

Assessment of Nutritional Status of Children 0 to 15 Years Using Anthropometric Parameters in Conflict-Affected Communities in Southern Kaduna, Nigeria

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Abstract

Background: Children are the bedrock of society, and their health and development are therefore essential in the determination of the health trend of the future population. A child is defined by the WHO as a human between the developmental period of infancy and puberty. Anthropometry is a noninvasive method of determining nutritional status of children and infants. Weight and height are a function of growth and point towards the development of the child. They suggest underlying health conditions as well predictive value for the overall health status of a community. Disorders of nutrition pose a public health concern in both the developing as well as the Western nations. **AIM:** This study was aimed at assessing the nutritional status of children aged 0 - 15 using the anthropometric measurements, weight and height in the Kagoro community of Kaura Local Government Area, Southern Kaduna State. **Methodology:** A cross-sectional descriptive study design was used. Questionnaires were administered for this study, and the anthropometric parameters Weight for age (WAZ), Height for age (HAZ), Weight for height (WHZ) of children aged 0 - 15 years in the community were obtained. Household selection was done by multi-stage sampling. Data were collected and analyzed using the Statistical Package for the Social Sciences (SPSS) version 27 and presented in tables. **Result:** The study found that the prevalence of underweight was 187 (27.7%), while 366 (54.2%) were normal weight for age, and 122 (18.1%) were overweight. The prevalence of stunting was 240 (35.6%), and 435 (64.4%) were of normal height for age. Summarily, the prevalence of wasting was 196 (29.0%). 78 (11.6%) were severely wasted, 51 (7.6%) were moderately wasted, 67 (9.9%) were mildly wasted, and 479 (71.0%) had normal weight for height.

Conclusion: The study reveals a high prevalence of child undernutrition in Kagoro, with wasting (29.0%), stunting (35.6%), and underweight (27.7%) presenting significant public health concerns. These findings underscore an urgent need for targeted community-level nutritional interventions, enhanced maternal-child health services, and sustainable food security initiatives in the Kaura Local Government Area.

Keywords

Anthropometry, Measurements, Nutrition, Health, Assessment, Kagoro, Southern Kaduna

1. Background

Children are the bedrock of society, and their health and development are therefore essential to determine the health trend of the future population. Anthropometry is a noninvasive method of determining nutritional status of children and infants. Weight and height are a function of growth and point towards the development of the child. They suggest underlying health conditions as well as predictive value for the overall health status of a community [1]-[3].

Disorders of nutrition pose public health concern in both the developing as well as the western nations. Malnutrition refers to an imbalance in caloric requirements versus the intake required for daily energy expenditure. Thus, malnutrition poses a threat, not only to the physical aspects of the child's health, but the overall well-being including the mental and emotional state of the child [2] [3].

Malnutrition accounts for about 54% of childhood mortality on the global scale in a study carried out by the WHO. In developing countries, 52% of school age children are stunted, and up to 62% of them are underweight [1] [3] [4]. The etiology of malnutrition in a rural community such as the Kagoro is multifactorial, some salient contributions may include the rise in insurgency over the past years, the economic recession leading to devaluation of the naira, increase in cost of living, lack of policies protecting the agricultural sector, inevitably leading to a macronutrient scarcity. Individual factors would include the high prevalence of child labor, illness, psychosocial deprivation, social inequality, poor hygiene predisposing to infections, as well as illiteracy and unemployment of caretakers [5]. On the global scale, food insecurity can arise from wars, epidemics, droughts, and floods resulting from climate change [5] [6].

2. Problem Statement

To assess the nutritional status of children between the ages 0 - 15 in the Kagoro community, using the anthropometric parameters weight and height. A child is defined by the WHO as a human between the developmental period of infancy and puberty [1] [2] [4]. The age group 0 - 15 years is a vulnerable population

where children in this age group are predisposed to malnutrition because they have an increasing need for quality nutrition to meet the demands of the growing body and are prone to deficiencies [1] [5] [6]. Early detection and treatment are paramount to achieving healthy growth and development of the children [1] [3] [4] [7].

