

Determinant factors of physical fitness in children with repaired Congenital heart disease

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BACKGROUND

- Advances in the treatment of children with congenital heart disease (CHD) have resulted in notable improvements in survival and life expectancy.
- Attention has shifted from mortality and cardiac morbidity to long-term cardiovascular and psychosocial health.
- Physical fitness is considered one of the most important health markers across the life course since it is a predictor of cardiovascular and all-cause mortality but also of academic performance and psychosocial problems.

Objective To determine factors associated with physical fitness in children who underwent surgery for CHD.

METHODS

Patients	Median age of surgery	Surgery	Catheterization
66 children 62.5% were boys		One stage repair	
Ventricular septal defect (28.8%)	5 months	two palliative pulmonary banding	one residual coarctation
Coarctation of aorta (15.2%),	40 days	no re-operation	two residual coarctation
Tetralogy of fallot (22.7%),	6 months	three aortopulmonary shunt and three underwent re-operation	two significant pulmonary arteries stenosis
Transposition of great arteries (33.3%)	6 days	no re-operation	two significant pulmonary arteries stenosis

- ✓ All children performed physical fitness tests: cardio-respiratory fitness, upper and lower-limb muscular strength, balance, flexibility and speed.
- ✓ Cardiac evaluation was done via echocardiography and cardio-pulmonary exercise test.
- ✓ Determinant factors related to child's characteristics (sex, age, body mass index), child's lifestyle (breakfast habit, fruit and vegetable consumption, dietary fat and sugar propensity, screen time, physical activity, quality-of-life), physical activity motivators/barriers and parental factors (socio-economic status, body mass index) were obtained.

❖ Multivariate (six fitness components together as outcome) and linear regression analyses were conducted, adjusted for CHD lesion type.

Physical fitness assessment

Cardio-respiratory fitness

Progressive 20mSRT shuttle run test



Flexibility

Back-saver sit-and-reach



Balance

Flamingo test



Speed

40m sprint test



Upper limb strength

Handgrip



Lower-limb strength

standing long jump test



RESULTS

- No differences in physical fitness performance nor in any of the tested determinant factors were observed according to CHD lesion type.
- Age and sex were the only factors associated with physical fitness in children with repaired CHD (partial η squared= 0.797, $p < 0.001$; partial η squared= 0.567, $p = 0.008$) respectively.
- Older children performed better than younger in muscular strength and balance and less in cardio-respiratory fitness. Sex and motivations showed an association with some physical fitness components.
- Boys had better cardio-respiratory fitness ($p = 0.007$), whereas girls were better in flexibility ($p = 0.017$) and balance ($p = 0.041$).
- Age, sex and motivators together reached an adjusted R^2 0.444 for speed, 0.484 for lower muscular strength, 0.707 for upper muscular strength, 0.021 for flexibility, 0.149 for balance and 0.382 for CRF.
- Adding other possible determinants did not significantly increase the adjusted R^2 .

Variables	Ventricular septal defect	Coarctation of Aorta	Transposition of great arteries	Tetralogy of Fallot
Fitness components				
VO2 max (ml kg ⁻¹ min ⁻¹)	44.7 ± 3.7	47.0 ± 4.0	46.1 ± 3.4	44.2 ± 3.5
Handgrip strength (kg)	17.3 ± 4.4	15.8 ± 6.3	16.0 ± 6.6	14.7 ± 6.0
Standing long jump (cm)	150.7 ± 21.9	142.8 ± 32.2	143.3 ± 32.3	134.0 ± 29.0
40 m sprint (seconds)	8.0 ± 0.8	8.7 ± 1.3	8.4 ± 1.1	8.6 ± 1.2
Flexibility (cm)	23.0 ± 5.7	23.5 ± 6.9	24.5 ± 4.8	19.7 ± 7.7
Flamingo balance test (attempts)	5.0 ± 4.1	7.0 ± 6.0	4.4 ± 3.0	5.1 ± 3.9
Child's characteristics				
Age (years)	10.9 ± 1.8	10.2 ± 2.1	10.4 ± 1.9	10.5 ± 1.9
BMI z-score	0.018 ± 0.44	0.166 ± 0.47	-0.054 ± 0.31	-0.084 ± 0.44
Child's lifestyle				
breakfast (time/week)	6.7 ± 1.5	7.0 ± 0.0	6.5 ± 1.5	7.0 ± 0.0
Fruit and Vegetable (time/week)	21.7 ± 17.8	15.8 ± 6.0	18.0 ± 9.2	13.6 ± 7.0
Fat propensity (%)	26.3 ± 6.2	28.6 ± 7.7	28.2 ± 9.9	33.6 ± 11.5
Sugar propensity (%)	22.2 ± 7.5	23.0 ± 12.0	23.8 ± 8.0	27.8 ± 8.4
Screen time (h/week)	16.6 ± 9.2	13.4 ± 6.7	16.6 ± 9.0	23.4 ± 11.4
Physical activity (min/day)	39.9 ± 23.5	53.6 ± 30.7	55.3 ± 22.5	38.9 ± 22.8
Parental factors				
socio-economic status	4.9 ± 1.2	4.4 ± 0.8	4.9 ± 1.1	4.8 ± 0.8
Maternal BMI	23.5 ± 3.0	22.4 ± 4.0	24.6 ± 4.6	25.3 ± 5.5
Paternal BMI	24.8 ± 3.8	25.4 ± 2.8	26.5 ± 4.1	27.8 ± 4.7

CONCLUSION

- ❑ Children with different repaired CHD lesions did not differ in physical fitness or activity. Apart from age and sex as non-modifiable determinants, motivation for physical activity seems the only relevant target to increase fitness in this patient group.