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Nutrition Consumption and Impact on Stunting and Underweight among Children in the Tengger Community, East Java, Indonesia

Konsumsi Zat Gizi dan Dampaknya terhadap Stunting *dan* Underweight *pada Balita Suku Tengger, Jawa Timur, Indonesia*

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ABSTRACT

Background: Stunting and underweight are still nutritional problems in toddlers in the world. In 2022, the number of stunting and wasting in Indonesia is still high. There are many factors that influence undernutrition, both external and internal factors in the Tengger community.
Objectives: The purpose of this study was to analyze the relationship between family characteristics, exclusive breastfeeding history, birth history, and birth attendants with the incidence of stunting and underweight in children under-5 of the Tengger Community.
Methods: This study was a cross-sectional study, which samples consisted of 100 mothers of children under-5 in the traditional territory of Tengger Community, taken by the random sampling technique. Data on family characteristics, exclusive breastfeeding, birth history and birth attendants were collected using questionnaires, the nutritional status of mothers and toddlers by measuring body weight and height directly, and food consumption patterns, compiled using the SQ-FFQ sheet and a food recall. Then, the chi-square analysis was utilized to scrutinize those data.
Results: No significant associations between family characteristics, breastfeeding history, birth history, and birth attendant with nutritional status of under-fives were found in W/A and H/A (p-value>0.05). Only fat intake had a significant association with W/A in under-fives (p-value=0.03) of all nutrients.
Conclusions: Energy and macronutrient intake were mostly in deficit, but only fat intake was associated with underweight. Therefore, macronutrient intake needs to be increased.

INTRODUCTION

Stunting and underweight are both nutrition disorders that are related to inadequate nutrition intake and can impact to child's growth and development. Globally, in 2012, WHO recorded that there were 162 million children under 5 years of age who were stunted and 99 million who were underweight[1]. This shows that undernutrition, especially stunting and wasting, is still a nutritional problem in children under-5. For example, in southern Africa the prevalence of stunting and underweight in 2014 was 30.8% and 20.5%[2]. In Congo, the prevalence of stunting and underweight in 2015 was 42.7% and 21.9%[3]. In Indonesia itself (2022), the stunting rate fell from the previous year's 21.6% while underweight rose to 17.1%[4]. Although there was a decrease in stunting, the decrease did not reach the national target where the national target for reducing stunting rates each year is 3.8%. The data shows that nutrition problems in children under-5, especially stunting and underweight, have not yet been addressed.

Many factors can contribute to an individual's nutritional status, including diet or consumption patterns, education, economy, income, food expenditure costs, and food prices[5-8]. Moreover, socio-cultural factors are also related to eating habits; it is believed to have a prominent role in shaping individuals' eating preferences and habits besides determining the food value, where food can be considered nutritious, high-class, or something else. These factors also shape how people eat and how to prepare food. At the household level, children's eating habits are formed from the family's eating habits[9-11].

The Tengger community is one of the communities in Indonesia that maintain their customs,

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not to mention their unique eating habits. The Tengger Community itself has a unique eating habit of eating *aron* rice with cement vegetables and salted fish as a side dish. The eating habits of the community are related to local beliefs, one of which is the prohibition for pregnant women to eat what is considered hot foods[12,13]. The community also carries out many socio-cultural-nutritional practices at certain life stages, such as breastfeeding mothers, babies, and toddlers. However, inappropriate socio-cultural-nutritional practices can result in less variety of food types consumed due to restrictions on certain types of food. This study, hence, aims to analyze the relationship between family characteristics, exclusive breastfeeding history, birth history, and birth attendants with the incidence of stunting and underweight in children under-5 of the Tengger Community, Pasuruan, East Java, Indonesia.

METHODS

This study was an analytic observational study that applied a cross-sectional design. The data used in this study included the primary data with both quantitative and qualitative approaches. This study was conducted in Tengger Community settlements in Wonokitri Village, Tosari District, Pasuruan Regency, East Java, Indonesia, from June to November 2019. The samples were mothers and toddlers as many as 100 samples, selected by the simple random sample technique, from a total population of 190 people living in the area. The inclusion criteria for the respondents were mothers and toddlers who did not suffer from certain chronic diseases (such as tuberculosis, diabetes mellitus, etc.), and the mother was not pregnant when this study was carried out.

