A Case Study on Undernutrition among Children under Five Years of Age in Barangay Calumpang, Nagcarlan, Laguna

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ABSTRACT

Background. In 2020, Barangay Calumpang, a 2nd class municipality in Nagcarlan, Laguna recorded the highest prevalence of undernutrition among children under five years of age out of the 52 barangays.

Objectives. This study was undertaken to describe the factors possibly causing undernutrition among children under five years of age in Barangay Calumpang and provide key recommendations to improve their nutritional status.

Methods. The study used a descriptive research design wherein secondary data from the 2020 Barangay Management Information System (BMIS) and Operation Timbang (OPT) 2021 was merged to extract the children's data. The Statistical Package for the Social Sciences (SPSS) was used for the principal component analysis (PCA) and creation of the wealth index. The children's nutrition situation and profile were also cross-tabulated.

Results. We included 28 children. Undernutrition was more prevalent in boys than girls. Most of the children had improved water sources, sanitation facilities, and waste disposal methods. The wealth index showed that half of the subjects were in the lower quintiles, and all were partially immunized. The most prevalent forms of undernutrition were severe underweight (36%) and severe stunting (39%). Other forms of undernutrition were also present in the barangay, such as underweight (14%) and severe wasting (14%). There was also a prevalence of 11% for both stunting and wasting.

Conclusion. Undernutrition was more frequent in boys, lower quintile households (stunting), and partially immunized children. Conducting gender-targeted nutrition programs, developing nutrition-focused livelihood programs, increasing awareness on the advantages of immunization, and promoting proper infant and child feeding practices were some of the recommendations given to improve the nutritional status of children under five.

Keywords: child undernutrition, rural community, Philippines

eISSN 2094-9278 (Online)
Published: April 28, 2023
https://doi.org/10.47895/amp.vi0.3970

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INTRODUCTION

Good nutrition is a key driver in achieving a satisfactory level of human development. However, malnutrition remains a major cause of mortality and morbidity among children across the world. Malnutrition is a state wherein an individual has impaired physical function, making it difficult to maintain adequate physical performance processes such as growth, pregnancy, lactation, and recovering from a disease.[1] The World Health Organization (WHO) estimates that by 2025, about 127 million children under five years old will be stunted, assuming that current trends continue. Also, according to UNICEF, 95 children in the Philippines

die from malnutrition every day, and 27 out of 1,000 Filipino children do not make it past their fifth birthday.[2,3]

Moreover, one-third of Filipino children are short for age or stunted after two years of age, and stunting can become permanent, irreversible, and even fatal.[3] Food security, mother and childcare, characteristics of the health services and environment, and potential resources were the identified factors that affect the prevalence of malnutrition among children under five years of age in developing countries.[4] With the realization that access to good food and nutrition should be a human right, national governments have emphasized reducing food insecurity and improving nutrition in developing and implementing poverty reduction strategies.

Region IV-A, also known as CALABARZON, is one of 17 regions in the Philippines. The region consists of five provinces: Cavite, Laguna, Batangas, Rizal, and Quezon. As of 2015, CALABARZON has the highest population in the country.[5,6] With its strategic location, huge population size, manufacturing hubs, abundant agricultural produce, top universities, and international research institutions, investors are continuously attracted to the region.[6] However, despite the signs of rapid development in the region, it was still reported that undernutrition was prevalent among children under five.

Laguna, the third-largest province in CALABARZON had a total population of 3,035,081 in 2015.[5] It had the highest percentage of food-secure households among the provinces, but despite this, the province recorded an increasing prevalence of stunting among under-five children from 22.4% (2013) to 27.7% (2015).[7,8] In 2018, stunting was still present but has decreased in prevalence to 24.0%.[9] The prevalence for underweight also increased from 2013 (15.1%)) to 2015 (20.4%), but decreased in 2018 (13.9%). Wasting, on the other hand, decreased prevalence from 12.7% (2013) to 7.7% (2015), to 3.7% (2018).[7-9]

