Determinants of Stunting in Young Women Age 13-15 Years in South Galesong District, Takalar Regency, Indonesia: a Cross-sectional Study

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ABSTRACT

Background and Objective. Malnutrition is a serious public health problem in developing countries, including Indonesia. Based on RISKESDAS 2018, the prevalence of stunting aged 13-15 years in Takalar Regency is 24.83%. This study aimed to assess the prevalence of stunting and the determinants of stunting in adolescent girls aged 13-15 years in the South Galesong District, Takalar Regency.

Methods. This is a cross-sectional study using purposive sampling method that included 247 adolescent girls in selected junior high schools. Data collection used questionnaires and anthropometric measurements. An anthropometric measurement was converted to the indices of nutritional status using World Health Organization Anthro Plus software.

Results. The prevalence of stunting was 25.1%. Bivariate analysis showed determinant factors related significantly to stunting were energy intake (p<0.001), protein intake (p<0.001), iron intake (p<0.005), and zinc intake (p<0.001). Multivariate analysis showed determinant factors related significantly to stunting were zinc intake (p<0.001, OR=7.993), protein intake (p<0.05, OR=2.248), and knowledge level (p<0.05, OR=2.032).

Conclusion. The occurrence of stunting is related to the quality and quantity of food and the level of adolescent knowledge about balanced nutrition. It is necessary to hold educational programs and interventions on improving nutrition initiated by stakeholders and the department of health, in this case, the health center is needed to reduce stunting rates, especially among adolescents.

Keywords: malnutrition, stunting, adolescents

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INTRODUCTION

The World Health Organization (WHO) defines adolescents as young people aged 10-19. Adolescence is the transformation of children to the world of adults.[1] More than 500 million young women live in low- and middle-income countries.[2] Based on the Central Statistics Agency in 2018, the number of teenagers in Indonesia was 63.82 million. With this number, the health and well-being of adolescents must be prioritized.[3,4]

Riskesdas 2013 shows that the prevalence of stunting in adolescents aged 13-15 is 35.1%. Meanwhile, Riskesdas 2018 showed that 26% of adolescents aged 13-15 experienced stunting. The prevalence of stunting in South Sulawesi is 28.3%, and in Takalar district, it is 24.83%.[5,6] Adequate nutrition during adolescence is important because it affects hormonal mechanisms related to growth and puberty.[7]

Adolescent girls are vulnerable to stunting and wasting during adolescence because this period is characterized by accelerated change, including sexual development, maturation, and early menarche. These factors lead to increased demand for nutrients, make them vulnerable to malnutrition, and are exacerbated by sociodemographic and economic factors.[8] In addition, they marry traditionally and get pregnant early, especially in developing countries. The long-term consequences of poor nutrition can impair adolescent cognitive development, resulting in decreased learning abilities and poor concentration.[9,10] Consequently, malnutrition is a strong predictor of human capital and social progress.[11] To break the cycle of malnutrition between generations, a special focus is needed to address adolescent malnutrition, especially among adolescent girls.[12]

Various factors are related to stunting in adolescents, namely coming from a large family size, using inadequate drinking water sources, mothers with lower education levels, and belonging to food insecure households.[13,14] A study among 736 adolescent girls conducted in Afar, Northeast Ethiopia, found that the prevalence of stunting was 26.6%. Variables that were significantly related were early adolescence, menarche, availability of latrine, household food insecurity, economic class level, food diversity, food sources, drinking water, and eating snacks.[15] A study conducted in the Sunamganj District of Bangladesh on 380 young women found that 26.6% were stunted, and the results of this study also explained that one third of young women (32.8%) had low knowledge status.[16]

Adolescent research is important for several public health agendas, including reducing maternal mortality.[17] The Lancet series (2013) shows that not only focusing on the first 1,000 days of life, the nutritional status of adolescent girls also needs more attention because it is a crucial period that supports maternal health and survival, fetal growth, and growth and development of children in later life.[18] Young women should be at the center of the life cycle approach.[19] Therefore, this study aimed to determine the prevalence and determinants of stunting in adolescent girls in Takalar Regency.

METHODS

The research was conducted in a coastal area in the sub-district of South Galesong, Takalar Regency, South Sulawesi, Indonesia. Geographically, it is located in the southern part of South Sulawesi Province at a distance of 40 km from Makassar city, with an area of 100.5 km^2. This research was conducted in July-August 2022 in six junior high schools.

