

Aerobic capacity as an indicator of health

Abstract

The exercise was carried out to evaluate and classify the level of physical fitness as an indicator of health, to measure the aerobic capacity, which in turn indicates the level of physical fitness. To achieve the objective, The most well-known test in the history of physical education is the Cooper running test, which is a maximum and field test, suitable for all age groups, teenagers, women and men, consists of running for 12 minutes, which refers to endurance aerobics, which is the ability to tolerate fatigue caused by exercise, managing to maintain the pace and intensity for a long time without a considerable drop in physical performance. The sample consisted of 44 2nd year students, in the 1st academic semester of 2022 at the Escola Superior de Ciências do Desporto (ESCIDE) of the Eduardo Mondlane University (UEM). The main measure for assessing aerobic capacity is maximum oxygen consumption ($VO_{2max} = \text{distance} - 504.1 / 44.9$), which indicates the maximum and integrated capacity of the organism to extract, transport and use oxygen molecules as an energy substrate. The evaluation was carried out on an athletics track with a 400 meter loop. Once the Cooper test was completed, the individual results obtained in the evaluation were compared and using the average health indicator Table 1 of maximum VO_2 for running, Table 2 women and Table 3 men, whose classification range is between very poor, poor, sufficient, good, excellent and higher education, resulted in an assessment of the students' physical fitness level as 1 poor, 6 sufficient, 11 good, 12 excellent and 14 superior.

Keywords: assessment, aerobic capacity, cooper test, VO_{2max}

Volume 9 Issue 1 - 2024

Cesar Nhamitambo

Departamento de Treino, César Nhamitambo, Universidade Eduardo Mondlane (UEM) Escola Superior de Ciências do Desporto (ESCIDE), Mozambique

Correspondence: Cesar Nhamitambo, Departamento de Treino, César Nhamitambo, Universidade Eduardo Mondlane (UEM) Escola Superior de Ciências do Desporto (ESCIDE), Mozambique, Tel +258828138210, Email nhamitamb57@gmail.com

Received: December 08, 2023 | **Published:** February 28, 2024

Introduction

Resistance is the ability to tolerate or endure something. A person's ability to perform a low or medium intensity effort over a prolonged period of time. This capacity depends on oxygen management, that is, on the balance that the subject manages to achieve between the need for oxygen for activities and the actual consumption. A person with good aerobic endurance can tolerate the fatigue caused by exercise, managing to maintain the pace and intensity for a considerable time. Through aerobic exercise, a process occurs that increases cardiac efficiency and this, in turn, improves oxygen transport and the capacity of skeletal muscles, reducing blood pressure and heart rate and, finally, causing the absorption of oxygen. oxygen has an increase in its capacity. Aerobic capacity can be defined as the maximum capacity to absorb, use and transport oxygen during physical exercise, as the longer the exercise or physical activity, the greater the need for oxygen to provide the body with greater aerobic resistance.¹

For Medeiros, (2010) cardiorespiratory fitness or aerobic resistance refers to the efficiency of the lungs, arteries, capillaries and heart, acting uninterruptedly in transporting sufficient oxygen and nutrients towards the muscles involved in the activity. Factors that influence aerobic capacity, such as genetics and heredity, have a direct relationship with the individual's aerobic potential, but the habit of regularly practicing physical exercise can reduce the incidence of these factors, being in guided practice the most effective intervention method. aerobic exercise is common. According to Kenneth Cooper² aerobic training improves the capacity of the central circulation and consequently the supply of oxygen, it also improves the use of oxygen by active muscles, reduces the appearance of cardiovascular diseases, strengthens the immune system and is efficient in the weight loss process, maintaining and increasing general physical fitness, physiological adaptations make the individual more able to perform physical activities and combat stress routine, consequently improving quality of life. Throughout the day, a person generally depends on the aerobic system for 98%. Muscles and the cardiovascular system can adapt to increase their ability to use oxygen. Maximum

