

# **Management of Innovation in Functional Food Products for Stunting Prevention as a Research Dissemination in Institution X**

**Mia Rahma Romadona, Rendi Febrianda, Anggini Dinaseviani  
and Andi Budiansyah**

Researchers, National Research and Innovation Agency  
Jalan Gatot Subroto kav.10 South Jakarta, Indonesia  
[romadona.mia@gmail.com](mailto:romadona.mia@gmail.com)

## **Abstract**

Using local resources, food processing experts have focused on functional food research for stunting prevention since 2018. This is intended to aid the government's stunting prevention initiatives, with a focus on nutritional therapies for infants and toddlers. The purpose of this study is to produce an appropriate description and set of recommendations for the distribution management of Institution X's revolutionary functional food items created for stunting prevention. This study employs a qualitative approach with a case study design to explain field data about the management of functional food dissemination developed by Institution X to combat stunting. This study illustrates the necessity of researchers collaborating from the onset with health practitioners specializing in stunting prevention and industry to identify the most effective local resources for functional food stunting. To attain toddler nutritional adequacy, Institution X and the government must distribute regionally appropriate functional food product innovations, particularly those based on animal protein. To maximize strategic measures so that the affordability of intake or use of functional meals to avoid stunting are directly on target, it is necessary to consider many factors, including the actors involved and the informational media.

## **Keywords**

Functional Food, Dissemination, Stunting Prevention, Nutrition Food, and Research Management.

## **1. Introduction**

Diverse nations are attempting to enhance the nutritional state of their populations, which has a substantial impact on the future readiness and quality of their human resources. According to the 2018 Global Nutrition Report (2018), there are three nutritional problems: stunting affects 22.2% of children under the age of five globally (150,8 million), wasting affects 7.5% (50,5 million), and obesity affects 5.6%. (38.3 million). Indonesia is one of the nations with a triple-double of nutritional issues, notably the nutritional status of children under the age of five, which causes stunting (Rokx, et al, 2018). The importance of stunting to Indonesians stems from its connection to government activities. Indonesia is rated second in ASEAN in terms of the prevalence of stunting, with a rate of 31.8%, after Timor-Leste, which has a rate of 48.0%. This is to ensure that future human resources will be of the highest quality (Katadata, 2021).

In Indonesia, stunting in children under the age of five is caused by a deficiency in calories, protein, and micronutrients in pregnant mothers, which leads to anemia in their offspring. Stunting is a result of the community's poor dietary habits, particularly among pregnant women and young children. This is influenced by the diet of the Indonesian people, as evidenced by 2017 Ministry of Agriculture data (Ministry of Agriculture's Food Security Agency, 2018) indicating that grains continue to dominate the Indonesian population's food consumption, while consumption of animal protein, vegetables, and fruits remains low. Even according to Riskesdas data from 2018 (Team Riskesdas, 2018), only 95.5% of the population aged 5 years consumed vegetables and fruits.

### **1.1 Objectives**

As a government research institute, Institution X also supports and assists the government in its efforts to reduce the prevalence of stunting among Indonesian children under the age of five by designing functional diets utilizing local resources. Through INSINAS 2018-2020, Institution X will receive financing from the Ministry of Research,

Technology, and Higher Education for a food security program titled "Development of Functional Foods Based on Local Resources" with an expected output by the end of 2020. (Palupi, 2013).

This study's analytic framework refers to Institution X's research or activities supported by INSINAS financing from the Ministry of Research, Technology, and Higher Education from 2018 to 2020. By participating in the INSINAS initiative, Institution X has defined its flagships for five commodities, namely coffee, tea, mangosteen, mocaf, and bananas, to be investigated and developed as a source of raw materials to be used as a functional food. Regarding the Institution X instance, which focuses on the contribution of science, technology, and innovation to INSINAS operations for stunting prevention, two commodities have the potential to become functional foods. The two commodities that can be claimed for stunting prevention as raw materials for functional food research are mocafe and bananas. According to the analytic framework of the study, certain circumstances regarding the management of Institution X need to be explored, particularly for stunting prevention from functional food, which relates to the two commodities whose potential is acceptable or not.

The question that will be investigated is how Institution X, which is in the business of doing research, manages research using local resources as the raw material for functional food research that is aimed at the prevention of stunting. This research was conducted to determine the processes involved in the administration of the management of the diffusion of functional food innovation items created by Institution X to combat stunting. This research will provide descriptions and ideal suggestions for the management of Institution X's unique products on special functional foods to avoid stunting. These findings are expected to be made available shortly.

## **2. Literature Review**

Stunting is defined as a condition in which children under the age of five fail to thrive due to chronic malnutrition, resulting in children who are shorter than average for their age because malnutrition occurs in the womb and the early stages of life after birth, but is not observed in children younger than two. Stunting is described as a condition in which a kid's length or height is less than their age by more than minus two standard deviations from the WHO child growth standard median. According to the World Health Organization, stunting in toddlers is caused by persistent nutritional difficulties resulting from a range of variables, including socioeconomic situations, maternal nutrition during pregnancy, baby discomfort, and a lack of nutritional intake in infants. Stunted infants will struggle to achieve optimal physical and mental growth in the future.

Stunted children will confront obstacles during their growth and development, making them susceptible to degenerative diseases and limiting their future access to human resources. This has a substantial influence on prospects to improve poverty rates, as less competitive human resources diminish future opportunities. Consequently, numerous nations continue to seek to lower the frequency of stunting in their nations.

Stunting, a chronic protein deficiency disorder, must be treated at conception or in utero. The health and nutritional state of the mother before, during, and after pregnancy influence the fetus's growth and the risk of stunting. Other variables include small stature, narrow spacing between pregnancies, teenage mothers, and insufficient nutrition during pregnancy (Center for Data and Information, Ministry of Health of the Republic of Indonesia, 2018).

