Behavioral variables and development of a central pattern of body fat from adolescence into adulthood in normal-weight whites: the Amsterdam Growth and Health Study

Frank J van Lenthe, Willem van Mechelen, Han CG Kemper, and G Bertheke Post

ABSTRACT Associations were investigated between the amount of physical activity, energy and macronutrient intake, smoking behavior, alcohol intake, and a central pattern of body fat (subscapular skinfold thickness and waist circumference) measured six times between the mean ages of 13 and 27 y in a healthy white population. Subjects (84 males, 98 females) were participants in the longitudinal Amsterdam Growth and Health Study. In longitudinal analyses, alcohol intake was positively associated with the subscapular skinfold thickness ($\beta = 0.09, 95\%$ CI: 0.01, 0.16) in males. In females, the subscapular skinfold thickness was negatively associated with physical activity ($\beta = -0.10, 95\%$ CI: $-0.15, -0.05$) and, unexpectedly, energy intake ($\beta = -0.25, 95\%$ CI: $-0.31, -0.19$), whereas a positive association was found with carbohydrate intake ($\beta = 0.09, 95\%$ CI: 0.02, 0.16). In both sexes, the mean value of behavioral variables, obtained from the mean value in adolescence and the values obtained at 21 and 27 y of age was not significantly associated with the subscapular skinfold thickness or waist circumference at the mean age of 27 y, except for a small positive association between physical activity and the subscapular skinfold thickness in males ($R^2 = 2.3\%$).


KEY WORDS Fat distribution, physical activity, food intake, smoking, alcohol, adolescence, longitudinal study, central pattern of body fat, humans

INTRODUCTION

In 1956 Vague (1) suggested that a central pattern of body fat was associated with an increased risk for chronic diseases. In the past decade, this suggestion was confirmed in several prospective studies of cardiovascular diseases (CVDs) (2–7).

With the recognition of a central pattern of body fat as a risk factor for the development of CVD there is a clear need to identify behavioral determinants of this pattern of body fat. Studies investigating the association between behavioral variables and a central pattern of body fat thus far were performed mainly in adult populations (8–16). A central pattern of body fat, however, increases from adolescence into adulthood (17–19). With regard to primary prevention, it is important to know whether, and to what extent, behavioral variables are associated with a central pattern of body fat in adolescence and adulthood.

In the Amsterdam Growth and Health Study (AGHS), an observational, longitudinal study that started in 1977, a healthy population of males and females was followed between the mean ages of 13 and 27 y (20). A unique feature of the study is that both behavioral variables (physical activity, food intake, smoking, and alcohol intake) and indicators of body composition were measured over this period of time. In the present study, the effects of physical activity, food and macronutrient intake, smoking behavior, and alcohol intake on a central pattern of body fat were investigated between 13 and 27 y of age.

SUBJECTS AND METHODS

Subjects

The aims and design of the AGHS are described extensively elsewhere (20–22). The study protocol was approved by the Medical Faculty of the Vrije Universiteit. Briefly, the study was initiated to describe growth and health of adolescents by measuring anthropometric, physiologic, and behavioral indicators longitudinally. All pupils of a first and second grade of a secondary school in Amsterdam were invited to participate in the study. Informed consent was obtained from the pupils and their parents. None of the subjects refused to participate and the initial healthy white population consisted of 148 boys and 159 girls.

The first period of measurements was in 1977 when the subjects had a mean age of 13.1 ± 0.6 y. In the next 3 y, follow-up measurements were performed annually, providing data for four periods of measurement between 13 and 16 y (adolescence). Additional follow-up measurements were carried out in 1985 and 1991 at the mean ages of 21 (young adulthood) and 27 y (adulthood). Only those subjects who participated in all six peri-
ods of measurement were included in the analyses. As a result, the population under study consisted of 84 males and 98 females.

