A study to develop motor fitness reference values of secondary school children in Sri Lanka

K.S.H.M.V.W.W. Senevirathne

Department of Education, Faculty of Arts, University of Peradeniya, Sri Lanka
DOI: https://dx.doi.org/10.47772/IJRISS.2021.5331

Abstract: **There is a dearth of reference values of physical fitness including motor fitness for secondary school children in Sri Lanka. The objectives of this study are to contribute to the available knowledge concerning the assessment agility (4x10m shuttle run), identifying sex and age-related norms of agility of the secondary school children in Sri Lanka. A quantitative approach was used in this study. Physical fitness assessments were implemented to measure 4x10m shuttle run of 1229 students (638 boys and 591 girls) which was a randomly selected sample in the Kandy District. All the data were computed and analyzed to formulate test norms as percentile values, stratified by chronological age groups separately for boys and girls. All the calculations were performed using SPSS vs. 17 for windows. revealed that P5 of the 4x10m shuttle run time of age 17 boys were very low comparing to other younger age groups. But at the end of the higher performance levels such as P75, P90 and P95, age 17 boys are performed better than their younger counterparts. This is an unusual pattern. The performance of girls of 4x10m shuttle run which is indicate that there are clear differences between age groups. Age 11 girls perform at a low level of agility as the normal and it is increased up to age 17 category gradually. The lowest P5 of boy's 4x10m shuttle run test performance is 14 seconds and the highest P5 is 13.25 seconds. Meanwhile, lowest P95 of boy's 4x10m shuttle run test performance is 11.7 sec. and the highest P95 is 9.7 sec. According to the graphs the lowest P5 of girls' 4x10m shuttle run test performance is 15.7 sec. and the highest P5 is 14.7sec. Furthermore, lowest P95 of girls' 4x10m shuttle run test performance is 12.3 sec. and the highest P95 is 11.3 sec. These norms are identical for some specific population. The agility levels of Sri Lankan children (both boys and girls) are not in the range of poor range. They are slightly different with the USA and European norms. However, we cannot say agility level of Sri Lankan boys and girls are not in a satisfactory level compared to such as USA standards, because these figures are normative base values**

Key words: **4x10m Shuttle Run, Reference Value**

I. INTRODUCTION

There are a lot of scientific evidences to demonstrate that physical fitness reduces the risk of morbidity and mortality from a number of chronic diseases (Biddle et al, 2004). The recognition of the importance of physical fitness for optimal health has led to an increased interest in the study of different aspects of physical fitness. The overweight and obesity prevalence among children in Sri Lanka show different ranges with provincial and gender variations; among boys and girls between 8 and 10 years this was 4.3% and 3.1% respectively and obesity prevalence among primary schoolchildren in Colombo district is 5.1% in 2008 (Thilakarathne and Wijesinghe, 2011; Wickramasinghe et al, 2004; Medical Research Institute of Sri Lanka, 2002).There were 3.8 million adolescents in Sri Lanka (2013) accounting 19% of population. Associated risk behaviors not only influence morbidity and mortality of adolescents, but also have long –lasting impact in determining future health and fitness (Danansuriya et al, 2013). Motor fitness is one of the major components of the health-related fitness.Motor fitness refers to components that are thought to improve the ability to learn and perform motor skills and include balance, coordination, agility, and speed. Many refer to this component as skill-related or performance-related fitness. The acquisition and improvement of motor skills is often a primary focus of physical education and youth sports programs, since it is assumed that this foundation provides a basis for the maintenance of active lifestyles over time (Welk & Meredith (Eds.) (2008).

There is a dearth of reference values of physical fitness including motor fitness for secondary school children in Sri Lanka. The objectives of this study were to contribute to the available knowledge concerning the assessment 4x10 m shuttle run and identifying sex and age-related reference values for agilityof the secondary school children in the Kandy district in Sri Lanka and to compare these values with other similar studies.

Author came across two major conceptual frameworks which were relating to physical fitness concept namely Consensus Guidelines Model (Bouchard & Shephard (1994) for Health related physical fitness and Institute of Medicine (IOM) Model (USA). These two models comprehensively discussed the relating factors to the Health Related physical Fitness (HRPF) concept and furthermore these models describe concept of HRPF under sub themes of morphological, muscular, motor, cardio respiratory, and metabolic fitness. Before 1994 there was no consensus among the sports scientists around the World on a concept of HRPF. To fulfill this need sports scientists and physical educationists gathered at Toronto, Canada in 1994 for landmark consensus conference on physical activity, fitness, and health led to the creation of a detailed conceptual framework for health-related fitness (Bouchard & Shephard, 1994).This model also named as a Toronto model because well reputed physical educationists and sports scientists agreed and develop this

model at the world forum in Toronto, Canada in 1994. (Figure 01)

