Determination of influence effectiveness of ethnic games on the componential body composition of adult people (in the age of 50-57 y.o.) with the help of bioimpedance analysis

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Abstract. The paper presents the results of research conducted for the first time in Kyrgyzstan under conditions of middle mountains aimed at studying the influence of ethnic games on the parameters of the componential composition of adults' bodies with the help of bioimpedance analysis. 92 adults in the age of 50-57 y.o. have been studied. In the group of ethnic games, 47 out of 92 (30 men and 17 women) were studied during the first inspection. 23 people (11 men and 12 women) had been studied during the second inspection. 22 people (9 men and 13 women) had been investigated in the group of modern physical culture. Analysis of methodological literature, bioimpedance analysis (TANITA RD-953). Statistical data processing was supported by the program SPSS 22. The application of the bioimpedance method aimed at analyzing the influence of ethnic games and modern means of physical culture on the parameters of the adults' body componential composition has shown the objective results of changes in the indices of respondents' body componential structure. During the second inspection of the healthy men and women at the age of 50-57 body composition involved into playing ethnic games, there had been revealed reliable changes (P<0,05) in such indices, as body weight, body build index, the total mass of fat, physical type, visceral fat, biological age, and water content. Comparative analysis of body composition between the group of men and women engaged in ethnic games and the groups of respondents engaged in modern physical culture means revealed that the men and women of both groups have indices of body build index, the total mass of fat, visceral fat, bone mass, physical type and biological age conforming to norms. The obtained results indicate the effectiveness and productivity of the bioimpedance analysis application for determining the influence on the componential composition of body and physical condition of adult people at the age of 50-57 years. They are occupied with ethnic games and modern means of physical culture in the conditions of mountain climate.

1 Introduction

As a methodological basis of the study on the componential composition of a human body, we have taken the results of the researches conducted earlier by scholars of the near and far abroad. These are the results of numerous research papers carried out by Martirosov E.G, Nikolaev D.V., Rudnev S.G. [1] in particular, which reflect the correlation between body composition and the indices of human physical efficiency, his adaptation to the conditions of an external environment as well as his professional and sports activity.

Among various methods for determining the body composition, the more perspective one is considered to be the bioimpedance analysis. Application of it in the similar respondents' investigation has been described in the works of the Russian scientists, like Gaivaronskiy I.V., Nichiporuk G.I., Gaivaronskiy I.N., Nichiporuk N.G. [2]. This is a contact method for the measurement of the biological tissues electrical conductivity allowing to assess a wide range of morphological and physiological parameters of an organism [2].

Due to the usage simplicity, high level of results reliability, integrated assessment of not only components of body composition but also several physiological indicators, bioimpedance analyzer has methodological advantages. That fact is reflected in the data of studies conducted on the identification of the features of a body build, physical development, and general condition of an organism [3]. However, the body composition undergoes significant changes throughout the human's ontogenetic cycle, such an analysis confirms that the conditions of organisms belonging to the same chronological age can considerably differ from each other from a perspective of viability [4].

For an effective organization of health-improving training with the peculiarities of individuals bearing in mind, it's necessary to penetrate modern forms of control over changes occurring in the organism of an individual. Bioimpedance analysis is exactly an objective method. It allows judging on the correlation of anabolic and catabolic processes within

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an organism as well as the ratio between bone, fat, and muscle mass of an individual along with the quantity of fluid [5]. As practice shows, the latter is quite an accurate, widely used method for studying body composition, and represents the contact method for measuring the electrical conductivity of the biological tissues allowing to assess a wide range of morphological and physiological parameters of an organism [6].

As a guideline for organizing our research paper we have taken the opinion of Nikolaev D.V., stating that within the work of physical culture and health promotion, bioimpedance analyzer enables to control the physical condition, conduct fatigue prevention, organize rational weight correction [7] as well as to monitor changes in the organism occurring during the physical culture sessions as the dynamics of the body componential composition indices depends on the quantity, intensity, and orientation of the training. Consequently, planning training sessions with taking into consideration quantity and intensity variation together with complying with the principle of health-improving training will allow reaching the optimum level of body composition indices of an individual [8].

The effectiveness of bioimpedance analysis system (Esteck System Complex (Multiscan)) usage enabling objectively identify the peculiarities of the cardio-vascular system and body composition of those involved in sports as well as impartially evaluate the adaptation of several systems in the organism to increased motion activity, mostly focused on endurance development has been proved by the results of studies, performed by Mavlieva F.A., Zotova F.R., Nazarenko A.S., Nabatov A.A. et.al [9].

