Psychoimmunomodulation and Integrated Mental Training

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Numerous studies in the field of “exercise immunology” have shown that a prolonged and intense physical effort in sports can alter the organism's immunological reactivity and create an immuno-deficient state (IDS). This leads to a reduction in the effectiveness of training process and increases the susceptibility to illness and disease in athletes (1-7). According to the proposed J-shaped relationship between upper respiratory infection sensitivity and exercise intensity, moderate exercise will protect individuals from infection while strenuous exercise will increase infection risk (8,9). Recently, a S-shaped relationship between exercise load and risk of infection has been proposed in elite athletes (10). The proposed hypothesis suggests that skilled elite athletes, with high physical, physiological and mental preparedness, have to posses a state of consciousness, which induce the immune system to withstand various environmental stressors (10). Psychoneuroimmunology investigates the relationships among psychological, neuroendocrine and immunological parameters (11). Exercise within the context of psychoneuroimmunology appears to be a very promising approach in promotion of heath and treatment of illness (11). The immune system response to exercise is multifaceted. Thus, the motivation behind recent research on the immune response raises several directions;

Examples of questions to be answered are: (2,3)

1. Are athletes immunocompromised?
2. Is downregulation of non-specific immunity beneficial or harmful?
3. What mediates communication between events in skeletal muscles and the immune system
4. Can exercise training provide a “countermeasure” against immunosuppressive events?
5. Can methods of psychoimmunomodulation be used in athletes with IDS in order to normalize the immunological state

Due to the fact that there are still few studies of methods and mechanisms for IDS correction in athletes the last question (5) became the starting point for the present study.

The basis for such a study was provided by reassuring data obtained during the past few years regarding the increase of cellular immunity in healthy subjects who used the method of integrated psycho-training (12-17).

These data provided the direction for this research project where the effect of the Swedish version of mental training (18,19) (IMT-Integrated Mental Training) on the immunity system of skilled athletes is the focus.

Materials and Methods of the Study

The study involved 25 athletes who were accomplished wrestlers involved in the training preparations for important competitions. They ranged in age from 17–19 years. Two groups were formed – one, an experimental group (12 persons), and the other, a control group for comparison (13 persons). At the same time, a second control group of practically healthy men (17 persons) covering the same age range was examined. They were not athletes and did not undergo any physical efforts during the study.

The experimental group went through the Integrated Mental Training (13), which is a systematical, step-wise up-build and long-term training of cognitive and emotional skulls and attitudes. After the basic training with psychomotor relaxation and induction of the inner mental room (self.hypnosis), the training continues with the four most important factors for Peak Performance and Wellness (Self-image-, Goal-Images-, Attitude- and Emotional-Training

In an alternative state of consciousness (Mental Room - MR) the subjects had to visualize the performance of a specific sports activity.. IMT consisted of ten sequences per day, each of them lasting for one hour. During the relaxation sequences the omega-potential was measured on a selective basis in order to gauge the athletes' state of consciousness objectively. A microprocessor and a variant of the "Omega-sport-testers" were used with an omega-potential quantization of 5s in the recording (16).

In the second group (the first control group) where similar training conditions existed, IMT sessions were not conducted. Each of the subjects including the inactive persons who made up the control group underwent two examinations of the immune system – once at the onset of HSPMR and once at the end, with an interval of 15 days.

The immune system check-up involved examining the contents of leucocytes, lymphocytes, T-lymphocytes and their status in reference to their basic sub-populations using the methods of V.Kozhevnikov and L.Sakhno (20). The levels sustained by circulating immune complexes (CIC) were established by means of the method devised by Y.Grinevitch and L.Kamenets [7]. The immunoregulator index (IRI) was calculated as the ratio of T-helpers to T-suppressors. The index of thymus function (ITF) was measured according to the methods of V.Kozhevnikov and co-authors (21). The measurement of the concentration of immunoglobulin (A, M, G) was carried out by using the method of radial immunodiffusion (22).

