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Ability of Young Women to Recall Past Body Size and Age at Menarche

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Abstract

KOPROWSKI, CAROL, RALPH J. COATES, AND LESLIE BERNSTEIN. Ability of young women to recall past body size and age at menarche. *Obes Res.* 2001;9: 478–485.

Objective: The ability of young women (n = 132, average age 17 years) to recall body size and age at menarche was examined. The use of body silhouettes to assist women in recalling their body size at menarche and to represent their current body size was also evaluated.

Research Methods and Procedures: Subjects, who previously participated in a cohort study, were asked to recall height and weight at the time of menarche, to select body silhouettes that best reflected their body shape at the time of menarche and their current body shape, and to recall age at menarche. Two sets of body silhouettes were developed, one representative of an adult body shape and another representative of an adolescent body shape.

Results: Pearson correlation coefficients between the adult and adolescent body figures and actual body mass index (BMI; kg/m^2) at the time of menarche were not significantly different (r = 0.82 for adult figures vs. r = 0.72 for adolescent figures, $p > 0.05$). The correlation between actual BMI at the time of menarche and body silhouette (r = 0.77, all subjects) was similar to the correlation between actual and recalled BMI at the time of menarche (r = 0.83) as well as the correlation between current BMI and current body silhouette (r = 0.75). Recalled and actual ages at menarche were highly correlated (r = 0.83).

Discussion: The recall of body shape was considered to be a less precise measure of body size than asking about height and weight, but use of body silhouettes may offer advantages in certain situations.

Key words: body weight, height, recall, body size, age at menarche

Introduction

A woman's weight relative to her height is an important risk factor for breast cancer and the effects vary by menopausal status. Heavier premenopausal women seem to have reduced breast cancer risk, whereas among postmenopausal women, being overweight increases risk (1). For both groups, the magnitude of risk seems to depend on the age at which weight is assessed, and for postmenopausal women, the time between weight assessment and diagnosis (2). In many studies of older women (2), weight gain during adult life is associated with increased risk, whereas weight gain in younger women has been associated with reduced risk (3). Weight gain during those periods when endogenous or exogenous hormonal status changes (e.g., menarche, menopause, initial oral contraceptive, or replacement hormone use) may also be a critical factor (2). Body mass may also modify the effects of other breast cancer risk factors, such as use of oral contraceptives (4) and replacement hormones (5) and exercise activity (6,7).

The accuracy of recalled information on body size is an important methodologic issue because of the potential importance of weight at different periods of life. Current weight is accurately reported by adults (8–10), and longitudinal studies (8,11) indicate that middle-aged and older adults recall weight during early adulthood relatively accurately. In addition, recalled body size assessed using silhouette drawings (Figure 1A) has been found to correlate well with measured body mass index (BMI; kg/m^2) earlier in adult life, although the measured BMI was more highly correlated with recalled BMI than with the figures (12). We are aware of only one study that has evaluated recall of adolescent weight by older adults (13). Must et al. (13) reported that elderly women were able to recall their weights during the last year of high school with a reasonable

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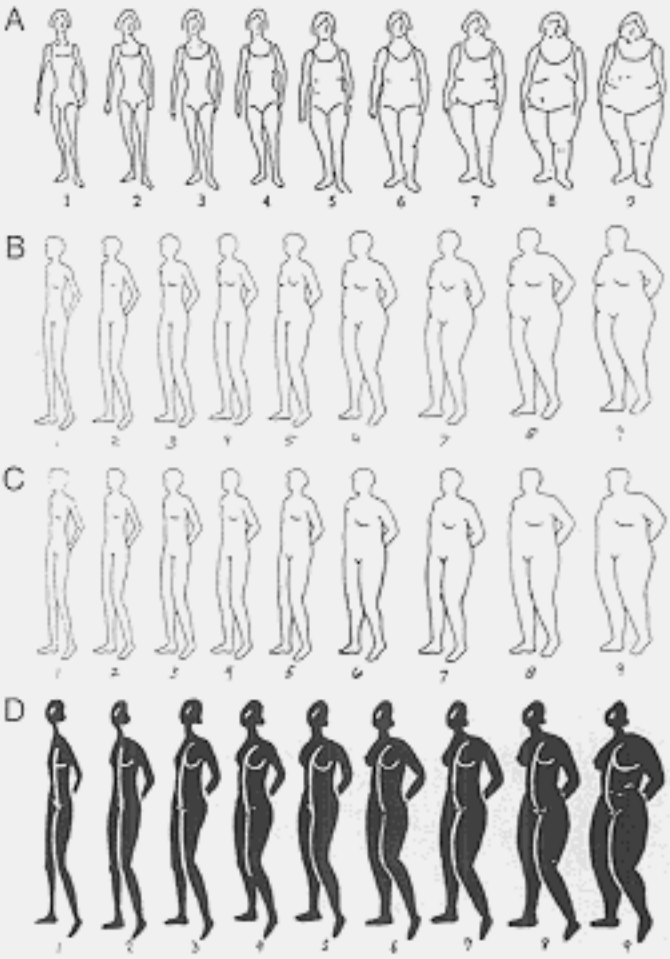