Based on a study conducted in Nigeria by UNICEF, 25 million Nigerians are at high risk of food insecurity, an increase from the projected 17million from a previous study. It is projected that about 17% of those at risk will be from the north-eastern states due to the persistent violence, banditry and kidnapping in these states. Six (6) million children under 5 years suffer from food insecurity in Borno, Adamawa, Zamfara, Katsina, Yobe and Sokoto states [6] [8].

3. Justification

The assessment of anthropometric characteristics of children aged 0 - 15 years in Kagoro is pivotal for implementing targeted health interventions. A precise anthropometric data will aid in identifications of specific health needs, nutritional deficiencies and growth patterns [9] [10]. Children at risk can be identified and timely interventions offered to prevent long-term complications. Kagoro may have a unique socio-cultural and environmental factor which may influence the health condition of children within the community.

Comparing the weight of children with their appropriate weight for age is key in identifying malnutrition. This comparison allows for early interventions, and provides a monitoring system which can aid in the prevention of stunting. It may give an insight on the nutritional status of children within the community [1] [3] [4] [11] [12].

Comparison between the height of children and the age-appropriate standard is essential for early detection of growth defects, and contributes to a nutritional assessment. An integrated evaluation of children's health and well-being can be assessed by comparing the height with the appropriate height for age, short stature or excessive height may indicate an underlying health challenge [10] [12] [13].

Comparing the height and weight of children of different sexes but the same age group allows for a comprehensive understanding of growth disparities [14] [15]. It may indicate a gender specific health challenge [13] [15] [16]. Socio-cultural factors may influence the developmental pattern of both sexes differently and this comparison will help with understanding how these factors affect the development [17] [18].

4. Research Questions

What are the anthropometric characteristics of children aged 0 - 15 years in Kagoro, and how do these vary across different age groups? How does the actual weight of children compare to their age-appropriate standards? How does the actual height of children compare to the appropriate age standards? How do the

height and weight of children vary between sexes of the same age group?

The study specifically sets out to assess the anthropometric characteristics of children aged 0 - 15 years in Kagoro, to compare the weight of the children to their appropriate weight for age and to compare the height of the children to their appropriate height for age.

5. Methodology

5.1. Study Area

The study was conducted in the Fada and Agban communities of Kagoro, Kaura Local government area of Kaduna State. Kagoro is a mid-size town in the region of Kaduna, North-West Nigeria with a population of approximately 77,000 people. Its geographical coordinates are 9°36'0" North, 8°23'0" East. Kaduna's capital Kaduna (Kaduna) is approximately 146 km/91 mi away from Kagoro. It contains six wards namely Mallagum, Kpak, Fada, Agban, and Kadarko [9] [10].

5.2. Sociocultural and Economic Information

The community's residents are a homogenous group, although other ethnic groups from Nigeria have settled amongst them. They are part of the larger Atyap Ethno-Linguistic Cluster, with Aegworok being its dominant ethnic group and other ethnic groups like Bajju, Hausa, Fulani, Yoruba, Igbo, and a variety of others scattered throughout. There, Christianity is the most common religion practiced by the locals, followed by Islam and a small number of African traditional religions [9] [10].

The majority of the population work as farmers, producing a range of crops such as guinea corn, millet, maize, yams, cocoa yams, potatoes, and cassava. Fruits like bananas, mangoes, and oranges are in abundant supply. It is home to Kagoro hills, a tourist favorite and a Water Board intake that supplies clean water for the community's consumption. The renowned ECWA School of Seminary and ECWA College of Health Technology are located there, along with primary and secondary-level educational institutions. Among its health institutions are the ECWA Comprehensive Health Centre and various PHC facilities and private hospitals and clinics.

5.3. Study Population

The Study population consists of children under the age of 15 in Agban and Fada community, Kagoro chiefdom, Kaura LGA, Southern Kaduna, Kaduna state.

Chiefdom	Ward	No. of Settlement	Household
Kagoro	Fada	4	762
	Agban	3	273
Total			1035

Inclusion Criteria: Those eligible for the study are the members of Kagoro community from the age of 0 to 15 years and currently resident there.

Exclusion Criteria: Households that didn't give their consent. Households with children not currently resident within the community. Anyone not within the age range of 0 to 15 years.

