The Role of Animal Protein in Preventing Stunting in Children: A Literature Review

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Abstract

Background: Stunting is a growth disorder or failure to thrive in children which is characterized by a shorter body condition than normal standards. Stunting is caused by consuming less nutrition and nutrition, one of which is protein intake. The purpose of this study was to analyze the role of protein, especially animal protein, in preventing stunting in children under five. The research design in this article is a literature review, by looking for several sources of literature in the form of research journals and the determination of the journal is animal protein and stunting in children under five. The selected research journals are summarized in the form of research designs, research descriptions, variables, and research results. Based on research results from several journals, it is known that the lack of animal protein intake is one of the factors causing stunting. Animal protein intake can increase height and reduce stunting rates in children under five in Indonesia. Consuming animal protein with stunting in toddlers has a significant relationship. Animal protein plays a major role in preventing stunting in toddlers. It is recommended to provide adequate nutritional intake for toddlers, especially animal protein intake.

Keywords : Animal Protein, Stunting, Under-Five Development, Malnutrition

1. Introduction

The results of the 2021 Basic Health Research of the Ministry of Health of the Republic of Indonesia reported that the prevalence of stunting in children aged five years was 24.4%1. In the ASEAN region, Indonesia has the second highest prevalence of stunting. Stunting is a physical growth disorder characterized by a decrease in growth rate and is the result of nutritional imbalances. According to the World Health Organization (WHO) Child Growth Standard, stunting is based on the index of body length compared to age (PB/U) or height compared to age (TB/U) with a limit (z-score) of less than -2 SD. According to the WHO study, the factors of stunting in Indonesia are exclusive breastfeeding, economic status, premature birth, short birth, low maternal height and low maternal education2 Stunting causes long-term impacts, namely disruption of physical, mental, intellectual, and cognitive development. Children who are stunted until the age of 5 years will be difficult to correct so that it will continue into adulthood and can increase the risk of offspring with low birth weight (LBW) (Meilinasari et al., 2023).

Child stunting is largely caused by poor nutrition, high disease burden, inadequate child feeding, poor sanitation, and lack of access to quality health and nutrition services. For child growth and development, intake of macro and micronutrients (such as energy, protein, and vitamins A, C, and calcium) is important. As

compared to those with adequate intakes (>90% RDA), children with energy and protein intakes below 70% RDA have a 1.3 times higher risk of stunting (Fikawati & Dhea, 2023).

Protein is one of the most important macronutrients because it contains essential components that cannot be replaced by other nutrients. Apart from its role in supporting children's growth, protein also determines body composition, neurocognitive development, immune system maturity, and organ function. The amount of human protein consumption needs is inversely proportional to age, so children have higher needs (0.92-1.02 g/kgBB/day) than older age groups. The average protein consumption of children in Indonesia exceeds this recommendation (1.16 g/kgBB/day), with most of the protein sources being vegetable protein (71.69%) and 78.54% being cereals (Sidiartha & Wiga, 2023) . Food sources of animal protein are very important for nutritional intake during the developmental period, namely at 1000 HPK. Consuming animal protein foods during this critical period can improve growth, cognitive function and nutritional status of children. The long-term effect of consuming protein foods is to improve the nutritional status of toddlers (Febrianti et al., 2023).

Therefore, it is necessary to conduct research on the role of animal protein in preventing stunting in toddlers. This study aims to analyze the role of animal protein in the incidence of stunting in children under five so that it can help in efforts to prevent and reduce the number of stunting in children under five in Indonesia.

2. Method

This literature review was made by collecting, reviewing, and citing related journals. The journals were obtained through searches from the Google Scholar and Pubmed search engines. The keywords used in the search included "Animal protein", "Stunting". The journals used were published between 2015-2023. From the search results, 15 journals were obtained and reviewed.