The purpose of the study: to determine the influence effectiveness of ethnic games on the parameters of componential body composition of adult people at the age of 50-57 with the help of bioimpedance analysis in the conditions of the middle mountains in Kyrgyzstan.

Research tasks:

1.   With the help of bioimpedance analysis to conduct a cross-sectional study on the parameters of componential body composition of adult men and women at the age of 50-57 years involved in ethnic games.

2.   To conduct a comparative analysis of the componential body composition parameters of adult men and women at the age of 50-57 years. They deal with modern means for physical culture and engaged in ethnic games as well.

2 Materials and methods

We investigated 92 men and women at the age of 50-57 years old. They were divided into two groups – the first group included those who are engaged in ethnic games. While in the second group people were dealing with modern means of physical culture. The first group during the first stage of the investigation had 47 people with 30 men and 17 women. While in the second stage there were 23 people in general and 11 men with 12 women in particular. The research was held in two stages in the group of men and women engaged in ethnic games, The first stage is considered to be initial level. The second stage is held after regular sessions of ethnic games. The second group of respondents was occupied with modern means of physical culture.

To improve the physical condition of adult people at the age of 50-57 years, there were selected 12 kinds of ethnic games exactly meeting the requirements of our research tasks on the first stage of it. In the second stage, there were conducted measurements for identification of the body composition of those, engaged with ethnic games (first stage of the research); effectiveness of suggested methods for sessions performance in the same group (second stage of research). The researches were conducted in the Issyk-Kul region of the Kyrgyz Republic (1700 meters above the sea level).

Under the guidance of a physical culture instructor, the first group of surveyed had trainings 3 times a week**. They were** playing ethnic games of the Kyrgyz people described and arranged in the works of national scholars in the field of national kinds of sport, folk games and competitions of the Kyrgyz, like Anarkulov Kh.F., Arstanbek Kasen et al. These games were divided as follows: for men wrestling on the ground by holding the belt, 'Kalpak kotorush' (raising kalpak, national headgear), 'Dongok jaruu (splitting a chock), 'Basty-basty' (people gather in a mess), 'Toogo chyguu zhana tushuu' (climbing and descenting a mountain), 'Arkan tartysh' or 'It tartysh' (tug-of-war), 'Tez atka minuu jana tushuu' (rapid boarding and disembarking from a horse), 'Kap menen urushuu' (battle with sacks), 'Kurosh' (wrestling), 'Naiza yrgytmai' (javelin throwing), 'Bel karmashyp tartyshuu' (pull each other by one's belt), 'Ashkabak chapmai' (blow to thee pumpkin) **[10, 11].**

The second group was busy by executing physical exercises 3 times per week leading to strengthening all muscle groups, walking, and cycling. The duration of the training was 60 minutes.

Research methods: analysis of methodological literature, bioimpedance analysis (TANITA RD-953). Statistical data processing was supported by the program SPSS 22 (statistical significance of differences between samples was determined using the Student's T-test and Levin's test. Differences were considered statistically significant when $p < 0.05$.)

3 Results and discussion

Comparative analysis of men componential body composition indices from the first and second stages of investigation (presented in Table 1) has shown a little difference (on 0,55 cm) in the *length of a body*, that can be explained by the change in the number of studied people. As for *the body weight*, there is observable a loss of 11,39 kg (P<0,05). During the first research, the body build indices are evidencing an excess of weight. While in the second research they conform to the norm. Differences between groups are reliable (P<0,05) (Table 1).

Table 1. Comparative indices between a group of men engaged with ethnic games during the first and second research and a group of men occupied with modern means of physical culture

Parameters	First research (M) (n=30)			Second research (M) (n=11)			p
	x	m	δ	x	m	δ	
Age	50,36	10,66	1,94	53,18	6,82	2,05	,056
Body length	169,63	6,28	1,14	170,18	4,11	1,24	,221
Body weight	81,96	8,99	1,64	70,57	11,82	3,56	,010
Body build index	28,47	3,48	,63	24,74	4,10	1,23	,006
General fat	28,59	5,97	1,09	19,52	6,64	2,00	,001
Muscle mass	55,56	6,58	1,20	54,25	6,84	2,06	,581
Muscle tissue	49,43	10,55	1,92	56,45	10,45	3,15	,066
Physical type	2,20	,55	,10	4,72	1,42	,42	,000
Bone mass	2,92	,32	,05	2,91	,39	,11	,988
Internal fat	10,76	4,00	,73	8,00	2,13	,64	,036
Metabolism	1726,60	191,91	35,03	1681,54	254,08	76,60	,546
Biological age	70,81	8,33	2,08	49,50	8,84	2,55	,000
% of water	40,76	2,93	,733	45,73	5,49	1,58	,005

