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VALIDITY OF SELF-REPORTED DIETARY INTAKES IN YOUNG MEN AND WOMEN WITH DIFFERENT PHYSICAL ACTIVITY

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Abstract

Introduction: A particular problem of self-reported dietary records is widespread under-reporting of energy intake regardless of the dietary assessment methods. However, under-reporting of dietary intakes in the Polish population has not been studied.

Aim of the study: This study was undertaken to determine the validity of self-reports in young sedentary and active male and female students.

Methods: A total of 111 students (56 males and 55 females) with physical activity about 30 min per day were classified as sedentary (Group S). Subjects with physical activity at least 1 h per day (129 males and 120 females) were classified as active (Group A). The subjects' macronutrient intake was briefly assessed from 24 h food records taken over 4 non-consecutive days and analyzed using computer program FOOD 2. The basal metabolic rate (BMR) was calculated from body fat and lean body mass and energy intake (EI) to BMR ratio was calculated to identify the under-reporters.

Results: In sedentary subjects the percent of under-reporters did not differ with respect to sex. In active subjects the percent of under-reporters was markedly higher in women than in men (P<0.001). The percent of under-reporters in active men was significantly higher vs. their sedentary counterparts (P<0.04). Moreover, in active women the percent of under-reporters was markedly higher than in all other groups (P<0.001). In sedentary women self-reported daily energy intake was significantly and inversely related to body fat (P<0.001). In active men the tendency (P<0.07) to lower self-reported energy intake with increasing body fat was noted. In contrast, neither in sedentary men nor in active women was self-reported energy intake associated with body fat.

Conclusions: Our data indicate that physical activity has an adverse effect on the validity of self-reported dietary intake, especially in women. Increasing body fat stores adversely affected self-reports in sedentary women and active men. In sedentary men and active women other factors than body fat seem to affect under-reporting.

***Key words**: under-reporting, energy intake, physical activity, gender*

Introduction

Numerous data have demonstrated that dietary habits have a pronounced influence on health affecting the risk of many diseases [1, 2]. For this reason in many studies an assessment of dietary habits is common, and the primary measure of usual daily intake is self-reporting [3, 4]. However, a particular problem of self-reported dietary records is widespread under-reporting of energy intake regardless of the dietary assessment methods [5].

The reasons of under-reporting have been thoroughly studied and many factors were recognized to contribute to this phenomenon. In general many studies have demonstrated that females, older people, obese persons and male smokers provide less valid dietary reports than males, young and lean people and male non-smokers [6-8].

Furthermore, regardless the gender, the degree of under-reporting of energy intake increases with increasing dietary restrictions. This indicates that the degree of under-reporting increases with decreasing food intake. [9]. It is well known that females are more prone than males to overestimate their weight and body fat [10, 11]. Additionally, female perception of body shape places pressure on them to lose weight and in consequence, females are at greater risk of restrained eating, which in turn contributes to false self-reported dietary intakes [12].

However, the importance of the education level, social desirability and socioeconomic status in under-reporting has also been underlined [13, 14]. Moreover, personality traits such as body image together with obesity have been suggested as the best predictors of under-reporting [15]. It is worth noting that in the western world there is an increasing focus on body image especially in adolescents and young adults. Pelegrini and Petroski [16] noted that 65.5% of adolescents were dissatisfied with their body image, 48.4%

of girls wished to reduce body fat and 51.3% of boys wished to increase body size. According to El Ansari et al. [17] about 40% of male and 60% of female UK students considered themselves as too fat. Similarly, Polish adolescents and youths perceive their body mass inadequately to reality and are critical of their appearance [18, 19]. Thus, they are at high risk of under-reporting.

Another factor possibly contributing to under-reporting is physical activity, but data on this issue are scarce. Briefel et al. [20] have noted that the percent of under-reporters tends to be higher in subjects with high physical activity vs. less active ones. Similarly, Jones et al. [21] have found that highly active participants markedly under-report their daily energy intakes. Rasmussen et al. [22] has found that under-reporting of energy intake is more frequent in subjects who over-reported activity energy expenditure. The above data suggest a relationship between self-reports of both food consumption and activity level.

Dietary habits from self-reports of Polish adolescents and young adults were thoroughly studied indicating their similarity to those of general Polish population with excess of saturated fat and protein and inadequate carbohydrate intake but also with inadequate consumption of selected micronutrients [23, 24].

