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Past and Current Body Size Affect Validity of Reported Energy Intake among Middle-Aged Danish Men[1–3]

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Abstract

Our objectives were to estimate the degree of misreporting energy intake (EI) and analyze associations with previous BMI, current BMI, or both. The study was part of the Adiposity and Genetics Study follow-up study including 309 Danish men (age 40–65 y) originally sampled from the obligatory draft board examination. Height and weight were measured at the mean ages of 20 (draft board), 33, 44, and 49 y (current age). Obesity was categorized as BMI $\geq$ 31 kg/m^2. Dietary intake for 7 d and physical activity (PA) level (PAL) were self-reported. Resting metabolic rate (RMR) was measured in a ventilated hood system. By comparing EI with energy expenditure and assuming energy balance, reporting accuracy (RA) was estimated as EI/(RMR·PAL). A plausibility interval was calculated to encompass specific variation components of EI, RMR, and PAL; the specific 95% plausibility interval was 1.00 ± 0.35. Participants were categorized as underreporters (RA $\leq$ 0.65), plausible reporters (0.65 $<$ RA $\leq$ 1.35), or overreporters (RA $>$ 1.35) of EI. The relation between RA and BMI was studied through linear regression analysis. Overall, the RA was (mean ± SE) 0.76 ± 0.01. Of 309 participants, 35% underreported and 7% overreported. Whether stratified for current BMI or draft board BMI, the obese men were more likely to underreport than those who were not obese. Among those currently not obese, underreporting was more prevalent among those who were obese at the draft board examination (44%) than among those who were not (21%). Regression analysis showed that both previous and current BMI and their combination were significantly associated with RA. Thus, underreporting of dietary intake seems to be associated with not only current BMI but also with current BMI in combination with previous BMI. J. Nutr. 139: 2337–2343, 2009.

Introduction

Habitual total energy intake (EI)[8] is difficult to assess, and both random and systematic errors are inherent in any method. Former studies have shown that obese participants tend to underreport EI more so than participants who are not obese and that the degree of underreporting is directly associated with weight status (1–4), although not all studies have found these associations (5). Other aspects like age, gender, health consciousness, and socioeconomic status have shown inconsistent associations to misreporting (1,5,6). Participant characteristics might influence how the amount of food and meals eaten is estimated. For example, long-term maintenance of weight loss has been found to be associated with restrained eating (7,8), which has been associated to dietary misreporting (2,6,9). Having a predisposition for obesity might be linked to a perceptual omission or underestimation of foods eaten and lead to a low reported EI. One aspect not considered so far is the importance of body size in youth for the accuracy of dietary reporting later in life.

Further knowledge of errors to be aware of when using specific dietary methods in particular settings and among particular populations is needed. The aim of the current study was therefore to estimate the degree of misreporting of EI in a population of middle-aged Danish men representing a broad

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[3] Supplemental Table 1 is available with the online posting of this paper at jn.nutrition.org.

[8] Abbreviations used: ADIGEN, The Adiposity and Genetics Study; BMR, basal metabolic rate; CV$_W$, intraindividual (within-subject) CV; CV$_B$, interindividual (between-subject) CV; E%, percent of energy; EE, energy expenditure; EI, energy intake; PA, physical activity; PAL, physical activity level; RA, reporting accuracy; RMR, resting metabolic rate; S-20, draft board examination conducted at a mean age of 20 y; S-33, follow-up conducted at a mean age of 33 y; S-44, follow-up conducted at a mean age of 44 y.

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range of BMI and to analyze whether such misreporting is associated with previous BMI, present BMI, or with both.

Methods

Study population. The present study is based on a 3rd follow-up study among Danish men who initially were manually identified from records from the mandatory draft board examination of 360,000 Danish men, which took place shortly after age 18 y (mean age, 20 y; range, 18–31 y).

