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Iodized Salt Intake by Pregnant Woman Can Affect Stunting in Toddlers: a Case Control Study

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Abstract. Iodized intake was important to pregnant women, because lack of iodine can lead to a spectrum of growth, developmental, and functional morbidities across the entire life cycle. This study aimed to determine the relationship between intake iodized salt with the prevalence of stunting among toddlers. This research employed case control study for toddlers in Rahayu Community Health Center area, Margaasih District. The sample consisted of 118 respondents divided into 59 cases and controls. All data were obtained through interviews, and testing iodized salt intake using iodine test kit. Results showed maternal anthropometry at risk was 33.1%, average parity was at second parity. Most education level was in low group. Age pregnancy at risk was 32.2%. As many as 30.5% respondents did not consume iodized salt for their daily intake. There was a significant relationship between maternal characteristics (p:0.019), maternal parity (p:0.023), maternal education level (p: 0.025), and maternal age during pregnancy (p:0.030) and consume of iodized salt (p: 0.009;) with stunting prevalence in toddlers. It can be concluded that it is needed to promote health information about iodized salt and the best way to storage, use and the amount consumed every day in the family.
Keywords: iodized intake, stunting, pregnant women, toddler nutrition

1 Introduction

Stunting is one of the main nutritional problems among toddlers in Indonesia that has not been resolved. Stunting caused by malnutrition in babies in the first 1000 days of life that lasts a long time and causes delays in brain development and child growth and development.(1) According to WHO, the prevalence of stunting in the world will reach 22.3% or 148.1 million people in 2022. The prevalence of stunting and very short toddlers in Indonesia was 30.8% in 2018.(2) According to the Indonesian Toddler Nutrition Status Survey (SSGBI) in 2019, this figure dropped to 27.7 %. The reduction in stunting rates has been declared a national priority program.(3)

Stunting can occur due to lack of micronutrient intake, one of which was iodine. Iodine can stimulate thyroid hormone synthesis, thereby Influencing and Strengthening Growth Hormone (GH). If GH deficiency occurs before puberty, it will cause growth that was not appropriate for age.(4) During pregnancy, it was important to provide the body of a pregnant woman with all the necessary nutrients, minerals and vitamins.(5) The energy value of the diet should also be properly planned. Deficiency or excess of nutrients can lead to permanent modifications of the body's hormonal and metabolic processes. A lack of iodine can lead to a spectrum of growth, developmental, and functional morbidities across the entire life cycle, which were known as iodine deficiency disorders. (6) The trace element iodine is a fundamental constituent of thyroid hormones. Humans take up iodine via routine dietetic consumption.(7) Pregnant women who do not consume dairy products may be particularly at risk of iodine insufficiency. During pregnancy and early infancy, iodine deficiency can cause irreversible effects. One of the most abundant and easily available food sources of iodine is iodized salt. Iodine fortification of salt is a step taken by the government to provide good iodine intake for the body because consumption of fish, meat or dairy products per capita in Indonesia was still low(8).

Measuring iodine adequacy in the body is important to monitoring iodized salt consumption in the household. This can be done in several ways, including measuring urinary iodine excretion levels. So far, there has not been much analysis of urinary iodine excretion levels in toddlers. Research related to analysis of urinary iodine excretion levels mostly carried out on school-aged children.(6) Efforts to improve nutritional status with iodine were part of nutritional interventions in integrated stunting prevention. The government has created a national strategy to accelerate stunting prevention.(9) There has not been much research regarding the relationship between consumption of iodized salt and the prevalence of stunting. Meanwhile, the stunting rate was still high, and it turns out that there were still many housewives who do not use iodized salt.

The main purpose of this research was to determine the relationship between the use of iodized salt and the prevalence of stunting in toddlers. Apart from that, we also want to know the relationship the relationship between maternal characteristics, which include maternal height, maternal parity, maternal education level, and maternal age during pregnancy with the prevalence of stunting in toddlers Rahayu Community Health Center area, Margaasih District, West Java Indonesia.

