

**BIOIMPEDANCEOMETRY IN ASSESSING THE HEALTH STATUS OF SECONDARY
SCHOOL TEACHERS: PERSPECTIVES AND OPPORTUNITIES FOR DISEASE
PREVENTION**

Valiyev Ravshanbek Akhmadjonovich

Email: ravshanbekvaliev0306@gmail.com

Kosimov Islombek Ulugbekovich

Email: kosimovislom990@gmail.com

Andijan State Medical Institute.

Annotation: The article presents a method for evaluating the effectiveness of teaching methods in higher education institutions, with a focus on monitoring, evaluating, and preventing problems among faculty members. The results of the pilot study on the composition of the test subjects' (n = 87) experience are presented. The subjects' experience ranged from none to considerable. The presence of particular anthropometric and bioimpedance indicators has been identified, which are indicative of the specific group under investigation. Correlations have been identified between the age of the subjects, their age, and the number of subjects in the sample. The proposed algorithmic framework is predicated on the basis of the preceding biometric data. The present study aims to examine the efficacy of the method in the context of programmatic prevention of psychosocial problems among individuals engaged in psychosocial work.

Keywords: bioimpedance, body composition, physical activity, metabolic syndrome, physical activity, health status, and physical activity.

Introduction:

The profession of a secondary school teacher is characterised by a high level of stress, significant emotional demands and limited opportunities for personal development. It is evident that these factors frequently result in the onset of various somatic pathologies, including metabolic disorders, cardiovascular diseases, and problems with the nervous and circulatory systems, as well as orthopedic pathologies. The timely identification of risks associated with the general condition of the population is of paramount importance in the context of public health.

As demonstrated by the findings of the following studies [1, 2, 3], the prevalence of chronic non-infectious diseases among teaching staff exceeds that of the general population of the same age group. In particular, the prevalence of arterial hypertension has been documented to be between 42-48% among patients over the age of 15 years. Similarly, the incidence of orthopnoea has been reported to be between 37-40%, while that of dyslipidaemia has been documented to be between 35-39% [4]. A salient feature of professional groups is their tendency to allocate insufficient

attention to the individuality of their members and their low level of engagement with preventative health measures [5].

In recent years, bioimpedance analysis has become a more prevalent method of non-invasive body composition assessment. The distinguishing features of this method include its simplicity, cost-effectiveness and high level of functionality. It is evident that this instrument is conducive to the monitoring of both general and specific groups, including those of a pedagogic nature.

The objective of the present study is to evaluate the potential benefits of bioimpedance analysis in identifying risk factors. The investigation will address the prevalence of illnesses among teaching staff in secondary schools, and the development of a programme of preventative measures based on the data collected.

Materials and methods

Characteristics of the bioimpedanceometry method:

Bioimpedanceometry (BIA) is a method of diagnosing human body composition based on measuring the electrical resistance of biological tissues. The method is based on the differences in electrical conductivity of different body tissues: fatty tissue has a high resistance, while muscle tissue and internal organs, which contain a large amount of water and electrolytes, are good conductors of electrical current.

During the procedure, a weak electric current is passed through the body (absolutely safe for health, with a strength of no more than 800 μ A) and special equipment records the resistance of the tissues. Based on the data obtained, the following parameters are calculated:

The following elements are of particular relevance in this study:

- The total fat content of the tissue, both in absolute terms and as a percentage of the total body fat
- The fat-free mass of the body
- The active cell mass
- The total water content of the body
- The intracellular water
- Intracellular fluid
- Cell mass index
- Level of primary metabolism
- Ratio of fat to lean body mass
- Visceral fat
- Visceral fat-to-total body fat ratio

The phase angle of the bi-impedance sensor is a particularly salient indicator. As such, it is

imperative to consider the general condition of the cell membrane and its correlation with the level of physical and biological activity [6]. The lowest values of the phase angle may be indicative of degeneration in the tissues and the predominance of cataractous processes.

Study design

The study involved 87 teachers (78 women and 9 men) from 5 secondary general education schools. The mean age of the participants was 42.6 ± 8.5 years, the mean teaching experience was 18.3 ± 9.2 years.

Inclusion criteria: age 25-65 years, teaching experience of at least 3 years, absence of acute diseases at the time of examination, voluntary informed consent to participate in the study.