Figure 1. (A) Body silhouettes developed by Stunkard et al. (15), used with permission; (B) body silhouettes representative of adult female body figures; (C) body silhouettes representative of adolescent female body figures; and (D) body silhouettes developed to assess eating disorders (16), used with permission.

degree of accuracy. In addition, using adult silhouettes (Figure 1A) to represent their body sizes at ages 10 and 15 years, women selected body sizes that were reasonably well correlated with body mass indices derived from measured height and weight during the adolescent years.

Because of their potential use in epidemiological investigations of the effects of weight and weight changes during hormonal transitions on the subsequent risk of breast cancer, we evaluated silhouettes created to assist women in their recall of BMI at menarche and to represent their current BMI. The silhouettes were developed for the Women's Contraceptive and Reproductive Experiences Study, a large, multicenter breast cancer case–control study among African American and white women ages 35 to 64 years. In a cohort of young women who had participated in a study of predictors of age at menarche (14), we examined the relationships between silhouettes and BMI based on weight and height measured at menarche and between silhouettes and BMI based on reported current height and weight. For these measures, we evaluated two different sets of silhouettes, one created to be more representative of adult figures (Figure 1B) and one created to be more representative of adolescent figures (Figure 1C). In addition, we examined the accuracy of recalled age at menarche and recalled height, weight, and BMI at menarche.

Research Methods and Procedures

Development of Body Silhouettes

From 1993 to 1994, during pilot testing of interview instruments for the Women's Contraceptive and Reproductive Experiences Study, one of the authors (R.J.C.) working with a medical illustrator coordinated development of body silhouettes for recall of body sizes at the age women had their first menstrual period, at age 30 years, and at 5 years before diagnosis. We first pilot-tested figures that had been developed by Stunkard et al. (15) (Figure 1A) and subsequently evaluated by others (12,13) as aids for adults to recall their own body sizes at different ages. Pilot interviews were conducted with ~45 African American and white women 35 to 64 years of age living in Seattle, Washington; Philadelphia, Pennsylvania; Los Angeles, California; Detroit, Michigan; and Atlanta, Georgia. Participants included women recently diagnosed with breast cancer as well as women without such a history. In conversation about the pilot interview, interviewers found that some participants viewed the figures as not representative of minority women. In addition, participants found that as body size increased, the figures were increasingly unattractive. This unattractiveness seemed to limit the women's willingness to select larger figures.

To address these concerns, we asked interviewers to show an alternative set of figures to a subsample of pilot study participants (Figure 1D). These idealized figures had been developed by Williamson (16) to assess eating disorders and were subsequently used to assess ethnic differences in men's preferences for women's shapes (17). Pilot study participants found the figures of Williamson (16) less specifically white and more attractive than the figures of Stunkard et al. (15), but shapes and proportions of different body parts did not correspond to each other and figures did not increase in size realistically. Therefore, women had difficulty identifying with a single figure.