2 Methods

This research was observational research with a case control study research design. This research was conducted in the Rahayu Community Health Centre area, Margaasih District from October 2023 to January 2024. Possible procedures were explained to respondents before signing the consent for participation in the study. Test procedures and protocols have been carried out in accordance with the Declaration of Helsinki. This research has received ethical approval from the health research ethics committee of the Immanuel Health of Institute. The method of agreement between researchers and respondents was by providing a consent sheet, that was provided before the study. All subjects gave their informed consent before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and protocol was approved Immanuel Health Sciences Ethical Committee Number 201/KEPK/IKI/XII/2023. The population in this study were all toddlers aged 12-59 months residing in the Rahayu Community Health Centre area, Margaasih District, West Java Indonesia.

Sampling technique was simple random sampling. The number of research subjects was calculated using the Lemeshow formula(10) with proportion exposed to cases as many as 0,869 and proportion exposed to controls was 0.562 (11). To obtain a sample size of 118 respondents with details of 59 respondents in the case group (stunting) and 59 respondents in the control group (not stunting). Sample in the study must meet the inclusion criteria, mothers who have toddlers and willing to be a respondent. The research exclusion criteria were toddlers who had congenital abnormalities or physical disabilities.

Data collected including: maternal parity, maternal education level, and maternal age during pregnancy. It collected by interview using a questionnaire, while maternal height data was obtained by measuring height using microtoise. Data on the use of iodized salt was collected by testing the iodine content in salt using an iodine test kit. Data stunting in toddlers were known by measuring the height divided by body length of toddlers compared to age. Then, using standard anthropometric tables for children in 2020 to compare with. Nutritional status were determined based on height and age. Maternal anthropometry consists of: maternal parity and maternal age during pregnancy. They were categorized into "risk" and "not at risk". Maternal education level was categorized into "low" and "high" and the use of iodized salt was categorized into "no" and " yes", and the prevalence of stunting in toddlers was categorized into "stunting" and "not stunting".

3 Results And Discussion

3.1 Result

The research location was in Margaasih District in Bandung Regency, West Java Province. It is one of urban area type of community. The respondents in this study were 118 mothers who had toddlers aged 12-59 months in Rahayu Community Health Center area, Margaasih District. An overview of the characteristics of respondents who participated in the research was presented in the following Table 1.

Based on Table 1, of the 59 cases group, the gender of children as many as 37 samples (62.7%) were male and 22 samples (37.3%) were female. In the control group of 59 samples, 29 samples (49.1%) were male and 30 samples (50.2%) were female. Most of the research case samples were male (62.7%). The percentage of maternal anthropometry at risk (< 150 cm) was 33.1% and not at risk (> 150 cm) was 66.9%. Most mothers' height were > 150 cm. Apart from that, it can also be seen that the number of mothers at risk (parity 1 or > 4) was 38.1% and not at risk (parities 2 and 3) was 61.9%. The average parity of respondents was at second parity.

Table 1 shows the percentage of respondents' education level was low (no school, elementary school, middle school) at 41.5% and high (> high school) at 58.5%. The average education level of respondents was junior high school/equivalent. There were still mothers who did not attend school, as well as mothers who had not completed basic education when research data was collected. The existence of mothers with low education caused by socio-economic factors and low public awareness about the importance of education for a mother.

Data collection results for the maternal age variable during risky pregnancy (age < 20 years and > 35 years) was 32.2% and not at risk (20-35 years) was 67.8%. The majority of mothers were 20-35 years old when pregnant, or the average mother’s age was 26 years old when they had pregnant. At the time of the research, it was still found that the mother's age at pregnancy was <20 years. Pregnant women aged < 20 years have incomplete blood circulation in the reproductive organs (cervix and uterus), which can disrupt the process of distributing nutrients from the mother to the fetus she has been carrying, so that the fetus's needs were not met. Pregnant women aged > 35 years begin to experience unbalanced food intake due to decreased absorption of nutrients.