oxygen consumption (VO_{2max}) is widely used as the best measure of individual cardiorespiratory fitness, and consequently the best measure of physical fitness. VO_{2max} is defined as the maximum volume of oxygen per unit of time (ml/min/kg) that an individual uses at maximum effort. Anyone can increase maximum oxygen consumption (VO_{2max}), but baseline levels vary according to age, sex, health, weight and physical activity (Lia Kubelka Back, Florianópolis). Throughout the literature review, it became clear that cardiovascular training requires at least 30 minutes of exercise per session, 3 times a week, for approximately 8 to 12 weeks to ensure an increase in aerobic capacity. According to Kenneth H Cooper² resistance is the best life insurance.

Methodology

The study is quantitative in nature, descriptive, comparative and exploratory. It is based on the Cooper Test as it is a field test that is easy to administer to a large number of people simultaneously, it is suitable for all age groups, for women and men, it consists of covering the greatest distance running over 12 timed minutes, after the time has elapsed. The distance covered in meters is counted and the Cooper test protocol is used to measure VO_{2max} . which corresponds to the formula $VO_{2max} = \text{Distance} - 504.1 / 44.9$, these last two variants being fixed. This protocol is designed to estimate maximum oxygen consumption, which corresponds to milliliters of oxygen consumed per kilogram of body weight (ml/min/kg), the main indicator of health and/or performance. To calculate running speed, the formula was used $\text{distance} / 12 \text{ min} = \text{meters/minute}$.

Procedure

44 students participated in the assessment, of which 8 women and 36 men aged between 19 and 39 years old. There were no exclusion criteria as participation in the assessment is mandatory except in the case of illness or injury. In accordance with the objective of measuring the level of physical fitness of students in the 2nd Year 2022 class at ESCIDE-UEM in classes related to the Discipline

Sports Practices II (Athletics) of the Degree in Sports Sciences. For evaluation, a previous record of age and weight was recorded, the Cooper Running Test and its protocol were used, on a 400 meter track and the results illustrated in Table 1 were obtained, all members of the class see columns referring to age, weight and race Cooper test, taking as a reference average indicator of VO2 Max for the race, Table 2, 3 the VO2 Max results were obtained, the average speed of the

race was calculated using the formula $\text{Distance}/12 \text{ min} = \text{Speed}$ and finally a comparison was made between the student who covered the same distance but have different weight, represented in Table 4–6. The illustrated evaluation results are starting age, weight, distance in meters, estimated VO2max, average speed and the corresponding evaluation of each sample unit.

Table 1 Research results obtained after the procedure

No.	Age/sex	Weight (kg)	Cooper run/distance/meter test	VO2max	Average speed: m/s	Assessment
1	23/M		2250	52.2	212.5	Higher
two	22/M	58	2900	53.3	241.6	Higher
3	20/M	64.5	2970	54.9	247.5	Higher
4	26/M	56	3500	63.3	291.6	Higher
5	23/M	68.2	2350	41.1	195.8	Enough
6	21/M	64	2500	44.4	208.3	Good
7	22/M	68	2450	42.6	204.1	Good
8	23/M		2200	37.7	183.3	Enough
9	23/M		2450	42.6	204.1	Enough
10	34/M	102	2500	44.4	208.3	Good
11	21/M	66	2750	50	229.1	Great
12	22/M	65	2800	52	236.6	Great
13	22/M	68	2500	44.4	208.3	Good
14	21/M		2750	50	229.1	Great
15	21/M		2450	42.6	204.1	Good
16	22/M	60	2800	51.1	233.3	Great
17	20/M	62	3250	61.1	270.8	Higher
18	23/M	64	2500	44.4	208.3	Good
19	22/M		3200	60	266.6	Higher
20	33/M	85	2400	42.2	200	Good
21	21/M	70	2900	53.3	241.6	Higher
22	23/M		2350	41.1	195.8	Enough
23	21/M	51	2750	50	229.1	Great
24	22/M	69	2420	42.6	201.6	Good
25	19/M	54	2850	52.2	237.5	Great
26	25/M		3170	59.3	264.1	Higher
27	24/M	67	3100	57.8	258.3	Higher
28	39/M		2420	42.2	201.6	Good
29	27/M	78	2920	53.8	243.3	Higher
30	24/M		3150	58.9	262.5	Higher
31	20/M	59	2700	48.9	225	Good
32	22/M	58	2900	53.3	241.6	Higher
33	22/M		2100	35.5	175	Poor
34	35/M	68	3050	56.7	254.1	Higher
35	24/M	64	2800	51.1	233.3	Great
36	19/M	63	2500	44.4	208.3	Enough
37	20/F	20	2250	38.8	187.5	Great
38	21/F		2100	35.5	175	Good
39	26/F		1900	31	158.3	Good
40	20/F	60	2200	37.7	183.3	Great
41	24/F		2200	37.7	183.3	Great
42	20/F	63	2300	39.9	191.6	Great
43	20/F	48	2650	47.7	220.8	Higher
44	22/F		1850	29.9	154.1	Enough

