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Original Research Article

Assessment of Growth and Development of Under-Five Children as per the New WHO Child Growth Standards

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Abstract:

Background: Early childhood is a critical period for physical and neurodevelopment, highly influenced by nutrition and environment. The WHO Child Growth Standards provide prescriptive criteria to identify growth faltering more accurately than older references, yet community-based data for under-five children remain limited.

Aim: To assess growth and development of under-five children using the WHO Child Growth Standards (2006).

Methodology: A hospital-based descriptive cross-sectional study was conducted among 125 children aged 0–59 months attending a Department of Pediatrics, Sheikh Bhikhari Medical College Hospital, Hazaribagh, Jharkhand, India. Anthropometric measurements (weight, length/height) were taken using standardized techniques and plotted on WHO growth charts. Nutritional status was classified using Z-scores (weight-for-age, height-for-age, weight-for-height). Data were analyzed using descriptive statistics.

Result: Most children were 37–59 months (45.6%) and male (56.8%). Underweight and severe underweight were observed in 22.4% and 13.6% respectively (35.9% total). Stunting and severe stunting affected 18.4% and 12.8% (31.2% total). Wasting and severe wasting were present in 20.0% and 16.8% (36.8% total), while overweight/obesity was 4.8%. Only 54.4% initiated breastfeeding within one hour.

Conclusion: A substantial burden of acute and chronic malnutrition persists among under-five children, indicating the need for strengthened growth monitoring and improved infant feeding practices using WHO standards.

Keywords: Under-Five Children, WHO Growth Standards, Undernutrition, Stunting, Wasting, Growth Monitoring.

Introduction

The initial stage of life is related to having significant growth and development opportunities and is extremely sensitive to both positive and negative environmental factors. The most crucial aspects of the life of a child that sets him or her among a grown-up are its growth and development [1]. Childhood and more so the first five years of childhood is a biologically vulnerable but developmentally dynamic period during which physical development, neurological development and behavioural adaptation co-exist and align together. The body composition, organ activities and cognitive ability of children during this time are highly changing and are affected by nutrition, health care, social environment and practices of parents.

It is very important to nourish a child in early life because it is the most critical time to have enough nutrition which contributes to the growth and development and overall health even at the adulthood stage [2] of life. Growth begins at the point of conception and goes through to the maturity of the child as an adult. Growth is a net increase in size or mass of tissue and development determines maturation of functionality [3]. Growth thus is quantitative physical i.e. increase in weight, height and head circumference whereas development is qualitative i.e. improvement in motor coordination, language acquisition and social behaviour. The two are interdependent processes that cannot be separated because when one is disrupted, the other is often disturbed. The fundamental aspect of child health care is therefore the early detection of deficiency in normal growth.

Various growth charts are applied in order to evaluate growth and development. Growth monitoring involves serial observation of both weight and height measurement with time in order to obtain a growth velocity. Growth charts are a visualized representation of body measurement used in the determination of body size, body shape and in monitoring of growth performance. They are also applied during the evaluation and follow up of children individually and they can also be a screening tool to identify malnutrition, chronic illness, endocrine disorders, and genetic disorders at early stages. Regular monitoring of growth is beneficial in that it aids in early intervention, parental counselling, and prevention of chronic complications of undernutrition and the stuttering of growth.

Inadequate nutrition at this critical age is a factor that leads to high morbidity and high mortality and the long-term effects are reduced working potential, compromised intellectual performance and predisposition to chronic illnesses. Fever (27%), acute respiratory infections (17%), diarrhoea (13%), malnutrition (43%), including many others are diseases that are common among children under the age of 3 years in India [4]. One third of deaths in children under five are due either directly or indirectly to malnutrition hence time to time assessment and monitoring are of paramount importance. Children with undernutrition are prone to infections, are slow to recover and fall into a terrible circle of infections and undernourishment. Childhood malnutrition therefore not only matters the survival but also educational levels, productivity and economic growth of the country [5].

