

Use of the IPAQ questionnaire in the form of a mobile application in monitoring physical activity of patients with cardiovascular diseases

Tomasz Saran^{1,A-F}, Jakub Owoc^{2,D,F}, Iwona Bojar^{3,D,F}

¹ Department of General and NeuroRehabilitation, Institute of Rural Health, Lublin, Poland

² College of Public Health, Zielona Góra, Poland

³ Department for Woman Health, Institute of Rural Health in Lublin, Poland

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Abstract

Introduction. Systematic, dynamic physical effort brings about tremendous health benefits, not only in young individuals, but as a form of primary prevention, and primarily as secondary prevention of cardiovascular system diseases.

Materials and method. The research project was conducted in the Rehabilitation Centre at the Witold Chodźko Institute of Rural Health (IMW) in Lublin, Poland, and covered a group of 927 ambulatory patients. From among the study group, two subgroups were distinguished (Groups 1 and 2). Selection of patients was targeted, based on the criterion of the existing diagnosis of cardiovascular diseases (Group 1; N=53), and the lack of these diseases (Group 2; N=53). The daily level of physical activity was assessed using the monitoring application (Instrument for Activity Measurement IMW) – using a short version of the International Physical Activity Questionnaire (IPAQ), and alternatively analyzing the data from a smartphone accelerometer.

Results. The total level of weekly physical activity in Group 1 was 4532.88±3611.6 MET-min/week, and was considerably higher, compared to the control group (3142.58±2536.9 MET-min/week). Also, the values of weekly caloric cost of physical activity (KAF kcalxweek⁻¹) showed higher values (6935.77±5957.4), compared to the control group (4274±3344.9). The group of cardiologic patients (Group 1) showed a higher level of activity, especially within the range of effort on an intensive level, and low level – going for walks, walking (MET1, MET3), which was also translated into the caloric cost of these levels of physical activity (KAF1, KAF3).

Conclusions. The results of the study indicated a significantly higher level of physical activity in the group of patients with concomitant cardiovascular diseases, compared to the control group. The overestimation of the level of physical activity perceived by patients seems to be an important problem, especially in the control group.

Key words

IPAQ, cardiovascular diseases, motor activity, telerehabilitation

INTRODUCTION

The development of civilisation and technical progress contribute to the sedentary life style among millions of people worldwide, which is reflected in their state of health. The report by the World Health Organization (WHO) indicates that patients with concomitant diseases, such as diabetes, ischemic heart disease, chronic obstructive lung disease, and other chronic diseases, constitute 77% of patients in Europe, and are the cause of as many as 86% of deaths [1].

A review of the relevant literature allows only the unequivocal emphasis that systematic dynamic physical effort brings about tremendous health benefits, not only in young persons, but as primary prevention of many diseases, and primarily as secondary prevention of cardiovascular system diseases. It is an important element of leisure of 'contemporary man' burdened with chronic civilisation stress and static effort [2].

The results of many studies prove that an increased level of physical activity exerts a great effect on the morphological, physiological and biochemical changes affecting the normal state of health of each individual. Systematic physical effort has an effect on the functional regulation of the cardiovascular system, modifies haemodynamics of morphological changes of blood vessels and the heart muscle, and also changes in its metabolism. Nevertheless, one of the most important benefits of undertaking this effort is the reduction of the risk of development of cardiovascular system diseases (CVD) [3]. In addition, it improves the functional balance between the coagulation system and fibrinolysis, decreases the level of systolic and diastolic blood pressure, results in an improvement of cardiovascular functions, exerts a beneficial effect on the body mass index, counteracting the development of overweight and obesity [4, 5]. Physical training affects also the vessels relaxation function of the epithelium, increases the sensitivity of tissues to insulin, thus decreasing the risk of contracting diabetes [6].

Medical literature not only unequivocally emphasizes the beneficial effect of physical activity on the reduction of the risk of cardiovascular system diseases [5, 7–10], but also on the decrease in the number of deaths, both

Address for correspondence: Tomasz Saran, Witold Chodźko Institute of Rural Health, Lublin, Poland, Jaczewskiego 2, 20-090 Lublin, Poland
e-mail: saran.tomasz@imw.lublin.pl

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premature and total [7]. Therapeutic management in which a systematic physical effort plays a superior role may result in a significant decrease in the mortality rate in the group of patients who had undergone cardiovascular events, especially those with a history of past myocardial infarction. This has been confirmed by two 3-year observation metaanalyses of 21 randomized clinical trials which covered a group of more than 4,000 patients who had undergone myocardial infarction, which showed a 25% reduction in mortality rate in the group subjected to the programme of therapeutic rehabilitation [11]. Also, metaanalysis of nine clinical trials ExTraMATCH, which included a group of 801 patients with heart failure, confirmed a decrease by 35% of mortality rate in a distant two-year observation [12].

Favourable economic balance in the form of reduction in the costs of health care has become a strong incentive for the development of telemedical systems. One of the first branches in their development is telerehabilitation, applied in cardiology, orthopaedics, neurology, or psychiatry [13]. In the presented study, for assessment of the level of physical activity, an application was adopted which used the potential of the contemporary mobile network to which almost everyone has access. A very important element of rehabilitation of patients with past cardiovascular events is the sustaining of the achieved results by the individual patient. Therapeutic management should cover not only a systematically undertaken physical activity, but primarily, widely-understood primary and secondary prevention, patient education aimed mainly at the implementation of physical activity into daily life, especially by young persons, as the primary prevention of many chronic diseases [14].