Atmarita (2018) emphasizes in her essay on the ideal nutritional intake to prevent stunting that stunting begins before conception when teenagers with poor nutritional status and anemia become moms. This is increased by living in a filthy environment and worsens during pregnancy due to inadequate dietary intake. In his essay, Romadona (2017) says that moms are less able to prepare food from seafood sources due to a lack of culinary and processing abilities, which are the key causes for a lack of seafood consumption, especially fish. The ability of women to supply complementary foods to breast milk is still limited since marine goods, such as fish, cannot be processed into baby-friendly foods.

According to data from 2014, urban and rural pregnant women from socioeconomic quintiles 1 to 5 suffer from energy and protein deficiencies (Riskesdas, 2018). In addition, the state of pregnant women with small heights of 150 centimeters has an effect on malnourished newborns with low birth weights of 2,500 grams and body lengths of less than 48 centimeters. In Indonesia, 4.3% of infants are born with low birth weight and a body length of 48 cm, with differences of 0.8% in Maluku and 7.3% in Papua. In addition, the gathered results indicate that exclusive breastfeeding among 0–6-month-old infants remains low (50%) and is exacerbated by inadequate complementary foods. In addition, only 36.6% of Indonesian children are in the Minimum Acceptable Diet (MAD) category, suggesting that they do not satisfy WHO feeding requirements (quantity, texture, frequency, variety, and quality of food). According to data from breastfeeding in

Indonesia in 2012 and 2017 (Armarita, 2018), the percentage of moms who exclusively nursed their infants (0–6 months) in 2012 was 27.1%, with a non-significant increase to 38.2% in 2017.

In 1984, Japanese scientists invented the phrase "functional food." Functional food is food that, in addition to providing the body's fundamental nutritional needs, has additional functions (health functions) (Tapsell, 2009a, 2009b). Food that has been treated naturally or chemically contains one or more chemicals that, according to scientific investigations, have beneficial physiological properties. In addition, functional foods have no contraindications or adverse consequences for the metabolism of other nutrients when used in the recommended dosage (BPOM).

Functional food product requirements (Tapsell, 2009a, 2009b): 1. Must be a food product derived from natural ingredients; 2. Can and deserves to be consumed as part of the daily diet or menu; 3. Has a specific function when ingested and can play a role in certain body processes, such as: strengthening the body's defense mechanism, preventing certain diseases, assisting in the restoration of the body's condition after certain illnesses, maintaining physical and mental condition, and slowing down; 4. Clear physical and chemical properties; 5. Does not contain any additives or preservatives; The content should not diminish the nutritious value of the food.

### **3. Methods**

#### **3.1 Design, Location, and Time**

This study employs a qualitative approach with a case study design to provide a descriptive account of the data gathered on the ground on the management of the spread of functional foods produced by institution X to combat stunting. Creswell (1997, 2014) says in his book that qualitative research with a case study methodology is a strategy that aims to investigate a "Bounded System" or case (or numerous cases) across time by collecting thorough, in-depth data from multiple context-rich sources. Creswell (1997, 2014) stresses once more that the "Bounded System" is limited by time and space, and that the case being examined is a program, an event, an activity, or an individual. The case study requires various sources of information, known as "multiple sources of information," such as observations, interviews, audio-visual materials, papers, and reports. The "Context of the Case" refers to the placement of the case inside its environment, which may be a physical location or a social, historical, or economic setting.

This research examines the Indonesia Research and Innovation Institute (institution X) as a government research institution using a case study methodology. Based on local resources, the example examines the management of functional food research to avoid stunting. It is intriguing to examine how the dynamics of the management of functional food research link to government difficulties in addressing or reducing the prevalence of stunting from 2018 to 2019. The research for this case study was completed between January and November 2019.

#### **3.2 Material and tools**

As the primary source of information, documents, talks, interviews, and observations served as the focus of data mining in this study. Purposive sampling is the most suggested way of data gathering by Creswell (2014) in the case study. This means that the data collected from each participant can provide an overview of the investigated situation.

#### **3.3 Data collection**

This study included 10 key informants, including seven researchers from institution X who studied functional foods and stunting prevention, a pediatrician who practiced health and stunting prevention, a health practitioner and child who focused on exclusive breastfeeding and stunting, and a representative from the Ministry of Health for the stunting prevention program. In addition to the data artifacts and primary documents about this study topic, additional papers are included to answer the research questions. Discussions with institution X researchers who conducted functional food research with potential outcomes related to stunting prevention, observations from various discussions and research products on functional foods, document data describing research designs for the institution X functional food industry, articles related to stunting information, and policy documents related to stunting all served as sources of information for this study.

#### **3.4 Data analysis**

The collected information is then transformed into a description that can explain the cases investigated in this study. As Creswell (2014) describes, qualitative data analysis with a case study approach is an ethnographic analysis in which a full description of the case and its context is provided. The researcher constructs a series of naturalistic generalizations

from the data analysis, generalizations that people can learn from the case for themselves or apply to the case population. All collected data have been triangulated to answer research questions and meet study objectives.

## **4. Results And Discussion**

### **4.1 Government Policy on Stunting Handling**

Parenting policies and strategies are outlined in Law Number 36 of 2009 concerning Health Article 128, Government Regulation Number 33 of 2012 on breastfeeding, the Strategic Plan of the Ministry of Health 2015-2019, and Decree Number HK.0202/MENKES/52/2015 of the Minister of Health.

Content The mandate of Law No. 36 of 2009 is as follows:

1. Except for medical reasons, every infant has the right to receive exclusive breastfeeding for the first six months after birth.
2. During breastfeeding, the family, government, local government, and society must provide particular times and facilities for the mother.

The mandate of the law is outlined in PP No. 22 of 2012 about breast milk (ASI), which stipulates:

1. Every woman who gives birth is required to breastfeed exclusively. The regulation of exclusive breastfeeding aims to: a) ensure the fulfillment of the baby's right to receive exclusive breastfeeding from birth to 6 months of age by paying attention to its growth and development; b) protect mothers who provide exclusive breastfeeding to their babies; and c) increase the role and support of the family, community, and government for exclusive breastfeeding.
2. Health workers and providers of health services are obligated to initiate early breastfeeding for at least one hour with newborns and their mothers. The early beginning of breastfeeding is accomplished by placing the infant face-down on the mother's chest or belly so that the baby's skin becomes adhered to the mother's skin.