Many decades ago, child growth in India could be assessed based on reference standards derived as a result of small population samples [6]. IAP standards have been used to estimate prevalence of undernutrition by all major national surveys conducted in India by the National Nutrition Monitoring Bureau, the National Family Health Survey and the District Level Household Survey. These standards, however, were more of description references but not prescriptive standards of what children are meant to grow under ideal conditions [7]. By literature review it has been found that majority of the studies which are on the growth and development of children or their nutrition have been done according to other standards besides the 21st century WHO growth standards. There are very few studies that have been carried out as per WHO New Global Child Growth Standards (MGRS multi growth reference study) [8].

New child growth standards, which were introduced by World Health Organization, were based on Multicentre Growth Reference Study (MGRS) that involved children of various ethnicities who were raised in conditions that promoted optimal child growth which includes exclusive breastfeeding, proper health care, and mothers who were not smoking [9]. The standards are a way of children growing as opposed to the way they grow within a certain population. They present internationally relevant standards of determining underweight, stunting, wasting, and overweight in children below the age of five years. The implementation of these standards enables a fruitful comparison of the countries and early detection of the growth faltering in cross-populations regardless of the ethnical or socioeconomic backgrounds [10].

Relative to the Indian context, majority of the research has been on growth and development of children according to IAP standards. Of these studies there are very little that have studied below five; few of them were premature babies, some of them were children aged up to 2 years old or between ages of five and 12/18 years old [11]. Therefore, this creates a gap of holistic assessment of under-five children based on the WHO new growth standards in the community. As the group of under-five children is the one that is the most exposed to malnutrition and developmental delay, planning the adequate measures to implement requires the evidence-based evaluation of the group through the updated standards [12].

The prevalence of underweight was estimated using both IAP and new WHO standards of growth in a study done at Chandigarh, Punjab India. Underweight in the first 6 months of life was almost 1.6 times higher calculated using WHO Child Growth Standards than using IAP growth curves. The proportions of underweight children (wholesale) aged 1 to 19 years were statistically more frequently lower, when IAP standards instead of new WHO standards were utilized, with a difference of 14.5 absolute ($P < 0.001$). General estimates were 3.8 times greater with the new WHO standards compared to IAP standards on severe malnutrition ($P < 0.001$). Besides, IAP standards caused an exaggerated prevalence of undernutrition among girls especially (by 21.2% versus WHO standards) [13]. Such results point to the fact that varying standards can considerably alter the understanding of nutritional status and as a result, impact health policy, programme implementation and individual clinical decision making.

Application of WHO growth standards is thus significant in proper classification of nutritional status, prompt identification of growth faltering and prompt corrective interventions like nutritional counselling, supplementation and medical assessment. In developing countries where malnutrition remains a major public health challenge, adoption of appropriate growth assessment tools becomes even more critical. Growth assessment based on updated standards not only improves individual childcare but also strengthens surveillance systems and helps in evaluating the effectiveness of national nutrition programmes.

Considering the superiority of WHO growth standards and paucity of information available from the present setting, the present study has been undertaken. The study aims to assess the growth and development of children under five as per new WHO growth standards, thereby generating local evidence for better child health monitoring and contributing to improved nutritional assessment strategies.

Methodology

Study Design: This was a hospital-based descriptive cross-sectional study conducted to assess the growth and development status of under-five children using the New WHO Child Growth Standards (2006).

Study Area: The study was conducted in the Department of Pediatrics, Sheikh Bhikhari Medical College Hospital, Hazaribagh, Jharkhand, India.

Study Duration: The study was carried out over a period of 12 months.

Sample Size: A total of 125 under-five children attending the Pediatric Department (OPD/IPD) during the study period were included.

Study Population: Children aged 0–59 months visiting the Pediatric Department accompanied by parents/guardians constituted the study population.

Sampling Technique: A consecutive sampling method (non-probability sampling) was used. All eligible children presenting during the study period were enrolled until the desired sample size was achieved.