Table 1. Distribution of respondent characteristics (n=118*)

Variabel	n = 118	%
Mother’s Height		
Risky	39	33.1
Not Risky	79	66.9
Maternal parity		
Risky	45	38.1
Not Risky	73	61.9
Level of education		
Low	49	41.5
High	69	58.5
Mother's age at the time of pregnancy		
Risky	38	32.2
Not Risky	80	67.8
Use of iodized salt		
No	38	32.2
Yes	80	67.8
Gender of the toddler		
Male	66	55.9
Female	52	44.1

*both cases and control

From Table 2, it can be seen from 59 respondents in the stunting group that 26 respondents (44.1%) found that maternal height was at risk and 33 respondents (55.9%) found that maternal height was not at risk, apart from that they also felt a decrease in the immune system, so they were at risk of experiencing various disease when the mother reaches the age of more than 35 years. As many as 30.5% of respondents did not use iodized salt, and 69.5% of respondents already used iodized salt. From the results of the data collection carried out, of the 36 respondents (30.5%) who did not use iodized salt. There were 20 respondents whose used right brand of salt. However, the iodine content in the salt was not good due to salt storage that did not meet standards, because they stored in open containers, exposed to sunlight, and close to the stove so that the salt becomes damp and wet. And there were 15 respondents who used a poor brand of salt, so that when tested with the iodine test the colour of the salt was pale purple. A bad salt brand can be seen from salt packaging that was easily opened, the colour of the salt was dull, the condition of the salt is damp even though it was still new, and it does not include an expiration date. Apart from that, it was also found that 1 respondent did not use salt without iodine fortification, so that when tested with the iodine test there was no colour change in the salt. Most respondents (97.2%) added salt during cooking.

Table 2. Bivariate analysis between all independent variables and Stunting

Independent Variables	Stunting				p value OR (CI 95%)
	Yes		No		
	f	%	f	%	
Mother's height					0.019*
Risky	26	44.1	13	22.0	2.788
Not Risky	33	55.9	46	78.0	(1.25-6.22)
Maternal parity					0.023*
Risky	29	49.2	16	27.1	2.598
Not Risky	30	50.8	43	72.9	(1.205-5.600)
Level of education					0.025*
Low	31	52.5	18	30,5	2.522
High	28	47.5	41	69.5	(1.187-5.359)
Mother's age at the time of pregnancy					0.030*
Risky	25	42.4	13	22.0	2.602
Not Risky	34	57.6	46	78.0	(1.165-5.811)
Use of iodized salt					0.009**
No	25	42.4	11	18.6	3.209
Yes	34	57.6	48	81.4	(1.393-7.389)

) Chi Square Test at level 5%, 1%**

A total of 59 respondents in the non-stunting group found that 13 respondents (22%) had a risk of maternal height and 46 respondents (78%) had no risk of maternal height. Chi Square test results show that there was a significant relationship between maternal height and the prevalence of stunting among toddlers in Margaasih District, Bandung Regency (p value = 0.019, p<0.05). The results of the Odds Ratio calculation show that a mother's height < 150 cm was 2.788 times more likely to experience stunting in toddlers compared to a mother's height who was not at risk (> 150 cm) (95% CI 1.250-6.217). Of the 59 respondents in the stunting group, it was found that 29 respondents (49.2%) had mothers at risk and 30 respondents (50.8%) had mothers who were not at risk. And of the 59 respondents in the non-stunted group, it was found that 16 respondents (27.1%) had mothers at risk and 43 respondents (72.9%) had mothers who were not at risk. The results of the Chi Square test showed that there was a significant relationship between maternal parity and the prevalence of stunting among toddlers in Margaasih District, Bandung Regency (p value = 0.023, P < 0.05). The results of the Odds Ratio calculation show that parity mothers at risk (parity 1 and parity > 4) have a 2.598 times risk of experiencing stunting in toddlers compared to parity mothers who were not at risk (parity 2 and 3) (95% CI 1.205-5.600).

The low levels of maternal education (no school, elementary school, middle school) were more common in the stunting group (52.5%) than in those without stunting (30.5%). The results of the Chi Square test show that there was a significant relationship between the mother's education level and the prevalence of stunting in toddlers (p value = 0.023, p < 0.05). The results of the Odds Ratio calculation show that a low maternal education level (no school, elementary school, junior high school) was 2.522 times more likely to experience stunting in toddlers compared to a high maternal education level (high school or above) (95% CI 1.187-5.359). Of the 59 respondents in the stunting group, it was found that 25 respondents (42.4%) had a risk of maternal age during pregnancy and 34 respondents (57.6%) had no risk of maternal age during pregnancy. And of the 59 respondents in the non-stunted group, 13 respondents (22.0%) found that the mother's age during pregnancy was at risk and 46 respondents (78.0%) found that the mother's age during pregnancy was not at risk.

