ORIGINAL ARTICLE

Evaluation of a body height and weight harmony among university students

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Abstract

Background and Study Aim: A harmony between the body weight and height is one of the most important sign of the right body composition. The aim of this research was to compare objective and subjective evaluations of the body weight and height correlation by university students.

Material and Methods: Students of three years Bachelor programs in the humanistic university were investigated: 137 males in the age of 22.1±1.7 years old, body height – 180.0±7.9 cm, body weight – 79.6±12.3 kg; 281 females in the age of 21.5±2.1 years old, body height – 166.4±6.0 cm, body weight – 59.6±8.9 kg. During the lessons of Physical Education, students were asked to evaluate mentally their body weight value using three categories: normal, overweight, and underweight. A body weight value was evaluated using BMI model too. Correlation between results of these two evaluations was determined using the Pearson interclass correlation coefficient.

Results: One way ANOVA showed relatively small differences between BMI values of three studied groups: ($p=0.235$). Within groups variation was in the medium interval: from V=11.4% in the Nursing group up to 16.6% – in the Physical Education group. Totally for all the participants, Pearson interclass correlation showed moderate significant correlation ($r=0.354$, $p<0.001$) between results of the objective as BMI values and subjective evaluations as data received from a special questionnaire.

Conclusions: Comparison of the objective evaluation results of body weight by BMI and results of subjective evaluation regarding the body weight were compared vs. results evaluated mentally by students. Subjective evaluated results very good met results obtained from BMI values. Corresponding error appeared negligible small. Statistical hypothesis regarding a common general population these two samples was accepted.

Keywords: physical education, bachelor, body composition, BMI, modelling

Introduction

A body height and a bogy weight are two most important and popular kinesiology parameters of a human body regarding Physical Education and family areas of human movements like Physical Therapy, Ergo Therapy, Para-Medical Rehabilitation, Sports, and others. A harmony between these two parameters is one of the most important sign of a right body composition. Body Mass Index (BMI) is the most popular model for determination of quality of the body composition. Because a body height is much more conservative parameter than a body weight, for determination of the optimal correlation between these parameters the second one is used usually as a function of the independent body height [1, 2].

With a purpose to improve health and general conditions, and to get a right body composition, people try to reduce a body weight to the acceptable level. Especially, this problem is an actual one for young persons, students. Last several decades, longing for "an ideal body composition" became to a standard among the university students. Father more, this aspiration for a minimal weight acquires features of a disease named Social Anorexia. For example, people who have anorexia severely reduce their food intake to lose weight [3, 4].

Although eating disorders aren't specific for age or gender, women are disproportionally affected by them. About 1 percent of all American women will develop anorexia, and 1.5 percent will develop bulimia, according to the National Association of Anorexia Nervosa and Associated Disorders. Mankind has faced the pandemic of overweight and obesity, which are factors of health and life quality deteriorating of the individuals, and the co-cause of millions premature deaths globally [5].

The frequency of overweigh and obesity occurrence is systematically rising. One of its causes is the deteriorated perception of one's body. Wrong BMI estimation causes risky eating habits, which may outcome as serious health problems. The way people perceive their body, and by how much is there perception impartial has a very big influence on their thoughts on themselves and others. Media build up fashion for one's with flawless appearance and skinny body. By promoting it mass media such as TV and internet cause among teenagers and young

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adults frustrating feeling of dissonance between their current and desirable look. It may cause many psycho and sociological problems. Uncertainty, poor self-esteem, decline in self-confidence often cause social alienation and even depression [6].

Hypothesis of the Study

It is reasonable to suppose that a person has his/her own intuitive model which appears in the mind based on life practice and models presented by intermediate technics, etc. So, this model is subjective one and should be evaluated using some objective criterion. BMI model is an objective method for quantitative determination of a body composition parameter. So, BMI could be used as an objective criterion for result of a subjective evaluation of a body composition. Therefore, the hypothesis of the study was formulated as follows: results of the subjective evaluation of body weight vs. body height are rather similar to results received from BMI model; an alternative hypothesis states independent results of the subjective and objective evaluations [7, 8].