3. Result

Table.1 Summary of articles reviewed

No.	Title	Author	Objective	Design	Sampling	Main Findings
1.	Consumption of Animal-Source Protein is Associated with Improved Height-for-Age Z Scores in Rural Malawian Children Aged 12 – 36 Months	(Kamilia et al., 2019)	to assess the relationship between type and protein quality of food consumed by people with stunting, environmental enteric dysfunction and acute malnutrition in children aged 6-36 months in Limera and Masenjere, two rural communities in Southern Malawi.	Randomized Controlled Trials (RCTs)	355 children (172 from RCT 1 and 183 from RCT 2).	Children from Limera consumed more fish (54% vs. 35%, p = 0.009) and more bioavailable protein (26.0 - 10.3 g/day vs. 23.1 - 8.1 g/day, p = 0.018, respectively) than children in Masenjere. Diet type and protein quality were not associated with any outcomes except for the association between animal protein consumption and increased height-for-age z score in children aged 12-36 months (p = 0.047).
2.	The Relationship of Animal protein Intake Diversity, Dietary Parenting, and Home Sanitation	(Farida et al., 2020)	Analyze the relationship between the diversity of animal protein intake, food parenting, and home sanitation hygiene on the incidence of stunting in	Cross Sectional	61 toddlers	There is no relationship between food parenting (p=0.327) and home sanitation hygiene (p=0.103) on the incidence of stunting in children under five.

	Hygiene to the Incidence of Stunting		children under five.			Multivariate test showed the diversity of animal protein intake and home sanitation hygiene together influenced the incidence of stunting (p=0.038, r2=0.102).
3.	Animal protein intake is associated with stunting in children aged 1 - 5 years in the working environment of the Nagi Health Center, Laratunaka City, East Flores Regency	(Sidiartha& Wiga, 2023)	Determine the relationship of animal protein intake in children aged 1-5 years who are stunted in the work environment of the Nagi Health Center, Larantuka City.	Cross sectional	124 children	The results of this study showed that of all respondents who were stunted, 78.3% had animal protein intake patterns <2x/week. This is statistically significant with a p value <0.01 and a confidence interval of 5.16-28.89, then of all respondents who were stunted, 34.8% had a pattern of vegetable protein intake <2x/week. Where this is not statistically significant with a p value> 0.01 and a confidence interval of 0.651-1.809. The results of the multivariate analysis test with logistic regression, only the animal protein consumption variable showed a significant relationship with stunting with (OR 76.6 95% CI 20.4-291.7).
4.	The relationship between animal and vegetable protein intake and the incidence of stunting in children aged 3-5 years in Penawangan Village, Pringapus Subdistrict, Semarang Regency	(Mulyasari et al., 2015)	To determine the relationship between animal and vegetable protein intake and the incidence of stunting in children aged 3-5 years in Penawangan Village, Pringapus District, Semarang Regency.	Cross sectional	64 children	There is a relationship between animal protein intake and the incidence of stunting (p = 0.0001, r = 0.798). There is a relationship between vegetable protein intake and the incidence of stunting (p = 0.0001, r = 0.560).
5.	Level of Animal Protein Consumption and its Relationship to the Incidence of Stunting in Toddlers	(Alpisah et al., 2022)	To determine the relationship between the level of animal protein consumption and the incidence of stunting in toddlers in Hantakan District, Hulu Sungai Tengah Regency.	Quantitative descriptive	60 toddlers	Based on the results of the study of 60 samples showed the level of animal protein consumption there were 22 toddlers in the less category, 18 toddlers in the medium category and 20 toddlers in the good category. It can be concluded that the level of animal protein consumption is related to the incidence of stunting in Hantakan District, Hulu Sungai Tengah Regency, because the p value = 0.001 <0.005 the results of Ho is rejected and Ha is