Parameters	Modern means of physical culture group (M) (n=9)			P
	x	m	δ	
Age	51,55	8,14	2,71	,019
Body length	169,55	10,06	3,35	,439
Body weight	70,42	9,11	3,03	,661
Body build index	24,43	1,41	,470	,831
General fat	20,87	4,73	1,57	,615
Muscle mass	52,91	7,55	2,51	,682
Muscle tissue	54,83	24,27	8,09	,843
Physical type	5,00	,000	,000	,574
Bone mass	2,78	,355	,118	,456
Internal fat	7,27	1,54	,514	,392
Metabolism	1618,88	224,58	74,86	,571
Biological age	35,55	7,14	2,38	,846
% of water	53,17	4,26	1,42	,816

The results of comparative analysis on *muscle mass* in the first and second researches presented in Table 1 are showing, that in the second research the amount of recipients' muscle tissues has significantly increased in number. According to *physical type,* the indices of the first research conform to 2. It is evidence for the plumpness and average skeleton. The high content of fat and mean muscle mass has been found of those being tested. During the second research, the index of a physical type has changed from 2 to 4 indicating that participants are trained (P<0,05). The parameters of *bone mass* during the first and second stages of research are a bit lower than the expected index with the given weight of 65-69 kg (3,31 kg) on 0,39 and 0,38 correspondingly. The indices of an *internal fat* of both groups conform to the norm. While on the second stage of the research its quantity reduces on 2,76 (P<0,05). *Daily calorie intake* in both of the groups shows their low physical activity.

On the first stage of the research, the *biological age* (metabolic age) of the participants is higher of a real age on 6,27 years. It means it is necessary to improve the metabolic level in that group, whereas on the second stage we could observe reliable lowering of an index on 16,73 years (P<0,05). Increase of a physical activity allowed to raise the muscle mass as a result of which the metabolic age of participants had reduced.

According to our data, on the first stage of the research, the water percentage in the organism of participants is on the lower limit of the norm. On the second stage indices were higher and were approaching the average limit of the norm. Reliable differences are being observed (P<0,05).

Taken from the first and second stages of the research the results of comparative analysis of componential body composition indices have detected some improvement in almost all parameters. It proves the influence effectiveness of ethnic games on organisms of tested men at the age of 50-57 years old.

Comparative analysis of the first and second stages research results of men from both groups given in the Table 1 demonstrates some changes in *body length* on 0,63 cm among men involved in the first group (i.e. group engaged with ethnic games), while in *body weight* that change indicator was equal 0,15 kg. The body build index in both groups conformed to the norm and no reliable differences are observed. The index of *general fat* in both groups correspond to norms, differences between groups are not valid (P<0,05).

The results of research participants *muscle mass* comparative analysis from the first group on the second stage of investigation is a bit higher than of the participants from the second group on 1,34. The same situation is in the *muscle tissues,* where the first group's indices are higher on 1,62 than of the group of modern means of physical culture. The *physical type* of the second group participants (i.e. group of modern means of physical culture) corresponds to type 5. It is equal to the norm. The results of the second research correspond to physical type 4. It shows the influence of training on men's organism. The indices of both group's respondents *bone mass* are a bit lower than the expected index with the given weight of 65-69 kg (3,31 kg) on 0,53 and 0,4 correspondingly. The indices of *internal fat* in both groups conform to the norm, but in the second group, that index is less than 0,73. *Daily calorie intake* in the same group and during the second stage of research corresponds to the index of law physical activity. The *biological age* (metabolic age) of men in the group of modern means for physical culture is lower of a real age on 16 years. In the second stage of the research that index is lower on 16,73 years in the group of ethnic games. These results can be served as an illustration of good metabolic level and well muscle mass in both groups as the metabolic age of participants has decreased. *The water percentage* in the group of modern means for physical culture is closer to the lower limit of the norm. While in the group of ethnic games given index is higher and approaches the average limit of the norm on 0,5.

The comparative analysis of both groups results proves that such indices as body build index, general fat, internal fat, physical type, biological age, all conform to the norm. The indices of muscle mass, muscle tissue quantity, and water percentage are a bit higher in men from the group of ethnic games, while the level of daily calorie intake is low in both of them.