Purpose of the Study

The research aims to compare objective and subjective evaluations of the body height and weight harmony among the university students. This goal was achieved by solving the problems as follow:

- participants' body height and body weight were measured and corresponding BMI values were calculated;
- evaluation of these body height and weight correlation was done using BMI values, i.e. the objective indicator, as well as values of the subjective indicator using results of the participants mental evaluation on the problem;
- to study a comparison of these two methods of evaluation, differences between correlation results regarding gender and speciality have been determine too.

Material and Methods

Participants

Students from Nursing, Physio-Therapeutics, and Physical Education three years Bachelor programs at Technological and Humanistic University in Radom (Poland) were investigated: 137 males in the age of 22.1±1.7 years old (M±SD), body height – 180±7.9 cm, body weight – 79.6±12.3 kg; 281 females in the age of 21.5±2.1 years old, body height – 166.4±6.0 cm, body weight – 59.6±8.9 kg.

The study was approved in advance by Ethical Committee of the Technology and Humanities University named after Kasimerz Pulaski in Radom. Students participated in the research voluntarily provided written informed consent before participating. The procedures were followed in accordance with the ethical standards of the Ethical Committee on Human Experimentation [9].

Study Design

The research has been carried out during 2021 – 2022 Academic Year. Regarding the lessons of Physical Education, students were asked to evaluate their body weight value using three categories as results: normal, overweight, and underweight. A body weight value was evaluated using BMI value too: 18.5÷24.5 – normal, >24.5 – overweight, and <18.5 – underweight. Correlation between results of these two evaluations was determined using interclass correlation coefficient. BMI was calculated according the formula as follows [10]: BMI=(body mass)/(body weight)^2 in (kg)/(squared meters). The body weight was determined using electronic scales with an error ±*0.05* kg; the body height was determined using a floor roller with an error ±*5* mm. BMI value was calculated up to one hundredth. The participants completed the questionnaire before calculations of the BMI value, so that they did not use results of this objective evaluation during their subjective evaluation.

Statistical Analysis

Kolmogorov-Smirnov test with Lilliefors correction was used to check normality of distribution of the samples of age, body height, body weight, and BMI. One way ANOVA was used with a purpose to determine differences between BMI values of three studied groups. The factor of the analysis was a Bachelor program of studied university students, i.e. Nursing, Physio-therapeutics, and Physical Education. This methods as well as coefficient of variation (V=100*SD/Mean, %) were used to determine dispersions of BMI values within studied groups. Corresponding results were evaluated using the scale as follow: V=0 – 10% small variation, 11 – 20% – moderate, and over of 20% – high variation [11, p.61].

The objective evaluation results of a body weight determined using BMI and results of the subjective evaluation regarding the body weight were compared vs. results evaluated by students using the two samples paired T-test. Pearson interclass correlation was used to study correlation between results of objective (as BMI) and subjective i.e. data from the students' questionnaire. A power of the correlation was evaluated correspondingly a module of a correlation coefficient value as follow: lower than 0.2 is weak correlation, over than 0.2 and lower than 0.4 is moderate correlation, over than 0.4 and lower than 0.7 is a medium correlation, and over than 0.7 is a strong correlation [12].

Calculations have been done using Data Analysis of Excel package (One way ANOVA, Paired two samples T-test) and Statistica computer program (Kolmogorov – Smirnov test).

Results

Because in the frames of Kolmogorov-Smirnov test with Lilliefors correction, normal distribution was revealed in all the samples (p>0.05), BMI values were elaborated using methods of parametric statistics (Table 1).

One way ANOVA showed relatively small differences between BMI values in three studied groups: 22.2÷22.9 (p=0.235, Table 2). Corresponding variation of data accumulated only Q=0.7% of the total variation. Practically all the variation was caused by the within variation in groups (Q=99.3%). Within group variation was in the medium interval: from V=11.4% in the Nursing group up to 16.6% – in the Physical Education group.

Totally, for all the participants, Pearson interclass correlation showed moderate significant correlation (r=0.354, p<0.001) between results of the objective (BMI values) and subjective evaluation data received from the students' questionnaire (Table 3).

Comparison of the objective evaluation results of body weight by BMI and results of subjective evaluation regarding the body weight were compared vs. results evaluated by students (Table 4). Subjective evaluated results very good met results obtained from BMI values. Corresponding error appeared 0.02 point (2.3%). Statistical hypothesis regarding a common general population these two samples was accepted using pared T-test on the convincing level of significance (p=0.395).

Significant and moderate correlation between these two samples was fixed as follows (r=0.326, p<0.001).

