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Measured versus self-reported body height and body mass in patients after an acute coronary syndrome

Zygmunt Domagała[1], Dariusz Kałka[3], Bożena Kurc-Darak[1], Krzysztof Womperski[2], Lesław Rusiecki[3], Ewa S. Krauz[4], Bohdan Gworys[1], Paweł Dąbrowski[1]

[1]Department of Anatomy, Wrocław Medical Uniwersity, Poland
[2]Cardiac Rehabilitation Unit, Ministry of Internal Affairs, Głuchołazy, Poland
[3]Department of Patophysiology, Wrocław Medical University, Poland
[4]Cardiac Rehabilitation Unit, Medinet Ltd.,Wrocław, Poland

Abstract: The basic anthropometric data describing a person in the broadest context are body weight and height, two of the most frequently analyzed somatometric parameters. The same is true I in relation to clinical patients. The aim of the present study was to compare the self-reported and actual body weight, height and BMI in patients suffering from coronary artery disease and undergoing cardiac rehabilitation. The study sample consisted of 100 patients treated for coronary artery disease. The patients were asked to state their body weight and height. At the same time a three-person study team took measurements, which were later the basis for verification and objective assessment of the data provided by the patients. Statistical analysis was performed with Statistics 11.0 PL software. The analysis of mean results for the assessed group of patients has shown the presence of statistically significant differences between declared and actual data. The differences were observed for both male and female study population. It has been proven that the subjects declare greater body height (mean value 1.697 m vs. 1.666 m) and lower body weight (80.643 kg vs. 82.051 kg). Based on the data from surveys and direct measurements, the body mass index for the self-reported and actual data was calculated. A comparison of these values has shown considerable statistically significant differences. The differences between declared and actual data point to highly subjective self-assessment, which disqualifies the declared data in the context of monitoring of treatment and rehabilitation processes. The authors believe that actual data should be used in direct trial examination of patients suffering from coronary artery disease who presented with acute coronary syndrome.

Key words: basic anthropometric measurements, ischaemic heart disease, body mass, height awareness

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Introduction

The basic anthropometric features, i.e. body weight and height, are some of the most frequently analyzed somatometric parameters. They also play a significant role in stratifying the cardiovascular risk in adults. Inappropriate and too high body weight is one of the easily modifiable risk factors (Lu et al. 2013, Ezzati et al. 2002). Overweight and obesity significantly increase the risk of hypertension (Pecin et al. 2013, Chrostowska et al. 2011), the incidence of lipid disorders (Bays et al. 2013), the risk of symptomatic coronary artery disease (Chrostowska et al. 2011, Mokdad et al. 2003, Van Gaal et al. 2006), the risk of diabetes (Mokdad et al. 2003, Van Gaal et al. 2006) and slightly increase the incidence of stroke in males from Northern European countries (Asplund et al. 2009). The assessment of body weight requires, apart from values for body weight, the data for hip, extremities and waist circumference, and skinfold measures (van Wier et al., 2006). The easiest and most objective and frequently used method of assessing the degree of obesity is calculating the BMI (Body Mass Index) (Phillips et al. 2013). Inappropriate and too high BMI is considered a significant, modifiable cardiovascular risk factor (Ezzati et al. 2002, Whitlock et al. 2009). Precise indication of body weight and height, and therefore BMI, is highly desirable for a proper course of treatment or rehabilitation after cardiac procedures or cardiac surgery. Imprecise, too high or too low, indication of somatic features can arrest the therapeutic and rehabilitation progress. The available data show that the most effective assessment of BMI is based on a direct measurement of the subject's body weight and height, and subsequent calculation of the BMI value (Phillips et al. 2013, Targonski et al. 2007).