Data Collection: Data were collected using a structured Growth and Development Assessment Proforma. After explaining the purpose of the study, written informed consent was obtained from the parents or guardians. A screening sheet was used to confirm eligibility. Demographic information of the child and parents was recorded. Anthropometric measurements including weight, length/height were taken using standardized WHO techniques. For children below two years of age, recumbent length was measured using an infantometer, and for children aged two years and above, standing height was measured using a stadiometer. Weight was recorded using a calibrated digital weighing scale. The measurements were plotted on WHO growth charts and interpreted using Z-score classification including weight-for-age, height-for-age and weight-for-height indices. Nutritional status categories such as underweight, stunting and wasting were determined. All findings were recorded in the proforma.

Inclusion Criteria

- Children aged 0–59 months.
- Attending Pediatric OPD/IPD during study period.
- Parents/guardians willing to participate.
- Parents/guardians able to understand Hindi/ English.

Exclusion Criteria

- Children with congenital anomalies affecting growth (e.g., Down syndrome, skeletal dysplasia).
- Critically ill children requiring emergency care
- Children with chronic debilitating diseases (e.g., congenital heart disease, cerebral palsy, chronic renal disease).
- Parents unwilling to give consent.

Procedure: Eligible children were identified in the pediatric department and screened according to the inclusion criteria. After obtaining consent, demographic details were recorded followed by anthropometric assessment using standardized techniques. Growth charts based on WHO Child Growth Standards were plotted and interpreted using Z-scores. Each child's nutritional status was categorized and documented in the Growth and Development Assessment Proforma. All measurements were taken by trained investigators to minimize inter-observer variation.

Statistical Analysis: Collected data were coded and entered into Microsoft Excel and analyzed using SPSS software (Version 25.0). Descriptive statistics such as frequency, percentage, mean and standard deviation were used to summarize the data. Nutritional status was classified according to WHO Z-score criteria. The results were presented using tables and graphical representations."

Result

Table 1 shows that the largest proportion of children belonged to the 37–59 months age group (45.6%), followed by 13–36 months (36.8%) and 0–12 months (17.6%). Males (56.8%) slightly outnumbered females (43.2%). Most children were born at 34–40 weeks of gestation (94.4%), with only 5.6% born before 34 weeks. The majority had a birth weight of 2–3 kg (83.2%), while 7.2% weighed less than 2 kg and 9.6% weighed more than 3 kg. All births were singletons (100%). Breastfeeding was initiated within one hour in 54.4% of cases, whereas 45.6% started after one hour.

Table 1: Socio-demographic Characteristics of Children (N = 125)			
Variable	**Category**	**Frequency (f)**	**Percentage (%)**
Age Group	0–12 months	22	17.6
	13–36 months	46	36.8
	37–59 months	57	45.6
Gender	Male	71	56.8
	Female	54	43.2
Gestational Age at Birth	34–40 weeks	118	94.4
	<34 weeks	7	5.6
Birth Weight	<2 kg	9	7.2
	2–3 kg	104	83.2
	>3 kg	12	9.6
Type of Birth	Single	125	100
Initiation of Breastfeeding	Within 1 hour	68	54.4
	After 1 hour	57	45.6

Table 2 shows that most fathers were labourers (43.2%) followed by private employees (32.8%), while government employees and businessmen each accounted for 12%. The vast majority of mothers were housewives (94.4%) with only 5.6% working. More children belonged to nuclear families (60.8%) than joint families (39.2%). Regarding income, 31.2% of families earned less than ₹10,000 per month, 44% earned ₹10,000–20,000, and 24.8% earned more than ₹20,000, indicating that most participants came from lower- to middle-socioeconomic backgrounds.

Table 2: Socio-demographic Characteristics of Parents (N = 125)			
Variable	**Category**	**Frequency (f)**	**Percentage (%)**
Father Occupation	Labourer	54	43.2
	Private job	41	32.8
	Government job	15	12
	Business	15	12
Mother Occupation	Housewife	118	94.4
	Working	7	5.6
Type of Family	Nuclear	76	60.8
	Joint	49	39.2
Monthly Income	< ₹10,000	39	31.2
	₹10,000–20,000	55	44
	> ₹20,000	31	24.8

Table 3 presents the distribution of weight-for-age (underweight) Z-scores among 125 children. A majority of children fell within the normal range: 63 (50.4%) between −1 and +1, 14 (11.2%) between −2 and −1, and 3 (2.4%) between +1 and +2. However, 28 (22.4%) children were underweight (−3 to −2) and 17 (13.6%) were severely underweight (< −3). Overall, 35.9% of the study population was underweight or severely underweight, indicating a considerable burden of undernutrition.

