

Publication date: 01.12.2023  
DOI: 10.24412/2782-6570-2023\_02\_04\_8  
UDC 796.964

## ANALYSIS OF EXTERNAL RESPIRATION AND DYNAMOMETRY INDICES IN BOYS, WHO PLAY BANDY, AT THE INITIAL TRAINING STAGE IN SPORTS SCHOOL

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**Annotation.** The aim of this study – to investigate indices of external respiration and dynamometry in bandy players born in 2013 to 2015 at the initial training stage of in the Olympic reserve sports school. The study analyzed the indices of the functional state of the respiratory system and dynamometry. The results revealed that most of the players did not have a significant reduction in the values of the respiratory system indices compared to the norm. Values of the dynamometry indices, registered during the study, were normal or exceeded the norm in most of the players, especially in those born in 2013. The back strength index in the group of players born in 2014 and 2015 was slightly lower. Only the index of retention of a given muscle force by 50% of the leading hand's muscle strength was low in all groups of young bandy players, reflecting insufficient strength endurance of the hand muscles.

**Key words:** physical development, young bandy players, initial training stage, functional status of the respiratory system, hardware and software complex.

**Introduction.** Bandy is officially considered as a winter sport by the International Olympic Committee. At present, great knowledge on scientific and methodological work has already been gathered in the field of bandy, concerning the theory and methods of athletes' training, assessment of players' functional state, psychological support of training and competitive activity [1-4]. The features of physical development of bandy players at the initial stage of sports training are of interest and are not fully studied. Therefore, we conducted a study of the external respiration, hand and back dynamometry indices of young bandy players born in 2013, 2014 and 2015 as part of the research project titled "Improvement of total and special fitness of bandy players in the Erofei Olympic Reserve Sports School with the use of model characteristics".

The purpose of this study – to investigate the external respiration and dynamometry indices in boys born in 2013 to 2015, who play bandy, at the initial training stage in the Olympic Reserve Sports School.

**Methods and organization.** The study took place in September-October 2023 in the morning in the Physical Condition Monitoring Laboratory located in the Far Eastern State Academy of Physical Culture. A total of 98 players participated in the study" 34 of them were born in 2013, 31 – in 2014 and 33 – in 2015.

We used the hardware and software complex titled "Portable microprocessor spirometer" (SMP-21/01), which is designed for qualitative and quantitative estimation of changes in the functional state of the lungs and is applied at various stages of the treatment and diagnostic process. Following indices were measured with the complex: vital capacity (VC, ml), the maximum amount of air one can forcibly exhale from one's lungs after fully inhaling or forced vital capacity (FVC, ml) and forced expiratory volume in the first second (FEV1, ml) when fully inhaling. These indices as the most significant for evaluation of physical development of children were recommended by the scientists from the North Caucasian Federal Scientific and Clinical Center, who

developed the “Sports orientation of children and adolescents” complex [5]. This complex is an automated testing system designed for identification of sports orientation, which was early applied in the studies of psychophysiological and morphofunctional indices of young athletes [6].

Using the “Silach” hand dynamometer, we registered strength indices of the right and left hand (kg), as well as the index of retention of a given muscle force by 50% of the leading hand’s muscle strength. Using the mechanical torso dynamometer, we studied the index of the back muscles’ strength (back strength).

The respiratory system indices were compared with the standard values according to the R.F. Klement and I.S. Shiryaeva methods for identifying lung volumes and expiratory flow rates for people under 18 according to the formula:  $K \times \text{Height(m)} + b$ . The K and b coefficients were identified in the table [7].

The statistical data processing included calculation of mean values and mean error of the indices. The distribution normalcy was identified according to the Shapiro-Wilk test. The data were compared according to the Student’s T-test.

**Results and discussion.** As a result, we have found that most of the athletes have an insignificant reduction of VC compared to the standard values on average by 150-200 ml,

8 players have standard values, 3 of them have a significant reduction by 400-500 ml.

FEV1 in the group of players born in 2013 was also insignificantly reduced by 200-300 ml, corresponded with the norm in 5 athletes, while 7 athletes have a significant FEV1 decrease compared to the norm by 400-550 ml.

FVC in the group of those born in 2013 had a trend to insignificantly decrease by 200-300 ml, 6 had normal values, 5 players had significantly reduced FVC on average by 400-500.

In the group of young bandy players born in 2014, we also found that most of them have a more significant reduction of VC compared with the standard values by 250-300 ml, FEV1 – by 250-300 ml, FVC – by 200-300 ml. 6 had normal VC, 4 athletes had normal FEV1 and only 3 had FVC corresponding with standard values. 5 athletes have a significant reduction of VC on average by 400-500 ml, 7 athletes have a significant decrease in FEV1 by 400-500 ml, 6 athletes – a decrease in FVC by 450-550 ml.

The group of young players born in 2015 also had a significant decrease in VC values by 250-300 ml compared to the norm, FEV1 – by 300-350 ml, FVC – by 200-300 ml. 4 players had normal VC values, 3 athletes – normal FEV1, 2 athletes had normal FVC. 4 athletes have a significant reduction of VC by 400-500 ml, 6 players – a reduction in FEV1 by 400-500 ml, 5 players – a reduction of VC values by 450-550 ml compared to the norm.

