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Optimization of the Players Functional State During Training in the Heating Conditions of the Sports Environment through the Use of Local Cooling

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***Abstract*—The article presents materials on the study of the local cooling (SLO) effectiveness in the form of cooling vests with cold panels in order to justify the methods of their use in the process of sports training. It is shown that SLO makes it possible to keep the necessary volumes and intensity of the load in the training process of football players, prevents overheating of the athlete's body, promotes optimal flow and acceleration of recovery processes. The time parameters, the area and location of cooling panels and the dosage of LAYER effects for the training process of the are football players are specified.**

Keywords—climate; load; cooling; overheating; efficiency; football; efficiency.

I. Introduction

In connection with the modern realities of climatic shifts and greenhouse effect, adaptation of the organism to the heating conditions of the sports environment is an important physiological and hygienic problem. Thermal stability, as well as the overall endurance of the athlete's body in the training process are among the most significant qualities.

The tasks of football players special physical training provide for the formation and improvement of professionally important physical and psychophysiological qualities, including:

1) quickness of reaction, dexterity;

3) emotional stability and noise immunity;

4) concentration, speed and accuracy of operational thinking;

5) ability to quickly adapt and maintain high performance in high temperatures, high humidity environment, leading to overheating of the body with loss of performance.

II. Literature Review

When performing physical exercises in conditions of high ambient temperature, the return of excess heat by the athlete's body is greatly hampered. This leads to a decrease in sports performance, which develops mainly due to three factors: overheating of the body, rapid dehydration (loss of water by the body), reduction of oxygen-transport capabilities of the cardiovascular system.

At the same time, the development of dehydration leads to a progressive increase in body temperature and an increase in the load on the functional systems of the body, which is clearly manifested in an increase in heart rate, high ambient temperature greatly hinders the return of excess heat by the athlete's body. This leads to a decrease in sports performance, which develops mainly due to three factors: overheating of the body, rapid dehydration (loss of water by the body), reduction of oxygen-transport capabilities of the cardiovascular system.

A significant heat load primarily adversely affects the functional state of the central nervous system and the neuromuscular apparatus of athletes: speed, accuracy and coordination of movements deteriorates, will decreases, apathy appears, the activity of the cardiovascular system and the implementation of a number of important physical and chemical processes in the body becomes difficult.

All this causes deterioration of health, decrease in sports performance, slowing of recovery processes. There is a

deterioration of endurance, as well as decrease in the level of the most important in sports psycho-physiological functions associated with the manifestation of speed, muscle strength, speed-strength qualities, coordination of movements, etc. This is evidenced by the results of many studies [1,2,3,4,5,6].

At the same time, the decrease in the ability to concentrate the attention of athletes occurs faster than the decrease in physical performance. It should be emphasized that the deterioration of mental performance is manifested primarily in the lack of self-control function, which is especially important for the effectiveness of the football players game.

Therefore, it should be considered local cooling, contributing to rapid and efficient heat collection, is one of the most promising areas of the training process optimization at high temperatures in speed-power work with a pronounced intellectual component, which is the football game.

Economization of an organism functional reserves during loadings at the expense of favorable thermal well-being and a temperature mode can promote not only increase of educational and training process efficiency, but also preservation and improvement of sports results, to be a factor necessary volumes and intensity of training loading maintenance. On the other hand, heat training was used in sports. Such special training in the heating environment is used many times for the development of general and special endurance.

III. Research Methodology

The research was conducted at the sports and training base of the Alexandria University in the conditions of typical training loads both in intensity and volume. Air temperature was in the range of 40-46 degrees, humidity 29-68%, the mobility of the air within the limits of 0,8-1,3 m/s.

To solve the tasks, heart rate and blood pressure registration, % of blood oxygenation, body and skin temperature measurement in 5 points with the calculation of the weighted average body surface temperature by Witte, body temperature, external respiration (PEF – FEV1X), muscle tone (rest – relaxation – tension), driving force were used.

Registration of heart rate (HR), was carried out with the help of the pulse recorder company < < polar>> (Model S - 610).

Arterial blood oxygen saturation was monitored using pulse oximeter MD 300 C2. In the study of muscle tone was used myotonometer, developed by NTO CITO in accordance with the author's certificate N 485331 in the name of Geller I. I., designed to measure muscle elasticity.

The skin temperature was determined in 5 points with the subsequent calculation of the weighted average body surface temperature according to the formula N. K. Witte infrared thermometer UT-102 with memory, manufacturer: a&D – a & D (Japan). SVTC reflects heat loss from the athlete's body surface.

To determine the function of external respiration, which allows to measure the maximum speed at which air passes through the respiratory tract during forced exhalation, the Piko-1 device was used. The device measured the following indicators of external respiration: peak air flow rate on the exhalation PEF and the volume of forced exhalation for 1 second FEV.

IV. Results

Three researches were performed: without using WORDS, using WORDS from the beginning of the exercise, using WORDS from the middle of the workout.

Why was the study undertaken in this format with two experimental groups?