The interview technique used a questionnaire to collect data on respondents' characteristics, such as father and mother's education, father and mother's occupation, family income, smoking history at home, birth history, breastfeeding history, and birth attendant midwife. Parental education was divided into 3 categories: elementary school, junior high school, and senior high school, parental occupation was divided into 2 categories: government/private employee or farmer/laborer, family income was divided into 2 categories: more than the regional minimum wage or less than the regional minimum wage, breastfeeding history was divided into 2 categories: exclusive breastfeeding or not. Meanwhile, birth history was classified into preterm or normal, with midwives or doctors as birth attendants. Data on the nutritional status of mothers and toddlers was obtained by direct anthropometric measurement of height and weight, while data on food consumption patterns were obtained using the SQ-FFQ for the past month, as well as food recall used to assess the food intake of mothers and toddlers. The data on the nutritional status of mothers obtained was compared with BMI according to who with the classification of underweight (<18.5), normal (18.5 – 22.9), and overweight (23 – 24.9). While the results of food recall are compared with the Recommended Dietary Allowances (RDA); thereby, the categories were deficit (<80% RDA), adequate (80-110%), and excess (>110% RDA).

In this study, the independent variable is the nutritional status of toddlers, where the nutritional status of toddlers was assessed based on weight-for-age (W/A) and height-for-age (H/A), W/A was classified as underweight (<-2SD) and normal (≥-2SD), while H/A was classified with stunting (<-2SD) and normal (≥-2SD). The data analysis was performed by statistical testing, where the nominal data were evaluated using the chi-square test and the ordinal data using the Spearman correlation test. Meanwhile, the descriptive data were presented in the forms of cross-tabulation and narrative. This study has obtained a certificate of ethical clearance from the Health Research Ethics Commission of the Faculty of Nursing, Universitas Airlangga on April 23, 2019 with number 1369-KEPK.

RESULTS AND DISCUSSIONS

The weight-for-age (W/A) index describes the nutritional status of children under five at present, while the height-for-age (H/A) index represents the nutritional status in the past. Changes in body composition may occur over a short period, but length or height is a long-term condition of an individual's nutritional adequacy[14,15,16]. In this study, an analysis of the relationship between the characteristics of the family in the Tengger Community with their nutritional status was carried out. Furthermore, the characteristics of the families regarded in this study were the parents' educational attainment, occupation, and family income using Spearman correlation test.

The parents' educational attainment was classified into elementary school, junior high school, and senior high school. Based on Table 1, parents who attained all three levels of education mostly sire toddlers with normal nutritional status. Underweight and stunting toddlers, nonetheless, mainly occur in children under five with elementary school-attained parents. However, based on the relationship test, no significant relationship was found between the parents' educational attainment and the incidence of underweight or stunting among the under-5 (p-value>0.05). Anyhow, this argument is possible due to the limited access to education, where most parents in the Tengger Community only complete elementary school. Based on data from the Indonesian Central Statistics Agency (2020) shows that in 2019, Tosari Village is one of the villages in the Tengger Community which has the least number of school facilities compared to other villages, namely only 8 elementary schools, 4 junior high schools, and 1 high school[17].

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Table 1. Cross-tabulation between father's and mother's education, father's and mother's occupation, and family income with underweight and stunted children in Tengger community in 2019

Variables	Nutritional Status based on the W/A Index							Nutritional Status based on the H/A Index						
	Under-weight		Normal weight		Total		p-value	Stunting		Normal		Total		p-value
	n	%	n	%	N	%		n	%	n	%	N	%	
Father's Educational Attainment														
Elementary School	14	25.9	40	74.1	54	100	0.531	22	40.7	32	59.3	54	100	0.877
Junior High School	5	15.6	27	84.4	32	100		14	43.8	18	56.2	32	100	
Senior High School	3	21.4	11	78.6	14	100		5	35.7	9	64.3	14	100	
Mother's Educational Attainment														
Elementary School	12	21.6	26	68.4	38	100	0.221	19	50.0	19	50.0	38	100	0.283
Junior High School	8	15.7	43	84.3	51	100		17	33.3	34	66.7	51	100	
Senior High School	2	18.2	9	81.8	11	100		5	45.5	6	54.5	11	100	
Father's Occupation														
Government/ Private Employee	3	21.4	11	78.6	14	100	1.000	4	28.6	10	71.4	14	100	0.308
Farmer/Laborer	19	22.1	67	77.9	86	100		37	43.0	49	57.9	86	100	
Mother's Occupation														
Government/ Private Employee	2	33.3	4	66.7	6	100	0.610	3	50.0	3	50.0	6	100	0.687
Farmer/Laborer	20	21.5	73	78.5	93	100		38	40.4	56	59.6	94	100	
Family Income														
>Regional Minimum Wage	4	22.2	14	77.8	18	100	1.000	7	38.9	11	61.1	18	100	0.841
<Regional Minimum Wage (RMW of Pasuruan District IDR. 3,861,518.00)	17	22.0	64	78.0	82	100		34	41.5	48	58.5	82	100	