A central pattern of body fat

In the AGHS, subscapular skinfold thickness was measured at all periods of measurement. Its change from 13 until 27 y of age was published previously (18). Waist circumference was measured at the mean age of 27 y only. All anthropometric indicators were measured by one experienced examiner between 1977 and 1985. During the last period of measurement another examiner (WVM) took over the measurements. Waist circumference was measured as the largest circumference between the umbilicus and the lower rim of the thorax with subjects in a standing position. A flexible steel tape was used and measurements were read to the nearest millimeter while the measuring tape was held horizontal. The subscapular skinfold thickness was measured with a Harpenden caliper to the nearest 0.1 mm according to guidelines of the International Biological Programme (23). It was measured on the left side of the body in duplicate and the highest value was used in the analysis. A coefficient of reproducibility of the subscapular skinfold-thickness measurement, estimated by the correlation coefficients when the time between two measurements is assumed to be 0 (24), was > 0.80.

Behavioral variables

The amount of daily physical activity was assessed from an interview covering leisure time physical activity, exercise, and school- or work-related physical activity (25). Activities were expressed in equivalents of the resting metabolic rate (METs) (eg, an activity of 4 METs demands four times the resting metabolic rate). Three categories were composed: light (4–7 METs), medium-heavy (8–10 METs), and heavy (> 10 METs) activities. The total weekly time spent per activity category was multiplied by 5.5 (for light activities), 8.5 (for medium-heavy activities), and 11.5 (for heavy activities) METs. Summation of these scores resulted in a weighted activity score, taking into account frequency, intensity, and duration of physical activity (20).

Food intake was derived from a modified crosscheck dietary history interview concerning nutritional habits during the days of the school or workweek and weekends (26). With use of the Dutch Food and Nutrition Table (27), food intake was converted into total energy intake (MJ/d) and macronutrient intake (percentage of total energy intake). The interview also yielded information on alcohol intake (g/d). Information on smoking habit (cigarettes/wk) was obtained through a questionnaire. Subjects were classified as smokers if they smoked ≥ 1 cigarette/wk, whereas nonsmokers did not smoke at all. All measurements were made in the same period of the year (March to June) to exclude seasonal variation in behavioral determinants.

Potential confounding variables

A potential confounder in the association between behavioral variables and a central pattern of body fat is the degree of total body fatness. In addition to the subscapular skinfold thickness, the biceps, triceps, and suprailiac skinfold thicknesses were measured. To adjust for total body fatness, the sum of the four skinfolds (SSF) was calculated. In prior research we found that girls with a relatively early menarche showed a more central pattern of body fat than did girls with a relatively late menarche (28). Statistical adjustment for age at menarche did not change our results essentially and was therefore not included in the final analyses.

Statistics

The distribution of the continuous variables was checked by comparing means and medians and by a Kolmogorov-Smirnov test. All variables showed a normal distribution, except for the subscapular skinfold thickness in males. A log-transformation of this variable did not change any result essentially and therefore the untransformed data were used. Before all analyses, continuous variables were converted into z scores. The longitudinal changes in the behavioral variables and potential differences in these variables between males and females were investigated by using multiple analyses of variance (MANOVA) for repeated measurements and Student’s t tests, with P < 0.05 considered statistically significant.

The subscapular skinfold thickness and the behavioral variables were measured longitudinally in six irregularly spaced follow-up measurements. Developments in longitudinal data analyses in the past decade made methods available through which the association can be investigated between the change in behavioral (independent) variables and the change in the subscapular skinfold thickness (dependent variable), after adjustment for the development of covariates. For this purpose the technique of generalized estimating equations (GEE) is well suited (29, 30) and was used with the following model:

\[
Y_{it} = \beta_0 + \sum_{j=1}^{J} \beta_{ij} X_{ijt} + \beta_2 t + \sum_{k=1}^{K} \beta_{jk} Z_{ak} + e_{it}
\]

where \(Y_{it}\) is observations of individual \(i\) from \(t_1\) to \(t_m\) (where \(m\) is the number of measurements), \(t\) is time, \(\beta_0\) is the intercept, \(J\) is the number of independent variables, \(\beta_{ij}\) is the standardized regression coefficient of the independent variable \(j\), \(X_{ijt}\) is the independent variable \(j\) of subject \(i\) at time \(t\), \(\beta_2\) is the regression coefficient of time, \(K\) is the number of time-dependent covariates, \(\beta_{jk}\) is the standardized regression coefficient of time-dependent covariate \(k\), \(Z_{ak}\) is the time-dependent covariate \(k\) of individual \(i\), and \(e_{it}\) is the measurement error of individual \(i\).

