The Cardiorespiratory System
A Research And Referencing Task

Teacher:
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The cardiovascular and respiratory systems both play an integral part in our ability to exercise. All the cells in the body require oxygen to survive.

The Respiratory System – Anatomy

The respiratory system is comprised of the airway, lungs and muscles that support respiration. Air, inhaled through the nose progresses to the nasopharynx through the larynx and into the trachea. The trachea begins level with the 6th cervical vertebra, it is supported by U-shaped rings of hyaline cartilage which helps maintain its structure. (Basmajian, 1980) The trachea then divides into two bronchi and then into further bronchioli. The bronchioli enters the lungs, two spongy organs that facilitate the exchange of oxygen. The bronchioli divide into the lung lobes; three on the right and two on the left. The bronchioli divide further into alveolar ducts which contain alveoli. In the alveoli, the gas exchange takes place. The lungs are supported by the diaphragm, a muscle that separates the chest cavity from the abdominal cavity. (BBC, 2014) During inhalation, the diaphragm flattens, creating more space for the expanding lungs. During exhalation, it expands and forces air out. (Zimmermann, 2016)

The Cardiovascular System – Anatomy

The cardiovascular system is comprised of the heart, vessels and blood. The vessels are vital in transporting blood, nutrients, waste, oxygen and hormones throughout the body. The heart powers the entire cardiovascular system. The heart is composed of cardiac muscle and is covered by a fibrous tissue called pericardium. The heart is comprised to two halves, the right and left side, each with two chambers, the atrium and ventricles. (myVMC, 2013) Veins deliver deoxygenated blood to the right side of the heart where blood drains into the superior and inferior vena cava. The blood then passes through the right atrium, right ventricle, the pulmonary trunk and pulmonary arteries and into the lungs where it absorbs more oxygen. The newly oxygenated blood returns to the left atrium and then through the left ventricle where it is pumped into the aorta and to the rest of the body through the arteries. The oxygenated blood is used and the cycle continues. (Bupa Health, 2011)
Gas Exchange

The alveoli are a hub of blood capillaries through which oxygen enters the blood while carbon dioxide is released. (Taylor, 2016) Blood arriving in the alveoli has a high concentration of carbon dioxide due to its production during the body’s respiration. The carbon dioxide in the capillaries diffuse into the alveoli where there is a lower concentration of carbon dioxide. Oxygen similarly enters the capillaries through diffusion. (BBC, 2014) The oxygen molecules bind with the haemoglobin in red blood cells to form oxyhaemoglobin which travels through the blood stream around the body. (Moss, 2016) Oxygen is received by muscle tissues from the blood stream also through diffusion; oxygen diffuses to the tissue which has a lower concentration of oxygen and carbon dioxide goes into the blood stream.

Acute Cardiorespiratory Response to Exercise

When exercising, the body acutely adapts to the increase in the demand for oxygen and ATP. (Dickins, 2014) Respiratory rate increases during exercise, as the working muscles require, to enable
the gas exchange in the lungs to occur more rapidly. The intercostal muscles expand the chest cavity more to allow more air to be drawn in during inhalation.

Stroke volume (volume of blood exiting the left ventricle with each pump) increases hugely with exercise. Cardiac output also increases with exercise proportional to the exercise intensity. (Davies, n.d.) Cardiac output can be calculated with the following formula:

\[ \text{CARDIAC OUTPUT} = \text{HEART RATE} \times \text{STROKE VOLUME} \] (AMAC, 2017)

The heart rate also rises during exercise, beginning to rise before the commencement of exercise due to anticipation. (Knox, 1940) Blood pressure increases, transporting vital oxygen to working muscles and blood is directed away from inactive organs and rather to the organs and muscles that require it. (Teach Pe, 2017)

References


