

Human physiology assignment - Health and fitness assessment report

Health-related fitness tests consist of several different components: body composition, cardiovascular endurance, muscular strength, muscular endurance and flexibility. These specific components collectively allow reflections to the body's major physiological systems. ACSM defines health-related physical fitness testing as “a demonstration of traits and capacities that are associated with a low risk of premature development of hypokinetic diseases”

Body composition is “the body’s amount of fat relative to fat-free mass” (University of Virginia), allowing insight into the specific metabolic health of an individual. It measures the levels of fat, muscle, water and bone that are held within the body. Measuring body composition or BMI levels can show associations between different metabolic and chronic diseases, such as cardiovascular disease, type 2 diabetes, hypertension, and metabolic syndrome. Higher levels of BMI and body composition can identify mortality risks. Cardiovascular endurance is “the ability to perform large-muscle, whole-body exercise at moderate to high intensities for extended periods of time” ([Saltin, 1973](#)). It links directly to both the respiratory and the cardiovascular system, indicating the efficiency of delivering oxygen to the working muscles during exercise. There is a wide variety of CV endurance tests, which can be carried out anywhere, making them one of the most accessible testing methods.

Muscular strength and endurance testing will have an effect on the largest number of systems in the body, i.e., neuromuscular, cardiovascular, metabolic and nervous. Muscular strength is “the maximal amount of force or torque a muscle or muscle group can generate in a specific movement pattern at a specific velocity of movement” (Knuttgen and Kraemer, 1987; Knuttgen and Komi, 2003). This is essential for force production, exerting the maximum force it can with resistance. Muscular endurance is “the ability of your muscles (or group of muscles) to continually exert force against resistance or a given movement”. It is important to measure as it is used in all occupational tasks and everyday life.

Finally, flexibility is also assessed when looking into health-related components of physical testing. Flexibility is “the ability of a joint or series of joints to move through an unrestricted, pain-free range of motion.” (UCDavisHealth). Adequate flexibility will allow more range of motion around the joint, making an individual less susceptible to joint and tissue injuries. Although there is no link to any chronic health diseases from inadequate flexibility, its importance remains the same in physiological health.

All 5 components together provide a detailed overview of physiological health. The components allow insight into many systems in the body, allowing individuals to be aware of any potential risk factors for chronic illnesses or areas that can be improved within their physical activity.

Reliable tests were carried out by following systematic and standardised protocols. This was essential to diminish potential measurement errors and ensure consistent data collection. All equipment was calibrated, with maintained rest periods in between all testing.

The test chosen for body composition was BMI, following the ACSM fitness testing videos. BMI uses the individual's anthropometric measures to test their weight-to-height ratio,

utilising a calibrated digital scale and stadiometer. Prior to gaining measurements, individuals remove heavy garments to guarantee correct height/weight status. Mass was measured to the nearest 0.01kg and height to the nearest 0.1cm. BMI was then calculated using both measurements, kg/M².

Using the UWTSD laboratory protocol, the Queen's College step test was assessed. This is used as an estimation of an individual's VO₂ max in a submaximal state. Before the test proceeds, the individual walks for 5 minutes. Using a metronome set to 88 beats/minute (females) or 96 beats/minute (males), proceed with a 3-minute step test using a 4-step cadence. The heart rate of the participant is taken 5 seconds post-test and used in the equation to work against the norm tables.

The isometric grip strength test was used to measure muscular strength; this protocol was also taken from the UWTSD lab. Implementing a hand grip dynamometer, which must be correctly adjusted for comfort, to gain the most reliable results. Subjects hold their elbow at a 90-degree position and press down on the dynamometer for approximately 3 seconds, palm facing up. The individual will do the testing 3 times on each hand with 2 minutes rest in between; each measurement is taken in kg. The highest value from each hand should be taken and totalled to compare with the norm table.

The 1-minute sit-up test, taken from [fitness-testing.com](https://www.fitness-testing.com), is used to measure muscular endurance. The protocol states, participants must start sitting up with their knees bent and feet flat on the floor. The timer will start when the participant's back touches the floor. The number recorded within 1 minute will be compared to the norm tables provided.

