



Imut integration program: increasing household dietary diversity to reduce stunting in mandailing natal regency

Zuraidah Nasution¹, Zulhaidah Lubis², Ida Nurhayati³, Evi Irianti^{4*}, Etti Sudaryati⁵, Erna Mutiara⁶, Mahdiah⁷, Tety Herta Dolok Saribu⁸, Ratna Zahara⁹, Aditianti¹⁰, Iram Barida¹¹

^{1,3,4,7,8,9} Health Polytechnic, Indonesian Ministry of Health, Medan, Indonesia; ^{2,5} Department of Public Health Nutrition, Faculty of Public Health, Universitas Sumatera Utara, Medan, Indonesia; ⁶ Department of Population and Biostatistics, Faculty of Public Health, Universitas Sumatera Utara, Medan, Indonesia; ^{10,11} National Institute of Health Research and Development, Jakarta, Indonesia

Corresponding author: iriantievi2@gmail.com*

Abstract:

Purpose: Increasing dietary diversity by ensuring household dietary availability is required, especially for children's health. We investigated the impact of IMUT integration program in household's dietary diversity conducted at two stunting locus of North Sumatera Province, Indonesia.

Patients and methods: IMUT integration program was conducted in Huta Godang and Tolang, villages at Ulu Pungkut District, Mandailing Natal Regency in 2022. This quasi experimental study consisted of intervention and control group, each consisted of 4 *dasawisma* and a total of 80 toddlers were recruited through purposive sampling. Assessment of dietary diversity was conducted using an open questionnaire in SSGI 2021.

Results: Substantial increase in diversified food intake was found following the implementation of IMUT program ($p = 0.003$). Prior to the implementation of IMUT, 28% of households participating in this study were not educated in providing diversified dietary intake, the proportion greatly reduced to just 9% after the program.

Conclusion: IMUT integration program successfully increases household dietary diversity and serves as impactful educational platform for families. We suggest that this program may even be reproduced in other regions, especially those with similar stunting burden.

Keywords: *IMUT integration programs, stunting, dietary diversity, dietary vulnerability*

Abbreviation:

IMUT stands for Ikan, Maggot, Udang, Tanaman (*Fish, Maggot, Poultry, and Plants*). It is a community-based program utilizing households yards to cultivate fish, maggot, poultry and plants, ensuring the security household dietary diversity, improving maternal and children nutritional status, increasing family's economics, and creating green environment.

Dasawisma (*dasa* means 10) is community unit consisting of 10 households.

SSGI is Indonesia's national nutritional status survey

Introduction

Regions with stunted children between 30 – 40% is classified as poor by the World Health Organization (WHO), therefore efforts to control the occurrence of stunting has to be a priority in these food-vulnerable districts.[1] According to SSGI 2021 statistics the prevalence of stunting in Mandailing Natal Regency is around 47.7%, which exceeds the WHO

categorization.[2] Following the Ministry of Agriculture data, the Food Security Index for Mandailing Natal Regency has declined from 68.37 in 2019 to 67.7 in 2020, despite this region is still being classified as moderately resistant. Nonetheless, the food security index of this region is still lower than that in the province of North Sumatera (72.25).[3] Increasing dietary diversity is necessary to meet the nutritional demands and dietary variations that are considerably important to support children's growth. Integrated agricultural empowerment, consisting of the management of agricultural and domestic waste to increase land and livestock productivity and reduce waste from agricultural sources as well as households, is one of the efforts taken to enhance household dietary diversity through the availability of sufficient food.[4] This initiative was once put up for trial in Central Cibirung Village, Bogor Regency, West Java and yielded satisfying result; increased vegetable cultivation and communal sheep farming. Using the Black Soldier Fly (BSF) larvae to manage organic waste from farms and renovated kitchens [4], compost fertilizer from the decomposition of the organic waste and maggots can be utilized for the cultivation of sawi (caisim), one of the most common commodities in the region. These compost fertilizer helps to preserve and boost the crop yields in the region.[5] BSF larvae (maggots) is also an alternative feed for livestock, and is cost-effective, particularly during economic recession due to Covid-19 pandemic, where livestock feeds prices were high [6], thus BSF larvae has business potential that should be considered.