In this model, \(\beta\) can be interpreted as a standardized longitudinal regression coefficient. Because repeated measurements in the same subjects are not statistically independent, an important feature of GEE analyses is that they correct for within-subject correlations. Therefore, a correlation structure must be defined a priori, based on the actual correlation coefficients between the subscapular skinfold thicknesses at all periods of measurement. Here, a stationary \(m\)-dependent correlation structure was used, in which the correlation coefficients between maximally \(m\) periods of measurements have different values (> 0) and correlations between data obtained more than \(m\) periods of measurement apart are 0. In this study, data from six periods of measurement were used in the analysis, and a stationary five-dependent correlation structure was chosen.

Second, multiple-linear-regression analysis was performed with the waist circumference and subscapular skinfold thickness at the mean age of 27 y as dependent variables. Mean values of behavioral variables over the entire period of study were used as independent variables and the mean SSF was entered in the analyses as a covariate. For physical activity, total energy intake, and macronutrient intake this mean value was calculated by first calculating the mean of the four scores obtained between 13 and
16 y of age. Subsequently, the mean adolescent value (13–16 y) and the values obtained in young adulthood (21 y) and adulthood (27 y) were calculated. For alcohol intake, the mean value was calculated in a similar way and the median scores (6.5 and 2.6 g alcohol/d for males and females, respectively) were used to characterize subjects as either alcohol users or nonusers. For smoking behavior, those who ever smoked between 13 and 27 y of age were compared with those who never smoked. All behavioral variables associated with the dependent variables at $P < 0.20$ (after adjustment for SSF) were put in a multiple-linear-regression model. By using a backwards elimination procedure, a model was built containing all statistically significant behavioral variables. All analyses were carried out by using SPSS and SPIDA for the personal computer (31, 32).

RESULTS

The means and SDs of anthropometric indicators at the mean age of 27 y are presented in Table 1. Males were significantly taller and heavier than females ($P < 0.05$). Body mass index (BMI; in kg/m$^2$) was borderline significantly higher in males than in females ($P = 0.06$). Mean waist circumference was also significantly higher in males than in females ($P < 0.05$). There was no significant difference in mean subscapular skinfold thickness between sexes. The means and SDs of the behavioral variables in adolescence, young adulthood, and adulthood are presented in Table 2.

The amount of physical activity decreased between 13 and 27 y of age in both sexes ($P < 0.05$) and the decrease was more pronounced in males than in females ($P < 0.05$). In males, an increase was found in total energy intake from adolescence into adulthood and a decrease was found from young adulthood into adulthood ($P < 0.05$). In females, no significant increase or decrease was found for total energy intake. In both sexes, a moderate decrease in fat intake (as a percentage of total energy intake) and a slight increase in protein intake was found. In males, the percentage of smokers increased over the entire period of study, whereas in females the percentage of smokers increased from adolescence into young adulthood but decreased from young adulthood into adulthood. The median value of alcohol intake increased in males and females, particularly from adolescence into adulthood ($P < 0.05$). An important source of bias in longitudinal studies comes from selective dropout, in which compliance with the study is higher in the healthiest part of the population under study. During the first four periods of measurement, 31.1% of the boys ($n = 46$) and 17.6% of the girls ($n = 28$) dropped out of the study because of leaving school or moving out of town. Between 1980 and 1991 another 17.6% of the boys ($n = 18$) and 25.2% of the girls ($n = 33$) dropped out of the study, with the major reasons being that they were too busy or were not interested any longer. Selective dropout was tested by comparing the means of anthropometric variables, the weighted activity score, and energy intake at the first period of measurement between those who dropped out and those who remained in the study. Only in females was there a higher mean thickness of the subscapular skinfold for the dropouts than for those who remained in the study. Only in females was there a higher mean thickness of the subscapular skinfold for the dropouts than for those who remained in the study (by Student’s $t$ tests). The lack of significant differences for other skinfold thicknesses or the behavioral variables (20, 28) did not provide evidence for selective dropout.