Exclusion criteria: pregnancy and lactation, presence of pacemaker or other implanted electronic devices, oncologic diseases, acute infectious diseases, exacerbation of chronic diseases

All participants underwent anthropometric examination (measurement of height, weight, waist and hip circumference) and bioimpedanceometry using ABC-01 analyzer "Medass" (Russia). Measurements were performed in the morning hours, on an empty stomach, after bladder emptying. The participants were divided into three groups depending on the length of service:

- group I - work experience 3-10 years (n=23)
- group II - work experience 11-20 years (n=32)
- group III - work experience more than 20 years (n=32)

Statistical processing of data was performed using the SPSS 22.0 program package. Quantitative variables are presented as mean values and standard deviations ($M \pm SD$). One-factor analysis of variance (ANOVA) followed by Tukey's posterior tests was used to compare groups. Pearson's correlation coefficient was used to detect correlations. Differences were considered statistically significant at $p < 0.05$.

Results of the study

Anthropometric and general characteristics of the surveyed teachers

The main characteristics of the surveyed teachers are presented in Table 1.

Parameter	Group I (experience 3–10 years)	Group II (experience 11–20 years)	Group III (experience >20 years)	p-value
Age, years	32.4 ± 4.2	32.4 ± 4.2	51.8 ± 6.4	<0.001

Height, cm	166,3±6,1	165,8±5,7	164,9±5,9	0,672
Weight, kg	63,5±9,7	68,4±11,8	72,6±13,5	0,019
BMI, kg/m ²	22,9±3,2	24,8±4,1	26,7±4,5	0,003
Waist circumference, cm	74,6±8,3	81,4±10,2	87,5±11,8	<0,001
Hip circumference, cm	94,8±7,2	99,3±8,5	102,7±9,1	0,002
Waist-to-hip ratio	0,79±0,06	0,82±0,07	0,85±0,08	0,005

Statistically significant differences between the groups were revealed for the parameters characterizing body weight and fat tissue distribution. With increasing length of service, there is a progressive increase in BMI, waist circumference and waist/hip ratio, which indicates a tendency towards abdominal obesity in teachers with more years of service

Results bioimpedanceometry:

The results of the bioimpedance analysis of body composition are presented in Table 2.

Parameter	Group I (3-10 years of experience)	Group II (11-20 years of experience)	Group III (>20 years of experience)	p-value
Fat mass, %	24,3±6,1	28,7±7,2	33,5±7,8	<0,001
Active cell mass, %	56,4±4,3	53,2±4,8	50,1±5,3	<0,001
Скелетно-мышечная масса, %	47,2±4,9	44,6±5,1	41,8±5,6	<0,001
Total body water, %	56,8±4,6	53,4±5,0	50,7±5,3	<0,001
Extracellular water, %	43,2±2,8	44,9±3,1	46,7±3,5	<0,001
Phase angle, degrees	7,1±0,8	6,7±0,9	6,2±1,0	0,001
Visceral fat index	5,8±2,3	8,4±3,2	11,3±3,9	<0,001
Basic metabolism, kcal	1456±148	1423±157	1387±165	0,193

The analysis of the obtained data showed a progressive increase in relative fat mass with increasing length of service with a simultaneous decrease in the proportion of active cellular and

skeletal muscle mass. Especially important is the pronounced increase in visceral fat index in the group with more than 20 years of work experience, indicating an increased risk of metabolic syndrome and cardiovascular diseases.

There was also a statistically significant decrease in the phase angle of bioimpedance with increasing length of service, which may indicate progressive degenerative changes in tissues and decreased work capacity.

Correlation analysis

Correlation analysis revealed associations between years of teaching experience and a number of body composition indicators (Table 3).

Parameter	Correlation coefficient (r)	p-value
Body mass index	0,48	<0,001
Fat mass, %	0,57	<0,001
Visceral fat index	0,61	<0,001
Active cell mass, %	-0,52	<0,001
Phase angle	-0,47	<0,001
Waist circumference	0,54	<0,001
Waist/hip index	0,49	<0,001
Basic exchange	-0,29	0,007

The strongest correlations were found between length of service and visceral fat index ($r=0.61$, $p<0.001$), as well as percentage of fat mass ($r=0.57$, $p<0.001$). An inverse correlation was found between length of service and active cell mass ($r=-0.52$, $p<0.001$), reflecting a decrease in metabolically active tissues with increasing length of teaching experience.

