Metabolic and Hormonal Responses, and Fluid and Electrolyte Status Following Badminton Matches in Junior Players: Implications for Player Recovery

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Introduction

Metabolic and hormonal responses to match play, and fluid and electrolyte losses during competitive matches and their recovery process are critically important in understanding the demand and intensity of the game.

The physiological demands on badminton players during training and matches have been widely investigated (Cabello et al., 2004; Cabello-Manrique & Gonzalez-Badillo, 2003; Faccini & Dal Monte, 1996; Faude et al., 2007; Ramachandran, 1996; Hughes, 1995), with some of these research specifically focused on analysis of heart rate and blood lactate responses during training or simulated badminton competition (Smith & Chang, 1999; Ghosh et al., 1990). Fluid and electrolyte imbalances following matches have due considerations for players recovery fluid homeostasis. In badminton tournaments especially at the junior level, players are required to play in successive matches in one day. This puts a high physical and physiological demand on the players, who may not get sufficient time for proper recovery. A critical examination of the metabolic and hormonal responses; and fluid-electrolyte imbalances post exercise and subsequent recovery post match, would represent a powerful tool to understand the demand and intensity of the game, and provide valuable knowledge for preparing scientific training schedules, and clear feedback and inputs regarding post match recovery patterns.

Method

Eight competitive singles players (4 male and 4 female) (Mean ± SD age: 15 ± 0.85; height 165.56 ± 7.26; body weight 60.35 ± 6.79) playing at the junior national level circuit in India volunteered to participate in this study. The participants played best of three singles matches against competitively matched opponent on league basis. Employing a descriptive design, data on selected metabolic, hormonal, and fluid and electrolyte variables were taken for pre match, immediate post match and thirty minutes post match recovery. Blood samples were assessed for plasma glucose, plasma lactate, serum sodium, serum potassium and serum ionized calcium, serum testosterone, serum cortisol, and growth hormone. Urine sample were analyzed for urine specific gravity, urine sodium and urine potassium. Fluid intake and sweat rate were also estimated during the badminton matches for every player. Heart rate was recorded throughout the match and during recovery period using Polar Sport tester (V800). The temporal structure was obtained from subsequent analysis of videotaped matches by calculation of work interval or performance time, average rest interval or rest time, and work density (ratio of performance time to rest time).

Results

The matches were played on wooden surface flooring with moderate mean environment temperature (28.06 ± 1.80^{0}C) with an average humidity of 38.10 ± 7.20%. The mean match playing time was 34.75 ± 6.03 mins in case of men's singles and 30.0 ± 5.91 mins in case of women's singles. The work-rest ratio was 0.54 ± 0.05 in men's singles and 0.47 ± 0.07 in women's singles. Average sweat rate of 0.99 ± 0.38 l/h in male badminton players and 1.23 ± 0.19 l/h in female players was observed during the singles matches. Heart rate and plasma lactate values increased significantly from pre to post match, with post match lactate concentrations of 4.02 mmol/L in case of male players and 3.50 mmol/L in case of female badminton players. The average heart rate of 178 beats.min^{-1} and 172 beats.min^{-1} respectively for male and female players indicate the high intensity at which the matches were played.

The heart rate and plasma lactate values decreased significantly from post match level to 30 minutes recovery period, but failed to reach pre match levels. Urine sodium showed significant decrease from pre to post match levels in case of male badminton players ($p < .05$). Serum cortisol concentration and serum human growth hormone (HGH) concentrations was significantly elevated post match in case of both male and female badminton players ($p < 0.05$).

Discussion & Conclusion

The study concludes that badminton is a highly demanding game in terms of cardiovascular efforts rather than metabolic variables. This is evident from higher heart rate at which the badminton player operates despite moderate level of lactate accumulation. The intermittent nature of the game with short lasting high intensity efforts interspersed with frequent rest intervals makes badminton game to have greater use of the alactic energy system and a lesser demand on the lactacid energy metabolism.

The lack of recovery in cardiovascular, metabolic and hormonal responses following badminton singles matches to baseline after thirty minutes may negatively affect subsequent performance. Players need to be involved in active recovery along with adequate rest and recovery period to ensure full recovery. Schedule of tournaments need to be planned by providing adequate recovery time for players before subsequent matches. The high variability in metabolic and hormonal responses and fluid and electrolyte imbalances among players after singles badminton matches suggest individualized consideration and advice on recovery and fluid replacement for players.

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