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An Investigation into the Measurement Level of Maximum Volume of Oxygen (VO_2 Max) Consumption Using Cooper 12-Minutes Run-Test

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Abstract

This study was carried out to investigate the measurement level of maximum volume of oxygen (VO_2 max) rate for a continued period of four weeks (one month) amongst randomly selected Bo Commercial Junior Secondary School (JSS I, II and III) pupils in the Bo Municipality, Sierra Leone. The significance of the study is to measure and compare the VO_2 max of both boys and girls at the three different strata i.e. JSS I, II & III using cooper-12-minutes-run test. A total of thirty (30) pupils (15 boys and 15 girls) were randomly selected at the three levels (JSS I, II & III), with age ranging from ten to seventeen (10-17) years. The Pearson Product Moment Correlation (PPMC) Coefficient, Dependent and Independent t-tests were used to compare the results of the study. The results were tested at ($p \leq$ **0.05)** level of significance. Analysis of results from weeks one, two, three and four shows both significant and insignificant differences between the measured values of VO_2 max rate of boys and that of girls (JSS I, II & III) at the beginning and at the end of the exercise which is recorded as r values [(i.e. r values ranging from r = 0.0000 to r = 0.7442) when compared with the c value (i.e. c value = 0.8783)] as shown in tables I, II, III and IV; and as t values [(i.e. t values ranging from t = 10.249 to t = 3.728) when compared with the dependent and independent c values (c = 2.776 and c-value = 2.306)] as shown in tables V, VI, VII, VIII, IX, X, XI and XII. Conclusively therefore, the major findings in this study shows that pupils (boys and girls) were experiencing quick fatigue at the beginning of the exercise which affected the low rate of their VO_2 max calculation greatly but they had to overcome the fatigue as the session continued into the subsequent weeks thereby improving their rate. In recommendation, the most effective approach to improving VO_2 max rate in pupils is by applying the endurance high intensity interval training (HIIT) during practical session in schools.

Introduction

Physical activity is important for children's current and future health with current recommendations calling for at least 60 minutes of moderate to vigorous physical activity at least 3 times a week

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(Biddle et al, 1998; U.S. Department of Health and Human Services, 2000; National Association for Sports and Physical Education, 2004). School-based physical education (PE) is one of only five interventions strongly recommended as a means for increasing physical activity by the Task Force on Community Preventive Services *(Centre for Disease Control and Prevention, 2001; Kahn, Ramsey, Brownson, Heath, Howze & Powell, 2002).*

The recognition that physical fitness is a major marker of health status at any age *(Ortega et al., 2007)*, has produced a wide range of studies on the influence of various factors on physical fitness levels, in particular the influence of body fat and physical activity *(Lennox et al., 2008; Artero et al., 2010; D'Hondt et al., 2009; Dumith et al., 2010;).* Increasing both aerobic and muscular fitness is essential for promoting health *(American College of Sports Medicine, 2007)* and should be a desirable goal in a training program *(Taanila et al., 2011).*

Children with high levels of motor competence are more active, more capable *(Castelli et al, 2007)* and spend less time on sedentary tasks *(Wrotniak et al., 2006).* On the other hand, improvement in the motor proficiency of children can also influence levels of habitual physical activity beyond school age, creating expectations of future maintenance of active lifestyles *(Sharkey, 2002; Andersen et al., 2004)* and is thus indispensable to potential decisions influencing the promotion of health *(Stodden et al., 2008).* Health-related fitness includes, besides others, aerobic endurance, muscular strength, and flexibility *(Hands et al., 2009).* Schools also provide a resource for describing activity levels in children because they offer structured activity classes (physical education) and unstructured time (recess) *(Caspersen, et al, 2000).*

Cooper's 12 minute run test *(Cooper, 1968)* is a popular field test used for measuring aerobic fitness. This fitness test was initially used to estimate the VO_2 max. Cooper found a very high correlation between the maximum distance one can run (or walk) in 12 minutes and the VO_2 max value, which measure the efficiency with which someone can use oxygen while exercising. This test is still one of the basic fitness tests used by the military, as well as many coaches, trainers and an individual to determine cardiovascular fitness and track fitness over time. This simple test also allows individuals to compare their cardiovascular endurance with others of the same age and gender. VO_2max (or