A different method is to use the declared body weight and height data from surveys or case histories (Dores et al. 2013, Younge et al. 2013, Sarno et al. 2011, Kalka et al. 2013, Gruszka et al. 2014). In this case, BMI is calculated based on declared data or measurements made on equipment without specifications or recommendations, by untrained healthcare staff. Using data collected in case history is easier when dealing with patients with severe general condition, unstable circulation or when there is no easy access to certified measuring equipment. The question remains, whether declared somatic data help provide an accurate calculation of BMI. A number of studies, carried out in different environments, have shown the utility of using this methodology of obtaining basic anthropometric data (Krzyżanowska and Umławska 2002, Lucca and Moura 2010, Bolton-Smith et al. 2000). On the other hand, different studies provide contrary results and advocate direct measurement as the only reliable way of obtaining data (Gajewska and Gromulska 2009, Gil and Mora 2011, Oliveira et al. 2009). Significantly, these studies base mostly on the analysis of data collected from healthy subjects and a number of them refer to a relatively young study population. The question remains: Can the conclusions from studies conducted in a healthy study population be transferred to a population comprising of subjects suffering from coronary artery disease who presented with acute coronary syndrome? We believe not. During wide-spread somatometric studies conducted among patients with coronary artery disease, we decided to assess the reliability of the declared subjective body weight and height data.

The aim of this study was to compare the self-reported and actual body weight, height and BMI in patients suffering from coronary artery disease with acute coronary syndrome.

Material and Methods

One hundred subjects treated for coronary artery disease and undergoing stage 2 cardiac rehabilitation in two centers in Lower Silesia and Opole who consented to participate in the study conducted between April 2013 and November 2014. The clinical characteristics of the group are presented in Table 1.

The patients with diagnosed osteoporosis and accompanying spinal compression fractures or with conditions that affect body height (e.g. amputations) and with conditions that could in a short period of time affect the current body weight (e.g. uncompensated heart failure, renal failure, thyroid gland condition) have been excluded from the study

Table 1. Basic clinical data of the study group

Number of participants (mean age in years)	100 (64.06)
Women	33 (64.23)
Men	67 (63.97)
Coronary artery disease treatment modality (%)	
PTCA	57
CABG	40
Myocardial infraction (%)	100
Education (no. of participants)	
Primary	10
Vocational	30
Secondary	41
Higher/Academic	19
Place of residence (no. of participants)	
Village	26
Small town	12
Town	17
City	15
Wrocław	30

CABG – coronary artery bypass grafting, PTCA – percutaneous transluminal coronary angioplasty.

The patients were assessed based on a survey prepared for this study. The subjects answered on their own, if they had any doubts they consulted one of the investigators. Data thus gathered have been coded to ensure anonymity and confidentiality, and later analyzed. If any doubts occurred, the subject's case history was consulted. The survey included basic demographic data, education, place of residence and basic medical data. The patients were asked to indicate their body weight and height to the best of their knowledge and subjective perception.

At the same time, an independent study team comprising of a medical doctor and two anthropologists verified the declared data. The measurements were taken before noon, with the patient dressed only in undergarments. Body mass was determined with a certified Radwag scale, with measurement accuracy of up to 0.00001 kg. Body height was determined with a certified Holtain anthropometer, with measurement accuracy of up to 0.0001 m. Each measurement was taken three times and the mean of all three measurements was used for statistical analysis. The instruments used in the study are CE certified and in accordance with directive MDD93/42EEC on medical instruments and appliances.

Body Mass Index was calculated as the patient's weight in kilograms divided by the squared height in metres. The following WHO classes were used for classification: normal range was defined as BMI <24.9 kg/m^2; overweight was defined as BMI 25–29.9 kg/m^2 and obesity as BMI <30kg/m^2 (WHO 1995).

Statistica 11.0 PL software was used for statistical analysis. The basic statistical parameters were calculated for the studied group. The results of χ^2 and student t-test were used for assessing the significance of statistical differences for continuous dependent variables.

The study was approved by the Bioethics Committee of Wroclaw Medical University (KB – 433/2010) in co-operation with the departments where the subjects were treated.

Results

The analysis of mean body height values has shown statistically significant differences between declared and actual data, both in men and women. The values declared by both sexes were higher than actual data (Table 2).

The analysis of mean body weight values has also shown a statistically significant difference between declared and actual data, both in men and women. Statistical analysis has shown that the values declared by both sexes were lower than actual data (Table 3).

Based on the data from surveys and direct measurements, we calculated BMI_1, for declared data, and BMI_2, for actual data. A comparison of these two values has shown considerable statistically significant differences (Fig. 1).