Because neither set of figures worked well in the pilot, we attempted to develop figures that possessed more realistic and integrated features as in the silhouettes of Stunkard et al. (15) and the greater desirability and ethnic neutrality of the figures of Williamson (16). We selected the three-quarters profile instead of the front profile because women staff and study participants considered buttocks an important component of their size and the inclusion of buttocks

helped them to make a choice. We used nine silhouettes, as the other investigators had done, to provide a reasonable range of choices. Figures were developed to approximate the wide range of sizes that women might report for ages at menarche to 64 years. These body sizes could range from a BMI of ~16 kg/m^2 for a slender 10-year-old (18) to 42 kg/m^2 for the largest size women at age 64 years (19) with a midpoint of ~26 kg/m^2. Because of our limited ability to identify pictures on which to base the figures, we used pictures taken for somatotype development (20) in combination with the figures of Stunkard et al. (15) and Williamson (16). During several cycles of drafting and review, investigators and staff were asked to match the draft figures to somatotype pictures, with known heights and weights. The figures were redrawn to more closely correspond to the desired BMI range. After a set of adult figures was developed (Figure 1B), we created a second set of figures with less rounded thighs, abdomens, and buttocks (Figure 1C) to illustrate more adolescent body shapes. Both the adolescent and adult body figures were tested in a second pilot that included some of the first pilot participants. Women reported liking these figures more than the earlier ones. Interviewers reported that women were better able to select a representative body figure. We compared figures selected by these women with their BMIs calculated from reported height and weight, then revised and rescaled the body figures to approximate the desired BMI distribution (Figure 1, B and C).

Study Subjects

The silhouettes were evaluated in a cohort that had been established by one of the authors (L.B.) to study the effects of diet, physical activity, and body size on age at menarche. This multiethnic cohort of 1378 southern California school girls ages 8 to 13 years, in the fourth through seventh grades, was followed for 4 years to determine the date at which they experienced menarche. A detailed description of the study and data collection methods has been reported elsewhere (14). Height and weight were measured annually and information on age at menarche was obtained during the last 2 years of the study. During this time, 517 girls were identified as having begun menstruating and were able to provide the month, day, and year of their first menstrual periods. Among those girls, 402 girls provided monthly menstrual calendars, and many continued to submit these calendars after the end of the study.

For the current study, 292 subjects who were still completing menstrual calendars in 1994 were sent a short questionnaire that included the body silhouettes developed for the Women's CARE Study. One-half of the girls received Figure 1B and one-half received Figure 1C. Each girl was asked to select the silhouette that best matched her current body size and to indicate which figure best represented her body size at the time of menarche.

Each subject was also asked to report her current height (in feet and inches) and weight (in pounds) and to recall her height and weight at the time of menarche. These values were converted to metric measures and used to calculate BMI at the time that the questionnaire was completed and at menarche. Each subject was asked to record her age at menarche. A total of 132 subjects completed the questionnaire. Subjects who participated in the follow-up study were not significantly different in terms of ethnicity or age at menarche from subjects who did not participate ($p < 0.05$).

Height and Weight at the Time of Menarche

Based on annual measures of height and weight before and after the time of menarche, two modeling methods, linear regression and exponential growth, were used to calculate height and weight at menarche. The methods provided nearly identical results, and the height and weight measures from linear regression are presented here. The term actual is used to describe the predicted height, weight, and BMI values calculated in this manner to differentiate this measure from that recalled in the questionnaire.

Data Analysis

Means and SE were calculated for the recalled and the actual ages at menarche and the body size variables (height, weight, and BMI). Because subjects recalled age at menarche in whole years, we used the age of the girl at her birthday just before beginning menstruation as the actual age at menarche. This approach assumes that the subject recalled her age at menarche in a similar manner, so that if menarche occurred at 12 years and X months, age at menarche would be reported as occurring at 12 years of age.

Individual means and SEs were calculated for actual and recalled weight at the time of menarche by silhouette selected. We used Student's t tests to compare the means of body size measures and age at menarche between girls receiving the adolescent silhouettes and girls receiving the adult silhouettes. The mean difference (between recalled and actual values) and its 95% confidence interval (CI) were calculated for weight, height, BMI, and age at menarche. Paired t tests were used to compare actual and recalled body size variables and age at menarche for all girls combined and stratified by silhouette style (adolescent and adult).