The cohort was originally sampled as all obese draftees (selected as those exceeding 35% overweight by a national standard in use at the time, which corresponded to BMI $\geq$ 31 kg/m^2) plus a 1% random sample of all draftees to obtain a study population representing the broad range of BMI (10,11). The participants lived in Eastern Denmark, i.e. mainly Sjaelland, Falster, and Lolland. One-half of the random sample and all in the obese sample still alive and living in the area were invited for follow-up examinations in 1982–1984 (Survey S-33, mean age 33 y, range 23–48 y) and 1992–1994 (Survey S-44, mean age 44 y, range 34–60 y) (12,13). The Adiposity and Genetics (ADIGEN) study was the 3rd follow-up. It was conducted in 1998–2000 with those participating in S-44 who were $<$65 y and with no self-reported illness or regular medication. The participation rate was 42% (323 of 764 invited) in the random sample and 34% (234 of 692 invited) in the obese sample (12,13). A dietary assessment was included; 232 participants from the random sample and 161 participants from the obese sample reported dietary intake. In the present study, we excluded 18 participants from the original random sample and 47 participants from the original obese sample who reported to be on a weight-loss program, formula diet, and/or taking slimming pills. Furthermore, data were reduced to 204 participants from the original random sample and 105 participants from the original obese sample due to lack of complete information on other variables [resting metabolic rate (RMR) n = 3; physical activity (PA) level (PAL) n = 16].

The study was approved by the ethical committees for Frederiksberg and Copenhagen and was in accordance with the guidelines of the second Helsinki Declaration. All participants signed a written consent before participating in the study (14).

Dietary intake. In ADIGEN, dietary intake was assessed with an estimated 7-d dietary record method comprehensively described elsewhere (15,16). The National Food Agency previously validated the method for reported protein intake with the 24-h urinary nitrogen method and found a general 10% underreporting of protein intake; no analysis of the misreporting of protein intake in relation to weight status was included (16).

Participants were carefully instructed to fill in the dietary records for 7 consecutive days. The preprinted questionnaires were chronologically divided into sections for food consumed for every meal and in-between snacks. The preprinted options of food items, dishes, and beverages commonly consumed were complemented by an open answer option. Portion sizes were given in common household measures, but specific types of foods (rice, pasta, vegetables) or meals (mixed dish, mixed salad, raw food) were quantified using a photo-sequence of 4 portion sizes. Also, the amount of fat spread on a slice of rye or wheat bread was quantified using photos (17). Furthermore, participants completed an additional questionnaire with details on use of household fats (frequency, type, and amount) and use of milk, cream, and sugar in coffee and tea. Finally, participants were asked to state whether in the week of recording their dietary intake they had been eating as usual, a little differently from usual, or a lot differently from usual. Dietary data were computerized twice and any discrepancy was adjusted. Nutrient calculation of dietary intake was assessed using SAS 9.1 (SAS Institute) by combining reported food intake with standard portion sizes, subtraction of loss of water and fat during cooking (15), and nutrient composition based on the Danish Food Composition tables from 1996 (18). All extreme numbers of portions were compared with the number in the original dietary record to check for data entry error. In total, 10 errors were corrected. In addition, the original dietary records for 10 randomly selected participants (registrations for all 7 d) were compared with the electronic files. Only 1 discrepancy between the registration and the file for the 70 records was detected. Thus, a good agreement between the reported and computerized dietary intake for all participants was assumed.

Anthropometric measurements. At the draft board examination (S-20), participants' height and weight were measured (10). At S-33 and S-44, participants were weighed and measured wearing light indoor clothes and no shoes. Weight was measured to the nearest decimal (0.1 kg) and height to the nearest 0.5 cm (10,19). In ADIGEN, participants were weighed to the nearest 0.05 kg on an electronic scale (Lindelltronic 8000, Lindell AB) in their underwear and after voiding (12). Height was measured without shoes to the nearest 0.5 cm with the participant standing against a wall-mounted stadiometer (Hultafors) with feet together and head in the horizontal plane.

BMI was calculated as kg/m^2. Obesity was defined as BMI $\geq$ 31 kg/m^2 as for the original sampling criteria.

RMR. In ADIGEN, participants were instructed to eat a minimum of 150 g carbohydrates each of the last 3 d before examination, to avoid vigorous activity the day before and the day of examination, and to fast 12 h overnight before RMR was estimated with indirect calorimetry using a ventilated hood system (Jaeger Oxycon Champion, software version 4.3, Jaeger, Mijnhardt) (12). The measurement period was 35 min, of which the measurement recorded between 10 and 30 min was used for analysis. During measurement, participants rested on a couch but were not allowed to sleep and the room was kept quiet, calm, well ventilated, and at a comfortable temperature (12). The intraindividual CV (CV$_W$) of RMR (kJ/d) in men has been estimated to 3.6% when using similar equipment (20).

Questionnaire. In ADIGEN, participants gave answers to a self-administered questionnaire the week before the physical examinations. The questionnaire included 35 questions with additional subquestions.

