The Monitoring System of Student and Working Youth Daily Aerobic Motor Activity

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Abstract

Aim of the Study: The aim of the research is to develop a monitoring system for daily aerobic motor activity of student and working youth and to prove its effectiveness through increasing their physical health. Materials and Methods: The research was conducted on the basis of the Municipal Sports Club "Progress" (Udmurt Republic, Russia) in the section "Recreational Running". 84 respondents took part, who were divided into two age categories: student youth - boys and girls of 18 - 27 years old (n = 46) and working youth - men and women of 28 - 40 years old (n = 38). To determine the level of physical health, the methods of E.A. Pirogova and N.M. Amosov were used, including express train-estimation of the testee's body physical condition level in terms of the cardiovascular system. Mathematical and statistical processing of the results was carried out according to the Chi-square at $p < 0.01$ and $p < 0.05$.

Results: It is found out that the introduction of a monitoring system for daily aerobic motor activity, including the calculation of steps while walking and running under various modes of movement, stimulates athletes to increase their daily, weekly and monthly activity.

Conclusion: The obtained research data showed that the impact of aerobic motor activity had a significantly greater impact on working youth of 28 - 40 years old. On the basis of mathematical and statistical processing of the results the study has proved that an active lifestyle at a high and medium motor level, including daily aerobic exercise, significantly increases the level of physical health and functionality of athletes.

Keywords: System; Aerobic Physical Activity; Steps; Monitoring; Physical Health; Athletes

Introduction

Recently, many researchers have proved that the implementation of the optimal motor activity of a person in its various forms has a positive effect on the state of health, the level of physical fitness and the functional state of the body [1]. Today, the fitness market offers a variety of systems for monitoring and self-monitoring the state of various ages athletes physical performance [2]. Various programmes and techniques for monitoring all body systems are popularized [3-5], in particular, the key one for analyzing the fitness of the body - the

cardiovascular system [6]. It is the functional state of the cardiovascular system that is regulated by the central nervous system [7]. It is synergistically associated with the activity of all organs and systems and therefore is a reflection of the organism functional state as a whole [8].

One of the main conditions for the full functioning of the human cardiovascular system is systematic physical exercise [9]. It is the sequence of performing physical activity in daily, weekly, and monthly regimes that ensures the transition of urgent adaptive reactions of the body to long-term adaptation to loads [10]. A positive effect can be achieved only when the effect of one activity is combined with the action of the next, if new compensation of energy resources [7]. In turn, this means that the basis for the development of fitness is the systematic impact of the load and the regularity of its repetition [11,12]. Violation of the systematicity and gradualness principle during the training process cannot only give the desired healing effect, but also lead to serious health problems [13,14]. The individual design of a programme for the implementation of physical activity should include the correct selection of exercises, their dosage and power of exposure [2]. However, despite the identified relevance of the physical exercises implementation for the physical health of young people. An insufficiently studied issue, in our opinion, is the methodological preparation of student and working youth for independent monitoring and, on its basis, the development of individual motor activity during the day, week or a specific training cycle. In this regard, the study determined the aim of the research is to develop a monitoring system for daily aerobic motor activity of student and working youth and to prove its effectiveness through increasing their physical health.

Materials and Methods

The research was conducted on the basis of the Municipal Sports Club "Progress" (Udmurt Republic, Russia) in the section "Recreational Running". 84 respondents took part. They were divided into two age categories: student youth - boys and girls from 18 to 27 years old (n = 46) and working youth - men and women from 28 to 40 years old (n = 38). In turn, each age group of participants was divided into two groups of the EG and the CG. All subjects did not have chronic diseases, however, a preliminary section revealed in most subjects a low level of physical health according to the methods used for the research. Only in a few isolated cases did the EG (n = 3) and the CG (n = 4) record an average level. All participants agreed to participate in the experiment and had independent experience with low and medium intensity physical activity.

