

Role of Physical Exercising in Heat and Sun

Suresh Kumar Choudhari

Department of Physical Education, Guru Ghasidas University, Bilaspur, Chhattisgarh- 495009 (India)

Abstract: *Present paper deals in India health benefits of physical activity. It is recommended that Americans engage in moderate - intensity exercise on a regular basis. However, exercising in a hot environment places an increased strain on the body and increases the risk for heat- related illness or injury. Understanding how the body responds and adapts to being physically active in the heat is critical to ensuring safe and effective exercise. The purpose of this review is to discuss. How exercising in the heat and sun can be a major challenge to body temperature regulation and physiological and behavioural adaptations to combat the threat of the potential illness or injury related to exercising in a hot environment, and Populations and predisposing factors that may be associated with an increased risk for heat- related problems. While the turn “ exercise” is used throughout this review, It is important to note that the information provided is relevant for anyone who is physically active in the heat, whether exposure to a hot environment.*

Keywords: Cardiovascular responses, Heat, Exercise, Environment

1. Introduction

In exercise to preserve optimal physiological functions, human body core temperature is usually regulated within a relatively narrow range (35-39°C or 95 - 102.2°F). During resting thermo neutral (mild environmental temperature) conditions, body core temperature (set point 37° C or 98.6° F) is maintained by an equal rate of body heat gain and heat loss. However, when the rate of heat gain is greater than the rate of heat loss, body core temperature will increase above set point, and in extreme situations, rise to dangerously high levels (40° C or 104°F). The primary means by which the body gains heat is from the environment and metabolism. When ambient temperature is greater than skin temperature (33° C or 91.4°F at rest, up to 36°C or 96.8°F during exercise) heat will be transferred from the surrounding air to the body. When exercise is performed. A large amount of heat is produced by the contracting muscles in fact, less than 25% of all the energy produced by contracting muscles is used to perform work, with the remaining 75% converted to heat in the muscles. The combination of exercise and high environmental temperature. Presents a serious challenge to body core temperature regulation. It means by which the body gains and losses heat during exercise.

The Metabolic heat production is directly proportional to exercise intensity radiation is the transfer of heat between two objects, with no physical contact being involved. The directions of radiant heat transfer depends on a thermal gradient examples, body heat loss from the skin to the environment occurs when skin temperature is greater than air temperature and heat is gained by the body when solar energy from direct sunlight is absorbed by skin. Convection is the heat exchange between the body and surrounding moving air wind or body fluids blood. In evaporations, heat is transferred from the body to water sweat on the surface of the skin. When this water gains sufficient heat, it is converted to a gas water vapour, thereby removing heat from the body. Evaporation of 1 kg of sweat from the skin will remove 580 kcal of heat from the body. An 44°C increase in body temperature is sensed by central and skin thermo receptors and this information is processed by the hypothalamus to trigger excess heat are by increasing skin blood flow, thereby allowing heat to be moved via

convection from the body core to the skin and secreting sweat onto the surface of the skin for subsequent evaporation. Heat loss via these two mechanisms increases in proportion the rate of heat production and usually increases. Sufficiently to balance metabolic heat production, allowing a new steady-state relatively constant body core temperature to be achieved slightly higher than resting body core temperature example as (38°C or 100.4° F).

2. Material and Methods

The cardiovascular system is also important in temperature regulation and the demand for increased blood flow to both the exercising muscles and skin during exercise-heat stress places an increased strain on this system. Exercise for instance, the increase in skin blood flow during exercise-heat stress is accomplished by an increase in cardiac output volume of blood ejected from the heart each min above that of exercise in cool conditions and the redistribution of blood away from the gastrointestinal tract, hepatic, and renal circulations towards the skin circulation. Additionally sweat loss during exercise-heat stress can cause a decrease in blood plasma volume. A smaller overall plasma volume will result in a reduction in the amount of blood that is returned to the heart cardiac filling or various return and thus a reduction in the amount of blood that is ejected from the heart with each beat stroke volume. A decreased stroke volume requires a compensatory increase in heart rate to maintain cardiac output. In this manner, a decrease in plasma volume causes cardiac strain and limits the amount of blood flow available to the muscles and skin during prolonged exercise-heat stress.

3. Result and Discussion

The possible problems that may arise as a consequence of exercise in a hot environment. Heat exhaustion, syncope, and cramps are relatively minor and common problems that can usually be resolved by cessation of exercise, replacing fluid and electrolytes, and relocating to a cooler environment.

3.1 Exercise Performance

It is well established that heat stress and or dehydration result in an earlier onset of fatigue prolonged aerobic exercise compared to exercise in cool conditions and or in a dehydrated state. There is also evidence that performance of intermittent, high-intensity exercise tasks, including skill sports examples soccer and basketball, is negatively impacted by heat stress and or dehydration. Dehydration exacerbates hyperthermia by impairing evaporative and convective cooling capacity and increasing circulatory strain. Additionally, blood flow to exercising muscles is attenuated with dehydration during exercise-heat stress. Hyperthermia causes a shift in metabolism; such that muscle glycogen oxidation and blood lactate accumulation occur at a faster rate than if exercise was performed in a cool environment. Any of these factors could contribute to the early onset of fatigue during exercise-heat stress; however, the most important may be central nervous system changes that occur as a result of hyperthermia. According to the critical internal temperature hypothesis, individuals exercising in the heat. Consistently reach the point of exhaustion at the same threshold body core temperature 40°C or 104°F. This critical core temperature coincides with voluntary fatigue despite variations in exercise intensity, initial core temperature, adiposity, acclimation. The concept underlying the critical core temperature hypothesis is that an increased body core and brain temperature is associated with a decreased central drive to exercise. The diminished drive to exercise is associated with an increased rating of perceived exertion and reduced motor unit recruitment and firing rate to the exercising muscle.