Table 3: Z-Score Distribution for Weight-for-Age (Underweight) (N = 125)			
Weight-for-Age (Z-score)	**Interpretation**	**Frequency (f)**	**Percentage (%)**
> +1 to +2	Normal	3	2.4
-1 to +1	Normal	63	50.4
-2 to -1	Normal	14	11.2
-3 to -2	Underweight	28	22.4
< -3	Severely Underweight	17	13.6

Table 4 shows the distribution of height/length-for-age (stunting) Z-scores among 125 children. Severe stunting (Z-score < −3) was present in 16 (12.8%) children and 23 (18.4%) were stunted (−3 to −2). Most children were within the normal range: 15 (12.0%) between −2 and −1, 58 (46.4%) between −1 and +1, and 9 (7.2%) between +1 and +2. Additionally, 4 (3.2%) children were above normal (> +2). Overall, stunting (including severe stunting) affected 31.2% of the study population, indicating a substantial burden of chronic undernutrition.

Table 4: Z-Score Distribution for Height/Length-for-Age (Stunting) (N = 125)			
Height-for-Age (Z-score)	**Interpretation**	**Frequency (f)**	**Percentage (%)**
> +2	Above normal	4	3.2
+1 to +2	Normal	9	7.2
-1 to +1	Normal	58	46.4
-2 to -1	Normal	15	12
-3 to -2	Stunted	23	18.4
< -3	Severely Stunted	16	12.8

Table 5 presents the distribution of weight-for-height (wasting) Z-scores among 125 children. Severe wasting (Z-score < −3) was observed in 21 (16.8%) children, while 25 (20.0%) were wasted (−3 to −2). The majority fell within the normal range, including 24 (19.2%) between −2 and −1, 38 (30.4%) between −1 and +1, and 11 (8.8%) between +1 and +2. Overweight (+2 to +3) was seen in 4 (3.2%) children and obesity (> +3) in 2 (1.6%). Overall, wasting (including severe wasting) was present in 36.8% of children, whereas only 4.8% were overweight or obese, indicating undernutrition was considerably more prevalent than overnutrition in the study population.

Table 5: Z-Score Distribution for Weight-for-Height (Wasting) (N = 125)			
Weight-for-Height (Z-score)	**Interpretation**	**Frequency (f)**	**Percentage (%)**
> +3	Obese	2	1.6
+2 to +3	Overweight	4	3.2
+1 to +2	Normal	11	8.8
-1 to +1	Normal	38	30.4
-2 to -1	Normal	24	19.2
-3 to -2	Wasted	25	20
< -3	Severely Wasted	21	16.8

Discussion

Among our sample of 125 children, 22.4% underweight and 13.6% severely underweight, i.e. 36% of children had low weight-for-age. The figure is relatively similar though a little less than the results of Allahabad where 36.4 percent of children were found to be underweight (Kumar et al., 2006) [14]. On the same lines, a Vietnamese study on NCHS standards showed that 31.8% of children were underweight (Hien & Kam, 2008) [15] which again is similar to what we saw. This less significant difference can be explained by a higher level of immunization, breastfeeding education and anganwadi-based nutrition programs of recent years, as compared to worse nutrition in the community in older studies. Nevertheless, even with positive changes, our results reveal that over a third of children are still underweight and that they have continued to experience nutritional vulnerability".

On stunting chronic malnutrition, our study depicted 18.4% stunted and 12.8% severely stunted children which amounted to 31.2. This is quite small compared with Allahabad study in which stunting was found to be 51.6 percent in children (Kumar et al., 2006) [14] and also relatively small compared with the Vietnamese findings of 44.3 percent stunting (Hien and Kam, 2008) [15]. This could be attributed to socioeconomic progress, enhancement of maternal education and maternal-child health services over the past years. But we are still more prevalent than the Puruliya tribal study whose stunting is still lower at 17.6% only (Ghos, 1994) [16]. This difference may be because of the environmental, genetic or dietary diversity factors and also sample characteristics. Therefore, despite the fact that chronic malnutrition seems to be decreasing when compared to the older national and international statistics, it still affects almost a third of children in our society.