The study used theoretical analysis and generalization of scientific and methodological literature, a pedagogical experiment, methods of mathematical statistics for Chi-square at $p < 0.01$ and $p < 0.05$. Prior to the experiment, mathematical-statistical uncertainty of differences in the level of physical health between the EG and the CG at $p > 0.05$ was recorded.

To determine the level of physical health the method E.A. Pirogova was used, it allows for rapid assessment of the physical condition level by an indicator of the circulatory system, according to the formula below: $X = (700-3*HR-2.5*APd+(APs-APd)/3-2.7*A+0,28*W)/(350-2.7*A+0.21*G)$, HR - heart rate, G - body growth, cm; W - body weight, kg; A - age, full years, APs - arterial systolic pressure, APd - arterial diystolic pressure. High level: $X \geq 0.8$; average level: $0.8 > X > 0.4$; low level: $X \leq 0.4$.

To determine the level of the organism functional capabilities, the method of N.M. Amosov was used. Respondents were monitored on the basis of the following formula: $X = 0.011*HR+0.014*APs+0.008*APd+0.014*A+0.009*W-(0.009*G+0.27)$. High level: $X \leq 2.3$; average level: $2.3 < X < 3.1$; low level: $X \geq 3.1$.

Procedure

During the experimental period (4 months), athletes performed daily and weekly self-monitoring of aerobic motor activity, consisting of various speed modes. Self-monitoring stimulated the participants in the experiment to an independent physical activity, optimal for maintaining the body's health, on the principle of "at least 10,000 steps per day" on daily, weekly and monthly cycles. During the research period, athletes from the CG carried out self-monitoring of motor activity using various mobile applications in smartphones and sports

gadgets. In turn, the participants in the EG study during the experiment monitored individual aerobic activity, consisting of walking and running in various speed modes, using authoring. Based on the analysis of special literature on the study of the respondents energy consumption for motor activity at different speeds and under different conditions [9,15-17] the author's system for monitoring daily aerobic motor activity was developed (Figure 1).

Walking (km / h)			
< 4	4-5	5-6	6-7
Coefficient			
1	1,3	1,6	2

Running (km / h)			
7-8	8-9	9-10	> 10
Coefficient			
2	2,3	2,6	3

Walking stairs (km / h)			
Up		Down	
80-100	100-120	100-120	120-140
Coefficient			
3	3,5	1,5	2

Climb during load (m)					
< 20	20-40	40-60	60-80	80-100	> 100
Coefficient					
1	1,4	1,8	2,2	2,6	3

Daily aerobic motor activity

Figure 1: *Monitoring system for daily aerobic motor activity.*

For four months, participants in the EG study performed self-control of steps at the time of performing the aerobic exercise of a cyclic nature daily. Each type of load in a different speed mode had a special coefficient. By counting the steps while walking or running steps at each time interval of physical activity of a cyclic nature, the athlete multiplied the resulting number by the corresponding coefficient. Moreover, when implementing walking or running in an area with a mountain surface, the result obtained in the previous calculation was multiplied again by a factor corresponding to the climb by the athlete during the load. Climb measurement during exercise was carried out using the special "Altimeter" function in a fitness tracker connected to a smartphone while driving. All data were entered in a special diary of self-control on paper or in a mobile phone through the use of a special mobile application. The main goal set for the respondents at the beginning of the experiment included a set of as many daily steps as possible, calculated using the author's coefficient system. The minimum value that the respondents of the EG should have collected during each week during the experiment: 70,000 steps according to the author's model. The process of counting motor actions was carried out for the most part by the EG (n = 29) of the respondents using fitness trackers, pedometers and other special devices. A smaller part of the EG (n = 13) - without the use of special gadgets. Participants in the experiment, implementing monitoring without the use of special equipment, used a stopwatch and maps of the area, as well as special recommendations from the mentor:

- The individual step length can be found out by measuring a distance of 20 meters and go through it at the usual average speed, counting steps. After this, it is necessary to divide the distance traveled in centimeters by the number of steps taken;
- The running step is calculated based on the estimated length of 65% of the respondent's height. However, this length cannot be considered universal for all athletes, but focusing on this figure, one can experimentally determine the approximate optimal length

of a running step. In which running becomes easy, smooth, not exhausting and does not require constant control over the position of the limbs and body;

- The speed of movement is determined by calculating the distance (using the navigator on the phone or a location map with a scale), the steps taken, divided by the time spent on the motor activity;

- The speed of walking or running can be calculated based on the standard values proposed for the participants of the experiment: 75 - 95 steps per minute = 3 - 4 km/h or 95 - 115 steps per minute = 4 - 6 km/h.

Results

As shown in figure 2 and 3, the number of participants in the EG and CG in the percentage for the three level groups in the control section is significantly different with a confidence level of $p < 0.01$ in the age group of working youth and with a confidence level of $p < 0.05$ in the age group of students according to the methods used in the study. It indicates the positive impact of the experiment.

The recorded data at the end of the experiment showed the effectiveness of the experimental work according to the method of E.A. Pirogova (Figure 2) and according to the method of N.M. Amosov (Figure 3). For all age categories, the significance of differences between the EG and the CG by the methods of physical health and functionality analysis was revealed. Moreover, the implementation in practice of the athletes author's daily monitoring model' walking and running has a significantly greater impact on working youth from 28 to 40 years old ($p < 0.01$), compared with the significance of the difference between the EG and the CG ($p < 0.05$) for the age group of students. As a result of the experiment, it was found that the implementation of daily monitoring, including counting steps when walking and running under various modes of movement according to the system proposed in the study, stimulates respondents to increase their daily, weekly and monthly activity.

For a more reliable study of the author's development positive influence, the results of the EG were studied after the end of the experiment within the focus group. This analysis aimed at identifying the optimal motor daily and weekly regimen of the athlete for a signifi-
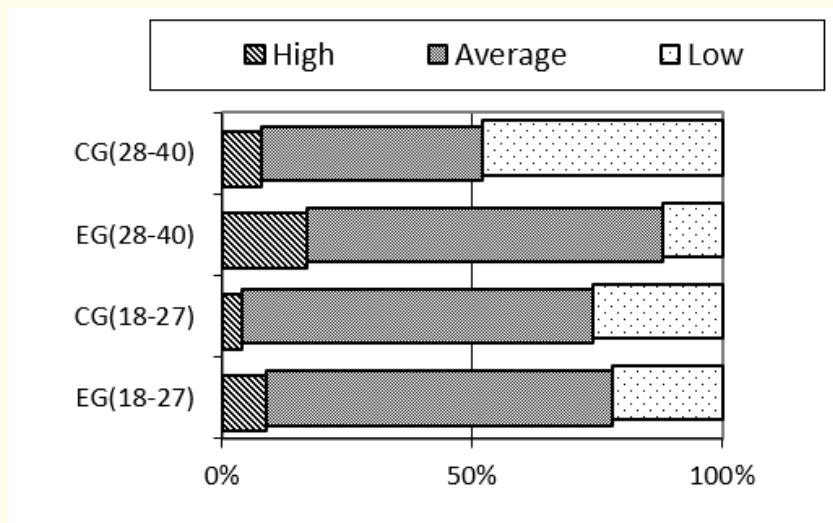
Figure 2: The results of the EG and the CG after the experiment according to the method of E.A. Pirogova by age.
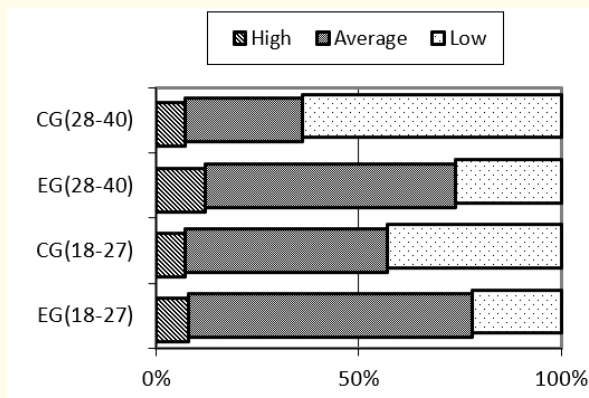
Figure 3: The results of the EG and the CG after the experiment according to the method of N.M. Amosov by age.