OBJECTIVE

The primary objective of the statistical analysis was an assessment of the weekly level of physical activity in a group of patients with concomitant cardiovascular diseases, compared to the control group consisting of patients using mobile application, processing the data from a smartphone accelerometer.

MATERIALS AND METHOD

Study design. The research project was conducted in the Rehabilitation Centre at the Witold Chodźko Institute of Rural Health in Lublin, Poland, and covered a group of 927 ambulatory patients. From among the study group, based on the patient's medical history at admission to the rehabilitation programme, two subgroups were distinguished (Groups 1 and 2). Selection of patients into individual groups was targeted, based on the criterion of concomitant cardiovascular system diseases and chronic diseases. In Group 1 (53 patients), chronic heart failure (I-II NYHA class) was reported in 42% of patients, arterial hypertension in 76%, and past history of coronary event, infarction or instable form of angina pectoris in 23%. The duration of the period which had elapsed since the occurrence of myocardial infarction was within the range of more than one year. Into Group 2, the same number of patients were qualified, without concomitant diseases, who constituted a control group for comparison

with Group 1. The control group was selected at random from among patients who did not report cardiovascular diseases in medical history taking.

Assessment of the level of physical activity was obtained using a monitoring application (Instrument for Measurement of Activity IMW) which, in practice, uses the potential of contemporary smartphones. The application was created in order to constantly monitor the level of physical activity of patients discharged from the Rehabilitation Centre at the Institute of Rural Health. Volunteers were engaged by physiotherapists, and also had the opportunity to take advantage of the so-called 'feedback' from a group of specialists, including doctors and physiotherapists. Physiotherapists had the opportunity to individually follow their patients at home by means of web software. All volunteers from the Rehabilitation Department received explanations and answers to questions about the telemonitoring system. Consent for medical monitoring and scientific evaluation of anonymous data was expressed by smartphone interface.

The application contains an original algorithm of data processing from the accelerometer, as well as the short version of the International Physical Activity Questionnaire IPAQ – 7 items. The processing of data from the smartphone accelerometer of each patient from the aspect of evaluation of the level of physical activity takes place using algorithms and filters for processing the values of gravitational acceleration vectors, and by means of two types of individual calibration. The first is a static calibration, which determines the values of gravitational acceleration measured on the accelerometer by placing the mobile phone flat and pressing the measuring key for three seconds ($g = \sqrt{x^2 + y^2 + z^2}$), as a result of the mean value obtained from measurements for three seconds ($x, y, z \rightarrow$ instantaneous acceleration components from accelerometer). Elimination of the differences in sensitivity of accelerometers of various types of smartphones was obtained by dynamic calibration, by pressing the key, placing the smartphone in the place in which it is carried, and subsequently starting marching over a flat surface for one minute, until the moment of obtaining the signal of ending calibration (dynamic correction = 3.3/amount MET-min for 1 min march).

The application allows daily monitoring of physical activity from 08:00 – 11:00, and by the diagram of a 'filling heart', as well as by text messages, enables the motivation of patients to increase the level of physical activity if it is too low. Full access to the data by physicians and physiotherapists is possible due to data collection (once a day), which are sent to the Institute's server and then presented in collective graphs (Fig. 1).

The international questionnaire IPAQ used in the application enabled the collection of information concerning the assessment of the level of physical activity within the last 7 days. The level of intensity of physical effort was evaluated by the metabolic equivalent – MET. For various levels of physical activity, the values were adopted, respectively: 3.3 MET for low frequency efforts (walks) – (MET3), MET4 for moderate level (MET2), and for intensive effort 8 MET (MET1). The total weekly level of physical activity (MET-min/week) was obtained by multiplying the number of days and duration of effort by the respective MET value ascribed to individual level of physical, and subsequently, summing-up of the results obtained which, according to the recommendations by the World Health Organization (WHO), allowed the qualification of patients into three different categories of physical activity [15]:

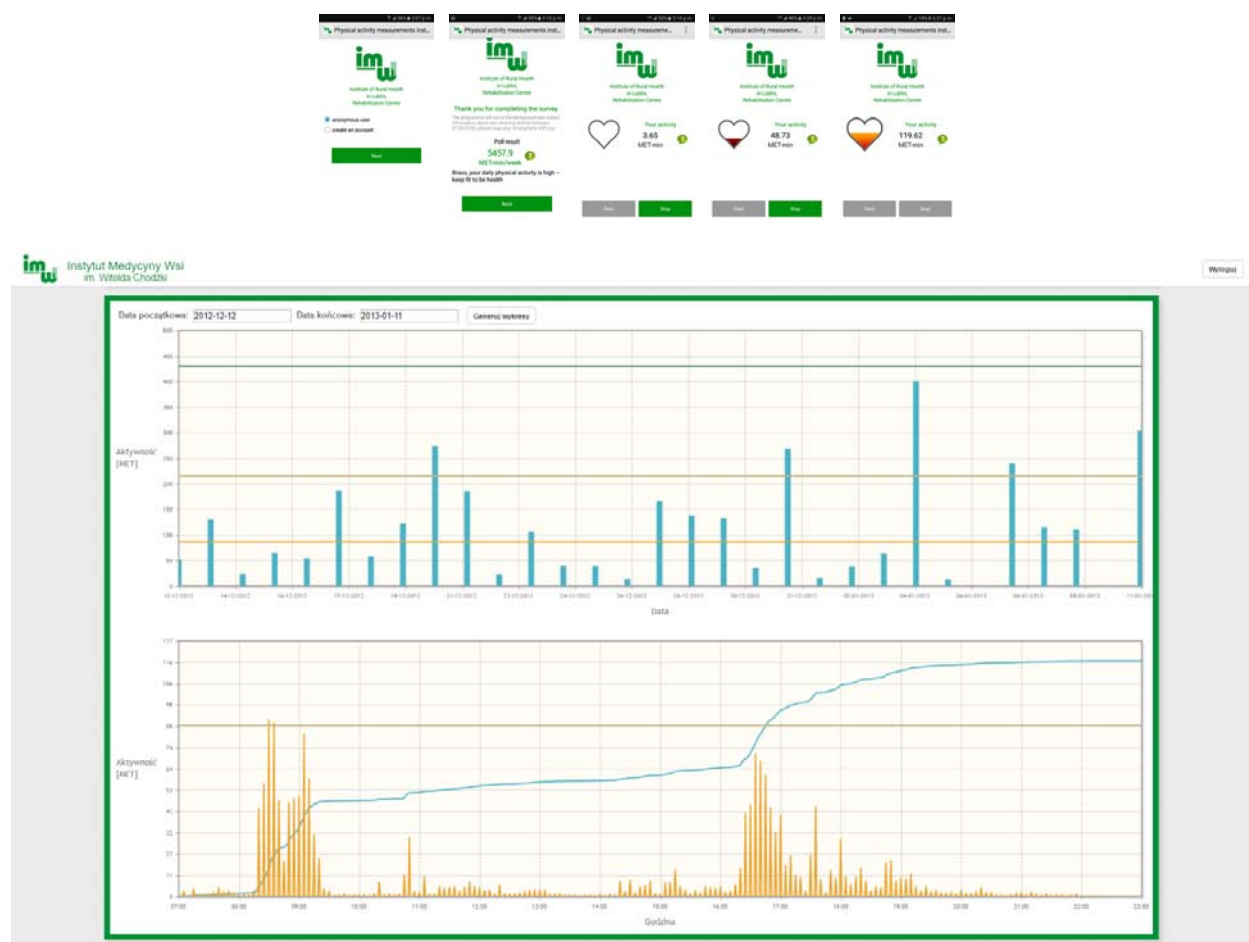


Figure 1. Above: measuring application (application interface). Below: sample reading of physical activity of one user (web data-showing interface)

- Insufficient – $\downarrow 600$ MET-min/week.
- Sufficient – 600–1500 MET-min/week, or a combination of intensive/moderate efforts, at least 600 MET-min/week:
 - ✓ 3days/or \uparrow intensive physical effort (not less than 20 min/daily);
 - ✓ 5days/or \uparrow moderate physical effort/or walks (not less than 30 min/daily).
- High – $\uparrow 1,500$ MET-min/week:
 - ✓ 3 days of intensive physical effort (not less than 30 min/daily);
 - ✓ daily physical activity on moderate/intensive level exceeding 3,000 MET-min/week (at least 30 minutes) [16].

Data analysis also included weekly caloric cost (KAF kcalxweek⁻¹) separately for individual levels of physical activity (KAF1- intensive efforts, KAF2- moderate efforts, KAF3- low frequency efforts, e.g. walks), which is the best reflection of weekly energy expenditure (MET-min/week) [17,18].

$$\text{KAF} = \text{TAF} \times 60 \text{ min}^{-1} \times \text{MC}$$

TAF – weekly volume of physical activity [MET-min/week]
MC – body weight [kg]

The criteria for evaluation of the level of physical activity used in the study consider contemporary health recommendations, the basis of which is the regularity of

undertaking this activity, especially by persons with concomitant cardiovascular diseases, but primarily in the prevention of chronic diseases [19].

Considering the inconsistency of data with normal distribution and a considerable number of outlying elements for the analysis of the examined parameters, non-parametric statistics were used. Statistical data were elaborated using the software Statistica 12.0. For analysis of data, basic descriptive statistics, sign test, Mann-Whitney U test, and Spearman rank correlation were used.

Study group. A group of 106 patients were qualified for statistical analysis and divided into two subgroups with 53 patients in each group. In Group 1, the mean age of patients was 35.77 ± 9.27 , with the largest number being males (92%); additionally, the largest part of this group were occupationally active (74%). Mean value of weight-to-height ratio was 27.31 ± 5.13 kg/m². Considering the BMI, 22% of patients showed a normal body weight, while 40% of patients in this group were overweight or obese (38%) (Fig.1; Tab.1).