The Municipality of Nagcarlan is a 2nd class municipality in the province of Laguna, which consists of 52 barangays and has a population of 63,057.[6] In the municipality's 2020 Operation Timbang (OPT), the prevalence of underweight, stunting, and wasting among children under five was 5.8%, 12.1%, and 3.1%, respectively.[10] The study will focus on Barangay Calumpang which has the highest prevalence of undernutrition among children under five years old. It is recognized that there is the greatest susceptibility to nutri-tional deficiencies from pregnancy and up until two years of age.[11] These deficiencies could increase child mortality, and those who do survive suffer the permanent effects of having diminished health as adults. In addition, the inadequacy of nutrition increases the risk of death due to common infections, increases the number and severity of the infections, and may lead to delayed recovery.[12] Therefore, optimizing nutrition early in life should be given attention to avoid the many consequences that undernutrition may pose.

This study aims to provide additional information on the socio-economic, environmental, health, and nutrition conditions and identify the possible causes of undernutrition among children under five in Barangay Calumpang.

METHODS

A descriptive research design was used in the study to present and discuss the nutrition situation and frequency of undernutrition among children under five years of age.

Selection of location

The study site was identified based on the consolidated 2020 OPT of the 52 barangays in Nagcarlan Laguna. Barangay Calumpang was selected because it has the highest prevalence of undernutrition.

Selection of Subjects

The subjects of the study were under-five children. The children included in the data analysis have complete data in the Barangay Management Information System (BMIS), OPT, and health records from the Barangay Health Worker (BHW).

Data Collection

Permission to conduct the study and access of secondary data (demographic, economic, environmental, health and nutrition data) were requested and coordinated through the Barangay Integrated Development Approach for Nutrition Improvement (BIDANI), Municipal Nutrition Officer (MNAO), Barangay Secretary, Barangay Nutrition Scholar (BNS) and Barangay Health Worker (BHW) of the Municipal Government of Nagcarlan, Laguna. The study used secondary data from the 2020 BMIS of Calumpang and OPT 2021. The OPT data were merged to the BMIS and then extracted the data of the under-five children. Of the 52 under-five children weighed, only 28 children have complete data. In measuring the weight, children were asked to remove footwear and heavy clothing and stand in the center of the scale. For children unable to stand, a hanging salter scale was used or parents were asked to carry their child and the weight of the parents was subtracted. In measuring the height of the children they were asked to remove footwear, bulky clothing, and head ornaments and they stood with their back against the wall with their head, shoulders, buttocks, and heels touching the flat surface. In children that were unable to stand, length was taken lying down using a measuring board.

Data Analysis

A descriptive analysis was used to present the profile of the under-five children using Microsoft Excel. The subjects' socio-economic situation, health, and nutrition situation were tabulated. The conceptual framework for Maternal and Child Undernutrition by UNICEF was the

basis for analyzing the results.[13] The wealth index describes the socioeconomic condition of the children. The wealth index measures relative wealth and poverty.[14] The parents' socioeconomic status is a crucial determinant of the children's health and nutritional status.[15] For the wealth index, the children's household utilities like electricity, type of water supply, type of toilet facilities, structural material, roofing material, flooring material, fuel used for cooking, and method of waste disposal as well as lot and house ownership were the variables considered. The considered variables were explored further to distinguish variables that would aid in the analysis of relative wealth. The frequency and variables owned by more than 95% or less than 5% of the sample were excluded from the analysis. Next, the remaining variables were recoded, and variables with more than two categories were transformed into bivariate variables. The Statistical Package for the Social Sciences (SPSS) was used for the principal component analysis (PCA) and creation of the wealth index. The process removed some variables due to collinearity, and correlations are too high or too low. Multiple rounds of PCA were done to obtain the best results, and for each round, a (Kaiser-Meyer-Olkin) KMO score was generated. For the wealth index variable, the first extracted component from the PCA was used since it accounted for the largest proportion of the variance. The resulting wealth index variable was categorized into five quintiles, with 1 being the poorest, 2 being somehow poor, 3 being average, 4 being above average, and 5 being the wealthiest. Cross-tabulation of nutrition data versus the participants' socioeconomic situation, the sources of water, toilet facilities, waste disposal, and immunization were done using Microsoft Excel to further examine the results.