For the assessment of PAL, participants were asked to state their PA during work as: *1*) mostly sitting (e.g. deskwork); *2*) sitting or standing, some walking (e.g. shop assistant, teacher); *3*) walking, some lifting (e.g. mailman, caregivers); *4*) heavy work (e.g. furniture remover, pavement constructor); and during leisure time as: *1*) almost totally physical inactive, or light PA $<$ 2 h/wk (e.g. reading, TV, cinema); *2*) light PA from 2 to 4 h/wk (e.g. strolling, cycle riding, light gardening, light keep-fit exercising); *3*) light PA $>$ 4 h/wk or 2–4 h/wk of more strenuous PA (e.g.

TABLE 1 Reported dietary intakes, their variance, and their variation in 2064 dietary records of 309 Danish men[1,2]

		VAR$_B$	VAR$_{day}$	VAR$_{week}$	VAR$_W$	CV$_B$	CV$_{day}$	CV$_{week}$	CV$_w$
Energy, *MJ/d*	10 (10 ± 4)	5	1.1	0.1	8	22	10	4	28
Protein, *g/d*	88 (93 ± 38)	390	54	12	1000	21	8	4	34
Carbohydrate, *g/d*	253 (267 ± 104)	5800	95	5	4900	28	4	1	26
Fat, *g/d*	83 (90 ± 43)	580	88	8	1200	27	10	3	39

[1] Values are median (mean ± SD), n = 309.

[2] VAR, variance; VAR$_B$, interindividual variance; VAR$_{day}$, day-to-day variance; VAR$_{week}$, weekend-to-weekdays variance; VAR$_W$, intraindividual variance; CV$_{day}$, day-to-day CV; CV$_{week}$, weekend-to-weekdays CV.

TABLE 2 Frequency of plausible, under-, and overreporters of EI stratified by S-20 BMI and current BMI among 309 Danish men

		S-20 BMI < 31 kg/m², n = 204			S-20 BMI ≥ 31 kg/m², n = 105		
Current BMI	n	UR[1]	PR	OR	UR	PR	OR
		n (%)					
BMI < 31 kg/m²	221	41 (21)	146 (75)	7 (4)	12 (44)	15 (56)	—
BMI ≥ 31 kg/m²	88	2 (20)	8 (80)	—	52 (67)	26 (33)	—
All	309	43 (21)	154 (75)	7 (3)	64 (61)	41 (39)	—

[1] UR, Underreporter, PR, plausible reporter, OR, overreporter.

fast walking and/or fast cycle riding, heavy gardening, heavy keep-fit exercises that make an individual sweat and short of breath); *4*) strenuous PA > 4 h/wk or regular heavy exercise (possibly competitive sports) several times per week. We assigned each combination of work and leisure time PA a PAL value as suggested by the Danish National Food Agency (16) modified from Black (21). Unemployed participants were assigned a PAL value according to reported leisure time PA (**Supplemental Table 1**).

For smoking habits, questions included whether the participants had smoked regularly or had stopped smoking since the last survey (S-44), how often the participant smoked, and how many cigarettes, cigars, or pipe tobacco were smoked or had been smoked per day. We combined these questions to create a single categorical variable for use in our analyses. The variable had 3 levels: nonsmoker, former smoker, and current smoker.

Participants were asked to state the names of medications, dosage, and frequency. Participants who reported using diet or slimming pills were excluded from the final analyses.

Participants were asked to report whether they currently were or were not on a weight-loss diet. Those who responded "no" were retained in the final analyses.

Statistical analysis

Data are presented as mean ± SE. For all tests, $P < 0.05$ was considered significant. All statistical analysis was performed using SAS 9.1 (SAS Institute).

Variation in reported dietary intake. We estimated the intraindividual (within-subject) CV (CV_W), interindividual (between-subject) CV (CV_B), day-to-day CV, as well as weekend-to-weekdays CV; we defined weekend days as Friday, Saturday, and Sunday. We used the SAS procedure VARCOMP for the calculations with dietary intake (EI, protein, carbohydrate, fat) as dependent variable and each of the variance components as independent random variables. Dividing participants into groups of obesity or according to reporting status (see below) resulted in groups that were too small to calculate the components of variance; therefore, the analysis was based on the total group of participants.