Group 2 – control group were 53 patients, mean age 48.77 ± 14.05 , occupationally-active (81%), with the prevalence of males (74%). The mean BMI values were slightly higher, compared to Group 1 (28.80 ± 5.63 kg/m²). In this group, the number of persons with normal body weight was considerably higher, compared to Group 1 (36%), the largest number of patients in this group were overweight (43%), with a lower percentage of those who were obese (21%) (Fig.1; Tab.1).

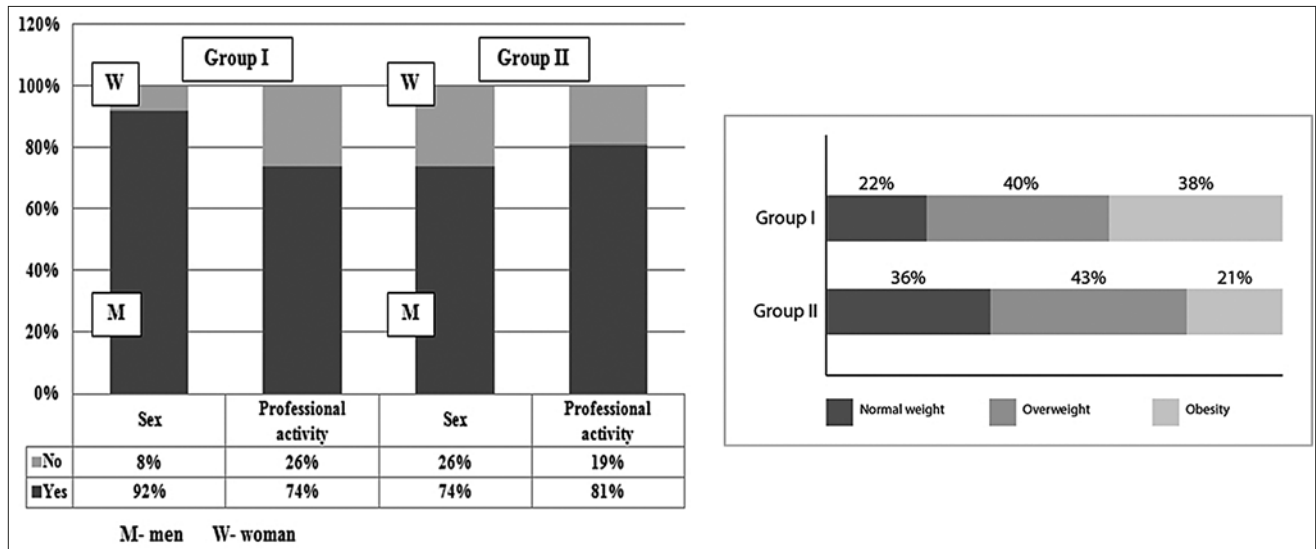


Figure 2. Characteristics of the examined group

Table 1. Characteristics of Groups 1 and 2

Variable	N	Mean	Median	Minimum	Maximum	(±SD)
Group 1						
Age [years]	53	35.77	34.00	14.00	59.00	9.27
Weight [kg]	53	84.90	85.00	49.00	170.00	19.53
Height [cm]	53	175.86	176.00	157.00	193.00	9.29
BMI [kg/m ²]	53	27.31	27.50	18.90	45.60	5.13
Group 2						
Age [years]	53	48.77	49.00	14.00	77.00	14.05
Weight [kg]	53	92.24	90.00	50.00	146.00	20.09
Height [cm]	53	178.60	180.00	159.00	197.00	7.03
BMI [kg/m ²]	53	28.80	27.80	16.90	44.60	5.63

RESULTS

In the evaluation of the level of physical activity, an important element is the sum of all types of physical activity undertaken during the week. The total level of physical activity expressed in MET-min/week, respectively, was in Group 1 – 4532.88±3611.6 MET-min/week, and was considerably higher, compared to the control group (3142.58±2536.9 MET-min/week). Also, the value of weekly caloric cost (KAF kcalweek⁻¹) showed higher values in Group 1 (6935.77±5957.4), compared to the control group (4274±3344.9).

Efforts on an intensive level (MET1) were undertaken with the mean energy expenditure in Group 1 – 1372.22±1001.8 MET/min/week, and the mean caloric cost KAF1 2004.82±1315.7 kcalxweek⁻¹. In Group 2 – 704.15±1001.8 (MET1); 942.17± 1315.7 (KAF1). Efforts on the moderate level were undertaken, on average, in Group 1 – (MET2 1372±1646.6; KAF2 2086.67±2580.3), in Group 2 – MET2 1539.62±1899.3; KAF2 2093.17±2469.9. Efforts related with walking/going for a walk was as follows: Group 1 – MET3 1788.66±2160.6, KAF3 2844.26±4007.8, Group 2 – MET3 898.81±2536.9, KAF3 1238.65±1356.03. The results of the study indicate that despite concomitant diseases, Group 1 showed considerably higher values of undertaking physical activity, especially intensive efforts and walking/going for

walks, compared to the control group, which was also reflected by the level of caloric cost of individual physical efforts (Fig. 3).

