Is personality related to fruit and vegetable intake and physical activity in adolescents?

Gert-Jan de Bruijn¹, Stef P. J. Kremers¹, Willem van Mechelen² and Johannes Brug³

Abstract
Personality is regarded as a distal determinant of health behavior and has been found to be associated with health behavior in young adults. Research investigating the association between personality and health behaviors in adolescents, however, is lacking. The present study explored the direct associations between Big Five personality dimensions with fruit and vegetable consumption and physical activity (PA) in two Dutch adolescent samples [Sample 1: n = 504; mean age = 14.5 years (SD = 1.7); response rate 20%; Sample 2: n = 476; mean age = 14.9 (SD = 2.0); response rate 17%]. Behavioral outcomes and personality were assessed with validated self-administered questionnaires. Bivariate correlations and multiple regression analyses were conducted, and Cohen’s effect sizes were used to interpret the associations found. Agreeableness was positively associated with vegetable consumption, while Openness to Experience was positively associated with fruit consumption and vegetable consumption. Extraversion was positively associated with sports-related PA. Standardized regression coefficients for personality dimensions ranged from 0.09 to 0.13, explaining 3–6% of variance in behavior, indicating small effect sizes. Our results suggest that personality dimensions are associated with fruit and vegetable consumption and sports-related PA in adolescents. Future research should explore possible mediators between personality and health behavior in adolescents.

Introduction
Healthy behaviors, such as regular physical activity (PA), non-smoking, and a diet high in fruit and vegetables, contribute to the improvement of public health (WHO, 2003). In order to promote healthy behaviors, it is necessary to study possible determinants of these behaviors. Most studies to date have focused on so-called proximal behavioral determinants, primarily cognitions such as those proposed in the Theory of Planned Behavior (TPB) (Ajzen, 1991). Recently, scientific attention has focused on more distal determinants of health behaviors, such as availability and accessibility of healthy dietary choices (Fisher and Birch, 1999; Zive et al., 2002) and PA opportunities (Zask et al., 2001; Sallis et al., 2002). In addition to such physical environmental influences, personality dimensions are also regarded as potentially important distal determinants of health behaviors (Flay and Petraitis, 1994; Rhodes et al., 2003).

Unlike attitudes and intentions, which are behavior specific, personality refers to broad dispositions, which may enable us to understand why certain individuals behave in a healthier fashion than others (Miller et al., 2004), beyond those explanations given by social cognitions. For instance, in a study...
among undergraduate students, Rhodes et al. (Rhodes et al., 2002, 2003) found that personality accounts for prediction of exercise behavior beyond one’s intention to exercise. In a similar study among university students, Conner and Abraham (Conner and Abraham, 2001) found that social cognitions only partially mediated the direct effect of personality on exercise behavior. These studies suggest that social cognitions are inadequate to fully explain the relationship between personality and exercise behavior, thus providing some evidence that personality may be an important additional predictor of health behavior.

Personality research in the last decade has been largely based on the so-called Big Five dimensions (Costa and McCrae, 1985), which are typically labeled as Extraversion, Agreeableness, Conscientiousness, Emotional Stability and Openness to Experience. Extraversion includes gregariousness, assertiveness, warmth, excitement seeking, activity and positive emotions. Facets of Agreeableness include modesty, compliance, straightforwardness, trust, altruism and tender-mindedness. Achievement, striving, self-discipline, deliberation, order and dutifulness are facets of Conscientiousness, while Emotional Stability includes depression, hostility, impulsiveness, vulnerability, self-consciousness and anxiety. Openness to Experience is characterized by aesthetics, feelings, fantasy, ideas, actions and values (Costa and McCrae, 1992). These dimensions have been found irrespective of factor analytical techniques (Goldberg, 1990), method of assessment (McCrae and John, 1992) and language (De Raad et al., 1998), and appear universal across cultures (Jang et al., 1998).

Studies have generally found Agreeableness and Conscientiousness to be positively correlated with a healthy diet. For instance, Booth-Kewley and Vickers (Booth-Kewley and Vickers, 1994) found that more conscientious individuals engaged in more healthy behaviors, including eating a healthy diet, with correlations ranging from 0.31 to 0.45. In another study (Lemos-Giralde and Fidalgo-Alisto, 1997), Conscientiousness and Agreeableness were positively associated with health behavior, most notably a diet high in fruit and fiber, and low in fat and salt. In addition, this study also showed that more conscientious and more agreeable individuals had a more positive attitude towards these healthy diets. The personality dimensions explained 6–12% of the variance, with standardized regression coefficients ranging from 0.12 to 0.22.

Regarding PA, several studies (Courneya et al., 1999; Rhodes et al., 2002; Rhodes et al., 2003) have found Extraversion to be positively associated with exercise behavior such as walking and jogging, with standardized regression coefficients ranging from 0.14 to 0.28.

To date, however, studies focusing on an association between personality and health behaviors have been conducted in (young) adult samples, even though the Big Five personality dimensions have been identified in both late childhood (Mervielde et al., 1995; Barbarenelli et al., 2003) and adolescence (Scholte et al., 1997). The present study explored the direct association between the Big Five personality dimensions and important health behaviors in a Dutch adolescent sample, i.e. fruit and vegetable consumption, and routine and sports-related PA. In line with the associations found in (young) adult populations, we hypothesized that more agreeable and more conscientious adolescent would consume more fruit and vegetables. We further hypothesized that more extraverted adolescents would be more active in both routine and sports-related PA.