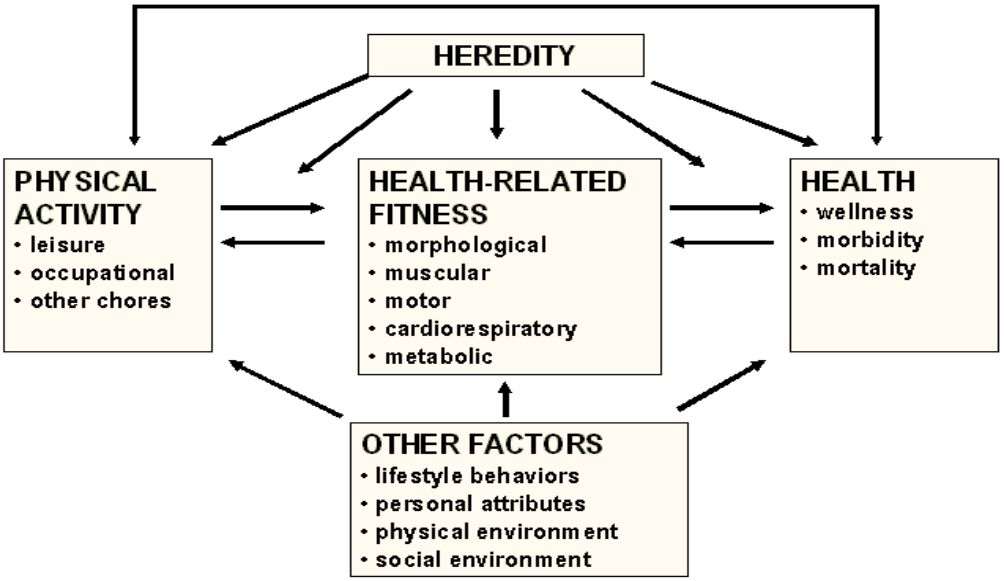

Figure 01: Consensus Guidelines Model (1994) - (Bouchard & Shephard 1994)

The above model considers the impact of heredity on HRPF and proposes different dimensions or components of physical fitness (morphological, muscular, motor, cardio respiratory, and metabolic).The model includes different dimensions than proposed by Caspersen et al. (1985), but this is because it takes a broader approach with regard to the concept of health-related fitness. This model was used as a theoretical framework of this study.The model also defines five main components of health related fitness:

1. A morphological component (body mass for height, body composition, ubcutaneous fat distribution, abdominal visceral fat, bone density, flexibility);
2. A muscular component (muscular power, muscular strength, muscular endurance);
3. A motor component (agility, balance, coordination, speed of movement);
4. A cardiorespiratory component (submaximal exercise capacity, maximal aerobic power, heart functions, lung functions, blood pressure); and
5. A metabolic component (glucose tolerance, insulin sensitivity, lipid and lipoprotein metabolism, substrate oxidation characteristics) (Bouchard and Sheppard, 1994; Pate, 1988).

II. MATERIALS AND METHODS

A quantitative approach was used in this study. A cross sectional survey method was adopted to measure 4x10m shuttle run test of 1229 students (638 boys and 591 girls) which was randomly selected sample in the Kandy District. A Multi-stage sampling method was adopted to select this student sample aged between 11 years and 17 years. To ensure standardization of data collection six physical education teachers thoroughly trained as data collectors through training workshop. Well known Agility test (4×10 m shuttle run test)was used in this study. There are various types of agility tests such as 'Change of Direction and Acceleration Test (CODAT), Illinois Agility Run (IAR) and 4×10 m shuttle run. In this study 4×10 m shuttle run was used to measure children's agility. The agility test indicates an assessment on the speed of movement, agility and coordination (Ortega et al (2012). In this study 4×10 m shuttle run was assessed on the non-slippery open ground.

Two parallel lines were drawn on the floor 10 m apart, for the running and turning (shuttle) test at maximum speed (4×10 m). In the start line there is one sponge and in the opposite line, there are two sponges. When the start is given, the child (without sponge) runs as fast as possible to the other line and returns to the starting line with the sponge, crossing both lines with both feet. The sponge is changed by the sponge in starting line.

Then goes back running as fast as possible to the opposite line and change the sponge and run back to the starting line. The tester showed the right performance. Two trials were performed and the best time was scored. The test stops when the child crosses the finishing line with one foot. The child should not slip or slide during the test. Therefore, a slip-proof floor was used.

