OPEN ACCESS

Indonesian Journal of Human Nutrition
P-ISSN 2442-6636
E-ISSN 2355-3987
www.ijhn.ub.ac.id

Association between Stunting in Children Under Five and Types of Food Sources

Nur Mufida Wulan Sari[1], Wilis Cahyaning Ayu[1], Trias Mahmudiono[1], Mahmudah[2], RR Soenarnatalina Melaniani[2]

[1]Nutrition Department, Faculty of Public Health, Universitas Airlangga, Surabaya, Indonesia
[2] Department of Biostatistics, Faculty of Public Health, Universitas Airlangga, Surabaya, Indonesia

Corresponding author: Nur Mufida Wulan Sari. E-mail: *nur.mufida.wulan-2021@fkm.unair.ac.id

Accepted: October 2022 Reviewed: October 2022 Published: July 2022

ABSTRACT

The prevalence of stunting in children under five years old has decreased from 25% in 2013 to 18% in 2019 in The Gambia. The consumption of certain food groups, as part of minimum dietary diversity, serves as a measure of the adequacy of nutrient density for children. This study aims to examine the association between stunted children under five years old and types of food sources, as well as wealth status. Secondary data from The Gambia Demographic and Health Survey 2019-2020 were analyzed, involving 2,533 out of 8,362 children. Logistic regression tests were performed with a 95% confidence interval. Staple foods were identified as the dominant food source for stunted toddlers ($p< 0.05$; OR = 1.78; 95% CI = 1.436-2.216) and considered a risk factor for stunting. Food intake from more than four food sources (OR = 0.6; 95% CI = 0.403-0.88), place of residence (OR = 0.72; 95% CI = 0.53-0.95), middle wealth status (OR = 0.47; 95% CI = 0.33-0.68), and wealthy household (OR = 0.74; 95% CI = 0.52-1.05) were significantly associated with a reduced likelihood of stunting and considered protective factors. The incidence of stunting is linked to the diversity of food sources given to toddlers. In providing care for stunted toddlers at the community level, stakeholders must consider food diversity, economic capacity, and type of residence.

Keywords: food source, stunting, wealth status, demographic and health survey

INTRODUCTION

Stunting is a condition where a child's height does not accord with the expected range of their age, typically measured with a standard deviation of less than -2 SD than the normal threshold based on the standards set by WHO. Stunting is the body's mechanism to make adjustments to prolonged periods of starvation (1). Long-term starvation can lead to chronic malnutrition regardless of age. Chronic malnutrition during the golden age has long-term consequences, such as low academic and immune abilities, as well as short-term consequences that affect brain growth and development (2). Therefore, optimal growth and development in children are

DOI: https://doi.org/10.21776/ub.ijhn.2023.010.01.2

related to the quality of human resources, which is often associated with the Human Development Index. Following the year 2010, Gambia experienced a declined Gross National Index (GNI) with the sharpest declines in 2011 and 2014. However, starting in 2017 to 2019, the Gambia's GNI began to rise (3). This upward trend was consistent with a decrease in the prevalence of childhood stunting, from 25% in 2013 to 18% in 2019 (4,5). In 2019, around 14% of children aged 6 - 24 months were reported to receive food that met the minimum recommended diet (5). The Minimum Dietary Diversity is a measure that reflects the adequacy of micronutrient density, and it is achieved by consuming at least five food groups. Among these food groups, children are required to consume at least one type of animal-protein food, one type of fruit or vegetable, and staple foods such as whole grains, roots, and tubers (6). In the Demographic Health Survey Standard Recode Manual for DHS 2018 data, the eight food groups are breast milk; grains, roots, and tubers; legumes and beans; dairy products (milk, yogurt, and cheese); flesh foods (meat, fish, poultry, liver/organs); eggs; fruit and vegetables with Vitamin A content; and other fruit and vegetables (7). We investigated the association between the types of food sources with stunted children aged 6-59 months using The Gambia DHS 2019-2020 data. The findings of this study will provide insights for designing effective health policies and programs to reduce the burden of malnutrition.