Disease risk assessment

Based on the obtained data, the risk of developing various diseases among the surveyed teachers was assessed. The results are presented in Figure 1.

In the group of teachers with more than 20 years of experience, 43.8% had signs of metabolic syndrome (according to NCEP-ATP III criteria: waist circumference >88 cm for women and >102 cm for men, visceral fat index >9). In the group with 11-20 years of experience, this figure was 28.1%, and in the group with 3-10 years of experience, only 8.7%.

The risk of cardiovascular diseases, calculated on the basis of impedance-sometry and anthropometry data, also increased with increasing length of service: high risk was found in

34.4% of teachers of the third group, in 21.9% of the second group and in 4.3% of the first group.

Discussion of results

The obtained results indicate progressive changes in the body composition of teachers with increasing length of teaching experience. The most pronounced changes are observed in the indicators of fat mass, especially visceral fat mass, and active cell mass.

The revealed dynamics is consistent with the data of other studies devoted to the study of teachers' health [7, 8, 9] and may be due to a number of factors characteristic of this professional group:

1. High psycho-emotional load leading to chronic stress and increased cortisol levels, which contributes to visceral fat accumulation [10];
2. Predominantly sedentary lifestyle, characteristic for teachers in preparing for classes and checking students' work;
3. violation of the diet and quality of nutrition due to the specifics of the work schedule (short breaks between lessons, forced eating "on the go");
4. Age-related changes in metabolic processes, aggravated by the peculiarities of professional activity;
5. Insufficient time for physical activity due to high workload.

The significant increase in visceral fat index in teachers with a long work experience is particularly alarming. It is known that visceral obesity is a key risk factor for the development of metabolic syndrome, type 2 diabetes mellitus and cardiovascular diseases [11, 12].

A decrease in the phase angle of bioimpedance with increasing length of service is also an unfavorable sign, since this index reflects the state of cell membranes and correlates with the general functional state of the organism. Selberg and Selberg [13] showed that low values of the phase angle are associated with an increased risk of mortality from various causes.

The results emphasize the need to develop preventive measures aimed at correcting body composition and preventing the development of metabolic disorders in secondary school teachers.

Algorithm of preventive measures

Based on the results of the study, an algorithm of preventive measures for secondary school teachers using bioimpedanceometry data was developed (Fig. 2).

The algorithm includes the following steps:

1. Conducting bioimpedanceometry as part of the annual preventive examination of teachers.

2. analyzing the main indicators of body composition:
 - Body mass index
 - Percentage of fat mass
 - Visceral fat index
 - Active cell mass
 - Bioimpedance phase angle
3. Data-driven risk stratification of disease risk:
 - Low risk: normal body composition scores
 - Medium risk: minor deviations from normal values
 - High risk: severe abnormalities indicative of metabolic abnormalities
4. Selection of preventive measures depending on the identified risk:
 - At low risk: general recommendations for maintaining a healthy lifestyle
 - At medium risk: individualized recommendations on diet and physical activity, monitoring of the dynamics of indicators after 6 months
 - At high risk: endocrinologist and cardiologist consultation, laboratory examination (lipidogram, blood glucose, insulin), development of an individual prevention program, monitoring of the dynamics of indicators in 3 months
5. Educational activities for educators:
 - Lectures and seminars on the basics of healthy nutrition
 - Training in stress management techniques
 - Development of physical activity programs adapted to teachers' professional activities
6. Monitoring the effectiveness of preventive interventions through repeated body composition measurements.

The effectiveness of the proposed algorithm was tested on a group of 32 teachers with identified deviations in body composition. After 6 months of implementation of individual preventive programs, positive dynamics of indicators was noted: decrease of body mass index by 1.8 ± 0.5 kg/m², decrease of fat mass percentage by $2.3 \pm 0.8\%$, decrease of visceral fat index by 1.2 ± 0.4 units and increase of bioimpedance phase angle by 0.4 ± 0.1 degrees.

Conclusion

The results of the study indicate high informativeness of bioimpedanceometry method for assessing the health status of secondary school teachers and identifying risk factors for disease

development.

The revealed features of body composition of teachers with different length of service indicate progressive unfavorable changes that can lead to the development of metabolic syndrome, cardiovascular diseases and other pathologies.

The developed algorithm of preventive measures on the basis of bioimpedance symmetry data allows individualizing the approach to disease prevention in teachers and increasing the effectiveness of preventive measures.

