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Impact of the Essential Oil Inhalation on the Functional Condition Shift of the Minigolf Players

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Abstract

Results of the experimental researches are given. The object of the evaluations was the impact of an inhalation of three mixtures of essential oils (activating, relaxing and placebo) on the functional condition of young minigolf players. The impact of the inhalations and fatigue on the functional condition of the players was determined based on the results of arterial pressure and pulse rate measurements and calculated Kerdo index. In addition, the analysis of impact of each of the three odorants on the game results was done.

It was figured out, that all odorants decrease the processes of excitation in the performance of autonomic nervous system. The greatest effect in the excitation decrease is achieved by inhaling activating odorant, effect of which is similar to effect of fatigue. In addition, various individual differences in the odorants effect on functional indexes were detected. Suggested, that the shift in functional condition may be determined by reflex reaction of an organism to deep breath in addition to biochemical impact of the odorants.

The greatest impact on the decrease of the Kerdo index (comparing with inhalations) is caused by fatigue of the players, which is caused by multiple repeats of the same monotonous gameplay actions within several hours. Speaking of odorants impact on sports achievements, it was calculated, that generally the sports results improve after inhaling activating and placebo oil mixtures.

Similarly to evaluation of shifts in functional condition, various individual reactions of players were detected in the form of sports results on stimulus of inhalation of different odorants.

Keywords: psycho-emotional condition, golf, aromatherapy, sports results, olfactomathics.

1. Introduction

Evaluation and control of the player's functional condition during their competitive exercises is one of the factors, that defines the outcome of the sports contest in different kinds of sports. Functional condition of an organism (FCO) of a sportsman directly relates to their psycho-emotional condition, which has following criteria: stress level, optimal readiness and frustration (Rodionov, 2002; Sopov, 2005). Meanwhile, functional condition and psycho-emotional condition impact on each other. This dependence reveals at its most in the kind of sports, that require high accuracy and, sequently, perfect coordination in performing motional actions of the same type.

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Those kinds of sports include following: shooting, golf, minigolf, darts, curling, bowling etc. In all those sports the result, in the end, is defined by how good a sportsman can dose their motions in the amplitude (effort) and direction of their application.

Control of the FCO during the competitions in those kinds of sports usually includes implementation of the techniques, like psycho-muscular, ideo-motor and autogenous regulations (Sopov, 2005) and it mostly leads to the decrease of the sportsman excitation. In addition to these methods of regulating the FCO and increasing the effectiveness, various methods and combinations thereof are used, based on physiological reflexes with respiratory delays, facial muscle relaxation, deep breathing, arbitrary syncopeies etc. (Korolkov, 2015).

All methods of FCO regulation are ultimately implemented in three ways: passive or active, or a combination thereof. The passive method is carried out at the expense of the information-energy costs of the sportsman: through volitional efforts, self-massage, sensory isolation, visualization, etc. This method includes techniques of psycho-muscle, ideo-motor and autogenous regulation. An active method of regulation of the FCO includes any external influences in the form of tactile, acoustic, thermal, mechanical, odorizing, visual and biochemical impacts. Active methods of FCO regulation include acupuncture, taping, the use of warming ointments, listening to musical compositions, inhalation, the use of various substances and that kind of external impacts. Some of these impacts are prohibited by the World Anti-Doping Agency.

Thus, the use of active methods of FCO regulation is delicate and provocative, since it can create advantages for one athlete who uses such methods over other athletes who do not use them.

The distinctive active ways of changing the FCO include artificial inhalation of vapors of medicinal substances by athletes suffering from asthma, and inhalation of ammonium hydroxide vapor by weightlifters before going to the stage.

In a number of practical studies in sprint, gymnastics and swimming, it was found that inhalations with essential oils have a certain effect on the perception of the kinematic parameters of locomotion (Popov et al., 2011). In some studies were found statistically significant changes in athletic performance, associated with odorizing effects (Sentyabryov, 2009). Meanwhile, essential oils belong to homeopathic remedies and the effectiveness of their influence on the human organism is not established in evidence-based medicine (Astafieva, Kobziev, 2017).