Study Design: This was a household-level, community-based, descriptive, cross-sectional study.

Study Duration: This study was conducted over a 3-month interval. Data collection was carried out over one month, analysis was completed over one month period, and final write up was done over one month.

Scope of Study: This study was focused on anthropometric characteristics of children from 0 - 15 years of age in the Agban and Fada communities in Kagoro, Kaura, Kaduna South, Nigeria.

Sample Size Determination: The Minimum sample size for the study was calculated using the Cochran formula, with a minimum sample size of 675.

Sample Technique:

A multi-stage sampling process was employed.

Stage 1: This stage involved the determination of the number of wards in Kagoro community (6 in number), from which two wards were selected using Simple random sampling (SRS) by balloting from these 6 settlements from Fada Cikin Geri, Aga-Fwat and Tuyit, Angwan Atuyong, Angwan Puis and Agwan Gada.

Stage 2: From the settlement list of each ward, all settlements were used.

Stage 3: The number of households enumerated (and numbered). Simple Random Sampling (balloting) was used to select the households.

5.4. Data Management

5.4.1. Data Collection Technique

The method for data collection is primary data collection. A Pretested Interviewer-administered structured household-level questionnaire was used. The questionnaire contains 4 sections; however, anthropometric parameters of children aged 0 - 15 years in the community were administered for this study. Data collection was carried out by research assistants who were medical students who were trained using an interviewer-administered questionnaire prior to the real exercise. Each questionnaire was checked for completeness before leaving the field on each day of data collection.

The quantitative data collection was using a pre-tested interviewer-administered structured questionnaire to the parents, guardians or caregivers of the children.

Anthropometric measurements of the preschool age children were taken on site. Weight in kilograms, height in meters, and mid-upper arm circumference in centimeters were taken with a calibrated medical-grade scale, measuring tape/stadiometer, and Shakir tape, respectively [11] [18]-[21]. Weight was captured using

a high-precision, medical-grade digital floor scale (UNICEF Electronic Uniscale or equivalent) possessing a 150 kg maximum capacity and a 0.1 kg graduation sensitivity [20] [21].

During weight taking, each subject was asked to stand without any heavy clothing, relaxed with arms at the sides, feet positioned close together, and weight evenly distributed across feet. Weight was measured using a weighing scale.

Height was measured by a measuring tape stadiometer without shoes and socks, while the feet were placed together with heels, back of the heels, buttocks, and shoulder blades touching the back plate/stick, and the head was positioned in the Frankfurt horizontal plane [22] [23].

5.4.2. Data Analysis

Data was collected, cleaned, and analyzed using statistical computer software, Statistical Package for social sciences (SSPS) version 27. Frequency tables and charts were generated to explain the study findings.

5.4.3. Ethical Consideration

The study did involve invasion of the human body and thus will not cause untoward physical harm to the participants. Ethical clearance was obtained from Bingham University Teaching Hospital Ethical Committee (BHUTHREC) for the study and permission was gotten from the Kaura LGA office and chief of Kgoro/traditional counsel. Household level permission from respective household heads.

There was participant's Consent and Information on the first page of the survey questionnaire that outlined the information on the research and solicitation of the participant's consent. Each participant was required to voluntarily affirm his/her consent and willingness to participate in the study, with the assurance of confidentiality and the right to opt out of the process without any repercussions.

Upon agreeing to participate in the study, the questionnaire was administered and upon completion, a number was assigned to each household for ease of cross-checking and if additional information was needed. The collected questionnaire and collated data were domiciled in the protective custody of the researcher to avoid needless spread of participants' information, with guided access only to the research team. The database was kept strictly with the research team and was not made available or known to anyone outside the team. However, if requested, participants will be provided with the BHUTHREC telephone number should any request of such be made thereof during questionnaire administration.

5.4.4. Limitations

The study was based on self-reports by the households. Some participants declined and did not consent, thus were excluded from the study.