The last test conducted was the sit and reach test, testing flexibility. This protocol is from the UWTSD lab; this test will need a warm-up to begin, to allow optimal results. Without shoes, participants must have full extension of the knees with feet against the edge of the sit and reach box. Hands should be placed over each other and in full extension, straight forward. When ready, hands should be slid forward until maximum reach, holding their position for 1-2seconds before taking a reading.

Components	Results	Norm table results
Height	164.3cm	-
Weight	53kg	-
BMI	19.6	Normal
Cardiovascular endurance	165bpm	Below average
Muscular strength (right)	24.5	40th percentile
Muscular strength (left)	19.9	“ “
Muscular endurance	27	Average
Flexibility	26cm	30th percentile

All normative tables were taken from the procedures followed: UWTSD protocols, WHO BMI scale and [fitness-testing.com](https://www.fitness-testing.com/).

When comparing the data to the norm tables, there is a varied overall physiological fitness status throughout the tests. The results demonstrate both strengths and weaknesses in the individual's fitness performance.

BMI results show that the participant has a normal classification within the ranges that can be found within the norm. As the individual's body mass is therefore relative to their height, the participant is less predisposed to any metabolic diseases that could arise. BMI is a non-invasive screening which makes it very easy to measure consistently. In contrast to this, BMI may not be seen as reliable as other ways when looking into body composition, as it is purely based on height and weight. It does not take into consideration the muscle mass and bone density of a person. When doing a thorough check of body composition, practitioners should perform more than one test to add reliability to their findings. In this case, the individual is within the normal BMI range, and so testing further is deemed unnecessary.

Cardiovascular endurance looks to be a weakness in the individual's testing, with a below-average score. The Queens College Step Test is a submaximal testing method that will provide the results of VO2 max. The body has limited capabilities to undergo high levels of aerobic activity, leading to faster fatigue. Having lower CV endurance can lead to higher risks of related diseases and high blood pressure.

Muscular strength gained through the hand grip dynamometer testing is within the 40th percentile; this is not a full weakness of the participants, however, it is within the lower standards of the norm. The muscular strength test gives us an overall indication of full-body strength. Having a lower CV score could also affect muscular endurance, as fatigue will affect both aerobic activities and muscular activities.

Muscular endurance was seen to be average within the norm values, presenting no major issues within this component of fitness. The sit-up test lets us observe the core stability and control within the posture. The chance of having lower back pain and issues when completing daily tasks is lowered.

The last test was flexibility, done by a sit-and-reach testing method. This was found to be within the 30th percentile of the norm standards, which is slightly below average for a participant of the age. Having reduced flexibility does not lead to any chronic diseases directly; however, more concurrent pain throughout the hamstrings and lower back may be found due to the lack of it. These results highlight an increased risk of injury when exercising and enable us to recognise that this needs to be worked on in future sessions.

The evaluation of the testing has further allowed us to focus attention on the components such as: cardiovascular endurance, muscular strength and flexibility.

These components will enhance capacities within physiological efficiency, furthermore, upholding long-term health.

Based on the interpretations of the scores received in the testing, there are several adaptations that can be implemented into an everyday routine to help improve overall physiological health and fitness. From the WHO recommendations, adults should be participating in 150-300 minutes of moderate aerobic activity per week or 30 minutes a day to help build up

cardiovascular endurance and overall health. This can also be done in vigorous stages of 75-150 mins per week. Alongside CV training, ACSM recommends muscular strength training and basic resistance training 2-3 times a week. To improve the participants' flexibility, it would be recommended to stretch at the end of each workout, increasing unrestricted pain-free movement around the joints.

Word count - 1,483

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Appendix -

Queens College Step Test norm table values -

Men		Age (years)					
CATEGORY	MEASURE	13–19	20–29	30–39	40–49	50–59	60+
I. Very Poor	$\dot{V}O_2$ max (mL • kg ⁻¹ • min ⁻¹)	<35.0	<33.0	<31.5	<30.2	<26.1	<20.5
II. Poor	$\dot{V}O_2$ max (mL • kg ⁻¹ • min ⁻¹)	35.0–38.3	33.0–36.4	31.5–35.4	30.2–33.5	26.1–30.9	20.5–26.0
III. Fair	$\dot{V}O_2$ max (mL • kg ⁻¹ • min ⁻¹)	38.4–45.1	36.5–42.4	35.5–40.9	33.6–38.9	31.0–35.7	26.1–32.2
IV. Good	$\dot{V}O_2$ max (mL • kg ⁻¹ • min ⁻¹)	45.2–50.9	42.5–46.4	41.0–44.9	39.0–43.7	35.8–40.9	32.3–36.4
V. Excellent	$\dot{V}O_2$ max (mL • kg ⁻¹ • min ⁻¹)	51.0–55.9	46.5–52.4	45.0–49.4	43.8–48.0	41.0–45.3	36.5–44.2
VI. Superior	$\dot{V}O_2$ max (mL • kg ⁻¹ • min ⁻¹)	>56.0	>52.5	>49.5	>48.1	>45.4	>44.3