cantly healing effect from aerobic exercise. Based on the analysis of the self-monitoring diaries of the participants in the EG study during the study according to the proposed system of coefficients, the respondents were divided into three groups regardless of age. EG1 (n = 8) - participants who implemented a 13-week cycle at a high level of physical activity: the average weekly volume of aerobic load of a cyclic nature during the experiment recorded more than 80,000 steps according to the author's model. EG2 (n = 20) - at an average level of motor activity: more than 75,000 steps, but less than 80,000 steps according to the author's system. EG3 (n = 14) - at a low level of motor activity: less than 75,000 steps according to the author's system.

A previous analysis of the data allowed us to identify in which age category of athletes a reliably significant healing effect from aerobic exercise is possible. In turn, the following comparative study of the EG1, EG2, EG3, and CG data allowed us to obtain new data. Namely, in which of the experimental groups that differ from each other in terms of the load intensity, the experiment will be statistically proven to increase the level of physical health and functional development of the study participants (Figure 4 and 5).
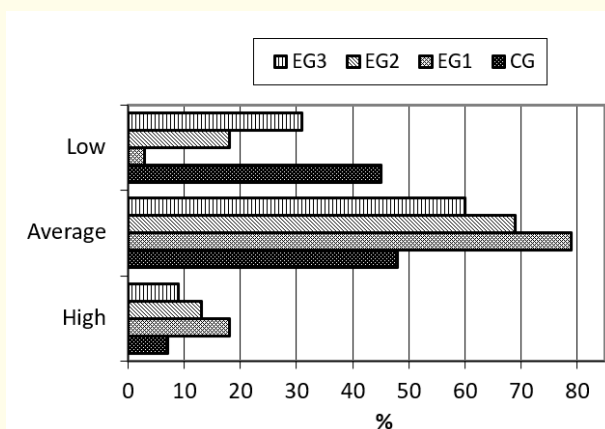

Figure 4: The results after the experiment by the method of E.A. Pirogova between KG, EG1, EG2, EG3.
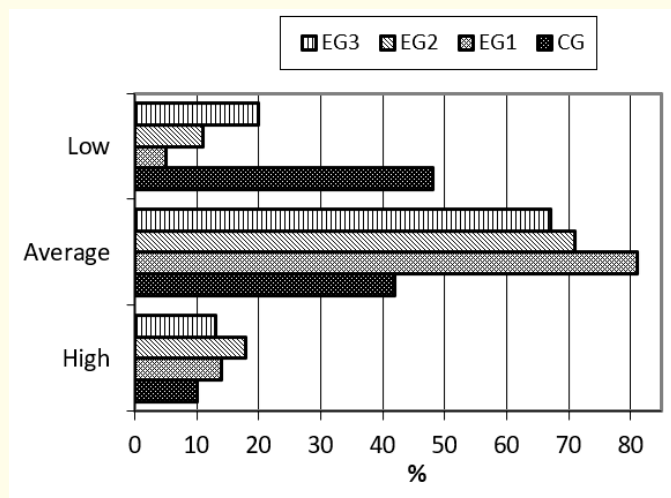
Figure 5: *The results after the experiment by the method of N.M. Amosov between KG, EG1, EG2, EG3.*