METHODS

Research design

The study used secondary data from The Gambia Demographic and Health Survey 2019-2020. The survey obtained data through a questionnaire with a cross-sectional design approach.

Setting and samples

The sample inclusion criteria were children under five years old and above six months, with available height-for-age-z-score (HAZ) data and complete food intake records. A total of 2,533 children out of 8,362 toddlers were included in this study. Children aged less than six months and above five years and those with incomplete food intake records and HAZ data were excluded. The independent variables of the research were place of residence (urban, rural), wealth quintile (poorer, middle, and rich), and food groups. The wealth index in this variable was calculated from the household's ownership of selected assets, such as televisions and bicycles; materials used for housing construction; and types of water access and sanitation facilities (7). The dependent variable was categorized as either stunting or not stunting.

Measurement and data collection

The measuring instrument in this study was a questionnaire to assess the consumption of food groups, such as staple food (grains, roots, and tubers), legumes (beans, legumes, and products), dairy products (milk, yogurt, cheese, and other dairy products), eggs, flesh foods (meat, fish, poultry, liver/organ, and meat products), fruit and vegetables[14]. Children were categorized as receiving a minimum dietary diversity if they consumed four or more types of food groups. The independent variables included were wealth status, which was categorized into three levels i.e., poor (from poor and the poorest), middle, and rich (from rich and the richest), and place of residence defined as dichotomous data, that were rural or urban.

Data analysis

The multivariate analysis employed to test the hypothesis was multiple logistics regression (binary) with a significance level of 95% ($\alpha = 0.05$) on one dependent variable (dichotomous) and

DOI: https://doi.org/10.21776/ub.ijhn.2023.010.01.2

more than one independent variable (nominal data scale). In addition, the data were interpreted in the form of an odds ratio to determine the association size between variables.

Ethical considerations

Ethical permission was obtained from Universitas Airlangga, Indonesia. All respondents' identities were hidden and permission for using the dataset was obtained from ICF International.

RESULTS

The number of respondents who met the inclusion criteria was 2,533 children under the age of five. Most of the toddlers resided in rural areas (57%) with a higher prevalence of stunting (18.6%). Most children received staple food (54%), followed by flesh foods (31%). A small portion of children received dairy (2%), eggs (7%), vegetables (8%), legumes (12%), and fruits (16%). Few children received four or more food groups as their meals (9%). While 2,308 (91%) children did not get a diverse diet and consumed less than four kinds of food the day prior to the survey was conducted. In terms of wealth status, a significant portion of respondents came from poor households (58%) and stunted children (20%) (see Table 1).

Table 1. Characteristics of Respondents

No.	Characteristics	Stunting				N (%)	
		Yes (%)		No (%)			
1	Place of Residence						
	Urban	183	((16.7))	914	(83.3)	1097	(43)
	Rural	267	(18.6)	1169	(81.4)	1436	(57)
2	Giving children staple foods						
	No	164	(13.9)	1012	(86.1)	1176	(46)
	Yes	286	(21.1)	1071	(78.9)	1357	(54)
3	Giving children legumes						
	No	385	(17.2)	1849	(82.8)	2234	(88)
	Yes	65	(21.7)	234	(78.3)	299	(12)
4	Giving children vegetables						
	No	408	(17.9)	1914	(82.1)	2322	(92)
	Yes	42	(16.7)	169	(83.4)	211	(8)
5	Giving children fruit						
	No	381	(17.8)	1745	(82.2)	2126	(84)
	Yes	69	(17.6)	338	(82.4)	407	(16)
6	Giving children eggs						
	No	424	(17.9)	1941	(82.1)	2365	(93)
	Yes	26	(15.5)	142	(84.5)	168	(7)
7	Giving children flesh food						
	No	302	(17.3)	1439	(82.7)	1741	(69)
	Yes	148	(18.7)	644	(81.3)	792	(31)
8	Giving children dairy food						
	No	442	(17.7)	2050	(82.3)	2492	(98)
	Yes	8	(19.5)	33	(80.5)	41	(2)
9	Diversity of food (Four types or more)						
	No	418	(18.1)	1890	(81.9)	2308	(91)
	Yes	32	(14.5)	193	(85.5)	225	(9)
10	Wealth status						
	Poor	296	(20.0)	1182	(80)	1478	(58)
	Middle	80	(16.2)	414	(83.8)	494	(20)