6. Result

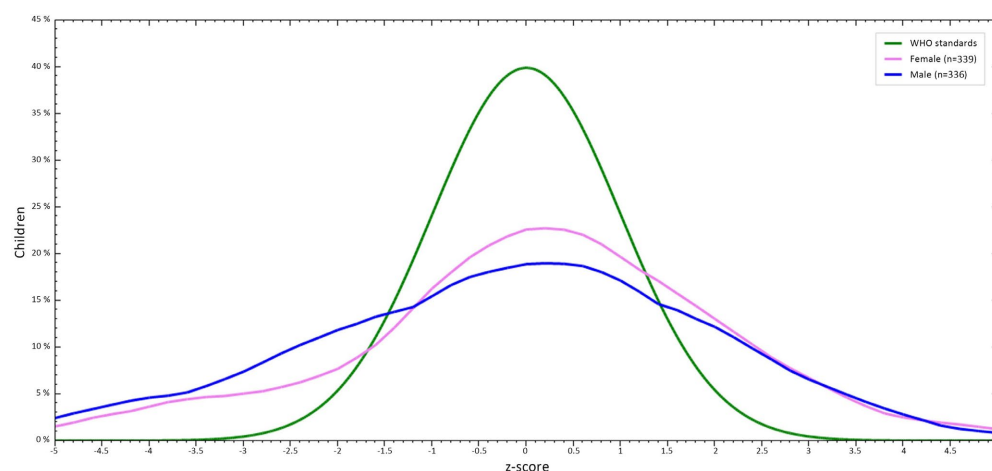


Figure 1. Weight for height/length.

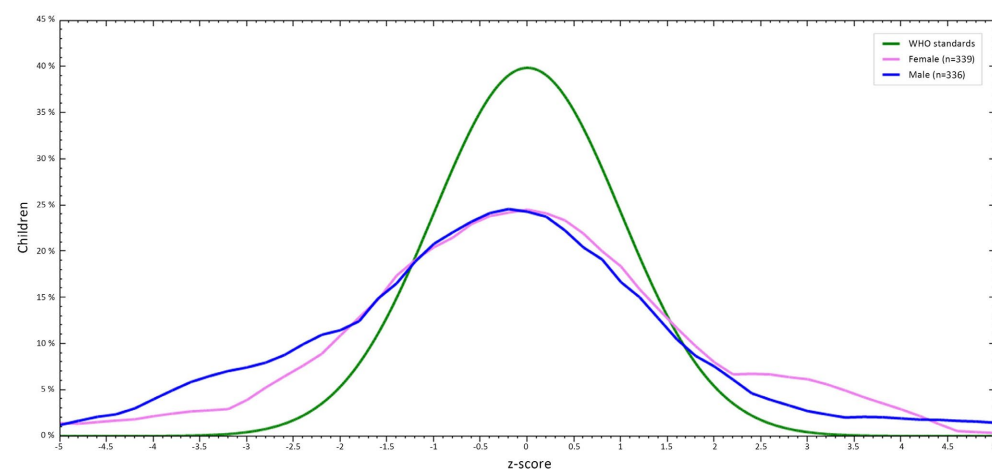


Figure 2. Weight for age.

Table 1. Weight for age (WAZ), height for age (HAZ), weight for height (WHZ).

Anthropometry	Male n = 336	Male (%)	Female n = 339	Female (%)	Total (Both)	Total % (Both)
Weight for age (WAZ)						
Severely underweight	22.0	6.5	29.0	8.6	51.0	7.6
Moderately underweight	26.0	7.7	17.0	5.0	43.0	6.4
Mildly underweight	43.0	12.8	50.0	14.7	93.0	13.8
Normal	185.0	55.1	181.0	53.4	366.0	54.2
Overweight	60.0	17.9	62.0	18.3	122.0	18.1
Total	336.0	100.0	339.0	100.0	675.0	100.0
Height for age (HAZ)						
Severe stunting	37.0	11.0	20.0	5.9	57.0	8.4

Continued

Moderate stunting	27.0	8.0	38.0	11.2	65.0	9.6
Mild stunting	57.0	17.0	61.0	18.0	118.0	17.5
Normal	215.0	64.0	220.0	64.9	435.0	64.4
Total	336.0	100.0	339.0	100.0	675.0	100.0
Weight for height (WHZ)						
Severe wasting	37.0	11.0	41.0	12.1	78.0	11.6
Moderate wasting	26.0	7.8	25.0	7.4	51.0	7.6
Mild wasting	23.0	6.8	44.0	13.0	67.0	9.9
Normal	250.0	74.4	229.0	67.6	479.0	71.0
Total	336.0	100.0	339.0	100.1	675.0	100.0

Table 2. Relationship between nutritional status and sex.

