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Association between Feeding Difficulties, Growth Parameters, and Maternal Stress among Children with Congenital Heart Defects: A Cross-Sectional Study

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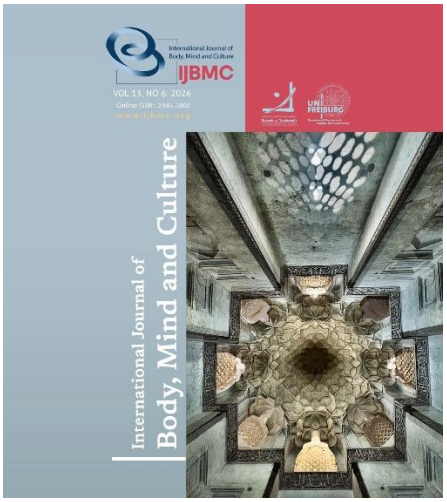

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ABSTRACT

Objective: Feeding difficulties are common in children with Congenital heart defects (CHDs). The purpose of this study was to explore the association between feeding difficulties, growth parameters, and maternal stress in children with CHDs.

Methods and Materials: A cross-sectional study was conducted at the Mosul Center for Cardiology and Cardiac Surgery from October 2025 to February 2026. A non-probability convenience sample of 100 children and their mothers was selected according to the study criteria. Feeding difficulties were assessed using the Montreal Children's Hospital Nutrition Scale, and maternal stress levels were measured with the Parental Stress Scale. Anthropometric measurements, such as height and weight, were recorded for each participant. Growth indicators were evaluated using standard growth charts. Data were analyzed using SPSS (version 27).

Findings: Most children (64%) showed severe feeding difficulties, while 5% had mild and 6% moderate levels. Regarding growth parameters, 51% were underweight, and 46% were stunted, according to the WHO growth chart. Regarding maternal stress, the mean score was 55.42 ± 15.26, reflecting variability in stress levels among mothers. Spearman's rho correlation analysis revealed a statistically significant positive correlation between feeding difficulties and maternal stress (r_s = 0.808, p = 0.01), weight-for-age (r_s = 0.343, p = 0.01), and height-for-age (r_s = 0.385, p = 0.01).

Conclusion: Feeding difficulties are common in children with congenital heart defects and are significantly associated with growth parameters and maternal stress.

Keywords: Feeding Difficulties, Growth Parameters, Congenital Heart Defects, Maternal Stress.

Introduction

Congenital heart defects (CHDs) represent a significant global health concern, with an estimated incidence of approximately 9 per 1,000 newborns worldwide. The condition is associated with several risk factors, including rubella infection, consanguineous marriage, and chromosomal abnormalities (Al-Musawi et al., 2020; Naeem & Ajil, 2025; Rashid & Musehab, 2025). CHDs pose major medical and psychological challenges for families, particularly during the early stages of the child's life (Golfenshtein et al., 2017). Children with CHDs commonly experience feeding difficulties, which may result from poor appetite, swallowing problems, fatigue during feeding, recurrent vomiting, and failure to thrive (Holst et al., 2019; Jones et al., 2021).

Several factors contribute to these difficulties, including the severity of the cardiac defect, delayed transition to oral feeding, feeding refusal, the intensive care environment, and impaired growth (Jones et al., 2021). Growth parameters, such as weight and height, are essential indicators of a child's nutritional status and overall development. These measurements are widely used to identify early growth disturbances and monitor health outcomes (Scheffler et al., 2017).

Feeding difficulties in children with CHDs may lead to malnutrition, underweight, short stature, and weakened immunity, necessitating continuous monitoring and appropriate interventions. Healthcare professionals, particularly nurses, play a crucial role in supporting optimal nutrition and guiding parents in appropriate feeding practices (Mohammed, 2019). Parental awareness and involvement in healthy nutrition management contribute to improved outcomes for children with chronic conditions (Kareem, 2021; Mohammed, 2018). However, mothers often bear the primary responsibility for child care and feeding, which may increase their psychological burden (Dardas et al., 2024; Jamei Khosroshahi et al., 2025; Darvishi et al., 2025).

Feeding difficulties and growth problems may extend beyond physical health and negatively affect maternal psychological well-being. Prolonged hospital stays, failure to thrive, and ongoing caregiving demands can increase parental stress and affect family functioning and quality of life (Robyn et al., 2024). Parents of children with CHDs frequently experience stress due to feeding challenges, intensive care experiences, and the long-term management of the child's condition (Golfenshtein et al., 2017; Hahn et al., 2025).

Although feeding difficulties are highly prevalent among children with CHDs, limited studies have examined their relationship with growth parameters and maternal stress. Therefore, this study aimed to explore the association between feeding difficulties, growth parameters, and maternal stress in children with congenital heart defects.