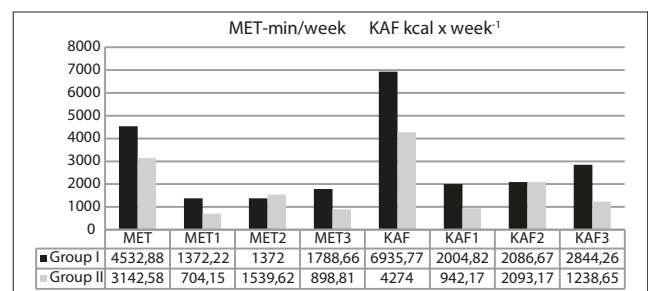


Figure 3. Level of weekly energy expenditure and caloric cost according to the level of physical activity (MET1/KAF1-intensive efforts; MET2/KAF2- moderate; MET3/KAF3-walking)

The results of the study demonstrate that according to the respondents' subjective opinions, the entire group, irrespective of concomitant diseases, may be classified into physical activity on a 'high' level (↑1,500–3,000 MET-min/week). However, considering the mean number of days and time of undertaking various forms of physical activity, the individual groups did not fall within the standards of this level of activity. The characteristics of a high level is the undertaking of activity for at least 3–7 days, and the sufficient level of 3–5 days. Additionally, it is recommended to undertake physical activity on a moderate level (≥150 min/week), or an intensive level (≥75 min/week), or the equivalent of a combination of the two types of physical effort. The results of the presented study show considerably higher values of the examined parameters in Group 1, compared to the control group.

The mean value of the days of intensive physical effort and its time (week), respectively, was in Group 1 – 1.962±1.9 days; 65.830±64.5 min, in Group 2 – 1.189±1.3 days; 45.377±45.5 min. The mean values of days/time of moderate physical effort was: in Group 1 – 3.830±2.3 days, 87.925±80.4 min; in Group 2 – 2.981±2.1 days, 101.981±94.4 min. The time and days devoted to walking was as follows: Group 1 – 5.887±1.9 days; 87.302±94.0 min, and in Group 2 – 4.962±2.3 days; 47.151±35.5 min. (Tab. 2).

Table 2. Evaluation of individual levels of weekly physical activity in the examined groups according to time/days

Variable	N	Mean	Median	Minimum	Maximum	St. dev. (±SD)
Group 1						
Intensive efforts (days)	53	1.962	1,000	0.0000	7.00	1.9
Intensive efforts (time/min)	53	65.830	60,000	0.0000	300.00	64.5
Moderate efforts (days)	53	3.830	4,000	0.0000	7.00	2.3
Moderate efforts (time/min.)	53	87.925	60,000	0.0000	390.00	80.4
Walking (days)	53	5.887	7,000	0.0000	7.00	1.9
Walking (time/min.)	53	87.302	60,000	0.0000	600.00	94.0
Sitting (days/time)	53	0.000	0,000	0.0000	0.00	0.0
Group 2						
Intensive efforts (days)	53	1.189	1,000	0.00000	5.00	1.3
Intensive efforts (time/min.)	53	45.377	30,000	0.00000	180.00	45.5
Moderate efforts (days)	53	2.981	3,000	0.00000	7.00	2.1
Moderate efforts (time)	53	101.981	60,000	0.00000	360.00	94.4
Walking (days)	53	4.962	5,000	0.00000	7.00	2.3
Walking (time/min.)	53	47.151	40,000	0.00000	180.00	35.5
Sitting (days/time)	53	0.000	0,000	0.00000	0.00	0.0

Considering the inconsistency of the data with normal distribution, Mann-Whitney U Test was applied instead of t-Student test, which showed a statistically significant difference on the level of total weekly energy expenditure (MET) and its caloric cost (KAF), as well as efforts on an intensive level (MET1, KAF1), walking/going for walks (MET3, KAF3), and the actual activity. The test did not show statistically significant differences on the level of moderate activity (MET2), and its caloric cost (KAF2) (Fig.4; Tab.3).

The results of the study demonstrate strong interrelation between weekly energy expenditure (MET-min/week), and its caloric cost (KAF kcal x week⁻¹) (Fig. 5).

Statistical analysis showed a statistically significant difference between the declared activity (self-reported) and the actual activity in the examined groups. The declared level of physical activity indicated statistically significant differences with respect to the actual activity (assessment from the application accelerometer) according to the BMI. In Group 1, as many as 77.3% of patients showed a higher level of declared physical activity, compared to the actual activity; in the control group, this percentage was slightly higher – 75.4%. Considering the BMI, the results of the study

demonstrate that in Group 1 the level of own physical activity was overestimated mainly by patients with a high BMI value (overweight-76.1%; obesity-85%), while in the control group, these were persons with a normal BMI – 78.9% (Tab. 4).

Table 4. Evaluation of the level of actual physical activity in the examined group (sign test)

Sign test p<0.05					
		N	%	Z	p
Actual activity& declaration of activity	Group 1	53	77.3	3.846096	0.000120
	Group 2	53	75.4	3.571375	0.000355
Sign test p<0.05					
Actual activity& declaration of activity	Group 1 Overweight	21	76.1	2.182179	0.029096
	Group 1 Obesity	20	85	2.906888	0.003650
	Group 2 Normal weight	19	78.9	2.294157	0.021781

The results of the study show the presence of a positive correlation between the total energy expenditure (MET) and its caloric cost (KAF), according to the level of physical efforts (MET1, MET2, MET3), and their duration, irrespective of the affiliation to the group (Tab. 5).