Pearson and Spearman correlation coefficients were calculated between actual and recalled variables. Because the results were very similar, only the Pearson correlation coefficients are reported. Correlations were calculated separately for those girls receiving the adult silhouettes and those receiving the adolescent silhouettes. Partial correlations were calculated adjusting for current age or the number of months between menarche and data collection for the current study. After categorizing BMI according to quartile distribution, we calculated Pearson correlation coefficients and their 95% CIs for each BMI category. We compared

equality of multiple correlation coefficients according to the method described by Zar (21).

Results

The mean age of respondents at the time that they completed the questionnaire was ~17 years, just under 5 years after they experienced menarche (Table 1). The majority of respondents were non-Hispanic white (44.7%) or Hispanic white (45.5%). No significant differences in mean ages or body size variables between subjects who received adolescent or adult body silhouettes are observed (data not shown).

Actual measures and recalled measures of body size and age at menarche are highly correlated (Table 2). Differences between recalled and actual measures of BMI and weight at menarche are small and not statistically significant. However, subjects overestimated their height at menarche by an average of 0.7 cm. Subjects also tended to overestimate age at menarche by an average of 0.2 years ($p < 0.01$), and the accuracy of recall decreased as length of recall time increased (data not shown). No significant differences in the mean difference between actual and recalled measures of body size (height, weight, and BMI) or age at menarche were observed when separate analyses were performed for Hispanic and non-Hispanic whites ($p > 0.05$, data not shown).

We were also interested in knowing what proportion of respondents could recall body size measures within specified limits. Of the subjects, ~45% were able to recall weight within 2.2 kg (~5 lb) of actual weight, 58% were able to recall height within 2.5 cm (~1 in) of actual height, resulting in 54% of subjects with recalled BMI within one unit of their actual BMI. The longer the interval between menarche and recall, the less accurate was the respondent's recall of age at menarche (data not shown).

The mean BMI and range of BMIs at menarche for each body silhouette are listed in Table 3. After removing one subject with implausible body silhouette data, no subject selected a body silhouette greater than seven for body size at menarche. The results are similar for actual and recalled BMI and show that mean BMI increases as the body size (silhouette) increases. However, the range of BMI values associated with each silhouette shows a large amount of overlap such that a subject with a BMI of 18 kg/m^2 might select a body silhouette ranging from 1 to 4.

The relationship between actual BMI at menarche and the relevant body silhouette is illustrated in Figure 2. Correlations between actual BMI at menarche and silhouette for adolescent and adult figure styles are not significantly different from each other ($r = 0.82$ for adult figures vs. $r = 0.72$ for adolescent figures, $p > 0.05$). Adjusting for the style of body figures (i.e., adolescent vs. adult), age, or time between menarche and study participation does not change the results (data not shown). The correlation between the recalled body size at menarche using the silhouette and measured BMI ($r = 0.77$) is similar to the correlation between recalled BMI (based on recalled height and weight at menarche) and actual BMI ($r = 0.83$; Table 2). Correlation coefficients for body silhouette and BMI are nearly identical for current BMI ($r = 0.75$) and BMI at menarche ($r = 0.77$, Figure 2). Body silhouettes one and nine were not selected by subjects to represent current body size.

We were concerned that a subject's current body size, as measured by BMI, might influence her recall of weight, height, and age at menarche. To examine this issue, we categorized current BMI into quartiles and conducted stratified analyses. For height and age at menarche, correlations between actual and recalled measures do not vary across BMI categories (data not shown). However, correlations between actual and recalled weight at the time of menarche do differ across BMI categories ($p = 0.03$; Figure 3). Correlation coefficients for the lowest and highest BMI categories are higher than those observed for the middle categories. No significant difference in mean age at time of the questionnaire or time since menarche is observed be-

Table 1. Characteristics of study population, Los Angeles, California, 1994 ($n = 132$ females)