Anthropometry	Male (%) n = 336	Female (%) n = 339	Test	p value
Weight for age (WAZ)			3.415 ^b	0.492
Severely underweight	22 (6.5)	29 (8.6)		
Moderately underweight	26 (7.7)	17 (5.0)		
Mildly underweight	43 (12.8)	50 (14.7)		
Normal	185 (55.1)	181 (53.4)		
Overweight	60 (17.9)	62 (18.3)		
Height for age (HAZ)			7.098 ^b	0.068
Severe stunting	37 (11.0)	20 (5.9)		
Moderate stunting	27 (8.0)	38 (11.2)		
Mild stunting	57 (17.0)	61 (18.0)		
Normal	215 (64.0)	220 (64.9)		
Weight for height (WHZ)			7.744 ^b	0.050*
Severe wasting	37 (11.0)	41 (12.1)		
Moderate wasting	26 (7.7)	25 (7.4)		
Mild wasting	23 (6.8)	44 (13.0)		
Normal	250 (74.4)	229 (67.6)		

Note: ^b: Fisher's exact test, *: statistically significant.

(1) Weight for age (WAZ), Height for age (HAZ), Weight for height (WHZ)

Concerning weight for age (WAZ), **Table 1** and **Figure 1** show that 51 (7.6%) are severely underweight, 43 (6.4%) were moderately Underweight, 93 (13.8%) were mildly underweight. Summarily, the prevalence of underweight was 187 (27.7%) while 366 (54.2%) were normal weight for age, and 122 (18.1%) were overweight.

Concerning Height for age (HAZ), **Table 1** and **Figure 2** show that 57 (8.4%) were severely stunted, 65 (9.6%) were moderately stunted, 118 (17.5%) were mildly stunted, 435 (64.4%) were normal height for age. Summarily, the prevalence of stunting was 240 (35.6%).

Concerning Weight for height (WHZ), **Table 1** and **Figure 2** show that 78 (11.6%) were severely wasted, 51 (7.6%) were moderately wasted, 67 (9.9%) were mildly wasted, 479 (71.0%) had normal weight for height. Summarily, the prevalence of wasting was 196 (29.0%).

(2) Relationship Between Nutritional Status and Sex

About 27% of males were underweight when compared with 28.3% of females underweight. But, there was no statistically significant difference between Weight for age (WAZ), and sex (male or female) ($p = 0.492$, Fischer's exact 3.415).

36.0% of males were stunted while 35.1% of females were stunted. There was no statistically significant difference between Height for age (HAZ), and sex (male or female) ($p = 0.068$, Fischer's exact 7.098).

25.6% of males were wasted, while 32.5% of females were wasted, there was a statistically significant difference between Weight for age (WHZ), and sex (male or female) ($p = 0.050$, Fischer's exact 7.744) (**Table 2**).

7. Discussion

According to the study carried out on children both male and female between the ages of 0 - 15 years, the anthropometric distribution of weight-for-age among the children in Kagoro provides critical insights into the community's nutritional landscape. When evaluating underweight metrics based on standard WHO Z-score thresholds, a clear baseline of vulnerability emerges. In this study, severe underweight (< -3 SD) was observed in approximately 8% of the cohort, while moderate underweight (≥ -3 SD to < -2 SD) affected 7% of the children. Crucially, when these two categories are aggregated to establish the clinical baseline for underweight prevalence (< -2 SD), the true combined rate stands at 15%. This 15% combined prevalence is the key metric that allows for valid, direct comparisons with regional and national Nigerian health data, which strictly exclude mild variations from core malnutrition calculations.

