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Research Article

Reference Values and Prediction Equation for Six-Minute Walk Distance in Children Aged 6-12 Years

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ABSTRACT

The Six-Minute Walk Test (6MWT) is a self-paced, inexpensive sub-maximal exercise test used as a reliable and valid measure of exercise capacity in children and adolescents. The American Thoracic Society has recommended establishment of specific reference values for Six-Minute Walk Distance (6MWD) for each population in various age groupings and ethnicities. However, limited information exists on reference values for different age groups in Nigeria. This study was designed to generate reference values for apparently healthy Nigerian children, aged 6-12 years. . This cross-sectional study involving 334 apparently healthy Nigerian children was approved by the appropriate Health Research Ethics Committee. Their physical and selected physiological characteristics were measured and determined, as appropriate. Each participant had a single trial of the 6MWT and distance covered was recorded. Data were analysed using both descriptive and inferential statistics at $p < 0.05$. Results showed the mean 6MWD of all participants was 504.38 ± 66.16 m. The males had a significantly higher 6MWD. Age, weight and height, correlated significantly with the 6MWD. Prediction equations were derived from the physical characteristics of the children for 6MWD. Height and BMI were found to be significant predictors of 6MWD in all the participants. Percentiles and quartile deviations were also reported. The outcome of this study provided the reference value of 456m-506m for the Six-Minute Walk Distance among the apparently healthy Nigerian children aged 6 to 12 years. The prediction equation derived in this study has both clinical and field usefulness with regards physical performance by children of this age-range.

Keywords: *Six-Minute Walk Distance, Reference value, Prediction Equation*

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INTRODUCTION

Evaluation of functional exercise capacity in patients was borne out of the understanding of the International Classification of Functioning, Disability and Health (ICF) model of health (Ubuane et al, 2018). The ICF model of health explains that diseases or injuries not only results in anatomical and physiological derangements but also in activity limitations and participation restriction (WHO, 2002). It was therefore argued that to achieve the highest level of patient care, it is important to pay attention to the evaluation and management of variables that may contribute to activity limitation and participation restriction (Barron et al., 2012; Wensel et al., 2013; Malhorta et al., 2016). One of such variables is Functional Exercise Capacity, also commonly referred to as Exercise Capacity (Bui et al, 2017).

Functional exercise capacity is a fundamental component of physical fitness, often measured in healthy and diseased populations (Bohannon and Crouch, 2017). It is defined as the ability to carry out daily activities, objectively quantified as the maximal oxygen consumption (VO_2 max), during a maximal-effort cardiopulmonary exercise test (American Thoracic Society, 2002). Several field and laboratory methods

exist for the objective evaluation of functional exercise capacity, among which the Cardiopulmonary Exercise Test (CPET) is said to be the gold standard (Burnett et al., 2013; Ubuane et al., 2018). It specifically provides information concerning physical limitation, disease progression and responsiveness to treatment (Almeri et al, 2009). The CPET, although a sensitive and specific laboratory test, is highly sophisticated, costly and time consuming, requiring specially trained personnel and complex data analysis, thus rendering the test readily inaccessible (Bui et al, 2017; Ubuane et al, 2018).

The 15-Minute Run test (15MRT) was developed as an alternative to the CPET in 1963 (Balke, 1963). This was later modified by Cooper into the 12-minute Run Test (12MRT) (Cooper, 1968). The Cooper's 12MRT was again modified into the 12-Minute Walk Test (12MWT) based on studies carried out by Spiro et al, (1975) and McGavin et al, (1976). Butland and his colleagues (1982), considered the 12MRT to be time consuming both to the observer and the individual being tested and also causing a great deal of fatigue to the individual being tested. This consideration led to a subsequent development of the 2-Minute Walk Test (2MWT) and the 6-

Minute Walk Test (6MWT) (Butland et al, 1982). Available evidences proved the 6MWT to be a better measure of exercise capacity when compared with the rather lengthy 12MWT and the poor discriminatory 2MWT (Ubuane *et al*, 2018).

The Six-Minute Walk Test (6MWT) is a self-paced, inexpensive sub-maximal exercise test used in objectively quantifying exercise capacity in clinical populations by measuring the distance an individual can walk in six minutes (American Thoracic society, 2002). The sub-maximal nature of this test enables it to closely reflect an individual's ability to perform activities of daily living (Nery et al, 2010). Following the development of the 6MWT, its use was restricted mainly to the adult population with chronic cardiovascular and airway disorders (Guyatt et al, 1985). Research in recent years has however extended the utility of the 6MWT beyond the cardiopulmonary domain, to include individuals with metabolic, haematologic, neuromuscular, rheumatologic, psychiatric, renal and chronic infectious disorders (Mandrusiak, 2009; Adedoyin et al., 2010; Lammers et al., 2011; Bartel et al, 2013; Andrianopoulos et al., 2015).

