Physiological Homeostasis Of An Active Person Versus A Non-active Person

Introduction

The maintenance of a steady internal environment regardless of a constantly changing external condition is called Homeostasis. It enables all body frameworks to perform within an acceptable range. Human bodies maintain a stable internal environment of ~37 °C, ~0.1% blood glucose, blood pH of ~7.35. It is maintained by feedback loops, mainly negative feedback loops which are processes where a mechanism is activated to bring the body back to its normal state. (Modell et al, 2015) If the system cannot restore its balance, it can lead to death.

The homeostasis of body temperature within a range by which a life form functions ideally is alluded to as thermoregulation. The core temperature of the body is usually different from the external temperature. The internal temperature must be kept up at a specific temperature to give an optimal environment for internal organs to perform adequately and efficiently. However, if the core temperature is not maintained, it could permanently damage internal organs. The circulatory system works together with thermoregulation. Circulatory system helps by directing blood towards the surface of the skin to excrete heat. The capillaries in the skin dilate to increase the amount of blood reaching the skin to give off the excess heat. This action increases blood flow thus the pulse or heartbeat increases. This process lowers the core temperature whilst increasing the external temperature.

The chemical reactions made during a rigorous exercise make the heart and working muscles very active, thus ending up releasing heat. Working muscles are being supplied with oxygen. Oxygen is used for aerobic respiration which breaks down glucose to form Adenosine Triphosphate (ATP), one of the major endogenous sources of energy of the body (“Energy for Exercise” 2007). ATP Hydrolysis is the breakdown of ATP which releases the energy needed for an activity, and heat. ATP production and hydrolysis happen simultaneously. The distribution of oxygen to the muscles to produce ATP and the distribution of the energy released from ATP hydrolysis is performed by the pumping of the heart. During exercise, the heart works extra hard to carry out this task, thus increasing the pulse, beats per minute, of the heart. The release of heat during ATP breakdown increases the core temperature of the body. In order to maintain the body’s normal temperature, the increase in blood flow also directs the heat produced to the surface of the skin, therefore increasing the external temperature.

In this study, we investigated the effects of rigorous exercise on physiological homeostasis. Specifically, we tested the proposed hypothesis that the activity level of a person affects their ability to maintain homeostasis. It is argued that the heart of an active person is more adapted to more physical work and does not need to pump as hard to attain homeostasis, thus should have less change in pulse and external temperature when in rest phase versus when in the response phase. The less active person, on the other hand, will experience a higher change in pulse and external temperature to maintain stability because she or he is less adapted to rigorous work, therefore, the person’s heart needs to work twice as much to attain homeostasis. This investigation is performed at a laboratory room at the DNA building at Trent University. Two parameters were measured for this experiment, the pulse, heartbeats per

minute, and the external temperature of the two test subjects who performed two minutes and thirty seconds of exercise.

Methods

The measurement of the two parameters used in this lab investigation; heartbeat and external temperature, is performed in a laboratory room in DNA building in Peterborough, Ontario Monday afternoon last January 14, 2018. The laboratory room has a controlled temperature of 22°C

In this study, we observed the three phases of homeostasis: rest, response, recovery. Our group chose to examine the circulatory system and thermoregulatory system. From these systems, we measured heartbeat using a sphygmomanometer and external temperature using an infrared thermometer.

Two female subjects, with an average age, weight, height, both non-smokers, participated in the study. The variable we chose to examine in regards is the physical activity level of the experimental subjects. The first test subject is somewhat active due to work, while the second test subject is rarely active. Both test subjects do not actively engage in competitive athletics. The test subjects performed two and a half minutes of skipping rope that elicited a physiological response that is based on the Borg Rating of Perceived Exertion (RPE). The first measurement taken is the rest phase of homeostasis and also the controlled measurement of the study in which the two test subjects were rested for 5 minutes that includes being seated, quiet and relaxed. After the 5 minutes mark, the heartbeat is measured using a sphygmomanometer that was cuffed around the upper arm of the test subject, the external temperature was also taken using an infrared temperature that was focused on the palm of the test subjects to get the reading. The subjects then performed the assigned exercise for 2 minutes and 30 seconds rigorously and consistently with controlled small in between breaks. Immediately after the exercise, the response phase is taken where the two chosen parameters were measured at the same time with the subjects seated, calm and quiet. Lastly, the recovery phase is taken in which a series of measurements were observed in 3 minutes interval for 30 minutes while the test subjects were seated, quiet, calm and unbothered. (Biology Department 'BIOL 1030H - FOUNDATIONS OF CELLULAR AND MOLECULAR BIOLOGY 2018-19 Academic Year (WI) Peterborough ") The two testees were asked to make minimal movements and do not monitor themselves in order to not get controlled measurements.

References

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