Based on the statistically significant differences between $BMI_{1\ (declared)}$ and $BMI_{2\ (measured)}$, we asked the following question: Did subjects suffering from obesity or overweight, aware of their weight being too high, declare lower body weight significantly more frequently? Was this dictated by the desire to conform to current standards of beauty, promoting lean, fit physique not only among youths but also adults? Statistical analysis has shown incorrectly declared body weight and

Table 2. Comparison of the self-reported and measured body height means and standard deviations in the study population

	Mean (m)	SD (m)	*p*-value
Measured body height	1.67	0.11	$p<0.001$
Self-reported body height	1.70	0.09	
Measured body height – F	1.57	0.09	$p<0.001$
Self-reported body height – F	1.61	0.07	
Measured body height – M	1.71	0.08	$p<0.001$
Self-reported body height – M	1.74	0.07	

SD – standard deviation, F – female, M – male.

Table 3. Comparison of the self-reported and measured body weight means and standard deviations in the study population

	Mean (kg)	SD (kg)	*p*-value
Measured body weight	82.05	15.00	$p<0.001$
Self-reported body weight	80.64	14.83	
Measured body weight – F	75.18	13.31	$p<0.001$
Self-reported body weight – F	74.00	12.79	
Measured body weight – M	85.43	14.72	$p<0.001$
Self-reported body weight – M	83.91	14.75	

SD – standard deviation, F – female, M – male.

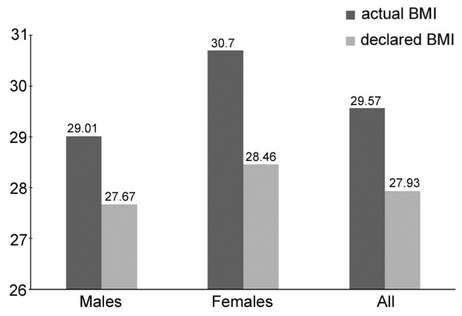

Fig. 1. Comparison of the declared and actual BMI in the study population. BMI – Body Mass Index

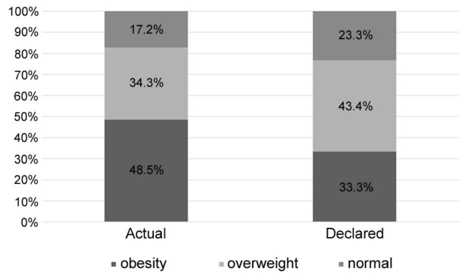

Fig. 2. Comparison of the percentage of participants (n=99) for the accuracy of body weight (BMI calculated based on declared and actual data). BMI – Body Mass Index, n – the number of participants who knew and declared their body weight and height

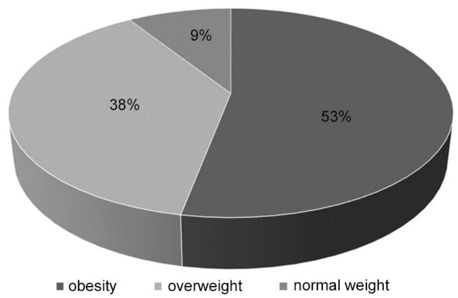

Fig. 3. Figure illustrating the percentage of patients declaring incorrectly their body weight and height

height, and, consequently, too low BMI, in the case of many obese (p=0.007) and overweight subjects (p=0.008) (Fig. 2).

Twenty five percent of subjects have declared incorrect data for body weight and height. The discrepancy between declared and actual data was significant enough to cause the subjects to be initially ascribed to a group with a lower body fat than prescribed by later measurements. Consequently, we determined that overweight and obese subjects more frequently provided incorrect body weight and height (Fig. 3).

Discussion

The study has shown that subjects with coronary artery disease presenting acute coronary syndrome do not have accurate knowledge of their body weight and height. The subjects declared their body weight to be too low and their body height to be too high. This is consistent with the results of Oliveira (2009), Jin-Mann (2010) and McAdams (2007). Consequently, BMI calculated from declared data is incorrect and statistically significantly different from BMI calculated from data obtained by direct measurement.

The mean difference between the declared and actual body weight among the study population was 1.41 kg, which amounted to 1.74%. Gil and Mora (2011) reported similar results for a similar age group, with the difference between declared and actual data amounting to 2%. In our study, the subjects from both sexes declared lower body weight (men by 1.81%, women by 1.59%), whereas in the study by Oliviera et al. (2009) men with diagnosed coronary artery disease declared their body weight to be higher by 0.5 kg, on average, and women, similarly to our study, lower by 1.51%.