Table 1. Parameters of participants: males (nM=137) and females (nF=281)*

Statistics	Age (year)		Body height (cm)		Body weight (kg)		BMI	
	Males	Females	Males	Females	Males	Females	Males	Females
M	22.1	21.5	180.0	166.4	79.6	59.6	24.5	21.5
SD	1.7	2.1	7.9	6.0	12.3	8.9	3.1	2.8
Max	29.0	43.1	204.0	186.0	125.0	91.0	38.6	33.8
Min	18.0	19.0	154.0	150.0	55.0	43.0	16.5	16.6
D	0.131	0.163	0.085	0.075	0.101	0.085	0.106	0.147

*Notes: nM and nF are male and female participants' numbers correspondingly, M is arithmetic mean value, SD is standard deviation, D is Kolmogorov – Smirnov statistics, p is significance, p(D)>0.05.

Table 2. Results of ANOVA of BMI values

Source of dispersion	SS*	df	MS	F	p	F(0.05, 2, 415)	Q, %
Between groups	30.4	2	15.2	1.453	0.235	0.051	0.7
Within groups	4346.4	415	10.5				99.3
Total	4376.8	417	10.5				100.0

*Note: SS is sum of squars, df is degree of freedem, MS – mean squars (variance), F is Fisher statistics, Q is a part of the total dispersion, p is significans.

Table 3. Results of the subjective evaluation of body weight (from questionnaire) vs. BMI values

Statistics*	Group			
	Nursing	Physio-therapeutics	Physical Education	Total
n	140	184	94	418
M	22.2	22.6	22.9	22.5
SD	3.7	3.2	2.6	3.2
V(%)	16.6	14.1	11.4	14.4
r	0.377	0.451	0.164	0.354
t	4.784	6.861	1.590	7.727
p(r)	<0.001	<0.001	0.058	<0.001

*Notes: n is participants' number, M is arithmetic mean value, SD is standard deviation, V is coefficient of variation, r is Pearson correlation coefficient, t is Student statistics, p(r) is significance.

Table 4. Comparison of the objective evaluation results of body weight by BMI and subjective evaluation results by questionnaire

Statistics*	Types of evaluation	
	Objective (using BMI)	Subjective (questionnaire)
n	418	418
M	1.15	1.17
SD	0.53	0.56
r, p(r)	0.326, <0.001	
D, p(D)	0.02, 0.395	

*Notes: n is participants' number, M is arithmetic mean value, SD is standard deviation, r is Pearson correlation coefficient, D is difference of means, p(D) and p(r) are significances.

Discussion

According to the purpose of the research, correlation results of the objective and subjective evaluations of body height and weight by university students have been compared. Hypothesis of the study about significant right correlation between results of the objective and subjective has been acceptes (r=0.354, p<0.001), but the problem of over weight is rather familiar to the theme of this research.

The closer the appearance is to the ideal promoted in the mass media (lower body mass and BMI), the more the chance for a proper self-esteem of one's body increases. This is confirmed by the observations from the surveys and anthropometric measurements of female students of Gdansk University of Physical Education and Sport (N = 1394) from 2003-2010, among whom 70.23% of students made a correct BMI self-assessment, 26.76% overestimated the results, and only 3.01 % underestimated values. In this study, attention is drawn to the fact that in the group of respondents who incorrectly recorded their BMI, 91.18% are female students practicing sports [6].

Social patterns of sex shape the perception of their own body also by students. This is confirmed by the research of Wright et al., which found that male and female students underestimated body weight and overestimated height at an average level, which led to more favourable BMI results [13, 14]. Additionally, it was shown that men had a stronger tendency to overestimate their height, while women mainly underestimated their weight. Similar conclusions were reached by Wilson et al. and Radwan et al. [15, 16].

Overweigh people are often perceived stereotypically as awkward, unattractive and lazy, whereas the slim one's enjoy public approval and recognition. It is commonly believed that they are attractive and happy, and that they can easily establish professional and social connections. Additionally, it should be feared that the rising factors of overweight and obesity in contemporary population may normalize heavier body as a reference, making it more difficult to diagnose themselves right. The overweight and obese will stop perceiving their appearance as a risk factor over time and will start to ignore messages about healthy lifestyle [17, 18].