Consequently, it is interesting to study the effect of various odorants based on essential oils for controling the FCO in competitive minigolf activities.

2. Methods and organization of the research

The studies were conducted from the January to April of 2017 to evaluate the effect of essential oils on FCO and sports results when playing on a real field for a minigolf in the Olympic Park (city of Sochi) in March 2017.

Three specially formulated mixtures of essential oils were used (Ovchinnikov et al., 2014): placebo, activating and relaxing. The placebo odorant was the essential oil of the grape bones. The activating aroma composition consisted of a 10 % mixture of essential oils: bergamot, ylang-ylang, lavender, lemon, mint, neroli and clary in grape seed oil. The relaxing 10 % mixture was composed of essential oils of basil, bergamot, geranium, lavender, rosemary and eucalyptus.

The effect was carried out by cold inhalation of the complete composition (odor inhalation of 1-2 drops applied to the cotton sponge). The duration of the odor exposure was three minutes. Inhalations were performed five minutes before the beginning of the measurement of blood pressure (BP) and heart rate (HR) or the performance of game actions.

Measurements of blood pressure and heart rate were carried out using the pressure-gauge Digital blood pressure monitor UA-705.

12 athletes aged 10 to 17 years were examined during the studies of the effect of ether odorants on FCO and sports achievements in minigolf.

To determine the FCO, we used systolic and diastolic blood pressure, heart rate and the value of the calculated Kerdo index. The measurements were taken in the morning hours one hour after breakfast before inhalation and after inhalation of each of the three mixtures, and in the evening after the end of the training sessions before dinner. The measurements were carried out for three consecutive days, which allowed to accumulate enough data for statistical processing and to make a judgment about the effect of fatigue on FCO.

The effect of ethereal odorants on the results of the game was evaluated based on the results of control trainings conducted in competitive mode for two days. Within this period of time, each athlete played at least five rounds after inhalation with each mixture and without inhaling essential oils. The accumulated volume of data on sports achievements allowed further correct statistical processing of the obtained results.

The statistical processing of the sets of research results was carried out using a licensed package of multidimensional data analysis Stadia 8.0. The validity of the statistical hypotheses was checked at a level of statistical significance p = 0.05.

3. Results, discussion and perspectives

Evaluation of the effect of odorants on the FSS was carried out based on the results of multiple measurements of blood pressure and heart rate, calculated Kerdo index before and after inhalation with each odorant. The values obtained were then compared with each other. Using the Kolmogorov criteria, Omega square and Chi square, the validity of the hypothesis "Distribution is no different from normal" was established. This allowed further comparisons of sample means using the Student's test. In addition, the values of the functional condition indicators were compared before and after training, which characterized the effect of fatigue on the FCO. The values of sample means for each condition, odorant and indicator are given in Table 1.

Table 1. The values of sample means before and after inhalations with different odorants

Odorant, condition\ indicator	SYS	DIA	HR	Kerdo index
No odorant	112,63	72,63	83,38	13,04
Activating	111,00	70,00	78,00	4,98
Placebo	110,00	69,50	81,00	8,82
Relaxing	110,50	75,00	81,00	9,95
Fatigue	114,50	77,50	79,00	2,18

As follows from the results of Table 1, as a result of inhalations, despite the composition of the inhaled odorant, the values of heart rate and the Kerdo index decreased in all subjects. This indicates a decrease in the processes of excitation in the activity of the autonomic nervous system. Meanwhile, the sharpest decrease in the Kerdo index in comparison with the norm occurred after inhaling the odorant initially assuming an activating reaction.

The effect of placebo inhalation is approximately the same as on inhalation of a relaxing odorant. It can be assumed that the effect of decreasing excitation processes is caused not so much by the chemical composition of the inhaled odorant, but by the reflex decrease in heart rate caused by deep breathing (Sopov, 2005).

In addition, it was found that the greatest effect in reducing excitation processes is still done by fatigue, which causes a significant intragroup decrease in the Kerdo index. The same results in terms of the effect of fatigue on the performance of minigolf players were obtained in previous studies (Korolkov, 2015).

