MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.36478/makrjms.2024.8.216.220

A Comparative Study of Anthropometric Parameters among Children with Cyanotic and Acyanotic Congenital Heart Disease in a Tertiary Care Hospital

[1]Subhendu Dey, [2]Timmasarthy Yaswanth Kumar, [3]Mukut Banerjee, [4]Sumanta Laha, [5]Rajesh Ranjan and [6]Sayan Bera

[1-6]Department of Pediatric Medicine, Burdwan Medical College Hospital, *Burdwan, West Bengal 713104, India*

OPEN ACCESS

Key Words
Anthropometry, children, congenital heart disease

Corresponding Author
Sumanta Laha,
Department of Pediatric Medicine, Burdwan Medical College and Hospital, Burdwan, West Bengal 713104, India

Author Designation
[1,3,4]Associate Professor
[2]Senior Resident
[5,6]Junior Resident

Received: 20 May 2024
Accepted: 17 July 2024
Published: 19 July 2024

Citation: Subhendu Dey, Timmasarthy Yaswanth Kumar, Mukut Banerjee, Sumanta Laha, Rajesh Ranjan and Sayan Bera, 2024. A Comparative Study of Anthropometric Parameters among Children with Cyanotic and Acyanotic Congenital Heart Disease in A Tertiary Care Hospital. Res. J. Med. Sci., 18: 216-220, doi: 10.36478/makrjms. 2024.8.216.220

Abstract
Impaired nutritional status is a complication that often occurs in children with congenital heart disease (CHD) and prevalence of underweight and stunting varies among cyanotic and noncyanotic CHD. Our study aimed to identify the areas of growth affected in both cyanotic and non-cyanotic congenital heart disease by comparing anthropometric measurements in both types of CHD in children. It was a comparative cross sectional observational study conducted with 52 children from 1 month to 12 years age, both male and female with congenital heart diseases clinically detected and confirmed by investigations divided into two groups(cyanotic CHD 20 child and acyanotic CHD 32 child) for comparison. Study was done in the department of Paediatrics, Burdwan Medical College and Hospital for a period of one year from November 2021 to October 2022.Anthropometric measurements like height/length, weight, head circumference, skin fold thickness were done and Z-scores were calculated for height/length for age, weight for age and weight for height/ length, head circumference and skin fold thickness in both groups and results analysed statistically. We found VSD as the commonest cyanotic CHD while TOF most common cyanotic CHD in our study. A significant number of severely underweight (45% in cyanotic,40.6% in acyanotic group), severely stunted (25% in cyanotic,46.9% in acyanotic group) and severely wasted (15% in cyanotic,6.3% in acyanotic group) children were detected and also microcephaly present in both groups(30% in cyanotic,53.1% in acyanotic group). Severe under-nutrition was found by skin-fold thickness for age Z-score among cyanotic(30%) and acyanotic CHD(28.1%) children. All anthropometric parameters like weight, height, head circumference, skin fold thickness are reduced among CHD patients in different proportions. Weight was found to be more affected than height in both cyanotic and acyanotic groups. Severe wasting is more in cyanotic group, whereas severe stunting is more in acyanotic group. Microcephaly is more prevalent among acyanotic CHD children. However, there is no statistically significant difference in anthropometric profiles of children was detected between cyanotic and acyanoticcongenital heart disease in this study.

INTRODUCTION

Congenital heart disease (CHD) is structural abnormalities of the heart or intra thoracic great vessels occurring during foetal development. CHD is the most common type of birth defect and the leading cause of morbidity and mortality among children with congenital malformations. CHD can be subdivided in non-cyanotic CHD and cyanotic CHD which is also called critical congenital heart disease (CCHD).Impaired nutritional status is a complication that often occurred in children with congenital heart disease (CHD). This malnutrition is multi factorial and often influenced by the feeding difficulties, increased caloric requirements, presence of congestive heart failure, older age at correction and type of heart anomaly. Corrective heart surgery in children with CHD is often delayed in developing countries as a result of limited economic, infrastructure and human resources. While corrective intervention significantly improves nutritional status on short term follow-up, complications arise with long waiting period for surgery. Children with CHD experience early simultaneous decreases in growth trajectory across weight, length head circumference. The simultaneous decrease suggests a role for altered growth regulation in children with CHD[1]. Prevalence of underweight and stunting varies among cyanotic and noncyanotic CHD in different studies[2].The There is a scarcity of literature on the relationship between under nutrition and CHD in children specially from developing countries like India and further research is necessary to get a more comprehensive knowledge of this topic. Our study aimed to identify the areas of growth affected in both cyanotic and non-cyanotic congenital heart disease by comparing anthropometric measurements in both types of CHD.