						accepted.
6.	Supplementation of Foods High in Animal Protein, Calcium and Zinc in Children 6 - 24 Months of Age as an Effort to Increase Child Length	(Melinasari et al., 2023)	To determine whether there is a difference in length/height and weight between treatment and control subjects, and whether there is a difference in the length/height and weight of children after supplementation with high animal protein, calcium and zinc in the stunting locus area.	Pure experiment	30 children aged 6-24 months	There was a significant difference in height of 0.41 ± 0.28 cm (p = 0.000) after supplementation. For body weight before treatment in the treatment subjects obtained an average body weight of 10.1 ± 1.5 kg and after treatment obtained an average body weight of 10.3 ± 1.5 kg, there was no difference (p = 0.082) in body weight after supplementation.
7.	Nurition Intake as a Risk Factor of Stunting in Children Aged 25 – 30 Months in Central Jakarta, Indonesia	(Fikawati & Dhea, 2023)	To determine the relationship between nutritional intake and the incidence of stunting and to determine the dominant factors associated with stunting in children aged 25-30 months in Gambir and Sawah Besar Subdistricts, Central Jakarta, Indonesia	Cross Sectional	121 children aged 25-30 months	The percentage of stunting in children aged 25 to 30 months is 29.8%. The factor associated with stunting was iron intake (OR=5.0; 95% CI: 1.02-25.25; p<0.05). Stunting was more likely to occur in children with inadequate iron intake than in children with adequate iron intake.
8.	Associations between High Protein Intake, Linear Growth, and Stunting in Children and Adolescents : A Cross-Sectional Study	(Xiong et al., 2023)	We aimed to investigate this relationship in children and adolescents aged 6 to 18 years in a population with relatively high protein consumption	Cross sectional	3299 respondents	There was an association of high protein intake with linear growth in children and children adolescents (p<0.05)
9.	Energy and Protein Intakes Are Associated with Stunting Among Preschool Children in Central Jakarta, Indonesia : A Case-Control Study	(Gemily et al., 2021)	This study aims to describe the nutritional intake of children aged 25-30 months and to determine the proportional difference in nutrient intake between stunted and normal children in Central Jakarta, Indonesia. and normal children in Central Jakarta, Indonesia	Case Control	121 children	Factors associated with stunting were energy intake (AOR=6.0; 95% CI=1.0-35.0) and protein intake (AOR=4.0; 95% CI=1.1-15.5) after controlling for fat, carbohydrate, vitamin C, iron, and zinc intake. The percentage of children with energy intake below recommendations was much higher among stunted children (86.1% compared to normal children (43.5%). Similarly, the percentage of children with protein intake below recommendations was much higher in stunted children (30.6% compared to 8.2% in normal children).
10.	Low Intake of Essential Amino Acids and Other Risk Factors of Stunting Among	(Sutjiati & Maulidina, 2021)	This study aimed to determine the amount of essential amino acid (EAA) intake and other risk factors for stunting	Case control	The study subjects were children aged 24-59	Intake of the nine EAAs in stunted children were lower than those who were not stunted. However, only histidine,

	Under-Five Children in Malang City, East Java, Indonesia		among children under five		months with a total number of 23 stunted (height-for-age Z-score <-2 SD) and 57 normal children (Z-score ⩾-2 SD).	isoleucine, and methionine were significantly different (p<0,05). The main risk factors for stunting include family monthly income is less than the Regional Minimum Wage. [OR=12.06, 95% CI 1.83-79.53], underweight [OR=7.11, 95% CI 1.49-33.93], breastfeeding less than 6 months [OR=5.34, 95% CI 1.28-22.20], and deficient EAA methionine intake [OR=0.14, 95% CI 0.03-0.67].
11.	Associations Among High-Quality Protein and Energy Intake Serum Transthyretin, Serum Amino Acids and Linear Growth of Children in Ethiopia	(Tessema et al., 2018)	The aim of this study was first to investigate the relationships among intake of protein, energy, and the essential amino acids tryptophan and lysine; serum levels of TTR, lysine, tryptophan, and IGF-1; and linear growth of Ethiopian children	Randomized Control Trial (RCT)	Ethiopian children aged 6-35 months (n=873).	The prevalence of stunting is higher for children >23 months (38%) compared to 23 months (25%). The prevalence of inflammation was 35% and intestinal parasites 48%. Three-quarters of the children were energy deficient and growth was stunted. children had lower daily energy intake than non-stunted children (p<0.05). Intake of tryptophan, protein, and energy, as well as serum tryptophan and IGF-1 levels were positively correlated with the children's linear growth of children. Controlling for inflammation, intestinal parasites, and sociodemographic characteristics, daily tryptophan (b = 0.01, p = 0.001), protein (b = 0.01, p = 0.01) and energy (b = 0.0003, p = 0.04) intake and serum TTR (b = 2.58, p = 0.04) and IGF-1 (b = 0.01, p = 0.003) were positively associated with linear growth of children. Possible linear growth failure in children in Ethiopia associated with low quality protein intake and insufficient energy intake
12.	Different Intakes of Energy and Protein in Stunted and Non-Stunted Elementary School Children	(Restuastuti et al., 2018)	This study aims to identify stunting data from an elementary school in Sungai Sembilan Dumai municipality, and others. average energy and	Cross sectional	299 children	There were 108 subjects (36.1%) who were stunted, of which 15.7% were overweight and 10.2% were underweight. There was no significant difference in the mean energy intake between

