Nutritional Status and Associated Factors Among Children With Congenital Heart Disease in Selected Governmental Hospitals and Cardiac Center, Addis Ababa Ethiopia.

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Abstract

Background: Children with congenital heart disease are at risk for poor growth and under-nutrition compared with healthy children. Inadequate energy intake, high energy requirement or both of these reasons are thought to be the reason for malnourishment of children with congenital heart disease. Therefore aim of this study to assess the nutritional status of children with congenital heart disease and associated factors in selected governmental hospitals and cardiac center Addis Ababa, Ethiopia.

Method: Institutional based cross sectional study was include 395 samples among children age under15years old diagnosed with CHD. Data was collected with structured questionnaire and chart review. Samples were selected by consecutive sampling method and data was collected by face to face interview. Multivariable regression model was developed after p value <0.25 in the binary logistic analysis then after p value< 0.05 was taken as significant.

Result: A total of 373 children were participated in this study. The prevalence of wasting and stunting was 144(38.6%) and 134(35.9%) respectively. The prevalence of underweight and malnutrition in children under 10years was 143(43.1%). Most of the children were diagnosed with VSD (36.7%). Children age group of 13months-5years were associated with wasting and underweight [AOR=0.434, 95%CI :(0.231, 0.816)] and [AOR=0.360, 95%CI :(0.183, 0.711)] respectively. Children diagnosed with PAH were 1.885 times more likely to be underweight [AOR=1.885, 95%CI :(1.094, 3.246)]. When the hemoglobin level increases by every unit per g/dl the chance to be wasting and underweight decreases by 13.1% and 18.6%[AOR=0.869, 95%CI :(0.792, 0.955)] and [AOR=0.869, 95%CI :(0.792, 0.955)] respectively. The level of SPO2 is associated with stunting and underweight [AOR=0.970, 95%CI :(0.943, 0.998)] and [AOR=0.970, 95%CI :(0.943, 0.998)] respectively.

Conclusion: The prevalence of malnutrition in children with CHD is pretty high. The responsible bodies should act on the accessibility of early treatment; focus on working in multidisciplinary way to prevent malnutrition and its consequences.

Introduction

Congenital heart disease is a defect in the structure of the heart walls and vessels that present at birth(1) Globally around 1.35 million live births are diagnosed with CHD every year(2). It's estimated that around 500,000 children in Africa are born with congenital heart disease every year. In low middle-income countries, the burden of congenital heart disease is vast(3).

Nutrition plays a major role in managing chronic illness. It is one of the major factor affecting recovery of patients after surgical intervention and decreasing the risk of infection in children with congenital heart disease (4–6).

Having high energy requirement, inadequate energy intake decreased mesenteric perfusion, lagged enteral feeding, delayed feeding milestone are some of the factors increase the risk of malnutrition in children with CHD. Also not knowing their nutritional desire and preference are some of the presumptions explained in the studies done to clarify the cause of malnutrition (7,8). In addition to this children who have congenital heart defect have increased resting energy expenditure especially before corrective surgery (9).

Studies show there is a high prevalence of malnutrition in children with congenital heart disease which is as high as 90.4%(10) Malnutrition in children with congenital heart disease has a great impact in increasing the risk of infection which results in poor treatment outcomes. Pre-operative nutritional status affects postoperative outcomes, poor growth, and the high mortality rate is also seen in this group. Nowadays improvements are seen on the management and it is going beyond surgery and medicine gives that attention to growth, development nutrition, and ensuring the quality of life of children with congenital heart disease(11,12)

There is a big difference in the result of the nutritional assessment of healthy children and children with congenital heart disease. A study in India claims that stunting and underweight were 58.72% and 82.53% in children with congenital heart disease(13). Another study done in Nigeria showed the prevalence of malnutrition in children with CHD was 90.4% and 21.1% in healthy children(10).More than half of the children diagnosed with congenital heart disease experience malnutrition in the study done in Hawassa, Ethiopia(14).

Even though there are a lot of researches done about malnutrition in children of Ethiopia there are not enough studies about children with congenital heart disease and their nutritional assessment specifically(14). This study aims to give insight into the impact of this disease on the nutritional status of children with CHD.