Beyond this clinical threshold, an additional 14% of the children fell into the mildly underweight category (> -2 SD to < -1 SD). While these mild cases are excluded from the primary malnutrition headlines to maintain statistical alignment with national surveys, they represent an important "at-risk" sub-population. These children exist on the precipice of nutritional insecurity, indicating that any minor economic shock or localized food shortage in the Kaura Local Government Area could easily push them into moderate clinical undernutrition. Conversely, the data also highlights a dual burden of malnutrition within the community. Although the majority of the children (54%) maintained a normal weight-for-age, a significant 18% were recorded as overweight (> -2 SD). This coexistence of undernutrition (15% clinical underweight) alongside overnutrition (18% overweight) within the same demographic indicates an emerging nutritional transition

in Southern Kaduna, where traditional caloric deficits now run parallel to changing dietary patterns and localized malnutrition shifts.

The prevalence of underweight was 27.7%, this is slightly lower than the finding from a study done in Lagos [4] (39.2%). It is important to note that the current prevalence of underweight (low weight-for-age) in Nigeria is 19% [22]. The findings from this study is far higher than the national value. This may be due to the rise in insurgency over the past years around the area, the economic recession leading to devaluation of the naira, increase in cost of living, lack of policies protecting the agricultural sector, inevitably leading to a macro-nutrient scarcity. This trend can be reversed if these challenges are resolved.

Stunting is usually associated with low socioeconomic conditions, poor maternal health and nutritional status, inappropriate feeding, and frequent hospital admissions in early life [10]. The height for age for the children, according to the study carried out on both males and females between the ages of 0 - 15 years, about 9% of the children were severely stunted, 8% of the children were moderately stunted and 18% of them were mildly stunted. Majority of the children had a normal height for age with a percentage of about 65%. The prevalence of stunting was 35.6%, this is similar to finding in a study done in Lagos [4] (34.5%). The National Demographic and Health Survey (NDHS 2024) [22] shows that stunting (low height-for-age), which points to chronic malnutrition, is 32%. This finding demonstrates a food security problem. Stunting (height-for-age) in a child refers to being too short for his or her age with a height-for-age Z-score less than -2 s.d. from the median of the reference population. It is an indicator of linear growth retardation and cumulative growth deficits in children because of chronic malnutrition [10] [11].

According to the study carried out on children between the ages of 0 - 15 years, about 12% of children were severely wasted, 8% of children were moderately wasted, and about 10% of children were mildly wasted. The majority of children had a normal weight for height, with a percentage of about 71%. The prevalence of wasting was 29.0%, which is lower than a similar finding in a study done in Lagos [4] [10] (21.9%). Wasting (low weight-for-height), which indicates acute malnutrition, is 6% in Nigeria according to the NDHS 2024 [23]. This study is also far higher than the National value. Thus, efforts should be made to alleviate malnutrition in the community.

Our study revealed, normal weight for age 54%, normal height for age 65% and normal weight for height was 74%. These differences in study could have occurred because of several factors which may include: low socio-economic conditions, poor maternal health and nutritional status, inappropriate feeding, and frequent hospital admissions in early life.

8. Conclusion

The 2023 Nigeria Demographic and Health Survey (NDHS) key findings indicate a national stunting prevalence of 32%, wasting at 6%, and underweight at 19% among children under five. This study showed similar trend, assessing the anthro-

pometric characteristics of children aged 0 - 15 years in Kagoro, it showed that the prevalence of underweight was 187 (27.7%), while 366 (54.2%) were normal weight for age, and 122 (18.1%) were overweight. The prevalence of stunting was 240 (35.6%), and 435 (64.4%) were of normal height for age. The prevalence of wasting was 196 (29.0%). 78 (11.6%) were severely wasted, 51 (7.6%) were moderately wasted, and 67 (9.9%) were mildly wasted. Summarily, the prevalence of stunting was 35.6%, wasting was 29.0% and underweight was 27.7%.