	in Indonesia		protein intake in stunted and non-stunted children.			stunted and non-stunted children (p=0.70). However, there was there was a significant difference in mean protein intake between stunted and non-stunted children (p=0.00).
13.	The Relationship between Fish Consumption Habits and Animal Protein Intake with the Incidence of Toddler Stunting in Pasaran Island, Bandar Lampung Municipality	(Rusyantia, 2018)	The purpose of this study was to determine the relationship between fish consumption habits and animal protein intake with the incidence of stunting in toddlers.	Cross sectional	60 toddlers	There was no significant association between frequency of fish consumption (p=1.000) and there was a significant association between animal protein consumption and the incidence of stunting (p=0.002).
14.	Low Animal Protein Consumption as a Risk Factor for Stunting in Toddlers in Samarinda City	(Risya et al., 2020)	The purpose of this study was to determine the risk of stunting in toddlers based on consumption of animal protein, vegetables and fruit.	Case Control	96 toddlers 32 stunted toddlers as case group and 64 toddlers as control group	The results showed that animal protein consumption during the week was protective against stunting (p=0.023, OR=9.000). In addition, toddlers who did not finish their food at every meal were three times more likely to be stunted (p=0.02, OR=2.882) and ten times more likely if the household provided vegetables less than three times a week (p=0.001, OR=10.333).
15.	Effect of Egg Consumption Rate and Processing Method on Prevalence of Stunting	(Febrianti et al., 2023)	Objective This study aims to determine the effect of egg consumption rate on the prevalence of stunting, to determine the effect of processing methods on the prevalence of stunting in children. stunting, to determine the effect of processing methods on the prevalence of stunting in Students of Bustanul Athfal Muhammadiyah Kindergarten, Sidenreng Rappang Regency.	Case control	30 respondents	The results showed that there was a significant influence between the number of egg egg consumption (p=0.002) and processing method (p=0.001) on the prevalence of stunting. Multivariate test results multivariate test results showed that the variable that most influenced the occurrence of stunting was the method of processing (OR=2.45; 95% CI: 0.89 - 2.97; p=0.001).

4. Discussion

In the study of Kaimila et al (2019) showed that food type and protein quality were not associated with any outcomes except the relationship between animal protein consumption and increased height-for-age z scores in children aged 12-36 months (p = 0.047) (Kaimila et al., 2019) . One of the causal factors that has the most

impact on the incidence of stunting is the lack of protein intake. This is because children under five need more protein for muscle and antibody formation (Farida et al., 2022).

Kamilia's research was supported by Farida et al (2022) There is no relationship between dietary parenting (p=0.327) and home sanitation hygiene (p=0.103) on the incidence of stunting in children under five. Multivariate test showed that the diversity of animal protein intake and home sanitation hygiene together influenced the incidence of stunting (p=0.038, r2=0.102) (Farida et al., 2022). Protein is one of the macro nutrients that has a crucial role in child growth. Adequate protein intake patterns of children will modify the secretion and action of osteotrophic hormones, namely Insulin Growth Factor (IGF)-1 known as Somatomedin, which is a polypeptide hormone that functions as a mitogen and stimulator of cell proliferation so that it plays an important role in growth, tissue repair and tissue regeneration. IGF-1 also has a role in activating Growth Hormone (GH) for child height growth. Another function that benefits child growth is that IGF-1 increases renal conversion of 25-hydroxy-vitamin D3 to the active form 1,25-dihydroxy-vitamin D3 which contributes to increased intestinal absorption of calcium and phosphorus used for child bone growth (Sidiartha & Wiga, 2023).

Sidiartha & Wega (2023) The results of this study showed that of all respondents who were stunted, 78.3% had animal protein intake patterns <2x/week. This is statistically significant with a p value <0.01 and a confidence interval of 5.16-28.89, then of all respondents who were stunted, 34.8% had a pattern of vegetable protein intake <2x/week. Where this is not statistically significant with a p value> 0.01 and a confidence interval of 0.651-1.809. The results of the multivariate analysis test with logistic regression, only the animal protein consumption variable showed a significant relationship to stunting with (OR 76.6 95% CI 20.4-291.7) (Sidiartha & Wiga, 2023). Proteins that contain complete essential amino acids will support optimal growth of toddlers, but if the amino acid content is incomplete, optimal growth in toddlers will not occur. A 15% increase in protein intake is consistent with rapid growth (cath-up growth) in children (Mulyasari et al., 2015).