The study will have important contribution to design preventive action on malnutrition in children with CHD. The result of this study targets to identify the nutritional status and prevalence of malnutrition in these groups of cases that will help policymakers to plan the use of resource directly for the affected population. Governmental and the non-governmental organization those are responsible for child health will be benefitted from the result of this study in terms of planning for early intervention based on the gaps. The generated results of the study will also be useful for future researchers as baseline data.

The aim of this study was assess the nutritional status of children with congenital heart disease and associated factors in selected governmental hospitals and cardiac center Addis Ababa, Ethiopia 2021

Methods

Study design and setup

Institutional based cross sectional study design was conducted in three governmental hospitals Black Lion Hospital, St. Peter specialized Hospital and yekatit 12 Hospital and cardiac center of Ethiopia. The study was conducted from February 27 to March 25, 2021G.c.

Source Population and study Population

Source population was all children diagnosed with congenital heart disease in a selected institution. And, the study population was children age under 15 years diagnosed with congenital heart disease and have follow up in selected health institutions.

Study Variables

Dependent Variable

- Nutritional status of children with CHD

Independent Variables

- Socio Demographic Characteristics (Age, Sex, Birth order, Parental Education, Income, Religion, Parental Occupation, Residency)
- Child Medical Condition: (Child Illness, Type of CHD (Cyanotic And Acyanotic, Pulmonary Hypertension, Heart Failure, Low Arterial Oxygen Saturation and low hemoglobin)

- Dietary Factor: (Complementary feeding, Feeding Practice(Breast Feeding, Bottle Feeding, Early Weaning) And Difficulty To Take Food/feeding problem)

Operational and Standard Definition

- Children : For this study age group is taken as child who aged under 15
- Dietary diversity: Individual food group taken during the 24 hour
- Adequate dietary diversity: When child have 4 or more food groups dietary diversity.
- Inadequate dietary diversity: When child have less than 4 food groups dietary diversity
- Wasting: WFH Below two standard deviation from median weight-for-Height of a reference population (weight –for-Height < -2SD Z-score) for above 2 years BMI for age < -2SD Z-score) (15).
- Underweight: Below two standard deviation from median weight-for-age of a reference population (weight –for-age < -2SD Z-score.) (15)
- Stunting: Below two standard deviations from median height-for-age of a reference population (height-for-age < -2 SD Z-score)(15)
- Malnutrition: If a child has one among wasting, stunting, underweight, overweight, and obesity.
- Congenital heart defect: major or minor congenital anomalies defined as anatomical structural and functional defect present at birth which was confirmed by pediatricians with echocardiography

Sample Size Determination and sampling Procedure

The sample size was calculated using single proportion formula. It is determined by using the prevalence 63% wasted and 29.8% stunted children with congenital heart disease according to the study done in Hawassa, Ethiopia(14). Based on this assumption, the actual sample size for the study is determined using the formula for single population proportion.

$$n=\frac{(Z\alpha/2)^2 P(1-P)}{d^2}$$

Where Zα/2 = standard normal distribution corresponding to significance level at α = 0.05 or confidence interval (CI), 95% = 1.96

P = prevalence from a study done about severe acute malnutrition is wasting 63% (14)

d= margin of error (5%)

α=0.05

n= minimum sample size

Therefore:

$$n=\frac{(1.96)^2 0.63(1-0.63)}{(0.05)^2}$$

n =358.19……based on the prevalence of wasting

$n = \frac{(1.96)^2 0.298(1-0.298)}{(0.05)^2}$

n =321.45……based on the prevalence of stunting

So as the sample size calculation shows it's better to take the larger number which is

n =358.19

After adding non response rate of 10% of non-response rate the final sample size is 359*0.1=35.9 359+35.9=394.9 approximately 395.

Sampling procedure

Three of the hospitals (TikurAnbessa Hospital, St. Peter specialized Hospital, Yekatit 12 Hospital) and cardiac center of Ethiopia was selected for conducting the research intentionally. These hospitals were selected because they have cardiac follow up clinic and a better patient load as they are referral hospitals. And also cardiac center is the only center for children with heart disease in Ethiopia also it is the only place they get corrective surgery for CHD. Children come to cardiac follow up to the selected areas 3 months prior to the data collection was counted and the proportional allocation was done based on that. Study subjects were selected by consecutive sampling technique.