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maximal oxygen consumption) is simply the maximum possible VO_2 that a given person can achieve. VO_2 and VO_2max are important in the context of exercise, because they are a measure of ones body's ability to generate ATP, and ATP is the energy source that allows your muscles to continue working while you are exercising. Therefore, by definition, a VO_2 max measurement is ultimately a measure of your cardiorespiratory fitness level *(Heyward, 2006).*

This study only emphasized on the measurement of maximum volume of oxygen (VO_2 Max) rate through Cooper 12-minutes-run test amongst Bo Commercial Junior Secondary School (JSS) pupils ranging from JSS I, II and III in the Bo Municipality, Sierra Leone. This study also compared the significant difference of VO_2 Max between boys and girls with respect to their age range and class level.

Material and Methods

Selection of participants:

The study was performed on both 15 JSS boys and 15 JSS girls. The average age of both groups of pupils were ranged from 11 – 17 years. Both groups of pupils were from the same micro socioeconomic background and were selected for the study on the basis of random sampling from JSS I, II and III sectors of Bo Commercial Secondary School, Bo, Sierra Leone respectively.

Instruments for measuring the parameter

Instruments such as the data collection guide sheet, measuring tape, stop watch, pen and pencil, scientific calculator and whistle were used for measuring recording and calculating the required parameters. The school register was used to estimate the age range of the pupils i.e. JSS I, II & III.

Test Procedures:

A well scaled 400 meter track was used to conduct the Cooper 12 minutes run test and the pupils were given a trial run on the first day of the exercise to familiarize themselves with the nature of the experiment for few minutes before the actual time of the test. After the familiarization exercise, the pupils were asked by the researcher to queue up for an experimental start. The pupils were then asked individually to run as many laps of the 400 meter track as possible for a maximum period of 12 minutes. At exactly

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12 minutes, the whistle was sounded for participants to immediately stop running. Then total distance in meters covered after 12 minutes by each individual pupil was then recorded.

Below is the formula for Cooper's 12 minute run test *(Copper, 1968)* that was used to predict the VO_2 max of the pupils who participated in the exercise. Where d_{12} is the total laps of the 400 meter track covered in 12 minutes.

$$\mathrm{VO_2\ max} = \frac{d_{12} - 505}{45}$$

Statistical Analysis: The Pearson Product Moment Correlation (PPMC) Coefficient, Dependent t-test and Independent t-test were collectively used to analyze the data obtained through a rearranged data collection guide that was originally developed in 1982 (recently updated in 2005) by The Cooper Institute in Dallas, TX to measure kids' fitness and find out whether there were significant differences in VO_2 max rate between boys and girls of JSS I, II and III according to their age range. The results were tested at $p \leq$ **0.05** level of significance.

Results:

Table I: Pearson Products Moment Correlation Coefficient (PPMCC = r), shows the scores of ten (10) JSS I pupils [boys (x) and girls (y)] in week one VO_2 max exercise using the Cooper-12-minutes aerobic run test.

Age	VO_2 max. for Boys (x)	VO_2 max. for Girls (y)	x^2	y^2	Xy
10-11	31.4	30.5	985.96	930.25	957.7
11-12	35.0	24.3	1225.0	590.49	850.5
12-13	35.0	28.8	1225.0	829.44	1008.0
13-14	42.1	32.3	1772.41	1043.29	1327.53
14-15	42.1	36.8	1772.41	1354.24	1549.28
* ∑	**189.6**	**152.7**	**6980.78**	**4747.71**	**5693.01**
	*** $(\sum x)^2$ = 35948.16**	***$(\sum y)^2$ = 23317.29**	***r = 0.7341**	***c = 0.8783**	

Table II: Pearson Products Moment Correlation Coefficient (PPMCC = r), shows the scores of ten (10) JSS II pupils [boys (x) and girls (y)] in week one VO_2 max exercise using the cooper-12-minutes aerobic run test.

