

Influence of demographics and anthropometrics on six minute walk distance in Indian children and adolescents.

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Abstract : Six minute walk test is a submaximal exercise test that assesses the functional exercise capacity and is an important component of quality of life as it reflects the capacity to undertake day -to- day activities .Among all the functional walk tests, six minute walk test shows the strongest measurement properties and is most commonly used in cardio respiratory domains. Studies done by researchers suggested that the 6minute walk distance obtained ,varied according to the population and Variation in pulmonary function was seen with anthropometrics and geographical location ,due to these variations the Prediction equations obtained from western population concluded that the same equation cannot be used for Indian population .So the aim of the study is to determine the influence of demographics and anthropometrics on six minute walk distance in healthy Indian children and adolescents and also intends to generate a normative data of 6MWD .

Key words : Sixminutewalktest,Sixminutewalkdistance,6MWD,6MWT,Anthropometrics,Demographics.

1. INTRODUCTION:

Six minute walk test is a quick ,inexpensive ,simple test ,that measures the maximum distance that a patient can quickly walk on flat hard surface within six minutes.¹ It assesses the functional exercise capacity and is an important component of quality of life ,as it reflects the capacity to undertake day –to –day activities² . The six minute walk test is used as an important tool in screening, management and helps to note the prognosis and predicts the mortality and morbidity in patients with pulmonary and cardiovascular diseases^{3,4,5,6,7} . Among all the functional walk tests (Two min walk test, twelve minute walk test ,self-paced walk test and the shuttle walk test)6minute walk test shows the strongest measurement properties⁸ . Six minute walk test is a reliable and valid functional test (concurrent validity was demonstrated by good correlation between 6 minute distance and maximal oxygen uptake determined on exercise treadmill) and test –retest reliability was done and ICC calculated was 0.94.⁹ Study done by Eastwood PR et al suggested that ,the regression equation obtained from Caucasian population cannot be used to obtain 6 –min walk distance of Singaporean adults as 78% variance in distance was seen¹⁰ .Sunil k Chhabra compared four equations ,one each from northern, Eastern ,Western and Southern part of India to predict the vital capacity and concluded substantial variation in results is seen obtained from various regional equations.¹¹

Anthropometry is the single most portable, universally applicable ,inexpensive and non-invasive method available to assess the proportion ,size and composition of the human body .It reflects both health and nutrition and predicts performance ,health and survival.¹² .Studies done by the researchers suggested that body dimensions varied with the geographical variation and pulmonary function also varied with age ,sex ,height ,weight race and geographical location .^{13,14}Prediction equations to estimate the six minute walk distance have been derived for western population and there is lack of data for Indian population .As the body dimensions vary with geographical variations the prediction equation obtained from western population cannot be used as a direct measure to estimate the distance covered by Indian population. So the purpose of the study is to determine the influence of demographics and anthropometrics on Six minute walk distance in Indian healthy children and adolescents and also intends to generate normative data of six minute walk distance for children and adolescent.

2. MATERIALS AND ASSESSMENT TOOLS:

1. Stop watch 2.Coloured tape 3.Weighing Machine 4.Traffic cones 5.Inch tape 6.Marker pen 7. Chair 8. Lap counter 9.Work sheet on a clip board.

3. METHOD :

Total 312 healthy children of age group 7 -11yrs and adolescents of age group 12-19yrs who met the inclusion and exclusion criteria according to the ATS guidelines for six minute walk were purposively selected from four regions of India so that the subjects are better representative of Indian population. 24 subjects were taken for each age group .A written consent approved by institution was obtained stating voluntary acceptance to be the subject .Six minute walk test was performed in the school corridors ,30meter length corridor was marked every 3 meter using bright colour tape .Demographic data of subject was taken and the total body weight (kg)and height were measured

according to standard techniques and body mass index (BMI) was calculated. Subjects were made to sit and were instructed to walk as far as possible for 6 minutes without running or jogging .Post-test the total number of laps covered were calculated and total distance was recorded.

4. ANALYSIS:

The collected data was statistically analyzed using SPSS (version 15.0). Data was reported as mean ±SD .The following tests were performed .Spearman Rank correlational analysis was done to investigate the relationship of 6MWD with, age, height , BMI and weight . Kruskal Wallis test was done to find the influence of Demographics and Anthropometrics on 6MWD And Backward regression Analysis was done to know which factors are significant Predictors of the Distance .