Data Collection Instrument and Procedures

Before conducting data collection structured questionnaire was prepared after reviewing the literatures. Pretest was done on 5% of the study subjects at a different Hospital who were not included for the final data the tool was modified accordingly. The data was collected by face to face interview for the socio demographic and dietary history data. Also 24 hour recall method was used for detailed history of dietary questions, while child medical history was gathered from medical charts of the child and anthropometric data were measured at the time of data collection.

Data was collected by health professionals (BSc Nurses) who obtained training for the data collection and supervised by the principal investigator and another Nurse. All of them were not working in the institutions where the data was collected

Anthropometric measurement was assessed as follows

- Infants and children under24 months of age had their lengths measured lying down (supine). Heights of children over 24 months of age was measured while standing to the nearest 0.1 cm. Patient positioning was made with the shoulder blades, buttocks, and heels on the vertical backboard.
- Weight was measured in kilograms. Infants or children who were unable to stand alone on the scale, was measured first as an adult stand on the scale and zero the scale with the adult standing on the scale. Then the child was handed to the adult to obtain an accurate measurement of the child. Children who can stand on the weight scale by themselves were measured with light clothing. Weight was measured to the nearest 0.1kg

Data Processing and Analysis

After editing and sorting the questionnaire's it was entered to EPI data version 4.6 and analyzed through SPSS version 25.The descriptive data was presented in tables, charts and texts. Binary logistic analysis followed by multivariable analysis was done to review the factors associated with nutritional status of children with CHD. Variables with<0.25 p-

value on binary was taken to multivariable analysis and variables with < 0.05 p- values was considered statistically significant in multivariable analysis. The anthropometric data was entered and analyzed using WHO AnthroPlus tool whose age is 0 to19 years of age.

Results

Socio demographic characteristics of children with congenital heart disease

There were 373 children participated in this study and among them 50.9% wee females and the male female ratio was (M: F = 0.96:1). Children age 6–15 years accounted for 42.3%. Majority of the participants were come from urban areas 342(91.7%). (Table 1)

Table 1
Socio demographic characteristics of children with congenital heart disease in selected governmental hospitals and cardiac center Addis Ababa, Ethiopia 2021

Variables	Category	Frequency (n = 373)	Percent
Gender	Male	183	49.1%
	Female	190	50.9%
Age	0–12 months	76	20.4%
	13months-5years	139	37.3%
	6-15years	158	42.3%
Relationship with the child	Mother	255	68.3%
	Father	92	24.7%
	Other	26	7.0%
Residency	Urban	342	91.7%
	Rural	31	8.3%
	Total	373	100%
Family size	< 4	309	82.8%
	>=4	64	17.2%
Income	<=5000 ETB	227	60.9%
	>=5001ETB	146	39.1%
Birth order	First order	139	37.3%
	2nd – 3rd	171	45.8%
	4th and more	63	16.9%
Birth interval	>=24 months	214	90.7%
	< 24 months	22	9.3%

Dietary Information

Among 132 children who were breast feeding 83(62.9%) of them breast feed immediately with in the 1st hour delivery. Ninety eight (74.2%) of them are still breastfeeding and 95 (72%) of them has started complementary feeding and 88(66%) use bottle feeding. (Table 2)

Table 2
Information about 0–24 months children with congenital heart disease in selected governmental hospitals and cardiac center Addis Ababa, Ethiopia 2021 (n = 132

Variable	Categories	Frequency (n = 132)	Percentage
Time when the child was first breastfeed	Immediately	83	62.9%
	Within first day	21	15.9%
	Within 3 days	9	6.8%
	More than 3 days	19	14.4%
colostrum	Yes	101	76.5%
	No	31	23.5%
Frequency of breast feeding	>=8 times	86	87.8%
	< 8 times	12	12.2%
bottle feeding	Yes	88	66.7%
	No	44	33.3%
Introduction of complementary feeding	>=6 months	82	85.4%
	< 6 months	14	14.6%

Feeding difficulty was diagnosed in 179(48%) of the children. About 68% of the children get the recommended minimum adequate dietary diversity.