This federal regulation is governed by:

1. Government, provincial government, and district/city government responsibilities;
2. Exclusive breastfeeding;
3. Utilization of infant formula and other baby items;
4. Workplace and general advice location;
5. Community support;
6. Funding; and
7. Counseling and oversight.

The mandate of the law and government regulations has been incorporated into the Ministry of Health's 2015-2019 Strategic Plan. In reality, in the field of compassion, the low rates of early initiation of breastfeeding (Inisiasi Menyusui Dini/IMD) and exclusive breastfeeding are related to the limited number of breastfeeding counselors that are not evenly distributed across all health centers, and there are no data available to describe what percentage of Puskesmas staff, such as breastfeeding counselors, provide IMD and exclusive breastfeeding counseling.

In addition, during the time of introducing supplementary foods (Makanan Pendamping Air Susu Ibu, or MP-ASI) to a 6-month-old infant who is still being breastfed for up to two years, breastfeeding should continue. According to WHO/Unicef guidelines, complementary feeding should include at least 4 or more 7 types of foods comprising carbs, animal and vegetable protein, fiber, and fat, termed the Minimum Dietary Diversity (MDD). In addition, it is noted that the provisions on the frequency of giving a Minimum Meal Frequency (MMF) to infants aged 6–23 months who are breastfed or not and have been given complementary feeding must be given according to the standard frequency, namely, babies aged 6–8 months given 2x/day or infants aged 9–23 months given 3x/day or more (breastfed babies), and babies aged 6–23 months given 4x/day or more (non-breast MDD and MMF must be met for the provision of supplemental foods, but these prerequisites are not met. The pattern of appropriate baby feeding according to WHO/UNICEF infant food criteria is still low, with just 36.6% of children aged 6-23 months with MAD consumption patterns exhibiting acceptable infant feeding.

Strategies related to efforts to improve parenting recommended are:

1. Monitoring post-training breastfeeding counselors mainly at the sub-district and village levels;
2. Implement sanctions against violators of the PP on breastfeeding;
3. Conduct breastfeeding counseling to pregnant women who come to antenatal care/ANC in the first 4 weeks of pregnancy to prepare for breastfeeding;
4. Improve campaigns and communications about breastfeeding;

5. Conduct counseling and training on how to provide and administer complementary foods according to standards (MAD).

Food security at the family level continues to be a global issue and is a crucial factor in preventing stunting. Concerning the issue of food availability in the home, the quality of the food consumed (intake) and the consistency of food availability, which is tied to the public's access to purchase.

According to Law No. 18 of 2012 concerning food, the mandate of food security is also related to the potential for product development from functional food to help prevent stunting, namely the diversification of food consumption aimed at raising public awareness and cultivating diverse food consumption patterns.

It is good based on the government's policy to prevent and eliminate stunting. However, implementing these policies requires the participation and cooperation of all sectors. As a research institution, it is institution X's responsibility to be able to generate research goods using functional foods derived from local resources. Referring to government policies, institution X has a tremendous chance to contribute to science and technology innovation with functional food, which refers to the level or type: of functional food aimed at adolescents, particularly young women as prospective moms. Adolescent females must have a balanced diet to be healthy and prepared to become pregnant in the future. Folic acid, iron to prevent anemia, and calcium to build strong bones and prevent osteoporosis are essential nutrients for teenagers. Functional foods intended for pregnant women need to be provided. Pregnant women have an increased need for calories and more nutrients, especially folic acid, iron, and calcium. These nutrients are needed to help the growth of the fetus in the mother's womb optimally and perfectly, thereby reducing the birth of undeveloped fetuses, dead fetuses, birth defects, and fetuses with chronic diseases.

Functional foods can also be consumed by breastfeeding moms throughout the "golden time" of breastfeeding, which lasts from 0 to 6 months. During this time, moms require a healthy and sufficient diet to produce breast milk optimally and easily.

Functional meals are aimed at infants aged 6 to 23 months, specifically during supplementary eating. At this age, infants require a greater nutrient intake than adults, thus they require meals of excellent nutritional quality and sufficient quantity. Iron, folic acid, zinc, and other micronutrients cannot be met by breast milk at this time; therefore, supplemental food is required. Malnutrition occurs frequently in infants after the administration of complementary foods because the quality, quantity, and frequency of administration do not meet the needs of the infant or do not adhere to WHO and Indonesian Pediatric Society (Ikatan Dokter Anak Indonesia /IDAI) recommendations, namely meeting MAD, MMD, and MMF.

Based on the preceding description, institution X's potential to manufacture research products in the form of functional foods using local resources must be continuously developed. The need to promote and advance functional food research must also consider the intended type or level since this will affect the potential for developing local resources.

#### **4.2 Multisector Stunting Prevention**

Every country in the world focuses on stunting as a global issue that must be eliminated as much as possible. Indonesia is committed to preventing and eliminating childhood stunting. In the meantime, the ministries of health and finance have analyzed stunting prevention programs, which are known to be multisectoral and interconnected.