Study Design

This study used an analytical observational, cross-sectional design where the dependent variable was stunting in adolescent girls and the independent variables include determinants related to the incidence of stunting such as energy intake, nutritional intake (protein, iron, zinc, calcium), knowledge of balanced nutrition, age at menarche, frequency of eating, parental education, parental occupation, family income, number of family members, clean water sources, and availability of family latrine. On the other hand, the researchers found one potential confounder, which was related to several variables and controlled through data analysis, namely the independent variable of family latrine availability, which was obtained by statistical considerations. There was a change in OR >10% before and after removing the variable of family latrine availability.

Sampling Design

The sampling method used in this study was purposive sampling. The population of this study was young women aged 13-15 years in junior high school. Isaac and Michael formula was used to determine the characteristics of the population.[20]

$$s = (\lambda^2 \cdot N \cdot P \cdot Q)/(d^2 \cdot (N-1) \cdot \lambda^2 \cdot P \cdot Q)$$

Information:
- s = sample size
- N = population
- λ^2 = Chi squared, its value depends on the degrees of freedom. The error level is 5%, so the chi square is 3.841
- d = degree of accuracy expressed as a proportion (0.05)
- P = chance of stunting Q chance of not being stunted = proportion of population 0.5

$$s = (3{,}841 \cdot 691 \cdot 0.5 \cdot 0.5)/([0.05]^2 \cdot (691-1) \cdot 3{,}81 \cdot 0.5 \cdot 0.5) = 247$$

From the above formula, it can be concluded that the minimum sample taken is 247 people, with the inclusion criteria being young women aged 13-15 years and who are actively attending school. Those who decline to participate in the study are excluded.

Data Analysis

Collecting data related to independent variables by filling out questionnaires through interviews, measuring stunting by measuring height according to age (Height/ <-2 z-score), Measurement of nutritional intake using the semi-quantitative Food Frequency Questionnaire (FFQ) method where food ingredients are analyzed into nutrients using a software program Nutrisurvey.[21] The FFQ was developed by conducting a field survey of the area studied, namely food trends that the adolescents often consume, and it has been taken for one month.

The food and drink consumed uses household measurements where the benchmark for the amount of food is under nutritional, culinary laboratory standards with the aim that it is easier for respondents to determine the amount/portion eaten while knowing the nutritional content of food through the nutrisurvey software program and then compared with Indonesia's healthy adequacy rate (RDA) in 2019 to find out the nutritional adequacy that respondents have consumed. It is said to be less if <80% RDA and good if 80% RDA,[22] balanced nutrition knowledge measurement by filling out a validated questionnaire. The research questionnaire was in the

form of respondent characteristics, socio-demographic and environmental conditions, a balanced nutrition knowledge questionnaire includes knowledge about nutritious food, the benefits of vitamins, and the respondent's perception of the definition of nutritious food. Knowledge is considered lacking if the respondent can answer correctly 55% and good if the respondent can answer correctly >55%.[23] The instruments used are microtoise, WHO Anthro Plus software, research questionnaires, validated balanced nutrition knowledge and the last month's SQ-FFQ form, Nutrisurvey software, and IBM SPSS 26 program.

Univariate analysis to describe the characteristics of each variable studied. Bivariate analysis with a chi-square test to see the relationship between two variables. And multivariate analysis to determine the relationship of more than one independent variable to the dependent variable with multiple logistic regression tests with a backward stepwise method.

Ethical Approval

This research received ethical approval on 27 June 2022 with No. 7019/UN4.14.1/TP.01.02/2022 from Hasanuddin University Makassar.

RESULTS

The authors present the results of the analysis of determinants with the prevalence of stunting sourced from the 2018 National Health Research data.[24]

Subject Characteristics

In this section, the researcher focused on parental education, parental occupation, family income, clean water sources, and availability of family latrine. Based on Table 1, most fathers (66%) and mothers (62.4%) graduated from elementary/junior high school. Thirty percent (30%) of fathers work as fishermen while 83% of mothers are housewives. Seventy-six percent (76.1%) of the families belong to below minimum wage income (<Rp. 3,165,876). Most of the families have >4 members (59.9%). Most of the families' sources of clean water are from municipal waterworks and they already have family latrines.