Earliest studies on the use of the 6MWT on paediatric subjects were carried out by Gulman et al (1996) and Nixon et al (1996) involving Dutch and American children respectively. The 6MWT has since been increasingly used in children because it is easy to administer, better tolerated and it closely reflects activities of daily living than other exercise tests (Saad et al, 2009). Originally, the 6MWT was used only in children with cystic fibrosis and end stage cardiopulmonary disorder but it is now being utilized in children and adolescents living with other chronic disorders such as congenital heart disease, end-stage renal disease, obesity, cerebral palsy, HIV infection, hemophilia, spina bifida, juvenile idiopathic arthritis and children awaiting heart and lung transplants, to assess disease severity, response to treatment and predict patient's prognosis (Nixon et al, 1996; Paap et al., 2005; Almeri et al, 2009; de Groot and Takken, 2011; Bartel et al, 2013; Sanyahumbi et al, 2017; Zuk et al, 2017). It is also said to be a reliable and valid measure of exercise capacity in children and adolescents (Klepper and Muir, 2011) as well as in detecting clinically meaningful changes in patients (Almeri et al, 2009).

The American Thoracic Society recommended an establishment of specific reference values for six-minute walk distance for each population in various age groupings and ethnicities (American Thoracic Society, 2002). Reference values on 6MWT has been established in various populations, based on the standardized guidelines by the American Thoracic Society including Nigeria, Hongkong, Brazil, Chile, Colombia, Spain, Uruguay, United States America respectively (American Therapist Society, 2002; Tsang et al. 2005; Chetta et al., 2006; Geiger et al., 2007; Li et al., 2007; Lammers et al., 2008; Priesnitz et al., 2009; Saad et al., 2009; Casanova et al., 2011, Tonklang et al., 2011; Klepper and Muir, 2011; Gatica et al, 2012; Ulrich et al., 2013; Mbada et al., 2015). A review of the literature further revealed availability of measured values or prediction equations for the 6MWT in apparently healthy children in China (Li et al, 2007); United Kingdom (Lammers et al, 2008); Tunisia (Saad et al, 2009); Chile (Gatica et al, 2012); Turkey (Kanburoglu et al, 2014); United States of America (Klepper and Muir,

2011); Thailand (Tonklang et al, 2011), India (D'silva et al, 2012), Belgium (Geomans et al, 2007), Switzerland (Ulrich et al, 2013); Saudi Arabia (Rahman and Alnegimshi, 2014); Brazil (Priesnitz et al, 2009) and Italy (Vandoni et al, 2018). Conversely, no such 6MWT reference values for children, particularly those aged 6-12 years is available in Nigeria. Considering that reference values extrapolated from the Western population may not be applicable to Africans due to the influence of demographic, anthropometric, psychosocial, cultural and racial differences (Gould et al, 2012; Ramanathan and Chandrasekaran, 2014), it becomes imperative to establish Nigeria-specific values. However, only a few studies had established reference values for different age groups in Nigeria. These are the studies by Mbada et al (2015) for young Nigerian adults, aged 18-35 years; Abdulkadir et al (2019) for ages 10 to 18 years; and that of Ajiboye et al (2014) which derived a regression equation for prediction of 6MWD from sex, age and height in apparently healthy Nigerians between the ages of 21 and 67 years (Ajiboye et al., 2014).

The influence of anthropometric, psychosocial, cultural and racial differences, the already established variation in reference values and the apparent dearth of reference values of 6MWT for apparently healthy children aged 6-12 years living in our environment, underscored the need for establishing reference values and prediction equations specific to the Nigerian population in this age group hence the need for this study. This study was carried out to establish the reference values for 6MWT for Nigerian children aged 6 to 12 years. Relationship was also studied between 6MWT and each of the age, weight, height and BMI of the children.

MATERIALS AND METHODS

Study design, Location and participants: This cross-sectional study involved 334 apparently healthy children aged 6-12 years. They were recruited into the survey from private and public randomly selected primary and secondary schools in Ibadan North Local Government Area in Oyo state, Nigeria. This local government area is one of the eleven local governments in the cosmopolitan city of Ibadan. It covers a land mass 27km² with a population of 856, 988.