3.2 Sleep Loss

Prolonged sleep loss has been shown to decrease skin blood flow and sweating rate at a given core temperature.

3.3 Chronic Diseases

Medical conditions that can raise the risk of incurring heat-related problems include hypertension alters the control of skin blood flow, obesity increased rate of metabolic heat production during exercise, and cystic fibrosis (increased salt loss in sweat).

4. Conclusion

Body core temperature during exercise -heat stress is determined primarily by the balance of environmental conditions examples temperature, humidity, air velocity, and radiant heat load) and the body's heat dissipating mechanisms examples skin blood flow and sweating. If body heat gain exceeds heat loss and or if fluid intake is not sufficient to match sweat loss, problems related to hyperthermia and or dehydration examples muscle cramping, heat exhaustion, heat syncope, and heat stroke can develop. Predisposing factors such as age older adults or children), disease, and medication, drug use, may put certain individuals at an increased risk for heat illness and injury. However, physiological examples heat acclimation and behavioural adaptations examples avoiding exercise when WBGT>73°F, wearing light-collared, loose-fitting,

moisture-wicking clothing, decreasing exercise intensity, consuming 16 oz. of fluid for every of sweat lost can minimize the risk for heat-related problems and thus facilitate the safe participation in regular exercise.

Exercising in a hot environment places an increased strain on the thermoregulatory and cardiovascular systems and increases one's risk for heat related illness or injury and understanding how the body responds and adapts to being physically active in the heat is critical to ensuring safe and effective exercise.

5. Acknowledgement

Author thankful to Department of Physical Education Guru Ghasidas University Bilaspur, Chhattisgarh provided valuable informations for study periods.

References

- [1] Almond, C.S.D. et al. Hyponatremia among runners in the Boston Marathon. *New England Journal of Medicine* 352:1550-1556, 2005.
- [2] Armstrong, L.E. *Exceptional Heat Illnesses*. Champaign, IL: Human Kinetics, 2003, 275 pp.
- [3] Armstrong, L.E., Y. Epstein, J.E. Greenleaf, E.M. Hayes, R.W. Hubbard, W.O. Roberts, and P.D. Thompson. American College of Sports Medicine position stand : heat and cold illnesses during distance running *Medicine and Science in Sports and Exercise* 28(12): I –X, 1996.
- [4] Armstrong, L.E., D.L. Costill, and W.J. Fink. Influence of diuretic induced dehydration on competitive running performance. *Medicine and Science in Sports and Exercise* 17(4): 456- 461, 1985.
- [5] Backer, H.D., E. Shoup, S.L. Collins, and H. Barman. Exertional heat illness and hyponatremia in hikers. *American Journal of Emergency Medicine* 17: 532-539, 1999.
- [6] Baker, L.B., T.A. Munce, and W.L. Kenney. Sex differences in voluntary fluid intake by older adults during exercise. *Medicine and Science in Sports and Exercise* 37(5): 789-796, 2005.
- [7] Binkley, H.M., J. Beckett, D.J. Casa, D.M. Kleiner, and P.E. Plummer National Athletic Trainers' Association position statement : exertional heat illnesses. *Journal of Athletic Training* 37(3): 329-343, 2002.
- [8] Centers for Disease Control. Heat – related deaths- Los Angeles County, California, 1999- 2000, and United States, 1979-1998. *Morbidity and Mortality Weekly Report* 50(29): 623-626, 2001.
- [9] Cian, C., P.A. Barraud, B. Melin and C. Raphael. Effects of fluid ingestion on cognitive function after heat stress or exercise – induced dehydration. *International Journal of Psychophysiology* 42:243-251, 2001.
- [10] Convertino, V.A., L.E. Armstrong, E.F. Coyle, G.W. Mack, M.N. Sawka, L.C. Senay, and W.M. Sherman. American College of Sports Medicine position stand: exercise and fluid replacement. *Medicine and Science in Sports and Exercise* 28(1): I-VII, 1996.
- [11] Coyle, E.F. and S.J. Montain. Benefits of fluid replacement with carbohydrate during

exercise. *Medicine and Science in Sports and Exercise* 24(9):S324-S330,1992.

- [12] Dougherty, K.A., L.B. Baker, M. Chow, and W.L. Kenney. Two percent dehydration impairs and six percent carbohydrate drink improves boys basketball skills. 38(9):1650-1658,2006.
- [13] Elsner, P., E. Holzle, T. Diepgen, S. Grether-Beck, H. Honingsmann, J. Krutmann, K. Scharffetter-Kochanek, T. Schwarz, and T. Luger. Recommendation : Daily sun protection in the prevention of chronic UV- induced skin damage. *Journal of the German Society of Dermatology* 2(5): 166-173,2007.
- [14] Fortney, S.M., C.B. Wenger, J.R. Bove, and E.R. Nadel. Effect of blood volume on sweating rate and body fluids in exercising humans. *Journal of Applied Physiology* 51: 1594-1600,1981.