Through the National Population and Family Planning Agency (BKKBN), the government has developed a National Action Plan to Reduce Stunting Rates (RAN PASTI) and disseminated it through the chancellor's forum to associated institutions, including universities. Tertiary institutions are encouraged to help and succeed in speeding stunting reduction, one of which is to increase food and nutrition security, [7]. In this instance, universities are encouraged to create program to help community to be independent in providing variety of produces by their own, hence ensuring the dietary availability in the community.

The active role of Poltekkes Kemenkes Medan as a tertiary institution to enhance the reduction of stunting rates in North Sumatra Province is manifested in IMUT program. This integrated IMUT program was implemented in Mandailing Natal, specifically in the villages of Huta Godang and Tolan in 2022. IMUT stands for Ikan, Maggot, Udang, Tanaman (*Fish, Maggot, Fish, Maggot, Fish, Maggot, Fish, Maggot, Fish, Maggot*).

Poultry, and Plants). It is a community-based program utilizing households yards to cultivate fish, maggot, poultry and plants, ensuring the security household dietary diversity, improving maternal and children nutritional status, increasing family's economics, and creating green environment. At the very core, this program disseminates the utilization of BSF larvae (maggots) in cultivation and farming to the community, as it serves as reasonable and cost-effective option. Furthermore, IMUT supports green economies, in which community not only is able to gain dietary source from their very own land, but also is able to market the produce, hence increasing household's income. In this present study we aimed to examine the the impact of IMUT integration program in household's dietary diversity conducted at two stunting locus (Huta Godang and Tolan) of North Sumatera Province, Indonesia.

Material and methods

Study design

Quasi experimental study with separate sample pretest-posttest control group design was used to implement IMUT in the villages of Huta Godang and Tolang. This study comprised of intervention and control groups, each consisting of four *dasawisma*. The intervention group received counseling on stunting, household dietary vulnerability, and was assisted to implement the program, whereas the control group received counseling on stunting only. Assessment of dietary diversity uses an open questionnaire used in SSGI 2021. Using SPSS software, Chi-Square, and Wilcoxon tests were used to analyze the data.

Sampling

Prior to the beginning of the study, we already gained approval from our institutional research ethic committee with statement letter number 001/KEPK/Poltekkes Kemenkes Medan/2022. Informed consent was assigned to each participants. Sampling was conducted using a purposive technique [8]; subjects were stunted toddlers discovered at the village. The inclusion criteria were as follows: the head of the family is a member of *dasawisma* at the stunting locus, *dasawisma* location is close to an organic waste disposal facility, and the family has stunted children. The minimal sample size for this study was 77 toddlers, rounded up to 80. The sample was obtained from the calculation of the sample size for the contingency tables test with the *G_Power*

application, using α 0.05 and power $(1-\beta)$ 90%. Hence, each intervention and control group consisted of 40 stunted toddlers.

Study procedure

Prior to intervention, we determined dasawisma at the village. Dasawisma is small community unit consisting of 10 nearby households. We then assisted the neighborhood to prepare BSF larvae (maggot) cage and livestock medium using dried husk, fruits, and vegetable waste (non-rotted). This medium will then attack flies, after the flies laid their eggs in the hatching medium, the eggs were moved to biopond when they are 6-days old. Maggots were fed daily for 25 days until they formed pupae. Maggots food constituted of cooked vegetables, fried foods, leftover side dishes, rice, coconut pulp, tofu waste, leavy greens, meat scraps, fish offal waste, and cattle manure. Excessive leavy waste, tomatoes, and oranges, are not recommended as maggots do not really like them and these type of foods decay faster and may cause unpleasant odor. The study procedure is shown in Figure 1.

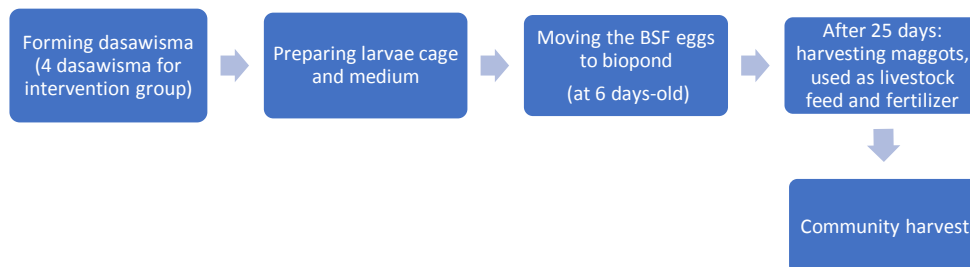


Figure 1: study procedure flowchart. At 25 days-old, maggots can be harvested and used as fish or poultry feed. Maggots can also be added to feed 8 weeks-old catfishes or 18-20 weeks-old hens.