RESULTS

Nutrition Situation

Of the 52 under-five children, 28 children (13 girls and 15 boys) had complete data, accounting for 46% and 54%, respectively.

Out of 28 children, 10 (36%) were severely underweight, 4 (14%) were underweight, 1 (4%) was overweight, and 13 (46%) were normal (Table 1). Based on length/height-for-age, half of the children were either severely stunted or stunted (50%). For the weight-for-length/height, 25% of the children were wasted or severely wasted, and 3 (11%) were overweight.

Subject's Profile

Socioeconomic Situation

Wealth index analysis showed that a double burden of malnutrition exists in Barangay Calumpang. Half of the selected families were above average, and 50% belong to the two poorest quintiles (Table 2). The wealth index and WAZ showed that 18% of the severely underweight and underweight children were below the poverty line. In HAZ it shows that stunting was observed among those families who belong to the poor and above-average wealth index. About eight poor children and six children in the above-average wealth index were stunted. On the other hand, it was observed that wasting was higher among children who have an above-average wealth index than the poor families. It was also noted that overweight children were in the first and second quintile classification.

Table 1. Nutrition profile of the twenty-eight (28) participants in Barangay Calumpang (N=28)

Weight-for-age (WAZ)

Gender	Severely underweight		Underweight		Normal		Overweight		Total	
	n	%	n	%	n	%	n	%	n	%
Female	2	7	1	4	10	36	0	0	13	46
Male	8	29	3	11	3	11	1	4	15	54
Total	10	36	4	14	13	46	1	4	28	100

Height-for-age (HAZ)

Gender	Severely stunted		Stunted		Normal		Tall		Total	
	n	%	n	%	n	%	n	%	n	%
Female	4	14	1	4	7	25	1	4	13	46
Male	7	25	2	7	5	18	1	4	15	54
Total	11	39	3	11	12	43	2	7	28	100

Weight-for-height (WHZ)

Gender	Severely wasted		Wasted		Normal		Overweight		Obese		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
Female	1	4	1	4	9	32	2	7	0	0	13	46
Male	3	11	2	7	9	32	1	4	0	0	15	54
Total	4	14	3	11	18	64	3	11	0	0	28	100

Table 2. Wealth index of the subject's family and WAZ, HAZ, and WHZ of children under five in Barangay Calumpang (N=28)

Weight-for-age (WAZ)

Wealth index	Severely underweight		Underweight		Normal		Overweight		Total	
	n	%	n	%	n	%	n	%	n	%
1 – poorest	3	11	0	0	5	18	0	0	8	29
2 – somehow poor	0	0	2	7	4	14	0	0	6	21
3 – average	0	0	0	0	0	0	0	0	0	0
4 – above average	7	25	2	7	4	14	1	4	14	50
5 – wealthiest	0	0	0	0	0	0	0	0	0	0
Total	10	36	4	14	13	46	1	4	28	100

Height-for-age (HAZ)

Wealth index	Severely stunted		Stunted		Normal		Tall		Total	
	n	%	n	%	n	%	n	%	n	%
1 – poorest	4	14	0	0	4	14	0	0	8	29
2 – somehow poor	3	11	1	4	1	4	1	4	6	21
3 – average	0	0	0	0	0	0	0	0	0	0
4 – above average	4	14	2	7	7	25	1	4	14	50
5 – wealthiest	0	0	0	0	0	0	0	0	0	0
Total	11	39	3	11	12	43	2	7	28	100

Weight-for-height (WHZ)

Wealth index	Severely wasted		Wasted		Normal		Overweight		Obese		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
1 – poorest	1	4	0	0	5	18	2	7	0	0	8	29
2 – somehow poor	1	4	0	0	4	14	1	4	0	0	6	21
3 – average	0	0	0	0	0	0	0	0	0	0	0	0
4 – above average	2	7	3	11	9	32	0	0	0	0	14	50
5 – wealthiest	0	0	0	0	0	0	0	0	0	0	0	0
Total	4	1	3	11	18	64	3	11	0	0	28	100

Environmental Sanitation

Factors such as a proper healthy environment, which includes the availability of safe water, sanitation, healthcare, and environmental safety, influence the immediate determinants of a child's nutritional status. The UNICEF identified that one of the three most common underlying factors that cause undernutrition in children is an unhealthy household environment.[13] Therefore, the child's source of water, toilet facilities, and waste disposal methods were examined in comparison to their nutritional status

Sources of Water

All 28 children had access to water at least 12 hours/day and water sources were located within their premises (Table 3). Twenty-seven children (96%), regardless of nutritional status, have improved water sources for drinking. Only one child who was severely stunted has an unimproved water source.