DOI: https://doi.org/10.21776/ub.ijhn.2023.010.01.2

Rich	74	(13.2)	487	(86.8)	561	(22)

This study found that staple food was dominantly given to stunted toddlers. The logistics regression analysis showed that providing staple food such as bread, noodles, and others made from grains, roots, and tubers was significantly associated with stunting ($p < 0.05$). This association was identified as a risk factor (OR 1.78; 95% CI 1.436-2.216). In contrast, providing more than four types of food sources (OR 0.6; 95% CI 0.403-0.88), having middle wealth status (OR 0.47; 95% CI 0.33-0.68), belonging to rich households (OR 0.74; 95% CI 0.52-1.05), and place of residence (OR 0.72; 95% CI 0.53-0.95) were significantly associated with stunting and determined as protective factors (Table 2). There were no significant associations found between stunting and consumption of legumes, vegetables, fruits, eggs, flesh foods, and dairy products.

Table 2 Association Between Stunting and Food Groups Intake

Variables	OR (95% CI)			p-values
	OR	Lower	Upper	
Place of Residence	0.715	0.532	0.957	*0.024
Giving children staple food	1.776	1.43	2.207	*0.000
Giving children legumes	1.318	0.937	1.853	0.112
Giving children vegetables	1.334	0.881	2.021	0.173
Giving children fruit	0.971	0.693	1.359	0.862
Giving children eggs	0.966	0.599	1.557	0.887
Giving children flesh food	0.837	0.638	1.097	0.197
Giving children dairy food	1.438	0.636	3.251	0.383
Diversity of food (Four groups or more)	0.582	0.39	0.869	0.008
Wealth status				
Middle	0.471	0.327	1.051	*<0.001
Rich	0.740	0.521	0.869	0.093

* logistic regression

DISCUSSION

Food grouping used in the DHS survey aligns with the 2010 WHO guidelines. This present study identified several factors associated with stunting and their contribution to dietary diversity. Consuming staple food only could increase the risk of stunting (OR 1.78 95% CI 1.436-2.216). Most children predominantly received staple food with less vegetables, eggs, fruits, dairy, and legumes; thus, putting them at higher risk of stunting. Previous studies in West Africa show that a larger proportion of staple foods in meals was associated with a greater likelihood of both stunting and wasting in Ugandan children, which was thought to be related to inadequate vitamin A, iron, and zinc in staple foods (8). Excessively consumption of staple food combined with limited intake of vegetables, fruit, animal sources, and nuts as a side dish may result in insufficient nutrition intake. Staple foods are often more affordable than other foods, especially animal sources foods, as shown in this study and the results of previous studies; thus, household wealth influences stunting (9,10). This study proved that