The mean difference between the declared and actual body height among the study population amounted to 1.8%. In the population studied by Gil and Mora (2011), the difference was lower and amounted to 0.9%. The analysis of dimorphic differences for this variable has shown that the difference between the declared and actual data corresponded to 2.5cm for the male population. Kuczmarski et al. (2001) reported similar results for a group of healthy volunteers. His team has proven that discrepancies between known and actual information about body height increase with the subject's age (Kuczmarski et al. 2001). Our results show a greater discrepancy for the female population, corresponding to 4.5 cm, which is consistent with the results of Kuczmarski et al. (2001): the mean age of female participants was higher than that of the males. This is consistent with the finding that discrepancies between known and actual information about body height increase with the subject's age (Table 1).

The analysis has shown a statistically significant difference between BMI_1 and BMI_2, which amounted to 5.9%, indicating a value higher by 1.6 unit of the marker, between declared and actual data. The achieved result is higher than those of Gil and Mora (2011), Kuczmarski et al. (2001) or Jin-Mann (2010), as all these authors have reported a difference corresponding to one unit of the marker. The studies by Oliveira et al. (2009), McAdams (2007) and Kuczmarski et al. (2001) conducted among older patients with overweight or obesity have shown results similar to ours.

In the study population of subjects suffering from coronary artery disease who presented with acute coronary syndrome, the reported differences between declared and actual somatic data are higher than between mean values for corresponding features reported by other authors and, at the same time, statistically significant. The results of corresponding studies conducted among Polish students, with data collected from surveys and measurements, have shown no statistically significant differences between mean values for body height (2002).

It would seem that one of the reasons for the observed phenomenon might be the already mentioned factor of the age of the participants. Even the study population analysed by Oliveira et al. (2009) was younger than ours. We also cannot exclude the influence of the specificity of local healthcare. Our own experiences in medical practice show that, after puberty, the body height of most patients is very rarely measured. Such measurements are often taken at home, by the patients, or during hospitalization.

Therefore, it should be stressed that, in the case of modifiable risk factors in patients suffering from coronary artery disease who presented with acute coronary syndrome, measurements for body weight and height should be made each time for the purpose of describing somatic features. The differences shown between declared and actual data have proven to be statistically significant. This means that analysing BMI calculated based on the subject's declaration is inaccurate and can negatively affect the set limit values for morphological data necessary to describe the state of the patient's health and biological condition, which can disturb the appropriate assessment of the cardiovascular risk. Imprecise assessment of the degree of obesity can lead to further problems with the patient's treatment and rehabilitation. The authors postulate the need to use actual parameters of patients suffering from coronary artery disease who presented with acute coronary syndrome, taken during direct examination.

Conclusions

Statistically significant differences were shown for body weight and height declared by the subjects and measured by a trained study team. The differences between declared and actual data point to highly subjective self-assessment, which disqualifies the declared data in the context of monitoring of treatment and rehabilitation processes. The authors believe that actual data should be used in direct trial examination of patients suffering from coronary artery disease who presented with acute coronary syndrome. The assessment of BMI based on declared data is inaccurate and can affect the limit values of morphological features necessary to describe the patient's health and further rehabilitation.

Limitations

The study was limited by an insufficient number of female participants, and the fact it was conducted in two distant centres for cardiac rehabilitation in Lower Silesia.

Authors' contributions

ZD designed the research, interpreted the results, wrote the manuscript and collected the data, DK collected the data and articles, EK and KW collected the data, KW and BG gave support and conceptual advice, LR performed statistical analyses, BKW gave support and conceptual advice, and also collected the articles, PD designed the research and collected the data. The final version of paper was prepared by ZD and BG and approved by all authors.

Conflict of interest

The author declares that there is no conflict of interests.

Corresponding Author

Bożena Kurc-Darak, 51-367 Wrocław Chałubińskiego 6a, Zakład Anatomii Prawidłowej Katedry Morfologii i Embriologii Człowieka Uniwersytetu Medycznego we Wrocławiu.
e-mail: bożena.kurc-darak@umed.wroc.pl

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