However, according to our best knowledge there are no studies concerning the validity of self-reported dietary habits of Polish youth. Thus, this study was undertaken to determine dietary habits from self-reports and to evaluate their validity in young sedentary and active male and female students.

Materials and methods

Subjects

Subjects were recruited on the basis of advertisements in student dormitories and by word of mouth. All the prospective participants were healthy non-smokers, not taking any medication on a regular basis. Further selection for the study was based on the participants' physical activity.

Physical activity

All prospective subjects were asked to provide precise reports of their weekly physical activity. The active group accepted for participation (Group A) consisted of 129 male and 120 female physical education students engaged in obligatory sport activities due to study program, but also participating in optional activities such as games, swimming and martial arts. However, none of them were high performance athletes.

Sedentary participants (Group S) were selected from another field of studies and were engaged exclusively in obligatory physical education classes of games and gymnastics and consisted of 56 males and 55 females. Thus, a total of 360 students were accepted for further studies. They were informed about the study protocol and gave their written consent prior to participation. In all subjects weight and height were measured and body fat was determined using the bioelectrical impedance method and BC 418 MA equipment (Tanita Co., Japan). Inter and intra-assay coefficients of variation for body fat measurements did not exceed 2 %. The study protocol was approved by the Ethics Commission at the University of Physical Education.

Dietary records

All participants were asked to follow their habitual diet throughout the study. None of the participants declared intentional dieting. Their macronutrient intake was briefly assessed from 24 h food records taken over 4 non-consecutive days and analyzed using computer program FOOD 2. A set of pictures of meals and foods were shown to the subjects by an experienced interviewers using the Album of Photographs of Food Products and Meals. The household measures of food intake were converted into gram weights. An interviewer assigned codes to the food reported by the subjects and performed computer analysis. Both the album and the computer program were purchased from the National Food and Nutrition Institute in Warsaw.

Calculation of basal metabolic rate and reliability of dietary intake

Basal metabolic rate (BMR) was calculated from body fat and lean body mass according to Graby et al. [25] and following formula:

$$BMR\ (kJ) = [26.88 \times \text{body fat (kg)}] + [116.76 \times \text{LBM (kg)}]$$

and expressed in calories.

To identify the under-reporters a cut-off points of energy intake to BMR ratio (EI/BMR) lower than 1.4 and 1.75 were used for sedentary and active subjects, respectively (26). Values of EI/BMR higher than 2.4 was used to identify over reporters.

Statistical analysis

Data distribution was evaluated using the Shapiro-Wilk test. One-way analysis of variance and the post-hoc Tukey test were used to compare data with normal distribution. For comparison of skewed data Kruskal-Wallis and Mann-Whitney tests were used. Spearman rank correlations between daily energy intake and the percent of body fat were also calculated. The comparison of the percent of under reporters between groups was performed using the χ^2 test. Data are presented as means ± SD. Significance was set at $P<0.05$. All calculations were performed using Statistica v.7.1 (Statsoft, USA).

Results

The subjects' characteristics are presented in Table 1. Weekly physical activity of active subjects (Group A) was markedly higher than in sedentary ones (Group S) (≤ 3 h vs. ≥ 7.0 h, respectively). Regardless of sex, physically active subjects were characterized by lower body fat and higher lean body mass.

In active men daily energy intake was markedly higher than in their sedentary counterparts ($P<0.04$) (Table 2). There were no differences in energy intake between sedentary and active women. The percentage of energy derived from protein, fat and carbohydrates was similar in all groups. However, protein, fat and carbohydrate intake per kilogram of body mass in females

Table 1. *Anthropometric characteristics of young men and women with different physical activity*

	Group S (n=111)		Group A (n=249)	
	Men (n=56)	Women (n=55)	Men (n=129)	Women (n=120)
Age (years)	21.0 ± 1.0	21.0 ± 1.4	20.5 ± 1.5	20.6 ± 1.2
Body mass (kg)	74.0 ± 9.0	60.5 ± 7.5	77.5 ± 9,1	60.7 ± 7.6
Body height (cm)	181.0 ± 6.0	167.5 ± 5.5	181.0 ± 6.5	168.2 ± 6.2
Fat (%)	16.4 ± 4.9	29.7 ± 7.1^	13.5 ± 4.3*	23.1 ± 4.2*,^
Fat (kg)	12.1 ± 4.1	18.0 ± 5.4^	10.5 ± 4.3*	14.0 ± 4.0*,^
LBM (kg)[&]	61.9 ± 11.5	42.5 ± 5.8^	67.0 ± 6.6*	46.7 ± 4.6*,^
Activity (h/week)	≤3.0	≤3.0	≥7.0	≥7.0

