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CLINICAL PREDICTORS OF GROWTH FALTERING AND NUTRITIONAL DEFICIENCIES IN CHILDREN UNDER FIVE YEARS. A CROSS-SECTIONAL CLINICAL STUDY

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ABSTRACT

Background: Growth faltering and nutritional deficiencies are still playing significant roles in childhood morbidity in developing countries. Timely detection of clinical predictors is important towards avoiding long-term physical and developmental disability in children below the age of five years.

Objectives: To identify clinical predictors of growth faltering and nutritional deficiency in children below the age of five years, who report to a tertiary care hospital.

Methods: 160 children of the age 659 months were reviewed in the cross-sectional clinical study. A structured questionnaire was used to record demographic features, feeding behaviors, socioeconomic status, frequent infections, immunization history, and medical conditions to collect data. Anthropometry was done according to the WHO standards encompassing weight, height/length, and MUAC. When necessary, laboratory tests comprised of hemoglobin and ferritin, vitamin D, and zinc concentrations. Chi-square tests and logistic regression were used as the statistical analysis with the level of significance of $p < 0.05$.

Results: 46.9 percent of the children had growth faltering with most of the abnormalities being stunting (27.5 percent). Nutritional deficiencies were revealed 58.1, iron deficiency anemia (36.2) and vitamin D deficiency (26.2) were the most common. Recurrent diarrhea ($p = 0.001$), recurrence respiratory infections ($p = 0.002$), poor dietary intake ($p < 0.001$), low birth weight ($p = 0.004$) and incomplete immunization ($p = 0.001$) were significant predictors of growth faltering.

Conclusion: Nutritional and infectious factors play a major role in the growth faltering of young children, which is complicated by socioeconomic issues. Preventive measures and remedial actions should be integrated through early detection, better feeding habits, better immunization coverage, and promotion of healthy growth during early childhood to reduce malnutrition.

Keywords: Growth, Malnutrition, Stunting, Infection, Nutrition, Pediatric

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INTRODUCTION

Nutritional deficiencies in early childhood and growth faltering are still of concern in the public health aspects, particularly in the population of the low and middle-income countries, where socioeconomic and dietary burdens and infectious disease burdens are high [1]. Children younger than five years old are an exceptionally vulnerable group since this age is characterized by an elevated rate of physical development as well as neurocognitive growth and metabolic rate [2]. Incomplete nutrition or underlying clinical conditions may result into the stunted growth, micronutrient deficiencies and developmental outcomes in the long run [3]. Malnutrition is a cause of almost half of all deaths of under-five years in the world and the most common proximate outcomes associated with malnutrition are stunting, wasting, anemia, vitamin deficiencies and recurrent infections [4].

Although there has been an improvement in maternal education and immunization coverage, and access to primary health care in Pakistan and other such areas, the growth faltering has remained in place because of multifactorial factors such as poor diet diversity, late complementary feeding, gastrointestinal diseases, frequent respiratory infection and socioeconomic barriers [5]. Early clinical predictors should be identified in order to diagnose

appropriately, implement specific nutritional interventions, and prevent morbidity-related complications in the long-term [6]. An examination of anthropometric indices, non-standard diets, food habits, environmental influences, and medical history can assist clinicians to identify children at risk before it leads to serious cases of malnutrition [7]. However, in most clinical scenarios, growth is not monitored regularly and even delicate warning signs are not observed until complications set in [8].

As such, the systematic evaluation is required to identify which clinical and demographic variables best forecast growth faltering and nutritional deficiencies among young children. The hypothesis of the present cross-sectional clinical research is to examine the most important clinical predictors regarding growth faltering and nutritional deficiencies in children under the age of five years who visit the tertiary care hospitals [9]. This study aims to help in screening, early management procedures and preventive measures in the field of pediatric health by highlighting the most relevant risk factors such as frequent infections, dietary inadequacy, maternal health indicators, socioeconomic and environmental factors [10].

MATERIALS AND METHODS

It was a cross-sectional study which involved a tertiary care hospital in the Pediatric Department across a period of time. Children that were under five years of age and were referred to the outpatient and inpatient units were assessed to determine their growth concerns and nutrition aspects. A sufficient sample size was calculated to cover the target population, and consecutive sampling was used to recruit all the eligible participants. The inclusion criteria included a sample of children aged 6 months to 59 months with full clinical record and parental consent to participate. Children who have congenital anomalies that are known, chronic metabolic disorders, genetic syndromes or other conditions that impact normal growth regardless of nutritional status were not eligible.

Data were collected by use of a structured pro forma that was meant to record the demographic features, feeding history, feeding patterns, immunization status, socioeconomic status and environmental conditions of hygiene. Clinical parameters comprised of detailed medical history that focused on recurrent respiratory or gastrointestinal infections, any incidence of diarrhea, frequency of fever and any previously diagnosed chronic illness. Anthropometric measurements were done according to WHO guidelines, which involved measurement of weight, height/length, mid-upper arm circumference (MUAC) and calculation of weight-for-age, height-for-age, and weight-for-height Z-score using WHO growth standards.