Recommendation

To The Government (State and Federal):

- 1) Security and conflict resolution: there is a need to ensure the farmers return to their farms to provide food for their families with adequate security.
- 2) Comprehensive Health Screening Assessments: Implement regular health screenings for children in schools and community centers to identify cases of malnutrition at an early stage. These assessments should include nutritional evaluations and access to healthcare services.
- 3) Nutrition Education Programs: Launch community-based workshops, seminars, or information campaigns aimed at educating parents, caregivers, and children about the importance of a balanced diet, adequate nutrition, and healthy eating habits. Collaboration with nutritionists and healthcare providers can enhance the effectiveness of such programs.
- 4) Accessibility of Nutritious Food: Establish initiatives that improve access to affordable, nutritious food within our community. This could involve setting up community gardens, subsidizing healthy food options in local markets, or implementing food assistance programs for families in need.
- 5) Partnerships and Collaboration: Foster partnerships between government agencies, local businesses, healthcare providers, and non-profit organizations to pool resources, expertise, and funding to address this issue collectively. Collaboration will amplify the impact of interventions and programs aimed at improving child nutrition.

To The Health Care Workers:

- 1) Early Identification and Screening: Initiate regular health check-ups for children visiting healthcare facilities. Include routine assessments for nutritional status, focusing on indicators of malnutrition. This will enable early identification and intervention for underweight cases [21] [23].
- 2) Nutritional Counseling and Support: Offer personalized nutritional counseling to parents and caregivers of underweight children. Provide guidance on locally available, affordable, and nutrient-rich foods, as well as appropriate feeding practices for infants and young children.
- 3) Community Outreach and Education: Organize community-based workshops, seminars, and outreach programs to educate families about the importance of balanced nutrition, hygiene, and the detrimental effects of malnutrition on a child's development. Tailor these programs to the cultural context of the commu-

nity [22] [23].

4) Collaboration with Local Organizations: Establish partnerships with local NGOs, community leaders, and religious institutions to reach a wider audience and gain trust within the community. Collaborative efforts can enhance the dissemination of information and access to resources.

Monitoring and Follow-up Care: Implement a system for tracking the progress of underweight children who receive interventions or nutritional support. Ensure continuous monitoring and follow-up care to evaluate the effectiveness of interventions and provide ongoing support.

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Author Contributions

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Casadei, K. and Kiel, J. (2022) Anthropometric Measurements. StatPearls.
- [2] Wong, M.C., Ng, B.K., Kennedy, S.F., Hwaung, P., Liu, E.Y., Kelly, N.N., *et al.* (2019) Children and Adolescents' Anthropometrics Body Composition from 3-D Optical Surface Scans. *Obesity*, **27**, 1738-1749. <https://doi.org/10.1002/oby.22637>
- [3] Katanic, B., Bjelica, D., Stankovic, M., Milosevic, Z., Vukovic, J. and Mekic, A. (2023) Anthropometric Characteristics and Weight Status of Early Adolescents (Aged 12 - 14) in Montenegro; Urban-Rural and Regional Differences. *Children*, **10**, Article 1664. <https://doi.org/10.3390/children10101664>
- [4] Abdel Wahed, W.Y., Hassan, S.K. and Eldessouki, R. (2017) Malnutrition and Its Associated Factors among Rural School Children in Fayoum Governorate, Egypt. *Journal of Environmental and Public Health*, **2017**, Article ID: 4783791. <https://doi.org/10.1155/2017/4783791>
- [5] WHO (2020) Malnutrition: Emergencies and Disasters. <https://www.who.int/news-room/questions-and-answers/item/malnutrition-emergencies-and-disasters>
- [6] UNICEF (2023) 25 Million Nigerians at High Risk of Food Insecurity in 2023. <https://www.unicef.org/press-releases/25-million-nigerians-high-risk-food-insecurity-2023>