Child Medical Condition

About 130(34.9%) of participants were sick in the past two weeks. Of the 373 participants 138(37%) have pulmonary hypertension and heart failure is found in 26(7%) of them. Corrective surgery was done for 51(13.7%) of children who have participated in this study. Mean age for corrective surgery was 50.8 months. Among children's with acyanotic CHD 129(34.6%) of them were having pulmonary hypertension and 9(2.4%) of children with cyanotic CHD have pulmonary hypertension. (Table 3)

Table 3
Medical status of children with congenital heart disease in selected governmental hospitals and cardiac center Addis Ababa, Ethiopia 2021

Medical condition	Categories	Frequency	Percentage
Type of CHD	Acyanotic CHD	298	79.9%
	Cyanotic CHD	44	11.8%
	Acyanotic plus cyanotic CHD	31	8.3%
Sickness in the last two weeks	Vomiting	30	23%
	Diarrhea	30	23%
	Cough/common cold	54	41.5%
	Other	49	37.6%
Pulmonary hypertension	Yes	138	37%
	No	235	63%
Heart failure	Yes	26	7%
	No	347	93%
Corrective surgery	Yes	51	13.7
	No	322	86.3
Acyanotic CHD*PAH[2]	-	129	34.6%
Cyanotic CHD *PAH[1]	-	9	2.4%

Types of congenital heart disease

Among 373 of study participants 298 (79.9%) have acyanotic CHD and 44(11.8%) of them have cyanotic CHD and the rest 31(8.3%) children diagnosed for both cyanotic and acyanotic CHD at the same time.(see Table3) Among children with acyanotic congenital heart disease VSD takes the biggest portion which was 137(31.8%) followed by PDA 112(26%). And from the cyanotic CHD group TOF 32(40%) is the major one followed by TGA 12(15%). (Fig. 1)

Nutritional status

The prevalence of wasting and stunting was 144(38.6%) 95%CI (33.64%, 43.57%) and 134 (35.9%) 95%CI (31.03%, 40.82%) respectively. Underweight was measured for children aged under 10years and the prevalence was 143(43.1%) 95%CI (37.7%, 48.4%). The prevalence of obesity and overweight in this study was 16(4.3%) 95%CI (2.2%, 6.3%), and 15(4%) respectively. All three types of undernutrition were predominant among children in the age group of 0-12months in which the prevalence's of underweight, stunting and wasting was 46(60.5%), 31(40.8%), and 40(52.6%) respectively. Underweight was predominant in children with acyanotic CHD 111(42%) and in children with cyanotic CHD stunting was more dominant 18(40.9%). (Table 4)

Table 4
Nutritional status of children with congenital heart disease in selected governmental hospitals and cardiac center Addis Ababa, Ethiopia 2021

Variables	Underweight (WAZ<-2) (n = 332)		Wasting (BAZ/WFH<-2) (n = 373)		Stunting (HAZ<-2) (n = 373)	
Sex	Yes	No	Yes	No	Yes	No
Male	74(45.7%)	88(54.3%)	80(43.7%)	103(56.3%)	67(36.6%)	116(63.4%)
Female	69(40.6%)	101(59.4%)	64(33.7%)	126(66.3%)	67(35.3%)	123(64.7%)
Age						
0–12 months	46(60.5%)	30(39.5%)	40(52.6%)	36(47.4%)	31(40.8%)	45(59.2%)
13months-5 years	56(46.3%)	83(59.7%)	45(32.4%)	94(67.6%)	50(36%)	89(64%)
6–15 years	41(35%)	76(65%)	59(37.3%)	99(62.7%)	53(39.6%)	105(66.5%)
Type of CHD						
Acyanotic CHD	111(42%)	153(58%)	117(39.3%)	181(60.7%)	105(35.2%)	193(64.8%)
Cyanotic CHD	15(38.5%)	24(61.5%)	12(27.3%)	32(72.7%)	18(40.9%)	26(59.1%)
Acyanotic + cyanotic	17(58.6%)	12(41.4%)	16(51.6%)	15(48.4%)	11(35.5%)	20(64.5%)
Cyanotic CHD * PAH([1])	4(50%)	4(50%)	3(33.3%)	6(66.7%)	5(55.6%)	4(44.4%)
Acyanotic CHD* PAH([2])	63(53.4%)	55(46.6%)	59(45.7%)	70(54.3%)	55(42.6%)	74(57.4%)

