

The Importance of Homeostatic Mechanisms and Running Marathons

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Homeostasis is very crucial in keeping the human body at the optimal condition, and being able to keep all the organs functioning correctly. All the organs will work together to adjust any changes that have been done to the body to bring it back to its equilibrium. This must be done in order to prevent serious problems from occurring in the body, like organ failures. A change in one system may affect all other systems in the body, which could then range anywhere from mild to devastating effects (Anatomy, n.d.). One very important organ that plays an important role in maintaining homeostasis in the body are the kidneys. The kidneys are responsible for maintaining fluid, electrolyte, and acid-base balance, metabolism of macromolecules, secretion of hormones, and excretion of wastes from metabolism. They are not the only organs in the body that maintains homeostasis, but they do many things to keep things at an equilibrium.

Homeostatic mechanisms of the body will come into play when a person is participating in an endurance extensive sport, like running in a marathon. Homeostatic metabolisms are put in place to ensure optimal athletic performances. A very important mechanism that the body goes through is vitamin D synthesis. This is important in maintaining bone health, muscle contraction, hormone secretion, and neurotransmitter releases (Anatomy, n.d.). The vitamin D will become active/synthesized when it undergoes a hydroxylation reaction in the kidneys. This will help the digestive tract absorb calcium and then it will be reabsorbed back through the kidneys. The kidneys will then maintain the normal concentrations of calcium and phosphate. Erythropoiesis is also important as it produces an amino acid called EPO to stimulate the formation of red blood cells in the bone marrow. The kidneys will produce about 85 percent of the

EPO while the liver will produce the rest of it (Anatomy, n.d.). The kidneys will produce more EPO when a person is in need of more oxygen when exercising. Another mechanism that the body goes through would be blood pressure regulation. Osmosis now comes into play, and that will make the water flow towards the area with more sodium. Water and glucose will also be recovered by the kidneys when it is reabsorbing and when urinating is forming. The kidneys will then work with other organs like the lungs and liver to control the blood pressure. The kidney is said to synthesize and release renin when the blood pressure is low (Anatomy, n.d.). Renin will then convert angiotensinogen into angiotensin I, and that then will activate angiotensin II by the lungs. Angiotensin II will start raising blood pressure to cause a vasoconstriction effect. Angiotensin II then will stimulate the adrenal cortex to release the hormone aldosterone. Aldosterone is a steroid hormone that helps the renal reabsorb sodium, and also recover water. Reabsorption of sodium helps raise and maintain blood pressure for the long term (Anatomy, n.d.). Regulation of osmolarity works the same ways as regulating blood pressure. In this case, it will regulate solute concentrations and fix any imbalances. With this regulation, it will help with reabsorbing protein that was in urine. When the body does not take in enough water, it will cause dehydration, vomiting, diarrhea, lethargy, or muscle cramps. With both of these two regulations, it also regulates the electrolytes that are needed in the body. Sodium, calcium, and potassium are closely regulated (Anatomy, n.d.). If electrolytes are not regulated, they can cause serious problems to the functions of the muscles and nerves. The last mechanism that the kidneys will do to maintain homeostasis is regulating the pH of the body. The kidneys will be able to make sure that the body is not too acidic or basic because it may

fluctuate with the enzymes losing their three-dimensional shape. If the kidneys do not maintain the pH, it can mess up the functions in the body like hormonal binding and nervous system signaling. So the kidneys play a very important role in the body to help maintain homeostasis.