Table 5. Correlations of parameters MET, KAF with the level of intensity of physical activity and time of its duration

Spearman rank correlation (random data) p <0.05						
Variable	Intensive efforts (days)	Intensive efforts (time/min.)	Moderate efforts (days)	Moderate efforts (time/min.)	Walking (days)	Walking (time/min.)
MET-min/week	0.506	0.491	0.515	0.542	0.361	0.547
KAF kcal x week ⁻¹	0.455	0.458	0.498	0.531	0.370	0.542

Table 3. Evaluation of statistical significance of examined parameters (Mann-Whitney U Test)

Mann Whitney U Test p<0.05										
Variable	Rank sum	Rank sum	U	Z	p	Z	p	N	N	2*1str
MET	2499.00	3172.00	1068.00	-2.12	0.033	-2.12	0.033	53	53	0.03
MET1	2514.00	3157.00	1083.00	-2.02	0.042	-2.07	0.037	53	53	0.04
MET3	2400.00	3271.00	969.00	-2.74	0.005	-2.76	0.005	53	53	0.005
Actual activity	2450.00	3221.00	1019.00	-2.43	0.014	-2.43	0.014	53	53	0.014
KAF	2410.00	3261.00	979.00	-2.68	0.007	-2.68	0.007	53	53	0.006
KAF1	2493.50	3177.50	1062.50	-2.15	0.030	-2.20	0.027	53	53	0.03
KAF3	2330.50	3340.50	899.50	-3.18	0.001	-3.18	0.001	53	53	0.001