Methods and Materials

Study Design

The study was cross-sectional. The study was conducted at the Mosul Center for Cardiology and Cardiac Surgery in Mosul, Iraq. The Participants were selected using nonprobability convenience sampling. The study included children with congenital heart defects aged 6 to 36 months and their mothers. The minimum sample size is 100 children with CHDs and their mothers, based on the available study population (100 affected children visiting monthly) and according to a 5% margin of error and a 95% confidence level. Data was collected from October 2025 to February 2026. Inclusion criteria included children within the specified age range (6–36 months) who were present at the study center during data collection, as well as mothers who provided written informed consent. Exclusion criteria included conditions affecting growth or feeding, Down syndrome, recent surgical interventions, and dependence on parenteral nutrition, to ensure sample homogeneity and minimize potential confounding factors. Data collection was carried out using the Arabic versions of the two scales, having obtained permission from the authors of both scales. The questionnaire took about 15 to 20 minutes for each participant to fill out.

Instruments

The study instrument consisted of three main sections: Demographics, the Montreal Children's Hospital Feeding Scale (MCH-FS) (Ramsay et al., 2011), and the Parental Stress Scale (PSS)(Hemade et al., 2024).

Demographic Questionnaire

This section includes the child's age, sex, and type of congenital heart defect, as well as the mother's age, educational level, and family history of congenital heart defect.

Montreal Children's Hospital Feeding Scale

The Montreal Children's Hospital Feeding Scale (MCH-FS) is a standardized 14-item instrument designed to assess feeding difficulties. The total score is calculated by summing all item responses and ranges from 14 to 98, with higher scores indicating greater feeding difficulties. A cutoff score of 45 was used in the present study; scores ≥45 indicate the presence of feeding difficulties, whereas scores ≤45 indicate no feeding difficulties. Severity levels were classified as mild (46–52), moderate (53–58), and severe (≥58). The scale was translated into Arabic using forward and backward translation procedures to ensure linguistic and conceptual equivalence. 12 experts in pediatric nursing established content validity. The instrument demonstrated good internal consistency, with a Cronbach's alpha of 0.845 in the original study and 0.840 in the current study, indicating satisfactory reliability.

Section Three: Parental Stress Scale (PSS)

The Parental Stress Scale (PSS) consists of 18 items designed to measure parental stress, with responses rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The total score ranges from 18 to 90, with higher scores indicating higher stress and lower scores indicating lower stress. A validated Arabic version of the scale was used in the present study. The instrument demonstrated good reliability, with a Cronbach's alpha of 0.91 in the original study and 0.89 in the current study, indicating satisfactory internal consistency.

Anthropometric Measurement

Anthropometric measurements (weight and height) were obtained for all children by the researcher after receiving appropriate training to ensure accuracy and reliability of the measurements. Growth parameters were calculated using Z-scores according to the World Health Organization (WHO) growth standards. The assessed indicators included weight-for-age (WAZ) and height-for-age (Hahn et al., 2025). Values below -2 were classified as underweight or stunted, whereas values ≥ -2 were considered within the normal range.

Data Collection

Data were collected by the researcher to ensure standardization and accuracy of procedures, following prior training in measurement techniques and data collection methods. The study procedures began with clearly explaining the aims and methods to the parents, followed by conducting structured face-to-face interviews using standardized instruments. Written informed consent was obtained before participation, with assurances that participation was voluntary, that the data would be used for research purposes only, and that it would be kept confidential. Body weight was measured with a calibrated electronic medical scale, and height with a medical stadiometer. All equipment was calibrated according to standard guidelines to ensure accuracy. Uniform measurement procedures were followed for all participants to minimize measurement error and enhance reliability. All questionnaires were reviewed before data entry and statistical analysis, and incomplete questionnaires were excluded to maintain data quality and accuracy.

Data Analysis

Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize the demographic characteristics and study variables. The normality of continuous variables was assessed using the Kolmogorov–Smirnov test before conducting inferential analysis. Based on the normality test results and the ordinal nature of some variables, Spearman's rank correlation coefficient was used to examine the relationships between feeding difficulties, growth parameters, and parental stress. The study was designed as a cross-sectional correlational study; therefore, the findings were limited to statistical associations and did not permit causal inference. The level of statistical significance was set at $p < 0.05$, and exact p-values were reported when applicable to ensure scientific transparency. All analyses were performed using SPSS version 27.