In the research of Mulyasari et al (2015) with the title The relationship between animal and vegetable protein intake with the incidence of stunting in children aged 3-5 years in Penawangan Village, Pringapus District, Semarang Regency provides results There is a relationship between animal protein intake and the incidence of stunting (p = 0.0001, r = 0.798). There is a relationship between vegetable protein intake and the incidence of stunting (p = 0.0001, r = 0.560). Based on the results of direct interviews with parents and semi-quantitative FFQ, animal protein intake is in a severe deficit category because families in the lower economic level have access to animal protein sources that are more expensive than vegetable protein sources so that in providing daily protein source foods they often provide tofu and tempeh besides that even though they can easily access animal protein source foods such as milk, chicken, eggs, sausages, etc., they are busy working so they do not have time to prepare food at home and do not pay attention to their children's diet, thus finally for the intake of quality protein sources such as children are required to drink milk is not given (Mulyasari et al., 2015).

Alpisah et al (2022), based on research that has been carried out from 60 samples shows the level of animal protein consumption there are 22 toddlers in the less category, 18 toddlers in the medium category and 20 toddlers in the good category. It can be concluded that the level of animal protein consumption is related to the incidence of stunting in Hantakan District, Hulu Sungai Tengah Regency, because the p value = 0.001 <0.005, the results of Ho are rejected and Ha is accepted (Alpisah et al., 2022). This study shows that the level of animal protein consumption of children under five is less and has a greater percentage of stunting. This is because children under five only consume protein sources that are favored and less varied over a long period of time. Height growth of children under five can be inhibited if the toddler experiences protein deficiency during the first thousand days of life and lasts for a long time.

Meilinasari et al (2023) in their research results obtained a significant difference in height of 0.41 ± 0.28 cm (p = 0.000) after being given supplements. For body weight before treatment in the treatment subjects

obtained an average body weight of 10.1 ± 1.5 kg and after treatment obtained an average body weight of 10.3 ± 1.5 kg, there was no difference (p = 0.082) in body weight after supplementation. The body needs protein to grow and to synthesize growth hormones, the more hormones produced, the better the growth20 The quantity and quality of protein intake has an effect on bone matrix and growth factors that play an important role in bone formation. The results of the study stated that children who experienced a lack of protein intake had a 3.46 times risk of becoming stunted compared to children who had sufficient protein intake. The quality and content of adequate protein in the diet is an important factor in the physiological process of bone growth as hard tissue (Meilinasari et al., 2023).

Fikawati & Dhea, 2023 mentioned that the percentage of stunting in children aged 25 to 30 months was 29.8%. The factor associated with stunting was iron intake (OR=5.0; 95% CI: 1.02-25.25; p<0.05). Stunting was more likely to occur in children with inadequate iron intake than in children with adequate iron intake. In previous studies, low iron intake was attributed to the lack of iron-containing foods. meat, chicken liver and beef liver are the best sources of iron. Iron deficiency is more common in children who eat fewer iron-rich foods. Incorrect timing of weaning according to the age of the child may also lead to insufficient iron intake. Based on per capita protein consumption, Indonesia has met the national protein adequacy guidelines; however, animal protein consumption is still slightly low. Egg consumption in Indonesia is between 4-5 kg/year, meat is less than 40 g/person, and milk and its derivatives are 0-50 kg/person/year (Fikawati & Dhea, 2023).

Xiong et al., 2023 gave results that there was an association of high protein intake with linear growth in children and adolescent children (p<0.05). The mean protein intake was 1.81 g kg-1 d×1 (17% E). After adjusting for serum calcium, zinc, vitamin D3, vitamin A levels, birth outcomes, lifestyle, and parental characteristics, each standard deviation increase in protein intake of 1 (0.64 kg×1 d×1) was found to be associated with a change of 5.78 cm in height (95% CI: ¬ 6.12, 5.45) and a change in HAZ of 0.79 (95% CI: 0.84, 0.74). Consistent results were observed when protein intake was expressed as %E or specifically as animal or plant protein. Moreover, the relationship between protein intake and linear growth remained consistent across genders in different pubertal stages, similar to participants overall (Xiong et al., 2023).

Gemily et al., 2021 mentioned that the factors associated with stunting were energy intake (AOR=6.0; 95% CI=1.0-35.0) and protein intake (AOR=4.0; 95% CI=1.1-15.5) after controlling for fat, carbohydrate, vitamin C, iron, and zinc intake. The percentage of children with energy intake below recommendations was much higher among stunted children (86.1% compared to normal children (43.5%). Similarly, the percentage of children with protein intake below recommendations was much higher in stunted children (30.6% compared to 8.2% in normal children (Gemily et al., 2021).