Evaluation of reported EI. Evaluation of reported EI is based on the assumption of energy balance, i.e. EI equals energy expenditure when body weight and the distribution of body compartments are stable (1,21). Thus, we evaluated the individual reporting accuracy (RA) as reported EI relative to estimated energy requirement, and the limit of plausibility for RA was calculated using the Goldberg equation as restated by Black (21). This method takes into account the mean CV of the CV_w for daily EI [$CV(EI)_w$ = 23%], basal metabolic rate (BMR) [$CV(BMR)_w$ = 4%], and PAL [$CV(PAL)_w$ = 15%], plus the number of days of dietary assessment (n = 7) (21). As the limits of plausibility are used for identification of misreporters of EI, we cannot use the $CV(EI)_w$ of the current study in the formula, because the potential misreporting of EI might influence this. In the calculation, we used measured RMR instead of a predicted measure of BMR (21) and PAL estimated from self-report. Further, to investigate the possibility of a bias from self-reported PA, we calculated RA using the PAL of males aged 40–64 y of 1.64 (21). The 95% limits of plausibility for RA were RA = EI/(RMR·PAL) = 1 ± 0.35.

Participants with RA in the given interval were called plausible reporters (0.65 < RA ≤ 1.35), whereas other participants were labeled misreporters. Misreporters with a ratio below limits of plausibility were underreporters (RA ≤ 0.65) and those with a ratio above were overreporters (RA > 1.35).

We stratified participants by reporting status (under-, plausible-, and overreporters), calculated mean values of various participant characteristics for each level of reporting status, and performed 1-way ANOVA to test for differences in means between groups of reporting status. In addition, we calculated the frequency of reporting status for stratified participant characteristics and used Fischer's exact test to determine whether the distribution in reporting status differed among levels of each stratified variable.

Mean RA, calculated for the combined variable comprised of 5 levels for current BMI and 5 levels for draft board (S-20) BMI, is presented graphically (Fig. 2).

Regression analysis. Further, we evaluated the relation between RA and BMI described as a continuous linear function using regression analysis. We transformed RA by the square root to obtain normally distributed residuals. The square root of RA was regressed as a function of previous (S-20, S-33, or S-44 BMI) and current BMI analyzed separately. Furthermore, we studied if RA was explained by an interaction between previous and current BMI by multiple regression analysis with the square root of RA regressed as a function of current BMI, previous BMI, and their interaction. Age was included in the regression analyses but was not significantly associated with the square root of RA in any of the analyses and results are thus not shown.

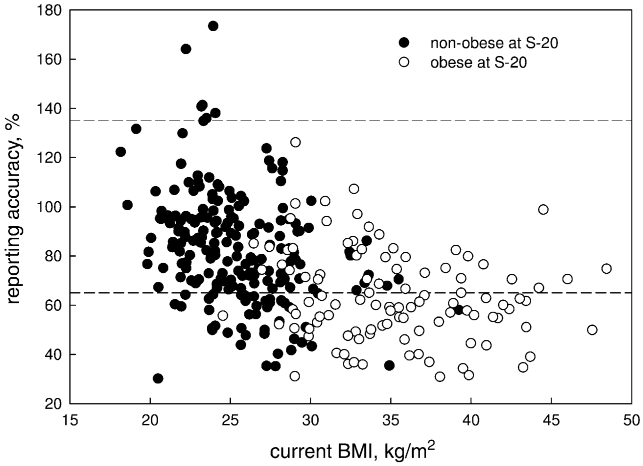

FIGURE 1 Current BMI compared with RA among 309 Danish men, stratified by obesity at S-20. Dashed lines are the 95% confidence limits for plausible energy reporting. Thus, plausible reporting is in-between lines, and over- and under-reporting above and below lines.

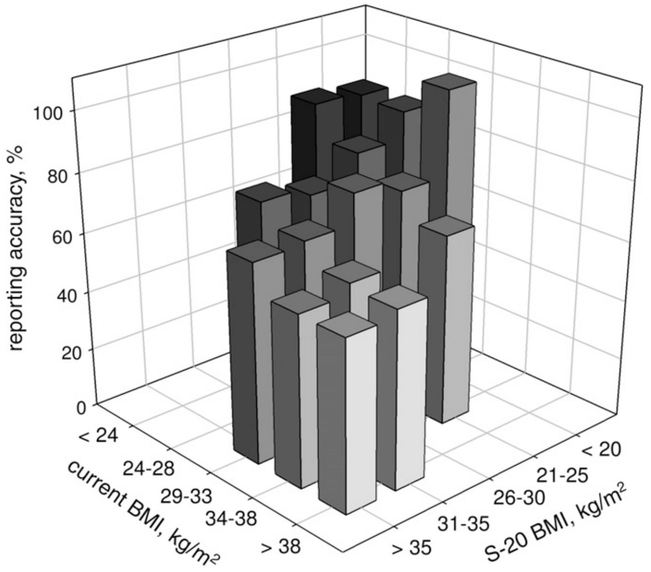

FIGURE 2 RA in relation to current and previous (S-20) BMI among 309 Danish men.