Concerning waste, which suggests acute malnutrition, we have had 20 percent wasted and 16.8 percent severely wasted children; that is, 36.8 percent of the children had acute malnutrition. This is significantly greater than the Allahabad study whose wasting was at 10.6% only (Kumar et al., 2006) [14] and also larger than the Vietnamese study which had a wasting of 11.9% (Hien & Kam, 2008) [15]. Our findings indicate that the increase is higher, which indicates that there has been recent or current nutritional stress that could be as a result of frequent infections, inadequate complementary feeding, or social economic instability. Previous studies have proposed wasting to be lower mostly than stunting but, in our case, we have shown the contrary where wasting is almost at the same level as underweight and higher than most of the past studies. This implies a change to acute malnutrition as compared to pure chronic deprivation.

Important comparisons are also indicated in our levels of severe malnutrition. In our study, severe stunting (12.8%), severe underweight (13.6%), were almost the same, which is also consistent with West Bengal where similar percentages of the stunted and underweight children were observed (Biswas et al.,

2009) [17] but with much higher proportions (around 48% each). The reduced magnitude of our research could be indicative of better food security and health interventions of the population in the long run. Nevertheless, waste in our study (16.8) was rather high as compared to most of the past reports, which argues in favor of the fact that underweight is a composite indicator that is dependent on both chronic and acute malnutrition. Our results are thus indicative that acute nutritional insults also may be a significant contributor of growth faltering in the current population.

In the interpretation of these findings in terms of the new WHO Child Growth Standards, one should take into consideration that the WHO standards tend to recognize more children as stunted and wasted than the older NCHS reference in that they are optimum patterns of growth under optimal conditions. Therefore, the proportion of waste in our study was rather high, which perhaps in part explains its sensitivity to identify growth deficits in the initial stage. The same has been reported in the past studies in which NCHS and WHO references have been compared, with WHO criteria showing greater proportions of children as malnourished (Hien and Kam, 2008) [15]. Therefore, the burden can be considered large, but the increased identification of at-risk children can be also possible.

The other study that is to be mentioned is that there was coexistence of over nutrition in our outcomes as 3.2% were overweight and 1.6% were obese. In previous research papers, the major emphasis was on undernutrition and overweight in under-five children were reported rarely (Kumar et al., 2006; Biswas et al., 2009) [14,17]. The existence of both under nutrition and over nutrition in our results indicate the new double burden of malnutrition in the developing world that is facing nutritional transition. This implies a shift in eating habits, availability of more energy-rich foods and less physical exercise even by young children.

On the whole, it can be compared to more recent studies wherein it is observed that chronic malnutrition like stunting has indeed reduced over the years, but acute malnutrition is still of a big concern in the current population. The results indicate a change in the prevalent chronic growth failure to a combination of acute undernourishment and premature overnutrition pattern. Thus, routine growth assessments based on WHO criteria are necessary to detect and treat early and as they are more reflective of the lifestyle, deviations to the ideal growth and have helped to identify both nutritional shortfall and surpluses.

Conclusion

The research on growth and development of children under five years and the application of new WHO Child Growth Standards indicated that even though there was a percentage of children in the normal nutritional range, a large percentage of children had some form of undernutrition such as underweight, stunting and wasting with a percentage severely deficient. Early breastfeeding initiation was not common, and majority of the children were in families with low socioeconomic status and most mothers who did not work; this may affect the nutrition and care practices of the child. Both acute and chronic malnutrition and a slight prevalence of overnutrition imply a dual burden of malnutrition in society. On the whole, the results emphasize the necessity of enhanced growth surveillance, enhanced infant and young child feeding habits, and specific nutrition education and interventions to families to enhance the optimal growth and development during early childhood.

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