MATERIALS AND METHODS

Study Type and Design: It was a hospital based comparative observational study with cross sectional design including 2 groups (cyanotic congenital heart disease and acyanotic congenital heart disease) for comparison.

Study Area: Out-patient Department (OPD) and In patient Department(IPD) of Paediatrics, Burdwan Medical College and Hospital

Study Period: One year: November 2021 October 2022

Study Population: The study group consisted of 52 children from 1 month to 12 years, both male and female with congenital heart diseases clinically detected and confirmed by investigations, who have attended OPD or admitted in IPD. Total number of sample 52, cyanotic congenital heart disease 20 and acyanotic congenital heart disease 32

Inclusion Criteria:

- All children from 1 month to 12 years, both male and female who were diagnosed with congenital heart diseases ,either cyanotic or acyanotic by clinical feature and echocardiographic findings attending OPD or admitted in IPD.

Exclusion Criteria:

- Patients who have undergone any surgical intervention for their heart disease.
- Major Congenital malformation,
- Any metabolic or genetic condition, chronic renal, hepatic, respiratory or neurological disease that may affect growth.
- Critically ill children
- Unwilling parents not given consent

Study Methods: The study was conducted after obtaining informed and written consent from the parents of the children and necessary ethical clearances from the Clinical Research Ethical Committee (CREC) of Burdwan Medical College. All cases were evaluated using the following variables age, sex, type of CHD (cyanotic/acyanotic), height/length, weight, head circumference, skin fold thickness. Z-scores were calculated for height/length for age, weight for age and weight for height/ length, head circumference and skin fold thickness . Anthropometric measurements were performed using same equipments throughout the study. Length/Height was measured in centimeters using infantometer (below age of 2 years) and stadiometer and weight in kilograms using digital weighing scale . Measuring the head circumference was done by placing a non stretchable tape around the head through glabella on the forehead and the back of the head (occipital protuberance) and expressed in centimeters. Measurement of skin fold thickness (SFT) was done using skin-fold calliper by pinching the skin apart from the muscles and expressed in millimeters. In this database, weight-for-height, height-for-age weight-for-age are interpreted by using the Z-score classification system. Z score between-2SD to+2SD classified as normal nutrition. Z-score <-2SD= low W/A = low H/A = low W/H classified as moderate and Z-score <-3SD classified as severe under-nutrition (WHO 2006).

RESULTS AND DISCUSSIONS

A total of 52 children with congenital heart disease were selected for the present study aged between 1

Table 1: Weight for Age (WAZ) Z-score among Cyanotic and Acyanotic CHD

Weight for Age (WAZ)	Cyanotic CHD (n = 20)		Acyanotic CHD (n = 32)	
	Frequency	Percentage	Frequency	Percentage
Adequate (Normal + Mildly Underweight)	5	25.0	11	34.4
Moderately Underweight (<-2 Z score)	6	30.0	8	25.0
Severely Underweight (<-3 Z score)	9	45.0	13	40.6
Total	20	100.0	32	100.0
Statistical Inference		Chi square: 0.522 p-value: 0.77		

Table 2: Height for Age (HAZ) Z-score among Cyanotic and Acyanotic CHD

Height for Age (HAZ)	Cyanotic CHD (n = 20)		Acyanotic CHD (n = 32)	
	Frequency	Percentage	Frequency	Percentage
Adequate (Normal+ mildly stunted)	10	50.0	11	34.4
Moderately Stunted(<-2 Z score)	5	25.0	6	18.7
Severely Stunted(<-3 Z score)	5	25.0	15	46.9
Total	20	100.0	32	100.0
Statistical Inference		Chi square:2.503 p-value:0.286		