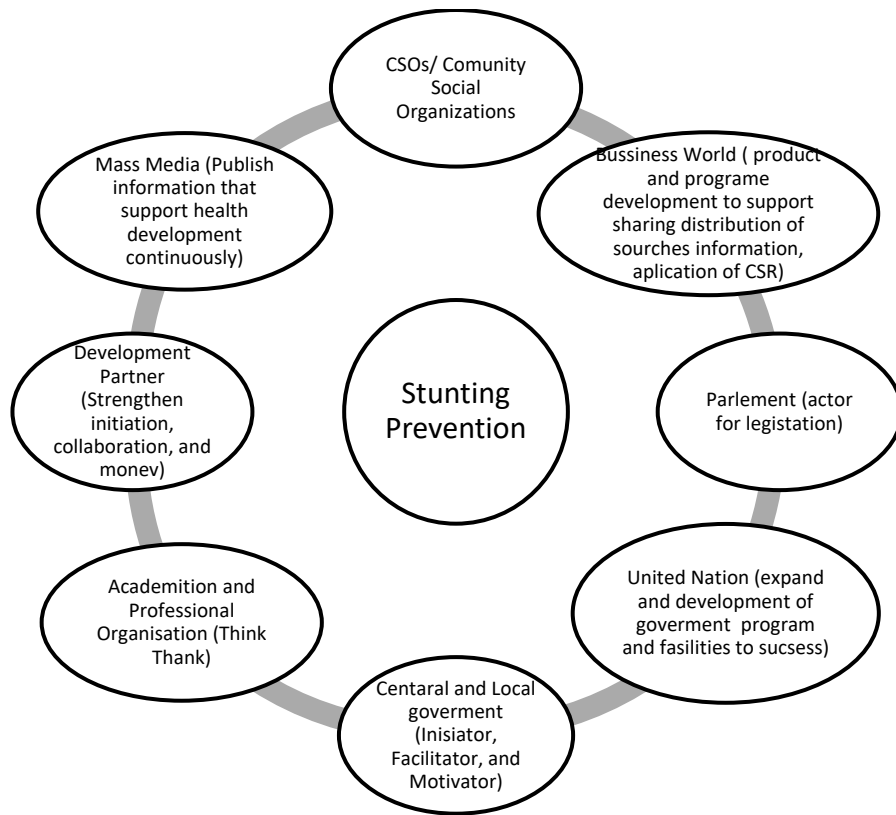


Figure 1. strategic of multisector stunting prevention in Indonesia (TNP2K, 2018)

Prevention of stunting is an activity and program that must involve multiple actors or components. Indonesia has proposed a multi-sector stunting prevention program involving actors, as shown in Figure 1. This refers to the lessons that Indonesia, via the Ministry of Health and the Ministry of Finance, has learned from numerous nations that have successfully reduced the prevalence of stunting.

According to the findings of expert interviews (pediatricians and mother-child health practitioners), the importance of preventing stunting through sufficient nutritional value is as follows:

*"...Exclusive breastfeeding is critical, especially during the first six months of life... providing the first complementary food to infants aged six months with adequate nutritional content from family cuisine sourced from animal protein, at least eggs, fish, meat, and chicken... There are many illusions regarding complementary foods, thus at first, newborns are only given carbohydrates and vegetables, depriving them of nutritious value for growth and development"* (mother and child health practitioner)

*"...The most important thing is to focus on knowledge and education for parents, particularly mothers, to provide adequate nutritional value complementary foods, such as giving animal protein, particularly red meat, chicken liver, eggs, fish, and chicken meat, because this group of animal proteins is easy to use. It is absorbed by the baby's body and contains a lot of micronutrients required to prevent malnutrition... not milk, especially after complementary foods...focus on solids with good management as advised by the government, specifically observe the portion of "fill my plate"(ISI piringku)..."* (Doctor of Pediatrics)

According to the results of the interviews, efforts to prevent stunting in infants can be better explained by exclusively breastfeeding during the first six months of life and providing supplemental foods with competent management and enough nutritional value after six months. The two practitioners continue to encounter numerous parents of infants who do not provide adequate therapy and complementary foods, such as rice porridge and vegetable soup as additional foods. Consequently, a significant number of youngsters continue to fall short of the nutritional adequacy value suggested by the growth chart, especially in terms of weight, height, and head circumference.

Pediatricians also reviewed much international research undertaken to combat stunting, citing Kampman et al. (2017) and Iannotti et al. (2017). Several countries have been successful in reducing the prevalence of stunting through various prevention strategies, including Senegal in 2017 where the percentage was reduced from 33 to 19 percent, Thailand in 2017 where it was reduced from 50 to 20 percent, and Peru in 2016 where it was reduced from 28 to 13 percent. Some of these nations have been successful in reducing the prevalence of stunting thanks to their governments' multisector efforts. Senegal was able to minimize the prevalence of stunting after 20 years due to its dedication to a multisectoral, results-based strategy and an excellent data monitoring system (Kampman, et al.2017). Thailand employs an "army" of well-trained, devoted community volunteers to visit houses and offer interpersonal counseling, agricultural investments, and local commitment (IFPRI, 2017, 2018).

Peru's achievement in reducing the prevalence of stunting is attributed in part to a massive multisectoral nutrition initiative (Kampman, et al, 2017). Reflecting on Peru's policy to avoid stunting with an extensive program of animal protein consumption at the home level and a minimum of eggs in supplemental foods, the country has been successful in preventing malnutrition in newborns and toddlers (Iannotti, et al. 2017). In their investigation, 80 toddlers aged 6 to 9 months were given one egg each day for six months as part of a randomized, controlled clinical trial. The experimental outcomes reduced the prevalence of stunting by 47% and underweight by 74%.

This achievement requires multisectoral coordination so that the Peru stunting prevention program may be conducted effectively (Kampman, et al. 2017; Iannotti, et al. 2017). Intriguingly, Peru's success is due to the involvement of political parties and supreme leaders, the social participation of the council, coordinated multi-sectoral programs, performance-based budgeting, and the alignment of incentives for households, health institutions, and local governments. Persuading policymakers, public officials, and parents of the significance of early childhood interventions to motivate them to combat malnutrition and make chronic malnutrition an issue is another crucial aspect of Peru's success. Peru's national communication effort against stunting was a success. In addition, a trustworthy data information system, clear and attainable goals, and a monitoring and evaluation system are necessary for the success of Peru's nutrition program. Community-Based Growth Promotion Programs (CBGP) play an important role in Peru, just as they do in Senegal, Thailand, and other countries. In promoting a child's growth through regular growth monitoring and advice for parents on proper nutrition practices. General assessments of healthy growth features (weight and length).

