# SYSTEM ANALYSIS OF MECHANISMS OF EFFECT OF ESSENTIAL OILS

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***Abstract.*** **The mechanisms of essential oils effects was analyzed with the principles of a systematic approach. We use the theory of functional systems, established by P.K. Anokhin, for exploring our own results. The essential oils show a variety of effects and the specifics of their deployment in the intense professional activity of an athlete. Improvements in working capacity, indicators of muscular activity were compared with changes in the central and peripheral links of the functional systems of a sports result. The leading physiological mechanisms include activation of limbic system, accompanied by an improvement in cerebral hemodynamics, muscle and psycho-emotional relaxation.**

***Key words:*** **essential oils, system analysis, cerebral bloodflow, EEG, relaxation**

**DOI: 10.25792/HN.2022.10.2.S2.134-136**

***For citation*: Sentyabrev N.N., Doletskii A.N., Miroshnikova S.S., Kamchatnikov A.G. System analysis of mechanisms of effect of essential oils.COVID-19 virus-positive patients after laringectomy: treatment in a hospital. Head and neck. Russian Journal. 2022; 10 (2, Suppl. 2): 134-136**

**Introduction.** Functional systems (FS) are self-regulating dynamic organizations, the activity of all the components of which mutually contributes to the achievement of adaptive results useful for the organism as a whole. A functional system of a purposeful behavioral act consist from 4 main stages: Afferent synthesis, decision-making stage, acception of the result of the action, the feedback stage.

Physical and emotional stress can develop during purposeful human activity [1]. The model of such activity is professional sports, which associate with the extreme training loads and competitive activity [2]. In this regard, violations of the coordination of the operation of functional systems are possible [3]. This dictates the search for relaxation methods aimed at improving the state of the central and peripheral parts of the FS to achieve the results of professional activity.

There are numerous data on the effectiveness of the regulation of body conditions and the increase in efficiency with the help of essential oils (EO) [4, 5]. The mechanisms of the effect of EO on the state of the human body are still not entirely clear [6]. We assume that the analysis of the results of our studies with principles of a systematic approach will allow us to make clear the relationships between many mechanisms of EO activity.

**Results**.Our studies have shown a variety of effects of odorant effects with the help of EO. The myotonometric characteristics of the state of the muscles changed under the influence of EO (Table 1). The ability of the muscles to maximum voluntary relaxation (To) increased without reducing the possibility of maximum voluntary tension.

Table 1. Change in myotonometric parameters after EO exposure

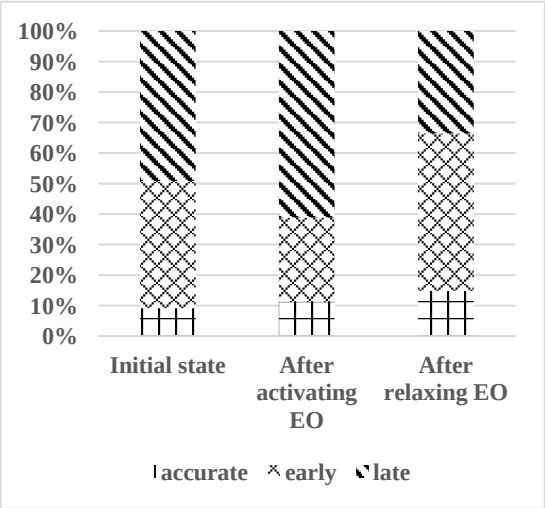
| Myotono-metric parameters | Initial state | After activating EO | After relaxing EO |
|---|---|---|---|
| Maximum voluntary tension | 97,0±1,12 | 101,2±1,23* | 97,2±0,83 |
| Maximum voluntary relaxation | -1,0±0,93 | 1,13±0,71 | -0,16±0,18* |

*Here and below * - the differences are significant ($p<0.05$)*

Changes in the state of the central nervous system were also reflected in the acceleration of simple sensomotor reactions, and the time of complex sensomotor reactions improved mainly due to a decrease in its latent time [4]. It can be assumed that component of the FS “decision time for action” was accelerated.

The effect of EO improved the state of cerebral haemodynamic according to rheoencephalography (REG) [5]. It was shown that recovery of the haemodynamic after bicycle exercise accelerated with EO. Heart rate variability was higher and stress index was lower in bicycle exercise with EO. This gives reason to assume that EO improve mechanisms of the cardiovascular system (CVS) regulation [6]. The maximum power of anaerobic work (the height of the jump up from a place) did not change after exposure the EO.

Fig. 1 Effects of the EO on ability to respond a moving object




But the time for performing a bicycle ergometric load at the level of PWC170 (working capacity at a heart rate of 170 beats/min) increased significantly (Table 2).

Table 2. Changing the time limit for performing a bicycle ergometric load

| | Activating EO | Relaxing EO |
|---|---|---|
| Initial state | 20,8±0.8 | 20,7±0.9 |
| After EO | 24,5±1.2* | 24,6±1.4* |

The increase in the ability to muscle relaxation was the most likely reason for the increase in the time of bicycle ergometric work of maximum power to failure.

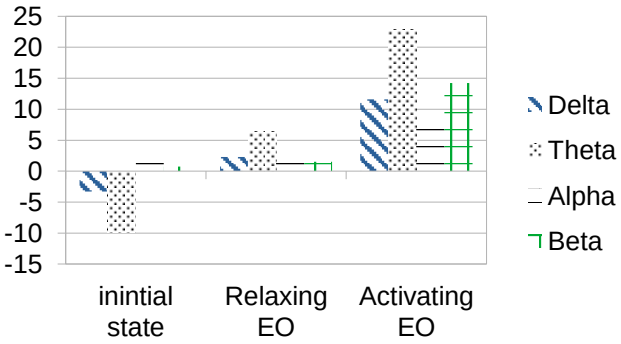
In addition, we noted an improvement in the coordination of muscle activity [3], better running economy and, as a result, less fatigue in the final part of the running distance [2]. As a result of such changes, the possibilities of achieving sports results in running at maximum speed increased. Such changes determined the growth of sports results of sprinters [7].