Age	VO_2 max. for Boys (x)	VO_2 max. for Girls (y)	x^2	y^2	Xy
11-12	36.8	22.5	1354.24	506.25	828.0
12-13	40.3	19.0	1624.09	361.0	765.7
13-14	36.8	27.0	1354.24	729.0	993.6
14-15	42.1	36.8	1772.41	1354.24	1549.28
15-16	42.1	36.8	1772.41	1354.24	1549.28
* ∑	**198.1**	**142.1**	**7877.44**	**4304.73**	**5685.86**
	*** $(\sum x)^2$ = 39243.61**	***$(\sum y)^2$ = 20192.41**	***r = 0.6387**	***c = 0.8783**	

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Table III: Pearson Products Moment Correlation Coefficient (PPMCC = r), shows the scores of ten (10) JSS III pupils [boys (x) and girls (y)] in week one VO_2 max exercise using the Cooper-12-minutes aerobic run test.

Age	VO_2 max. for Boys (x)	VO_2 max. for Girls (y)	x^2	y^2	Xy
12-13	44.8	25.2	2007.04	635.04	1128.96
13-14	52.7	35.9	2777.29	1288.81	1891.93
14-15	50.1	38.6	2510.01	1489.96	1933.86
15-16	50.1	47.4	2510.01	2246.76	2374.74
16-17	55.4	46.5	3069.16	2162.25	2576.1
***∑**	**253.1**	**193.6**	**12873.51**	**7822.82**	**9905.59**
	*** $(\sum x)^2$ = 64059.61**	*** $(\sum y)^2$ = 37480.96**	***r = 0.7442**	***c = 0.8783**	

Table IV: Pearson Products Moment Correlation Coefficient (PPMCC = r), shows the scores of ten (10) JSS I pupils [boys (x) and girls (y)] in week two VO_2 max exercise using the Cooper-12-minutes aerobic run test.

Age	VO_2 max. for Boys (x)	VO_2 max. for Girls (y)	x^2	y^2	Xy
10-11	41.2	39.5	1697.44	1560.25	1627.4
11-12	39.4	39.5	1552.36	1560.25	1556.3
12-13	41.2	39.5	1697.44	1560.25	1627.4
13-14	41.2	39.5	1697.44	1560.25	1627.4
14-15	41.2	39.5	1697.44	1560.25	1627.4
***∑**	**204.2**	**197.5**	**8342.12**	**7801.25**	**8065.9**
	*** $(\sum x)^2$ = 41697.64**	***$(\sum y)^2$ = 39006.25**	***r = 0.0000**	***c = 0.8783**	

Table V: Dependent T-test (t) shows the scores of ten (10) JSS II pupils [boys (x) and girls (y)] in week two VO_2 max exercise using the Cooper-12-minutes aerobic run test.

Age	VO_2 max. for Boys (x)	VO_2 max. for Girls (y)	D	D^2
11-12	46.5	44.7	1.8	3.24
12-13	46.5	43.9	2.6	6.76
13-14	48.3	45.6	2.7	7.29
14-15	48.3	46.5	1.8	3.24
15-16	48.3	46.5	1.8	3.24
	***∑**		**10.7**	**23.77**
	***$(\sum D)^2$**		**114.49**	
	***t-value = 10.249**	***c-value = 2.776**		

Table VI: Dependent T-test (t) shows the scores of ten (10) JSS III pupils [boys (x) and girls (y)] in week two VO_2 max exercise using the Cooper-12-minutes aerobic run test

Age	VO_2 max. for Boys (x)	VO_2 max. for Girls (y)	D	D^2
12-13	55.4	37.7	17.7	313.29
13-14	55.4	43.9	11.5	132.25
14-15	55.4	48.3	7.1	50.41
15-16	57.2	51.0	6.2	38.44
16-17	57.2	53.6	3.6	12.96
	***∑**		**46.1**	**547.35**
	***$(\sum D)^2$**		**2125.21**	
	***t-value = 3.728**	***c-value = 2.776**		

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Table VII: Dependent T-test (t) shows the scores of ten (10) JSS I pupils [boys (x) and girls (y)] in week three VO_2 max exercise using the Cooper-12-minutes aerobic run test

Age	VO_2 max. for Boys (x)	VO_2 max. for Girls (y)	D	D^2
10-11	46.5	44.7	1.8	3.24
11-12	46.5	44.7	1.8	3.24
12-13	46.5	46.5	0.0	0.00
13-14	50.1	47.4	2.7	7.29
14-15	50.1	47.4	2.7	7.29
	*∑		**9.0**	**21.06**
	*$(\sum D)^2$		**81**	
	***t-value = 3.652**	***c-value = 2.776**		