Ethical considerations: Ethical approval for this study was obtained from the appropriate institutional ethics committee and data was collected over the period of one month.

Measurements: Physical characteristics of the children such as weight, height, BMI were measured and calculated, as appropriate. Weight was measured in Kilogram (kg) to the nearest 0.1kg using a digital portable weighing scale. The children wore light apparel and they were barefooted while taking their measurements. Height and weight were measured in metres (m) to the nearest 0.1m and 1.0 Kilogramme respectively using a portable stadiometer, following standard procedures. From the measurements taken, Body Mass Index was calculated using the formula, weight/height². Resting heart rate was measured after ten minutes of sitting calmly on a waiting chair, prior to commencement of the test. The resting heart rate was measured using a stop watch.

The Six-Minute Walk Test was conducted according to the methodology described by the American Thoracic Society

(2002). The children involved were randomly selected from different classes in the schools selected for the study. The procedure was explained to the selected children collectively to ensure uniformity of information given. They were also told to avoid vigorous exercise in the two-hour period before the test was conducted. A hard surface on an unexposed corridor free of obstruction measuring at least 15metres was identified in each school and demarcated longitudinally with a long string held by poles at either end into two 15-metre-long walk surfaces giving a 30-metre lap on returning to the start point. A start point at the beginning of the walk surface was marked with coloured tape on the floor. A chair was provided for the children who felt the need to rest at any point during the six-minute walk test. They were instructed to walk the length of the corridor covering as much distance as possible over a six-minute period. The children were asked to walk as fast a pace as they were comfortable with but not to run. They were allowed to rest at any point if they needed to. Standardized words of encouragement such as “you are doing well”, “keep up the good work”, “you are halfway done” were given at every minute to the children in an even voice.

A stopwatch was programmed to give a sound six minutes after the walk started. The walk was stopped at six minutes or whenever any child indicated that they could no longer continue. A mechanical lap counter was used to count the number of laps completed (one complete lap consisted of walking from the starting line to the end of the 15-metre track, turning, and walking back to the starting line). The distance covered in metres was recorded. Pulse rate was also recorded at the end of the test for each of the children.

Data analyses

Descriptive statistics of mean and standard deviation were calculated for age (in years), weight (kg), height (m), BMI, and distance covered (m). Percentile and quartile distributions were calculated for the Six-Minute Walk Distance (6MWD). Independent t-test was used to compare the physical characteristics (age, height, weight, BMI) and 6MWD between the male and female children while Pearson product moment correlation was used to test for the relationship between the 6-minute walk distance 6-MWD and each of age, height, weight, and BMI. Prediction equation(s) for six-minute walk distance (6MWD) was derived using multiple regression analysis. The level of significance was set at 0.05.

RESULTS

A total number of 334 apparently healthy children who were approached for the study agreed to participate and completed the study. They comprised 163 males (48.8%) and 171 females (51.2%). The mean age of the children was 9.01 ± 1.83 years. The physical characteristics of the children are presented in Table 1. Independent t-test was used to compare the physical characteristics of the children and the Six-Minute Walk Distance (6MWD) for the male and female participants. The results showed that male children weighed more ($p=0.04$) than their female counterparts. Other comparisons are further presented in Table 2. The relationship between the physical characteristics and Six-Minute Walk Distance (6MWD) of the children was analysed using Pearson product moment correlation coefficient (r). Results revealed a significant

positive correlation between 6MWD and age($r = 0.48$; $p=0.00$); height ($r=0.50$; $p=0.00$); weight ($r= 0.51$; $p=0.00$); and PR_2 ($r = 0.24$; $p= 0.00$) as shown in Table 3.

Table 1:
Physical Characteristics of the Children (N=334)

Variables	Males (n=163)	Females (n=171)	All participants (n=334)
Age (Years)	9.30±1.84	8.73±1.76	9.01±1.83
Weight (Kg)	25.39±5.18	24.20± 5.19	24.78± 5.21
Height (m)	1.28± 0.11	1.26± 0.11	1.27±0.11
BMI (kg/m ²)	15.29±1.81	14.99±1.56	15.13±1.6
SPO _{2i} (%)	98.16±1.37	98.11± 1.44	98.13±1.40
PR ₁ (Bpm)	90.88±12.63	94.26±12.81	92.61±12.82
Laps	16.88±2.57	15.95±2.07	16.41±2.370
6MWD(M)	517.58±68.55	491.80±61.40	504.38±66.16
SPO _{2f} (%)	98.55±1.03	98.39±1.11	98.46±1.07
PR ₂ (%)	107.15±15.07	110.63±14.72	108.93±14.97