Better coordination of muscle activity after EO exposure was also noted in increasing the accuracy of aiming actions (hitting free throws in basketball and throws at the target in the game "Darts") [8].

Bioelectrical activity in brain with activating EO lead to right-sided gradient of slow rhythms in frontal, central and temporal brain areas (Fig.2). This changes in EEG parameters are explained by the relationship between olfaction and the limbic system [9].

The relationship between the state of vegetative support (CVS), effectors (running step parameters), central system (time of sensorimotor reactions, state of the regulatory apparatus) and characteristics of the result of activity (time of maximum bicycle ergometric work) demonstrated with change all measured parameters after EO exposure. These changes were especially pronounced after relaxing EO.

Fig. 2 Effects of the EO on asymmetry of EEG activity




It is noted that most of the observed effects are associated with the subjective preference of the smell (pleasantness/unpleasantness).

**Discussion**. The impact of EO changes the state of the entire structure of the FS, aimed at achieving the result of sports activities. The effector, executive part of the FS and the central architectonics of the FS are improved. The influence of EO modifies the stage of efferent synthesis in FS. As result it lead to improve programs of purposeful sports activity. Improved cerebral hemodynamics lead to better response on metabolic demands, decision-making is accelerated, the interaction between the structures of the effector muscular apparatus is improved (optimization of intermuscular coordination). As a result, the efficiency of muscle activity increases and its result improves. It should be noted that not only the direct influence of EO on the centers of perception of odorant influences is of significant importance. The role of conscious perception of smell is indicated the importance of cortical processes.

**Conclusion**. The results of our research demonstrate the mechanisms of EO influence as a multidimenstional process that captures the whole structure of a behavioral act.

**Conflict of Interest**: The authors declare no conflict of interest.

REFERENCES

1. Sudakov K.V., Umryuhin P.E. Sistemnye mekhanizmy emocional'nogo stressa. M. GEOTAR-Media. 2010. 112s. (In Russian).

2. Shlyk N.I. Variabel'nost' serdechnogo ritma v pokoe i ortostaze pri raznyh diapazonah znachenij MXDMN u lyzhnic-gonshchic v trenirovochnom processe. Nauka i sport: sovremennye tendencii. 2020: 8 (1): 83-96. (In Russian).

3. Kajdalin B.C., Kamchatnikov A.G., Sentyabrev H.H., Katuncev V.P Vliyanie raznomodal'nyh sensornyh stimulov na funkcional'noe sostoyanie organizma i pokazateli napryazhennoj myshechnoj aktivnosti. Aviakosmicheskaya i ekologicheskaya medicina. 2007: 41 (4): 34-38. (In Russian).

4. Sentyabrev N.N., Kamchatnikov A.G., Rakova E.V., Ovchinnikov V.G. Obonyatel'nye vozdejstviya na sostoyanie regulyacii serdechno-sosudistoj sistemy sportsmenov. Black Sea Scientific Journal of Academic Research. 2015: 22 (4): 30-34 (In Russian).
5. Sentyabrev N.N., Kamchatnikov A.G., Gorbaneva E.P., Rakova E.V. Izmeneniya stepeni asimmetrii cerebral'noj gemodinamiki pri vozdejstvii efirnyh masel na fone fizicheskih nagruzok. Fizicheskaya kul'tura, sport - nauka i praktika. 2016: 66-71 (In Russian).
6. Sentyabrev N.N. Dinamichnost' parametrov kardioritmogrammy pri modifikacii funkcional'nyh sostoyanij sportsmenov. V sbornike: Materialy XXIII s"ezda Fiziologicheskogo obshchestva im. I.P. Pavlova s mezhdunarodnym uchastiem. 2017. S. 2056-2058 (In Russian).
7. Popov M.V., Sentyabrev N.N., Mandrikov V.B. Dinamika funkcional'nogo sostoyaniya organizma i harakteristik anaerobnoj rabotosposobnosti begunov-sprinterov pri vozdejstvii efirnyh masel. Uchenye zapiski universiteta im. P.F. Lesgafta. 2011: 5 (75): 96-100 (In Russian).
8. Frolov E.V., Sentyabrev N.N. Ispol'zovanie v trenirovochnom processe zhenskih basketbol'nyh komand vuzov metodov optimizacii funkcional'nogo sostoyaniya. Sovremennye problemy nauki i obrazovaniya. 2017: 6: 230 (In Russian).
9. Doletskii A.N., Sentyabrev N.N., Dokuchaev D.A., Matokhina A.A., Kamchatnikov A.G., Busygin A.E. The effect of music and aromatherapy on the electrical activity of athlete's brain. Rehabilitation Sciences. 2017: 2(3): 54-57.
10. Doleckij A.N., Gubanova E.I., Klauchek S.V., Hvastunova I.V., Sentyabrev N.N. Nejrofiziologicheskie kriterii modifikacii funkcional'nyh sostoyanij sportsmenov s pomoshch'yu aroma- i muzykal'nyh vozdejstvij. Fizicheskoe vospitanie i sportivnaya trenirovka. 2020: 3 (33): 39-46 (In Russian).
11. Doletskii A., Sentyabrev N., Gorbaneva E., Achundova R., Klitochenko G. The effects of essential oils and music on the bioelectrical activity in brain. Cardiometry. 2021: 9: 100-105.