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SUMMARY, CONCLUSION AND RECOMMENDATIONS

This part of the research report highlights the summary of the research report with the researcher’s conclusion and recommendation based on this research.

5.1 SUMMARY

For more than one hundred years scientists have attempted to describe the physique characteristics of elite athletes with the objective of relating their physique to athletic performance. Theoretically most successful athletes are those with the appropriate structure to perform their event and Olympic or world championship athletes represent the optimum combination of genetic and environmental influences to produce maximum performance. Describing the physique of the elite athletes assists in understanding the link between performance and physique. Within a sport there will be a degree of individual variation in physique that reflects the athlete’s genetic and ethnic make up as well as their dietary intake. For some sports, there is a much greater tolerance in physique as other performance factors dominate.

The capacity to perform during prolonged exercise is a trainable property of the asymptomatic human organism. Average trainability as we know it, is not sufficient, however, to account for endurance performance of elite athlete. Favourable genetic effects, acting in concern with systematic training and lifestyle appear to be the critical factors responsible for success in endurance performance.

The relationship between endurance performance, body measurements and physique appears to be of vital importance. It is often found that the illustration of the effect of such traits are associated with performance mainly
because of their correlation with other dominates of performance. Generalisation about endurance performance is quite difficult, since endurance sports or event vary considerably in terms of rules, contact requirements, equipment used etc. An enlarged heart and circulatory function and an increased work adaptive capacity characterize the performers in endurance sports. Recent research have indicated that the endurance athletes has a large heart size, bradycardia at rest, a larger stroke volume and cardiac output during maximal exercise than other individuals, a reduced heart rate for the same submaximal work with little difference in maximal heart rate, a decreased arterial pressure at rest and for a given work load, and an increased arteriovenous oxygen difference at exhaustion. It is fairly well established that some of these characteristics can be partly developed as a result of endurance training.

It is generally believed that the capacity of the pulmonary system to meet the needs of alveolar ventilation and pulmonary capillary gas exchanges is not a critical factor limiting performance in endurance events. Excessive ventilatory responses may sometimes approach the limit of tolerance of ventilation during intensive exercise and increase the probability of fatigue in the respiratory muscles acidosis; they can have adverse consequences on endurance performance.

At the initiation of exercise, the metabolic rate increases immediately; however, the thermoregulatory effector responses respond more slowly. The thermoregulatory effector responses, which enable dry and evaporative heat loss to occur, increase in proportion to the rate of heat production. Eventually, these heat loss mechanisms increase sufficiently to balance metabolic heat production, allowing a steady-state core temperature to be achieved.
Exercise training improves thermoregulation during exercise at the same absolute work rate. To obtain thermoregulatory benefits as a result of training, individuals must adequately stimulate thermoregulatory effector responses; in other words they must exercise at sufficiently high exercise intensity. Most serious athletes exercise regularly at intensities above 70% VO2max. Such training has been shown to allow individuals to achieve thermal equilibrium during exercise at 25-35% VO2max in desert heat conditions, but of course this is not race pace! However, appropriate training does allow an increased tolerance of exercise in hot conditions and acclimation to warm environments confers further benefits in terms of the ability to regulate body temperature during exercise in the heat at higher exercise intensities.

Sport training improves thermoregulation in the heat by an earlier onset of sweat secretion, and increasing the total amount of sweat that can be produced. Thus, training induces an increase in the sensitivity of the sweat rate/core temperature relationship, as well as a decrease in the internal temperature threshold for sweating. Sweat rates can vary markedly between individuals, even at the same relative exercise intensity, but there is evidence that those characterised as heavy sweaters have larger sweat glands than light sweaters. Training appears to induce a hypertrophy of existing sweat glands, without increasing the total number. Other adaptations to training include an increase in total blood volume and maximal cardiac output. As a result, blood flow in muscle and skin, with its heat flux, is better preserved during strenuous exercise in the heat.

Heat production during exercise is nearly proportional to body weight. Heavy must be concerned about possible heat storage. Generally tall and heavy or short and stocky physique has greater heat storage because of greater body volume per minute of body surface area. Obese people are at a disadvantage in the heat because of greater thickness of the body shell makes conductance of heat through the tissue more difficult.
The physique, body composition; physical growth and one's motor development are of fundamental importance in developing criteria of talent selection and development in sports. Somatotype characteristics blended with highly developed physiologic support systems provide important ingredients for a champion performance.