Women		Age (years)					
CATEGORY	MEASURE	13–19	20–29	30–39	40–49	50–59	60+
I. Very Poor	$\dot{V}O_2$ max (mL • kg ⁻¹ • min ⁻¹)	<25.0	<23.6	<22.8	<21.0	<20.2	<17.5
II. Poor	$\dot{V}O_2$ max (mL • kg ⁻¹ • min ⁻¹)	25.0–30.9	23.6–28.9	22.8–26.9	21.0–24.4	20.2–22.7	17.5–20.1
III. Fair	$\dot{V}O_2$ max (mL • kg ⁻¹ • min ⁻¹)	31.0–34.9	29.0–32.9	27.0–31.4	24.5–28.9	22.8–26.9	20.2–24.4
IV. Good	$\dot{V}O_2$ max (mL • kg ⁻¹ • min ⁻¹)	35.0–38.9	33.0–36.9	31.5–35.6	29.0–32.8	27.0–31.4	24.5–30.2
V. Excellent	$\dot{V}O_2$ max (mL • kg ⁻¹ • min ⁻¹)	39.0–41.9	37.0–40.9	35.7–40.0	32.9–36.9	31.5–35.7	30.3–31.4
VI. Superior	$\dot{V}O_2$ max (mL • kg ⁻¹ • min ⁻¹)	>42.0	>41.0	>40.1	>37.0	>35.8	>31.5

Muscular strength -

Percentile ranks for sum of grip strengths (kg, right plus left) for females.

Percentile rank	Age (yrs)																	
	10	11	12	13	14	15	16	17	18	19	20-24	25-29	30-34	35-39	40-44	45-49	50+	
90	30	37	44	49	65	60	58	61	59	63	61	67	65	66	64	64	57	
80	25	33	40	44	50	54	53	54	55	59	57	62	60	59	58	57	52	
70	22	30	36	41	48	49	49	50	52	54	53	57	57	55	54	53	48	
60	20	27	33	38	44	45	48	47	49	50	50	53	53	53	51	52	45	
50	18	25	31	36	41	43	43	44	46	48	48	49	49	51	49	49	43	
40	17	23	28	34	39	41	41	42	43	46	45	48	47	49	47	47	40	
30	15	20	26	32	36	38	39	39	39	42	42	46	44	46	43	44	38	
20	14	17	22	30	32	36	36	36	36	39	38	43	41	43	40	40	34	
10	10	12	18	26	27	31	33	31	31	36	34	37	36	36	36	34	30	

Flexibility -

Percentile Ranks and Normative Data for the Traditional Sit-and-Reach Test (cm)

AGE (y)		20-29		30-39		40-49		50-59		60-69	
Sex		M	F	M	F	M	F	M	F	M	F
Percentile rank	90	39	40	37	39	34	37	35	37	32	34
	80	35	37	34	36	31	33	29	34	27	31
	70	33	35	31	34	27	32	26	32	23	28
	60	30	33	29	32	25	30	24	29	21	27
	50	28	31	26	30	22	28	22	27	19	25
	40	26	29	24	28	20	26	19	26	15	23
	30	23	26	21	25	17	23	15	23	13	21
	20	20	23	18	22	13	21	12	20	11	20
	10	15	19	14	18	9	16	9	16	8	15

May be used for the traditional, backsaver, and V-sit tests. If values fall between the percentile ranks, interpolate the data. For example, if a male subject is 21 years old and achieves a result of 37 cm, then his percentile rank is 85.

Source: Canadian Physical Activity, Fitness & Lifestyle Approach: CSEP-Health & Fitness Program's Appraisal and Counselling Strategy, 3rd edition, © 2003. Reprinted with permission from the Canadian Society for Exercise