Results

Variation in reported dietary intake. Intra- and interindividual CV contributed most to the total variation in reported dietary intake, whereas the variation from day-to-day and weekdays-to-weekend days was small. The largest variation in macronutrient intake was that of carbohydrate (**Table 1**).

TABLE 3 Age, anthropometrics, and dietary intake for 309 Danish men stratified by reporting status[1]

	UR[2]	PR	OR
n	107	195	7
RA, *%*	52.2 ± 9.6^{c}	86.6 ± 14.6^{b}	146.9 ± 15.3^{a}
Age, *y*	48.9 ± 5.8	49.4 ± 6.3	49.9 ± 5.8
Weight, *kg*	102.0 ± 20.9^{a}	86.7 ± 18.7^{b}	75.6 ± 3.6^{b}
Height, *m*	1.78 ± 0.06	1.79 ± 0.06	1.80 ± 0.03
RMR, *MJ/d*	1.3 ± 1.3^{a}	7.5 ± 1.2^{b}	6.7 ± 0.03^{b}
PAL	1.9 ± 0.2^{a}	1.8 ± 0.2^{b}	1.5 ± 0.2^{c}
BMI, *kg/m²*			
Current	32.2 ± 6.1^{a}	27.0 ± 5.4^{b}	23.4 ± 0.6^{b}
S-20	28.6 ± 5.7^{a}	23.6 ± 5.3^{b}	21.2 ± 1.0^{b}
S-33	29.4 ± 5.2^{a}	25.2 ± 4.3^{b}	22.0 ± 1.1^{b}
S-44	31.5 ± 5.6^{a}	26.7 ± 5.6^{b}	23.0 ± 0.5^{b}
Dietary intake			
EI, *MJ/d*	8.5 ± 2.1^{c}	11.2 ± 2.1^{b}	15.1 ± 2.1^{a}
Protein,[3] *E%*	16.1 ± 2.6^{a}	15.1 ± 2.2^{b}	$15.2 \pm 2.6^{a,b}$
Fat, *E%*	31.8 ± 4.7^{b}	33.4 ± 4.7^{a}	$34.8 \pm 2.7^{a,b}$
Carbohydrate, *E%*	44.1 ± 6.6	43.4 ± 6.8	42.9 ± 7.1
Alcohol, *E%*	8.0 ± 7.2	8.1 ± 6.4	7.1 ± 4.4
Dietary fiber, *g/d*	19 ± 6^{c}	23 ± 7^{b}	32 ± 9^{a}
Sugar, *E%*	5.8 ± 5.8^{b}	7.3 ± 4.8^{a}	$7.4 \pm 4.7^{a,b}$
SFA, *E%*	13.1 ± 2.3^{c}	14.0 ± 2.5^{b}	$14.9 \pm 1.2^{a,b}$

[1] Values are means ± SD. Means in a row with superscripts without a common letter differ, $P < 0.05$.

[2] UR, Underreporter, PR, plausible reporter, OR, overreporter.

[3] E%, percent of energy.

Evaluation of reported EI. The overall mean RA was 0.76 ± 0.01. It differed between participants who were not obese (0.83 ± 0.02) and those who were obese (0.63 ± 0.02) at the draft board examination (P <0.001, t test).

In total, 195 of 309 participants (63%) reported a plausible EI, whereas 107 underreported (35%), and 7 participants overreported (2%). Among participants who were obese at draft board, more of the currently obese men underreported than men who were not currently obese, but the frequency of underreporting was still more than twice that of the participants who were not obese at the draft board examination (**Table 2**; **Fig. 1**). Thus, regardless of current obesity, participants who were obese at the draft board examination were more likely to underreport than participants who were not obese at the draft board examination. In addition, the RA tended to be lower with increasing level of the combined variables of current and draft board BMI (**Fig. 2**).

