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Tennis in Hot Environment

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Abstract – Tennis is a lifetime sport. Any section of the society can play tennis all around the year. Playing tennis in a hot environment for a longer duration of time can be very detrimental for both performance and health point of view. Although, playing tennis on a hard surface in a hot environment is more difficult as compared to a clay surface because a hard surface reflects the heat and through the sole, heat induces into the player's body whereas on a clay surface, the heat is absorbed and the surface temperature relatively remains low. Hence, Fluid replacement should be given top priority to maintain the body's homeostasis. Around 200 ml of fluid, every 15 minutes is an adequate rate to drink when the environment temperature is above 27º c and the Carbohydrate Electrolyte Drink is considered as one of the best drinks in a hot environment.

Keywords: Tennis, Hot Environment, Fluid Replacement, Hard and Clay Surface.

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1. INTRODUCTION

Professional tennis players have to play the tournaments across the globe around the year in a varied climatic condition from hot to cold [1]. Most of the tennis tournaments are played outdoors in warm to hot climates. Tennis players often consider the heat as the toughest opponent[2]. During certain parts of the competitive year, tennis players may be exposed to warm- hot ambient conditions for both training and competition. The effect of hot environmental temperatures on tennis performance is enormous, and the performance, as well as physiological functioning, reduces as a match progress [3]. The major challenges that occur while playing tennis in a hot environment are mentioned below in detail.

2. CHALLENGES OCCUR WHILE PLAYING TENNIS IN A HOT ENVIRONMENT

Tennis is a sport, which is mostly played at high temperatures and various researches have been conducted in hot conditions. In Tennis, players have to play multiple matches every day continuously for a week and sometimes for two weeks [4], if the player plays the finals of the tournament.

Playing tennis at high temperatures is always very challenging because an additional amount of heat induces in the body from the environment which generally increases the thermal stress and arises the hydration concern of the body. Performance and health both may deteriorate [5] if proper precautions are not taken on time.

1.1 Fluid and Electrolyte Replacement

One of the biggest challenges while playing tennis in hot conditions is to replace the lost fluid and electrolytes which eliminates from the body through evaporation of sweat. To avoid the chances of dehydration and muscle cramping, optimum fluid replacement is very important. The condition of hypohydration generally takes place in a hot environment and it has a huge negative impact on performance. Although tennis has no standard length for matches, and match times can range from 30 minutes to four hours. Providing general recommendations for such sport is more challenging than for those sports thathave set match time. Fluid loss from the body also depends on various factors such as environmental conditions, hydration status, age, gender, intensity of play, duration of match acclimatization, aerobic fitness [6]. It has been observed that players can induce sweat rates of over 2.0 l/h [7], this is the reason, why fluid replacement should be kept on top priority and fluid intake strategies should be usedto replace the lost sweat.

It is also very important to maintain the electrolyte balance of the body during the play to sustain the performance. Bergeron (2003) reported that an extraordinary water loss due to extensive sweating can lead to a large electrolyte deficit particularly sodium [1]. Therefore, Sodium replacement during prolonged exercise in the heat may be critically important to maintain fluid and electrolyte balance and muscle contractility and to avoid the chance of heat cramps. However, to minimize the physiological disturbances, ad-libitum drinking of the Carbohydrate Electrolyte beverage is very effective during exercise to maintain body electrolyte balance, where the

duration of an event is more than 2 hours [1, 8, 9, 10, 11, 12, 13].

1.2 Impact of Playing Surfaces

Tennis is a game, which is played on different surfaces such as clay, grass, and hard in the professional arena.

Tennis hard courts are made of a concrete or asphalt foundation and on top of it, synthetic/acrylic layers are laid down. In the study of Buskirk et al., 1971, it was found that the surface temperature of the synthetic turf was 37º F higher than asphalt and 86.5º F hotter than natural turf. The solar illuminance and the surface temperature of outdoor sport surfaces were measured in the summer, the surface temperatures of the artificial turf (67.0 ºc), the natural turf (42.2 ºc), the artificial turf (63.9 ºc), the clay track (45.1 ºc), and the tennis court (59.3 ºc) were measured. Therefore, the temperature of the hard surface is much higher than the clay surface during high environmental temperature. Hence, it was concluded that the heat transfers from the surface to the body through the sole of an athlete's foot and it is significant enough to bring greater physiological stress that may result in serious heat-related health problems [17].

1.3 Sweat Rate

To perform at optimum level in a hot environment, acclimatization is very important.Acclimatized athlete generally sweats earlier and that is why acclimatized athletes have a higher sweat rate than non-acclimatized athletes. Acclimatized athlete also loses fewer electrolytes in sweat such as sodium, chloride, and potassium compared to non-acclimatized athletes.

The rate of sweating varies among different individuals; in fact, some are more prone to dehydration than others. The human body contains two different types of sweat glands: the apocrine sweat glands are located in hairy areas of the body, such as armpits, and secrete an oily mixture to decrease friction and another sweat gland is eccrine, which are about 2-3 million over the surface of the body, which are primarily involved in temperature regulation. In a hot environment, the sweat rate increases enormously, in the study of Bergeron (1996) and he concluded that the sweat rate was extensive (2.5 l/hr) due to which heat cramps take place [14].

1.4 Body Temperature

In humans, normal body temperature is approximately 98.4º F (37º C) and can be measured in a variety of ways, but the two most common methods are oral and rectal. Body temperature is controlled by the autonomic division of the central nervous system. The hypothalamus is an important structure in the brain that is involved in the control of a wide variety of physiological functions, including body temperature. In tennis, no. of researchers has noted the body temperature during and after the match in varied environmental conditions.