Based on Figure 1, the nutritional status of severely stunted height/age is 1.6%, stunted is 23.5%, and normal is 74.9%. Based on BMI/Age, most respondents experienced good nutrition (74.9%).

Bivariate Analysis

Table 2 shows that respondents who experienced stunting were greater in those who had less energy intake (42.45%), less protein intake (57.45%), less iron intake (30.29%), less zinc intake (47.66%), lack of knowledge (30.53%), age at menarche ≥12 years (28.37%), eating frequency <3x (26.16%). Variables that have a significant effect are energy, protein, iron, and zinc intake ($p<0.05$).

Table 1. Distribution of Respondents Based on Household and Environmental Characteristics in South Galesong District, Takalar Regency, Indonesia

Characteristics of Household and Environment	n=247	%
Father's education		
No school	9	3.6
Elementary/junior high school graduate	163	66.0
Graduated high school/PT	75	30.4
Mother's education		
No school	10	4.0
Elementary/junior high school graduate	154	62.4
Graduated high school/PT	83	33.6
Father's occupation		
Employee/Private employee	16	6.4
Entrepreneur/Trader	56	22.7
Fisherman	74	30.0
Laborer	23	9.3
Farmer	68	27.5
Others	10	4.0
Mother's occupation		
Housewife	205	83.0
Work outside the home	42	17.0
Family income		
<Rp 3.165.876 (does not meet minimum wage)	188	76.1
≥Rp 3.165.876 (meets minimum wage)	59	23.9
Family members		
>4	148	59.9
≤4	99	40.1
Clean water source		
Tap water/Municipal waterworks	212	85.8
Drilling well/pump	127	10.9
Protected dug well	8	3.2
Latrine		
One's own	240	98.0
Commonly owned	5	2.0

Source: Data Primer from Study Takalar Data Collection, 2022

Table 3 shows that respondents who experience stunting have parents with low education (father=26.74%, mother= 26.22%); the mother's work is a risk (25.85%), while the father's work is not a risk (26.14%); low family income (27.13%), the number of family members at risk is >4 people (27.03%), clean water sources are not PDAM (28.57%), and family latrine is not available (60%).

Multivariate Analysis

Based on Table 4, the determinant variables that have the most dominant and significant influence on the risk of stunting are zinc intake ($p<0.001$, OR=7.993), protein intake ($p<0.05$, OR=82.248) and knowledge ($p<0.05$, OR=2.032).

DISCUSSION

The results showed that 25.1% of adolescent girls aged 13-15 experienced stunting. This is in line with research in West Lombok, Indonesia, where the prevalence of stunting in adolescent girls is 25%.[25] In contrast, the prevalence of stunting among adolescent girls is 48% in Bangladesh and