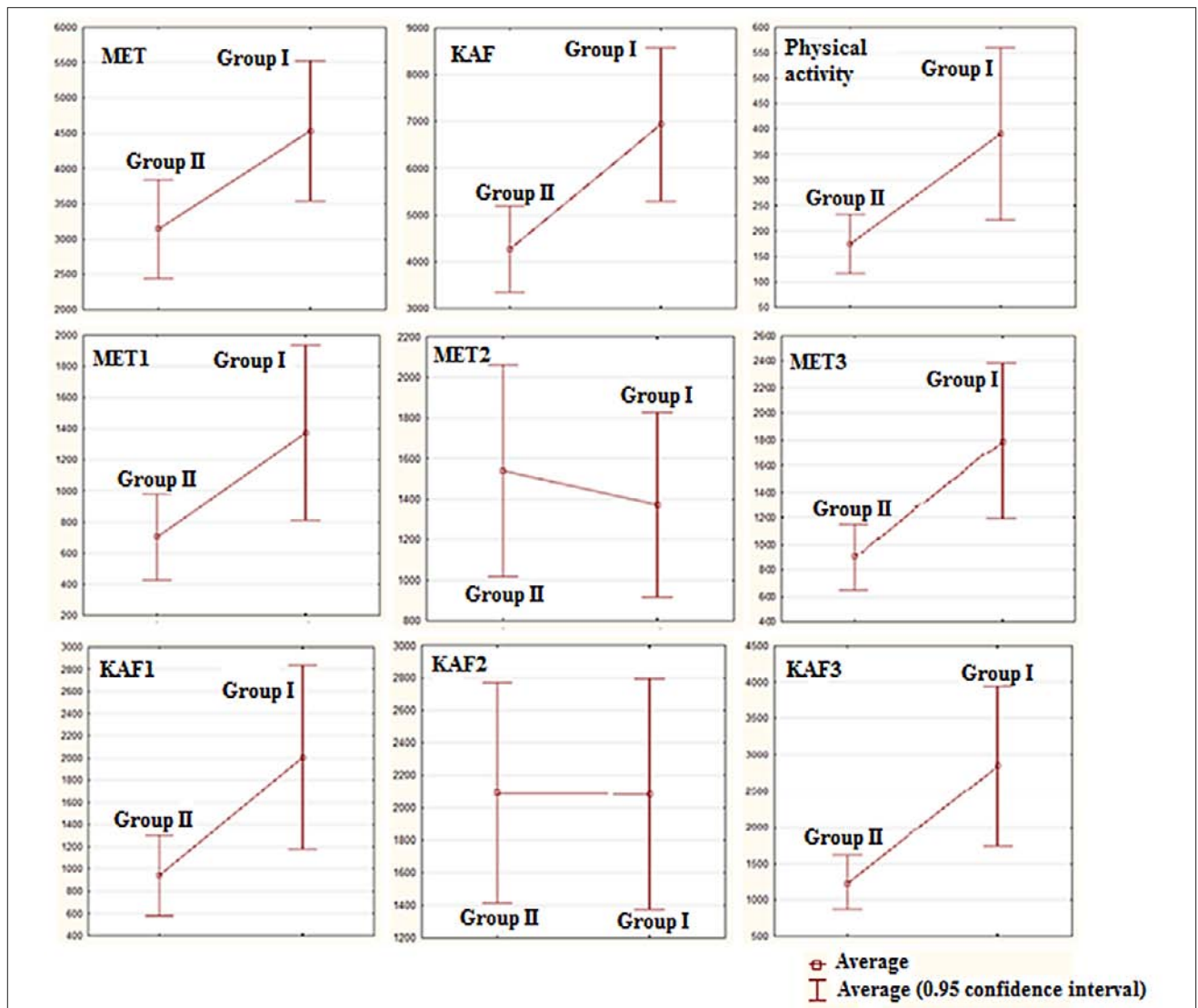


Figure 4. Evaluation of mean values of examined parameters in individual groups

DISCUSSION

Physical activity is an important element resulting in the reduction of the rate of cardiovascular events [20], and it also exerts a positive effect on the level of cardiac efficiency and quality of life in patients with heart failure and coronary disease [21, 22]. There are many non-modifiable risk factors of cardiovascular system diseases, for example, male gender [23]. The results of the presented study indicate that the prevalent part of the study group were males, both in Group 1 (92%) and in Group 2 (74%).

Statistical analysis assessing the level of physical activity in the examined groups confirmed that patients with concomitant diseases of the cardiovascular system showed a considerably higher level of physical activity, compared to the control group. The total level of weekly physical activity in Group 1 was 4532.88 ± 3611.6 MET-min/week, and was considerably higher, compared to the control group (3142.58 ± 2536.9 MET-min/week). Also, the values of weekly caloric cost (KAF kcal \times week $^{-1}$) showed higher values (6935.77 ± 5957.4), compared to the control group (4274 ± 3344.9). The group of cardiologic patients (Group 1) presented a higher level, especially from the aspect of efforts

on the intensive level and low level – walking/going for walks (MET1, MET3), which was also translated into the caloric cost of these levels of physical activity (KAF1, KAF3). The results of studies by Wang et al. indicated that one of the factors which may exert an effect on the level of physical activity after a cardiac event is the self-management of the rehabilitation programme in home conditions [24]. In addition, Wolf-May et al. confirmed that a past cardiac event, especially in a group of males, resulted in a considerable change in health behaviours through an increase in physical activity [25], which may also be observed in the difference in undertaking physical activity in the groups examined in the presented study.

The level of physical activity not exceeding 4–5 MET, or not causing expenditure of over 500 kcal during the week, is ascribed to physical activity on an insufficient level. Many researchers define such an activity as physical effort lower than 10% of the total daily energy expenditure, or of duration not exceeding 25 minutes daily. According to the guidelines, the recommended level of physical activity performed during leisure time should be more than 1,000 kcal/week, which is equivalent to physical activity on a moderate level, until reaching 60–70% of the maximum rate of contraction of