Participants were categorized according to reporting status (**Tables 3** and **4**). Previous and current BMI differed significantly between the underreporters and others as did reported intakes of protein, total fat, dietary fiber, sugar, and saturated fat (Table 3).

The number of underreporters, plausible reporters, and overreporters differed when they were categorized by PA during work and tended to differ (P = 0.05) between those reporting to be eating as usual and those reporting not to be eating as usual during the period of dietary reporting. However, there were no

TABLE 4 Frequency of plausible-, under-, and overreporters of EI categorized by selected stratified variables among 309 Danish men

Descriptive variables	*n*	UR[1]	PR	OR	*P*-value[2]
			%		
n	309	35	63	2	
Age, y	309				
40–49	171	37	61	2	0.80
50–54	84	35	62	4	
55–59	33	27	70	3	
60–65	21	29	71	—	
Reported dietary intake	225				
As usual	157	31	68	1	0.05[2]
Different than usual	68	34	59	7	
PA in leisure time	309				
Almost passive	28	32	61	7	0.45
Light activity, 2–4h	152	32	66	3	
Light activity, > 4h or medium 2–4h	115	39	60	1	
Hard activity	14	36	64	—	
PA during work	309				
Unemployed	28	21	79	—	—
Mostly sitting	92	23	71	7	<0.0001[3]
Sitting or standing	77	26	73	1	
Walking, some lifting	72	47	53	—	
Heavy work	40	65	35	—	
Smoking habits	309				
Nonsmoker	59	31	63	7	0.11
Former smoker	169	35	65	1	
Smoker	81	37	60	2	

[1] UR, Underreporter, PR, plausible reporter, OR, overreporter.

[2] Fishers Exact Test.

[3] The association between the distribution of participants in reporting statuses (UR, PR, OR) and the stratified variable was significant.

differences according to age, PA in leisure time, or smoking habits (Table 4).

The number of underreporters increased directly with the level of PA during work. The number of misreporters was also higher among those reporting to be eating differently from usual (41%) than among those reporting to eat as usual (32%) (Table 4).

Regression analysis. Current BMI (**Table 5**) and previous BMI (S-44, S-33, and S-20 BMI) (data not shown) were inversely associated with the square root of RA. In multiple regression analysis, current BMI, previous BMI (S-44, S-33, or S-20 BMI), and their interaction were associated with the square root of RA (Table 5). Hence, regression analyses showed that the RA decreased with increasing current and previous BMI and was associated with their combination.

Using a fixed PAL for calculation of RA showed a similar pattern of misreporting of EI for stratified as well as regression analysis, indicating that a possible misreporting of PA did not substantially affect the results.

Discussion

The objective of this study was to determine the discrepancy between self-reported EI and estimated energy expenditure at the individual level among middle-aged Danish men and to discuss whether such misreporting was associated with previous body size, current body size, or both.

More than one-third of the participants underreported EI and those presently obese were more likely to underreport than those who were not obese. However, irrespective of current obesity, participants who were obese at the draft board examination were more likely to underreport than participants who were not obese at the draft board examination. RA was associated with the combination of current and previous BMI such that underreporting was not only a problem among the currently obese but was also dependent on past obesity.

The inverse association between current obesity and underreporting of EI is well established (1,22–27). We analyzed the association between current reporting of EI and previous BMI at 3 previous points in time.

Although we found that reporting to eat differently from usual during the dietary report period was related to reporting status, 32% of participants who reported to eat as usual were also categorized as misreporters of EI. Therefore, a participant's self-evaluation of having a 'usual' dietary intake did not clearly predict RA. Furthermore, and in agreement with results from a Danish validation study by Rasmussen et al. (28), age was not related to reporting status, whereas level of PA during work was, as the frequency of underreporters rose with higher levels of PA. Smoking was not related to RA, but Rasmussen et al. found nonsmokers underreported to a higher degree than smokers (28).