Values are Mean ± S.D of number of participants

Table 2:
Comparison of Physical Characteristics and 6MWD of the Children by Sex (N=334)

Physical characteristics	Males (n=163)	Females (n=171)	t	sig
Age	9.30 ± 1.18	8.73 ± 1.78	2.88	0.00*
Weight (Kg)	25.39 ± 5.18	24.20 ± 5.19	2.08	0.04*
Height (M)	1.28± 0.11	1.264±0.12	1.57	0.12
BMI (Kg/m ²)	15.29 ± 1.81	14.99 ± 1.56	1.61	0.11
6MWD	517.58±68.55	491.80 ±61.39	3.62	0.00*
PR ₁ (BPM)	90.88±12.63	94.26±12.81	-2.43	0.02*
LAPS	16.88±2.7*	15.95±2.07	3.65	0.00
PR ₂ (BPM)	107.15±15.07	110.63±14.72	-2.13	0.03*

Key: BMI = Body Mass Index, SPO_{2i} = Initial oxygen saturation, PR₁ = Initial pulse rate, LAPS = NUMBER OF LAPS COMPLETED, 6MWD= SIX-MINUTE WALK DISTANCE, SPO_{2f} = Final oxygen saturation, PR₂ = Final pulse rate

* = Significance, Where, level of significance is set at $\alpha = 0.05$.

Table 3:
Relationship between Physical Characteristics and Six-Minute Walk Distance of the Children (N=334)

	Six-Minute Walk Distance (6MWD)	p-vale
Age	0.48	0.00*
Weight (Kg)	0.51	0.00*
Height (M)	0.50	0.00*
BMI (Kg/m ²)	0.20	0.00*
PR ₁ (BPM)	-0.07	0.18
PR ₂ (BPM)	0.24	0.00*

Key: BMI = Body Mass Index

* = Significance

Where, level of significance is set at $\alpha = 0.05$.

Presented in Table 4.is the regression analysis for predicting the 6MWD from the physical characteristics (age, height, weight, BMI) of the participants. The models accounted for 29%, 82%, and 29% of the variability in 6MWD in all the participants, males and females respectively as stated below: The equation derived for all the children (male and female combined) was:

$$6MWD = - 338.78 + 1.59 (Age) + 570.80 (Height) - 7.50 (Weight) + 19.02 (BMI) + 55.82$$

Table 4.:

Prediction of Six-Minute Walk Distance (6MWD) from Physical Characteristics of the Children

	ALL (N=334)			Males (n=163)			Females (n=171)		
	B	S.E	P-value	B	S.E	P-value	B	S.E	P-value
Constant	-338.78	218.13	0.12	-55.07	342.13	0.87	-559.48	273.57	0.03
Age	1.59	2.57	0.54	4.74	3.61	0.19	-4.55	3.61	0.21
Weight	-7.50	4.29	0.08	-1.67	6.63	0.80	-13.13	5.44	0.01*
Height	570.80	175.64	0.00*	326.64	274.60	0.02*	827.55	221.06	0.00*
BMI	19.02	7.06	0.01*	9.93	10.86	0.03*	26.85	9.01	0.00*
Adjusted R ²		0.29			0.82			0.29	

KEY:

B = Unstandardized Coefficient ; S.E = Standard Error ;

BMI = Body Mass Index ; Adjusted R² = Adjusted R Squared* = Significance, where, level of significance is set at $\alpha = 0.05$

The equation derived for male children was:

$$6MWD = -55.07 + 4.74 (\text{Age}) + 326.64 (\text{Height}) - 1.67 (\text{Weight}) + 9.93 (\text{BMI}) + 58.09$$

The equation derived for female children was:

$$6MWD = -559.48 - 4.55 (\text{Age}) + 827.55 (\text{Height}) - 13.13 (\text{Weight}) + 26.85 (\text{BMI}) + 51.86$$

Reference values for the Six-Minute Walk Distance were determined and presented as quartile deviation and percentile range. These are shown in Tables 5 and 6.

