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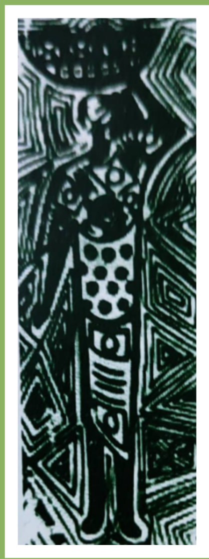

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Does Nutritional Status Influence the Surgical Outcome in Children with Cleft Palate at The University of Port Harcourt Teaching Hospital, Port Harcourt, Nigeria?

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Abstract

Background: Cleft palate, a congenital deformity affecting the roof of the mouth, poses challenges in feeding, speech, and overall health. Surgical intervention is often required, but several factors, including nutritional status, may influence the success of the surgery.

Objective: To evaluate the relationship between the nutritional status and cleft palate surgery outcomes at the University of Port Harcourt Teaching Hospital.

Methods: This retrospective study reviewed medical records of 82 children with cleft palate who had surgical repair between 2018 and 2020. Their nutritional status was assessed using the weight-for-age (W/A) and height-for-age (H/A) SDS, calculated with the NiGrowth application (www.nigrowth.com). Clinical parameters were recorded, including cleft classification, cleft dimensions (width and length), and postoperative outcomes like fistula formation.

Results: The study showed that 19.41% of children were underweight, and 40.2% were stunted before surgery. There were 24 cases (29.3%) of fistula formation, with 4 (4.9%) in underweight patients and 9 (11%) in stunted patients. Significant correlations were observed between weight SDS, height SDS and cleft length ($r = 0.375$, $p = 0.029$), ($r = 0.405$, $p = 0.018$) respectively.

Conclusion: Nutritional status (W/A and H/A SDS) significantly impacts cleft length but does not influence the occurrence of fistula formation post-surgery. The moderate correlation between nutritional status and cleft dimensions highlights the need for a holistic approach to patient management.

Keywords: Cleft palate, Fistula formation, Nutritional status, Surgical outcome, UPTH.

Introduction

Growth and development represent fundamental pillars in paediatrics and medical disciplines concerned with the well-being of children. The primary goal of these disciplines is to ensure that every child grows and develops to their full potential, which is especially critical in the context of congenital conditions that may hinder this process. [1] Among these conditions, cleft palate stands out as a significant congenital deformity that affects the roof of the mouth, leading to a variety of challenges related to feeding, speech, hearing, and overall health. [2-4] The cleft palate can manifest with varying degrees of severity, affecting either or both the primary and secondary palates and often requires surgical intervention to correct. The timing, technique, and outcomes of such surgeries can differ based on numerous factors, including the specific type of cleft, the surgical methods employed, and the patient's overall health and nutritional status. [5-7]

Historically, the absence of early surgical repair options for cleft palate often led to dire consequences for affected infants, including severe undernutrition and, in many cases, death.

[8 - 11] Before modern surgical advancements and the establishment of guidelines for cleft palate management, many children with this condition were unable to survive infancy due to complications related to inadequate nutrition and the inability to feed effectively. [7, 12-14] The introduction of structured surgical guidelines, coupled with advancements in pediatric care, has significantly improved the survival rates and quality of life for children born with cleft palate. These guidelines emphasise the importance of early surgical intervention, optimal nutritional support, and comprehensive multidisciplinary care to address the complex needs of these patients. [9, 10, 15, 16]

One of the critical factors influencing the success of cleft palate surgery and the overall outcomes for the patient is the child's nutritional status before the operation. Nutritional status is often represented by standard deviation scores (SDS) for weight and height, which provide a quantitative measure of how a child's growth compares to standardised growth charts. [17-19] In children with cleft palate, nutritional status is not only a reflection of their overall health but also an indicator of their ability to withstand surgery and heal properly post-operatively. Malnutrition, characterised by low weight-for-age or height-for-age SDS, can have a profound impact on surgical outcomes, including an increased risk of complications such as fistula formation—a condition where an abnormal connection develops between the mouth and the nasal cavity, often requiring additional surgical interventions. [12, 20, 21]