TABLE 5 Association between RA and current and previous BMI among 309 Danish men

	β	SE	P	R^2
Current BMI	−0.10	0.01	<0.0001	0.21
Current BMI	−0.21	0.06	0.001	0.25
BMI S-44	−0.25	0.06	<0.0001	
Interaction, Current × S-44	0.01	0.00	0.0007	
Current BMI	−0.25	0.07	0.0004	0.25
BMI S-33	−0.22	0.07	0.003	
Interaction, Current × S-33	0.01	0.00	0.007	
Current BMI	−0.24	0.07	0.0007	0.24
BMI S-20	−0.19	0.07	0.005	
Interaction, Current × S-20	0.01	0.00	0.02	

Compared with participants with plausible energy reporting, participants who underreported EI reported a higher relative intake in energy percentage of protein and a lower intake of total fat, saturated fat, sugar, and fiber. This is consistent with results from most other studies. In the 1995 Danish part of the Monica study (29), participants in the lowest quintile of EI/BMR reported a higher relative intake of protein and a lower relative intake of fat and carbohydrate. Rasmussen et al. (28), who used a similar dietary method, also found that underreporters reported a significantly higher relative protein intake and a lower intake of added sugar, but reported intake of fat, carbohydrate, alcohol, dietary fiber, fruit and vegetables, and fish did not differ. Furthermore, Livingstone and Black (1) summarized results from 20 studies using different dietary methods and showed reporting of a higher relative protein intake and a lower relative fat intake among those who underreported compared with those who did not. In general, this could indicate a tendency to systematically underreport the intake of foods with a high amount of sugar and fat, foods well recognized as 'unhealthy' foods (30), although, in the present study, fiber intake was also reported less. On the other hand, instead of a response bias of social desirability, the actual diet between groups could be composed differently. However, these hypotheses could not be examined further in the current study.

Some limitations should be noted. Nonparticipation may possibly bias the external validity, if related to accuracy of reporting of EI (31). Individuals who participated in all 3 follow-up studies were among the most devoted and cautious participants and are therefore expected to provide higher RA than would others. Therefore, the current study might overestimate RA and underestimate the relation between RA and previous and current BMI.

The 7-d dietary record method used in the present study was developed, evaluated, and used by the Danish National Food Agency for nationwide studies (15,16) and is hence a well-prepared comprehensive method for estimation of current dietary intake. A limitation to this method is, however, the possibility that participants may change dietary habits in the period of recording and accuracy relies on the participant's ability to report the foods eaten and to accurately quantify the portion sizes. In the present study, each participant was therefore carefully instructed in food reporting and quantification of portion sizes. In addition, quantification was made as easy as possible by using common household measures and providing pictures of portion sizes of specific foods and illustrations of the amount of fat spread on bread. We cannot exclude the possibility that some of those participants characterized as misreporters in reality were reporting their dietary intake accurately but that the assumption of being in zero energy balance during the 7-d food recording was not fulfilled. Apparent underreporting could in theory be due to slimming attempts producing a negative energy balance.

The CV_w of EI (CV_w = 28) was higher in the present study than in most other studies (mean 23%, range 15–45%) reviewed up to 1989 (27 studies) (21). In addition, we identified a single study performed by Palaniappan et al. (32), which included adult men (n = 571, age 18–65 y). Compared with the present study, they found a similar level of CV_B and CV_w of EI, but the CV in macronutrient intake was higher (32). Thus, it seems as if variability of the dietary reporting in the present study is high but not extreme.

Use of the Goldberg formula has its limitations. Grouping participants into categories of plausible, under-, or overreporters of EI is based on calculation of a confidence limit for plausible reporting with a wide range and therefore only extreme degrees of misreporting will be identified.

Level of PA was self-reported and thus might be prone to recall bias, social desirability bias, and other bias, and weight status of the participant may also affect the accuracy of reporting. Although patterns in reporting of PA are not very well documented, former studies (28,33,34) indicate that for men, reporting bias for PA is not significantly related to BMI or to misreporting EI. To rule out the possibility of a bias from PA in our analyses, we also used a fixed PAL of 1.64 [mean PAL value of males aged 40–64 y (21)]. However, a similar pattern of misreporting of EI emerged for stratified as well as for regression analyses. Thus, we assume that a possible misreporting of PAL has not substantially affected the results.

In addition, the methodology of the current study had 2 important strengths when using the Goldberg formula. First, RMR was measured rather than estimated based on body weight. Second, the level of PA was reported for both work and leisure activities, giving a measure of total habitual PA. These 2 measures improve accuracy of the Goldberg formula and the evaluation of reporting across the range of EI (21).

In conclusion, dietary RA seems to be influenced not only by current body size but also via an interaction between previous and current body size. Future studies need to consider that obesity at younger ages may influence accuracy of dietary reporting even among participants who are currently normal weight.

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