Table 2 Cooper running test protocol regarding physical fitness for women

Age	Very poor	Poor	Normal	Good	Great	Higher
13 to 19	Minus 25	25 to 31	31 to 35	35 to 39	39 to 42	Over 42
20 to 29	Minus 23	23 to 29	29 to 33	33 to 37	37 to 41	Over 41
30 to 39	Minus 23	23 to 27	27 to 31	31 to 35	35 to 40	Over 40
40 to 49	Under 21	21 to 24	24 to 29	29 to 33	33 to 37	Over 37
50 to 59	Minus 20	20 to 23	23 to 27	27 to 31	31 to 36	Over 36
60 and over	Under 17	17 to 20	20 to 24	24 to 30	30 to 31	Over 31

Table 3 Cooper running test protocol regarding physical fitness for men

Age years	Very poor	Poor	Normal	Good	Great	Higher
13 to 19	Minus 35	35 to 38	38 to 45	45 to 51	51 to 56	Over 56
20 to 29	Minus 33	33 to 36	36 to 42	42 to 46	46 to 52	Over 52
30 to 39	Minus 31	31 to 35	35 to 41	41 to 45	45 to 49	Over 49
40 to 49	Minus 30	30 to 33	33 to 39	39 to 43	43 to 48	Over 48
50 to 59	Minus 26	26 to 31	31 to 36	36 to 31	41 to 45	Over 45
60 and over	Minus 20	20 to 26	26 to 32	33 to 36	36 to 44	More than 44

Table 4 Cooper race test results for women the 8 women constitute 18.1% of the class aged between 20 and 29 years old and coincidentally correspond to an age group in the cooper VO2max race protocol, presented the following results

Age group/Classification	Very poor	Poor	Enough	Good	Great	Higher
13-19	-----	-----	-----	-----	-----	-----
20-29	-----	-----	1	2	4	1
30-39	-----	-----	-----	-----	-----	-----
40-49	-----	-----	-----	-----	-----	-----
50-59	-----	-----	-----	-----	-----	-----
	-----	-----	1	2	4	1

Table 5 Results of the cooper race test for men the 36 Men constitute 81.81% of the class and representing 3 age groups, according to the Cooper VO2max running protocol, presented the following results

Age group/classification	Very poor	Poor	Enough	Good	Great	Higher
13-19	-----	-----	1	-----	1	-----
20-29	-----	1	4	6	7	12
30-39	-----	-----	-----	3	-----	1
40-49	-----	-----	-----	-----	-----	-----
50-59	-----	-----	-----	-----	-----	-----
	-----	1	5	9	8	13

Table 6 Comparison of physical fitness between students who covered the same distance, but with different body weight