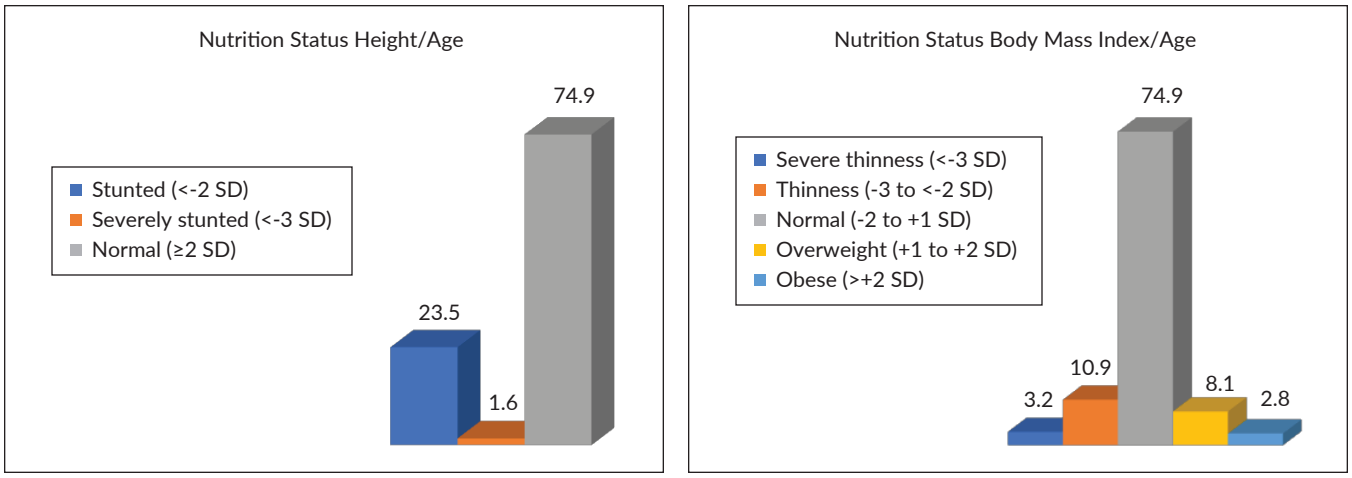

Figure 1. Overview of the nutritional status of respondents in South Galesong District, Takalar Regency.

Table 2. Relationship of Individual Characteristics with Stunting Incidence Prevalence in South Galesong District, Takalar Regency

Individual Characteristics	Nutritional status (height/age)				Total		P Value
	Stunting		Non-stunting				
	n	%	n	%	n	%	
Energy (kcal)							0.000[a]
Not enough	45	42.45	61	57.55	106	100	
Well	17	12.06	124	87.94	141	100	
Protein (g)							0.000[a]
Not enough	27	57.45	20	42.55	47	100	
Well	35	17.50	165	82.50	200	100	
Iron (mg)							0.003[a]
Not enough	53	30.29	122	69.71	175	100	
Well	9	12.50	63	87.50	72	100	
Zinc (mg)							0.000[a]
Not enough	51	47.66	56	52.34	107	100	
Well	11	7.86	129	92.14	140	100	
Knowledge level							0.120[a]
Not enough (<55%)	29	30.53	66	69.47	95	100	
Well (≥55%)	33	21.71	119	78.29	152	100	
Menarche age							0.172[a]
<12 years (earlier)	22	20.75	84	79.25	106	100	
≥12 years (medium and slow)	40	28.37	101	71.63	141	100	
Eating frequency							0.560[a]
<3x/day	45	26.16	127	73.84	172	100	
≥3x/day	17	22.67	58	77.33	75	100	

[a]*Chi-Square Test;* [b]*Fisher's Exact Test*

47% in Nepal.[26] This difference may be due to differences in the study area and socio-economic, socio-cultural, and developmental eating habits among the respondents. Intake of energy, protein, iron, and zinc had a significant relationship ($p<0.05$). In the body, energy plays an important role in all matters relating to the synthesis and absorption of nutrients.[27,28] Proteins and amino acids are the main nutrients involved in linear growth and increasing levels of hormones, such as insulin and IGF-1, which stimulate endochondral ossification. Iron (Fe) is a component of enzymes and cytochrome components that affect growth, and Zinc is the main component of hundreds of enzymes involved in cell growth and differentiation as well as immune function.[29] Knowledge level, age at menarche, parents' education and occupation, family income, number of family members, clean water sources, and availability of family latrines did not have a significant relationship ($p>0.05$).

Several provinces in Indonesia that show a fairly high prevalence of adolescent stunting are East Nusa Tenggara (46.6%), Papua (46%), and Aceh (36.3%). Meanwhile,

Table 3. Relationship between Household and Environmental Characteristics with Stunting Incidence Prevalence in South Galesong District, Takalar Regency, Indonesia

Characteristic of Household and Environment	Nutritional status (body height/age)				Total		P Value
	Stunting		Non-stunting				
	n	%	n	%	N	%	
Father's education							0.367[a]
Low	46	26.74	126	73.26	172	100	
Higher	16	21.33	59	78.67	75	100	
Mother's education							0.569[a]
Low	43	26.22	121	73.78	164	100	
Higher	19	22.89	64	77.11	83	100	
Father's occupation							0.780[a]
Risky	39	24.53	120	75.47	159	100	
No risk	23	26.14	65	73.86	88	100	
Mother's occupation							0.547[a]
Risky	53	25.85	152	74.15	205	100	
No risk	9	21.43	33	78.57	42	100	
Family income							0.190[a]
Low	51	27.13	137	72.87	188	100	
Higher	11	18.64	48	81.36	59	100	
Number of family members							0.393[a]
Risky (>4)	40	27.03	108	72.97	148	100	
No risk (≤4)	22	22.22	77	77.78	99	100	
Clean water sources							0.609[a]
Non-PDAM	10	28.57	25	71.43	35	100	
PDAM	52	24.53	160	75.47	212	100	
Family latrine							0.102[b]
Available	3	60.00	2	40.00	5	100	
Not Available	59	24.38	183	75.62	242	100	