The copies of information letters, physical activity readiness questionnaire and consent form were sent to schools for distribution to relevant parents/ guardians of students for their signatures to give the consent for their children to participate. Students that returned their completed parental consent forms with completed physical activity readiness questionnaire were

invited to participate. The physical activity readiness questionnaire, which was administered to parents was aimed at obtaining awareness data on the levels and history of health condition of their children to make inclusion for the study . This questionnaire was adapted from revised version of the Physical Activity Readiness Questionnaire (PAR –Q and You, 1994) owned by the Canadian Society for Exercise Physiology. The result was scored in Seconds with one decimal.All the data were computed and analyzed to formulate test norms as percentile values, stratified by chronological age groups separately for boys and girls. All the calculations were performed using SPSS vs. 17 for windows.

III. RESULTS

Table 1 shows the normative values of 4x10m shuttle run test of age categoriesfrom11 to 17 years for the Sri Lankan secondary school students, as it was done in age categories, it was classified according to sex and age expressed in percentiles from 5 to 95.

Age		P5	P10	P25	P50	P75	P90	P95
11yrs	Male	13.8755	13.5070	12.9025	12.3300	11.9000	11.4430	11.2080
	Female	15.2450	14.6900	14.3950	13.5800	12.7450	12.3600	12.1000
12 yrs	Male	13.4680	13.1640	12.6100	11.7900	11.3600	10.9900	10.5760
	Female	15.2360	14.6900	14.0300	13.4800	12.7500	12.1200	11.7460
13 yrs	Male	13.6440	13.0600	12.4000	11.7900	11.3500	10.9100	10.8040
	Female	15.5010	15.1520	14.1425	13.3450	12.2975	11.6070	11.3840
14 yrs	Male	13.3190	12.9000	12.1125	11.5700	10.9925	10.3810	10.2320
	Female	15.7610	15.2420	14.7500	13.5550	12.8400	12.1030	11.3840
15 yrs	Male	13.2000	12.9000	11.7775	11.3300	10.9000	10.2880	10.1780
	Female	15.6450	15.2740	14.8700	14.2000	13.2050	12.5100	11.7260
16yrs	Male	13.6000	13.3860	11.9575	11.2300	10.6725	10.2010	10.0805
	Female	14.7940	14.7480	14.1300	13.5000	12.3800	11.6540	11.2040
17yrs	Male	14.0275	13.6600	12.6600	11.5850	10.4275	9.9600	9.7750
	Female	14.8720	14.7620	14.0000	12.7800	12.0000	11.5380	11.1000

Table 1: Normative values of 4x10m shuttle run test of age categoriesfrom11 to 17 years

According to the above percentile table boys performed better than girls in agility test (4x10 m Shuttle Run) in all the age categories. It is also revealed that the performance of the 4x10m shuttle increased according to their physical growth pattern and not significant contradiction with growth.

Figures 2 and 3 illustrate the performance of 4x10m shuttle run (agility test) norms of boys and girls according to their age category.

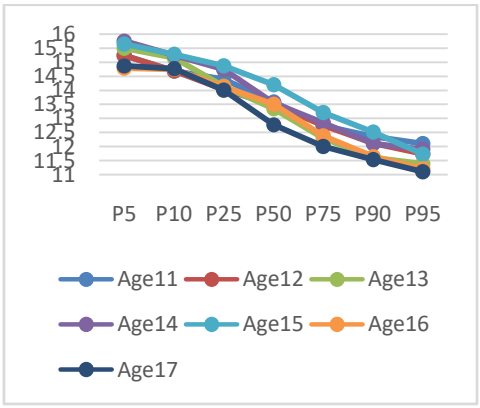

Figure 2: A Comparison of agility test norms of boys

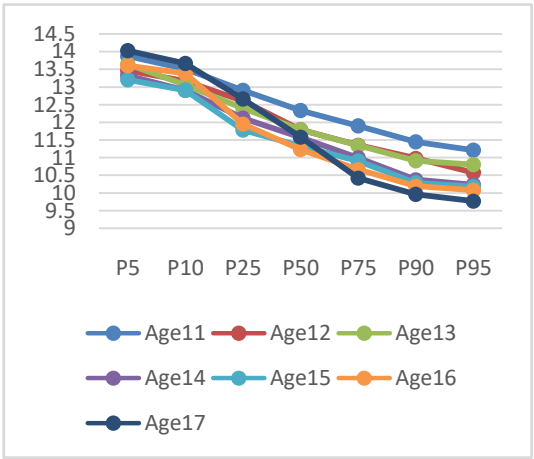

Figure 3: A Comparison of agility test norms of girls

Figure 2 and 3 revealed that P5 of the 4x10m shuttle run time of age 17 boys were very low comparing to other younger age groups. But at the end of the higher performance levels such as P75, P90 and P95, age 17 boys are performed better than their younger counterparts. This is an unusual pattern. Figure 2 shows the performance of girls of 4x10mshuttle run which is indicate that there are clear differences between age groups.