Table VIII: Dependent T-test (t) shows the scores of ten (10) JSS II pupils [boys (x) and girls (y)] in week three VO_2 max exercise using the Cooper-12-minutes aerobic run test

Age	VO_2 max. for Boys (x)	VO_2 max. for Girls (y)	D	D^2
11-12	49.2	47.4	1.8	3.24
12-13	49.2	48.3	0.9	0.81
13-14	52.8	49.2	3.6	12.96
14-15	52.8	51.0	1.8	3.24
15-16	52.8	51.0	1.8	3.24
	*∑		**9.9**	**23.49**
	*$(\sum D)^2$		**98.01**	
	***t-value = 2.093**	***c-value = 2.776**		

Table IX: Independent T-test (t) shows the scores of ten (10) JSS III pupils [boys (x) and girls (y)] in week three VO_2 max exercise using the Cooper-12-minutes aerobic run test

Age	(f)	(x)	(y)	f(x)	f(y)	(x-X)	(y-Y)	$(x-X)^2$	$(y-Y)^2$	$f(x-X)^2$	$f(y-Y)^2$
12-13	12.5	55.4	43.9	692.5	548.8	-3	-7	9	49	112.5	612.5
13-14	13.5	56.3	51.8	760.1	699.3	-2.1	0.9	4.41	0.81	59.5	10.9
14-15	14.5	59.8	51.9	867.1	752.6	1.4	1.0	1.96	1.0	28.4	14.5
15-16	15.5	59.8	52.8	926.9	818.4	1.4	1.9	1.96	3.61	30.4	56.0
16-17	16.5	59.8	52.8	986.7	871.2	1.4	1.9	1.96	3.61	32.3	59.6
*∑	**72.5**			**4233.3**	**3690.3**					**263.1**	**753.5**
		***t-value = 4.507**				***c-value = 2.306**					

Table X: Independent T-test (t) shows the scores of ten (10) JSS I pupils [boys (x) and girls (y)] in week four VO_2 max exercise using the Cooper-12-minutes aerobic run test

Age	(f)	(x)	(y)	f(x)	f(y)	(x-X)	(y-Y)	$(x-X)^2$	$(y-Y)^2$	$f(x-X)^2$	$f(y-Y)^2$
10-11	10.5	53.6	52.8	562.8	554.4	-2.7	-2.2	7.29	4.84	76.55	50.82
11-12	11.5	54.5	55.4	626.8	637.1	-1.8	0.4	3.24	0.16	37.26	1.84
12-13	12.5	56.3	55.4	703.8	692.5	0.0	0.4	0.0	0.16	0.0	2.0
13-14	13.5	56.3	55.4	760.1	747.9	0.0	0.4	0.0	0.16	0.0	2.16
14-15	14.5	59.8	55.4	867.1	803.3	3.5	0.4	12.25	0.16	177.63	2.32
*∑	**62.5**			**3520.6**	**3435.2**					**389.94**	**59.14**
		***t-value = 1.084**				***c-value = 2.306**					

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Table XI: Independent T-test (t) shows the scores of ten (10) JSS II pupils [boys (x) and girls (y)] in week four VO_2 max exercise using the Cooper-12-minutes aerobic run test

Age	(f)	(x)	(y)	f(x)	f(y)	(x-X)	(y-Y)	$(x-X)^2$	$(y-Y)^2$	$f(x-X)^2$	$f(y-Y)^2$
11-12	11.5	59.8	56.3	687.7	647.5	-2.1	-1.9	4.41	3.61	50.72	41.52
12-13	12.5	59.8	55.4	747.5	692.5	-2.1	-2.6	4.41	6.76	55.13	84.5
13-14	13.5	62.5	58.9	843.8	795.2	0.6	0.7	0.36	0.49	4.86	6.62
14-15	14.5	63.4	59.8	919.3	867.1	1.5	1.6	2.25	2.56	32.63	37.12
15-16	15.5	63.4	59.8	982.7	926.9	1.5	1.6	2.25	2.56	34.88	39.78
*∑	**67.5**			**4181.0**	**3929.2**					**178.22**	**209.44**
		***t-value = 3.459**						***c-value = 2.306**			