5. RESULTS:

Table 6.1: Age and gender distribution of subjects studied

Age in years	Male	Female	Total
7-11	78	78	156
12-19	78	78	156

Table 6.2 : Anthropometric data:

Age	N	Weight (kg)		Height(cm)		BMI	
		Mean ± SD	Std. error	Mean ±SD	Std .error	Mean ± SD	Std error
7.00	24	16.89 ± 1.7	0.36	114.62 ± 3.3	0.68	12.95 ± 1.2	0.25
8.00	24	25.37 ± 2.6	0.53	130.75 ± 4.9	1.01	14.86 ± 1.2	0.25
9.00	24	26.50 ± 3.0	0.62	132.95 ± 4.8	0.98	14.97 ± 1.4	0.29
10.00	24	26.95 ± 4.6	0.94	135.37 ± 3.9	0.79	14.64 ± 2.0	0.40
11.00	24	26.12 ± 3.3	0.67	136.87 ± 4.4	0.90	13.93 ± 1.2	0.25
12.00	24	33.79 ± 3.5	0.71	139.89 ± 4.7	0.97	17.29 ± 1.2	0.25
13.00	24	35.18 ± 5.1	1.05	145.16 ± 9.9	2.02	16.66 ± 1.1	0.23
14.00	24	42.37 ± 3.9	0.80	157.95 ± 8.2	1.67	16.92 ± 1.0	0.21
15.00	24	49.16 ± 4.6	0.94	165.75 ± 6.7	1.38	18.00 ± 0.9	0.20
16.00	24	50.33 ± 4.8	0.98	164.45 ± 7.2	1.47	18.37 ± 1.5	0.31
17.00	24	50.93 ± 0.6	1.23	165.72 ± 9.0	1.85	18.17 ± 0.9	0.18
18.00	24	54.45 ± 6.4	1.31	167.50 ± 6.4	1.30	19.40 ± 1.4	0.28
19.00	24	52.72 ± 3.7	0.76	169.29 ± 6.4	1.32	18.43 ± 0.9	0.19
Total	312	37.75 ± 13	0.73	148.17± 18.3	1.03	16.51 ± 2.3	0.13

N= no. of subjects, SD= standard deviation

TABLE 1.3: Shows the mean distance with standard deviation , Standard error and 95% Confidence interval for mean distance of age group ranging from 7 to 19.

Age	Number of subjects	Mean±std deviation	Std.Error	95% CI for mean	
				Lower bound	Upper bound
7.00	24	514.91± 6.2	6.26178	527.8701	501.9632
8.00	24	534.52 ±6.5	6.57299	548.1181	520.9236
9.00	24	537.60 ±6.1	6.13495	550.2953	524.9130
10.00	24	548.14 ±6.0	6.08897	560.7418	535.5498
11.00	24	551.83 ±5.4	5.47414	563.1574	540.5092
12.00	24	568.79 ±7.5	7.52050	584.3490	553.2343
13.00	24	578.45 ±7.5	7.52676	594.0286	562.8880
14.00	24	586.79 ±8.3	8.39081	604.1494	569.4340
15.00	24	598.91 ±6.6	6.68112	612.7376	585.0957
16.00	24	633.58 ±6.1	6.12133	646.2463	620.9204
17.00	24	650.64 ±4.3	4.31026	659.5623	641.7294
18.00	24	663.10 ±7.0	7.07580	677.7416	648.4667
19.00	24	681.12 ±9.1	9.19954	700.1557	662.0943

Total	312	588.34±3.4	3.46253	595.1543	581.5284
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TABLE: 1.4 Mean distance covered age group 7-11 and 12 - 19

Age	Number of Subjects	Mean distance (m)	Std.Error	95%CI for mean	
				Lower bound	Upper bound
7-11					
Female	68	509.68	4.396	501.03	518.33
Male	68	565.12	4.396	556.47	573.77
Total	156				
12-19					
Female	68	587.25	3.475	580.41	594.09
Male	68	653.09	3.475	646.26	659.93
Total	156				

TABLE: 1.5 Shows distance covered by various regions of India

Place	N	Mean SD	SE	95% Confidence interval		Maximum	Minimum
				Lower bound	Upper bound		
Pune	78	87.79±62.76	7.10	573.64	601.94	480.00	742.00
Mumbai	78	87.42±60.04	6.79	573.89	600.95	467.00	729.00
Kerela	78	88.75±62.17	7.03	574.73	602.77	481.00	732.00
Mangalore	78	89.38±60.79	6.88	575.67	603.09	470.00	720.00
Total	312	88.34±61.16	3.46	581.52	595.15	467.00	742.00