All these mechanisms must work properly or be maintained to maintain homeostasis. When there is renal failure in any of these mechanisms, it can cause major problems to the human body. For vitamin D synthesis, it is important for the kidneys to work properly to carry out the function of calcium absorption. Like stated earlier, it will be important for bone health, muscle contractions, and even hormone secretion. Without this, a person's body would not be in optimal shape or condition to be running a marathon. The runner would not be able to carry out any of the proper functions to even run properly, let alone run and finish a marathon. The bones would not be strong enough and would be too frail to even move with such force for an extended period of time. The muscles would not contract properly which could then cause injuries. The runner's body would not be able to communicate properly to do anything which would cause many problems overall. For erythropoiesis, it is very important to be able to get enough oxygen for the body and its tissues. The tissues in the body will require more oxygen when aerobic exercise is being done (Anatomy, n.d.). If the tissues in the body are not getting enough oxygen when running a marathon, it will also cause some severe problems to the body. This will decrease the endurance that the runner has and it can cause the body to overwork itself. That alone will cause many problems, like fainting, vomiting, and overheating. Blood pressure and osmolarity regulation will also be very important. Renal failure for that would cause diabetes, severe dehydration, and

even losing control of vascular volume (Anatomy, n.d.). All of this could then potentially cause a heart attack, stroke, and/or an aneurysm. It can cause damage to the brain or even result in death if it is really severe. Electrolytes are also important to maintain. Renal failure will cause an imbalance and cause problems for nerve conduction, muscle contraction, rhythm, and function. This is extremely important for exercising or participating in sports that require a lot of endurance and power. No one would be able to carry out any physical movements for things that require power or endurance if their muscles and nerves cannot function properly. As much as they try, the body would not cooperate since the nerves and neurotransmitters cannot efficiently communicate with each other. So if renal failure were to occur, the body would not be able to maintain homeostasis, and definitely not able to run a marathon.

When metabolic imbalances come into play, it can affect athletic performances. Metabolic imbalances can occur from many things. It can occur when someone is actively exercising and the body is working hard. It is said that it is important for there to be a balance between training-induced fatigue and sufficient recovery to be in place (Woods et al., 2018). This kind of imbalance can be restored through time and rest. It does not cause much of a problem since it is a minor imbalance and homeostasis can be restored a lot quicker. If the athlete does not let their body rest, then it can cause other problems. The body can have a risk of maladaptation, illness, or injury if proper recovery is not added to the agenda (Woods et al., 2018). If it gets worse, it will cause an extreme state of severe overreaching. This means that the body will not be able to sustain any efforts in any intense workout or activities. It will also cause endurance to decrease dramatically since the body can no longer maintain any progression of training

and the body will become fatigued more frequently. From all that was stated above, it can also cause more detrimental effects to the athletes mental health as well, like stress, mood disturbances, nutritional and sleep disturbances, and even other illnesses (NWoods et al., 2018). Another kind of metabolic imbalance can occur which can be more severe. It is said that about one-third of adults in the U.S. have this syndrome, and it is becoming more common (Metabolic, 2019). This is called metabolic syndrome and it is usually due to being overweight and not having enough exercise. There are a cluster of conditions that can arise from this syndrome, like increasing the risk of heart disease, stroke, and type 2 diabetes. This will also cause high blood pressure, high blood sugar, extra fat, and abnormal cholesterol and triglyceride levels in the body (Metabolic, 2019). This will cause many problems for someone who wants to become a marathon athlete. Lifestyle changes must be done in order to help reduce this problem and for the body to perform better. Some examples of lifestyle changes would be exercising more, maintaining a healthy weight, eating a better diet, and not smoking. This will then help with training and building up endurance and stamina.

The kidneys play a huge role in maintaining the body's homeostasis, especially for athletes. They are able to maintain fluid, electrolytes, acid-base balance, metabolism of macromolecules, secretion of hormones, and excretion of waste products that were produced via metabolism. Everything must be maintained and work properly in order to keep the body at optimal condition. If there is renal failure in any of these areas, it will cause problems for the rest of the regulations processes. For an athlete that runs marathons, it is important for all of these functions to stay at optimal conditions so that one can train and prepare for a big marathon. If not, the body will struggle to

communicate and carry out proper functions to do any actions. Also if there is renal failure, not only will it affect the other functions, it will also affect other organs in the body as well. So the kidneys are very important organs that help carry out vital roles to survive.

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