Feeding difficulties are common challenges in children with cleft palate, primarily due to disrupting the normal oral and pharyngeal anatomy. In a typically developed infant, feeding, especially sucking, relies on the ability to create a tight seal in the mouth and generate sufficient intraoral pressure to extract milk from the breast or bottle. However, in infants with cleft palate, these physiological mechanisms are compromised, leading to inefficient feeding, prolonged feeding times, and reduced caloric and protein intake. The inability to feed effectively can result in undernutrition, which not only hampers the child's growth and development but also complicates the surgical repair of the cleft palate. [20, 22- 24]

Given the critical role of nutrition in the perioperative period, there is a strong emphasis on optimising the child’s nutritional status before surgery. [25-28] Early surgical repair of the cleft palate is encouraged to minimise the duration of undernutrition and to support the child’s growth and development. However, performing surgery on a malnourished child presents significant risks, including impaired wound healing, increased susceptibility to infection, and a higher likelihood of postoperative complications such as fistula formation. These risks highlight the importance of ensuring that children with cleft palate are in the best possible nutritional state before undergoing surgery.

Several studies have examined the relationship between preoperative nutritional status and surgical outcomes in children with cleft palate. For example, a study conducted in Uganda found that the mean weight-for-age SDS for patients before surgery was -3.21, indicating severe malnutrition among the study population. [29] Another study in the same region reported that 39% of their patients were undernourished prior to surgery. [30] In contrast, a cohort of 296 patients in the United States showed that 17.5% had various forms of acute malnutrition before undergoing cleft palate repair. [12] These findings suggest significant regional variations in the nutritional status of children with cleft palate, which may be influenced by factors such as access to healthcare, socioeconomic status, and cultural practices related to infant feeding.

The impact of nutritional status on surgical outcomes has also been explored in relation to specific anthropometric measures, such as the height-for-age and weight-for-height SDS. In the aforementioned U.S. study, the odds of fistula formation were significantly associated with height-for-age, with an odds ratio (OR) of

0.78 and a p-value of 0.01, indicating that shorter stature predicted increased risk for this complication. [12] However, weight-for-height did not show a significant association with fistula formation, with an OR of 1.19 and a p-value of 0.25. These findings underscore the complexity of the relationship between growth parameters and surgical outcomes, suggesting that the timing of surgery and the child's overall growth trajectory must be considered in managing cleft palate.

While the Rule of 10 is a widely accepted guideline for cleft lip repair, stipulating that surgery should be performed when the child reaches 10 weeks of age, weighs at least 10 pounds, and has a haemoglobin level of at least 10 g/dL, the optimal timing for cleft palate repair is less standardised. [11, 31] Various studies have proposed different age ranges for palate repair, each with its own set of outcomes. The timing of surgery must balance the need for early intervention to support feeding and speech development with ensuring that the child is nutritionally and physiologically prepared for surgery.

This study aimed to evaluate the relationship between weight and height SDS and specific cleft palate parameters, such as cleft width and length, and the occurrence of fistula post-surgery. By understanding these relationships, we can better tailor surgical timing and nutritional interventions to improve outcomes for children with cleft palate, ultimately supporting their growth, development, and quality of life.

Methods

This retrospective study utilised a comprehensive dataset from the hospital records and anthropometric measurements during cleft palate repair at the University of Port Harcourt between October 2018 and May 2020. The primary objective was to explore whether the nutritional status of these patients, as indicated by their weight and height SDS, had any significant correlation with cleft palate characteristics and surgical outcomes.

Data collection and variables

The study involved a thorough review of medical records of patients diagnosed with cleft palate who had undergone surgical repair. Anthropometric data were meticulously gathered from these records, including the age, sex, weight, and height of the participants. Additionally, detailed clinical parameters related to the cleft palate were collected. These included cleft classification, cleft width, the dimensions of the right and left palatal segments, cleft length, and the cleft palate index, which was derived from the measured palate width and length.

The nutritional status of the participants was assessed by calculating the W/A and H/A SDS using the NiGrowth application, accessible via www.nigrowth.com. This tool applies growth curves recommended by the World Health Organisation (WHO) and the Centers for Disease Control and Prevention (CDC) to generate SDS values. [17 - 19] These scores enabled a standardised assessment of each participant's growth relative to a healthy reference population.