Age 11 girls perform at a low level of agility as the normal and it is increased up to age 17 category gradually. The lowest P5 of boy's 4x10m shuttle run test performance is 14 seconds and the highest P5 is 13.25 seconds. Meanwhile, lowest P95 of boy's 4x10m shuttle run test performance is 11.7 sec. and the highest P95 is 9.7 sec. According to the graph 43 the lowest P5 of girls' 4x10m shuttle run test performance is 15.7 sec. and the highest P5 is 14.7sec. Furthermore, lowest P95 of girls' 4x10m shuttle run test performance is 12.3 sec. and the highest P95 is 11.3 sec.

IV. DISCUSSION

Finding of this 4x10m references constructed the school children lives in the Kandy distract of Sri Lanka. The other limitation of this study is the sample size consisted of 1229 (both boys and Girls).Therefore, to established Sri Lanka National Norms the sample size is not enough and it need a large sample. The findings of this study differ with similar studies especially in European Union studies (Kolimechkov, S., Petrov, L., & Alexandrova, A. (2019).

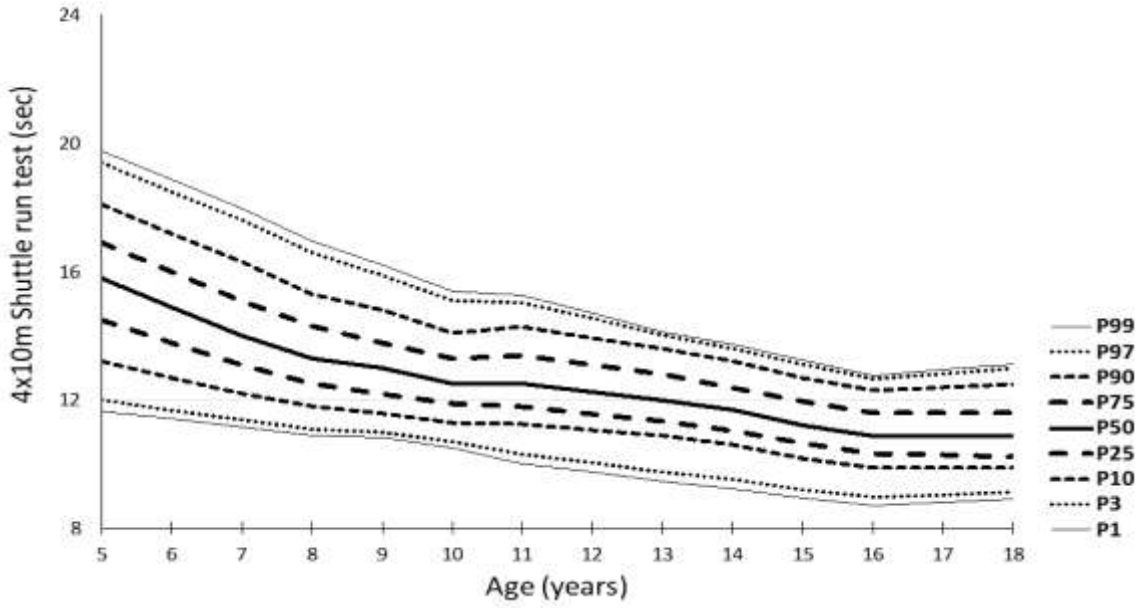

Figure 4: Alpha-fit test battery norms for children and adolescents from 5 to 18 years

According to the above figure 4 it can be identified the normative value deference between two studies .Meanwhile, 4x10m shuttle run is a valid and trustworthy measure, with the advantage of being used to evaluate a large number of participants simultaneously(Castro-Piñero J, Artero EG, España-Romero V, Ortega FB, Sjöström M, Suni J, et al. 2010).Another advantage is the motivational aspect, because it involves running activity, which is considered to be an attractive activity among children. In clinical practice, field tests are more viable because they do not require high cost equipment and are simpler to be applied, because tests performed on a treadmill, for instance, depend on the child's motor adaptation.

V .CONCLUSION

It can be concluded that although the agility levels of Sri Lankan children (both boys and girls) are not in the range of poor range. They are slightly different with the USA and European norms. However, we cannot say agility level of Sri Lankan boys and girls are not in a satisfactory level compared to such as USA standards, because these figures are normative base values. These norms are identical for some sp population. It can be recommended that agility fitness c objectively assessed by tests conducted in laboratory, but the need of expensive equipment limits its use in school environment. In this context, field tests might be an alternative for assessing agility fitness in school children, due to its low cost and its easy applicability, with the advantage that a big number of children can be assessed simultaneously.

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