1-cyanotic congenital heart disease with pulmonary hypertension

2-acyanotic congenital heart disease with pulmonary hypertension

Factors associated with nutritional status

Compared to children age 0–12 month, children in the age group 13months-5 year were 56.6% times less likely to be wasted and when hemoglobin level increases by every unit in gram per deciliter the chance of being wasted decreases by 13.1%. Children who were sick in the previous two weeks before the study period were 2.203 times more likely to be wasted. The chance of being wasted increases 1.072 times when the age to getting corrective surgery increases by 1 year.

In comparison to children whose fathers were employed to governmental or non-governmental job, children who had fathers that were merchants were 61.6%less likely to be stunted. The delay in age of the children when getting surgery

increases the chance of being stunted by 1.040 times. The odds of being stunted decreases by 3% when the level of SPO2 increases by 1%. Children who were not bottle feed were 2.993 times more likely to be stunted.

The chance of being underweight decreases by 18.6% when the level of hemoglobin increases by 1g/dl. Compared to children who were not sick children who had sickness in the past two weeks were 1.834 times more likely to be underweight. The level of SPO2 increases by 1% the chance of being underweight decreases by 6.4%. The odds of being underweight decreased 64% in children age 13months-5 years compared to children age 0–12 months and also it's decreased by 56.1% in children 6-10years. Compared to children who had not feeding difficulty children who experience feeding difficulty were 1.744 times more likely to be underweight. Also children diagnosed with pulmonary hypertension were 1.885 times more likely to be underweight (Table 5)

Table 5
Binary logistic regression and multivariable analysis among children with congenital heart disease in selected governmental hospitals and cardiac center Addis Ababa, Ethiopia 2021

Variables	Yes	No	COR (95% CI)	p-value	AOR (95% CI)	p-value
WASTING						
Age						
0–12 months	40(52.6%)	36(47.4%)	1		1	
13 months-5 years	45(32.4%)	94(67.6%)	0.431(0.243,0.765)	0.04	0.434(0.231,0.816)	**0.01***
6–15 years	59(37.3%)	99(62.7%)	0.536(0.308,0.933)		0.684(0.363,1.287)	0.239
Sickness in the last two weeks						
Yes	69(53.1%)	61(46.9%)	2.534(1.633,3.930)	0.00003	2.203(1.367,3.551)	**0.001***
No	75(30.9%)	168(69.1%)	1		1	
Age of surgery	-		1.020(1.005,1.036)	0.011)	1.072(1.001,1.049)	**0.046***
Hgb level	-		0.918(0.844,0.998)	0.045)	0.869(0.792,0.955)	**0.03***
STUNTING						

Discussion

The prevalence of underweight in the present study was 43.1% 95%CI(37.72%, 48.43%) this was relatively similar to a study done at Uganda and Egypt in which the prevalence was 42.5% and 44%respectively(16,17). In contrast the prevalence of underweight in the study done in London was 11% (6). Also the result in this study is higher than the prevalence in a study done in Nigeria which was 20.5% (10).

The prevalence of wasting in the present study is 144(38.6%) 95%CI (33.64%, 43.57%). In consistent with this a study done in Egypt and Nigeria the prevalence was 37.5% ,and 41.1% respectively (10,18). But in contrast to the present study a study in the Chile found only 12.1% (19). The studies in Egypt also founds 6.7%, and 23.8%of the participants to be wasted(16,20) which had less prevalence compared to the present study. A study done in Hawassa Ethiopia reveals that 63% of the study subjects were wasted this is higher compared to the present study(14).