DOI: https://doi.org/10.21776/ub.ijhn.2023.010.01.2

different levels of wealth status were linked to stunting. Middle-wealth status (OR 0.47; 95% CI 0.33-0.68) and rich households (OR 0.74; 95% CI = 5.18-1.05) had a lower risk of having stunted children. The results showed that families with middle-wealth status had a significant association with food diversity. Higher-income families are more likely to have access to a variety of food than those with the poorest wealth status, while the lowest wealth status is associated with insufficient minimum dietary diversity (11,12). Fulfillment of nutritional needs according to dietary guidelines is significantly related to food security and household income (13–15). Poverty-stricken communities with household food insecurity often change their food consumption patterns to cope with hunger, resulting in compromised nutrition (16). A higher family's economic capacity could prevent stunting in addition to accessing various food at least four or more types (17). Providing a variety of foods more than four types of food sources significantly lowers the risk of stunting (OR 0.6; 95% CI 0.403-0.88). This result accords with the other study that stunting was negatively associated with dietary diversity (OR 0.95, 95% CI 0.91-0.99, p=0.01) (18). It has been reported that household food insecurity was associated with stunting (15,19–21). Dietary diversity has also been associated with a lower likelihood of childhood stunting in Asian countries (OR 0.89; 95% CI 0.80-0.98) (22). In other words, dietary diversity has been proven as a protective factor leading to a low risk of stunting in children.

In addition to macronutrients, such as carbohydrates, proteins, and fats, micronutrients are also needed for optimal cell development, growth, and countless metabolic functions within the human body (23). Since vegetables, fruits, and nuts are sources of important nutrients, especially micronutrients, the composition of a toddler's daily diet needs to consider their inclusion in a child's feeding (6,24). The results of the study showed that children's respondents received vegetables, fruits, and nuts in limited amount (Table 1). Animal source foods, especially meat, play an important role in providing protein, easily absorbed zinc, and other essential minerals (iron, potassium, and selenium), amino acids, and vitamins (B2 (riboflavin), B3 (niacin), B6, and B12) (25,26). Consumption of animal-protein foods is significantly associated with a reduced risk of stunting (OR 0.69; 95% CI 0.54-0.89; p<0.01) (18). Consuming a variety of animal-sourced food is more beneficial than relying on one animal-sourced food (27). Despite being a crucial source of high-quality nutrients for children aged 6-23 months, the significance of animal-sourced foods is often overlooked by nearly 800 million people. For sustainable development, the animal-sourced needs of the poorest and most vulnerable people must be addressed to prevent stunting (27–29). This study found that no more than 40% of children in Gambia consumed animal-sourced foods, such as flesh food, dairy, and eggs. It appears that they consumed animal-sourced food in small amounts, resulting in prolonged malnutrition.

A recent study showed that stunting prevention in Sub-Sahara Africa has not been accompanied by improved equity in accessing minimum dietary diversity (p<0.01) and composite coverage index (p<0.001) persisted by wealth status and place of residence variables (30). Place of residence (rural/urban) has a simultaneous effect on preventing stunting, as it provides a geographical map of food sources. In this study, place of residence was associated with stunting in Gambia (p<0.05). Access to food, particularly in relation to housing, plays an important role in food security. It has been reported that West Africa is

DOI: https://doi.org/10.21776/ub.ijhn.2023.010.01.2

vulnerable to variability and climate change that threatens food security (31). Weaknesses in food production systems due to extreme climate change, such as droughts and floods, can exacerbate food insecurity. In 2018, it has been suggested the adaptive response in addressing the impacts of climate change by improving regulations for restricting agriculture and livestock grazing activities, strengthening early-warning systems, crop diversification and rotation, and switching to drought-tolerant crop and animal species (32). Therefore, government support must be increased across all wealth quintiles to ensure that children receive a variety and adequate food intake across all regions.

The study was based on high-quality data regularly collected by an international expert group. In addition, the findings from nationally representative data are more feasible for policymakers to design appropriate intervention programs.

However, this study has some limitations. Included, data unavailability on each type of food sources amount consumed may be limited, and data may suffer bias in recalled information.
Since dietary diversity is significantly associated with stunting, types of food and the affordability of family to food sources must be considered in efforts to nutrition improvement. Incomplete data on staple food such as grains, roots, and tubers and intake of food sources could be further investigated in future studies.

CONCLUSION

Providing at least four types or more of food sources has a significant effect on stunting prevention. The types of food given to toddlers are closely related to the incidence of stunting. Therefore, when caring for stunted toddlers at the community level, stakeholders need to pay attention to food diversity, family's economic capacity, and place of residence.