Nutritional Status Classification

Based on the SDS values generated by the NiGrowth application, participants were categorised into different nutritional status groups. For weight, participants with scores between <-3 and -2.00 SDS were classified as undernourished, those with scores between -1.99 and +2.00 SDS were considered to have an adequate weight for their age, and those with W/A SDS > +2 were classified as overweight. Similarly, for height, participants with scores between <-3 and -2.00 SDS were labelled as stunted, those with scores between -1.99 and +2.00 SDS were categorised as having normal height for their age, and those with H/A SDS > +2 were classified as very tall.

Surgical and clinical data

Surgical data, including the type of cleft, age at surgery, and surgical techniques employed, were also recorded. The timing of surgeries was determined based on the optimisation of the patient's health status and their financial readiness. Some patients could undergo surgery immediately after meeting these criteria, while others were eligible for financial support through *Smile Train* waivers, which provided funding for the procedure. The specific surgical techniques utilised for primary cleft palate repair were documented, along with the names of the surgeons who performed the procedures. Postoperative outcomes, particularly the occurrence of complications such as fistula formation and infections, were meticulously recorded.

Data analysis

The W/A and H/A SDS, were the independent variables and the various cleft palate parameters and surgical outcomes were the dependent variables. Statistical analyses were performed using correlation coefficients and regression analysis to achieve this. These methods were employed to explore potential relationships between the SDS values and clinical parameters such as cleft classification, cleft dimensions, and the incidence of postoperative complications. All statistical analyses were conducted with a significance level set at $p < 0.05$.

Results

Demography

Eighty-two children aged 1 – 19 years with a mean age of 6.13±5.84 years were studied. There were 44 (53.7%) females and 38 (46.3%) males (Table I). On average, females had higher median weight and height but lower weight SDS and height SDS compared to males.

Positive correlations were observed between W/A SDS and cleft length (r = 0.375) and between H/A SDS and cleft length (r = 0.405). However, correlations between W/A SDS, H/A SDS and cleft palate index were relatively weak, indicating that these anthropometric measures are more strongly associated with cleft length than with cleft palate index (Table II).

A total of 16 (19.5%) had varying degrees of underweight malnutrition prior to surgery, and 33 (40.2%) were stunted, as shown in Table III.

Table I: Differences in the mean anthropometric and cleft palate dimensions between males and females

	Male	*Female*	*T* -test	*p-value*
Frequency	38 (46.3%)	44 (53.7%)		
Median weight (kg)	14.00	14.70		0.662*
Weight for age SDS	-0.76 ± 1.11	-0.59 ± 1.44	-0.582	0.562
Median height (cm)	87.75	88.95		0.556*
Height for age SDS	-1.44 ± 1.81	-1.12 ± 1.36	-0.949	0.345
Cleft width	10.08 ± 3.62	11.45 ± 4.29	-1.55	0.124
Cleft length	42.25 ± 16.11	42.99 ± 13.72	-0.136	0.894

Table II: Correlation between anthropometric parameters and cleft palate dimensions

		Cleft Length	Cleft Width	Cleft Index
W/A SDS	Pearson Correlation	0.375*	0.014	0.094
	Sig.	0.029	0.898	0.401
	N	82	82	82
H/A SDS	Pearson Correlation	0.405*	-0.118	-0.063
	Sig.	0.018	0.290	0.572
	N	82	82	82

*** Correlation was significant at the 0.05 level (2-tailed). **Correlation was significant at the 0.01 level (2-tailed).**

There were 24 (29.3%) children with fistula formation, and of these, 4 (4.9%) were underweight, but the proportion was higher in the stunting category, where 9 (11%) had fistula formation. Underweight children had 0.33 odds for fistula formation, as against children with normal weight who had an odds of 0.43. Similar odds were found in the height category, as stunted children had an odd of 0.375 for fistula formation, compared to children with normal height who had an odd of 0.44.