Bergeron et al., (2007) reported core temperature increased during singles and remained elevated, even after 10 min following the end of play [2]. Pre-to post-match body temperature increased 1.1 ± 0.4° C [18]. However, in a hot environment rectal and skin temperature were found to be insignificant in pre to post-exercise [9].

During hot environmental conditions, the maintenance of core body temperature within an optimal range is very challenging. It is very hard to monitor the core body temperature in a live tournament situation. Therefore, few studies with simulated conditions or in laboratory conditions were conducted and various fluids were also administered to check the core body temperature during play [2].

The large majority of points in tennis last less than 10 seconds with rest periods lasting no more than 25 seconds. Such a work/rest ratio can cause large changes in body temperature but allows ample time for fluid replacement. Ultimately, such a work-rest/work ratio helpsin reducing the gradual rise in body temperature[2].

1.5 Blood Lactate

It was found that lactate production varies among the studies. The blood lactate production is more in the players who play longer points with shorter recovery time than the players who play short points with longer recovery time [5]. Technical and Tactical tennis performance declines as the blood lactate elevates above 7-8 mmol/l [19]. In hot and humid conditions, blood lactate production increases might be due to more amounts of heat production in the body and less amount of heat dissipation from the body. Fluid replacement can reduce lactate production but, playing surface in tennis at high temperatures is producing more blood lactate is an issue. In the study, Martin et al., (2011) concluded that the lactate production is more in clay surface as compared to hard surface [20].

However, the lactate level also depends on various other factors such as type of playing surface, ball diameter, environmental temperature and humidity, type of match, and characteristics of subjects.

1.6 Blood Glucose

The blood sugar concentration or blood glucose level is the amount of glucose (sugar) present in the blood. The body naturally regulates blood glucose levels as a part of metabolic homeostasis. Glucose is the primary source of energy for the body's cells, and blood lipids (in the form of fats and oils) are primarily a compact energy store. Glucose is transported from the intestines or liver to body cells via the bloodstream and is made available for cell absorption via the hormone insulin, produced by the body primarily in the

pancreas. Many researchers have tested blood glucose level after the match and found varied results. Carbohydrate drink enhances blood glucose concentrationafter the match [21,22,23], whereas contradictory findings were found in the study of Mcrae (2010), where glucose concentration did not change throughout the match play condition and recovery when compared to pre-exercise measures [24].

For tennis players, blood glucose can be very important because tennis is a game that lasts for a long duration, and glucose stored in the muscle burns very quickly, but an excess amount of glucose stores in the liver in the form of glycogen then converts into glucose and provide energy to the working muscles. It is important and critical that players understand which carbohydrates they should consume and when. However, liquid carbohydrate sources and foods containing simple carbohydrates may be used when it is necessary to raise the glucose level quickly during training or in a match.

3. CONCLUSION

A considerable amount of attention has been paid to the composition of these carbohydrate solutions and it is recommended that the concentration of glucose solutions used for fluid replacement should be no more than 2.5% and of low osmolality. The optimal amount of fluid consumption to maintain hydration is individualized dependent upon environment, intensity level, body mass, and sweat rate [6]. It has also been suggested that 200 ml of fluid, every 15 minutes is an adequate rate to maintain body fluid balance in a warm environment (WBGT 27º c). This recommendation is equal to 0.80L·hr-1, which is less than half the amount of fluid that can be lost due to sweating in hot conditions. This level of fluid can be increased in conditions if the temperature is greater than (WBGT 27º c). Although fluid intake is also based on individual players.

Supplementation also plays a vital role to achieve peak performance. For tennis matches greater than 1 hour in duration, a Carbohydrate electrolyte drink is recommended on-court beverage, it minimizes the physiological disturbances, as well as can be more effective in recovery [9].

The data also prove that Carbohydrate drink intake may facilitate the maintenance of physical quality during long-lasting intermittent exercise to fatigueand can contribute towards maintaining performance by increasing the overall percentage of successful serves and increasing return success rates [6].

Therefore, for tennis play and training in the heat, it is important to follow a hydration plan that will minimize on-court water deficits, by optimizing fluid availability, consumption, and absorption.

If the match lasts less than 90 minutes, water alone is sufficient for fluid replacement [15]. Other supplements such as milk can be an effective post-exercise rehydration drink [26].

However, in India, the average temperature in summers is around 36º c to 42º c, and the Maximum no. of tennis tournaments held in April to June. Tennis is an outdoor game and characterized by high-intensity efforts (i.e., accelerations, decelerations, changeovers, and upper arm involvement) of very short duration as well as followed by active recovery (between points: 20 seconds) and sitting periods (between changeover break in play: 90 and 120 seconds) and most matches are held in the day time and it takes around 1 to 2 hours to complete the match. Therefore, players have to compete in very high temperatures and it becomes very challenging. So, proper fluid replacement is very important to maintain the performance and minimize the physiological disturbances.

4. PRACTICAL RECOMMENDATIONS

- If the duration of play is less than 90 minutes then water alone can be used as fluid replacement. However, Carbohydrate Electrolyte Drink and Carbohydrate Drink are some of the best drinks during play.
- Carbohydrate Electrolyte Drink and Carbohydrate Drink and even other supplements: milk can also be used as a recovery drink.
- 200 ml of fluid, every 15 minutes is considered to be best to drink if the environment temperature is above 27º c.

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