The measurement of behavioral variables and indicators of a central pattern of body fat are susceptible to measurement error. Despite considerable attention paid to the reliability of the measurements, misclassification resulting from measurement error may have resulted in an underestimation of the real associations. In studies of a central pattern of body fat, advanced methods, such as computerized tomography, are more reliable, but their high costs will not make them soon available in epidemiologic studies. A major point of concern in longitudinal studies of a central pattern of body fat, covering the period from adolescence into adulthood, is the choice of the most appropriate indicators. Evidence has emerged that the increased risk of CVD associated with a central pattern of body fat is due to an increased amount of intraabdominal fat. Currently, the use of the waist circumference is preferred over the waist-to-hip ratio (WHR) in adults (36). As far as we

### Table 1

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Males ($n = 84$)</th>
<th>Females ($n = 98$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body height (cm)</td>
<td>183.1 ± 6.5</td>
<td>170.0 ± 6.1$^2$</td>
</tr>
<tr>
<td>Body weight (kg)</td>
<td>75.6 ± 8.3</td>
<td>63.3 ± 7.8$^2$</td>
</tr>
<tr>
<td>BMI (kg/m$^2$)</td>
<td>22.6 ± 7.8</td>
<td>21.9 ± 2.5</td>
</tr>
<tr>
<td>Waist (cm)</td>
<td>78 ± 6</td>
<td>68 ± 6$^2$</td>
</tr>
<tr>
<td>Subscapular skinfold thickness (0.1mm)</td>
<td>115 ± 37</td>
<td>124 ± 47</td>
</tr>
</tbody>
</table>

$^1$ ± SD.

$^2$ Significantly different from males, $P < 0.01$.

DISCUSSION

In this study, the effects of physical activity, energy and macronutrient intake, smoking, and alcohol intake on a central pattern of body fat were investigated between 13 and 27 y of age. Before any conclusions are drawn from the results, several remarks need to be made. The population of this study was healthy and white. From the level of occupation, income, and education of the subjects’ parents it was concluded that the mean socioeconomic status (SES) of the population was slightly higher than the mean of the Dutch population (33). Several studies have shown an inverse effect of SES on the distribution of body fat (34, 35). Therefore, it cannot be excluded that our results underestimate the association of behavioral variables with a central pattern of body fat in the Dutch population because of the slightly higher SES in our study population.

An important source of bias in longitudinal studies comes from selective dropout, in which compliance with the study is higher in the healthiest part of the population under study. During the first four periods of measurement, 31.1% of the boys ($n = 46$) and 17.6% of the girls ($n = 28$) dropped out of the study because of leaving school or moving out of town. Between 1980 and 1991 another 17.6% of the boys ($n = 18$) and 25.2% of the girls ($n = 33$) dropped out of the study, with the major reasons being that they were too busy or were not interested any longer. Selective dropout was tested by comparing the means of anthropometric variables, the weighted activity score, and energy intake at the first period of measurement between those who dropped out and those who remained in the study. Only in females was there a higher mean thickness of the subscapular skinfold for the dropouts than for those who remained in the study (by Student’s $t$ tests). The lack of significant differences for other skinfold thicknesses or the behavioral variables (20, 28) did not provide evidence for selective dropout.

The measurement of behavioral variables and indicators of a central pattern of body fat are susceptible to measurement error. Despite considerable attention paid to the reliability of the measurements, misclassification resulting from measurement error may have resulted in an underestimation of the real associations. In studies of a central pattern of body fat, advanced methods, such as computerized tomography, are more reliable, but their high costs will not make them soon available in epidemiologic studies. A major point of concern in longitudinal studies of a central pattern of body fat, covering the period from adolescence into adulthood, is the choice of the most appropriate indicators. Evidence has emerged that the increased risk of CVD associated with a central pattern of body fat is due to an increased amount of intraabdominal fat. Currently, the use of the waist circumference is preferred over the waist-to-hip ratio (WHR) in adults (36). As far as we
know, however, validation studies have not yet been performed in adolescents. Therefore, the use of skinfold thicknesses, adjusted for total body fatness, remains of importance in youth (37).

In this study, the mean value of behavioral variables was calculated from the mean value obtained between 13 and 16 y (adolescence), and 21 (young adulthood) and 27 y (adulthood) of age. This can result in a situation in which persons have a relatively high or low mean value over the entire period of study, caused by a high or low value on only one period of measurement. It seems reasonable to expect that the period of adolescence has the least influence on a central pattern of body fat in adulthood because of the long period until the mean age of 27 y.