[a]*Chi-Square Test;* [b]*Fisher's Exact Test*

Table 4. Multivariate Analysis of Stunting Determinants in South Galesong District, Takalar Regency

Variable	B	P Value	OR	CI 95%	R^2
Protein	0.810	0.046	2.248	1.014-4.986	0.336
Zinc	2.079	0.000	7.993	3.504-18.234	
Knowledge	0.709	0.042	2.032	1.026-4.025	
Family latrine	-1.914	0.062	0.147	0.020-1.101	
Constant	-2432	0.065	0.088		

Source: Data Primer from Study Takalar Data Collection, 2022

the prevalence of stunting in adolescents is below 20% in the provinces of DKI Jakarta (10%), DI Yogyakarta (9.3%), and Bali (9.2%). Stunting is considered a health problem if the prevalence is above 20%.[6] Stunting can affect children's physical growth and cognitive, motor, and verbal development.[30] Adolescent girls are prospective mothers where the mother's height is related to the physical growth of her child. Mothers who are short due to pathological conditions (such as growth hormone deficiency) have genes in their chromosomes that carry short traits so that their children will have a higher risk of becoming stunted.[31] A study by Khatoon in Bangladesh showed that short maternal stature is an indicator of cumulative nutritional deficiency during infancy.[32] Girls stunted during their preconception age are more susceptible to various disorders in later life such as reproductive disorders, complications during pregnancy, difficulty giving birth, and perinatal death.[33] Women with short height are more at high risk of experiencing physical disorders in the development of the anatomical system of pregnancy and metabolic diseases such as low maternal glucose levels, and protein and carbohydrate deficiencies.[34]

Multivariate analysis showed that the variables zinc intake, protein, and level of knowledge are related significantly in the incidence of stunting. Adequate nutrition is important in achieving changes in adolescents and neurocognitive performance.[19] Nutrients remain important growth regulators during childhood and adolescence.[35] In line with Sulistianingtias research, zinc deficiency has a 5.94 times greater risk of stunting in Sukoharjo, Central Java.[36] Research conducted by Chastity found that out of 29 samples of stunted adolescents, 75.9% of them had a pattern of insufficient protein intake and 24.1% of them had a pattern of sufficient protein intake.[37] Research conducted by Shapu et al. revealed that respondents had poor knowledge of reducing malnutrition. Research conducted in the United Arab Emirates showed that 86% of adolescents had poor nutrition knowledge.[38] Stunting can cause a slowdown in the myelination process, disruption in synaptic neuro-

transmitters, and decreased dendritic production. This can cause cognitive development to slow down.[39] In the early teenage period, there is very rapid brain development. There is an increase in brain plasticity, which can give individuals new abilities and competencies.[40] A study from Southwest Ethiopia found a significant correlation between stunting and academic achievement.[41]

CONCLUSION

Young women aged 13-15 years who experienced stunting in South Galesong District were found to be 25.1%. The determinant factors that are significantly related to stunting are intake of energy, protein, iron, and zinc. While the factors that are not related are the level of knowledge, age at menarche, education and occupation of parents, family income, number of family members, sources of clean water, and availability of family latrines. The most dominant factors contributing significantly were zinc intake, protein intake, and level of knowledge.

Strengths and Limitations

The scope of this study includes the prevalence of stunting in young women and its determinants in Takalar Regency, South Sulawesi, Indonesia. Other researchers or local governments can use data from this study to serve as a basis for further research and policies related to nutrition improvement, especially for young women. The strength of this study, with the cross-sectional approach, researchers can maximize the completeness of their main data points because they look at the entire population group at one specific point in time. That leads to fewer errors, as data is not collected multiple times, but rather all collected at one time. Whereas the limitation of this study state that cross-sectional studies cannot make causal inferences due to the temporal relationship between exposure and outcome variables.

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Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

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