cross-national comparison of diet quality as illustrated by China and the United States. *The Journal of nutrition*, *133*(11), 3476-3484.

[14] Jalloun RA, Maneerattanasuporn T. Comparison of diet quality among female students in different majors at Taibah University. Nutr Health. 2020. doi:10.1177/0260106020967846

[15] World Health Organization . (2017). *Classification of nutritional status of infants and children*. Retrieved July 21, 2021, from https://www.ncbi.nlm.nih.gov/books/NBK487900/table/fm.s1.t1/

[16] Sholeha, A. (2023). Relationship between maternal height and the incidence of stunting in children aged 24-59 months in Wonomerto District, Probolinggo Regency in 2022. Healthy Tadulako Journal, 9(1), 19-26.

[17] Agustin, L., & Rahmawati, D. (2021). The relationship between family income and the incidence of stunting. Indonesian Journal of Midwifery (IJM), 4(1), 30

[18] Wanimbo, E., & Wartiningsih, M. (2020). The relationship between maternal characteristics and the incidence of stunting in toddlers (7-24 months). Journal of Health Management, Dr. Soetomo Hospital Foundation Volume 6, Number 1 April 2020

[19] Husnaniyah, D., Yulyanti, D., & Rudiansyah, R. (2020). The relationship between maternal education level and the incidence of stunting. The Indonesian Journal of Health Science, 12(1), 57-64.

[20] Savita, R., & Amelia, F. (2020). The Relationship of Maternal Employment, Gender, and ASI Eklusif with Incident of Stunting inToddler Aged 6-59 Months. Jurnal Kesehatan Poltekkes Kemenkes RI Pangkalpinang, 8(1), 6-13

[21] Ministry of Health. Regulation of the Minister of Health of the Republic of Indonesia Number 41 of 2014 Concerning Balanced Nutrition Guidelines.

[22] World Health Organization. Fruit and vegetable promotion initiative/a meeting report. Report of the meeting (2003). doi:http://www.who.int/dietphysicalactivity/publications/f&v_promotion_initiative_report.pdf

[23] Hayana, I., & Lasepa, W. (2023). The Relationship between Pregnant Women's Nutritional Intake and the Incidence of Stunting Systematic Review Method. Tambusai Health Journal, 4(4), 7095-7103.
[24] Ministry of Health. Regulation of the Minister of Health of the Republic of Indonesia Number 28 of 2019 Concerning Recommended Nutritional Adequacy for the Indonesian People
[25] World Health Organization updates guidelines on fats and carbohydrates 17 July 2023 https://www.who.int/news/item/17-07-2023-who-updates-guidelines-on-fats-and-carbohydrates
[26] U.S. Department of Agriculture and U.S. Department of Health and Human Services. Dietary Guidelines for Americans, 2020-2025. 9th Edition. December 2020. Available at DietaryGuidelines.gov.
[27] World Health Organization. Sodium reduction 14 September 2023 https://www-who-int.translate.goog/news-room/fact-sheets/detail/saltreduction?