To investigate the influence of relatively high or low values for behavioral variables in adolescence, regression analyses were repeated by using the data at the mean age of 21 and 27 y only. In both sexes, the results were essentially comparable with the results presented in Tables 4 and 5. Only the positive association between mean physical activity and the subscapular skinfold thickness in males was not significant. When the results obtained at the mean age of 27 y were included in a regression analysis, no significant associations of behavioral variables with the subscapular skinfold thickness or waist circumference were found in either sex. Our longitudinal design further enabled us to look in more detail into the temporal separation in the association between behavioral variables and a central pattern of body fat. Therefore, the mean of the behavioral variables, calculated from the data obtained between 13 and 16 y of age, was related to indicators of a central pattern of body fat at the mean age of 27 y. The results of these analyses showed no significant associations of behavioral variables with the subscapular skinfold thickness or waist circumference in either sex.

Several cross-sectional studies have found an inverse association between the amount of physical activity and WHR (8, 9, 16, 34, 38). In the study of Seidell et al (9), leisure time physical activity was not associated with WHR, whereas in the other studies mentioned work, leisure time activity, and exercise were combined. This could mean that exercise was the factor with the highest potential to change the distribution of body fat. Some studies investigated the effects of exercise intervention on the distribution of body fat. Després et al (39) reported a loss of total abdominal fat as a result of 14 mo of aerobic training in obese premenopausal women, which was due to a decrease in subcutaneous trunk fat and not in visceral fat. Schwartz et al (40) found a decrease in WHR after endurance training in older men but not in younger men. Younger and older men both showed a decrease in visceral fat. Goulding et al (41) reported a difference in trunk fat as a percentage of total body fat between highly trained individuals and sedentary subjects. A major proportion of the highly trained individuals, however, were power lifters, presumably undertaking more resistance training than aerobic training.

In the study of Duncan et al (34), a score including physical activity in work and leisure time and exercise, was also not associated with the ratio of subscapular to triceps skinfold thicknesses. Haffner et al (10) investigated the relation between exer-

### TABLE 2

Behavioral variables at three periods in life for males and females

<table>
<thead>
<tr>
<th></th>
<th>Males (n = 84)</th>
<th>Females (n = 98)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Activity (METs/wk)</td>
<td>Energy intake (MJ/d)</td>
</tr>
<tr>
<td>Adolescence</td>
<td>4290 ± 1500†</td>
<td>12.3 ± 2.1</td>
</tr>
<tr>
<td>Young adulthood</td>
<td>3446 ± 2248</td>
<td>13.8 ± 3.1</td>
</tr>
<tr>
<td>Adulthood</td>
<td>2909 ± 2262</td>
<td>12.7 ± 3.0</td>
</tr>
<tr>
<td></td>
<td>Percent as fat (%)</td>
<td>42.5 ± 4.0</td>
</tr>
<tr>
<td></td>
<td>Percent as carbohydrate (%)</td>
<td>45.2 ± 3.8</td>
</tr>
<tr>
<td></td>
<td>Percent as protein (%)</td>
<td>11.8 ± 4.6</td>
</tr>
<tr>
<td></td>
<td>Percent smoking (%)</td>
<td>18.1</td>
</tr>
<tr>
<td>Smoking (cigarettes/wk)</td>
<td>18.5 ± 33.8</td>
<td>102.6 ± 67.9</td>
</tr>
<tr>
<td>Alcohol (g/d)</td>
<td>0.2</td>
<td>7.8</td>
</tr>
</tbody>
</table>

†Adolescence is 13–16 y of age, young adulthood is 21 y of age, and adulthood is 27 y of age.