Table 2 represents the results of the women's group indices comparative analysis involved in ethnic games in both stages of the research. After the second stage, there are seen changes of 0,67 cm in the *length of a body* among women. The indices of *body weight* have lowered on 16,75 kg (P<0,05). During the first research, the body build indices are pointing to the obesity of participants' bodies. During the second research, body build indices are high, differences between groups are reliable (P<0,05). At the first stage, the indicators of *general fat* show its excess whereas at the second they are on the bound of norms. Differences between the 2 stages of groups' participants research are reliable (P<0,05) (Table 2).

Table 2. Comparative indices between a group of women engaged with ethnic games during the first and second research and a group of women occupied with modern means of physical culture

Parameters	First research (W) (n=17)			Second research (W) (n=12)			P
	x	m	δ	x	m	δ	
Age	56,05	6,44	1,56	57,12	3,87	1,11	,363
Body length	162,41	6,16	1,49	163,08	5,05	1,45	,759
Body weight	85,52	11,23	2,72	68,77	11,15	3,21	,001
Body build index	32,24	3,39	,823	25,74	4,12	1,19	,000
General fat	42,45	3,99	,968	31,40	6,58	1,90	,000
Muscle mass	46,14	4,10	,994	44,26	4,14	1,19	,235

Parameters	Modern means for physical culture group (W) (n=13)			P
	x	m	δ	
Age	50,15	11,27	3,12	,016
Body length	159,0	5,59	1,55	,068
Body weight	59,95	3,94	1,09	,013
Body build index	23,79	2,31	,642	,154

General fat	30,50	4,97	1,38	,702
Muscle mass	39,06	2,94	,818	,001
Muscle tissue	48,30	9,37	2,60	,677
Physical type	3,92	1,60	,445	,830
Bone mass	2,10	,144	,039	,002
Internal fat	5,53	2,16	,600	,063
Metabolism	1241,69	79,76	22,12	,003
Biological age	39,69	12,29	3,40	,031
% of water	47,57	3,31	,918	,316

As the results of a group of women componential body composition indices comparative analysis engaged in ethnic games show, the indices of muscle mass on the first stage is more on 1,88 than of the second stage. The indicators of *muscle tissue quantity* on the second stage of the research have increased on 10,11 and have reliable differences (P<0,05).

In the first stage of the research, the *physical type* of women at the age of 50-57 years old conform to 2 type. It indicates the plumpness and average skeleton. A high *content of fat* and *average muscle mass* has been detected in the organism of investigated.

During the second research, the index of a physical type has changed to 4 indicating the effectiveness of ethnic games and trained condition of participating women with (P<0,05). The parameters of *bone mass* during the first and second stages of research are corresponding to the expected index with the given weight of 68-85 kg (2,09 kg). The indices of an *internal fat* conform to the norm, but at the women's research, its quantity reduces on 4,48 (P<0,05).

The *daily calorie intake* of the women group engaged with ethnic games conforms to low physical activity index in both stages of the research. The identification of *biological age* at the first stage of the investigation indicates that metabolic age is older of a real one on 14,76 years. Consequently, it's necessary to improve the metabolic level in that group. However, it the second stage of the research, we have observed a reliable decrease in this index on 7,62 years (P<0,05). In such a way, the increase of physical load allows enlarging muscle mass as a result of which the metabolic age of respondents is decreased.

The first stage of *water percentage* research revealed its low level on the bound of the norm, but the results of the second stage indicate its improvement by reaching the average level of the norm (P<0,05).

The comparative analysis of indices taken from two stages of research on componential body composition of women engaged with ethnic games have detected some improvement after the second stage of the research. Obtained indices reflect the positive impact of ethnic games on the organism of participated women at the age of 50-57 years old. The *bone mass* and *internal fat* indicators of respondents belonging to the abovementioned group conformed the norm at the end of the second stage. According to the number of *muscle tissues* and *physical type*, in the results of 2 stages of the research a reliable difference (P<0,05) is being observed.

Table 2 shows the results of the comparative analysis of componential body composition indices of a group of women engaged with ethnic games and a group of women dealt with the modern means for physical culture. Interestingly, that the *body length* indices of participants from the first group are higher on 4,08 cm as well as in the category of *body weight,* where their parameters more on 8,82 kg in comparison with the indices of the second group women, that is reliable with (P<0,05). Nevertheless, the body build index conforms to the norm in both groups as well as the general fat indices.

Results of women *muscle mass* comparative analysis from two groups reveal the fact that these indices are higher in the group of ethnic games than in the group of modern means for physical culture on 5,2 times (P <0,05). The indices of *muscle tissue quantity* are higher on 1,45 times as well than in the group of modern means for physical culture.