The Indonesian government, specifically the Ministry of Health and the Ministry of Finance in 2017, accelerated the role of stunting after learning about Peru's successful stunting prevalence reduction approach. Peru's political commitment to

good policies and strong administration to improve health and social services for millions of children is an essential factor that might be replicated. The Indonesian government is committed to improving health services, altering behaviors that contribute to the prevention, and decreasing the prevalence of stunting (Marini, et al. 2017).

Also required is Institution X, a government research organization that serves as a think tank for stunting prevention. The function of institution X to perform impactful research and development in science, technology, and innovation determines its participation in stunting prevention initiatives. As institution X has undertaken INSINAS research on functional foods utilizing local resources, it has the potential to contribute to stunting prevention initiatives. Based on the commodities derived from mocaf and bananas, the principal commodities of institution X in the INSINAS program are mocaf and bananas.

As one of the players having a role in stunting prevention in terms of the advancement of science, technology, and innovation, Institution X must collaborate with other sectors and cannot function independently. The necessity for institution X to be more attentive and proactive in its response to the stunting phenomena and the community's requirements, notably the market for functional food products that will be generated in the future.

In addition, the efforts of institution X to produce functional foods based on local resources for stunting prevention must comply with WHO/IDAI/the Ministry of Health/UNICEF criteria. According to WHO/guidelines Unicef's for supplementary feeding, each 6-to-23-month-old infant should ingest at least four food groups (out of seven food groups) at least three times per day (minimum acceptable diet). Nevertheless, according to 2014 SKMI statistics, children in Indonesia older than 6 months are likely to ingest 95% of the cereal (carbohydrate) group, specifically rice, and very little of the protein group (animal and vegetable), vegetables, and fruit.

Table 1. Food Intake for Infants and Children 0-5 Months in 2

Age	Group Food	%	Age	Group Food	%	Age	Group Food	%
0-6 Months	Cereals	23,5	7-11 Months	Cereals	95,8	1-3 Years	Cereals	98,5
	Tubers	0,3		Tubers	0,6		Tubers	0,5
	Nuts	1,4		Nuts	0,9		Nuts	0,1
	Fruits and preparations	1,8		Fruits and preparations	0,6		Meats and preparations	0,1
	Milk and preparations (Breast=70%)	73,0		Milk and preparations (Breast=70%)	0,1		Milk and preparations (Breast=70%)	0,9
				Eggs and preparations	1,9			
	Total	100,0		Total	100,0		Total	100,0

According to Table 1, it is unsurprising that the stunting prevalence rate among Indonesian children is still fairly high, as the rate in 2020 was 24.4%. (National Institute of Health Research and Development, 2014). This occurs because the child has failed to grow from a 2-month-old infant due to the expectant mother who is pregnant, namely the adolescent girl who has problems that persist when the mother is pregnant and has problems as well.

Due to their poor nutritional status, babies and children are sensitive to infection and hence frequently fall ill. Four out of ten Indonesian children under age five are stunted, according to Riskesdas' 2013 research. One of the causes of stunting, according to UNICEF/Lancet, is the influence of parenting, coverage, and quality of health, environmental, and food security services, particularly at the family level. As a means of promoting the growth and development of newborns and children, the parenting pattern involves early initiation of breastfeeding (IMD), exclusive breastfeeding for up to 6 months, and breastfeeding followed by complementary nutrition for up to 2 years.

### 4.3 Institution X Management on Functional Food Research for Stunting Prevention

The direction and pattern of information standards from the Ministry of Health, WHO, IDAI, and UNICEF should be considered when evaluating the feasibility of developing functional foods from locally sourced ingredients. When toddlers are lacking in iron and micronutrients found in a variety of food sources, stunting occurs. Iron and micronutrient deficiencies can be mitigated by supplying food derived from animal protein. The human body absorbs animal protein



derived from farm animals, poultry, and the sea most readily, particularly in newborns. In addition, the nutritional content of dietary resources obtained from animal protein has a level of resistance that is quite consistent, so not too much will be lost during processing. This differs from plant-based food sources, which are typically severely harmed or diminished by the heating process or food preparation.

The following functional food sources have yet to be created and are the subject of research at institution X:

Table 2. Local Ingredients for Functional Food Sources developed by the institution.

<b>Types of Local Resources</b>						
<b>Tubers</b>	<b>Fruits</b>	<b>Nuts</b>	<b>Seafood</b>	<b>Livestock</b>	<b>Vegetables</b>	<b>Others</b>
Ubi taka	Dragon Fruit	Nuts	Abalon	Milk	Moringa leaves	Coffee
Cassava	Pomegranete		Snakehead Fish		Katuk Leaves	Lactic Acid Bacteria (BAL/Bakteri Asam Laktat)
Suweg	cocoa		Eel		Tea	
Stevia	Mangosteen		Catfish			
	Banana		Sea Cucumber			
<b>Top Priority as an Institution X Commodity</b>						
<b>Tubers</b>	<b>Fruits</b>	<b>Nuts</b>	<b>Seafood</b>	<b>Livestock</b>	<b>Vegetables</b>	<b>Others</b>
Mocaf	Banana			Tea		
	Mangosteen					
	Cocoa					

In 2018, institution X determined that five key commodities would serve as flagships for INSINAS research, to serve as fundamental materials for functional food research (Table 2).

Functional food research items with the potential to prevent Stunting developed by the institution X INSINAS. Institution X researched biofortified rice, cassava, and other staple foods.

