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Asthenic syndrome development among highly qualified athletes in case of magnesium deficiency

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Abstract: To achieve high sports results, especially in the pre-competitive and competitive periods, it is important to reveal magnesium deficiency among athletes. The study revealed the presence of moderate magnesium deficiency among 69.8% of athletes, manifested by a spectrum of clinical syndromes. We defined valid correlations of magnesium deficiency with various factors provoking it: irrational nutrition of athletes, misuse of thermal procedures for weight loss and the presence of chronic pathology of the digestive tract. The connection of magnesium deficiency with some positions that are mentioned in the scientific sources (swimmers as a risk group, the amount of physical activity above the standard) has not been confirmed. We made the conclusion concerning the necessity to correct the risk factors of magnesium deficiency among athletes, and the identified deficiency - with magnesium drugs, and not with food supplements. **Material.** The material for the study was the official data of clinical and laboratory studies, the results of the questionnaire and the conclusion of the current medical control, the level of physical load during educational-training classes. **Research methods.** We analyzed the profile studies of native and foreign authors, the results of the survey and the level of functional readiness. **Result.** It was revealed that magnesium deficiency causes working capacity decrease, instability of the emotional background, and in some cases clinical manifestations of anxiety. **Conclusion.** Identification and correction of magnesium deficiency among athletes will help to avoid the formation of anxiety syndrome, stabilize sports results and emotional background. **Scientific novelty.** We revealed the correlation between the level of magnesium in the organisms of highly-qualified athletes, on the one hand and the indices of asthenic syndrome development on the other hand. At the same time, among the athletes-swimmers we didn't reveal this dependency. **Practical significance.** The level of magnesium revelation in an organism and its correction would help to decrease the risk of pathological emotional background instability, depression, mental manifestation of unreasonable anxiety development.

Keywords: athletes, magnesium deficiency, risk factors, working capacity, emotional background, manifestation of unreasonable anxiety.

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Introduction

Present level of sport development is characterized by constant training and competitive physical loads (PL) volume and intensity increase [4,5,6]. For optimal sports results achievement it is extremely important to have regular trainings and an "adequate" nutrition ration. An important component of rational nutrition of athletes, which helps to fulfill considerable muscle loads, is macro and micronutrients [1,3]. Clinical research works of recent years prove fundamental significance of an athlete's organism provision with magnesium

(Mg²⁺) for an effective training process in order to achieve high sport results [11].

We should acknowledge the significance of global problem of magnesium deficiency (MD), as at the present stage low nutritious Mg²⁺ supply of the whole adult population of the Russian Federation is proved [2,7]. It is almost 75%. If we additionally take into consideration sports loads, highly-qualified athletes can be included into the group of high risk according to MD [10]. Among the main reasons for MD is not only irrational nutrition, especially different diets with low concentration of

greens, fresh fruit and vegetables, nuts and seeds, constant alcohol, fat-containing and salt-containing products intake, but also often or constant use of some drugs, for example diuretics and hormones and also malabsorption syndrome connected with gastrointestinal tract (GIT) disorders and intensive mental and physical load, chronic stress. Quantitative assessment of Mg²⁺ has clinical restrictions, as there are constant Mg²⁺ oscillations in blood serum, it is difficult to define its valid level, especially within the range of indices lower bound [9]. For this purpose Mg²⁺ concentration in saliva or in hair is used. However these tests are not widely available. At the same time it is proved that even latent MD can cause clinical symptoms of anxiety, parasomnia, emotional instability, mental and gastrointestinal tract (GIT) disorders, chronic tiredness [8]. In this connection in clinical practice valid questionnaires for complex MD diagnostics are used, for example International Magnesium Deficiency Questionnaire (MDQ) [12]. Taking into account mentioned above facts, we should confess that MD revelation and prevention among athletes is extremely urgent. Realizing the difficulty of interconnections between magnesium status and different risk factors, which influence its provision, we tried to specify some aspects of the discussed question. In this connection we formed the aim of the research- to reveal the influence of magnesium deficiency on asthenic syndrome among highly-qualified athletes of different sports specializations.

Materials and methods

We analyzed the results of anonymous questionnaire survey according to specially created electronic Google-form. It included 5 blocks. Block 1 – A.M. Vane questionnaire, 1998: the scale with 11 questions in order to reveal the features of vegetative disorders. Interpretation – the norm was till 15 points. Block 2 - Hospital Anxiety and Depression Scale (HADS): the scale includes 7 questions in order to estimate anxiety level. Block 3 – HADS: scale includes 7 questions in order to estimate depression level. Interpretation: 0-7 points – "norm" (the absence of distinct anxiety and depression symptoms); 8-10 points – "subclinically demonstrated anxiety/depression"; 11 points and higher – "clinically demonstrated anxiety/depression". Block 4 – characteristics of the kind of sport, sports categories and ranks, training process period, physical load volume. Block 5: A – the peculiarities of nutrition and eating preference, B – chronic illnesses (including professional ones) and pathological states. They provide magnesium deficiency development, created on the basis of International Magnesium Deficiency Questionnaire (MDQ): the scale with 23 questions. Interpretation – there is no MD if the sum is till 9 points.

Cut-off criteria: chronic stress situation (6 months and longer), post-COVID syndrome till 6 months and longer, pregnancy, alcohol intake and smoking, special reduced diets use.

The received results were handled using Microsoft Excel, 2019 package. For each variable we determined mean (M) and standard deviation (σ). Validity of differences (t) between mean values was calculated according to Student's test and defined probability of accidental difference (p). The results were considered statistically valid in case of significance level $p < 0,05$. Normality of the sampling distribution was defined according to Kolmogorov-Smirnov criterion. During correlation estimation between the studied qualitative indices we used Pearson criterion χ^2 and correlation coefficient (r).