Twenty-seven children (96%), regardless of their nutritional status, have improved water sources for general use, and only one child who was considered severely stunted has an unimproved source (Table 4), which is similar to the source of water for drinking.

Toilet Facilities

Of the 28 children, 26 have sanitary toilet facilities regardless of nutritional status. Twenty-three families (82%) owned a pour/flush type toilet with a septic tank. Two families (7%) have an owned, covered pit with ventilation and shared, and another two families (7%) with a poured/flush type toilet with the septic tank while one household (4%) has an owned, water-sealed, without sewage/septic tank. Twenty-six (93%) owned sanitary toilet facilities, while only 2 (7%) have unsanitary toilet facilities.

The two severely underweight and severely stunted children have unsanitary toilet facilities (Table 5). On the other hand, one wasted child has an unsanitary toilet.

Waste Disposal

The most common method of waste disposal was waste collection by the barangay, with 21 families (75%) having their waste collected by the barangay (Table 6). Backyard composting was practiced by six families (21.%), while one household (4%) used an open pit. Overall, there was no difference in the method of waste disposal among children with different nutritional statuses because almost all have improved waste disposal.

Table 3. Source of the subject's drinking water and WAZ, HAZ, and WHZ of children under five in Barangay Calumpang

Weight-for-age (WAZ)

Condition	Severely underweight		Underweight		Normal		Overweight		Total	
	n	%	n	%	n	%	n	%	n	%
Improved										
Own use faucet, Barangay water system	7	25	1	4	7	25	0	0	15	54
Water District directly to household	3	11	3	11	5	18	1	4	12	43
Unimproved										
Shared tubed/piped deep well	0	0	0	0	1	4	0	0	1	4
Total	10	36	4	14	13	46	1	4	28	100

Height-for-age (HAZ)

Condition	Severely stunted		Stunted		Normal		Tall		Total	
	n	%	n	%	n	%	n	%	n	%
Improved										
Own use faucet, Barangay water system	6	21	1	4	7	25	1	4	15	54
Water District directly to household	4	14	2	7	5	18	1	4	12	43
Unimproved										
Shared tubed/piped deep well	1	4	0	0	0	0	0	0	1	4
Total	11	39	3	11	12	43	2	7	28	100

Weight-for-height (WHZ)

Condition	Severely wasted		Wasted		Normal		Overweight		Obese		Total	
	n	%	n	%	n	%	n	%			n	%
Improved												
Own use faucet, Barangay water system	3	11	2	7	8	29	2	7	0	0	15	54
Water District directly to household	1	4	1	3	9	32	1	4	0	0	12	43
Unimproved												
Shared tubed/piped deep well	0	0	0	0	1	4	0	0	0	0	1	4
Total	4	14	3	11	18	64	3	11	0	0	28	100

Health Situation

Immunization

Immunization can be classified into three: full immunization, partial immunization, and no immunization. Vaccines included in the immunization were the Bacille Calmette-Guerin (BCG) vaccine, pentavalent (PENTA/OPV) vaccine, hepatitis B vaccine, rotavirus vaccine, measles vaccine, and the MMR vaccine. All 28 children were partially immunized regardless of their nutritional status (Table 7). Thus, it shows that all children are still at risk of developing diseases that may affect their nutritional status since they are only partially immunized.

DISCUSSION

In Barangay Calumpang, the two most prevalent forms of undernutrition were severe underweight (36%) and severe stunting (39%). The prevalence of underweight and severely wasted was 14% while stunting and wasting was 11%. The prevalence of these different forms of undernutrition was higher than the provincial figures and based on the WHO classification for magnitude and severity, it was 'very high' for all forms.[16] The results are alarming as it increases the risk of deaths among children.