The prevalence of stunting in the present study is 134(35.9%) 95%CI (31.03%, 40.82%). In contrast with this a study in Egypt found 61.9% of the participants to be stunted this shows a big discrepancy with the present study(20). The results

in the study done in Thailand shows less prevalence of stunting when compared with the current study which is about 16%(21).

The prevalence of overweight and obesity in the present study reported to be 4% 95%CI(2.2%,6.3%) and 4.3% this was consistent with the result of the study done in Thailand in which the prevalence's of overweight was 3% (21).

The commonest type of cardiac lesion from the acyanotic group of CHD in the present study was VSD which accounts for 31.8% and from the cyanotic CHD group TOF was the major type which accounts for 40%. Similar to this study done in India, Indonesia, Thailand, Iran, Egypt, Nigeria and Hawassa, Ethiopia which VSD and TOF was the major type of lesions from the acyanotic and cyanotic CHD respectively although there was a difference in prevalence VSD that ranges between (13%-56%) and TOF (10.5%-56%) (10,13,14,20–23). The discrepancy may be explained by the difference in study setups most of the studies were single-center studies so the sample may be small in size to explain the real prevalence.

In the present study child age, being sick in the past two weeks, age at getting surgery, and hemoglobin level was associated with wasting. And stunting was found to be associated with occupation of the parent, bottle feeding, age at time of surgery, and level of SPO2. On the other hand underweight was associated with age, sickness, pulmonary hypertension, level of hemoglobin, and SPO2.

Compared to children aged 0–12 month children aged 13months-5 years were less likely to be wasted in the present study [AOR = 0.434, 95% CI:(0.231,0.816)] likewise a study done in Hawassa Ethiopia also mentioned children under age 1 year are more likely to be malnourished(14). also a study in China revealed that children age less than one years were more likely to be malnourished with high prevalence in the three indicators(24).

Similar to the current study, studies done in India, Egypt, Nigeria and Ethiopia found a significant association between malnutrition and pulmonary hypertension, low SPO2 and low Hgb(10,13,14,18,20,22,25). These reports are in line with our study the plausible explanation for the similarity is as oxygen and hemoglobin are useful in the metabolism of nutrients in a human body so decreasing of this two in the cells may cause disturbance in normal metabolism which may lead to malnutrition.

Compared to children who are not diagnosed with pulmonary hypertension children diagnosed with pulmonary hypertension were 1.885 times more likely to be underweight. This could be explained by that pulmonary hypertension increase energy requirement as the heart works hard to get blood to the lungs and the rest of the body against high pressure in the blood vessels and it also precipitates decreased nutritional intake and interrupts feeding due to the feeling of fatigue and shortness of breath this could lead to malnourishment.

Age at surgery was associated with wasting and stunting in which children having treatment later have a relatively high risk of being malnourished [AOR = 1.072, 95%CI:(1.001,1.049)], and [AOR = 1.040, 95%CI:(1.007,1.074)] respectively. The results were consistent with the study in India, Thailand, and Nigeria older age at corrective surgery was one of the predictor of malnutrition. Different literatures reveals that early corrective surgery found to have a good impact on positive outcomes of nutritional status(21,25,26).

Limitation

The sampling technique in this study was consecutive sampling technique because it's difficult to generalize the result. Using single 24 hour recall method is also another limitation for this study because there will be misinformation or biased response

Conclusion

The prevalence of wasting and stunting among the study participants was 144(38.6%) and 134(35.9%) respectively. Underweight measured for children under 10 years and 143(43.1%) found to experience underweight. Child's age, feeding difficulty, bottle feeding, being sick in the prior two weeks of the study, pulmonary hypertension, level of hemoglobin, level of SPO2 was the factors in this study which were found to be associated with malnutrition.

Hence the prevalence of wasting, stunting and underweight is high in children with CHD in the study settings. Therefore a need to action regarding to early intervention (surgery), giving a focused care for children under age of 12 months and children presented with other comorbidities. This will help decrease prevalence of malnutrition in children with CHD. Studying nutrient deficiency by using different types of dietary assessment techniques and including further laboratory investigations will help in getting a good result to know the severity.