Ethical Consideration

Ethical approval was obtained from the Scientific Research Committee, Graduate Studies Department, College of Nursing, University of Baghdad, Iraq (Reference No. 25, dated August 18, 2025), before the commencement of data collection. Mothers were provided with clear and detailed information regarding the study's purpose, procedures, and anticipated benefits. Participation was entirely voluntary, and written informed consent was obtained from all participants before their enrollment in the study. Confidentiality and anonymity were strictly maintained. No names or identifying information were recorded; instead, coded numbers were used. Participants were

also informed of their right to withdraw from the study at any time without any consequences or impact on the healthcare services provided to their children.

Findings and Results

The results showed that the largest proportion of children belonged to the 6–12-month age group, representing 40% of the study sample, with an overall mean age of 18.57 ± 10.31 months. A slight male predominance was observed, with 54% of participants male and 46% female. Among congenital heart defects, ventricular septal defect (VSD) was the most frequently identified, accounting for 31% of cases, followed by atrial septal defect (ASD) at 22%. At the same time, the remaining types were reported at lower proportions in the sample.

Table 1

Distributions of Children according to their Socio – Demographic Characteristics (N=100)

Demographic	Estimate	F	%	Mean	Std. D.
Age	(6 - 12) Months	40	40.0		
	(13 - 24) Months	33	33.0	18.57	10.31
	(25 - 36) Months	27	27.0		
Sex	Male	54	54.0	_	_
	Female	46	46.0		
Types of CHDs	ASD	22	22.0		
	VSD	31	31.0		
	PS	16	16.0		
	TOF	17	17.0		
	PDA	14	14.0		
Total		100	100.0		

F. =Frequency, %=Percentage, Std. Deviation = Standard Deviation, N = Number

In the present study, the majority of mothers were aged 24–29 years, with a mean age of 29.21 ± 7.10 years. Regarding educational attainment, the highest proportion of mothers had a primary education. Concerning family history of congenital heart diseases, most mothers (81%) reported no family history of CHDs.

Table 2

Distributions of Mothers according to their Socio – Demographic Characteristics (N=100)

Demographic	Estimate	F	%	Mean	Std. D.
Mother's age	(18-23) years	23	23.0		
	(24-29) years	31	31.0		
	(30-35) years	25	25.0	29.21	7.10
	(36-41) years	16	16.0		
	(42-47) years	5	5.0		
Mother's educational attainment	Write and read	17	17.0		
	Primary	20	20.0		
	Intermediate	14	14.0		
	Preparatory	15	15.0	_	_
	Diploma	8	8.0		
	Bachelor's	19	19.0		
	Post Graduated	7	7.0		
Family history	Yes	19	19.0		
	No	81	81.0	_	_

F. =Frequency, %=Percentage, Std. Deviation = Standard Deviation, N = Number

The results showed that 64% of children had severe feeding difficulties, 6% had moderate difficulties, and 5% had mild difficulties. In contrast, 25% of the children showed no feeding difficulties. The mean feeding difficulty score was 58.81 ± 20.12. Regarding maternal stress, the overall mean maternal stress score was 55.42 ± 15.26.

Table 3

Distribution of the feeding difficulties and maternal stress (N=100).

Feeding Difficulties	F	%	Mean	Std. Deviation
None	25	25.0		
Mild	5	5.0	58.81	20.12
Moderate	6	6.0		
Severe	64	64.0		
Maternal Stress	-	-	55.42	15.26

F: Frequency, %: Percentage, Std. Deviation: Standard Deviation, N: Number

The study results showed that, based on the weight-for-age index, 54% of the children were underweight and 46% were of normal weight for age. Regarding height-for-age, 52% of the children were stunted, while 48% were of normal height-for-age.

Table 3

Distribution of the Growth Parameters according to WHO – Z score

Growth Parameters		F	%	Z score Mean	Z score Std. D.
WAZ	Underweight	54	51.0	-2.1416	2.18
	Normal weight-for- age	46		46.0	
HAZ	Stunted	52	52.0		
	Normal height-for- age	48	48.0	-2.0156	1.525

F. =Frequency, %=Percentage, Std. Deviation = Standard Deviation, N = Number

The results showed a statistically significant positive correlation between feeding difficulties and maternal stress (r_s = 0.808, p = 0.01), weight-for-age (r_s = 0.343, p = 0.01), and height-for-age (r_s = 0.385, p = 0.01).

Table 4

Spearman's rho correlations among study variables

Variables	1	2	3	4
1-Feeding difficulties				
2-Parental stress	.808**			
3. Z-score length-for- age	.343**	.482**		
4. Z-score weight-for-age	.385**	.466**	.403**	

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

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

Discussion and Conclusion

The results of the present study showed that the majority of children were aged between 6 and 12 months, a range similar to that reported in Amelia et al. (2023). Regarding sex distribution, the current study showed that the percentage of males is higher than that of females. This result is consistent with Al-Musawi et al's

(2020) study. The result also showed that VSD had a high percentage among types of CHDs. These findings align with previous studies (Moniruzzaman, 2025).