Table 3: Weight for Height (WHZ) Z-score among Cyanotic and Acyanotic CHD

Weight for Height (WHZ)	Cyanotic CHD (n = 20)		Acyanotic CHD (n = 32)	
	Frequency	Percentage	Frequency	Percentage
Adequate (Normal+ mildly wasted)	15	75.0	26	81.2
Moderately wasted (<-2 Z score)	2	10.0	4	12.5
Severely wasted(<-3 Z score)	3	15.0	2	6.3
Total	20	100.0	32	100.0
Statistical Inference		Chi square: 1.108 p-value: 0.574		

Table 4: Head Circumference for Age (HCAZ) Z-score among Cyanotic and Acyanotic CHD

Head Circumference for Age (HCAZ)	Cyanotic CHD (n = 20)		Acyanotic CHD (n = 32)	
	Frequency	Percentage	Frequency	Percentage
Microcephaly	6	30.0	17	53.1
Normocephaly	14	70.0	15	46.9
Total	20	100.0	32	100.0
Statistical Inference		Chi square: 2.668 p-value: 0.102		

Table 5: Skin-fold Thickness for Age (SFTAZ) Z-score among Cyanotic and Acyanotic CHD

Skin-fold Thickness for Age (SFTAZ)	Cyanotic CHD (n = 20)		Acyanotic CHD (n = 32)	
	Frequency	Percentage	Frequency	Percentage
Adequate (Normal+	8	40.0	13	40.6
Moderate Under-nutrition (<-2 Z score)	6	30.0	10	31.3
Severe Under-nutrition (<-3 Z score)	6	30.0	9	28.1
Total	20	100.0	32	100.0
Statistical Inference		Chi square: 0.022 p-value: 0.989		

month to 12 years. Age wise distribution of children with CHD were divided into age groups of <1year, 1-5 years and 6-12 years. Majority of the children with CHD were pre-schoolers (1- 5 years) 29 (55.8%), followed by 15 (28.8%) in age group of 6-12 years and 8 (15.4%) below the age of 1 year.

(Table 1) shows that in children with cyanotic CHD, 9 (45%) children were found to have weight for age <-3 standard deviation (SD), 6 (30%) between-2 to -3 SD and 5 (25%) children had adequate weight for age. In children with acyanotic CHD, 13 (40.6%) have weight for age <-3 SD, 8 (25%) between-2 SD and-3 SD and 11 (34.4%) had adequate weight for age. Both the groups were comparable in terms of weight for age z score (p value = 0.77).

Height for age z-score among cyanotic and acyanotic CHD is presented in Table 2. A total of 5 (25%) children with cyanotic heart disease had their height for age below-3 SD, 5 (25%) between-2 SD and -3 SD and 10 (50%) had adequate height for age z-score. 15 (46.9%) children with acyanotic heart disease had their height for age below-3 SD, 6 (18.7%) between-2 SD and-3 SD and 11 (34.4%) patients had adequate height for age z score. Both the groups were comparable in terms of height for age z score (p value = 0.286).

(Table 3) shows that a total of 3(15%) children with cyanotic heart disease had their weight for height below-3 SD, 2 (10%) between-2 SD and-3 SD and 15 (75%) had normal weight for height. 2 (6.3%) children with acyanotic heart disease had their height for age below-3 SD, 4 (12.5%) between-2 SD and-3 SD and 26 (81.2%) patients had adequate weight for height z score. Both the groups were comparable in terms of weight for height z score (p value = 0.574).

Head circumference for age z-score among cyanotic and acyanotic CHD is presented in Table 4. Out of the total 20 children in cyanotic CHD, 6 (30%) children had microcephaly and 14 (70%) had normocephaly. In acyanotic CHD 17 (53.1%) children had microcephaly and 15 (46.9%) children had normocephaly. Both the groups were comparable in terms of head circumference for age z score (p value = 0.102).