More boys suffered from undernutrition in all the three indices used compared to girls. Eleven boys were considered underweight in comparison to only three girls. In addition, nine boys and five girls were stunted, while five boys and two girls were considered wasted.

In a systematic review conducted by Thurstans et al., undernutrition in children under five is more likely to affect boys than girls though further research is important to explore the reasons for these differences and their implications on nutrition policy and practice.[17] In another study conducted in the rural areas of Bijapur, India, similar results were observed, with the prevalence of malnutrition in any form more seen among boys than girls. In this study, the mother's age had a significant association with the children's nutritional status.[18] These findings, however, are contradictory to a study in rural Eastern Kenya wherein girls were more stunted, underweight, and wasted than boys at all age categories due to their consistent lower food intake.[19] There are many factors to consider when looking at the nutritional status disparity between boys and girls, such as mother's age, mother's educational level, wealth index, diseases, child disability,

Table 4. Source of the subject's water for general use and WAZ, HAZ, and WHZ of children under five in Barangay Calumpang (N=28)

Weight-for-age (WAZ)

Condition	Severely underweight		Underweight		Normal		Overweight		Total	
	n	%	n	%	n	%	n	%	n	%
Improved										
Own use faucet, Barangay water system	4	14	0	0	3	11	0	0	7	25
Water District directly to household	6	21	4	14	9	32	1	4	20	71
Unimproved										
Shared tubed/piped deep well	0	0	0	0	1	4	0	0	1	4
Total	10	36	4	14	13	46	1	4	28	100

Height-for-age (HAZ)

Condition	Severely stunted		Stunted		Normal		Tall		Total	
	n	%	n	%	n	%	n	%	n	%
Improved										
Own use faucet, Barangay water system	3	11	1	4	3	11	0	0	7	25
Water District directly to household	7	25	2	7	9	32	2	7	20	71
Unimproved										
Shared tubed/piped deep well	1	4	0	0	0	0	0	0	1	4
Total	11	39	3	11	12	43	2	7	28	100

Weight-for-height (WHZ)

Condition	Severely wasted		Wasted		Normal		Overweight		Obese		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
Improved												
Own use faucet, Barangay water system	1	4	2	7	3	11	1	4	0	0	7	25
Water District directly to household	3	11	1	4	14	50	2	7	0	0	20	71
Unimproved												
Shared tubed/piped deep well	0	0	0	0	1	4	0	0	0	0	1	4
Total	4	14	3	11	18	64	3	11	0	0	28	100

and early childhood development. However, ultimately, children under five and their caregivers must be included in a high priority group for targeted nutrition interventions, and it should be targeted according to their needs.[17,20]

Almost half of the residents in Barangay Calumpang have reached primary and secondary education. The top source of income was elementary occupation – unskilled workers such as construction laborers, dry goods vendors, hand launderers, housemaids, fish vendors, candy vendors, and sidewalk vendors. These occupations have an average daily pay of PhP260.36. The National Economic Development Authority (NEDA) stated that an average Filipino family needs an aggregate income of PhP 42,000 a month or PhP 1,400 a day to live above the poverty line.[21,22] This disparity between the income of almost half of the residents in the barangay and the suggested income of the government for a comfortable life can affect their choices in food, living conditions, and healthcare.

The conceptual framework developed by UNICEF was used to analyze the results, with one of the basic causes of undernutrition being inadequate income.[13] The association between income and wealth is an indicator of financial security. The relationship between undernutrition and wealth has been well-established by studies made through the years that have stated an inverse relationship between household wealth and a child's health and nutritional status.[23] Undernutrition is more likely to be found in children from lower wealth quintiles than those who are from higher wealth quintiles. According to a study by Angeles-Agdeppa et al., children belonging to lower wealth quintiles are more prone to undernutrition since lower financial capacity is found to be associated with food insecurity, which then results in poor consumption.[24] On the other hand, families who belong to the higher quintiles have greater financial capability and, therefore, can provide proper nutrition for their children.