Abbreviations

ASD- Atrial Septal Defect

AVSD- Atrioventricular Septal Defect

BAZ- Body Mass for age Z score

CHD- Congenital Heart Defect/Disease

CoA- Coarctation of Aorta

HAZ- Height for Z-score

MUAC- Mid Upper Arm Circumference

PDA- Patent Ductus Arteriosus

PFO- Patent Foramen Ovale

PAH- Pulmonary Hypertension

PS- Pulmonary Stenosis

SAM-Sever Acute Malnutrition

SD- Standard Deviation

TAPVR- Total Anomalous Pulmonary Venous Return

TGA- Transposition of Great Artery

TOF- Tetralogy of Fallot

TR-Tricuspid Regurgitation

UNICEF- United Nations Children's Fund

VSD – Ventricular Septal Defect

WAZ- Weight for Age Z-Score

WHZ- Weight for Height Z-Score

WHO –World Health Organization

Declarations

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Ethical Consideration

Ethical clearance was obtained from institutional review board of Department of Nursing ,School of Nursing and Midwifery, Addis Ababa University. Support letter was received from Addis Ababa health bureau research and emergency directorate. Official letter of permission was written from the department to the respective hospitals to get permission to carry out the study. Informed verbal consent was obtained from each respondent (parents and guardians) after explaining the purpose and procedure of the study. Name or other personal identifying information were not included in the instrument

Competing interest

Consent for publication

Not applicable

Availability of data and materials

The data sets collected and analyzed for the current study are available from the corresponding author and can be obtained at a reasonable request.

Authors' contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Figures

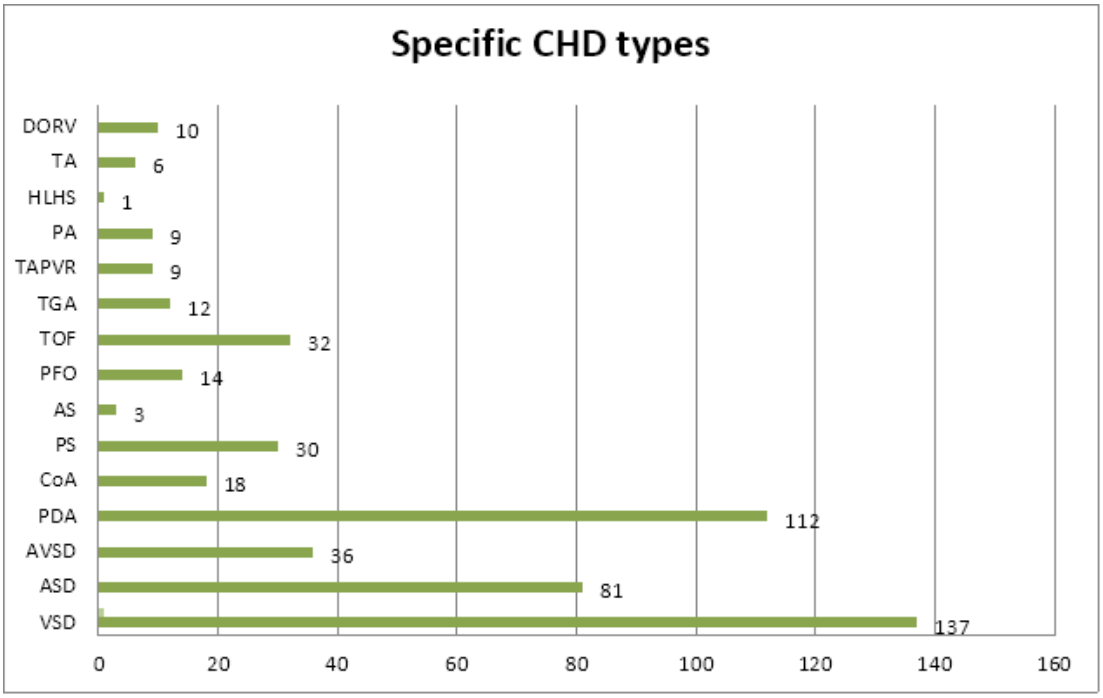

Figure 1

Specific types of congenital heart disease among children with congenital heart disease in selected governmental hospitals and cardiac center Addis Ababa, Ethiopia 2021