RMW=Regional Minimum Wage, W/A=Weight-for-Age, H/A=Height-for-Age

Based on the research carried out by Haryani et al. (2022) and Atyeo et al., (2017), parents' educational attachment was not significantly related to the incidence of stunting in the highlands[18,19]. Research conducted by Appoh & Krekling (2005) showed that the level of parental education is not directly related to the nutritional status of children, but the level of knowledge about health and parental attitudes are more important factors[20]. Laksono et al. (2021) proved that the level of parental education is an important factor but does not affect nutritional status directly because the parenting factor that will be given to their children will affect the nutritional status of children[21]. On the contrary, Alderman and Headey (2017); Roba et al., (2016); Babar et al., (2010); and Urke et al., (2011), agreed that parents' educational attainment had a great opportunity to affect the nutritional status in countries with a very poor prevalence of malnutrition, while in developing and developed countries, it was not substantial[22,23,24,25]. The claim was no other than due to the educational curriculum that has not yet supported the importance of nutrition for a better generation. This result, however, was different from the result of Khanra et al., (2021) and Ahirwar et al., (2020), which concluded that the majority of stunted children in India are born from families with low education levels of parents, especially mother`s education[26,27]. Therefore, it can be asserted that the effect of parents' education on the nutritional status varies, depending on the characteristics of each region.

The results of this study in Table 1 also displayed that fathers who worked as farmers/laborers had underweight and stunting children more than those who worked as government/private employees. However, it was also found that more underweight and stunted under-5 had unemployed mothers instead of working mothers. Despite the statistics, based on the relationship test, there was no significant relationship between parents' occupation with the nutritional status of the under-5 (p-value=1.000; p-value=0.308; p-value=0.610; p-value=0.687). Likewise, household income was categorized into two groups: below the regional minimum wage and above the regional minimum wage. The analysis discovered that most underweight, stunted, and normal under-5 came from families with more than

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the regional minimum wage of income. In addition, by referring to the correlation test, there was no significant relationship between the household income and the children's nutritional status, based on the W/A and H/A (p-value=1.000; p-value=0.841). Farmers or farm laborers have become the main occupation for most of the Tengger Community, given its mountainous-contoured area in the highlands. Thus, other job opportunities are limited. However, working as farmers/farm laborers allows the community income below the regional minimum wage. Most of the mothers also work as farmers. After preparing their children's needs in the morning, they go to the fields, then come home in the evening, making it arguable that there is no significant relationship between parents' occupation or income and the nutritional status of children under five. Prior studies support these arguments in terms of the economic background and occupation of most of the respondents, namely as farmers/farm laborers[28,29]. Other research shows there is a relationship between the occupation of the father with the conditions of the nutritional status of children while the same study showed no relationship between mother's work with the conditions of the nutritional status of children[30,31].

The nutritional characteristics scrutinized in this study comprise the mother's nutritional status, smokers at home, the history of exclusive breastfeeding, and the history of births and birth attendants. These were examined to see the potential for double burden of malnutrition problems and factors affecting children's nutritional status. The relationship between the nutritional characteristics of both the mothers and children under five and the children's nutritional status based on the W/A and H/A is presented in more detail in Table 2.