Table XII: Independent T-test (t) shows the scores of ten (10) JSS III pupils [boys (x) and girls (y)] in week four VO_2 max exercise using the Cooper-12-minutes aerobic run test

Age	(f)	(x)	(y)	f(x)	f(y)	(x-X)	(y-Y)	$(x-X)^2$	$(y-Y)^2$	$f(x-X)^2$	$f(y-Y)^2$
12-13	12.5	62.5	57.2	781.25	715.0	-8.1	-6.7	65.61	44.89	820.13	561.13
13-14	13.5	64.3	58.0	868.05	783.0	-6.3	-5.9	39.69	34.81	535.82	469.94
14-15	14.5	67.0	58.0	971.5	841.0	-3.6	-5.9	12.96	34.81	187.92	504.75
15-16	15.5	67.0	61.6	1038.5	954.8	-3.6	-1.4	12.96	16.81	200.88	260.56
16-17	16.5	67.0	61.6	1105.5	1016.4	-3.6	-1.4	12.96	16.81	213.84	277.2
*∑	**67.5**			**4764.8**	**4310.2**					**1958.6**	**2073.6**
		***t-value = 1.542**						***c-value = 2.306**			

Discussion of Findings

Maximum oxygen uptake capacity (VO_2 max) has been widely considered to be reliable and valid measure of cardio respiratory fitness *(Das & Dhundasi, 2001).* The result of the maximum volume of oxygen (VO_2 max) rate in the above investigation shows an insignificantly low VO_2 max in the beginning of the session between boys and girls as shown in tables I, II and III.

This study mainly shows that maximum oxygen uptake (VO_2 max) is known to be significantly correlates with age. As suggested by *Astrand and Rodhal (1986),* that maximum oxygen uptake increases with age up to 20 years. Hence, there is a gradual decline in maximum oxygen uptake. *Hagen et al. (1993)* and *Biswas et al. (2004)* also suggested the same view, which state that the decrease of maximal volume of oxygen uptake corresponds to the advancement of age. The Pearson Product Moment Correlation (PPMC) Coefficient, Dependent and Independent t-tests were used to compare the results of the study. The results were tested at ($p \leq$ **0.05)** level of significance. Analysis of results from weeks one, two, three and four shows both significance and insignificance differences between the measurement level of VO_2 max rate of

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boys and that of girls (JSS I, II & III) at the beginning and at the end of the exercise which is recorded as r values [(i.e. r values ranging from r = 0.0000 to r = 0.7442) when compare with the c value (i.e. c value = 0.8783)] as shown in tables I, II, III and IV; and as t values [(i.e. t values ranging from t = 10.249 to t = 3.728) when compared with the dependents and independent c values (c = 2.776 and c-value = 2.306)] as shown in tables V, VI, VII, VIII, IX, X, XI and XII.

In the concluded investigation analysis above, age was observed to have a significant relationship with the VO_2 max in both boys and girls. *Biswas et al. (2004)* also noted similar type of observation. This study also found that there is a very high correlation between the distances someone can run in 12 minutes and their VO_2 max value. The correlation coefficient between VO_2 max and 12 minutes run distance in the above investigation shows r values range from (r = 0.0000) to (r = 0.7442), and dependent and independent t values range from (t = 10.249) to (t = 3.728) in case of both boys and girls within the age range of 10 – 17 years at JSS level. However, Cooper in 1968 observed that the result of correlation coefficient was 0.90 with an age range of 17 – 54 years.

Conclusion: Based on the findings of the study, it concluded that high level of physical fitness requires a high VO_2 max value. The above findings further concluded therefore that, boys have slightly or equal cardiorespiratory fitness level when compared to girls due to slight significant or insignificant levels recorded at $p \leq 0.05$ during the analyses of their VO_2 max status in 12 minutes run cooper test with regards their age bracket and class level. The study also concluded that significant correlation coefficient was found between age bracket and VO_2 max value in both boys and girls. Since oxygen is ultimately consumed in the muscles during exercise, it follows that the VO_2 max, when measured, will vary in accordance with the specific form of exercise performed or a total distance covered as in this study with the cooper 12-minutes run test.