	Means (SE)	Range
Current age (yr)	16.8 (0.1)	14.0–19.5
Time since menarche (yr)	4.8 (0.1)	2.5–9.2
Age at menarche (yr)		
Observed	11.6 (0.1)	8.0–14.0
Recalled	11.8 (0.1)	9.0–15.0
Height (cm)		
Current	162.6 (0.6)	144.2–178.4
At menarche (actual)	153.5 (0.6)	129.0–170.8
At menarche (recalled)	154.2 (0.7)	121.4–172.0
Weight (kg)		
Current	58.4 (0.9)	32.3–90.9
At menarche (actual)	48.6 (0.8)	27.3–75.3
At menarche (recalled)	48.9 (0.8)	27.3–77.3
BMI (kg/m^2)		
Current	21.9 (0.3)	14.4–37.9
At menarche (actual)	20.4 (0.3)	15.0–33.0
At menarche (recalled)	20.4 (0.3)	14.4–32.5
Ethnicity*		
Non-Hispanic white	59 (44.7)	
Hispanic white	60 (45.5)	
Pacific Islander/Asian	12 (9.1)	
African American	1 (0.8)	

* Number of subjects; number in parentheses represents percentage of subjects.

Table 2. Comparison between actual and recalled body size measures and age at the time of menarche, Los Angeles, California, 1994 (n = 132)

	Recalled vs. actual*	Pearson r‡	Percent within recall
Weight (kg)	0.36 (−0.47,1.20)	0.87 (0.82,0.91)	Within 2.2 kg: 44.7
Height (cm)	0.71 (0.13,1.29)†	0.91 (0.87,0.94)	Within 2.5 cm: 57.6
BMI (kg/m^2)	0.03 (−0.32,0.37)	0.83 (0.77,0.88)	Within 1 unit: 53.8
Age at menarche (yr)	0.20 (0.08,0.32)†	0.83 (0.77,0.88)	Exact recall§: 62.1

* Mean difference between recalled and actual measures; 95% CI given in parentheses.
† p value < 0.01 for paired t test.
‡ Numbers in parentheses, 95% CI.
§ Exact recall refers to actual and recalled age at menarche occurring within the same year.

tween BMI categories (data not shown). Because the range of BMI values varied across quartiles, BMI was categorized into three categories with each category having a similar range of BMI values (low BMI, 14.4 to 20.0 kg/m^2; medium BMI, 20.1 to 26.0 kg/m^2; high BMI, 26.1 to 32.0 kg/m^2; two subjects with BMI > 32.0 kg/m^2 were excluded). The correlations for the high (r = 0.82, n = 13) and low (r = 0.87, n = 44) are greater than the correlation for the medium body size group (r = 0.71, n = 73).

Discussion

The results of this study suggest that subjects are able to recall their height and weight at menarche with a reasonable degree of accuracy. Our results are consistent with results reported from other studies in terms of the ability to recall past measures of body size (9–13,22), where correlations between actual and recalled weight range from 0.74 (22) to 0.99 (11). None of these studies asked subjects to recall body size at the time of menarche; however, several studies asked about body weight at age 18 years. The correlation between recalled and actual weight at age 18 years was 0.87 for subjects in the Nurses' Health Study II with an average recall period of 17 years (9), and Casey et al. (11) reported similar results.

Despite the ability of women to recall past weight with reasonable accuracy, some investigators observed differences in ability to report past measures of body size. Using data from the National Health and Nutrition Examination Survey I Epidemiological Follow-Up Study, Perry et al. (22) found that women who were overweight at the time of the follow-up interview (average follow-up period was 10 years) tended to underestimate past weight and that women

Table 3. Mean and range of actual and recalled BMI at menarche by body silhouette, Los Angeles, California, 1994 (n = 131)*

		BMI at menarche			
		Actual		Recalled	
Body silhouette†	n	Mean (SE)	Range	Mean (SE)	Range
1	13	17.1 (0.3)	15.0–18.6	17.7 (0.7)	14.6–24.5
2	34	18.0 (0.3)	15.3–21.1	18.6 (0.3)	14.4–23.0
3	30	19.4 (0.4)	15.1–25.1	19.7 (0.3)	16.2–23.1
4	30	21.8 (0.4)	18.0–28.2	21.1 (0.4)	17.2–29.3
5	19	24.5 (0.8)	18.9–30.1	23.5 (0.7)	18.1–29.2
6	4	26.3 (1.5)	22.0–29.0	27.4 (1.0)	24.6–29.3
7	1	33.0	33.0	32.5	32.5

* BMI calculated as kg/m^2; one subject was excluded due to implausible data.
† Body silhouette selections ranged from one (thinnest) to nine (heaviest), silhouettes eight and nine were not selected.