As shown in figure 3 and 4, the number of the EG1 and the CG participants in the percentage for the three level groups after the experiment is significantly different at a confidence level of $p < 0.01$ according to the analysis of the physical health of the body and is not statistically equal at a confidence level of $p < 0.05$ according to the analysis functional capabilities of the body. In turn, the number of participants in the EG2 and the CG in the percentage for the three level groups is significantly different at a confidence level of $p < 0.05$ according to the method of analyzing the physical health of the body and is not statistically equal at a confidence level of $p < 0.01$ according to the method of analyzing the body's functional capabilities. However, the number of participants in the EG3 and the CG as a percentage of the three level groups is statistically the same at a confidence level of $p > 0.05$, according to the methods used in the study. These data testify to the positive effect of the experiment only in the EG1 and EG2 groups; among the EG3 respondents, there was no statistically significant healing effect from the use of the author's development. Moreover, the obtained mathematical and statistical data on both methods show a comparative equality of the athletes distribution in terms of the EG1 and the EG2 ($p > 0.05$). In turn, these data prove that the athlete's optimal motor weekly regimen for a significantly significant healing effect is at least 75,000 steps according to the author's model of athletes' daily monitoring walking and running.

Discussion

The experimentally proven results of this study are consistent with the findings of other studies of the motor activity of people of different ages using the technologies of self-monitoring and self-diagnosis [3,13]. An analysis of studies on the dependence of increasing the physical health indicators of various ages athletes, in particular the cardiovascular system [6,7], on the increase in their physical activity during a certain fixed cycle proves the reliability and relevance of the results obtained in the study [8,18]. It is a systematic daily monitoring of aerobic activity that has a positive effect on the functional and health-saving development of the body. However, a significantly greater impact on working youth of 27 - 40 years, compared with athletes of student age.

Experts prove that classes using systematic monitoring of physical health [2,10] and differentiation and individualization of physical activity are one of the effective conditions for the formation of a motivational-value attitude to physical education and a healthy lifestyle [15]. Scientific work proves the effectiveness of increasing the daily number of steps taken by respondents to improve various functional

systems of the body and overall physical health [7,11]. The positive effects of the optimal motor mode, controlled by a pedometer, on the psychological characteristics of athletes are justified [19]. It ultimately leads to an increase in sports mass and an increase in the level of the population physical development, in particular youth [10]. However, the pedometer itself is not a factor motivating a person to change his activities [20] but acts only as a means of monitoring the process of achieving their goals [2]. In turn, the author's study supplements previous scientific developments with the proposed holistic monitoring system. The scientific novelty of the study is determined by the obtained experimental data, confirmed by mathematical and statistical processing. Namely, that the athlete's optimal motor weekly regimen for a significant healing effect should be at least 75,000 steps according to the author's model of athletes' daily monitoring walking and running [21-24].

Conclusion

The practical implementation of the monitoring system for daily aerobic physical activity of students and working youth stimulates respondents to increase their physical activity. The statistics revealed during the research allow us to conclude that the use of monitoring, including daily counting of steps while walking and running at different speeds and stairs, stimulates athletes to increase their daily, weekly and monthly activity. The findings of the study have showed that the impact of motor activity has a significantly greater impact on working youth from 28 to 40 years old. It can be explained by the fact that at a younger age a certain "health reserve" is still preserved. On the basis of mathematical and statistical processing of the results the research has proved that an active lifestyle at a high and medium motor level, including daily walking, running and ladder runs, significantly increases the level of physical health and functionality of students. Consequently, physical exercises performed not systematically and not at the optimal motor level are useless for the population in the health aspect.

Bibliography

1. Kraus WE., *et al*. "Daily Step Counts for Measuring Physical Activity Exposure and Its Relation to Health". *Medicine and Science in Sports and Exercise* 51.6 (2019): 1206-1212.

2. Wennman H., *et al*. "Gender, age and socioeconomic variation in 24-hour physical activity by wrist-worn accelerometers: the Fin-Health 2017 Survey". *Scientific Reports* 9.1 (2019): 6534.

3. Plotnikoff RC and Karunamuni N. "Steps towards permanently increasing physical activity in the population". *Current Opinion in Psychiatry* 24.2 (2011): 162-167.

4. Podrigalo L., *et al*. "Features of physical development and somatotype of girls and women involved in fitness". *Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports* 23.4 (2019): 189-195.