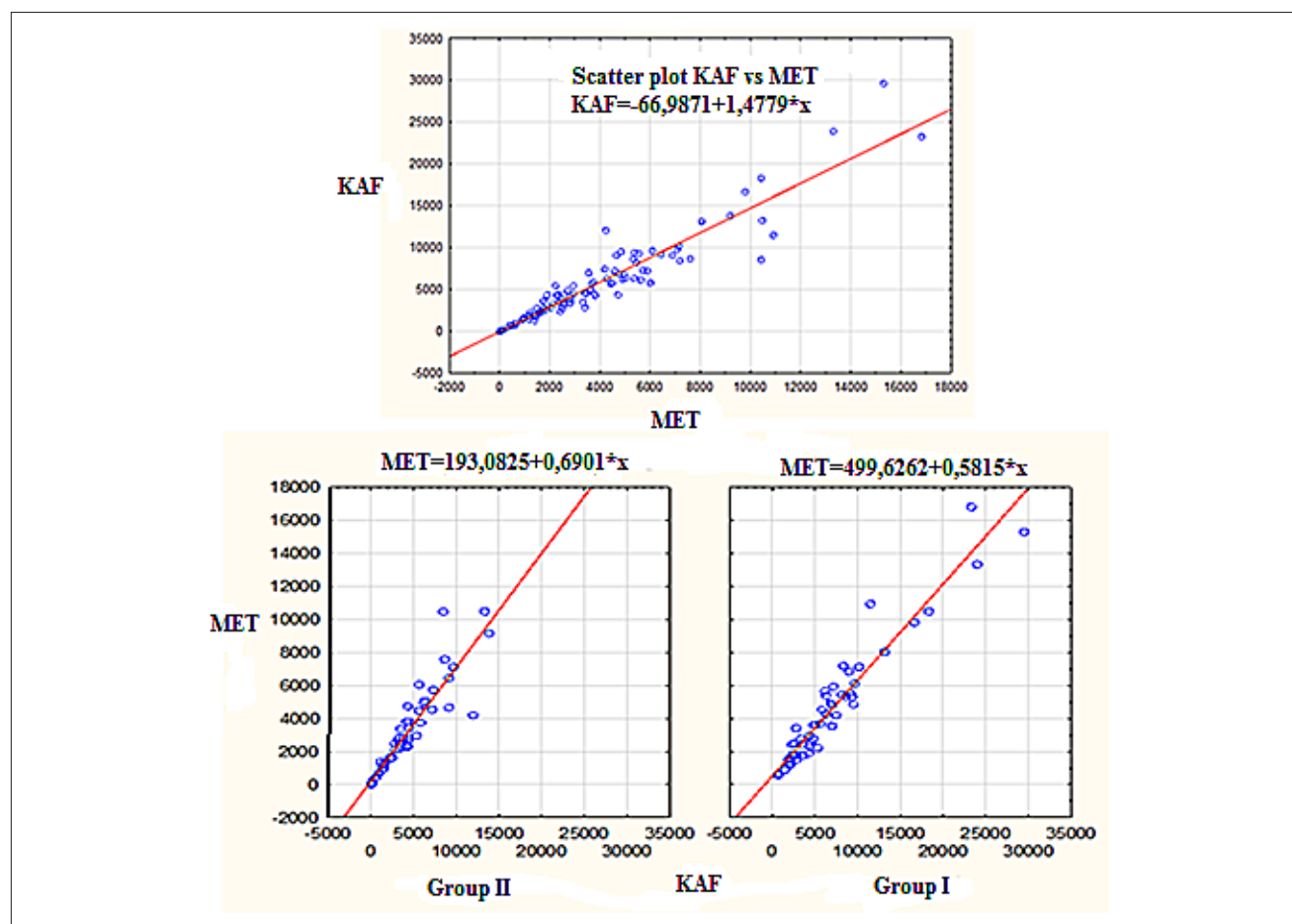


Figure 5. Dispersion of weekly physical activity (MET) and caloric cost (KAF) in the examined group

the cardiac muscle [26]. In own study, the weekly caloric cost of individual levels of activity in individual groups was assessed. Using the assumptions by Paffenbarger et al., for an adult person (70 kg body weight) the minimum energy expenditure should remain within 2,000 kcal x week⁻¹ (300 kcal /day⁻¹) [27]. The study showed that in Group 1, all levels of physical activity remained within normal values (KAF1 KAF1 2004.82±1315.7; KAF2 2086.67±2580.3; KAF3 2844.26±4007.8), while in Group 2 only the efforts on a moderate level were above the normal value (KAF2 KAF2 2093.17±2469.9). Health organizations worldwide, such as the American Collage of Sport Medicine and the World Health Organization, in order to maintain health and counteract civilisation diseases among adults (aged 18–65), recommend undertaking physical activity on a moderate level (4–6 MET) for not less than 30 minutes daily (≥ 150 min/week), for at least 5 days a week, or intensive efforts (> 6 MET), 3 times a week for at least 20 minutes daily (≥ 75 min/week) [28, 29].

The results of the presented study, despite the qualification of the group into the level of high/sufficient activity, do not satisfy the criteria from the aspect of frequency and time of undertaking physical effort. The mean value of the days of intensive effort and its time (week), respectively, was: in Group 1 – 1.962±1.9 days; 65.830±64.5 min, and in Group 2 – 1.189±1.3 days; 45.377±45.5 min., whereas the values of moderate efforts were: in Group 1 – 3.830±2.3 days, 87.925±80.4 min; in Group 2 – 2.981±2.1 days, 101.981±94.4 min. However, it should be emphasized that the results of the majority of the examined parameters showed considerably

higher values in Group 1, compared to the control group.

The results of studies conducted for many years emphasize that the undertaking of any physical activity is better than its lack, and the higher the level of physical activity, the higher the level of total energy expenditure [30]. This is also confirmed by the results of the presented study which indicate a strong relationship between weekly energy expenditure (MET-min/week) and its caloric cost (KAF kcal x week⁻¹). In addition, the results show the presence of a positive correlation between total energy expenditure (MET) and its caloric cost (KAF), according to the level of physical efforts (MET1, MET2, MET3) and their duration, irrespective of affiliation to the group.

One of the major problems observed in this study was a considerable overestimation of the level of physical activity self-reported by patients, which was also confirmed by the results of the study by Shephard et al. [31]. In Group 1, as many as 77.3% of patients declared a higher level of physical activity with respect to the actual activity; in the control group, this percentage was slightly higher – 75.4%. Considering the BMI value, the results of the study showed that in Group 1 own level of physical activity was overestimated mainly by patients with a high BMI (overweight -76.1%; obesity -85%), while in the control group, those with a normal BMI – 78.9%.

Physical activity plays an important role in patients who have undergone cardiovascular events, as an instrument of secondary prevention, but primarily as an important factor in counteracting these events, playing a superior role in primary prevention. Therefore, an important role of health

services is the promotion of physical activity, mainly by the education of patients whose share in the shaping of own health is the greatest.

CONCLUSIONS

1. The results of the study indicated a statistically significantly higher level of physical activity in the group of patients with concomitant cardiovascular diseases, compared to the control group, which may constitute an important problem in the primary prevention of heart diseases in this group of patients.
2. An important problem also seems to be the overestimation of the level of physical activity in the subjective opinions of patients, especially in the control group.

PROTECTION OF HUMAN SUBJECTS

The study was performed in compliance with the World Medical Association Declaration of Helsinki on Ethical Principles for Medical Research Involving Human Subjects. The authors requested the opinion of the Ethics Committee at the Institute of Rural Health and obtained consent for the study.

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