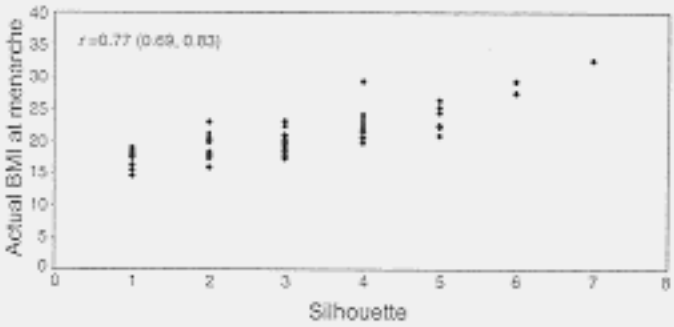

Figure 2. Actual BMI (kg/m^2) at menarche vs. silhouette (n = 131, one subject excluded due to implausible data). Body silhouette selections ranged from one (thinnest) to nine (heaviest), silhouettes eight and nine were not selected. Numbers in parentheses represent 95% CIs for the correlation coefficient.

who had lost weight since the baseline assessment tended to underestimate past weight more than women with stable weight or weight gain. Casey et al. (11) found that women consistently underreported past weight, regardless of current body size. Subjects in the Nurses' Health Study II also tended to underreport past weight by an average of 1.45 kg (9). Must et al. (13) did not find that current body weight affected recall of body weight during the last year of high school in a group of elderly women; however, recall of past weight was better among women who were lean during adolescence compared with women who were overweight during adolescence (0.9 kg mean difference between recalled and measured for lean adolescents vs. 2.3 kg mean difference for obese adolescents). In contrast, Olivarius et al. (10) did not find that current body size was associated with the ability to recall past weight among a group of women with diabetes, and these women tended to overestimate past weight. When recalling height and weight at the time of menarche, subjects in our study tended to overestimate both height and weight, but the overestimation of weight is not statistically significant.

We find that current body size affects recall of weight at menarche. The correlation between actual and recalled body weight at the time of menarche is stronger for subjects with the lowest body size (BMI < 19.5 kg/m^2, r = 0.90) and the highest body size (BMI > 22.9 kg/m^2, r = 0.84). The women in our study were younger and the period of recall less than that reported in other studies. What effects these differences would have is not clear; however, one possible explanation is that young women at the extremes of body size are more focused on body size compared with other young women, which leads to a more accurate recall of body weight. Although our results support such an explanation, our highest BMI category started at a BMI of 23 kg/m^2, which is not considered an extreme value among U.S. women. Additional research is needed involving subjects with higher BMI values.

Consistent with the results of other studies (23,24), a high proportion of subjects (62.1%) were able to recall accurately their ages at menarche. Similar to Koo and Rohan (23), we