Results and discussion

In general we estimated 73 Google-forms of athletes, students of Kuban State University of Physical Culture, Sport and Tourism and Astrakhan State Medical University with the average age $22 \pm 2,8$ years-old, 39 men (53,4%) and 34 women (46,6%). General group was divided into group № 1 – swimmers ($n_1=43$; 58,9%), and group № 2 – mixed sport disciplines ($n_2=30$; 41,1%): sports gymnastics – 7 people, track and field athletics – 5 people, freestyle wrestling – 5 people, rowing – 7 people, polyathlon – 6 people. Among them there were 39,2% of candidate masters of sports, 43,8% of masters of sports and 17% of the 1st category athletes. All athletes were examined during the training cycle before the competitions. Most part of athletes (66%) had considerable volume of training classes: 29 people (39,7%) – till 20 hours/week, 17 people (23,3%) – till 30 hours/week, 2 people (2,7%) – more than 30 hours/week. Only 25 people (34,0%) had a moderate (standard) volume of the loads – till 10 hours a week.

During the research we revealed that each 5th athlete complained of blush or skin blanching in case of excitement- in 20,5% of cases; sleep disturbance: difficulty in falling asleep/often awakenings/"pathological drowsiness" – in 20,5% of cases; attention concentration disorders – in 20,5% of cases. Each 6th athlete mentioned hands/ feet skin color change, tachycardia during excitement, in a stuffy room (in 15,1% of cases), emotional sensitivity and impatience (in 16,4% of cases). In 8% of cases athletes mentioned fainting in a stuffy room or in case of long-term vertical position. It shows adaptive mechanisms disorder in cardiovascular regulation. Each 4th athlete complained of working capacity level decrease and quick fatigability (26,0% of cases), each 3rd athlete complained of acrohidrosis during excitement (31,5% of cases).

According to HADS questionnaire norm indices in "Anxiety" and "Depression" scales were among

89,0% and 95,0% of athletes. However, among 9,6% of athletes (n=7) we revealed subclinical anxiety or depression, 4 athletes (5,5%) had clinical significant anxiety.

Consolidated results of estimating total values of the used scales use for MD revelation are presented

in the table. Taking into account the information concerning potential MD among swimmers [3], not only with physical loads, but also with the increased need for Mg²⁺ in order to realize heat exchange, we divided all respondents into 2 groups: swimmers and athletes of other sport disciplines.

Table

The average total points comparison in scales "VDS"(vegetative dystonia syndrome), "Anxiety", "Depression", "MPQ" and physical load volume among the athletes of different groups

Criteria	Group 1 (swimming) N ¹ =43	Group 2 (other kinds of sport) N ² =30	General group of athletes n=73	t	p
"VDS" scale (A.M. Vane questionnaire), point	27,53±11,78	24,94±14,63	13,50±12,6	t ¹ = 0,81 t ² =0,59 t ³ =0,14	p ₁ =0,41 p ₂ =0,55 p ₃ =0,89
"Anxiety" scale (HADS questionnaire), point	8,97±3,47	3,38±2,81	4,01±3,19	t ¹ = 1,05 t ² =0,15 t ³ =1,52	p ₁ =0,29 p ₂ =0,88 p ₃ = 0,21
"Depression" scale (HADS questionnaire), point	6,30±2,68	5,66±2,39	3,08±2,46	t ¹ = 0,89 t ² =0,75 t ³ =0,18	p ₁ =0,37 p ₂ =0,45 p ₃ = 0,85
MD scale (MPQ questionnaire), point	14,21±8,07	11,74±5,50	25,7±6,7	t ¹ =1,10 t ² =1,61 t ³ =0,25	p ₁ =0,27 p ₂ =0,11 p ₃ = 0,80
Physical load (volume of hours /week)	13,94±7,38	17,74±8,64	15,76±8,06	t ¹ = 0,17 t ² =0,17 t ³ =0,33	p ₁ =0,86 p ₂ =0,86 p ₃ = 0,73

Student's criterion t¹ – differences of the compared index between group 1 and general group; *t²* – between group 2 and general group; *t³* – between groups 1 and 2; p – validity

It was underlined that among swimmer total point according to "VDS" scale was 12,53 pints higher than the norm and twice higher, than in general group (27,53±11,78 points against 13,50±12,6 points; p>0,05), and the average point according to "Anxiety" scale was 1,97 points higher than the norm and twice higher than in general group (8,97±3,47 against 4,01±3,19; p>0,05). Table shows that in case of thorough statistical analysis the differences of the studied indices between the groups of athletes are not statistically valid; p>0,05 (Student's criterion t=0,110-0,986 with critical t=1,99 in case of p=0,05). Thus, using Spearman correlation coefficient we revealed that the athletes had direct vivid connection of MD and clinical manifestation of VDS (p<0,001, r=0,652) and subclinical depression (p<0,001, r=0,606), and direct connection (according to Cheddok scale) with anxiety (p<0,001, r=0,750). At the same time swimmers had weak connection between MD and clinical asthenic symptoms (χ²=0,945; p=0,331; Pearson conjugacy coefficient C=0,162), although, taking into consideration their sports specificity we expected reverse effect. Thus, it was stated that MD among athletes is accompanied by transformation into clinical syndromes in a form of anxiety and depression states. In terms of statistically valid differences absence.

Conclusion

- 69,8% of athletes during the period of trainings before the competitions had magnesium deficiency.
- Among each third athlete asthenic syndrome had high direct correlations (p<0,001) with magnesium deficiency. At the same time each 10th athlete had magnesium deficiency. It was in a form of clinically significant anxiety.

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