5. Yagotin RS., *et al*. "Criterion score of the physical and psychophysiological condition of students in the context of determining their individual adaptability to physical loads". *Physical Education of Students* 23.1 (2019): 51-57.

6. Abbasi J. "For Mortality, Busting the Myth of 10000 Steps per Day". *JAMA-Journal of the American Medical Association* 322.6 (2019): 492-493.

7. Schorr E., *et al*. "Abstract P276: Activity Tracker Increases Daily Step Count Post-Cardiac Rehabilitation Compared to Placebo Device". *Circulation* 137.1 (2018): AP276.

8. Thijs I., *et al*. "Assessment of Physical Activity by Wearable Technology During Rehabilitation After Cardiac Surgery: Explorative Prospective Monocentric Observational Cohort Study". *JMIR Mhealth Uhealth* 7.1 (2019): e9865.

9. Troiano RP., *et al*. "Reported physical activity and sedentary behavior: why do you ask?" *Journal of Physical Activity and Health* 9.1 (2012): 68-75.

10. Lee IM and Shiroma EJ. "Using accelerometers to measure physical activity in large-scale epidemiological studies: Issues and challenges". *British Journal of Sports Medicine* 48.3 (2014): 197-201.

11. Exel J., *et al.* "Physical activity and sedentary behavior in amateur sports: master athletes are not free from prolonged sedentary time". *Sport Sciences for Health* 15.2 (2019): 385-391.

12. Nagovitsyn RS., *et al.* "Sports selection in martial arts based on the harmonic stability of results at competitions". *Journal of Human Sport and Exercise* 14.4 (2019): S867-S876.

13. Esliger DW and Tremblay MS. "Physical activity and inactivity profiling: the next generation". *Canadian Journal of Public Health* 98.2 (2007): S195-S207.

14. Nagovitsyn RS., *et al.* "Modernization of Regional Continuing Pedagogical Education in the "School-College-Institute". *European Journal of Contemporary Education* 8.1 (2019): 144-156.

15. Brown W., *et al.* "10,000 Steps Rockhampton: establishing a multi-strategy physical activity promotion in a community". *Health Promotion Journal of Australia* 14.2 (2003): 95-100.

16. Eakin EG., *et al.* "Correlates of pedometer use: results from a community-based physical activity intervention trial (10,000 Steps Rockhampton)". *International Journal of Behavioral Nutrition and Physical Activity* 4 (2007): 31-39.

17. Sallis JF and Saelens BE. "Assessment of physical activity by self-report: Status, limitations, and future directions". *Research Quarterly for Exercise and Sport* 71 (2000): 1-14.

18. Hildebrand M., *et al.* "Age group comparability of raw accelerometer output from wrist-and hip-worn monitors". *Medicine and Science in Sports and Exercise* 46.9 (2014): 1816-1824.

19. Troitskaya EA. "Psychological aspects of increasing physical activity using a pedometer". *Bulletin of Moscow State Linguistic University. Education and Pedagogical Sciences* 719 (2015): 177-188.

20. Toth L., *et al.* "Validity of Activity Tracker Step Counts during Walking, Running, and Activities of Daily Living". *Translational Journal of the ACSM* 3 (2018): 52-59.

21. Kuznetsova Z., *et al.* "The experimental method of middle distance runners hypoxic training". Proceedings of the 6th International Congress on Sport Sciences Research and Technology Support (2018).

22. Kuznetsov A., *et al.* "Diagnostics of functional state and reserve capacity of young athletes' organism". Proceedings of the 5th International Congress on Sport Sciences Research and Technology Support (2017).

23. Kuznetova Z., *et al.* "Athletes preparation based on a complex assessment of functionals rate". Proceedings of the 3th International Congress on Sport Sciences Research and Technology Support (2015).

24. Ildus G Gibadullin., *et al.* "Theoretical and practical aspects formation of physical health of students of technical University". *Russian Journal of Physical Education and Sport* 14.3 (2019): 59-64.