It was found that the differences in selective mean of functional parameters of heart rate and Kerdo index compared to the norm after inhalation by all odorants and as a result of fatigue are statistically significant.

As a result of paired comparisons of FCO indices in norm, after inhalations and fatigue, it was established that the effect of these effects is individually different. Figure 1 shows a histogram of the distribution of effects from these effects, which caused a decrease in the Kerdo index by more than 10 units.

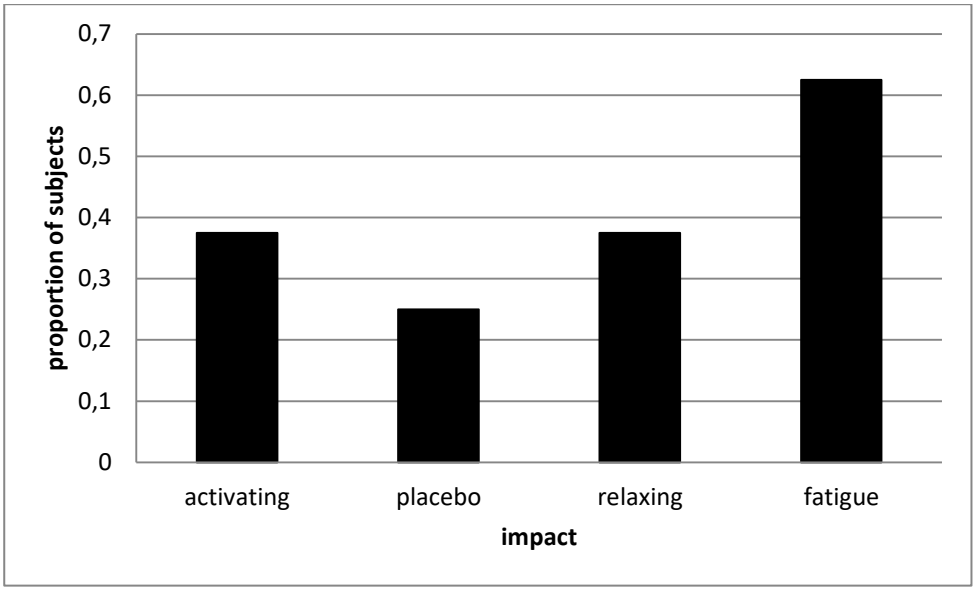

Fig. 1. Distribution of subjects by the effect of various effects on the FCO

According to this figure, inhalation with an activating and relaxing odorant caused a decrease in the Kerdo index in 38 % of the subjects, inhalation of the placebo caused the same changes in 25 % of subjects and fatigue caused the same effect in 62 %. Meanwhile, for some athletes, the same effects of decreasing the processes of excitation arose under the action of various stimuli.

Thus, the use of odorants for controlling the FCO should be carried out with considering the individual reactions of each athlete.

The analysis of the effect of aromatic odorants on the shift in the performance of players was also carried out as a result of repeated practical measurements. Each player at least five times played the game on 15 holes after inhalation with each of the three odorants and without the odorizing effect. Selected average results for each exposure are displayed in Table 2.

According to the data of this table, the best intra-group result was achieved by athletes after inhalation of placebo. In addition, all the average best results were achieved after inhalations, and the results of the game without the odorizing effects were worse. Presumably, we can conclude that the improvement in the results in this case was due to the fact that odorants were inhaled before the game, and not by their biochemical action. That is, the inhalation of odorants before the game has primarily a placebo effect and a reflex reduction in heart rate and Kerdo index as a result of deep breathing, as shown above.

Table 2. Selected average results for different odorizing exposures

Odorant	Activating	Placebo	Relaxing	No odorant
Average result	25,07	24,42	24,64	26,33

Fig. 2 shows the histograms of the distribution of results after inhalation with various odorants. Meanwhile, although the level of statistically significant differences between sample medians was not greater than 0.15, external differences in the distribution of results after inhalations of the activating and placebo odorant as compared with the relaxing one are obvious. Approximately the same effect of the influence of the activating mixture on the decrease in the processes of excitation of players was established in the evaluation of their FCO.