The results of the Chi Square test showed that there was a significant relationship between maternal age during pregnancy and the prevalence of stunting among toddlers in Margaasih District (p value = 0.030, p<0.05). The OR calculation results show that maternal age during pregnancy < 20 years and > 35 years has a 2.602 times risk of experiencing stunting in toddlers compared to maternal age during pregnancy between 20 years and 35 years (95% CI 1.126-5.235). As many as 59 respondents in the stunting group were found to use non-iodized salt, 25 respondents (42.4%) and 34 respondents (57.6%) used iodized salt. And of the 59 respondents in the non-stunted group, it was found that 11 respondents (18.6%) used non-iodized salt and 48 respondents (81.4%) used iodized salt. Chi Square test results show that there was a significant relationship between the use of iodized salt and the prevalence of stunting in toddlers (p value = 0.009, p < 0.05). The results of the Odds Ratio calculation show that the use of non-iodized salt has a 3,209 times risk of experiencing stunting in the economy, and other factors cause stunting in toddlers.

In the first year of life, men were more susceptible to malnutrition than women because men's body size was larger, so they require greater energy intake. If nutritional intake was not met and this condition occurs over a long period of time, growth disorders will increase.(12) Genetic factors can influence a child's growth and development, such as genes that influence nutrient absorption, metabolism, and other factors related to growth. A large number of parities will disrupt children's growth due to limited nutritious food due to low economic status.

A mother's level of education and knowledge plays an important role in increasing the mother's competence in managing family resources, to obtain sufficient food ingredients and knowing the available health service facilities and environmental sanitation, which will be used optimally for family health.(13) The prevalence of stunting in toddlers was more common in respondents whose maternal height was not at risk (> 150 cm), possibly due to other factors not studied by researchers that can influence the nutritional status of toddlers, such as variable nutritional intake, infectious diseases, environmental sanitation, social-economics, and other factors that cause stunting in toddlers.(14) Maternal height was not a risk factor for stunting.(15) DNA or heredity was one of the main factors in determining a person's height. Parents will pass on genes for physical characteristics to their children which include: height, face shape, weight, hair and skin color, and intelligence. Parents' height inherits 70% of their child's growth. The researchers concluded that 30% of a child's height can be maximized with a nutritious diet, hormonal conditions and physical activity.(16)

The prevalence of stunting in toddlers was more common in respondents with parity mothers who were not at risk (parity 2-3). Mothers with parity were more likely to have stunted children due to poor parenting patterns and inadequate nutrition during the growth period. Apart from that, a large number of parities will disrupt children's growth due to limited nutritious food due to low economic status. Children born later were at risk of stunting because the more children, the greater the burden borne by parents. This will affect the child's growth and development if the child's nutritional needs were not adequat.(17) This research was in line with research on the relationship between maternal height and the prevalence of stunting in toddlers aged 0-59 months. The height of mothers at risk (<150 cm) was higher in the group of toddler cases (stunting), namely 18 people (23.4%) compared to the control group (not stunting)(18). Relationship between history of hypertension and maternal parity with the prevalence of stunting in toddlers shows that the respondents were multiparous and

most of the respondents' children were stunted. It can be concluded that there was a relationship between maternal parity and the prevalence of stunting in toddlers.(19)

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Table 2 shows, from 59 respondents in the stunting group that 26 respondents (44.1%) found that maternal height was at risk and 33 respondents (55.9%) found that maternal height was not at risk, apart from that they also felt a decrease in the immune system, so they were at risk of experiencing various disease when the mother reaches the age of more than 35 years. As many as 30.5% of respondents did not use iodized salt, and 69.5% of respondents already used iodized salt. From the results of the data collection carried out, of the 36 respondents (30.5%) who did not use iodized salt. There were 20 respondents whose used right brand of salt. However, the iodine content in the salt was not good due to salt storage that did not meet standards, because they stored in open containers, exposed to sunlight, and close to the stove so that the salt becomes damp and wet. And there were 15 respondents who used a poor brand of salt, so that when tested with the iodine test the colour of the salt was pale purple. A bad salt brand can be seen from salt packaging that was easily opened, the colour of the salt was dull, the condition of the salt is damp even though it was still new, and it does not include an expiration date. Apart from that, it was also found that 1 respondent did not use salt without iodine fortification, so that when tested with the iodine test there was no color change in the salt. Most respondents (97.2%) added salt during cooking.