Table 5:

Reference values for Six-Minute Walk Distance Presented as Quartile Deviation (N=334)

Participants	n	mean \pm SD	25 th	50 th	75 th
Males	163	517.58 \pm 68.55	472.3	524.6	572
Females	171	491.80 \pm 61.40	447.7	497	528
All	334	504.38 \pm 66.16	456	506	546

Table 6:

Reference Values for Six-Minute Walk Distance presented as Percentile Range (N=334)

Percentiles	Males (n=163)	Females (n=171)	All Participants (N=334)
10 th	423.60	405.00	413.05
20 th	455.44	436.80	444.00
30 th	485.14	461.20	473.00
40 th	503.31	481.00	492.00
50 th	524.60	497.00	506.00
60 th	540.00	510.20	524.00
70 th	559.60	524.40	540.00
80 th	578.20	538.80	563.00
90 th	600.00	570.00	586.50

DISCUSSION

The age of children in this study ranged from 6 to 12 years old with a mean age of 9.01 \pm 1.83 years. Their mean weight was 24.78 \pm 5.21kg. This mean weight falls between the 5th and 85th percentile of weight for age growth charts established by the Centers for Disease Control and Prevention (CDC) (2017), showing that the children in this study are within healthy

weight category. The mean weight recorded in this study is comparable with that reported for Indian children by D'silva et al (2010), but lower than what was reported in studies involving Italian and Taiwanese children by Vandoni et al (2018) and Chen et al (2015) respectively. This disparity in weight observed in Nigerian, Italian and Taiwanese children may be due to the high prevalence of obesity reported among children younger than 10 years in Italy (Ahrens et al., 2014). The disparity could also be explained by the fact that the study involving Taiwan children covered those aged between 7 and 17 years as opposed to this study while the present study involved children between the ages of 6 and 12 years. The mean height recorded for the children in this study was 1.27 \pm 0.11m. This height falls within healthy height limit for children between the ages of 6 to 12 years as highlighted by the Centre for Disease Control in the United States of America in 2017. The mean Body Mass Index (BMI) of children in this study was 15.13 \pm 1.69kg/m². This BMI also falls between the 5th and 85th percentiles of BMI-for-age growth charts for children in the age category involved in this study (Li et al et al, 2007; Kasovic et al 2021). This implies that majority of the children in this study are within healthy weight category. In this study, males weighed significantly more than females. This could be explained by the fact that male children typically possess more lean muscles than female children (Cossio et al, 2019). This may be a significant contributor to the observed weight difference among male and female children in this study. This finding is similar to findings from other studies which showed that males weighed more than their female counterparts (Kahraman et al, 2019). This study found that there is no significant difference between the height of the male and female children which is contrary to other studies by Li et al, (2007) and Kasovic et al, (2021), which reported that the males were significantly taller than females. A possible explanation could be that the previous other studies which reported significant difference between the heights of male and female children recruited more males in their study while this study recruited more females. This present study also found that there was no significant difference between BMI of male and female children. A possible explanation to this could be that since there was no significant difference in the height of the male and female children in this study there may also not be a significant difference in the BMI of male and female

children in this study. This is because BMI is a function of height (from the formula, $BMI = \text{weight}/\text{height}^2$).

The Body Mass Index of the children in this study was lower compared to the BMI values observed for the American, Thai, Swiss, Turkish and Chinese children, but higher than that of Indian Children (Li et al., 2007; Klepper and Muir, 2011; Tonklang et al., 2011; Ulrich et al., 2013; Kanburoglu et al., 2014). This may be because of the food habits, socio-cultural factors and also the difference in anthropometric measurements (D'silva et al., 2012). Those influencers were however not explored in this study. Nevertheless, this reported variations across communities underscores the need for reference values of the 6MWD that are specific for each population.

Among the participants in this study, there was a significant positive correlation between age and 6MWD ($r = 0.48$). This implies that with increase in age, there is a corresponding increase in 6MWD. This may be due to growth and development that occurs with increase in age (Saad et al., 2009). Such growth and development involve increase in the length of bones, increase in muscle mass and increase in stamina (Degache et al., 2010). These factors which constitute growth and development may contribute to higher levels of physical functioning with age (Lammers et al., 2008; Ito et al., 2021). These may then lead to an increase in speed of walking and distance covered (Dourado, 2011). The findings from this study are in consonance with findings from other studies which recorded that there is a positive correlation between age and 6MWD among children and adolescents (Lammers et al., 2008).