Table 2. Cross distribution between maternal nutritional status, smoking status, exclusive breastfeeding, birth history, and birth attendants with underweight and stunting incidents in Tengger community in 2019

Variables	Nutritional Status based on the W/A Index						p-value	Nutritional Status based on the H/A Index						p-value
	Under-weight		Normal weight		Total			Stunting		Normal		Total		
	n	%	n	%	N	%		n	%	n	%	N	%	
Mother's Nutritional Status														
Underweight	1	33.3	2	66.7	3	100	0.743	0	0	3	100	3	100	0.378
Normal	9	23.7	29	76.379.7	38	100		15	39.5	23	60.5	38	100	
Overweight	12	20.3	47		47	100		26	44.1	33	55.9	59	100	
Smoker at Home														
Yes	16	20.3	63	79.7	79	100	0.393	30	38.0	49	62.0	79	100	0.233
None	6	28.6	15	71.4	21	100		11	52.4	10	47.6	21	100	
Exclusive Breastfeeding														
No	14	22.6	48	77.4	62	100	0.858	24	38.7	38	61.3	62	100	0.552
Yes	8	21.1	30	78.9	38	100		17	44.7	21	55.3	38	100	
Birth History														
Premature/ Preterm	17	25.8	49	74.2	66	100	0.206	25	37.9	41	62.1	66	100	0.377
Normal	5	14.7	29	85.3	34	100		16	47.1	18	52.9	34	100	
Birth Attendant														
Midwife	14	18.4	62	81.6	76	100	0.124	29	38.2	47	61.8	72	100	0.304
Doctor/ Obstetrician	8	33.3	16	66.7	24	100		12	50.0	12	50.0	24	100	

W/A=Weight-for-Age, H/A=Height-for-Age

Based on the study results, it can be implied that overweight mothers can bear underweight, normal, and stunted children. In other words, there was no significant relationship found between maternal nutritional status and nutritional status of the under-5 if referring to the W/A and H/A indexes (p-value=0.743; p-value=0.378). There is no relationship between the two variables, possibly because during pregnancy, the mother attended regular antenatal care visits so that the nutritional status during pregnancy is in good condition so that it does not affect the incidence of stunting and underweight in children at this time. A study that was conducted by Haileslassie et al. (2013) showed that women who attended more than three antenatal care visits a year were 4.1 less likely to be underweight[31]. Similarly, Gebre et al. (2018) showed that women who had not attended antenatal care were 83% more likely to be underweight[32]. Antenatal care provides the setting to identify and treat such high-risk pregnancies and it offers nutritional and educational interventions which can promote healthy eating habits, hygienic practices, and lifestyle changes to reduce low birth weight. In addition, a study that was conducted by Young et al. (2018) showed that the nutritional status of the mother during the preconception period is a strong predictor that affects the incidence of stunting or underweight, which this study did not examine[33]. On that research also showed that nutritional status based on low BMI during preconception had a 1.3 times higher risk of a child experiencing stunting or other malnourished conditions. This study's results are in line with other research that there is no significant relationship between maternal nutritional status and nutritional status of children under-5 years based on W/A, H/A, and W/H indexes[34,35]. Nonetheless, this result is not in line with the conclusions of other prior studies. Having a mother with a better nutritional status benefits

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the child's nutritional status. Maternal anthropometrics were correlated with weight-for-height Z score (WHZ) and height-for-age Z score (HAZ) of children[36,37]. The reciprocal relationship between the nutritional status of mothers and children emphasizes the value of improving the mothers' because the improvement will affect the health outcomes of both parties.

Furthermore, smokers are mostly still high in underweight, normal, and stunted children under-5's households. Based on the correlation test, there was no significant relationship between the presence of smokers at home with the nutritional status seen from the W/A and H/A indexes (p-value=0.393; p-value=0.233). There is no relationship between the two variables because maybe the children under-5's in this study did not get exposure to cigarette smoke from smokers in the house for a long and constant period of time, especially in their 1000 days of life[38]. The study conducted by Astuti et al. (2020) showed that smoking duration >3 hours per day increased the risk of stunting by 10.3 times[39]. A study shows that exposure to cigarette smoke in the long term can increase nicotine levels in the body, which can reduce oxygen supply by 30-40% and interfere with the absorption of several nutrients such as calcium, minerals, and vitamin C, which are important for children's growth[40]. Meanwhile, the duration and frequency of smokers in this study were not investigated further. The results of the study are in line with the research conducted by Dadras et al. (2017) showed that smokers were not related to the nutritional status of children as seen from the H/A and W/A indexes[41].