In addition, the major finding in this study shows that pupils (boys and girls) were experiencing quick fatigue at the beginning of the exercise which affected the low rate of their VO_2 max calculation greatly but they had to overcome the fatigue as the session continued into the subsequent weeks thereby improving their rate.

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Recommendations: In recommendation, the basic aerobic endurance training is usually sufficient for children especially at junior secondary school level. The most effective approach to improving VO_2 max is by applying the endurance high intensity interval training (HIIT), Tabata, Izumi; Irisawa, Kouichi; Kouzaki, Motoki; Nishimura, Kouji; Ogita, Futoshi; & Miyachi, Motohiko (1997). This can be implemented in schools during Physical Education lessons, thereby allotting enough time on the teaching time table for Physical Education and also to encourage more professionals of Physical Education be trained and employed to teach the subject in schools for children to reap the full benefits of improved VO_2 max for physical fitness and sports training.

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References:

American Heart Association and American College of Sports Medicine. 2007. Joint Position Statement: Exercise and acute cardiovascular events: placing the risks into perspective. *Med. Sci. Sports Exerc*., **39:** 886–897. DOI: 10.1161/CIRCULATIONAHA.107.185649

Andersen L, Hasseltrom H, Gronfeldt V, Hansen S, Karsten K. 2004. The relationship between physical fitness and clustered risk, and tracking of clustered risk from adolescence to young adulthood: Eight years follow-up in the Danish Youth and Sport Study. *Int. J. Behav. Nutr. Phys. Act.*, **1:** 6

Artero E, España-Romero V, Ortega F, Jiménez-Pavón D, Ruiz J, Vicente-Rodríguez G, Bueno M, Marcos A, Gómez-Martínez S, Urzanqui A, González-Gross M, Moreno L, Gutiérrez A, Castillo M. 2010. Health-related fitness in adolescents: underweight, and not only overweight, as an influencing factor. The AVENA study; *Scand. J. Med. Sci. Spor.*, **20(3):** 418–427. DOI: 10.1111/j.1600-0838.2009.00959.x

Astrand, P. O. & Rodahl, K. 1986. Text book of work Physiology. New York: McGraw Hill Book Co.

Biddle, S., Cavill, N. and Sallis, J. 1998. Policy framework for young people and health-enhancing physical activity. In Young and Active? Young People and Health-enhancing Physical Activity: Evidence and Implications (edited by S. Biddle, J. Sallis and N. Cavill), pp. 3±16. London: Health

Education Authorit Biswas, R., Samanta, A., & Chatterjee, S. 2004. Maximal Aerobic Capacity of Indian Inland Fisherman. *Indian Journal of Physiology & Allied Sciences*, **58(3):.**70-79

Bradley, C. B., McMurray, R. G., Harrell, J. S., & Deng, S. 2000. Changes in common activities of 3rd through 10th graders: the CHIC study. Medicine and Science in Sports and Exercise, 32, 2071-2078. **DOI:** 10.1097/00005768-200012000-00017

Caspersen, C. J., Pereira, M. A. & Curran, K. M. 2000. Changes in physical activity patterns in the United States, by sex and cross-sectional age. *Medicine and Science in Sports and Exercise*, **32:** 1601-1609. DOI: 10.1097/00005768-200009000-00013

Castelli, D. M., Hillman, C. H., Buck, S. M., and Erwin, H. E. 2007. Physical fitness and academic achievement in third- and fifth-grade students. *Journal of Sport and Exercise Psychology*, **29:** 239–252. PMID:17568069

Centre for Disease Control and Prevention. 2001. Increasing physical activity: a report on recommendations on the Task Force on Community Preventive Services: MMWR 50:1–14.

Cooke, S.R., Patersen, S.R., & Quinney, H.A. 1997. The influence of maximal aerobic power on recovery of skeletal muscle following aerobic exercise. *European Journal of Physiology*, 75: 512-519.