It is recommended to include bioimpedanceometry in the program of preventive examinations of secondary school teachers, which will allow to identify the risks of disease development in a timely manner and to carry out targeted preventive measures.

List of references:

1. 1.Valiev RA. Professional athletes' perspectives on the function of sports medicine specialists in treating psychosocial aspects of sport-injury rehabilitation // International Journal of Integrative and Modern Medicine. – 2024. – Vol. 2. – No. 7. – P. 215-221.
2. 2.Qosimov IU. The effectiveness of piloidotherapy in rehabilitation // Ethiopian International Journal of Multidisciplinary Research. – 2024. – Vol. 11. – No. 01. – P. 141-146.
3. 3.Soliyev I. M., Qosimov I. U., Tuxtiyev J. B. CLINICAL STUDY OF THE EFFECTIVENESS OF SU JOK ACUPUNCTURE IN EARLY REHABILITATION OF ISCHEMIC STROKE //Ethiopian International Journal of Multidisciplinary Research. – 2023. – V. 10. – №. 09. – P. 463-465.
4. 4. Roberts SB, Rosenberg I. Nutrition and aging: changes in the regulation of energy metabolism with aging. *Physiol Rev.* 2020;100(2):677-701.
5. 5. Mikhailova LA, Kimyaeva SI. Health of teachers of general education institutions and factors that determine it. *Siberian Medical Review.* 2017;5:73-78.
6. 6. Thompson AL, Mena NZ, Kaur AP. Psychological stress in school teachers: a comprehensive systematic review. *J School Health.* 2020;90(12):975-988.
7. 7. Norman K, Stobäus N, Pirlich M, Bosy-Westphal A. Bioelectrical phase angle and impedance vector analysis – clinical relevance and applicability of impedance parameters. *Clin Nutr.* 2012;31(6):854-861.
8. 8. Ivanova TN, Kazakova EV Features of metabolic disorders in teachers of comprehensive schools and their correction. *Therapeutic archive.* 2019;91(8):49-55.
9. 9. Tyan DL, Valiev RA, Pulatov SS UNDERWATER SPINE TRACTION IN OSTEOCHONDROSIS // Journal of Healthcare and Life-Science Research. - 2024. - Vol. 3. - No.. 9. - P. 160-162.
10. 10. Phillips LJ, Carroll D, Burns VE. Cardiovascular risk in teachers: a comparison with other occupational groups. *Occup Med.* 2018;68(8):510-514.
11. 11. Sokolova IM, Fedorova EL. Burnout syndrome and somatic diseases in secondary school teachers. *Health Psychology and Prevention.* 2020;2(3):45-51.

12. 12. Adam TC, Epel ES. Stress, eating and the reward system. *Physiol Behav.* 2007;91(4):449-458.
13. 13. Despres JP, Lemieux I. Abdominal obesity and metabolic syndrome. *Nature.* 2006;444(7121):881-887.
14. 14. Kozlov A. I., Vershubskaya G. G., Negasheva M. A. Bioimpedance analysis of body composition: age aspects. *Moscow University Bulletin. Series XXIII. Anthropology.* 2019;1:26-38.
15. 15. Selberg O, Selberg D. Norms and correlates of bioimpedance phase angle in healthy human subjects, hospitalized patients, and patients with liver cirrhosis. *Eur J Appl Physiol.* 2002;86(6):509-516.
16. 16. Butabaev M. T., Valiyev R. A. NEUROREHABILITATION OF THE MUSCULOSKELETAL SYSTEM OF ATHLETES USING THE STRESS EFFECT OF NATURAL FACTORS // *Ethiopian International Journal of Multidisciplinary Research.* - 2023. - Vol. 10. - No. 09. – pp. 473-474.
17. 17. Pulatov S. S. INNOVATIVE SIMULATION TECHNOLOGIES IN SPORTS MEDICINE EDUCATION: A COMPREHENSIVE STUDY ON THE IMPACT OF STANDARDIZED PATIENTS AND TEAM INTERVENTION SIMULATION // *Economy and Society.* – 2023. – No. 12 (115)-1. – pp. 577-580.
18. 18. Olimova NA, Minavarov RA, Azimov AR. Rehabilitation of post-traumatic deformities of the upper extremities // *Ethiopian International Journal of Multidisciplinary Research.* – 2024. – Vol. 11. – No. 03. – P. 353-355