(Table 5) shows that a total 6 (30) children with cyanotic heart disease had their skin fold thickness for age below-3 SD, 6 (30%) between-2 SD and-3 SD and 8 (40%) had normal skin fold thickness for age. 9 (28.1%) children with acyanotic heart disease had their skin fold thickness for age below-3 SD, 10(31.3%) between-2 SD and-3 SD and 13 (40.6%) had adequate skin fold thickness for age. Both the groups were comparable in terms of skin fold thickness for age z score (p value = 0.989).

In this study we have evaluated the nutritional status and anthropometric profile in children with un-operated cyanotic and noncyanotic congenital heart disease.

Mechanisms for growth deficiency in CHD are multi factorial including associated chromosomal anomalies/genetic syndromes, inadequate nutrition due to feeding difficulties poor nutritional absorption from the digestive tract in chronic congestive heart failure (CHF). Also, increased caloric support is required to sustain the increased myocardial, respiratoryneuro-humoral functions in CHD-related heart failure. Chronic CHF and chronic under-oxygenation in CHD impair cellular metabolism and cell growth, while repeated chest infections demand an increased metabolism[3]. These conditions cause high incidence of nutritional status impairment. Malnutrition in children with CHD has been associated with increased morbidity and mortality as indicated by frequent hospitalization, poor surgical outcomes, persistent impairment of somatic growth increased death.

Among total of 52 children with congenital heart disease in our study, majority were pre-schoolers (1-5 years) 29 (55.8%), followed by 15 (28.8%) in age group of 6-12 years and 8 (15.4%) below the age of 1 year. Okoromah CA *et al.* in their study had similar distribution of cases with maximum 64.3% cases in 0-59 months age group and 23.1% in 60-120 months of age group which is comparable with the present study[3]. In the study by Mondal S *et al*. also majority of the children with CHD 23 (46%) were pre-schoolers (<5 years) followed by 19 (38%) in 5-10 years and 8 (16%) above 10 years[4]. In this study 44.2% of the study subjects were male and 55.8% were female. Clinical presentation were fever 41 (78.4%), breathlessness 39 (75%), feeding problem 12 (18.18%), heart murmur 37 (71.2%), respiratory distress 35 (67.3%) anemia 24 (46.2%) and poor weight gain (40.4%) . In the present study acyanotic CHD (61.5%) outnumbered cyanotic CHD (38.5%). Tetralogy of Fallot was the predominant in cyanotic-CHD group (55%) followed by single ventricle, double outlet left ventricle and double outlet right ventricle involving 10% each and least common types critical pulmonary stenosis, supra cardiac TAPVC and tricuspid atresia involving 5% each. Ventricular septal defect was the predominant in acyanotic-CHD group (50%) followed by atrial septal defect (31.2%) and patent ductus arteriosas (18.8%). In children with cyanotic CHD, 9 (45%) of patients were found to have weight for age <-3 standard deviation (SD) and 6 (30%) of patients between-2 SD and-3 SD. In children with acyanotic CHD, 13 (40.6%) patients have weight for age <-3 SD, 8 (25%) patients falling between-2 SD and-3 SD .

A total of 5 (25%) children with cyanotic heart disease had height for age below-3 SD, 5 (25%) between-2 SD and-3 SD. 15 (46.9%) of children with acyanotic heart disease had their height for age below-3 SD, 6 (18.7%) of patients had their height falling between-2 SD and-3 SD. So stunting is more among acyanotic heart disease group. A total 3 (15%) children with cyanotic heart disease had their weight for height below -3 SD, 2 (10%) falling between-2 SD and-3 SD .2(6.3%) children with acyanotic heart disease had their weight for height below-3 SD, 4 (12.5%) between-2 SD and-3 SD. Wasting is more among cyanotic group. Vaidyanathan B *et al* noted in their article that, under nutrition is a common cause of morbidity in children with congenital heart disease which can be caused by inadequate nutritional intake or absorption, excessive energy expenditure, frequent respiratory infections leading to limitation of growth potential[5] .Hassan BA et al reported that overall prevalence of malnutrition was high in patients with CHD. All anthropometric measurements and levels of biochemical markers of nutritional state were significantly lower in the patients group compared to controls. In patients with acyanotic CHD, stunting was proportionately higher than in cyanotic CHD, while wasting was predominant in the latter[6], which is similar to our study. Out of the total 20 children in cyanotic CHD, 6 (30%) children had microcephaly and 14 (70%) had normocephaly. In acyanotic CHD 17 (53.1%) children had microcephaly and 15 (46.9%) hadnormocephaly. So microcephaly is more prevalent among acyanotic CHD child. A total 6 (30%) children with cyanotic heart disease had their skin fold thickness for age below-3 SD, 6 (30%) falling between-2 SD and-3 SD. 9 (28.1%) children with acyanotic heart disease had their skin fold thickness for age below-3 SD, 10 (31.3%) between-2 SD and-3 SD. Staebel OD *et al,* reported that weight and height are