Table 3. Commodities and Products of Research Functional Food Institution X for Stuntin

<b>Commodity</b>	<b>Research Types</b>	<b>Brands</b>	<b>Level</b>	<b>Status</b>
Corn	Non-wheat noodles	Aitamie	<ul style="list-style-type: none"> <li>• Teenager</li> <li>• Pregnant Mother</li> <li>• Nursing Mothers</li> <li>• Babies 12-23 Months</li> </ul>	small-scale prototype
Banana	Banan Bar	Probarz/Banan Bar	<ul style="list-style-type: none"> <li>• school age children &gt; 6 years</li> <li>• teenager</li> <li>• pregnant Mother</li> <li>• Nursing Mothers</li> </ul>	small-scale prototype
Banana	Complementary foods	Biscuits	Babies 12-23 Months	small-scale prototype
Banana	Banana Flake	Banana Flake	<ul style="list-style-type: none"> <li>• school age children &gt; 6 years</li> <li>• teenager</li> <li>• pregnant Mothers</li> <li>• Nursing Mothers</li> </ul>	small-scale prototype
Sorghum	Complementary foods Flakes	Complementary base on Sorghum	<ul style="list-style-type: none"> <li>• Babies 12-23 Months</li> <li>• Toddler 2-5 years</li> </ul>	small-scale prototype
Pumpkins	Complementary foods	Puding Probabies	<ul style="list-style-type: none"> <li>• Babies 6-23 Months</li> <li>• Toddlers 2sd 5 years</li> </ul>	small-scale prototype

Contains Mocaf	Complementary foods	Complementary foods natural folic acid (porridge, soup, cookies)	Babies 7-11 Months	small-scale prototype
Mocaf	Complementary foods	Porridge	Babies 6-23 Months	small-scale prototype

According to the supplied evidence (Table 3), X's functional food items are predominantly derived from local plant-based resources. Researchers at institution X focus on the biofortification of functional food research products intended to prevent stunting. Due to a lack of suitability for the intended market share and interaction with the industry, the findings of the functional food innovation research have all halted at the prototype stage and will not continue. This inhibits the functional food innovation research product from advancing to the subsequent development stage. These results are intriguing since they do not align with the program advocated by WHO, UNICEF, IDAI, and the Ministry of Health to maximize the availability of animal protein-based foods for the prevention of stunting.

Institution X has a program of research activities aimed at preventing stunting with functional food derived from mocaf and bananas, which have the potential to be developed. Several items can be characterized as functional foods that aim to prevent stunting based on the outcomes of the development and progress of research derived from the study that has been and is being conducted on these two commodities. Mocaf and bananas were developed by Institution X's "Development of Local Resource-Based Functional Foods" initiative, which is planned to be completed by the end of 2020. Of the five types of functional foods targeted, three can help prevent stunting in Indonesia. The three functional food kinds are:

1. Food products for pregnant and lactating women: functional foods help calcium absorption and increase breast milk products such as biscuits/cookies/bread/flat noodles/instant pudding;
2. Food products for toddlers: functional snacks based on local ingredients to help reduce stunting rates in Indonesian toddlers;
3. Food products for teenagers: functional food for anemia prevention and immune enhancement based on local ingredients.

#### **4.4 The Dynamics of Management of Functional Food Research by Institution X to Help Prevent Stunting**

The problem of stunting begins during the gestational stage, while the mother is pregnant. As a result, adolescents and pregnant women are folic acids, iron, and calcium deficient. Teenagers are advised to prevent anemia and maintain a healthy nutritional state so that, by the time they reach the age of marriage, they are mature and physically well enough to become prospective mothers. Folic acid is essential for the development of the fetus in pregnant women; deficits result in birth abnormalities. In addition, pregnant women need additional iron because physiological anemia causes iron shortage during pregnancy. Due to the increased need for calcium and iron during pregnancy, pregnant women require an additional 300 calories per serving. Therefore, pregnant women must consume nutritious, well-balanced diets to produce healthy children.

Infants who are fed or given liquids other than breast milk during exclusive breastfeeding will feel full, limiting their consumption and absorption of optimal and maximum nutrients and putting them at risk for malnutrition. To produce sufficient breast milk for her child, the woman must consume a nutritious and balanced diet. This is done so that the mother can breastfeed her child exclusively from 0 to 6 months, and subsequently from 7 to 23 months. Due to insufficient nutrition, infants and children are more prone to infection, resulting in recurrent illness and limited growth and development. The 2013 research findings of Riskesdas reveal that children who fail to flourish from birth tend to grow shorter by 18 months, and it was discovered that four out of ten children under the age of five in Indonesia are stunted.

According to UNICEF/Lancet, the problem of stunting is caused by the influence of parenting styles, coverage, and quality of health, environmental, and food security services at the household level. The parenting pattern involves early initiation of breastfeeding (IMD), exclusive breastfeeding for up to 6 months, and breastfeeding followed by complementary eating for up to 2 years to promote newborn and child growth and development.

As an active research institution, institution X is required to aid in the prevention of stunting through the advancement of science, technology, and innovation. The focus of Institution X on stunting prevention should be expanded to cover

not only the development of these commodities but also the social realm. This pertains to interventions in cases of stunting, including sensitive and particular nutrition interventions that need changes in parenting habits to offer healthy meals for their families.

Beyond mofaf and bananas, the development of functional foods for stunting prevention must be expanded. IDAI refers to the WHO's guidelines for feeding infants and toddlers a range of foods to meet their nutritional needs, namely: meat, poultry, fish, and eggs should be consumed daily, or as frequently as possible. Vegetarian diets cannot provide nutritional needs at this age without nutritional supplements or fortified foods. This is based on the problem of stunting resulting from a chronic protein-energy deficiency in children with 1000 HPK. Consequently, institution X must place a greater emphasis on functional foods for teenagers, pregnant women, breastfeeding mothers, and infants aged 6–23 months that are adapted to food sources with high nutritional content, such as carbs, proteins, and fats. In addition, it must examine the adequacy of the volume, variation, and schedule or frequency of giving nutritious meals, particularly to infants receiving complementary foods. Stunting is a persistent protein-energy deficiency that requires additional protein and micronutrients. To prevent Institution X's functional food, it is required to design functional food based on animal protein (livestock, poultry, and marine items) that is rich in nutrients and easily absorbed by the body.