Table 1.6: Shows how different places influences the distance

PLACE	N	Mean Rank	Test of Statistics
			Kruskal wallis test
1	78	154.83	Asymp.Sig 0.990
2	78	154.91	
3	78	157.24	
4	78	159.02	
total	312		

Table 1.7: Shows correlation of Distance with Age, Weight, Height and BMI

Distance	Age	Weight	BMI	Height
r(Spearman's rank correlation)	.829	.830	.648	.831
P value	.000	.000	.000	.000

Table 1.8:

Backward regression analysis of various characteristics of subjects
 Results of backwad regression analysis to evaluate the effect of various factors

Coefficients(a)

Model		B	Std.Error	Beta	T	Sig	95% Confidence interval for B	
							Lower bound	Upper bound
1	(Constant)	679.564	30.605		22.205	.000	619.342	739.787
	Age	14.253	.598	.873	23.850	.000	13.077	15.429
	Sex	-62.757	1.748	-.514	-35.892	.000	-66.197	-59.316
	Weight	2.239	.429	.478	5.226	.000	1.396	3.083

	Height	-1.214	.225	-3.64	-5.402	.000	-1.656	-.772
	BMI	-5.271	.998	-.201	-5.284	.000	-7.234	-3.308

A Dependent Variable: DISTANCE

Model	R	R ²	Adjusted R ²	Std. error of Estimate
1	0.974	0.948	0.948	13.99342

A predictors : constant BMI ,Sex ,height ,weight ,age

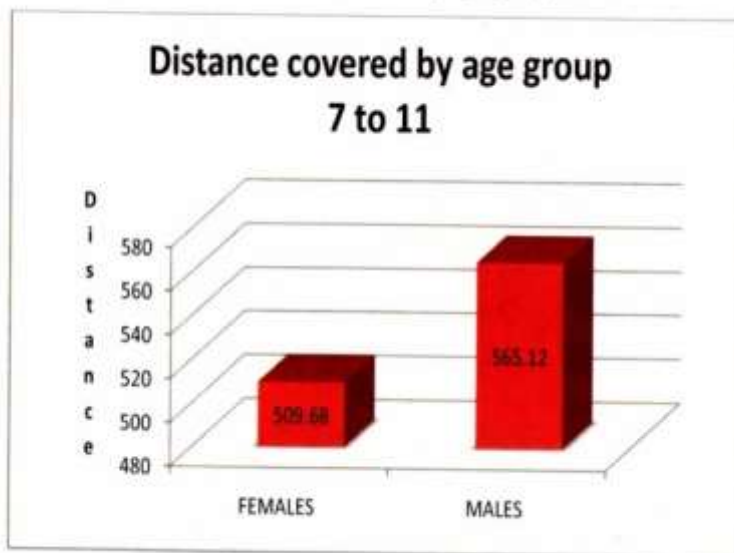
Equation is

$$\text{DISTANCE} = 679.56 + 14.25 * \text{age} - 62.76 * \text{Sex} + 2.2 * \text{weight} - 1.2 * \text{height} - 5.2 * \text{BMI}$$

(Note : Female = 0, Male = 1 has to be substituted)

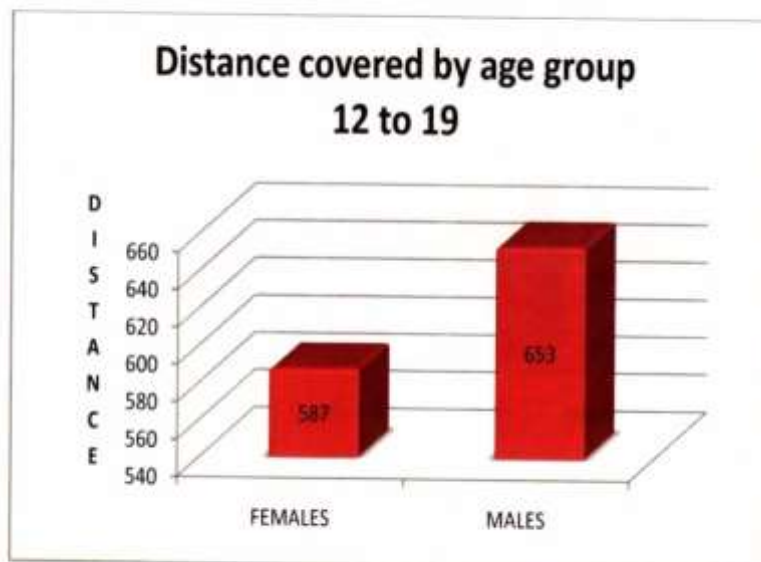
Graph 1.1: Shows mean distance covered by age group 7 – 11 Years