Journal of Exercise Science & Physiotherapy is indexed with Citefactor, Researchbible, Medind, Hinari, Innospace, I-Scholar, Indian Citation Index, Informit, Google Scholar, Academic Keys, wordCat, J-Gate, Jour Informatics, GIF, Directory of Science (Impact Value 19.79), Indianscience.in, ICMJE, Infobase Index (IBI factor 3.4). Electronic Journals Library, University Library of Regensburg, International Scientific Indexing (ISI), SIS, International Impact Factor Service, MIAR, DRJI, Advanced Sciences Inerdex (ASI) Germany (Impact factor 0.8), Jifactor (Impact Factor 0.5), Open Academic Journals Index, Sjournals Index, Index Copnicus, http://www.sherpa.ac.uk/romeo/ as Romeo blue journal. Digital archiving finalised with Portico

Cooper, K.H. 1968. A means of assessing maximum oxygen intake. *JAMA*, **203:** 135-38

Crocker, P. R., Eklund, R. C., & Kowalski, K. C. 2000. Children's Physical Activity and Physical self-perceptions. *Journal of Sports Sciences*, **18:** 383-394

D'Hont, E., Deforche, B., Bourdeaudhuij, I., Lenoir, M. 2009. Relationship between motor skill and Body Mass Index in 5-to 10-year-old children. Adapt. Phys. Act. Q**. 26:** 21–37.

Das, K. K., & Dhundasi, S. A. 2001. Physical fitness: a longitudinal study among Muslim children of Bijapur (Karnataka*). Indian Journal of Physiology and Pharmacology;* **45(4):** 457-62. PubMed ID 11883153

Dumith, S., Ramires, V., Souza, M., Moraes, D., Petry, F., Oliveira, E., Ramires, S., Hallal, P. 2010. Overweight/Obesity and physical fitness among children and adolescents. *J. Phys. Act. Health*, **7:** 641–648.

Eisenmann, J. C., Bartee, R. T., & Wang, M. Q. 2002. Physical Activity, TV viewing, and weight in U.S. youth: 1999 Youth Risk Behaviour Survey. *Obesity Research*, **10:** 379-385

Gavarry, O., Giacomoni, M., Bernard, T., Seymat, M., & Falgairette, G. 2003. Habitual Physical Activity in Children and Adolescents during school and free days: *Medicine and Science in Sports and Exercise*, **35:** 525-531

Guidetti, L., Musulin, A., & Baldari, C. 2002. Physiological factors in middleweight boxing performance. *Journal Sport Medicine Physical Fitness*, **42:** 309-314

Hagen, K. B., Vik, T., Myher, N. E., Opsahl, P. A. & Ringdahl, K. H. 1993. Physical workload, perceived exertion and output of cut wood as related to age in motor manual cutting. *Ergonomics*, 36: 479-488

Hands, B., Larkin, D., Parker, H., Straker, L. and Perry, M. 2009. The relationship among physical activity, motor competence and health- related fitness in 14-year-old adolescents. *Scand. J. Med. Sci. Sport;* **19(5):** 655-663. doi: 10.1111/j.1600-0838.2008.00847.x. Epub 2008 Aug 5.PMID:18694431

Hernandez, B., Gortmaker, S. L., Colditz, G. A., Perterson, K. E., Laird, N. M., & Parra-Cabrera, S. 1999. Association of obesity with physical activity, television programs and other forms of video viewing among children in Mexico City. International *Journal of Obesity and Related Metabolic Disorders***, 23:** 845-854 Page 12 of 13, PMID:10490786

Heyward, V. H. 2006. Advanced Fitness Assessment and Exercise Prescription (5th edition): Publisher: Human Kinetics

Hong, S. L. 1997b. Physiological and biochemical characteristics of excellent Korean contestants of Taekwondo. *The Academic Journal of Beijing Physical Education University*, **20(1):** 22-29. Human Kinetics.

Kahn, E.B., Ramsey, L.T., Brownson, R.C., Heath, G.W., Howze, E.H., Powell, K.E., Stone, E.J., Rajab, M.W. & Corso, P. 2002. The effectiveness of interventions to increase physical activity: A systematic review by the U.S. Task Force on Community Preventive Services. *American Journal of Preventive Medicine*, **22(S):** 73–102. PMID: 11985936

Kimm, S. Y., Glynn, N. W., Kriska, A. M., Barton, B. A., Kronsberg, S. S., Daniels, S. R. Crawford, P.B., Sabry, Z.I. & Liu, K. 2002. Decline in physical activity in black girls and white girls during adolescence. *New England Journal of Medicine*, **347:** 709-715. PMID:12213941

Lennox, A., Pienaar, A. and Wilders, C. 2008. Physical fitness and the physical activity status of 15-year-old adolescents in a semi-urban community*: S. Afr. J. Res. Sport Phys. Educ. Recreation.*, **30(1):** 59–73.