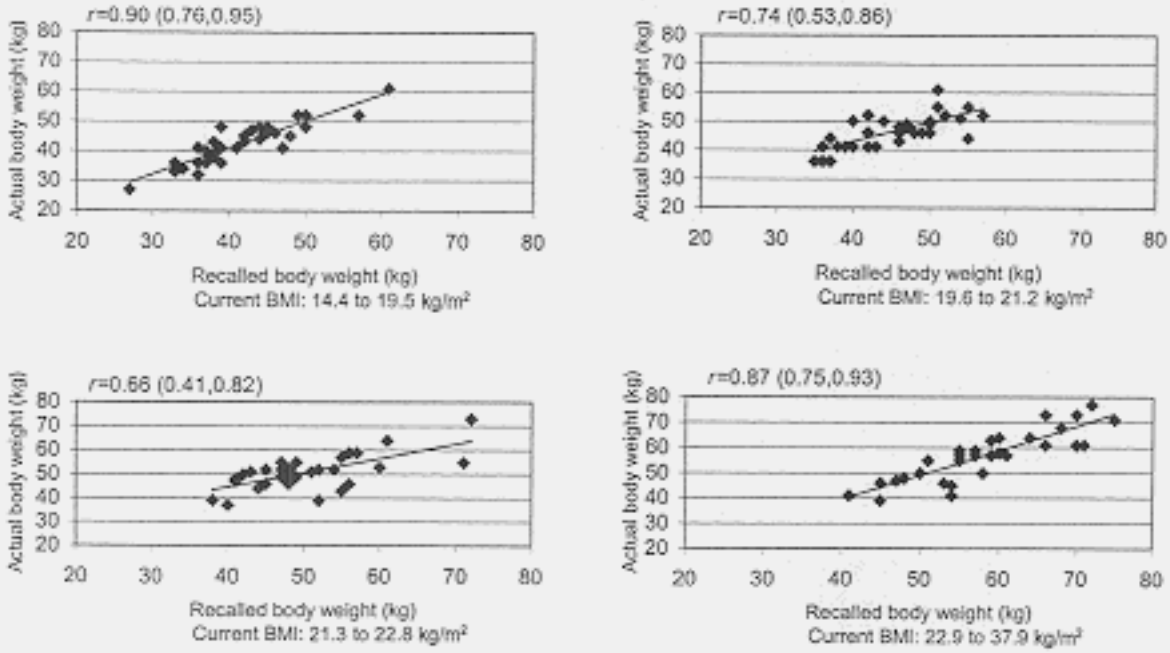

Figure 3. Plot of actual vs. recalled body weight at the time of menarche by BMI (kg/m^2) category. Numbers in parentheses represent 95% CIs for the correlation coefficient; correlation coefficients were significantly different between BMI categories (21).

observed that the longer the interval between menarche and recall, the less accurate was the respondent's recall of age at menarche.

Two sets of body silhouettes were used in our study, one set considered to be more representative of adult figures (Figure 1B) and the other set more representative of adolescent figures (Figure 1C). Correlations between actual BMI at menarche and silhouette for each body figure style do not differ significantly, suggesting that adult body figure shapes are appropriate for obtaining information on body size at menarche ($r = 0.72$ for adolescent figures vs. $r = 0.82$ for adult figures, $p > 0.05$). One limitation of our study is an insufficient number of subjects to examine the relationship between figure style and ethnicity.

The body silhouettes represent gradations in body size; although, as shown in Table 3 and Figure 2, a large amount of overlap exists in the BMIs associated with each body silhouette. The correlation between body silhouette and actual BMI at menarche ($r = 0.77$) is weaker than the correlation between actual and recalled BMI at menarche ($r = 0.83$). This difference in correlations is not surprising, and, in fact, is expected given the limited range of ordinal values for the silhouettes. Other investigators have reported similar findings (9,12,13). Troy et al. (9) reported a correlation of 0.66 between BMI at age 18 years and silhouettes compared with a correlation of 0.84 for actual and recalled BMI at 18 years. Munoz et al. (12) obtained correlations of 0.75 for BMI and silhouettes compared with 0.89 for actual and recalled BMI. Must et al. (13) examined long-term recall of body size at different ages by asking subjects in the Third Harvard Growth Study to recall height at weight at different ages and to use body silhouettes as an estimate of body size. Their results are similar to those reported by others. Recall of body shape was considered to be a less precise measure than asking about height and weight, but use of body silhouettes may offer a more practical method of obtaining this information, especially when dealing with low-literacy populations or when asking subjects to recall the distant past (12,13).

Although we do not observe any significant differences in ethnicity or age at menarche in subjects who participated in the study and nonparticipants, we do not know whether subjects who participated have better recall of past body size and age at menarche. Additional research involving a longer period of recall and a higher participation rate is needed to confirm our findings.

In conclusion, we observed high degrees of validity in recalled height, weight, and age at the time of menarche. The use of body silhouettes as an estimate of current or past body size seems to be a less precise measure than obtaining height and weight information but may offer advantages in certain situations.

Acknowledgments

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