Shows mean distance covered by age group 7 to 11

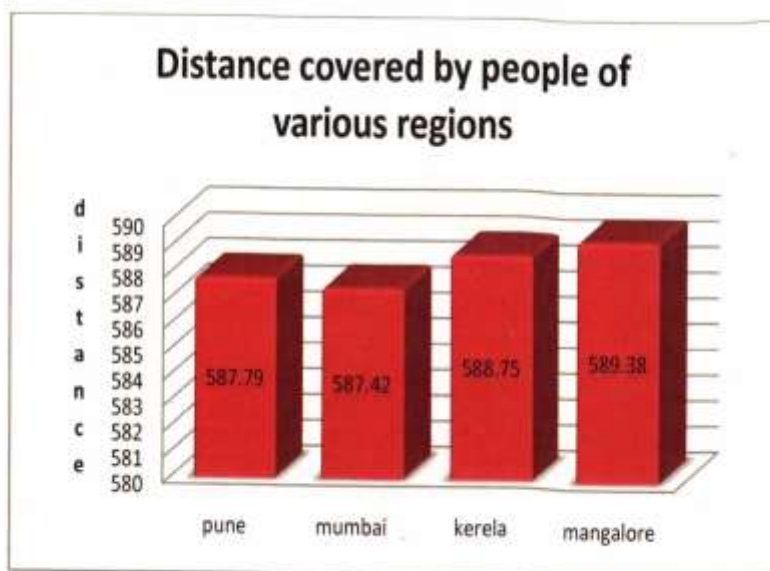


Graph:1.2 :shows distance covered by age group 12 -19

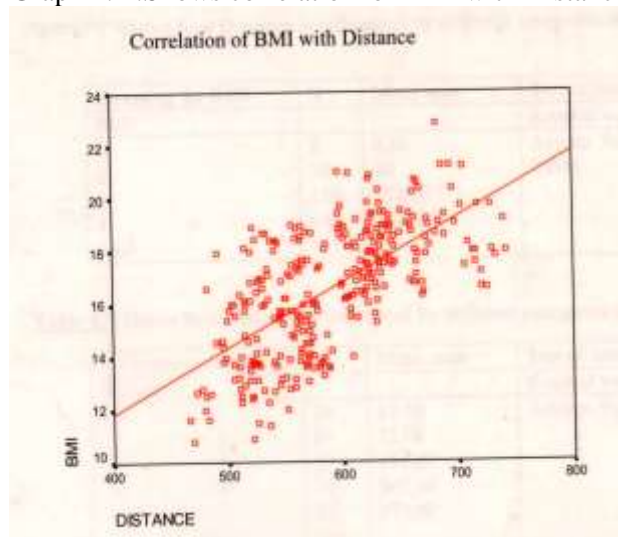
Shows the mean distance covered by age group 12 to 19



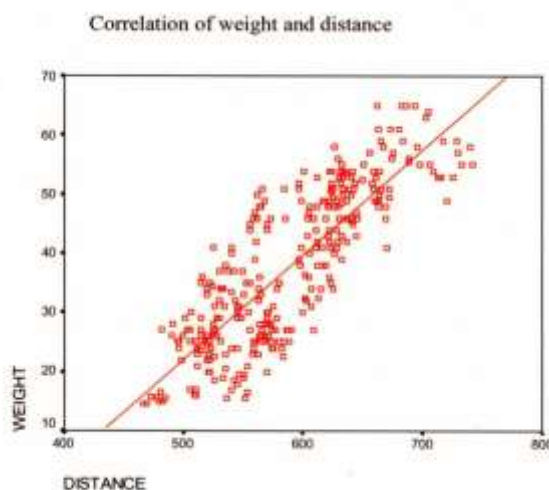
Graph 1.3: Shows distance covered by various regions of India