This study found that for height-for-age, the prevalence of stunting was higher among subjects belonging to the lower quintiles and that subjects with normal nutritional status belonged to the higher quintile, which is consistent with previous literature. However, the results for weight-for-age and weight-for-height were opposite. Further-more, a high prevalence of underweight and wasted was observed among those who belonged to the 4th quintile, while those with normal nutritional status were higher among the lower quintiles. Thus, it indicates that wealth may be a contributory factor in stunting, but not for underweight and wasting.

Table 5. Toilet facilities of the subject's household and WAZ, HAZ, and WHZ of children under five in Barangay Calumpang (N=28)

Weight-for-age (WAZ)

Condition	Severely underweight		Underweight		Normal		Overweight		Total	
	n	%	n	%	n	%	n	%	n	%
Sanitary Toilet										
Owned, Pour/Flush type with septic tank	8	29	4	14	10	36	1	4	23	82
Owned, covered-pit w/ ventilation	0	0	0	0	2	7	0	0	2	7
Owned, water-sealed, without sewage/ septic tank	0	0	0	0	1	4	0	0	1	4
Unsanitary Toilet										
Shared, Pour/Flush type with septic tank	2	7	0	0	0	0	0	0	2	7
Total	10	36	4	14	13	46	1	4	28	100

Height-for-age (HAZ)

Condition	Severely stunted		Stunted		Normal		Tall		Total	
	n	%	n	%	n	%	n	%	n	%
Sanitary Toilet										
Owned, Pour/Flush type with septic tank	8	29	2	7	11	39	2	7	23	82
Owned, covered-pit w/ ventilation	0	0	1	4	1	4	0	100	2	7
Owned, water-sealed, without sewage/ septic tank	1	4	0	0	0	0	0	0	1	4
Unsanitary Toilet										
Shared, Pour/Flush type with septic tank	2	7	0	0	0	0	0	0	2	7
Total	11	39	3	11	12	43	2	7	28	100

Weight-for-height (WHZ)

Condition	Severely wasted		Wasted		Normal		Overweight		Obese		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
Sanitary Toilet												
Owned, Pour/Flush type with septic tank	4	14	2	7	15	54	2	7	0	0	23	82
Owned, covered-pit w/ ventilation	0	0	0	0	2	7	0	0	0	0	2	7
Owned, water-sealed, without sewage/ septic tank	0	0	0	0	0	0	1	4	0	0	1	4
Unsanitary Toilet												
Shared, Pour/Flush type with septic tank	0	0	1	4	1	4	0	0	0	0	2	7
Total	4	14	3	11	18	64	3	11	0	0	28	100

House ownership is considered one of the most significant determinants of child health and nutritional status.[25] Therefore, more privileges and better living conditions of the residents were likely due to owning a house and lot. On the other hand, having a less desirable lot and house ownership may result in poorer living conditions, leading to lower nutritional status for the residents.[15] Based on the findings of the study, most undernourished children had desirable housing conditions. For both lot and house ownership, only one severely wasted subject had a less desirable condition. It was also observed that the levels of undernutrition and normal nutritional status were also comparable in number. Therefore, the study results indicate that lot and house ownership were not associated with the frequency of undernutrition, which contrasts with other studies.

Environmental conditions such as poor water, sanitation, and hygiene practices were identified as underlying causes of undernutrition in UNICEF's Conceptual Framework of Maternal and Child Undernutrition.[13] Access to clean water sources for families is vital as it lessens children's susceptibility to harmful pathogens, which may lead to waterborne diseases that may affect their nutritional status.[26] In a study by Danaei et al., which examined 137 developing countries, it was reported that cases of undernutrition were attributed to unimproved sanitation.[27] It is difficult for families to have adequate sanitation facilities or practice good hygiene without an adequate, clean, and safe water source.