Sutjiati & Maulidina, 2021 mentioned in the results of their research that the intake of the nine EAAs in stunted children was lower than children who were not stunted. However, only histidine, isoleucine, and methionine were significantly different (p<0.05). The main risk factors for stunting include family monthly income less than the Regional Minimum Wage [OR=12.06, 95% CI 1.83-79.53], underweight [OR=7.11, 95% CI 1.49-33.93], breastfeeding for less than 6 months [OR=5.34, 95% CI 1.28-22.20], and deficient methionine EAA intake [OR=0.14, 95% CI 0.03-0.67] (Sutjiati & Maulidina, 2021). This study showed that the intake of nine EAAs in stunted children tended to be lower than in non-stunted children, while only three EAAs (histidine, isoleucine, and methionine) were found to be significantly lower. Inadequate intake of EAAs causes nitrogen imbalance in protein synthesis which replaces the entire loss of protein turnover in the human body. EAAs play various roles in human health, such as regulation of various metabolic pathways to promote general health, including growth and development, reproduction, and lactation functions. Therefore, an insufficient amount of EAA intake in children has detrimental effects on their physical growth and development, known as stunting.

Febrianti et al., 2023 in their research results showed that there was a significant influence between egg consumption rates (p=0.002) and processing methods (p=0.001) on the prevalence of stunting. The results of the multivariate test showed that the variable that most influenced the occurrence of stunting was the processing method (OR = 2.45; 95% CI: 0.89 - 2.97; p = 0.001). Processing of protein foods that are not properly controlled can cause a decrease in nutritional value. In general, protein food processing can be done physically, chemically or biologically. Physically, it is usually done by crushing or heating, chemically by using organic solvents, oxidizers, alkalis, acids or sulfur dioxide; and biologically by enzymatic hydrolysis or fermentation. Among these processing methods, the most widely done is the processing process using heating such as sterilization, cooking and drying. Meanwhile, we know that proteins are reactive compounds composed of several amino acids that have reactive groups that can bind with other components, such as reducing sugars, polyphenols, fats and their oxidation products and other chemical additives such as alkali, sulfur dioxide or hydrogen peroxide (Febrianti et al., 2023).

Risva et al., 2020 in their research results showed that animal protein consumption in a week was protective against the incidence of stunting (p=0.023, OR = 9.000). In addition, toddlers who do not finish their food every meal are three times more likely to experience stunting (p = 0.02, OR = 2.882) and ten times more likely if the household provides vegetables less than three times a week (p = 0.001, OR = 10.333) (Risva et al., 2020).

Rusyantia, 2018 states that there is no significant relationship between the frequency of fish consumption (p = 0.000) and there is a significant relationship between animal protein consumption and the incidence of stunting (p = 0.002) (Rusyantia, 2018).

Restuastuti et al., 2018 mentioned that there were 108 subjects (36.1%) who suffered from stunting, of which 15.7% were overweight and 10.2% were underweight. There was no significant difference in the average energy intake between stunted and non-stunted children (p=0.70). However, there was a significant difference in mean protein intake between stunted and non-stunted children (p=0.00) (Restuastuti et al., 2018).

Tessema et al., 2018 mentioned that the prevalence of stunting was higher for children >23 months (38%) compared to 23 months (25%). The prevalence of inflammation was 35% and intestinal parasites 48%. Three-quarters of the children were energy deficient and growth stunted children had lower daily energy intake than non-stunted children ($p < 0.05$). Tryptophan, protein, and energy intake, as well as serum tryptophan and IGF-1 levels were positively correlated with children's linear growth. Controlling for inflammation, intestinal parasites, and sociodemographic characteristics, daily tryptophan (b = 0.01, p = 0.001), protein (b = 0.01, p = 0.01) and energy (b = 0.0003, p = 0.04) intakes and serum TTR (b = 2.58, p = 0.04) and IGF-1 (b = 0.01, p = 0.003) were positively associated with children's linear growth. The possibility of linear growth failure in children in Ethiopia is associated with low quality protein intake and insufficient energy intake (Tessema et al., 2018).

5. Conclusion

Animal protein has an important role in preventing or minimizing the occurrence of stunting in children under five. Children under five who consume sufficient animal protein can avoid stunting. This is because animal protein contains essential amino acids that can synthesize growth hormones so that it can accelerate the growth rate of toddlers and prevent toddlers from experiencing stunting. Therefore, it can be concluded that food sourced from animal protein can accelerate the growth rate and prevent stunting.

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