Most of the published studies on venous electrolytes, acid-base balance, core temperature and some physiological parameters changes were measured generally in athletes and non-athletes and they were not done specifically on somatotyped athletes. Hence the investigator has chosen this area to investigate the response of the sub maximal treadmill run on heart rate, respiratory rate, core temperature and serum electrolytes of somatotyped university athletes.

For testing the hypothesis the athletes were selected by using the Heath-Carter anthropometric somatotype method and chosen thirty subjects ten subjects in each category (ten mesomorphic-endomorph, ten ectomorphic-mesomorph and ten mesomorphic-ectomorph). To fix the average submaximal exercise intensity in the treadmill, a pilot study was conducted and recorded their heart rates. Based on their heart rates submaximal intensity was fixed as 12 km/hr for 6 minutes and the inclination was set at 5.5 percent in the treadmill. Before and immediately at the end of the submaximal run, heart rate, respiratory rate and core temperature were recorded by using biomonitor and venous blood samples were taken from the femoral venous catheters and analyzed the Na', K' and Cl', and analyzed by using AVL 983-S Automatic Electrolyte Analyzer. To test the validity and significance of the difference between the means of somatotyped athletes' analysis of covariance (ANCOVA) was used. The significance of the paired adjusted post-test means was tested by Scheffes' post-hoc test. The level of confidence was fixed at 0.05, which was sufficient for this research. The F-ratio obtained by analysis of covariance
needed 3.35 for significance and Scheffes’ post-hoc test of significance in which 6.74 was needed at the 0.05 level of confidence.

5.2. FINDINGS

The following results were obtained when the data were computed by Analysis of Covariance and Scheffes’ post-hoc test to test the significance.

1. Pre-test heart-rate means showed that there is no significant ($P > 0.05$) difference among the somatotyped athletes.

2. Post-test heart rate means showed that the heart rate had significantly ($P < 0.05$) increased higher in the somatotyped athletes and especially the mesomorphic-endomorph athletes had higher heart rate than the ectomorphic-mesomorph and mesomorphic-ectomorph athletes.

3. The pre-test respiratory rates showed that the mesomorphic-ectomorph and ectomorphic-mesomorph athletes had significantly ($P < 0.05$) lesser respiratory rate than the mesomorphic-endomorph athletes.

4. The post-test respiratory rates mean difference showed that the ectomorphic mesomorph and mesomorphic-ectomorph athletes have lesser respiratory rate than the mesomorphic-endomorph athletes.

5. Pre-test Core Temperature results showed that there is no significant ($P > 0.05$) difference among the mesomorphic-endomorph, ectomorphic-mesomorph and mesomorphic-ectomorph athletes.

6. Post-test exercise Core Temperature results showed that there is no significant ($P > 0.05$) difference among the mesomorphic-endomorph, ectomorphic-mesomorph and mesomorphic-ectomorph athletes. Though there is a slight increase in core temperature when comparing with pre-test core temperature, the increase is statistically insignificant ($P > 0.05$).
7. Pre-test venous blood Sodium \([\text{Na}^+]\) results showed that there is no significant \((P > 0.05)\) difference among the mesomorphic-endomorph, ectomorphic-mesomorph and mesomorphic-ectomorph athletes.

8. Post-test submaximal exercise venous blood Sodium \([\text{Na}^+]\) results showed that there is no significant \((P > 0.05)\) difference among the mesomorphic-endomorph, ectomorphic-mesomorph and mesomorphic-ectomorph athletes. Though there is a slight increase in venous blood sodium \([\text{Na}^+]\) when comparing with pre-test venous blood Sodium \([\text{Na}^+]\), the increase is statistically insignificant \((P > 0.05)\).

9. Pre-test venous blood Potassium \([\text{K}^+]\) results showed that there is no significant \((P > 0.05)\) difference among the mesomorphic-endomorph, ectomorphic-mesomorph and mesomorphic-ectomorph athletes.