ACKNOWLEDGMENTS

We would like to acknowledge all participants who made this study possible. We confirmed that all of our research members participated sufficiently in conceptualizing, designing, analyzing, writing, and revising the manuscript. Furthermore, we stated that the materials used in this study or similar materials have never been submitted to or published in any other publication.

AUTHOR CONTRIBUTION

Study design: NM, MM, RN
Data analysis: NM, WA, TM
Manuscript writing and revisions for important content: NM, TM, WA, MM, RN.

CONFLICT OF INTEREST

There are no conflicts of interest associated with this publication. This study received no specific grant from any funding agency, commercial, or not-for-profit organizations.

1. Kundan I, Nair R, Kulkarni S, Deshpande A, Jotkar R, Phadke M. Assessment, outcomes and implications of multiple anthropometric deficits in children. BMJ Nutr Prev Heal. 2021;4(1).
2. Soliman A, De Sanctis V, Alaaraj N, Ahmed S, Alyafei F, Hamed N, et al. Early and long-term consequences of nutritional stunting: From childhood to adulthood. Acta Biomed. 2021;92(1).
3. World Bank. World Bank Country and Lending Groups. World Bank Country and Lending Groups. 2020.
4. Gambia Bureau of Statistics (GBoS), ICF. The Gambia Demography and Heath Survey 2013. GBoS ICF. 2014;(April):2014–5.
5. Gambia Bureau of Statistics

(GBoS), ICF. The Gambia Demographic and Health Survey 2019-2020. GBoS ICF. 2021;56(4).
6. WHO. Indicators for assessing infant and young child feeding practices: Part 1 Definitions. World Health Organization. 2008.
7. ICF. Demographic and Health Surveys Standard Recode Manual for DHS 7. Usaid [Internet]. 2018;145. Available from: https://dhsprogram.com/pubs/pdf/DHSG4/Recode7_DHS_10Sep2018_DHSG4.pdf
8. Amaral MM, Herrin WE, Gulere GB. Using the Uganda National Panel Survey to analyze the effect of staple food consumption on undernourishment in Ugandan children. BMC Public Health. 2017;18(1).
9. Ettyang GAK, Sawe CJ. Factors associated with stunting in children under age 2 in the Cambodia and Kenya 2014 Demographic and Health Surveys. DHS Work Pap. 2016;(126).
10. Mutisya M, Kandala NB, Ngware MW, Kabiru CW. Household food (in)security and nutritional status of urban poor children aged 6 to 23 months in Kenya Global health. BMC Public Health. 2015;15(1).
11. Dafursa K, Gebremedhin S. Dietary Diversity among Children Aged 6-23 Months in Aleta Wondo District, Southern Ethiopia. J Nutr Metab. 2019;2019.
12. Victor R, Baines SK, Agho KE, Dibley MJ. Factors associated with inappropriate complementary feeding practices among children aged 6-23 months in Tanzania. Matern Child Nutr. 2014;10(4).
13. Wilcox S, Sharpe PA, Liese AD, Dunn CG, Hutto B. Socioeconomic factors associated with diet quality and meeting dietary guidelines in disadvantaged neighborhoods in the Southeast United States. Ethn Heal. 2020;25(8).
14. Berra WG. Household Food Insecurity Predicts Childhood Undernutrition: A Cross-Sectional Study in West Oromia (Ethiopia). J Environ Public Health. 2020;2020.
15. Belayneh M, Loha E, Lindtjørn B. Seasonal Variation of Household Food Insecurity and Household Dietary Diversity on Wasting and Stunting among Young Children in A Drought Prone Area in South Ethiopia: A Cohort Study. Ecol Food Nutr. 2020;
16. Oldewage-Theron WH, Dicks EG, Napier CE. Poverty, household food insecurity and nutrition: Coping strategies in an informal settlement in the Vaal Triangle, South Africa. Public Health. 2006;120(9).
17. Sekartaji R, Suza DE, Fauziningtyas R, Almutairi WM, Susanti IA, Astutik E, et al. Dietary diversity and associated factors among children aged 6–23 months in Indonesia. J Pediatr Nurs. 2021;56.
18. Darapheak C, Takano T, Kizuki M, Nakamura K, Seino K. Consumption of animal source foods and dietary diversity reduce stunting in children in Cambodia. Int Arch Med. 2013;6(1).
19. Sreeramareddy CT, Ramakrishnareddy N, Subramaniam M. Association between household food access insecurity and nutritional status indicators among children aged <5 years in Nepal: Results from a national, cross-sectional household survey. Vol. 18, Public Health Nutrition. 2015.
20. Agho KE, Mukabutera C, Mukazi M, Ntambara M, Mbugua I, Dowling M, et al. Moderate and severe household food insecurity