It should be noted that the *physical type* of women from the group of modern means for physical culture as well as the women from the group for ethnic games corresponds to physical type 4. Undoubtedly that indicates women's trained condition of the organism and the effectiveness of sessions performed by representatives of the age category from 50-57 years by the means of modern physical culture in general and ethnic games in particular.

By the end of training sessions, the respondents' research results are indicating noticeable changes in *bone mass* in both groups. In the first group of women, the index of bone mass is higher of the expected one on 1,13 with the given weight of 50-75 kg. While in the group of modern means for the physical culture that index is higher on 0,87. The indices of *internal fat* in both groups conform to the norm, but in the second group, that index is less than 1,63. *Daily calorie intake* required for ensuring major metabolism within the women of both groups corresponds to the index of law physical activity. The *biological age* indices pointing out that the given groups have a good metabolic level along with good muscle mass. The *metabolic age* of respondents from the second group is lower from their real age on 10,46 years, while in the first group that index is 7,62 years. *The water percentage* in the group of ethnic games is near to the lower limit of the norm, while in the group of modern means for physical culture given index is higher and approaches the average limit of the norm on 1,84.

Thus, it should be noted that the usage of the bioimpedance method to analyze the influence of training with ethnic games and modern means for physical culture and sport on the componental body composition of adult people at the age of 50-57 years in the condition of middle mountains had detected the objective results of indices changes of surveyed participants. The results analysis of both groups second stage research is showing that the indices in such parameters as body build index, general fat, bone mass, biological age are corresponding to the norms. But, the indices of muscle mass and muscle tissue quantity in the group of ethnic games are a bit higher. While the indices of water percentage are higher in the group of modern means for physical culture. The daily calorie intake hasn't changed. It has remained at a low level in both groups.

4 Conclusions

The results of the research conducted for the first time in Kyrgyzstan under conditions of middle mountains with the use of bioimpedance analysis on the parameters of the componental composition of healthy men and women bodies engaged with ethnic games and modern means for physical culture, allow to make following conclusions:

1. In the group of men engaged with ethnic games, as a result of the second stage of the research, there were observed reliable differences (P<0,05) in such parameters, like body weight, body build index, general fat, internal fat, biological age, and water percentage. Ethnical games training influenced on enlarging of muscle mass and muscle tissues, whereas the indices of bone mass, daily calorie intake remain below the norm in both stages of the research.

In the group of women engaged with ethnic games, at the second stage of the research, there were observed reliable differences (P<0,05) in such parameters, like body weight, body build index, general fat, muscle tissue quantity, physical type, internal fat, biological age, and water percentage of an organism. Some increase in the number of muscle mass is being observed as well. It should be noted that in comparison with the group of men, in the group of women the indices of bone mass and internal fat correspond to norms at both stages of the research.

2. The comparative analysis of componental body composition of men and women at the age of 50-57 years involved in ethnic games as well as in the training with modern means for physical culture has demonstrated:

1) The results analysis of men from both of the groups on the second stage of the research has identified, that indices of body build index, general fat, internal fat, physical type, and biological age conform to the norms in both groups. While the indices of muscle mass, muscle tissue quantity, and water percentage are a few higher in the group of men engaged in ethnic games, than in the second group.

2) The results analysis of women-participants from the group of modern means for physical culture and group of ethnic games show that body build index, general fat, bone mass, internal fat, physical type, and biological age indices correspond to norms. Along with this, the indices of muscle mass, muscle tissue quantity are a little higher in the group of ethnic games. While the water percentage indices are higher in the group of women involved in modern means for physical culture.

Obtained data as a result of an experimental study on the componental body composition of people at the age of 55-57 years conducted for the first time in Kyrgyzstan under conditions of middle mountains with the use of bioimpedance analysis, conform and even supplement the findings. They have been earlier set forth in the works of our predecessors, Russian scholars Vasilets V.V., Vrublevskiy E.P., et al. They stated that the usage of bioimpedance analysis enables to conduct scientifically grounded regulation of a bodyweight loss process with considering all-natural mechanisms of the organism metabolic processes of those involved in training [12]. Our research on the componental body composition of men and women at the age of 50-57 years has also confirmed and supplemented the conclusions reached earlier by Rybakova E.O., Shutova T.N., Bodrov I.M., Kolganova E.Yu., and others, where they have stated that the lack of physical activity after the 30 years, in every 10 years women can lose from 3 up to 5% of their muscle mass, the fat balance can be increased on 6-10%. While the level of general water percentage within the organism can decrease on 5-9% [13; 14].

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