[&]Lean body mass; Group S – sedentary subjects; Group A – active subjects; * $P<0.001$ – statistically lower vs. sedentary subjects; ^$P<0.001$ – statistically higher vs. males

Table 2. *Energy and macronutrient daily intakes, calculated BMR and EI to BMR ratio in young men and women with different physical activity*

	Group S (n=111)		Group A (n=249)	
	Men (n=56)	Women (n=55)	Men (n=129)	Women (n=120)
Energy (kcal/day)	2545 ± 696	1725 ± 508	2875 ± 689*	1727 ± 476
Protein (g)	85.0 ± 24.2	57.3 ± 19.5	100.7 ± 29.1	63.3 ± 16.8
%	13 ± 2	14 ± 3	14 ± 3	15 ± 3
Protein (g/kg)	1.1 ± 0.3	0.9 ± 0.4**	1.3 ± 0.3^	1.0 ± 0.3**
Fat (g)	105.0 ± 39.7	69.5 ± 25.7	119.0 ± 34.4	69.5 ± 24.8
%	37 ± 6	35 ± 6	37 ± 5	36 ± 6
Fat (g/kg)	1.4 ± 0.5	1.1 ± 0.5**	1.5 ± 0.4	1.1 ± 0.3**
Carbohydrates (g)	319.8 ± 85.6	230.2 ± 67.8	350.3 ± 99.6	227.7 ± 67.6
%	50 ± 6	51 ± 7	49 ± 7	49 ± 6
Carbohydrates (g/kg)	4.3 ± 1.2	3.8 ± 1.3**	4.5 ± 1.2	3.8 ± 1.2**
BMR (kcal)[#]	1805 ± 219	1302 ± 164**	1937 ± 197^	1350 ± 134**
EI/BMR[$]	1.41 ± 0.40	1.32 ± 0.41**	1.48 ± 0.38	1.27 ± 0.37**

Group S – sedentary subjects; Group A – active subjects; [#] – calculated basal metabolic rate; [$] – energy intake to basal metabolic rate ratio; *$P<0.04$ – statistically higher vs. sedentary men; **$P<0.002$ – statistically lower vs. respective groups of men; ^$P<0.007$ – statistically higher vs. sedentary men

Table 3. *Frequency of under-and over reporters among young men and women with different physical activity*

	Under-reporters		Over-reporters	
	n	%	n	%
Group S				
Men (n=56)	34	60.7	-	-
Women (n=55)	31	56.4	1	1.8
Group A				
Men (n=129)	98	75.9*	3	2.3
Women (n=120)	107	89.2**	2	1.7

Group S – sedentary subjects; Group A – active subjects; * $P<0.04$ significantly higher vs. sedentary men; ** $P<0.001$ – statistically higher vs. all other groups

Table 4. *Correlation coefficients between daily energy intake and body fat in young men and women with different physical activity*

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Sedentary	
Men (*n*=56)	0.124
Women (*n*=55)	-0.430*
Active	
Men (*n*=129)	-0.163^
Women (*n*=120)	-0.100

*$P<0.001$; ^$P<0.07$

was markedly lower than in males of matched physical activity ($P<0.002$). In addition, in active men protein intake per kilogram of body mass was significantly ($P<0.007$) higher than in sedentary ones. Despite sex calculated BMR in active subjects was significantly higher than in sedentary counterparts ($P<0.007$ and $P<0.03$ for males and females, respectively).

In sedentary subjects the percent of under-reporters did not differ with respect to sex (Table 3). In active subjects the percent of under-reporters was markedly higher in women than in men ($P<0.001$). Despite sex the percent of under-reporters in active subjects was significantly higher vs their sedentary counterparts ($P<0.001$). Only a few over-reporters were observed in all groups.

In sedentary women self-reported daily energy intake was significantly and inversely related to body fat ($P<0.001$) (Table 4). In active men the tendency ($P<0.07$) to lower self-reported energy intake with increasing body fat was noted. In contrast, neither in sedentary men nor in active women was self-reported energy intake associated with body fat.