Decayed maggots and chicken manure were also used as organic fertilizer in the cultivation.

Produces that were cultivated were kale, long beans, bananas, papaya, etc. Fishpond waste water was used to water the plantation. As soon as after 4 weeks, the dasawisma might already harvested eggs from hens fed with maggots, catfishes could be collected within 8 weeks, and after 40 days, fruits and vegetables could also be harvested.

Results

Table 1: Frequency of stunting in children under 5 years old in North Sumatra, Huta Godang, and Ulu Pungkut in 2022 (source: SSGI 2021)

Location	Not stunted		Stunted		Total	
	F	%	F	%	F	%
Province of North Sumatra	7750	74.75	3005	25.25	107	100
Village of Huta Godang and Tolang	61	73.49	22	26.51	83	100

Huta Godang and Tolang, known as stunting locus at North Sumatra Province are located in Mandailing Natal Regency. Their stunting proportion alone (26.51%) was even higher than that in the entire province (25.25%). Data from **Table 2** indicated that dietary diversity in North Sumatra province is low, regardless whether or not the children are stunted, hence dietary diversity is statistically shown to be unrelated to stunting ($p = 0.6784$). Nevertheless the fact is only 1.51% of stunted children received diversified dietary intake. This proportion is lower than that in non-stunted children (4.1%).

Table 2: Household dietary diversity in North Sumatra (source: SSGI 2021)

Dietary diversity	Non-stunted		Stunted		Total		Chi Square p value
	F	%	F	%	F	%	
Diversified	427	4.1	158	1.51	585	5.61	0,6784
Undiversified	6919	70.09	2793	24.3	9712	94.39	
Total	7346	74.19	2951	25.81	10297	100	

Considerable difference of dietary diversity was found in the intervention group. It was shown in **Table 3** that there is a considerable reduction of having undiversified diets (from 28% to 9%) following the implementation of IMUT program ($p = 0.003$).

Table 3: Dietary diversity before and after IMUT program

Dietary diversity	Before				After				Wilcoxon p value
	Control		Intervention		Control		Intervention		
	F	%	F	%	F	%	F	%	
Diversified	29	81	34	72	34	94	43	91	0,003
Not Diversified	7	19	13	28	2	6	4	9	
Total	36	100	47	100	36	100	47	100	

Discussion

Stunting was associated with monotonous and undiversified complementary diets. In addition, it was discovered that stunting was more prevalent among children who had snacks or instant noodles ≥ 3 times per week. Vast majority of snacks and instant noodles are made from simple carbohydrates, causing the children that consume these reach fullness easily. Consequently, these children will reject other foods, thus nutritional needs are commonly unmet.[8][9] Carbs, proteins, vitamins, and minerals are essentials for children growth. Not only their sufficiently, the balance of these macro and micro nutrients is even more important. [10] Study from another Province, South Sulawesi, showed that dietary diversity is closely related to the prevalence of stunting. In addition, this study indicated that approximately 44.9% of stunted children will be lacking of energy and fat. According to the study, toddlers with stunted growth were most likely to suffer from a fat deficit.[11] The variety of foods toddlers consume is greatly influenced by the mother's parenting style, particularly her capacity to process food and regulate the toddler's diet. However, this is inextricably linked to family finances, which can lead to food insecurity [12][13]. Food security leads to dietary diversity in the household. In accordance to national law act 18 of 2012, state is required to ensure availability of diverse, nutritious, equitable, and affordable food in a sustainable way to live a healthy, active, and productive life. [14][1] Our program serves as sustainable way to increase food availability as it can be independently continued by the community. We provide not only assistance in creating neighborhood farming, but also education about preparing nutritious and well balanced diets, particularly for children. These efforts are useful not only in changing perception, but also influencing behavior.