## **5. Conclusions**

Based on the findings of this study, it is possible to conclude that cultural changes in the behavior of pregnant women, infants, and toddlers (focused on the first 1000 days of life/HPK), particularly the consumption of animal protein, should be the primary focus for preventing stunting. Various research sources about the treatment of malnutrition, particularly stunting, include the consumption of food with a balanced nutritional value, particularly in animal protein, as Peru has succeeded in reducing the prevalence of stunting with a program requiring the daily consumption of at least one egg during the first 1000 days of life/HPK. The stunting management program can more precisely refer to prior research sources, allowing for faster implementation of initiatives to reduce the prevalence of stunting. Moreover, numerous government entities play significant roles in the multisectoral reduction of stunting. Through functional food research, Institution X, an Indonesian research institution, also helps to the government's attempts to minimize the prevalence of stunting.

According to the conclusions of this study, institution X should place a greater emphasis on functional and complementary diets for adolescents, pregnant and breastfeeding mothers, and toddlers. The research on functional foods conducted by Institution X to prevent stunting should pay close attention to the functional food classification. It must be modified so that the texture, variety, flavor, and amount conform to the nutritional adequacy rate value. The emphasis should be switched from generating functional foods from local resources to including or utilizing those generated from animal protein. The sources of animal protein are livestock, poultry, fish, and seafood. This is because animal protein includes nutrients that are more readily absorbed by the body than those found in plant-based foods. Children, especially newborns and toddlers, have a higher protein requirement than adults.

The focus of the study on functional foods is on teenagers and pregnant women, particularly food sources that can prevent anemia, such as iron and folic acid, zinc, calcium, etc. There is a substantial possibility for research on the nutritional value of marine items, including fish and others, which can be employed as a food source to prevent stunting.

Institution X must work with industry from the outset to profit from its research products and mass-produce them for stunting prevention efforts. Institution X is required to engage with various associations, professions, or health advocacy groups concentrating on stunting prevention. Additionally, Institution X must actively educate the public on stunting facts to market its research products. There is a need for institution X to actively participate in stunting prevention efforts through various media to introduce research products that are easily accessible to the public via social media. The necessity for institution X to aggressively engage with other governments, such as the Ministry of Health with Puskesmas and Posyandu, to aid in the prevention of stunting through research products. This research is constrained by the limited time available for data collection. Researchers have a hurdle due to the lack of integrated information data regarding research and research progress.

## **Acknowledgments**

The authors would like to thank the Center for Science and Technology Policy and Management Research, LIPI, and the Ministry of Research and Technology for their support in carrying out this research now under the name of the

National Research and Innovation Agency (BRIN). In addition, this research is one of the results of the second wave of 2019 INSINAS program research outputs.

## **Funding**

This study was funded by the INSINAS Program from the Ministry of Research, Technology, and Higher Education of the Republic of Indonesia Scheme Grant in 2019.

## **Declarations Conflict of Interest**

All authors have no conflict of interest in the research.

## **References**

- Armarita. Optimal Nutrition Intake to Prevent Stunting. Health Data and Information Window Bulletin, Semester 1. [Asupan Gizi yang Optimal untuk Mencegah Stunting. Buletin Jendela Data dan Informasi Kesehatan, Semester 1]. Accessed 30 Desember 2019, 2018. Available at: <https://pusdatin.kemkes.go.id/download.php?file=download/pusdatin/buletin/Buletin-Stunting-2018.pdf>
- BPOM RI. Regulation of the Head of the Drug and Food Control Agency of the Republic of Indonesia Number HK.03.1.23.11.11.09909 of 2011 concerning Supervision of Claims on Processed Food Labels and Advertisements [Peraturan Kepala Badan Pengawas Obat dan Makanan Republik Indonesia Nomor HK.03.1.23.11.11.09909 Tahun 2011 tentang Pengawasan Klaim dalam Label dan Iklan Pangan Olahan]. Available at: [https://members.wto.org/crnattachments/2012/tbt/IDN/12\\_1795\\_00\\_x.pdf](https://members.wto.org/crnattachments/2012/tbt/IDN/12_1795_00_x.pdf)
- Center for Data and Information the Republic of Indonesia's Ministry of Health [Pusat Data dan Informasi Kementerian Kesehatan RI]. The situation of Short Toddlers (Stunting) in Indonesia: Center for Data and Information, Ministry of Health, Republic of Indonesia. [Situasi Balita Pendek (Stunting) di Indonesia: Pusat Data dan Informasi, Kementerian Kesehatan RI]. Buletin Jendela Data dan Informasi Kesehatan. 1. 1-13. 2018.
- Creswell, J. W. Qualitative Inquiry and Research Design Choosing Among Five Traditions. SAGE Publications, Inc: California. 1997.
- Creswell, J. W. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches-4<sup>th</sup> ed. SAGE Publications, Inc.: USA. 2014.
- Decree of the Minister of Health Number HK.0202/MENKES/52/ 2015. Regarding the Strategic Plan of the Ministry of Health for 2015-2019 [Tentang Rencana Strategis Kementerian Kesehatan Tahun 2015-2019].
- Government Regulation Number 33 of 2012 concerning Breastfeeding, Strategic Plan of the Ministry of Health 2015-2019, Available at: <https://pergizi.org/images/stories/downloads/PP/pp%2033%202012%20ttg%20pemberian%20asi%20eksklusif.pdf>
- Global Nutrition Report 2018, Available at: <https://globalnutritionreport.org/reports/global-nutrition-report-2018/>
- Iannotti, L. L., Lutter, C. K., Waters, W. F., Gallegos Riofrío, C. A., Malo, C., Reinhart, G., Palacios, A., Karp, C., Chapnick, M., Cox, K., Aguirre, S., Narvaez, L., López, F., Sidhu, R., Kell, P., Jiang, X., Fujiwara, H., Ory, D. S., Young, R., & Stewart, C. P.. Eggs early in complementary feeding increase choline pathway biomarkers and DHA: a randomized controlled trial in Ecuador. *The American journal of clinical nutrition*, 106(6), 1482–1489. 2017. <https://doi.org/10.3945/ajcn.117.160515>
- International Food Policy Research Institute (IFPRI). 2018. 2017 Annual report. Washington, DC: International Food Policy Research Institute (IFPRI). 2017. Available at: <https://doi.org/10.2499/9780896293465>
- International Food Policy Research Institute (IFPRI). 2017 Global food policy report: Synopsis. Washington, DC: International Food Policy Research Institute (IFPRI). 2017. Available at: <https://doi.org/10.2499/9780896292550>
- Kampman, H., Zongrone, A., Rawat, R., & Becquey, E. How Senegal created an enabling environment for nutrition: A story of change. *Global Food Security*. 13. 57-65. 2017. <https://doi.org/10.1016/j.gfs.2017.02.005>
- Katadata. Indonesia has the second highest rate of under-five stunting in Southeast Asia.[ Prevalensi Stunting balita Indonesia Tertinggi ke-2 di Asia Tenggara]. Accessed 31 Desember 2021. 2021. Available at: <https://databoks.katadata.co.id/datapublish/2021/11/25/prevalensi-stunting-balita-indonesia-tertinggi-ke-2-di-asia-tenggara>
- Marini, A., Rokx, C., and Gallagher, P. Standing Tall: Peru's Success in Overcoming its Stunting Crisis. World Bank, Washington, DC. © World Bank. 2017. Available at: <https://openknowledge.worldbank.org/handle/10986/28321> License: CC BY 3.0 IGO.” <http://hdl.handle.net/10986/28321>