The study's findings showed that all children with undernutrition have improved drinking water sources except for one. Similar results were also found for the sources of water for general use. Therefore, it is likely that the source of drinking water and source of water for general use may not affect the nutritional status of the children. In contrast, studies have revealed an association between sources of water and nutritional status. A study conducted in Zimbabwe showed that in rural areas of low-income and middle-income countries, having improved water was unlikely to reduce undernutrition.[28,29] The differences of findings may

Table 6. Waste disposal of the child's household and WAZ, HAZ, and WHZ of children under five in Barangay Calumpang (N=28)

Weight-for-age (WAZ)

Condition	Severely underweight		Underweight		Normal		Overweight		Total	
	n	%	n	%	n	%	n	%	n	%
Improved										
Backyard composting	3	11	1	4	2	7	0	0	6	21
Collected by barangay	7	25	2	7	11	39	1	4	21	75
Unimproved										
Open-pit	0	0	1	4	0	0	0	0	1	4
Total	10	36	4	14	13	46	1	4	28	100

Height-for-age (HAZ)

Condition	Severely stunted		Stunted		Normal		Tall		Total	
	n	%	n	%	n	%	n	%	n	%
Improved										
Backyard composting	3	11	0	0	3	11	0	0	6	21
Collected by barangay	8	29	2	7	9	32	2	7	21	75
Unimproved										
Open-pit	0	0	1	4	0	0	0	0	1	4
Total	11	39	3	11	12	43	2	7	28	100

Weight-for-height (WHZ)

Condition	Severely wasted		Wasted		Normal		Overweight		Obese		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
Improved												
Backyard composting	1	4	0	0	4	14	1	4	0	0	6	21
Collected by barangay	3	11	3	11	13	46	2	7	0	0	21	75
Unimproved												
Open-pit	0	0	0	0	1	4	0	0	0	0	1	4
Total	4	14	3	11	18	64	3	11	0	0	28	100

Table 7. Immunization of the subject and WAZ, HAZ, and WHZ of children under five in Barangay Calumpang, Nagcarlan (N=28)

Weight-for-age (WAZ)

Condition	Severely underweight		Underweight		Normal		Overweight		Total	
	n	%	n	%	n	%	n	%	n	%
Full immunization	0	0	0	0	0	0	0	0	0	0
Partial immunization	10	36	4	14	13	46	1	4	28	100
None	0	0	0	0	0	0	0	0	0	0
Total	10	36	4	14	13	46	1	4	28	100

Height-for-age (HAZ)

Condition	Severely stunted		Stunted		Normal		Tall		Total	
	n	%	n	%	n	%	n	%	n	%
Full immunization	0	0	0	0	0	0	0	0	0	0
Partial immunization	11	39	3	11	12	43	2	7	28	100
None	0	0	0	0	0	0	0	0	0	0
Total	11	39	3	11	12	43	2	7	28	100

Weight-for-height (WHZ)

Condition	Severely wasted		Wasted		Normal		Overweight		Obese		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
Full immunization	0	0	0	0	0	0	0	0	0	0	0	0
Partial immunization	4	14	3	11	18	64	3	11	0	0	28	100
None	0	0	0	0	0	0	0	0	0	0	0	0
Total	4	14	3	11	18	64	3	11	0	0	28	100

be explained by varying household sanitation and personal hygiene practices, and according to a study done in India by Reddy et al., better water and hygiene practices were related to improved knowledge of caregivers.[30]

Children from families with unimproved toilets have a higher risk of undernutrition than those with improved toilets.[31] In addition, an increase in infections such as diarrhea may be caused by fecal contamination due to unimproved toilet facilities.[32,33] This may reduce the children's food intake and nutrient absorption.

The study results revealed that all subjects with unimproved toilet facilities have a nutritional status of either underweight or stunted, which is consistent with previous research. However, it was also observed that many subjects with undernutrition have improved toilet facilities as opposed to subjects with unimproved facilities. A possible explanation for this is that even with improved toilet facilities, the household rarely does proper sanitation and hygiene practices like handwashing with soap. Such practices have been reported to contribute to child undernutrition.[27] Therefore, it is likely that the type of toilet facilities that subjects use affects their nutritional status. However, the effect might not be as significant as what has been revealed in previous studies, which found an association between the type of toilet facilities and nutritional status.

It may seem that waste disposal is unconnected to malnutrition. However, in this study, it may be reflective of the sanitary practices by the family of the children. The method of waste disposal employed by a household was associated with undernutrition, and having inadequate sanitary conditions in the families may lead to illnesses in children due to infectious and parasitic diseases.[32,34] Furthermore, in low-income countries, waste disposal methods such as open dumping and open burning heavily contribute to environmental pollution that may pose a serious health risk.[35] Therefore, families need to have proper waste management strategies to avoid adverse health impacts.