Nutritional deficiencies were both clinically assessed and with laboratory studies, when necessary, e.g., hemoglobin level to assess anemia, serum ferritin, level of vitamin D and stool samples to assess malabsorption. There were also physical appearances such as pallor, changes in the hair, skin abnormalities, edema, and wasting. Measurement bias was minimized by having the pediatric healthcare staff undertake all measurements. The calculations were done and analyzed in SPSS 26. Demographic and clinical variables were summarized using descriptive statistics such as means, frequencies and percentages. Inferential statistics like chi-square test, independent t -test and logistics regression were used to determine significant predictors of growth faltering and nutrition deficiencies. The p-value was less than 0.05 and was regarded as statistically significant. Data collection began with the institutional review board approving the ethical of the research and all the parents or guardians of the children in the research giving informed consent.

RESULTS

A total of (n = 160) children under five years of age were included in the study. The mean age of participants was 28.4 ± 14.7 months, with 54.3% (n = 87) being male and 45.7% (n = 73) female. Overall prevalence of growth faltering was 46.9%, and nutritional deficiencies were identified in 58.1% of the children. The demographic features of the 160 children who are enrolled in the study are shown in Table 1. The age distribution demonstrates that age groups between 13–24 months (28.7%), and age groups between 37-59 months (27.5%) accounted the majority of the participants, which made age groups representative of the early childhood. There was a balanced gender distribution of slightly more than half of the children (54.3% males). The socioeconomic analysis revealed that 58.7 percent of the sample was represented by low-income households which is a crucial contextual aspect since restricted financial resources have a serious impact on dietary variety and accessibility to healthcare. The middle social economic group was at 35 percent and the percent of the higher income family was at 6.3. This profile brings out the fact that children at nutritional risk are largely those that have a socioeconomically disadvantaged background.

Table 2 represents the anthropometric indicators that are applied to determine growth faltering. Age-specific weight measurements revealed that a significant proportion of children (46.2) was in a range of mild to severe underweight conditions, which was an indication of chronic nutritional deficiencies. Height- for-age (stunting) was especially common, as 27.5% were showing moderate to severe stunting implying chronic nutritional inadequacy and recurrent infections. Weight-for-height (wasting), as an indicator of acute malnutrition, demonstrated almost 40 percent of the children were affected. Also, the proportion of 24.3% of the participants who had MUAC below 12.5 cm was used to define children at risk of severe acute undernutrition. Altogether, this table highlights the extent of growth issues in young children, and stunting becomes the most prevalent anthropometric issue.

Table 3 gives an overview of the prevalence of nutritional deficiencies reported in the study population. The most frequent abnormality was iron deficiency anemia, which occurred in 36.2 of children, which highlights the grave nature of micronutrient deficiency among children. Deficiency in vitamin D was observed in 26.2 in spite of the lack of sunlight and poor dietary sources, probably. Protein-energy malnutrition was witnessed in 23.1 which represents the lack of adequate calorie and protein intake. Zinc is relatively lower (17.5%), but of clinical significance since it is related to poor immunity and high predisposition to infection. The general trend of deficiencies proves that various micronutrient deficiencies interact with each other and tend to multiply growth faltering during early childhood.

Table 4 identifies the significant clinical predictors of growth faltering. High levels of growth failure in children with recurring diarrhea (52.0%), recurring respiratory infections (64.0%), were significantly higher than in absence of these conditions, which were significantly represented by p-values ($p < 0.01$). The strongest predictor was inadequate dietary intake with 73.3 percent of the affected children having faltered growth and diet was identified as a central modifiable factor. There were also high associations observed with low birth weight (38.7% and incomplete immunization (54.7%), implying that the weaknesses experienced in their early lives have long-term implications that shape growth patterns. The statistical significance of all the variables is the confirmation that nutritional and infectious factors are critical in predicting the children who are at the greatest risk.

Table 1: Demographic Profile of Children Under Five Years (n = 160)

Variable	Category	Frequency (n)	Percentage (%)
Age Group	6–12 months	32	20.0
	13–24 months	46	28.7
	25–36 months	38	23.7
	37–59 months	44	27.5
Gender	Male	87	54.3
	Female	73	45.7
Socioeconomic Status	Low	94	58.7
	Middle	56	35.0
	High	10	6.3

Table 2: Anthropometric Indicators of Growth Faltering (n = 160)

Indicator	Normal (%)	Mild Faltering (%)	Moderate/Severe Faltering (%)
Weight-for-Age	86 (53.7)	42 (26.2)	32 (20.0)
Height-for-Age (Stunting)	79 (49.3)	37 (23.1)	44 (27.5)
Weight-for-Height (Wasting)	96 (60.0)	33 (20.6)	31 (19.4)
MUAC < 12.5 cm	—	—	39 (24.3)

Table 3: Frequency of Nutritional Deficiencies (n = 160)