Household food security is associated with household's income.[15] As in accordance with the findings from Masthalina (2021), the income of interviewed families in Central Tapanuli Regency was below the national standard, which would affect their purchasing ability. Children from middle- lower income families have a diet with less variation and are more likely to be malnourished. The quantity, quality, and safety of the food in the home must be sufficient to suit the needs of all family members.[16] The family's ability to meet nutritional needs in a balanced

manner is influenced by purchasing, knowledge, and the region's and family's capacity to produce and offer appropriate food.[17] Families who can do so are referred to as having adequate food security.[18] Food supply refers to the quality and quantity of food ingredients that meet the nutritional requirements for persons to carry out daily activities.[19] Households can also be dietary vulnerable, affecting children's growth due to less access to nutritious and good quality food.[20] Dietary vulnerability in families prevents them from serving diversified diets which may result in micronutrient deficiencies in the long term, hence are more susceptible to stunting. Children who received only animal protein, without sufficient fruits and vegetables, will be more likely to develop stunting, as their absorption for animal protein is negatively affected. Protein synthesis requires micronutrients to produce ATP or to form energy reserves.[11, 21-23]

According to 2018 data from Riskesdas, 95.5% of Indonesians consume fewer fruits and vegetables. Based on a 2014 analysis of the entire diet, it was determined that the majority of the Indonesian's dietary consumption consists of carbohydrates. Even while the average daily consumption of carbohydrates is 243 grams per person and the average daily protein consumption is 52 grams per person, there is a shift in consumption habits that favor processed foods [11, 21, 24, 25]. Thus the IMUT integration program can be an alternate method to promote household dietary diversity. In addition, it can help the family's economic situation, as the community has seen since the harvest of vegetables can be marketed to help the family's other essential expenses. The community has benefited from IMUT integration program, which they readily obtain by cooperating and sharing equitably.

Conclusion

IMUT integration program successfully increases household dietary diversity and serves as impactful educational platform for families. We suggest that this program may even be reproduced in other regions, especially those with similar stunting burden.

Conflict of Interest

The authors declare no conflict of interest.

References

1. Pertanian K. Indeks Ketahanan Pangan 2020. Vol. 0, Badan Ketahanan Pangan Kementerian Pertanian. 2020. 0 p.
2. Litbangkes. Buku Saku Hasil Studi Status Gizi Indonesia (SSGI) Tingkat Nasional, Provinsi, dan Kabupaten/Kota Tahun 2021. Kementerian Kesehatan RI. 2021. 16 p.
3. Pangan BK. Indeks Ketahanan Pangan 2020. Vol. 0, Badan Ketahanan Pangan. 2021. 0 p.
4. Rhamadani RA, Noviasy R, Adrianto R. Underweight, Stunting, Wasting Dan Kaitannya Terhadap Asupan Makan, Pengetahuan Ibu, Dan Pemanfaatan Pelayanan Kesehatan. *J Ris Gizi*. 2020;8(2):101–6.
5. Tuhuteru S, - I. Pembuatan Mikroorganismes Lokal Bonggol Pisang pada Kelompok Tani Tunas Harapan Distrik Walelagama, Jayawijaya, Papua. *Agrokreatif J Ilm Pengabdian Kpd Masy*. 2019;5(3):188–94.
6. Ahmad SM, Sulistyowati S. Pemberdayaan Masyarakat Budidaya Maggot Bsf Dalam Mengatasi Kenaikan Harga Pakan Ternak. *J Empower*. 2021;2(2):243.
7. Perpres. Percepatan Penurunan Stunting. Pemerintah Indones. 2021;(1):75.
8. Scott D, Usher R. *Researching Education: Data, methods and theory in educational enquiry (Continuum Research Methods)*. 2nd editio. London: Continuum; 2011.
9. Nurdin SSI, Katili DNO, Ahmad ZF. Faktor ibu, pola asuh anak, dan MPASI terhadap kejadian stunting di kabupaten Gorontalo. *J Ris Kebidanan Indones*. 2019;3(2):74–81.
10. Kragel EA, Merz A, Flood DMN, Haven KE. Risk factors for stunting in children under the age of 5 in rural guatemalan highlands. *Ann Glob Heal*. 2020;86(1):1–5.
11. Basri H, Hadju V, Zulkifli A, Syam A, Ansariadi, Stang, et al. Dietary diversity, dietary patterns and dietary intake are associated with stunted children in Jenepono District, Indonesia. *Gac Sanit [Internet]*. 2021;35:S483–6. Available from: <https://doi.org/10.1016/j.gaceta.2021.10.077>
12. DwiKurnia I, Krisnana I, Tyas Dwi Rahmadhani. Perceived barriers of nutritional feeding related to severe stunting. *Enfermería Clínica [Internet]*. 2021;36(2):533–6. Available from: <https://www.sciencedirect.com/science/article/abs/pii/S1130862120305106>
13. Yuliza A, Lisa E. Peran amal usaha Muhammadiyah dan Aisyiyah dalam menurunkan stunting di Kenagarian Tanjung Bungo. 2022;6(1):75–84.
14. Andrianto D, Husnawati, Muchammad Z, Prastiwi DO, Sabrina GO, Farhan M, et al. Pemberdayaan Pertanian Terpadu Bermodal Limbah Ladang, Dapur dan Kandang Berbasis Koperasi di Desa Cibitung Tengah, Bogor. *Agrokreatif J Ilm Pengabdian Kpd Masy*. 2020;6(3):195–205.
15. Zuraidah Nasution; Zuhaida Lubis; Ida Nurhayati; Etti Sudaryati; Mahdiah; Tety Herta Doloksaribu; Evi Irianti; Ratna Zahara; Aditianti; Iram Barida. STUNTING SERTA POTENSI INTEGRASI IMUT SEBAGAI UNIVERSITAS SUMATERA UTARA / POLTEKKES MEDAN