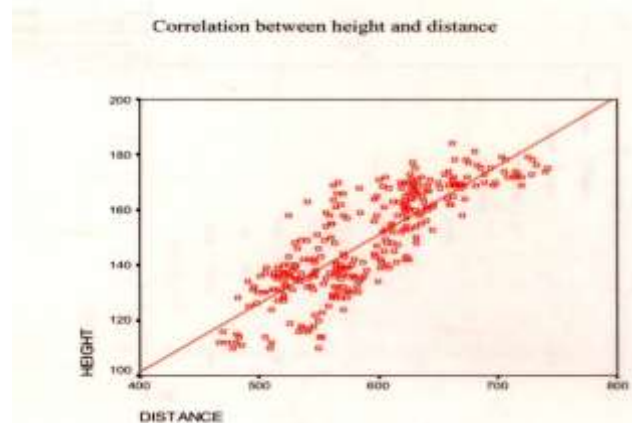
Graph 1.4 :Shows correlation of BMI with Distance



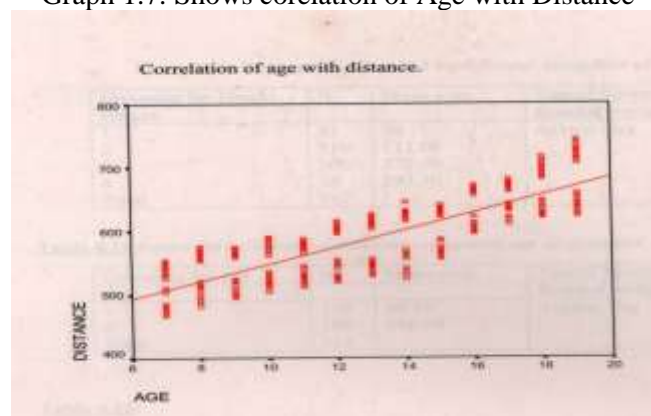
Graph 1.5 : Shows correlation of weight with Distance



Graph 1.6: Shows correlation of height and distance



Graph 1.7: Shows correlation of Age with Distance



6. DISCUSSION :

To our knowledge the present study has considered larger sample and it has included samples from different places to know the effect regional and geographical variation on six minute walk distance and to be a better representative of Indian population .As previous studies have suggested that the equation obtained from western population could not be used for Indian population, the aim of the study was to establish reference values of 6MWT for Indian children and adolescents.

Important findings of the study are :In our study the mean distance covered by age group 7-11 females is 509.68m with 95% confidence interval for mean with lower bound as 501.03 and upper bound as 518.33m and the mean distance covered by males of same group is 565.12 m with 95% confidence interval for mean with lower bound as 556.47m and upper bound 573.77m.Similarly the mean distance covered by age group 12-19 females is 587.25 with 95% CI for mean with lower bound as 580.41m and upper bound as 594.09 m and the mean distance covered by males of the same group is 653.09 and 95% CI for mean distance with lower bound ad 646.26m and upper bound as 659.93m.

Lower bound value represents the critical value .values less than the critical values signify that there is some impairment in the functional capacity for that particular age group .The normative data that we attained will help us to guide the physical education teachers regarding the child or adolescent who is in danger of developing disease later in life and can be referred to a physician or dietician for further advice .This will help prevent further complications and can also monitor the progress after rehabilitation .

Subjects were covered from Pune , Mumbai , Kerela and Mangalore ,So the subjects were mainly from southern and western part of the country and it also had migrants from Central and northeast part of the country. Statistical Analysis was done to know the variance in distance covered by the subjects of four different regions but no variation in distance was observed.

Our study also aimed to know the influence of anthropometrics and demographics on the distance covered in six minutes .Correlational Analysis has shown a positive correlation of distance with age, weight and height but a moderate correlation with BMI .Age shows a positive correlation with distance in our study but study done by Paul Enright et al and Ma. Bernardita which was done on elderly population shows a negative correlation the cause could be as our study has included subjects who were young and adolescents the muscular and bony changes have not

affected the distance covered.^{2,15} The subjects with more weight has also not affected the distance as the subjects were highly motivated .Height has also shown a positive correlation with distance this is in agreement with other studies done by Paul Enright et al and Ma.Bernardita and as taller subjects will have longer stride length they tend to cover more distance^{2,15}.

Limitations

When the children were instructed to walk some of them ran, skipped and galloped .so we had to keep reminding them to walk .We had little control over the behaviour, motivation level of the subject and they got distracted when other classes were outside for recess.

7. CONCLUSION:

This study was able to establish a reference value of six minute walk test for healthy Indian Children of age group 7-11 and adolescents of age group 12 – 19 .In addition to this we conclude that there was good correlation of Distance with age ,sex ,weight ,height and moderate correlation with BMI and distance was also influenced by Sex, Weight, Height and BMI ,but the variation in Distance with the Geographical Variation was not seen. Backward regression analysis done revealed age as a significant predictor with beta value 0.873.

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