predicts stunting and severe stunting among Rwanda children aged 6–59 months residing in Gicumbi district. Matern Child Nutr. 2019;15(3).
21. Gassara G, Chen J. Household food insecurity, dietary diversity, and stunting in sub-saharan africa: A systematic review. Nutrients. 2021;13(12).
22. Mahmudiono T, Sumarmi S, Rosenkranz RR. Household dietary diversity and child stunting in East Java, Indonesia. Asia Pac J Clin Nutr. 2017;26(2).
23. Ofoedu CE, Iwouno JO, Ofoedu EO, Ogueke CC, Igwe VS, Agunwah IM, et al. Revisiting food-sourced vitamins for consumer diet and health needs: a perspective review, from vitamin classification, metabolic functions, absorption, utilization, to balancing nutritional requirements. Vol. 9, PeerJ. 2021.
24. WHO; MIYCF. Essential Nutrition Actions IMPROVING MATERNAL, NEWBORN, INFANT AND YOUNG CHILD HEALTH AND NUTRITION [Internet]. WHO Library Cataloguing. The WHO Document Production Services, Geneva, Switzerland; 2013. 144 p. Available from: (www.who.int)
25. Papier K, Tong TY, Appleby PN, Bradbury KE, Fensom GK, Knuppel A, et al. Comparison of major protein-source foods and other food groups in meat-eaters and non-meat-eaters in the epic-oxford cohort. Vol. 11, Nutrients. 2019.
26. Bradbury KE, Tong TYN, Key TJ. Dietary intake of high-protein foods and other major foods in meat-eaters, poultry-eaters, fish-eaters, vegetarians, and vegans in UK biobank. Nutrients. 2017;9(12).
27. Headey D, Hirvonen K, Hoddinott J. Animal sourced foods and child stunting. Am J Agric Econ. 2018;100(5).
28. Adesogan AT, Havelaar AH, McKune SL, Eilittä M, Dahl GE. Animal source foods: Sustainability problem or malnutrition and sustainability solution? Perspective matters. Vol. 25, Global Food Security. Elsevier B.V.; 2020.
29. Zaharia S, Ghosh S, Shrestha R, Manohar S, Thorne-Lyman AL, Bashaasha B, et al. Sustained intake of animal-sourced foods is associated with less stunting in young children. Nat Food. 2021 Apr 1;2(4):246–54.
30. Baye K, Laillou A, Chitweke S. Socio-economic inequalities in child stunting reduction in sub-Saharan Africa. Nutrients. 2020;12(1).
31. Obayelu OA, Adepoju AO, Idowu T. Factors influencing farmers ' choices of adaptation to climate change in Ekiti State , Nigeria. J Agric Environ Int Dev - JAEID. 2014;108(1).
32. Amuzu J, Jallow BP, Kabo-Bah AT, Yaffa S. The climate change vulnerability and risk management matrix for the coastal zone of The Gambia. Hydrology. 2018;5(1).

DOI: https://doi.org/10.21776/ub.ijhn.2023.010.01.2