affected equally in cyanotic patients. Acyanotic lesions especially the septal defect, left to right shunt, affect weight more than height. Acyanotic lesions were related to acute malnutrition whereas cyanotic lesions are related to chronic malnutrition[7].

Mondal Swagata *et al.* found acyanotic malformation were tended to have acute malnutrition while stunting was more severe in children with cyanotic defects. 82% were underweight and 86% were stunted and have statistically significant growth retardation (P<0.001)[8]. Damayanti R *et al.* found out the prevalence of under nutrition in CHD was 51.1%, with 22.3% severe under nutrition. FTT was found in 64.9%, short stature in 49.5% and microcephaly in 37% patients. In acyanotic, weight was affected more than length (72.2% vs 49.3%). In cyanotic, weight and length affected equally (42.9% vs 54.5%)[1]. Irving SY *et al* reported that CHD infants had lower weight, lengthHC z-scores at 3-, 6-9-months of age[9].

CONCLUSION

At the end of the study we found acyanotic heart diseases as more prevalent than cyanotic disease and VSD was the commonestacyanoticheart disease while TOF was found to be the most common cyanotic CHD. Weight was found to be more affected than height in both cyanotic and acyanotic groups. Severe wasting is more in cyanotic group, whereas severe stunting is more in acyanotic group. Microcephaly is more prevalent among acyanotic CHD child. All anthropometric parameters like weight, height, head circumference, skin fold thickness are reduced among CHD patients in different proportions. However, there is no statistically significant difference in anthropometric profiles of children was detected between cyanotic and acyanoticcongenital heart disease in this study.

REFERENCES

1. Sjarif, D.R., S.L. Anggriawan, S.T. Putra and M.M. Djer, 2011. Anthropometric profiles of children with congenital heart disease. Med. J. Indonesia, 20: 40-45.
2. Rubia, B. and A. Kher, 2018. Anthropometric assessment in children with congenital heart disease. Int. J. Contemp. Pediatr.s, 5: 634-639.
3. Okoromah, C.A.N., E.N. Ekure, F.E.A. Lesi, W.O. Okunowo, B.O. Tijani and J.C. Okeiyi, 2011. Prevalence, profile and predictors of malnutrition in children with congenital heart defects: A case-control observational study. Arch. Dis. Childhood, 96: 354-360.
4. Mondal, S., L. Joy, D'Souza, P., 2016. Anthropometric profiles of children with congenital heart disease. Int. J. Pediatr. Res. 3: 577-583.
5. Vaidyanathan, B., S.J. Roth, K. Gauvreau, K. Shivaprakasha, S.G. Rao and R.K. Kumar, 2006. Somatic growth after ventricular septal defect in malnourished infants. The J. Pediatr.s, 149: 205-209.
6. Hassan, B.A., E.A. Albanna, S.M. Morsy, A.G. Siam and M.M.A. Shafie et al., 2015. Nutritional status in children with un-operated congenital heart disease: An Egyptian center experience. Front. Pediatr.s, Vol. 3 .10.3389/fped.2015.00053.
7. Staebel, O.D., 2000. Malnutrition in belgian children with congenital heart disease on admission to hospital. J. Clin. Nurs., 9: 784-791.
8. Irving, S.Y., C. Ravishankar, M. Miller, J. Chittams, V. Stallings and B. Medoff-Cooper, 2022. Anthropometry based growth and body composition in infants with complex congenital heart disease. Clin. Nurs. Res., 31: 931-940.