Results of the Study

The analysis of the omega-potential dynamic during IMT revealed the following general regularities:

1. During mental relaxation in and the formation of ASC, a reduction of the level of omega-potential to the values 15.0±4.5 was noted;

2. During the phase of mental relaxation a sharply defined stabilization of omega values was noted along with the cessation of super-slow fluctuations which are special to the background and consequence of the common states of consciousness.

The results of statistical analysis showed that both the level and stability of omega-potential in ASC differed reliably from the values indicated in the common state of consciousness ($p < 0.01$). Some typical alterations in omega-potential given the conditions provided by the middle IMT sequences are shown.

The analysis of the immunogram parameters showed that during the preparational training for important competitions, each of the examined athletes suffered from a cellular humoral immuno-deficiency. This was apparent due to the reduction in numbers of the general, complex T-lymphocytes and T-helpers; increase in the number of immature forms of T-cell; drop in the immunoregulator index and the index reduction of thymus activity (Table 4-1).

The decrease in concentration of immunoglobulins of class "G" and "A" and the reduced values of the circulating immune complexes (relative to the control group) define the development of IDS in athletes, categorized by humoral type (Table 4-2).

The immunological testing carried out after IMT sequences was completed by the athletes of the experimental group; revealed the normalization of peripheral blood leucocytes and lymphocytes. The indices of cellular immunity changed as follows: The number of general-, complex- and helper-lymphocytes increased considerably; at the same time the number of immature forms of T-cells decreased. The number of T-suppressor did not show significant differences from the background values, but in this case the correlation between T-helpers and T-suppressors became normal through an increase in IRI (Table 4-1). The indices of humoral immunity in the experimental group were characterized by an increase in the concentration of all classes of immunoglobulins and at the same time by an increase of the concentration of circulating immune complexes (Table 4-2).

In the control group of athletes (no IMT), a significant oppression of cellular humoral immunity was noted. The reduction of IRI and functional oppression of the thymus were especially unfavourable regarding the IDS development and manifestation. The indices for humoral immunity were characterized by the reduction in levels of G-class immunoglobulins and the tendency to reduce A-class immunoglobulins, however in this case the level of M-class immunoglobulins increased reliably relative to the initial value ($p < 0.01$). The level of circulating immune complexes decreased considerably relative to the control and initial value in the group of athletes.

The second control group of inactive men did not show any reliable differences in the indices of immunity during the same period.

Table 4-1

Modification of the cellular immunity under in influence of HSPMR

Indexes	Control group, n = 17	Groups of athletes		
		Whole group before IMT n = 25	Experimental group after IMT n = 12	Control group 1, n = 13
	A	B	C	D
Leucocytes, ABS·10^9/l	6.14±0.09	5.86±0.12	7.51±0.16^{a}	5.72±0.14
Limphocytes, ABS·10^9/l	2.03±0.04	1.79±0.09^{x}	2.28±0.11^{a}	1.73±0.11
Common T-limphocytes, c/mkl	1412.0±116.1	1108.4±106.5^{xx}	1542.1±113.2^{a}	1011.6±123.3
T-helpers, c/mkl (T4 cells)	883.4±65.1	607.9±71.3^{xx}	964.3±48.4^{aaa}	600.3±59.6
T-supressors, c/mkl (T8 cells)	510.3±39.7	449.1±30.9	479.8±21.5	498.2±27.4
Nondifferentiated	17.20±1.42	68.00±8.35^{xxx}	21.10±2.03^{aaa}	75.10±9.13

cells, c/mkl				
Integrated T-limphocytes, c/mkl	1475.6±120.4	1324.2±183.1^{x}	1589.7±110.4^{a}	1396.7±152.4
Immunoregulatory index	1.76±0.18	1.34±0.11^{x}	2.01±0.09^{aa}	1.19±0.07^{o}
Timus function index	2.04±0.14	1.37±0.08^{xx}	2.27±0.11^{aa}	1.12±0.17^{o}

Distinction: $^{x, xx, xxx}$ – between A and B; $^{a, aa, aaa}$ – between B and C;
^{o} – between B and D.
$^{x, a, o}$ – $p < 0.05$; $^{xx, aa}$ – $p < 0.01$; $^{xxx, aaa}$ – $p < 0.001$.