Deficiency	Present n (%)	Absent n (%)
Iron Deficiency Anemia	58 (36.2)	102 (63.8)
Vitamin D Deficiency	42 (26.2)	118 (73.8)
Protein-Energy Malnutrition	37 (23.1)	123 (76.9)
Zinc Deficiency	28 (17.5)	132 (82.5)

Table 4: Clinical Predictors Associated with Growth Faltering

Predictor	Growth Faltering Present (n = 75)	Growth Faltering Absent (n = 85)	p-value
Recurrent Diarrhea	39 (52.0%)	21 (24.7%)	**0.001***
Recurrent Respiratory Infections	48 (64.0%)	29 (34.1%)	**0.002***
Inadequate Dietary Intake	55 (73.3%)	28 (32.9%)	**0.000***
Low Birth Weight	29 (38.7%)	14 (16.5%)	**0.004***
Incomplete Immunization	41 (54.7%)	23 (27.1%)	**0.001***

*Significant p-value < 0.05

DISCUSSION

This cross-sectional clinical investigation was an evaluation of clinical predictors of growth faltering and nutritional deficiencies in children under the age of five years, indicating that malnutrition is a significant burden and the impaired growth at early childhood is a multifactorial problem. Almost half of the participants responded with a certain level of growth retardation with the most common anthropometric abnormality being stunting. This trend is consistent with the global and regional statistics showing that stunting has been the most enduring type of chronic malnutrition especially in the

South Asian people where inadequate dietary practices, frequent infections and socioeconomic limitations have been prevalent [11]. The fact that the number of children in low socioeconomic backgrounds is high in this study highlights the role of poverty, food insecurity, and poor access to quality healthcare in influencing early childhood nutritional outcomes [12].

The experiment has shown that nutritional deficiencies were widespread, especially iron deficiency anemia, as well as vitamin D deficiency. These results have been found to be consistent with the existing literature on developing nations having both micronutrient deficiencies and protein-energy malnutrition which cause morbidity [13]. Early childhood iron deficiency is known to affect cognitive development, immunity and physical growth, whereas vitamin D deficiency is known to affect poor bone mineralization, frequent infections and slow motor development. The two or more deficiencies identified in this study are indicative of the poor dietary variety and supplement deficiency among the target population [14].

There were strong associations between growth faltering and clinical predictors including recurrent diarrhea, respiratory infections and inadequate dietary intake. These results support the long-established fact of a correlation between infection and malnutrition, which is also known as the malnutrition infection cycle [15]. The recurring episodes of diarrhea disrupt nutrient absorption, raise metabolic requirements and cause dehydration and electrolyte imbalance, as well, all of which adversely impact development. On the same note, the recurring respiratory infections enhance the catabolic state and suppress the appetite, which is even more degrading to the nutritional state [16]. The fact that inadequate dietary intake is significantly associated with growth failure highlights the importance of early feeding habits such as the introduction of complementary foods on time, dietary diversity, and meal frequency [17].

Another serious predictor of growth faltering was low birth weight. This is in line with a lot of evidence that intrauterine growth restriction and maternal undernutrition are some of the causes of deficits in childhood growth and development in the long run. The low birth weight has lesser physiological reserves and are more prone to infections and nutrient deficiencies in infancy, and thus, end up increasing their chances of failure to thrive [18]. The correlation between the lack of immunization completion and growth faltering highlights the significance of regular vaccinations in the prevention of infections that undermine nutritional issues and general growth potential.

On the whole, the results of this research indicate the need to develop comprehensive child health activities, which will involve both nutritional and infectious causes of growth. During early childhood, it is possible to avert the burden of malnutrition by identifying the at-risk children by routine anthropometric surveillance, maternal education, enhancing the complementary feeding habits, and promoting exclusive breastfeeding [19]. The regular supplementation programs, vaccination, and health education on hygienic practices are essential elements that can interrupt the chain of infection-related malnutrition. Enhancement of its public health policies, access to pediatric healthcare and decrease in socioeconomic inequalities are all crucial towards the improvement of the nutritional conditions and growth outcomes among children under five years [20].

CONCLUSION

This research proved that growth faltering and nutritional deficiencies are also significant pediatric health issues in children below the age of five years, particularly in resource constrained environments. Almost fifty percent of the children were observed to have impaired growth and stunting being the most common type of chronic malnutrition. Nutritional deficiency - especially iron deficiency anemia and vitamin D deficiency were widespread and were strongly related to insufficient dietary and feeding habits, and low socioeconomic status. Clinical variables such as frequent diarrhea, frequent respiratory infections, low birth weight, and incomplete immunization were shown to be good predictors of growth failure, and viral, nutritional, and developmental variables are interconnected.

The results emphasize the necessity to implement child-health programs, which are based on early nutritional evaluation, regular growth screening, maternal schooling, avoidance of infection, and enhanced immunization. The burden of growth faltering is amenable to substantial reductions by strengthening the public health programs, increasing dietary diversity, and setting up improved socioeconomic support systems. Early interventions should be given first priority to achieve maximum physical development, cognitive development, and health outcomes of children in the vulnerable groups.

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