Results of the study showed that all underweight and stunted subjects except for one subject from each employed improved methods of waste disposal, while all wasted subjects, on the other hand, all have improved methods of waste disposal. In addition, a relatively larger number of children with undernutrition have improved waste disposal methods compared to those with unimproved methods. The results indicate that it is likely that the method of waste disposal employed by a household did not affect underweight and stunting. Further investigation is needed to truly establish whether or not the method of waste disposal has an association with undernutrition in the children's area.

Deaths among children under five are predominantly due to infections. Therefore, vaccination can hugely benefit malnourished children.[36] It was stated by Samaik & Emeto, that partially vaccinated children are at higher risk of infections and diseases that can affect their nutritional status.[37] The study results showed that all undernourished subjects were partially immunized, and as protection from vaccine-preventable diseases is low, there is a high risk of developing diseases that can alter nutritional status.[38] It indicates that it is highly likely that immunization influences the nutritional status of under-five children, which is consistent with what previous studies have stated.

Inadequate health services were among the identified underlying causes of undernutrition in the framework by UNICEF. The accessibility of vaccination as a healthcare service may be hampered by inadequate transportation and communication, especially for rural communities. Therefore, it is possible to explain why the children were only partially immunized instead of fully immunized. Furthermore, many parents/guardians have not felt the full benefits of such healthcare services due to the lack of knowledge on the advantages of having children vaccinated.[37] As a consequence, children lack the protection they need from diseases that vaccines can provide. Therefore, it is very probable that inadequate healthcare service contributed to undernutrition in the area.

The results of the study suggest that due to frequency of undernutrition in factors such as biological sex (boys), wealth index (lower quintiles), healthcare (partially immunized) there is a possible relationship between these and nutrition though further research is needed. In a study by Waibel & Hohfeld they found that different variables were correlated to nutrition outcomes, depending on whether the child is undernourished and poor or not. It is also important to note that they concluded that non-monetary factors are important in addressing undernutrition and monetary poverty reduction is insufficient in solving nutrition problems in rural populations in emerging market economies.[39] In another study by Siddiqui et al. about the intertwined relationship of poverty and malnutrition they suggested that nutrition interventions should be designed in a well-rounded, holistic manner. It would give better results if it involves various stakeholders including health, education, agriculture, water, sanitation and hygiene, gender, and economics.[40]

Study Limitations

The study only covered selected under-five children in Barangay Calumpang, Nagcarlan, Laguna. The results of the study therefore may not be generalizable for the whole under-five population of the Philippines.

CONCLUSION

Important factors related to undernutrition are the biological sex of the child (boy), wealth index (lower quintiles), and health services (partial immunization). The frequency of stunting is particularly high in the subjects in lower quintile households. Therefore, improvements in nutritional status depend on an adequate quantity of financial resources and access to good quality healthcare services.

Recommendations

The study proposes recommendations geared towards improving nutritional status among under-five children in Barangay Calumpang, Nagcarlan, Laguna.

1. Increase income, food consumption, and food security by developing nutrition-focused livelihood programs.
2. Conduct prenatal education in the community to increase awareness regarding pregnancy, childbirth, postpartum, and childhood.
3. Increase promotion of Infant and Young Child Feeding (IYCF) practices among women of reproductive age.
4. Conduct gender-targeted nutrition programs.
5. Increase the awareness and knowledge of parents/ guardians on the advantages of having children vaccinated.
6. Efforts to promote community motivation must be accompanied by increased accessibility to healthcare services such as immunization.
7. Capacity building on documentation and record-keeping.
8. One of the study's limitations is a small sample size. Therefore, to lessen the variability in results and margin of error, further investigation of the determinants of undernutrition with a larger sample size is warranted.

Acknowledgments

The authors thank the municipal office of Nagcarlan Laguna, Barangay Calumpang, BIDANI Network Program, children, and parents for being part of the study.

Statement Of Authorship

All authors participated in data collection and analysis and approved the final version submitted.

Author Disclosure

The authors declared no conflicts of interest.

Funding Source

None.

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