The breastfeeding history as the following variable was divided into two categories: exclusive breastfeeding and not. Meanwhile, the birth history is classified into preterm and normal, with midwives and doctors as the birth attendants. In terms of the breastfeeding history, it can be noticed that more than 50% of the under-5 respondents were not exclusively breastfed, especially those who were preterm-born assisted by midwives. One study showed that most mothers living in areas with low income levels did not exclusively breastfeed because they did not receive an explanation of the reasons for the importance of exclusive breastfeeding even though they received information and support to provide exclusive breastfeeding to their children by the public health center or integrated healthcare center[42]. In addition, although health cadres have received health training from the community health center, they often have an inappropriate understanding of the nutritional status of children. In addition, the study also explained that most breastfeeding mothers get information related to health only from information passed down in their families from generation to generation[42]. Based on the test results, there is no significant relationship between exclusive breastfeeding and the nutritional status of children under-5 as seen from the H/A and W/A indexes (p-value=0.552; p-value=0.858). The results of this study are in line with research conducted by Aktar (2021) and Nova & Afriyanti (2018) which also showed that exclusive breastfeeding was not significantly related to the incidence of stunting and underweight in children under-5[43,44]. This is different from the research conducted by Ahmad (2022) and Kumar (2015) which showed that exclusive breastfeeding is a factor that significantly influences the nutritional status of children as seen from the W/A and H/A indexes[45,46].

The prevalence of smoker households with low economic and educational conditions in Indonesia is still very high[47]. Households with smoking fathers spend 16.6% of their household income on cigarettes[48,49]. Moreover, children whose fathers smoke tend to be shorter than those whose fathers do not want due to limited access and the possibility of infectious diseases since children act as passive smokers. Although there was no significant relationship between the two found in this study, there was a tendency for children with smoking households to experience nutritional problems, including underweight or stunting.

This study also analyzed the relationship between macronutrient consumption and the nutritional status of children under five. The macronutrients studied were the adequacy of energy, carbohydrates, proteins, and fats. The cross-distribution table between the adequacy of macronutrients and the nutritional status of the under-5 is presented in Table 3.

Table 3. Cross-distribution between levels of energy, carbohydrate, protein, and fat consumption with the incidence of underweight and stunting in Tengger community in 2019

Variables	Nutritional Status based on the W/A Index							Nutritional Status based on the H/A Index						
	Under-weight		Normal weight		Total		p-value	Stunting		Normal		Total		p-value
	n	%	n	%	N	%		n	%	n	%	N	%	
Energy														
Deficit (<80% RDA)	18	22.0	64	78.0	82	100	0.887	33	40.2	49	59.8	82	100	0.236
Adequate (80-110% RDA)	3	25.0	9	75.0	12	100		7	58.3	5	41.7	12	100	
Excess (>110% RDA)	1	16.7	5	83.3	6	100		1	16.7	5	83.3	6	100	
Carbohydrate														
Deficit (<80% RDA)	21	24.1	66	75.9	87	100	0.287	37	57.5	50	57.5	87	100	0.743
Adequate (80-110% RDA)	0	0	8	100	8	100		3	62.5	5	62.5	8	100	
Excess	1	20.0	4	80.0	5	100		1	80.0	4	80	5	100	

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Variables	Nutritional Status based on the W/A Index							Nutritional Status based on the H/A Index						
	Under-weight		Normal weight		Total		p-value	Stunting		Normal		Total		p-value
	n	%	n	%	N	%		n	%	n	%	N	%	
(>110% RDA)														
Protein														
Deficit (<80% RDA)	15	27.3	40	72.7	55	100	0.417	23	41.8	32	58.2	55	100	0.680
Adequate (80-110% RDA)	3	15.8	16	84.2	19	100		9	47.4	10	52.6	19	100	
Excess (>110% RDA)	4	15.4	22	84.2	26	100		9	34.6	17	65.4	26	100	
Fat														
Deficit (<80% RDA)	18	23.4	59	76.6	77	100	0.034*	32	41.6	45	58.4	77	100	1.000
Adequate (80-110% RDA)	0	0	13	100	13	100		5	38.5	8	61.5	13	100	
Excess (>110% RDA)	4	40.0	6	60	10	100		4	40	6	60	10	100	