### TABLE 3

Association between behavioral variables and subscapular skinfold thickness after adjustment for the sum of four skinfold thicknesses between 13 and 27 y of age in males and females

<table>
<thead>
<tr>
<th></th>
<th>Males (n = 84)</th>
<th>Females (n = 98)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>95% CI</td>
</tr>
<tr>
<td>Physical activity</td>
<td>0.01</td>
<td>-0.03, 0.04</td>
</tr>
<tr>
<td>Energy intake</td>
<td>0.03</td>
<td>-0.00, 0.06</td>
</tr>
<tr>
<td>Percent as fat</td>
<td>0.02</td>
<td>-0.02, 0.06</td>
</tr>
<tr>
<td>Percent as carbohydrate</td>
<td>-0.01</td>
<td>-0.05, 0.05</td>
</tr>
<tr>
<td>Percent as protein</td>
<td>0.00</td>
<td>-0.05, 0.05</td>
</tr>
<tr>
<td>Smoking</td>
<td>0.09</td>
<td>-0.05, 0.22</td>
</tr>
<tr>
<td>Alcohol</td>
<td>0.09</td>
<td>0.01, 0.16</td>
</tr>
</tbody>
</table>
TABLE 4
Results of multiple-linear-regression analysis of the subscapular skinfold thickness and waist circumference at the mean age of 27 y on values of behavioral variables between 13 and 27 y of age after adjustment for the sum of four skinfold thicknesses in males

<table>
<thead>
<tr>
<th>Dependent variable and</th>
<th>Univariate (P &lt; 0.20)</th>
<th>Multivariate (P &lt; 0.05)</th>
<th>Additional R^2 %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>SE</td>
<td>P</td>
</tr>
<tr>
<td>Subscapular skinfold thickness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>0.15</td>
<td>0.07</td>
<td>0.03</td>
</tr>
<tr>
<td>Alcohol intake</td>
<td>−0.19</td>
<td>0.14</td>
<td>0.17</td>
</tr>
<tr>
<td>Waist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>0.15</td>
<td>0.10</td>
<td>0.15</td>
</tr>
<tr>
<td>Energy intake</td>
<td>0.19</td>
<td>0.10</td>
<td>0.07</td>
</tr>
<tr>
<td>Protein intake</td>
<td>−0.15</td>
<td>0.10</td>
<td>0.14</td>
</tr>
</tbody>
</table>

1 n = 84.
2 Adjusted for the sum of four skinfold thicknesses.
3 Additional explained variance after adjustment for the sum of four skinfold thicknesses.

The results of our study and other reported studies suggest that behavioral variables can alter the development of a central pattern of body fat. Because in some studies effects could only be detected after comparing groups with extreme values and because there were also several studies that did not find an effect of behavioral variables on a central pattern of body fat, it seems that in a general population the effects are small. Studies showing an effect of behavioral variables on a central pattern of body fat were mainly carried out in populations older than our study population. In the only study using a population in the same age category, total energy intake, physical activity, smoking, and alcohol intake explained ≈10% of the variance of WHR (16).

If behavioral indicators are only moderately associated with a central pattern of body fat in healthy individuals, the question remains what the determinants of this body fat pattern are. Donahue et al (48) reported significant familial aggregation of body fat distribution. Other studies also showed the importance of heritability of a central pattern of body fat (49, 50). A central pattern of body fat in some studies was associated with an increased production of androgens (51). Recently, Mantzoros et al (52) found that differences in circulating dehydroepiandrosteronsulfate and total testosterone were independently associated with WHR. These results suggest that a neuroendocrine dysregulation could play an important role in the development of a central pattern of body fat.

Our results, in combination with results published in the literature, suggest that a strategy aimed at preventing the development of a central pattern of body fat is difficult to accomplish in

TABLE 5
Results of multiple-linear-regression analysis of the subscapular skinfold thickness and waist circumference at the mean age of 27 y on mean values of behavioral variables between 13 and 27 y of age after adjustment for the sum of four skinfold thicknesses in females

<table>
<thead>
<tr>
<th>Dependent variable and</th>
<th>Univariate (P &lt; 0.20)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>SE</td>
</tr>
<tr>
<td>Subscapular skinfold thickness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protein intake</td>
<td>−0.11</td>
<td>0.07</td>
</tr>
<tr>
<td>Waist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy intake</td>
<td>0.10</td>
<td>0.08</td>
</tr>
<tr>
<td>Protein intake</td>
<td>−0.12</td>
<td>0.08</td>
</tr>
</tbody>
</table>

1 n = 98.
2 Adjusted for the sum of four skinfold thicknesses.
REFERENCES