Table 4-2

Modification of the humoral immunity under influence of IMT

Indexes	Control group 2 n = 17	Groups of athletes		
		Whole group before IMT n = 25	Experimental group after IMT n = 12	Control group 1 n = 13
	A	B	C	D
Concentration of immunoglobulins, mg/ml				
G	12.80±0.18	10.97±1.23^{x}	16.40±2.53^{aaa}	9.71±0.33^{o}
A	1.26±0.14	0.89±0.04^{xx}	1.94±0.06^{aaa}	0.82±0.06
M	1.45±0.11	1.32±0.07	1.49±0.02^{a}	1.56±0.11^{oo}
Level of the immune complexes	55.30±10.70	42.30±6.51^{xx}	62.80±7.50^{aa}	30.70±4.81^{o}

Distinction: $^{x, xx, xxx}$ – between A and B; $^{a, aa, aaa}$ – between B and C;
^{o} – between B and D.
$^{x, a, o}$ – $p < 0.05$; $^{xx, aa}$ – $p < 0.01$; $^{xxx, aaa}$ – $p < 0.001$.

Discussion

The findings show that the systematic use of IMT enables us to remove or diminish the immuno-deficiencies, which often appear in athletes during periods of

intense training prior to important competitions. In particular, a decrease of non-differentiated forms of lymphocytes, the normalization of IRI (see above) and the restoration of thymus function can be noted.

It is important to point out that if IMT is systematically applied, the growth of helper T-lymphocytes (which carry out the most activity in the synthesis of neuroleucines) appears to be most significant (23). The latter is confirmed by the influence of integrated psychical training on the immune status of healthy subjects (14, 24). One important thing here is to include a combination of muscular and mental relaxation with positive thinking and visualizations. In particular, visualizations of how the blood cell elements conquer the viruses were used. This method of concrete positive imagining was based on the subjects' prior knowledge of the organism's immune protection system.

It is important that the normalizing of athletes' immune status (given IMT) which was revealed during this study should occur against a background of expressed alterations of omega-potential during the mental training sequence. In this case it is typical to find no reliable change in the level of background values of omega-potential in the subjects throughout the course of IMT. At the same time the following is observed during the IMT sequence: 1. A reduction of omega-potential to 15.0±4.5 during mental training and 2. An expressed stabilization of its values. Such alterations of omega-potential were discovered previously given the conditions of mental relaxation and the formation (according to experimental research) of the alternative state of consciousness in the subjects (14).

If we compare all of the present data and take into consideration the information accumulated in literature up to the present time (25) we will have every reason to consider that the effect of mental training on the state of the immune system is associated to a considerable extent with the reconstruction of information-controlling mechanisms of the brain. It may be characterized as the formation of the system of control given the conditions provided by IMT (18,19,26,27).

According to the findings, the reconstruction of the activation level of the cortex and parts of its functional asymmetry appear to be neurophysiological markers showing the beginning phase of the alternative system of control.

At the same time the highly effective influence of the integrated forms of psycho-training on the neuroimmune interaction process is defined from our point of view by a purposeful activation of the mechanisms of brain self-confirmation produced by these conditions – the system of opioid peptides (15). The leading significant factor in this process is the use of positive imagination (visualization).

Thus, the psychoimmunomodulating effects , showed in this study, indicates that IMT should be used as a part of the preparation for important competitions. The study also indicates that IMT could be a valuable tool to prevent the negative effects of “overtraining”.

Conclusion

1. While engaging in preparative training for important competitions, the case of immune insufficiency develops in athletes.

2. Systematic and integrative mental training stabilizes the parameters of the immune system and levels-out the developing immune deficiency (the T-lymphocyte helpers respond most actively).

3. The effects of the psycho-immunomodulation by mental training and the reconstruction of the information-controlling mechanisms of the brain could be of great significance in competitive preparatory training and to prevent “overtraining”

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