Discussion

Anthropometric characteristics and dietary habits of the participants of the current study were close to those reported previously in male and female sedentary and active students [27].

In sedentary men and women the mean daily energy intake was adequate and covered 98.8% and 90.7% of the recommended intake, respectively [26]. Thus, it could be tentatively postulated that neither sedentary men nor women were focused on intentional caloric restriction. In active subjects the mean daily energy intake covered 85.8% and 71.9% of recommended intake in men and women, respectively. In consequence, exclusively in active women dieting had to be taken into consideration. However, our unpublished data have indicated that despite low self-reported caloric intake in active females their body mass is stable during one a year period suggesting intentional under-reporting.

Excessive fat and protein intake and inadequate carbohydrate consumption in our subjects indicate that their dietary habits were close to those characteristics for general Polish population [28].

In sedentary and active participants both protein and fat intake per kilogram of body mass were higher than recommended [29, 30]. Sedentary men consumed an adequate amount of carbohydrates per kilogram of body mass but in sedentary women daily carbohydrate intake relative to body mass was close to the lower limit (3-5 g/kg). Both in sedentary men and women daily carbohydrate consumption in relation to body mass was lower than recommended.

Calculated BMR in sedentary men and women was close to that reported by others in young subjects [31, 32]. Similarly, BMR of active men and women was close to that reported by Gillat-Wimberly and Melby et al. [33, 34] in active subjects. In addition, higher BMR in active than in sedentary subjects is in agreement with many studies due to markedly higher lean body mass in the former than in the latter [35].

Our study revealed that in sedentary subjects the percent of under-reporters did not differ with respect to sex. This finding is in contrast with some other data which indicated more frequent under-reporting in female than in male subjects [36, 37]. However, it should be stressed that data concerning sex-related differences in under-reporting are controversial indicating lower, higher, or similar percent of under reporters in females than in males [36, 38, 39].

The above discrepancies reflect a complex and confounding nature of underreporting which according to Macdiarmid and Blundel [40] may be intentional, unintentional or reflecting the changes in dietary habits at the moment of the study.

Interestingly, exclusively in sedentary women the reported daily energy intake was significantly and inversely related to body fat as was also found by others [41]. Thus, the reasons of under-reporting in sedentary men are possibly of different nature. It could not be excluded that male under-reporting was due to limited knowledge about healthy diet and poor dietary habits [42].

Our data confirmed that physical activity had a pronounced and adverse effect on the validity of self-reported dietary habits as was postulated earlier by others [20-22]. In consequence, regardless of sex the percentage of under-reporters in active subjects was much higher than in sedentary ones with significantly less valid self-reports in women than in men.

Surprisingly, in active men reported daily energy intake tended to decrease with increasing body fat. Thus, taking into account low body fat and high lean body mass in this group it could be tentatively postulated that their body image was distorted contributing to underreporting but also to under-eating as was suggested by Yager and O'Dea [43] in young men.

In contrast, body fat content did not influence daily energy intake in active women, who were characterized by a very high percentage of under-reporters, even higher than the 68% noted by Okubo and Sasaki [44] in young lean Japanese women.

Nonetheless, it should be noted that a high percentage of under-reporters in active females of our study probably reflects both under-reporting and under-eating. It is well documented that dieting is common in young women with a high percentage of restrained eating in active ones [45, 46]. However, the diagnosis of under-eating in females is difficult since their body fat stores are protected as a consequence of depressed BMR [47]. Thus, to recognize under-eating more precise evaluation of BMR, physical activity and water balance are needed [48].

Summing up, according to our best knowledge this study is the first which evaluated under-reporting of energy intake in Polish young men and women with different physical activity. However, our study has several limitations such as calculation, not determination of BMR and expression of physical activity in hours, without calculation of energy expenditure. Despite that, it clearly demonstrates the need for careful interpretation of self-reported dietary habits in young people.

Conclusions

1. Under-reporting of dietary intakes is common in young Polish men and women
2. Physical activity has an adverse effect on the validity of self-reported dietary intakes especially in women
3. In sedentary women and active men under-reporting is affected by increasing body fat stores
4. In sedentary men and active women other factors than body fat seem to affect under-reporting. In sedentary men poor knowledge, but in active women – intentional under-eating have to be taken into consideration as a possible reason for under-reporting

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