Table III: Proportion of children with fistula formation in relation to nutritional status

Nutritional status		No Fistula, n (%)	Fistula, n (%)	Total, n (%)
Weight	Underweight	12 (20.7)	4 (16.7)	16 (19.5)
	Normal weight	46 (79.3)	20 (83.3)	66 (80.5)
Height	Stunting	24 (41.4)	9 (37.5)	33 (40.2)
	Normal height	34 (58.6)	15 (62.5)	49 (59.8)

Logistic regression multivariate analysis for fistula formation

The logistic regression model examined the relationship between W/A and H/A SDS and the likelihood of fistula formation and found no statistically significant associations. W/A SDS (Odds Ratio = 1.225, p = 0.315) and H/A SDS (Odds Ratio = 0.918, p = 0.590) were not significant predictors of fistula occurrence. The model had a Pseudo R-squared value of 0.020, indicating a very low explanatory power, with the likelihood ratio test also not being significant.

Discussion

This study highlights the critical role of nutritional status in the surgical management of children with cleft palate, particularly its influence on cleft dimensions and postoperative outcomes. The finding that 19.5% of patients exhibited various forms of undernutrition before surgery aligns with results from similar studies, such as that by Egbunah *et al.* in Nigeria, [32] where a comparable prevalence was noted. However, our prevalence rate for undernutrition is lower than those reported in studies from the USA [12], England, [33] and Uganda, [29] which reported undernutrition rates of 29%, 38%, and 39%, respectively. Delange *et al.* reported a lower prevalence of underweight malnutrition in children with cleft palates compared to those with cleft lip and palate. [23] These differences may reflect temporal variations in study dates, with higher prevalence rates observed in older studies than those conducted recently. This temporal trend might suggest improvements in nutritional management and early surgical intervention in cleft palate patients over time or improved parents' socioeconomic status in recent times. Another reason for our findings may be the non-homogeneity of our participants, as they ranged from 1 year to 19 years.

Notably, the moderate positive correlations between W/A SDS and H/A SDS with cleft length suggest that children with better nutritional status tend to have longer clefts. This observation, the first of its kind, may be attributed to better-nourished children generally exhibiting more developed tissues, potentially leading to larger anatomical dimensions, including longer cleft palates. However, it is essential to note that despite these correlations, neither W/A SDS nor H/A SDS emerged as significant predictors of cleft length in the multivariate analysis. A larger cohort of participants may reveal the predictive value of the nutritional status of cleft dimensions and, eventually, the outcome of surgery. While nutritional status may influence the overall physical development of a child, it may not directly impact specific cleft dimensions, such as width and/or length. Therefore, although it remains crucial to optimise nutritional status before surgery, other factors play more significant roles in determining the dimensions of the cleft, and this should not delay the surgery. For instance, genetic factors, prenatal development, and the timing of surgical intervention could be more influential in shaping cleft dimensions.

The logistic regression analysis revealed no significant relationship between nutritional status and fistula formation. The absence of a significant relationship between nutritional status and fistula formation highlights the complexity of surgical outcomes in cleft palate repair and the need for a multifactorial approach to improving these outcomes. This finding suggests that factors other than nutritional status, such as surgical technique, postoperative care, and possibly genetic factors, play more critical roles in determining the likelihood of fistula formation. [5,7,34] The lack of a significant association between nutritional status and fistula formation also aligns with previous research indicating that fistula formation is primarily influenced by factors related to the surgical procedure itself rather than the child's preoperative condition.

The study's findings suggest that while good nutritional status may contribute to better tissue development and a longer cleft, it may not directly impact surgical complications such as fistula formation. This observation reinforces the need for a multifaceted approach to improving surgical outcomes, which goes beyond nutritional interventions to address other critical factors that influence the success of cleft palate repair. For instance, optimising surgical techniques, enhancing postoperative care, and understanding the genetic and biological factors that predispose children to complications are all essential components of this approach [4, 12, 29, 35 - 37]

Limitations of the study

Researchers would have preferred to follow up with the participants after the repairs to understand their nutritional parameters post-surgery, but most participants were lost to follow-up.

Conclusion

While weight and height SDS (a proxy for nutritional status) significantly impact cleft length, they do not significantly influence cleft width or the likelihood of fistula occurrence. The original theory that nutritional status correlates with cleft dimensions and surgical outcomes was disproved; there is a need for further research to identify other determinants of surgical outcomes and to explore the role of comprehensive preoperative care, including nutritional interventions, in improving these outcomes.

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