Ministry of Health Republic of Indonesia 2018. Available at:

[http://www.tnp2k.go.id/filemanager/files/Rakornis%202018/Sesi%201\\_01\\_RakorStuntingTNP2K\\_Stranas\\_22Nov2018.pdf](http://www.tnp2k.go.id/filemanager/files/Rakornis%202018/Sesi%201_01_RakorStuntingTNP2K_Stranas_22Nov2018.pdf)

Ministry of Agriculture's Food Security Agency [Badan Ketahanan Pangan Kementerian Pertanian]. Directory of Food Consumption Development 2018. [Direktori Perkembangan Konsumsi Pangan 2018]. 2019. Available at: <http://bkp.pertanian.go.id/storage/app/uploads/public/5bf/ca9/06b/5bfca906bc654274163456.pdf>

National Institute of Health Research and Development [Badan Penelitian dan Pengembangan Kesehatan]. Total Diet Study: 2014 Indonesian Individual Food Consumption Survey. [Studi Diet Total: Survei Konsumsi Makanan Individu Indonesia 2014]. 2014. Available at: <https://linisehat.com/download-survei-diet-total-survei-konsumsi-makanan-individu-2014/>

Palupi, N. S. Functional Food in Food Consumption Patterns for a Healthy, Active and Productive Life. Presented at the "Appreciation Activity for the Development of Food Consumption Patterns, Bogor, 21-23 March 2013. [Pangan Fungsional dalam Pola Konsumsi Pangan untuk Hidup Sehat, Aktif dan Produktif. Disampaikan pada "Kegiatan Apresiasi Pengembangan Pola Konsumsi Pangan, Bogor, 21-23 Maret 2013]. 2013.

Rokx, C. Subandoro, A., & Gallagher, P. Aiming High: Indonesia's Ambition to Reduce Stunting. World Bank, Washington, DC. © World Bank. <https://openknowledge.worldbank.org/handle/10986/30151> License: CC BY 3.0 IGO. 2018. ” <http://hdl.handle.net/10986/30151>

Romadona, M.R. Fish consumption and its barriers in Indonesian society. [Konsumsi ikan dan hambatannya di masyarakat Indonesia]. Prosiding Seminar Nasional Riset Sosial Ekonomi KKP 2017. 473-482. 2017. Available at: [http://bbpse.litbang.kkp.go.id/perpustakaan/index.php?p=show\\_detail&id=369&keywords=](http://bbpse.litbang.kkp.go.id/perpustakaan/index.php?p=show_detail&id=369&keywords=)

Tapsell, L.C. Nutrients, foods and diets: challenging functional food development. *Australian Journal of Dairy Technology*. 64 (1), 5-7, 2009a.

Tapsell, L.C. Functional food: An Australian perspective. *Nutrition & Dietetics* 2008. 65 (Suppl. 3), S23-S26, 2009b. DOI: 10.1111/j.1747-0080.2008.00256.x

Team Riskesdas. RISKESDAS National Report 2018. [Laporan Nasional RISKESDAS 2018]. Kementerian Kesehatan Republik Indonesia, Badan Penelitian dan Pembangunan Kesehatan [Ministry of Health of the Republic of Indonesia, Health Research and Development Agency], 2018.

The mandate of Law number 36 of 2009 Regarding Health [Undang-undang Republik Indonesia Nomor 36 Tahun 2009 Tentang Kesehatan]. Available at: <https://peraturan.bpk.go.id/Home/Details/38778/uu-no-36-tahun-2009>

## **Biographies**

**Mia Rahma Romadona** is a young researcher in the Research Center for Industrial, Services, and Trade Economics of the National Research and Innovation Agency (BRIN) of the Republic of Indonesia. She is a researcher in the field of technological innovation management and is interested in parts of social science and behavioral science due to her background as a master in industrial and organizational psychology. She has a record of study and publications pertinent to her area of expertise.

**Rendi Febrianda** is a researcher at the Research Center for Industrial, Service, and Trade Economics of the National Research and Innovation Agency (BRIN) of the Republic of Indonesia. He earned a degree from Mie Japan University in food processing technology. The technology and innovation management research and publication group are active.

**Anggini Dinaseviani** is a researcher at the National Research and Innovation Agency of the Republic of Indonesia (BRIN). Education at the Indonesian Marketing Management University. She is a young scholar who actively writes in the subject of management policy and technology innovation.

**Andi Budiansyah** is a researcher at the National Research and Innovation Agency of the Republic of Indonesia (BRIN). He is a researcher in industrial technology with a Bachelor of Education. Actively publish as a young researcher interested in technology management and innovation.