10. Post-test submaximal exercise venous blood Potassium \([\text{K}^+]\) results showed that there is no significant \((P > 0.05)\) difference among the mesomorphic-endomorph, ectomorphic-mesomorph and mesomorphic-ectomorph athletes. There was no significant change when comparing with pre-test venous blood Potassium \([\text{K}^+]\).

11. Pre-test venous blood Chloride \([\text{Cl}^-]\) results showed that there is no significant \((P > 0.05)\) difference among the mesomorphic-endomorph, ectomorphic-mesomorph and mesomorphic-ectomorph athletes.

12. Post-test submaximal exercise venous blood Chloride \([\text{Cl}^-]\) results showed that there is no significant \((P > 0.05)\) difference among the mesomorphic-endomorph, ectomorphic-mesomorph and mesomorphic-ectomorph athletes. Though there is a slight increase in venous blood Chloride \([\text{Cl}^-]\) when comparing with pre-test venous blood Chloride \([\text{Cl}^-]\), the increase is statistically insignificant \((P > 0.05)\).
5.3 CONCLUSION

After detailed analyses within the limitations of the present research, the following conclusions were drawn.

1. Ectomorphic-mesomorph athletes had lesser resting and post submaximal exercise heart rate than the mesomorphic-ectomorphs and mesomorphic-endomorph athletes. Ectomorphic and mesomorphic components were predominance in the elite athletes' physique. Ectomorphic-mesomorph mesomorphic-Ectomorph athletes were characterized by an increased heart size and more efficient circulatory system at rest and during submaximal work.

2. Mesomorphic-ectomorph athletes had lesser pre and post submaximal respiratory rate than the mesomorphic-endomorph and ectomorphic-mesomorphic athletes. A systematic endurance-training programme enhances the respiratory performance and decreases the resting respiratory rate and post-test submaximal respiratory rate. Ectomorphic component is predominance in elite athletes and the ventilatory performance was higher in mesomorphic-ectomorph athletes.

3. Pre and post-test submaximal exercise venous blood Sodium [\(\text{Na}^+\)] showed that there is no significant difference among the somatotyped athletes. This could be due to endurance training adaptation of the somatotyped athletes. A systematic endurance training programme may improve the metabolic adaptations and due to this adaptation effective core temperature is maintained during submaximal exercise. Since the exercise was not prolonged, there is no change in core temperature and due to this; the loss of sodium in the blood is less.
4. Pre and post-test submaximal exercise venous blood Potassium \([K^+]\) showed that there is no significant difference among the somatotyped athletes. This could be due to endurance training adaptation of the somatotyped athletes. A systematic endurance training programme may improve the metabolic adaptations and due to this adaptations effective temperature is maintained. Since the exercise was not a prolonged there is no change in temperature and due to this the loss of potassium in the blood is less.

5. Pre and post-test submaximal exercise venous blood \([Cl^-]\) showed that there is no significant difference among the somatotyped athletes. This could be due to endurance training adaptation of the somatotyped athletes. A systematic endurance training programme may improve the metabolic adaptations and due to this effective temperature is maintained. Since the exercise is not a prolonged there is no change in core temperature and due to this the loss of chloride in the blood is less.

6. Pre and post-test submaximal exercise Core Temperature showed that there is no significant difference among the somatotyped athletes. This could be due to the quality of sport training and only prolonged submaximal exercise in heat influence core temperature with minute ventilation. During exercise, larger proportions of the blood volume are distributed to the cutaneous vessels, thus effectively reducing cardiac return and central blood volume. Sport training improves thermoregulation in the heat by an earlier onset of sweat secretion, and increasing the total amount of sweat that can be produced.
5.4 RECOMMENDATIONS

1. Similar Study can be conducted by investigating and comparing athletes and non-athletes.

2. Similar study can be conducted with other related bio-chemical variables like hormone, enzyme, serum cholesterol and serum protein.

3. It is also recommended that similar study can be conducted with different exercise intensities and loads.

4. Similar study can be conducted by comparing different age groups, male and females, and different somatotyped athletes and non-athletes.

5. It is also recommended that similar study can be conducted by altering testing conditions like room temperature, high altitude and sea level.