Table

Physical development indices of young bandy players,  $X_{i \pm m}$

| Indices           | Born in 2013 | Born in 2014 | Born in 2015 |
|-------------------|--------------|--------------|--------------|
| VC, ml            | 1932±86.0    | 1441±69.1    | 1173±56.5    |
| FEV1, ml          | 1616±103.8   | 1230±67.8    | 870±52.0     |
| FVC, ml           | 1641±104.8   | 1232±70.0    | 905±58.2     |
| Dynamometry, kg   |              |              |              |
| Right hand        | 20±0.8       | 18±0.4       | 16±0.5       |
| Left hand         | 19±0.9       | 16±0.6       | 15±0.4       |
| Back strength     | 38±2.1       | 31,5±1.7     | 28±1.4       |
| 50% time trial, s | 4±0.7        | 3±0.5        | 4±0.35       |

Note: VC – vital capacity; FEV1 – forced expiratory volume in the first second; FVC – forced vital capacity

Among young bandy players born in 2013 to 2015 there was a substantial difference ( $p < 0.05$ ) in the respiratory system indices. For example, VC values were better by 25.4% in the group of bandy players born in 2013 than VC values of those born in 2014 and better by 39.3% than VC values of players born in 2015 ( $p < 0.05$ ) (table). VC of young athletes born in 2014 was substantially better by 18.6% than VC of those born in 2015.

FEV1 was also significantly better by 23.9 and 46.2% in the group of athletes born in 2013 compared to those of bandy players born in 2014 and 2015 respectively. There was also a substantial difference in FEV1 between players born in 2014 and 2015 by 29.3% in favor of the first group.

Finally, FVC also was different in the group of young bandy players born in 2013 compared to athletes born in 2014 and 2015 by 25 and 44.9% respectively. Between hockey players born in 2014 and 2015, we also found a significant difference in the FVC index by 26.6% in favor of the first group.

While comparing average values of left and right hand dynamometry of young bandy players with the standard values, we found that most young athletes have muscle strength indices that are normal or exceed the norm. However, there are slight but substantial differences in the indices of the group born in 2013 compared to boys born in 2014 and 2015 respectively.

The index of back strength in the group born in 2013 corresponds with the values standard for this age according to the data presented by V. Kunevich [3], while the back strength index of those born in 2014 and 2015 was slightly lower than the age-related standard (34 kg – 9 years, 32 kg – 8 years). Meanwhile,

the index of back strength of youth bandy players born in 2013 was significantly better by 17.1 and 26.3% compared to players born in 2014 and 2015 respectively.

The index of retention of a given muscle force by 50% of the leading hand's muscle strength was relatively low in all groups.

**Conclusion.** Thus, having analyzed the indices of physical development in the groups of young bandy players, it can be noted that in general, the majority of players had no pronounced decrease in the indices of the respiratory system compared to the standard values and only a small number of players had reduced indices. The lower indices of young athletes born in 2014 and 2015 and reliable differences compared to players born in 2013, especially in such indices as FEV1 and FVC, can be explained by lower functional capacity of respiratory muscle strength in conditions of slight oxygen deficit in the indoor arena of "Erofei".

The dynamometry indices registered during the study corresponded with standard values and even exceeded the norm, especially in players born in 2013. The back strength index in the groups born in 2014 and 2015 was slightly lower. The index of retention of a given muscle force by 50% of the leading hand's muscle strength was low in all groups, which reflects insufficient strength endurance of the hand muscles.

The obtained data on physical development of young bandy players will make it possible to make appropriate changes in the educational and training process at the stage of initial training and develop model characteristics corresponding to this sport.

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

## REFERENCES

1. Galitsyn S.V., Ziganshin O.Z., Chiligin D.V., Kramarenko D.V., Popov P.D. Functional states of players of the "SKA-Neftyanik-2005" bandy team in the preparatory period. *Scientific Notes of the P.F. Lesgaft University*, 2021, no. 1 (191), pp. 43-46. (in Russ.)
2. Mezentshev V.V., Ziganshin O.Z., Galitsyn S.V., Tkachenko P.A. Dynamics of changes in psychomotor performance of SKA-Neftyanik-2 ball hockey players within the annual cycle. *Scientific Notes of the P.F. Lesgaft University*, 2020, no. 5(183), pp. 273-276. (in Russ.)

3. Milevskaya N.A., Galimov G.Ya. Methodology of teaching playing bandy for sportsmen of initial level. *BSU bulletin. Philosophy*, 2014, no. 13-1, pp. 133-135. (in Russ.)
4. Ziganshin O.Z., Kononenko P.B., Usenko V.P., Shishenkov V.M. Competitive activity of elite bandy players. *Theory and Practice of Physical Culture*, 2015, no. 5, p. 69. (in Russ.)
5. Nopin S.V., Koryagina Yu.V., Ter-Akopov G.N. Development of the computer program "Sports orientation of children and adolescents". *Modern Issues of Biomedicine*, 2017, vol. 1, no. 1 (1), p. 5. (in Russ.)
6. Muscle system in children. Available at: <https://medicinskiportal.ru/razdely/pediatrica/oso-bennosti-razvitiyadetej-shkolnogo-vozrasta/myshechnaya-sistema-u-detej> (accessed 11.11.2023). (in Russ.)
7. Nopin S.V., Koryagina Yu.V., Ter-Akopov G.N. Sports orientation of children and adolescents. Certificate of the computer program registration RF 2018612450, 2018. (in Russ.)

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**For citation:** Ziganshin O.Z., Mezentsev V.V., Popov P.D., Nopin S.V. Analysis of external respiration and dynamometry indices in boys, who play bandy, at the initial training stage in sports school. *Russian Journal of Sports Science: Medicine, Physiology, Training*, 2023, vol. 2, no. 4. DOI: 10.24412/2782-6570-2023\_02\_04\_8