No. in table I	Age	VO2max X Weight = ml/kg/min
16	22	51.1 X 60 kg = 3,066 ml/kg/min
35	35	51.1 X 64 kg = 3,270 ml/kg/min
21	21	53.3 X 70 kg = 3,731 ml/kg/min
two	22	53.3 X 58 kg = 3,091 ml/kg/min
10	34	44.4 X 102 kg = 4,528 ml/kg/min
13	22	44.4 X 68 kg = 3,019 ml/kg/min
18	23	44.4 X 64 kg = 2,841 ml/kg/min
36	19	44.4 X 63 kg = 2,797 ml/kg/min
11	21	50.0 X 66 kg = 3,300 ml/kg/min
23	21	50.0 X 51 kg = 2,550 ml/kg/min
7	22	42.6 X 68 kg = 2,896 ml/kg/min
4	22	42.6 X 69 kg = 2,939 ml/kg/min

Discussion

After carrying out the exercise that resulted in the tables above, it was expected that, based on the results of the Cooper running test,

women would present physical fitness capabilities similar to those of men, as mentioned in the bibliography that women can with stand prolonged efforts so well because their metabolism is processed more economically. Students with the same distance covered, which has greater weight uses a greater maximum volume of oxygen per unit of time (ml/min/kg), which suggests that it has better aerobic capacity level, comparative Table 6. The result of the Cooper 12-minute running test (maximum test) helps to understand aerobic endurance capacity through maximum oxygen consumption (VO2max) and reflects the person's health status (physical fitness), which corroborates reports that are included in the bibliography review.³⁻¹²

Conclusion

Of the 44 students who make up the sample, following the Cooper protocol for running, differentiated into women and men and grouped by age, they present the following levels of physical fitness: Poor 1=2.27% man; Sufficient 6=13.63% with 1 woman and 5 men; Good 11=25% being 2 women and 9 men; Excellent 12=27.27% being 4 women and 8 men and Superior 14=31.81% being 1 woman and 13 men. The VO2max values presented are generally above the Good capacity by 84.08%. As for performance it can be seen that the

student who has more body weight compared to the other with the same distance traveled uses a greater maximum volume of oxygen per unit of time (ml/min/kg), which leads to the consideration that comparatively he has a better Physical aptitude.

Acknowledgments

None.

Conflicts of interest

None.

References

1. Pollock Michael L, Wilmore Jakc. *Physical exercises in health and illness*. 2 edn. 1930.
2. Kenneth H.Cooper. *Aerobic Exercises –Physical fitness at any age*.1982.
3. Felipe Caamaño Navarrete, Pedro Delgado Floody, Daniel Jerez Mayorga, et al. Low levels of physical performance, $VO_{2\text{MAX}}$ and high prevalence of obesity among school children from 9 to 14 years of age. *Nutr Hosp*. 2016;33(5):1045–1051.
4. Jeferson Macedo Vianna. *Aerobic exercises*.
5. Jogging. *A maintenance sport for the heart and circulatory system Training Tactical Technique Manfred Blondorn/Paul Schmidt LDA publishing house*. Lisbon.
6. <https://finishermag.com/running/heres-why-runners-need-to-know-about-ma>
7. <https://slideplayer.com.br/slide/3630050/> “cardiorespiratory capacity”
8. <https://finishermag.com/running/heres-why-runners-need-to-know-about-maximum-oxygen-uptake>
9. Assessment and classification of aerobic physical capacity of wheelchair basketball athletes evaluation.
10. Antonelli CBB, Hartz CS, Santos SDS, et al. Effects of inspiratory muscle training with progressive loading on respiratory muscle function and sports performance in high-performance wheelchair basketball athletes: A randomized clinical trial. *International Journal of Sports Physiology and Performance*. 2020;15(2):238–242.
11. *The effects of aerobic gymnastics on cardiorespiratory capacity in women*.
12. M Vanderthommen, M Francaux, C Colinet, et al. A multistage field test of wheelchair users for evaluation of fitness and prediction of peak oxygen consumption. *J Rehabil Res Dev*. 2002;39(6):685–692.