Results from this study also showed that weight and height had the best correlation ($r = 0.51$ and 0.50 respectively) with 6MWD. This means that 6MWD increases with increasing weight and height. This pattern may be connected to the fact that taller people have larger stride length and thus walk greater distances (Li et al., 2007; D'silva et al., 2012). The positive correlation between 6MWD and each of age, weight and height in this study is in consonance with findings from previous studies exploring the relationships among those parameters (Li et al., 2007; Geiger et al., 2007; Lammers et al., 2008; Priesnitz et al., 2009).

This study further derived predictive equations for the 6MWD for apparently healthy children aged 6-12 years living in Ibadan. As stated below: The equation derived for all the children combined:

$$6MWD = -338.78 + 1.59(\text{Age}) + 570.80(\text{Height}) - 7.50(\text{Weight}) + 19.02(\text{BMI}) + 55.82$$

The equation derived for male children:

$$6MWD = -55.07 + 4.74(\text{Age}) + 326.64(\text{Height}) - 1.67(\text{Weight}) + 9.93(\text{BMI}) + 58.09$$

The equation derived for female children:

$$6MWD = -559.48 - 4.55(\text{Age}) + 827.55(\text{Height}) - 13.13(\text{Weight}) + 26.85(\text{BMI}) + 51.86$$

The models accounted for 29%, 82%, and 29% of the variability in 6MWD in all participants, male, and female participants respectively. The regression models for males, females and all participants showed that height and BMI had a significant predictive impact on the 6MWD. More precisely, height and BMI were positively related to 6MWD. These findings are similar to what obtained among Chinese girls and

Austrian children, where an increase in BMI correlated with an increase in 6MWD, but contrary to what obtained in Chinese boys, where BMI related to a decrease in 6MWD (Li et al., 2007; Lammers et al., 2008). These findings are also similar to what obtained in other studies, where an increase in height caused an increase in 6MWD (Geiger et al., 2007; Li et al., 2007; Lammers et al., 2008; Saad et al., 2009).

In the equation derived for females, although height was found to have a significant and positive influence on 6MWD, weight was found to have a significant but negative influence on 6MWD. This implies that an increase in weight is associated with a decrease in 6MWD. This finding is in consonance with previous data which depicts that 6MWD increases with increase in height and decreases with increase in weight (Geiger et al., 2007; Li et al., 2007; Lammers et al., 2008; Saad et al., 2009).

In this study, age was not a significant factor related to the 6MWD. This finding is similar to the findings by Kahraman et al (2019), which reported that age was not a significant predictor of 6MWD. This is contrary to the report by other studies (Geiger et al., 2007; Lammers et al., 2008; Priesnitz et al., 2009; D'silva et al., 2012; Ulrich et al., 2013). The disparities in relative contribution of each age of age, weight, height and BMI, could be explained by the variation in characteristics used in deriving the equation. While some studies, derived prediction equation using only age, weight, and height, this present study included BMI, which caused a variation, in the final models fitted by the multiple linear regression.

In this study, the mean 6MWD of all the participants was 504.38 ± 66.16 m, which is comparable to 518.50 ± 73.56 reported by Chen et al (2015) for children aged 7 to 11 years in the United States. This mean value is however, comparatively lower than that of Indian children aged 7 to 16 years (609.00 ± 166.00); Chinese children aged 7 to 16 years (660 ± 58 m); Caucasian children aged 3 to 18 years (694 ± 43 m); but higher than that of children in the United Kingdom aged 4 to 11 years (470 ± 59 m) (Li et al., 2007; Lammers et al; 2008; D'silva et al., 2012) respectively. This variation in the mean walk distance may be due to the influence of demographic, anthropometric, psychosocial, nutritional, cultural and racial differences observed among different countries may also have accounted for these differences (Gould et al, 2012; Ramanathan and Chandrasekaran, 2014; Mylius et al., 2016; Cacau et al., 2016; Rodriguez-Nunez et al., 2018).

In concordance with earlier studies, male participants covered longer distances than their female counterparts (517.58 ± 68.55 m versus 491.80 ± 61.40 m respectively) (D'silva et al., 2012; Oliveira et al., 2013; Tonklang et al., 2011). This may be because males have been purported to have greater exercise capacity and 6MWD than young females, a trend that was reported in the present study. This observation is probably as a result of their greater muscle mass in the male children (Li et al., 2005). This gender discrepancy of the 6MWD may also be explained by the typical disparities in functional characteristics during exercise between both genders in this age-group (Vandoni et al., 2018).

In conclusion, this study established reference values and prediction equations for Six-Minute Walk Distance in

apparently healthy children aged 6 to 12 years living in Nigeria. The relatively small sample size may constitute a limitation to the general applications of the findings in this study.

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