The somatic development study of successive generations allows us to observe varied influences of social, economic and urban changes on melding of morphological traits of the population. Crucial is to consider relation of two basic factors of physical development that is height and body mass. On the one hand, we can observe the acceleration of human development, which manifests itself in a greater body height of successive generations, but on the other, we see dangerous for health development of overweightness and obesity [19, 20, 21].

Studies on somatic development of the population are generally based on survey data. The respondents state in the questionnaire their height and body mass, what allows us to count the Body Mass Index (BMI) and estimate fast weather the respondent is underweight – in a correct value – overweight. Sadly, the self-description is often not objective. The inconsistencies of self-descriptions are caused by underestimations of body mass, overestimating the height or both. The literature review shows that women mostly underestimate body mass, what can be caused by a will of perceptual adjustment to cultural ideal promoted by media, whereas man overestimate their height and weight to emphasize the need of being big and muscular [22, 23].

Among people who underestimate their weight beside women studies indicate heavier people of both sexes, whereas the height is commonly overestimated by smaller man and elder people of both sexes. Beside sex and age mistakes in estimations (although in a smaller range) can be the result of education, marital status, and even race It seems that the growing awareness considering healthy lifestyle induce people to state anthropometric values, which in fact are they dream values. If the results of the study are being unreliable it affects unfavourably public health monitoring, especially in high-risk populations [24, 25].

Relatively fewer studies have been conducted on the differences between objective and reported height, body weight and BMI values among students. They were the subject of national and international research mainly due to the psychological and social instability accompanying this age group and the specificity of functioning in the university environment [26, 27].

It is motivating that the same awareness regarding healthy lifestyle patterns encourages people to take beneficial pro-health activities. The growing interest in health is indicated by the fitness industry, which has been dynamically developing since the end of the last century, with has currently around 185 million members worldwide (with an increase of 54% over the last decade). Exercising in fitness clubs is often promoted as a fat loss strategy - which is very encouraging, attractive and socially necessary [28].

A review of the literature generally shows large variations in body image dissatisfaction among students of ranging from 5% to 87%. This both sexes, dissatisfaction resulted from students' contacts with social and normal media, and were associated with low self-esteem, more often related to the female gender. Relatively fewer studies have been conducted on the differences between objective and reported height, body weight and BMI values among students. They were the subject of national and international research mainly due to the psychological and social instability accompanying this age group and the specificity of functioning in the university environment [29].

The research on the level of body image dissatisfaction among students of specific faculties is very inspiring. It seems especially important to monitor dissatisfaction and disturbed body perception among students who will be professionals responsible for the promotion and enhancement of public health in the future. This applies, for example, to students of physical education, nursing, physiotherapy, medicine [30].

As the presented research results show, the BMI assessment cannot be based solely on information obtained from self-assessment, because even athletes with perfect bodies make mistakes in this regard. In each case, a self-esteem that deviates from reality may result in, improper food choices and have serious health consequences. It is extremely important that future specialists responsible for the promotion and enhancement of public health (today's students of nursing, physical education, physiotherapy and medicine) were able to reliably examine and assess the level of their somatic development and how to take best care of their health. During their studies, they should be equipped with knowledge and practical skills in this field. This will guarantee the effectiveness of their work in the field of public health [31, 32].

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Conclusions

Comparison of the objective evaluation results of body weight by BMI and results of subjective evaluation regarding the body weight were compared vs. results evaluated by students. Subjective evaluated results very good met results obtained from BMI values. Corresponding error appeared negligible small. Statistical hypothesis regarding a common general population these two samples was accepted using pared T-test on the convincing level of significance.

Highlights

There were discovered the normal distribution of a body height and a body weight values in students of all the three specialities i.e. Nursing, Physio-therapeutics, and Physical Education ($p>0.05$) that made possible to apply methods of parametric statistics in elaboration of results of measurements and questioning.

BMI values of students in the Physical Education students appeared greater (22.9 ± 2.6) than corresponding values in the Nursing (22.2 ± 3.7) and in the Physio-therapeutics students (22.6 ± 3.2). However, these differences were not significant.

The interclass correlation between results of subjective and objective evaluation in the group of the Physical Education students appeared rather weaker ($r=0.164$, $p=0.058$) comparatively with two others groups ($r=0.337\div0.451$, $p<0.001$).

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Conflict of interest

The authors declare no conflict of interest.

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