Tahun 2022. Medan; 2022.

16. Ayu SC, Nindya TS. Hubungan Ketahanan Pangan dan Penyakit Diare dengan Stunting pada Balita 13-48 Bulan di Kelurahan Manyar Sabrangan, Surabaya. 2017;52-61.
17. Lestari W, Rezeki HI, Siregar DM, Manggabarani S, Gizi D, Kesehatan Helvetia I, et al. Factors Related Without Stunting on Children in Elementary School 014610 Sei Renggas West Kisaran Subdistrict Asahan District. *J Dunia Gizi* [Internet]. 2018;1(1):59-64. Available from: <https://ejournal.helvetia.ac.id/jdg>
18. Nailis A, Rachim F, Pratiwi R. Hubungan Konsumsi Ikan Terhadap Kejadian Stunting pada Anak Usia 2-5 Tahun. 2017;6(1):36-45.
19. Larson JB, Castellanos P, Jensen L. Gender, household food security, and dietary diversity in western Honduras. *Glob Food Sec* [Internet]. 2019;20(March 2018):170-9. Available from: <https://doi.org/10.1016/j.gfs.2019.01.005>
20. Prihati DR, Kostania G. Pengaruh Multiple Mikro Nutrien (MMN) Terhadap Berat Badan Bayi Baru Lahir Di Desa Pandes Klaten. *J Kebidanan dan Kesehat Tradis*. 2017;2(2):66-70.
21. Hendrayati, Asbar R. Faktor Determinan Kejadian Stunting. *Media Gizi Pangan*. 2018;25(1):39-50.
22. Zogara AU, Hedi H, Arjuna T. Riwayat pemberian ASI eksklusif dan MPASI dini sebagai prediktor terjadinya stunting pada baduta di Kabupaten Timor Tengah Selatan , Nusa Tenggara Timur. Vol. 2, *Jurnal Gizi dan Dietetik Indonesia*. 2014. p. 41-50.
23. Priyono P. Strategi Percepatan Penurunan Stunting Perdesaan (Studi Kasus Pendampingan Aksi Cegah Stunting di Desa Banyumundu, Kabupaten Pandeglang). *J Good Gov*. 2020;16(2):149-74.
24. Wahdah S, Juffrie M, Huriyati E. Faktor risiko kejadian stunting pada anak umur 6-36 bulan di Wilayah Pedalaman Kecamatan Silat Hulu, Kapuas Hulu, Kalimantan Barat. *J Gizi dan Diet Indones (Indonesian J Nutr Diet*. 2016;3(2):119.
25. Mariana R, Nuryani DD, Christin A. Hubungan sanitasi dasar dengan kejadian stunting di wilayah kerja puskesmas Yosomulyo kecamatan Metro pusat kota Metro tahun 2021. *J Community ...* [Internet]. 2021;1-18. Available from: <http://e-jurnal.ipohrr.com/index.php/chi/article/view/99>