National Association for Sport and Physical Education: Physical activity for children; a statement of guidelines for children ages 5–12, 2nd Ed. Reston, VA: American Alliance for Health, Physical Education, Recreation and Dance, 2004, pp. 1–26.

Ortega, F. B., Ruiz, J. R., Mesa, J. L., Gutierrez, A. and Sjostrom, M. 2007. Cardiovascular fitness in adolescents: the influence of sexual maturation status - the AVENA and EYHS studies. *Am. J. Hum. Biol.*, **19:** 801-808. PMID:17712790

People and Health Enhancing Physical Activity; London: Health Education Authority, 1998, pp. 3–49.

Plowman, S.A. & Meredith, M.D. Eds. 2013: Fitness gram/Activity gram Reference Guide. Dallas, TX: The Cooper Institute.

Sharkey B. J. 2002. Fitness & Health; Hong Kong: Publisher: Human Kinetics.

Stodden, D. F., Goodway, J. D., Langendorfer, S. J., Roberton, M. A., Rudisill, M. E., Garcia, C. & Garcia, L. E. 2008. A developmental perspective on the role of motor skill competence in physical activity: an emergent relationship. *Quest*, **60:** 290–306.

Taanila H, Hemminki A, Suni J, Pihlajamäki H, Parkkari J. 2011. Low physical fitness is a strong predictor of

Journal of Exercise Science & Physiotherapy is indexed with Citefactor, Researchbible, Medind, Hinari, Innospace, I-Scholar, Indian Citation Index, Informit, Google Scholar, Academic Keys, wordCat, J-Gate, Jour Informatics, GIF, Directory of Science (Impact Value 19.79), Indianscience.in, ICMJE, Infobase Index (IBI factor 3.4). Electronic Journals Library, University Library of Regensburg, International Scientific Indexing (ISI), SIS, International Impact Factor Service, MIAR, DRJI, Advanced Sciences Inerdex (ASI) Germany (Impact factor 0.8), Jifactor (Impact Factor 0.5), Open Academic Journals Index, Sjournals Index, Index Copnicus, http://www.sherpa.ac.uk/romeo/ as Romeo blue journal. Digital archiving finalised with Portico

health problems among young men: a follow-up study of 1411 male conscripts. *BMC Public Health.* **11:** 590. doi:10.1186/1471-2458-11-590

Tabata, Izumi; Irisawa, Kouichi; Kouzaki, Motoki; Nishimura, Kouji; Ogita, Futoshi; Miyachi, Motohiko 1997. "Metabolic profile of high intensity intermittent exercises", *Medicine & Science in Sports & Exercise*, **29(3):** 390-5.

U.S. Department of Health and Human Services and Department of Education 2000. Promoting better health for young people through physical activity and sports. A Report to the President from the Secretary of Health and Human Services and the Secretary of Education; Silver Spring, MD: Centre for Disease Control.

Wrotniak, B.H., Epstein, L.H., Dorn, J.M., Jones, K.E. and Kondilis, V.A. 2006 'The relationship between motor proficiency and physical activity in children', *Paediatrics*, **118, (6):** 1758-176. PMID: 17142498

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Journal of Exercise Science & Physiotherapy is indexed with Citefactor, Researchbible, Medind, Hinari, Innospace, I-Scholar, Indian Citation Index, Informit, Google Scholar, Academic Keys, wordCat, J-Gate, Jour Informatics, GIF, Directory of Science (Impact Value 19.79), Indianscience.in, ICMJE, Infobase Index (IBI factor 3.4). Electronic Journals Library, University Library of Regensburg, International Scientific Indexing (ISI), SIS, International Impact Factor Service, MIAR, DRJI, Advanced Sciences Inerdex (ASI) Germany (Impact factor 0.8), Jifactor (Impact Factor 0.5), Open Academic Journals Index, Sjournals Index, Index Copnicus, http://www.sherpa.ac.uk/romeo/ as Romeo blue journal. Digital archiving finalised with Portico