RDA=Recommended Dietary Allowances, W/A=Weight-for-Age, H/A=Height-for-Age, *) Indicates a significant value

Based on Table 3, it can be perceived that most of the children under five had a low energy sufficiency level (<80% RDA) for underweight, stunting, and normal. In line with energy, the respondents' average adequacy of carbohydrates, proteins, and fats is at a low level. However, based on the relationship test, there was no significant relationship between the adequacy level of energy, carbohydrates, and protein and the nutritional status of the under-5, seen from both W/A and H/A indexes (p-value>0.05). In contrast, the fat intake was significantly associated with the W/A nutritional status (p-value=0.03). The deficiency of macronutrients in toddlers can be caused by food taboos, where a rigorous belief in abstinence from food can lower the nutrition level in pregnant women and interfere with fetal growth[50]. Food taboos among the Tenggerese include groups of fruits, side dishes, vegetables, hot foods, and foods considered unusual, such as *dempet* or twin foods[51]. The highly adopted food taboos, especially in the Tengger Community, are no other than the symbolic, functional, and value or religious approach adhered to[11]. In brief, the Tengerese believe in several dietary restrictions, such as meat (goat), fish, and squid, which are protein sources. Meanwhile, mothers and toddlers who are deficient in protein consumption have the potential to have a low nutritional status, which in pregnant women may lead to malnourished babies[52,53,54].

The results of the research on the types of food consumed, the carbohydrate food sources consumed by the majority of toddlers are rice and potatoes while protein food sources are tofu and tempeh. Rarely do they consume meat, either beef, pork, mutton, or buffalo meat. Toddlers also rarely consume fish, both sea fish and freshwater fish. Meat and fish are not only a source of protein, but also a source of fat. Whereas in addition to being a source of protein, meat and fish are also a source of fat. This is also influenced by local culture, where there is a food taboo for pregnant women who are not allowed to consume fish, which affects the choice of food at the family level.

Fat is a source and reserve of energy for individuals. Low levels of fat consumption can cause reduced energy in the body which will cause changes in body mass and tissue as well as impaired absorption of fat-soluble vitamins such as vitamins A, D, E, and K, which also function to support the growth and development of children[55]. In addition, the body of children under five who experience a lack of fat will cause the fat supply in the body to be used continuously so that fat reserves are reduced and can cause thin children under five. Lack of fat makes essential fatty acids, namely linoleic and linolenic fatty acids, also reduced. The impact of linoleic deficiency on growth will be decreased, reproductive failure, changes in skin and hair structure and liver pathology[56,57]. This finding is arguably due to the limited public trust and information regarding the importance of fat. In line with the research study, there is a significant relationship between the level of fat intake and the nutritional status according to the W/A and H/A indexes (p-value<0.05)[58,59], which also implied that the fat intake of children living in cities is higher than those in rural areas[60]. The results of this study, thus, provide another evidence about the importance of providing education to parents, especially to mothers, about balanced nutritional foods.

The advantage of this study is that it can display data on external and internal factor that cause under-five nutritional problems. In addition, the researchers also divided the tested subject groups between nutritional status based on W/A and H/A. However, this study didn't include the types of food consumed by under-five, so it could not identify the most frequently and rarely consumed food types, which nutritional status can also be influenced by food diversity, not just the level of nutrient adequacy.

CONCLUSIONS

After scrutinizing all the variables, it can be assumed that the occupation, family income, and education of parents do not significantly influence the nutritional status of children under five. However, there is an effect of fat consumption on children's nutritional status and the consumption of energy and other macronutrients tends to be insufficient. Thus, it is

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necessary to pay more attention to food consumption patterns because they have an impact on long-term health and prevent the emergence of various degenerative diseases and changes in nutritional status.

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CONFLICT OF INTEREST AND FUNDING DISCLOSURE

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AUTHOR CONTRIBUTIONS

LM: conceptualization, funding acquisition, investigation, methodology, supervision, validation, visualization, writing-original draft, writing-review & editing; MAR: investigation, project administration, resources, supervision, validation, visualization; DI: data curation, formal analysis, software; CTA: writing-review, editing; AS: writing-review, editing.

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