The current study also revealed that most mothers are between 24 and 29 years old. This finding aligns with previous research. Mamasoula et al. (2023). Regarding the mothers' education level, the current study found that most mothers had a primary education. This finding aligns with a study conducted in Iran. Amini-Rarani et al. (2021). The results also indicated that 81% of families had no history of CHDs. This result aligns with a study conducted in the Canary Islands (Martínez-Quintana et al., 2021).

The study also showed that 75% of children with CHDs experience feeding difficulties of varying degrees, with severe feeding difficulties being the most common. This result is consistent with previous studies, indicating a prevalence of feeding difficulties ranging from 18% to 83% (Norman et al., 2022).

The study also revealed that children with CHDs exhibit significant growth retardation, characterized by lower weight and height according to the World Health Organization's Z-score. These results are consistent with previous studies (Noori et al., 2017). Several factors contribute to growth retardation in children with CHDs. The severity of the heart defect plays a pivotal role, as more severe forms of CHDs are associated with increased metabolic demands and impaired nutrient absorption (Noori et al., 2017).

The results showed a statistically significant positive correlation between feeding difficulties and children's growth parameters, as measured by weight-for-age or height-for-age. This result is consistent with previous studies that found children with feeding difficulties had significantly lower weight and height compared to children without feeding difficulties and had lower calorie intake (Fitriany et al., 2025). Another study indicates that feeding disorders are common in children with CHDs, along with multiple risk factors, and are associated with growth problems such as low weight and height (Vazzana et al., 2025).

Feeding problems, such as fatigue during feeding, poor appetite, and high metabolic demands, often lead to insufficient caloric intake (Vazzana et al., 2025). Nutritional interventions are essential for improving growth outcomes in children with CHDs. Regular monitoring of growth indicators and nutritional intake, along with tailored nutritional support, can help meet the specific needs of these children (Young et al., 2025).

The findings also revealed a statistically significant positive correlation between feeding difficulties and maternal stress (r_s = 0.808, p = 0.01), indicating that more feeding difficulties are associated with a notable increase in maternal stress levels. This result, consistent with previous studies, demonstrated that feeding difficulties are closely linked to parenting styles and attitudes, leading to increased anxiety and stress due to frequent disagreements during meals and concerns about the child not receiving enough food. Similarly, another study indicated that maternal psychological factors, including stress and anxiety, directly influence feeding practices and the child's response during meals. (Almaatani et al., 2023; Hasbani et al., 2023). Another study conducted by Tabangi et al. (2025) also found that mothers who face challenges during the introduction of solid foods experience higher levels of anxiety and stress, especially when lacking sufficient knowledge or professional support (Tabangi et al., 2025).

Previous studies indicate that family and environmental pressures can worsen this effect. A study by Kadhim et al. (2026) showed that families with children facing feeding difficulties experience higher psychological stress, which hampers parents' ability to manage these issues effectively. Similarly, a study by Mosli et al. (2022) found that increased maternal stress correlates with negative changes in feeding behaviors, potentially creating a vicious cycle of feeding problems and heightened stress (Augustin et al., 2025; Mosli et al., 2022).

The stress faced by parents comes from various situations, including the infant's fragile health and medical issues, changes in their parenting role within the CICU setting, and extended separation from other family members (Wadi & Ajil, 2025). After discharge, parents face illness-related burdens, increased caregiving duties, feeding problems, and the irritable temperaments often shown by these infants. This increased stress negatively affects family dynamics, particularly through poor illness adaptation, less effective parenting practices, reduced quality of life, and overall well-being (Golfenshtein et al., 2017).

Limitations

Several limitations should be considered when interpreting the findings of this study. The cross-sectional design limits the ability to establish causal relationships between feeding difficulties, growth parameters, and maternal stress. The study was conducted at a single center, which may reduce the generalizability of the results. Additionally, the use of convenience sampling may introduce bias and affect the sample's representativeness. The study did not stratify participants by CHD severity, which could have influenced feeding outcomes and growth indicators. Furthermore, multivariable analysis was not performed to control for potential confounding variables, such as socioeconomic status and clinical characteristics. Relying on maternal self-report measures may also introduce measurement bias.

The findings of this study revealed significant links between feeding difficulties, growth parameters, and maternal stress. These results indicate that feeding difficulties are common in children with CHDs and are associated with poorer growth outcomes and increased maternal stress. Early detection of feeding issues is crucial to promote optimal child health. Further research using longitudinal designs is recommended to understand these relationships better.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Declaration of Helsinki, which provides guidelines for ethical research involving human participants. Ethical considerations in this study were that participation was entirely optional.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contribute to this study.

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