- [7] Fryar, C.D., Gu, Q., Ogden, C.L. and Flegal, K.M. (2016) Anthropometric Reference Data for Children and Adults: United States, 2011-2014. National Center for Health Statistics.
- [8] UNICEF (1990) UNICEF Policy Review: Strategy for Improved Nutrition of Children and Women in Developing Countries. 5-36.
<https://digitallibrary.un.org/record/227230?v=pdf>
- [9] Orga, D.Y. and Emmanuel-Anthony, R.K. (2024) The Tourism Potentials of Kagoro Community and Its Socioeconomic Potentials in Kaura Local Government Area, Kaduna State, Nigeria. *Journal of Travel, Tourism and Recreation*, **4**, 10-19.
<https://doi.org/10.22259/2642-908x.0401002>
- [10] Bassi, A.P., Idoko, L., Ogundeko, T.O., Ramyil, M.S.C., Abisoye-Ogunniyan, A., Ogbole, E.A., *et al.* (2017) Substance Abuse and Its Prevalence among Secondary School Adolescents in Kagoro, Kaduna State, Nigeria. *World Journal of Research and Review (WJRR)*, **5**, 11-16.
- [11] Odunayo, S.I. and Oyewole, A.O. (2006) Risk Factors for Malnutrition among Rural Nigerian Children. *Asia Pacific Journal of Clinical Nutrition*, **15**, 491-495.
- [12] Abidoye, R.O. and Ihebuzor, N.N. (2001) Assessment of Nutritional Status Using Anthropometric Methods on 1 - 4 Year Old Children in an Urban Ghetto in Lagos, Nigeria. *Nutrition and Health*, **15**, 29-39. <https://doi.org/10.1177/026010600101500104>
- [13] Raikar, K.J., Maaheraa, A. and Sobti, S. (2019) A Study of Anthropometric Parameters of School Children: A Cross Sectional Study in Rajasthan. *International Journal of Community Medicine and Public Health*, **6**, 1499-1504.
<https://doi.org/10.18203/2394-6040.ijcmph20191374>
- [14] Khadilka, V.V., Khadilkar, A.V., Cole, T.J. and Sayyad, M.J. (2007) Cross-Sectional Growth Curves for Height, Weight and Body Mass Index for Affluent Indian Children, 2007. *Indian Pediatrics*, **46**, 477-489.
- [15] Omisanjo, A.O., Orimadegun, A.E. and Akinbami, F.O. (2014) Accuracy of Nelson and Best Guess Formulae in Estimation of Weights in Nigerian Children Population. *Annals of Ibadan Postgraduate Medicine*, **12**, 80-88.
- [16] Hosseini, S.A. and Malihi, R. (2015) A Comparison between Anthropometric Characteristics of Children Ages Three to Six Years Old of Kindergartens of District 3 of Ahwaz Education with NCHS Standard-1391. *Biomedical and Pharmacology Journal*, **8**, 157-164. <https://doi.org/10.13005/bpj/572>
- [17] Joseph Ogheneruese, O. (2016) Gender Differences in Anthropometric Indices among Primary School Children in Delta South-Senatorial District, Delta State Nigeria. *International Journal of Nutrition and Food Sciences*, **5**, 220-223.
<https://doi.org/10.11648/j.ijnfs.20160503.20>
- [18] May, J., Witten, C., Lake, L. and Skelton, A. (2020) The Slow Violence of Malnutrition. In: *South African Child Gauge 2020*, Children's Institute, University of Cape Town, 24-45.
- [19] Baruah, U. and Bhattacharyya, R. (2021) Nutritional Status: Anthropometric Perspective of Pre-School Children. *International Journal of Innovations in Biological and Chemical Sciences*, **14**, 17-33.
- [20] Azcorra, H., Castillo-Burguete, M.T., Lara-Riegos, J., Salazar-Rendón, J.C. and Mendez-Dominguez, N. (2023) Secular Trends in the Anthropometric Characteristics of Children in a Rural Community in Yucatan, Mexico. *American Journal of Human Biology*, **36**, e23995. <https://doi.org/10.1002/ajhb.23995>
- [21] Hafiz, A., Ibrahim, A.Y. and Atiku, M.K. (2012) Nutritional and Health Status of Adolescents from Selected Secondary Schools in Katsina State, Nigeria. *Nigeria Journal of Nutritional Sciences*, **33**, 11-14.

- [22] Goon, D.T., Toriola, A.L., Shaw, B.S., Amusa, L.O., Monyeki, M.A., Akinyemi, O., *et al.* (2011) Anthropometrically Determined Nutritional Status of Urban Primary Schoolchildren in Makurdi, Nigeria. *BMC Public Health*, **11**, Article No. 769. <https://doi.org/10.1186/1471-2458-11-769>
- [23] Federal Ministry of Health and Social Welfare (FMoHSW), National Population Commission (NPC) and ICF (2024) Nigeria Demographic and Health Survey 2023-24: Key Indicators Report. NPC & ICF.