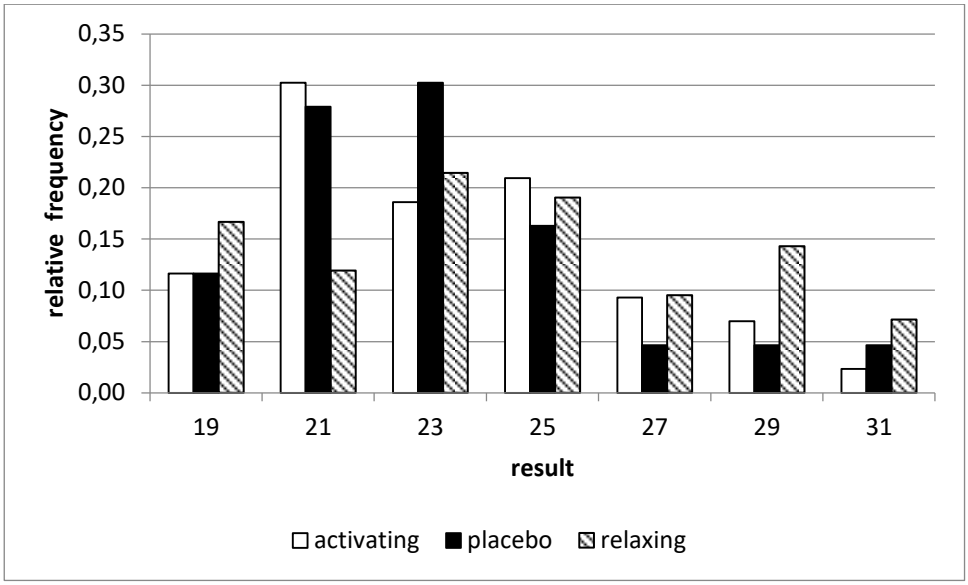

Fig. 2. Distribution of results after inhalation with various odorants

As in the case of the individual effect of odorants on the FCO, their individual impact on the results of the game is also variable. Statistically significant differences in the results of the game compared to the results without inhalations occurred in 50 % of the players after the inhalation with an activating odorant, in 50 % after inhalation of the placebo and in 33 % after inhalation of the relaxing mixture. There were no statistically significant differences in results after inhalations for two players out of 12.

Just as with changing the FCO after inhaling odorants, some players experienced the same effect of the activating and placebo odorant on improving the results of the game.

4. Conclusion

When studying the effect of odorants on the functional condition of athletes, it was found that all odorants, including placebo, lead to a decrease in excitation processes in the activity of the autonomic nervous system. In this case, the greatest effect of reducing excitation is caused by inhalation with an activating odorant, the effect of which is comparable to the effect of fatigue. In addition, various individual differences in the effect of various odorants on the regulation of functional indices have been revealed. It is assumed that changes in the functional state can be determined not only by the biochemical effects of odorants, but also by the reflex responses of the body to deep breathing, which is carried out within three-minute intervals.

It was also found that the greatest influence on the reduction of the Kerdo index, in comparison with inhalations, is caused by fatigue of players, caused by repeated repetition of monotonous game operations of the same type for several hours.

Regarding the effect of odorants on athletic performance, it is established that, on average, the improvement in results occurs after inhalations of the activating and placebo ether mixture. In this connection, it is assumed that this effect can also be caused by reflex reactions to deep breathing, and not only by the chemical composition of the inhaled odorants.

As in the study of changes in the functional condition, various individual reactions of athletes in the form of sports results to stimuli in the form of inhalations with various odorants have been established.

The prospects for further research in this direction include the study of the possibility of reducing monotonous fatigue in minigolf with the help of ethereal odorants of different composition, the effect on the functional condition of certain essential oils, and not their combinations, repeated refining studies of the use of essential oils and their effect on sporting achievements, mental and functional condition of players on large volumes of samples of subjects of the same age and sex.

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