The fact that the cooling effect lasts about 45 minutes and it was interesting to see what is more effective: the use of SLO from the beginning of training or in the second half of it, when there are already pronounced symptoms of overheating of the body, but the performance is still maintained at a sufficient level. Therefore, the analysis begins with body temperature as the main characteristic of overheating with subsequent disturbances. Athletes who are well prepared and adapted to training and competition in hot climates are able to tolerate a significant increase in internal body temperature.

The analysis shows that all variants of the study revealed an increase in temperature in the range of 2.26 Gy.C without cooling vest, 0.47 gr.With the use of it in the first half of training and 0.7-in the second. It is interesting to note the absence of significant differences between the groups at the end of training, although the dynamics of temperature growth in all cases was significant at $p < 0.05$. It is also important to consider the fact of a lower initial temperature in the variant.

The processes of heat removal are reflected in the dynamics of SVTC. Naturally, at sports work comfortable heat sensations correspond to lower Svtk, than in a state of rest. Clearly traced the growth of SVTC during training. It should be noted that in the 1 variant the difference was almost 2 gr.C., and in the second and third much lower-0.6 and 0.54 gr.C., which indicates the economization of the heat removal process. There were no differences between the data with a cooling vest before training – with a cooling vest in the middle of training ($p > 0.05$).

From the tabular heart rate data, it can be seen that the heart rate (HR) increased dramatically by the end of training, and the use of SLO had a pronounced effect on the heart rate in the direction of its decline.

If without SLO the pulse rate by the end of training was over 100 beats/min, then in experiments with SLO only about 80 beats / min. with significant differences between the final indicators ($p< 0.05$). At the same time, there were no significant differences between the data with a cooling vest before training and with a cooling vest in the middle of training $p > 0.05$; ($T= 12$; $p =0.4$).

Registration of blood oxygenation (SO2) in the case of work without SLO showed that blood oxygenation of athletes decreased, and with the use – increased ($p <0.05$). If in the first case we had a marked decrease in the level of oxygenation at ($p< 0.05$), then in the case of using SLO, the

blood oxygenation index is significant. At the same time, there were no differences between the groups with initial and mid-training use of SLO $p > 0.05$ ($T= 7$; $p =0.24$).

According to arterial systolic pressure (ASD), there were also marked changes in the direction of greater growth by the end of training without the use of a LAYER – 7-10 mmHg. However, with significant differences between these data, $p <0.05$ ($T= 1.00$; $p =0.017$) and $p <0.05$ ($T= 1.5$; $p =0.021$). There were no differences between the ASD data after training between the groups with variants of SLO use $p> 0.05$ ($T= 7$; $p =0.24$).

Arterial diastolic pressure had a slightly different dynamics. It practically did not change during the experiment in all groups of subjects. There were no significant differences in either the dynamics of the experiment or between the groups at the end of the experiment.

External respiration indicators FEV and PEF significantly deteriorated in the players by the end of training only in the group without the use of cooling vests. In their application, the shifts were unreliable, and in absolute terms there was some increase in indicators.

Determination of muscle tone (quadriceps femur) revealed significant differences in performance after the load in the heat towards lower tonic strains of the quadriceps muscles when using a cooling vest.

According to the results of the dead power study, attention should be paid, first of all, to the different degree of the indicator improvement when using SLO and without IT.

It is clearly seen that without the use of cooling vests shift in the direction of this indicator improvement was less pronounced. At the same time, as in other indicators, there were no differences between the final data with the use of a cooling vest before training – with a cooling vest in the middle of training $p > 0.05$ ($T= 4$; $p =0.9$).

V. Discussion

It is known that there is a close correlation between the thermal health and performance of the athlete and the parameters of the microclimate. However, these relationships depend on many factors and are unequal, which is confirmed by the data of the study.

Due to the fact that there are no significant differences between the data with the use of SLO at the beginning and middle of training, both variants of the use of SLO in the heating conditions of the training process of Egyptian football players can be considered justified.

Options use depend in greater extent from organizations and conditions coaching received (far whether refrigerating cell), that feel more comfortable for a trainer and doctor-masseur: cloth vests until coaching received, or in mid-its.

In our opinion, the second use case is more optimal for maintaining the optimum thermal state, but much more time-consuming.

These studies suggest that the applied means of relieving thermoregulatory stress has a high potential for generalized effects on all functions of the human body associated with the manifestation of both general and special performance.

Minimization of negative thermoregulatory shifts affected not only the temperature indicators, but also the efficiency of the cardiovascular and respiratory systems, and even the muscular apparatus of thermal balance.

In conditions of air high temperature at athletes deterioration of endurance, and also decrease in level of the most important in sports activity of the psycho-physiological functions connected with display of speed, muscular force, speed-power qualities, coordination of movements, etc. is observed.

The practical implementation of the recommendations arising from the work is associated with the production of convenient designs of vests with appropriate pockets for placing cooling tablets, selection of optimal designs of tablets and coolants, availability of refrigeration equipment within availability.

VI. Conclusion

Thus, the use of SLO makes it possible to minimize overheating of the athlete's body, to ensure the portability of the necessary volumes and intensity of loads, and thereby increase the efficiency of the Egyptian football players training process.

The time parameters, the area and location of cooling panels and the dosage of LAYER effects for the training process of Egyptian football players are specified.

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