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3.1 Discussion

In the first year of life, men were more susceptible to malnutrition than women because men's body size was larger, so they require greater energy intake, so if nutritional intake was not met and this condition occurs over a long period of time, growth disorders will increase.(12) Genetic factors can influence a child's growth and development, such as genes that influence nutrient absorption, metabolism, and other factors related to growth. A large number of parities will disrupt children's growth due to limited nutritious food due to low economic status.

Parent level of education and knowledge plays an important role in increasing the mother's competence in managing family resources, to obtain sufficient food ingredients and knowing the available health service facilities and environmental sanitation, which will be used optimally for family health.(13) The prevalence of stunting in toddlers was more common in respondents whose maternal height was not at risk (> 150 cm), possibly due to other factors not studied by researchers that can influence the nutritional status of toddlers, such as variable nutritional intake, infectious diseases, environmental sanitation, social-economics, and other factors that cause stunting in toddlers.(14) Maternal height was not a risk factor for stunting.(15) DNA or heredity was one of the main factors in determining a person's height. Parents will pass on genes for physical characteristics to their children which include: height, face shape, weight, hair and skin color, and intelligence. Parents' height inherits 70% of their child's growth. The researchers concluded that 30% of a child's height can be maximized with a nutritious diet, hormonal conditions and physical activity.(16)

The prevalence of stunting in toddlers was more common in respondents with parity mothers who were not at risk (parity 2-3). Mothers with parity were more likely to have stunted children due to poor parenting patterns and inadequate nutrition during the growth period. Apart from that, a large number of parities will disrupt children's growth due to limited nutritious food due to low economic status. Children born later were at risk of stunting because the more children, the greater the burden borne by parents. This will affect the child's growth and development if the child's nutritional needs were not adequat.(17) This research was in line with research on the relationship between maternal height and the prevalence of stunting in toddlers aged 0-59 months. The height of mothers at risk (<150 cm) was higher in the group of toddler cases (stunting), namely 18 people (23.4%) compared to the control group (not stunting).(18) The relationship between history of hypertension and maternal parity with the prevalence of stunting in toddlers shows that the respondents were multiparous and most of the respondents' children were stunted. There was a relationship between maternal parity and the prevalence of stunting in toddlers.(19)

Mothers who were highly educated more likely to make decisions that will improve their child's nutrition and health, have better knowledge for their children such as providing adequate breast milk, nutritious food, immunization, and family planning. Education for women will be a useful step in reducing the prevalence of malnutrition, especially stunting.(20) There was a significant association between stunting and mother’s and father’s education status.(21) The prevalence of stunting in toddlers was more common in respondents who had iodized salt intake. The others factor that can effect of stunting in toddlers such as variable nutritional intake, infectious diseases, socio-economics, and other factors that cause stunting in toddler.(22)

Data shows that the prevalence of stunting in toddlers was more common in families that do not use iodized salt compared to families that use iodized salt.(23) There was around 5-20 mg of iodine in our body. Most of the iodine around 70-80% was found in the thyroid gland. The thyroxine hormones in the thyroid gland, namely T4 and T3, play a role in growth, namely stimulating the secretion and strengthening of Growth Hormone (GH) and affecting nerve and mental cells in toddlers and fetuses. If GH deficiency occurs before puberty, it causes Darwinism, namely small/abnormal, growth that was not appropriate for age. The research results show that consumption of iodized salt was a risk factor for stunting in toddlers.(24) The limitation of this study was the lack of information on family iodine intake.

4 Conclusion

Most mothers whose height was not at risk of stunting under-five pregnancies. Mothers who were not in a good height dimension, mothers with parity at greater risk and have lower education were at risk of giving birth to stunted children, and families who did not use iodized salt. The risk factors for stunting in toddlers were maternal height, maternal parity, maternal education, maternal age during pregnancy and iodized salt in daily intake. It was hoped that this research can provide information for local health centre to provide education on the use of iodized salt, especially in storage, use and the amount consumed every day in the family.

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