Methods

Subjects and procedures

In the present study, 12- to 18-year-old adolescents were requested to complete a questionnaire as part of a large, ongoing prospective cohort study in the city of Eindhoven, a city of approximately 200 000 inhabitants located in the southern part of The Netherlands. In this prospective study, all patients over 12 years of age (some 35 000 patients), which are covered by the seven medical practices in Eindhoven, were invited to participate. Of these 35 000 patients, some 2800 are in the 12–18 years age bracket. In this age group, informed consent is
required from both the respondent and their parents. Participant addresses were obtained through the GP. Anonymity was guaranteed and respondents were informed that GPs would not be informed about participation. Only those adolescents for whom informed consent was received from themselves and their parents were included in the study. In the case of non-response to the initially mailed questionnaire, a reminder was sent 2 weeks later.

In November 2002 and May 2003, the 12- to 18-year-old adolescents \((n = 2536\) and \(n = 2837\), respectively) were invited to complete a self-administered questionnaire at home. For both samples, questionnaires were identical. In addition to the questionnaire sent, an explanatory covering letter and reply-paid envelope were included. In November 2002, 504 [response rate 20%; 296 girls and 208 boys; mean age = 14.5 years \((SD = 1.7)\)] and in May 2003, 476 [response rate 17%; 263 girls and 213 boys; mean age = 14.9 years \((SD = 2.0)\)] adolescents completed the questionnaire. Since both samples did not differ on demographics, we combined both samples to allow greater statistical degrees of freedom and to increase the power of our analyses. Those of whom questionnaires were received on both occasions \((n = 155)\) were removed from the second sample before merging the data sets, leaving a total sample of 825 [468 girls and 357 boys; mean age = 14.8 years \((SD = 2.0)\)].

**Measures**

Big Five personality dimensions were assessed using a shortened version of a Dutch translation of Goldberg’s adjective 100 list (Gerris et al., 1998). Respondents were asked to indicate on a seven-point scale whether or not they agreed \((0 = \text{totally agree}; 7 = \text{totally disagree})\) with such statements as ‘I am creative; I am quiet; I am helpful; I am careless’. Adolescents in the age range 12–18 years have been found to give reliable reports on this shortened, 30-item questionnaire (Scholte et al., 1997).

Fruit consumption and vegetable consumption were assessed with, respectively, five items and two items from a validated questionnaire (Van Assema et al., 2002; Bogers et al., 2004). Regarding fruit consumption, respondents were asked to indicate on how many days per week they consumed the following fruits \((1 \text{ piece} = 125 \text{ g})\): apples, pears, bananas, citrus fruits (oranges, grapefruits, lemons, tangerines) and other fruits. Additionally, respondents were asked to indicate the number of pieces they consumed of each of those fruits on such a day. Two pieces of tangerines were considered as one piece of fruit. A single score was computed for the average amount of grams of fruit per day. Regarding vegetable consumption, respondents were asked to indicate on how many days per week they consumed heated and raw vegetables. They were further asked to indicate the number of serving spoons \((1 \text{ serving spoon} = 50 \text{ g})\) they consumed of both heated and raw vegetables on such a day. A single score was computed for the average amount of grams of vegetables per day.

PA was assessed using a validated questionnaire. The relative validity of this questionnaire was assessed by comparing it with a 7-day physical record. The Spearman rank-order coefficient was 0.50 between these two methods and 0.73 for the test–re-test reliability. Cohen’s \(k\) was 0.33 between these two methods and 0.58 for the test–re-test reliability (Koremans et al., 2000; Ronda et al., 2001). Respondents were asked to indicate on how many days per week they were engaged in various physical activities for at least 10 min a time. In addition, respondents were asked to indicate for how many minutes a day they were engaged in each of these activities. A single score for average minutes per day was computed for both the amount of routine PA (walking, cycling, using stairs, gardening and household labor) and for sports-related PA (jogging, swimming, gymnastics, tennis, martial arts, canoeing, field sports and skating).

**Analyses**

Spearman (gender) and Pearson correlations were computed between behavioral outcomes, gender, age and each of the Big Five dimensions. We used multiple linear regressions with Big Five dimensions as the independent variables and each of the behavioral outcomes as the dependent variable. Furthermore, if gender and/or age were significantly correlated with a behavioral outcome in the
bivariate analyses, we adjusted for this demographic variable in the multiple regression analysis.

The magnitude of the effect size ($r$) was used as the main source of information, since it is insensitive to group sizes (Tabachnick and Fidell, 1996; Rigby, 1999). Effect size interpretations were based on Cohen’s ([Cohen, 1988], pp. 79–81) descriptive guidelines. For univariate analyses, effect sizes between 0.10 and 0.30 were defined as small. Effect sizes between 0.30 and 0.50 were defined as medium sized, while effect sizes larger than or equal to 0.50 were defined as large. In the multiple regression analyses, effect sizes ($f^2$) were computed by dividing the amount of explained variance ($r^2$) by the amount of error variance ($1 - r^2$). Effect sizes were regarded as small when they were between 0.02 and 0.15, medium between 0.15 and 0.35, and large when equal to or larger than 0.35 ([Cohen, 1988], pp. 413–414]. Effect sizes for multiple regression analyses are based on the total effects the independent variables have on the dependent variable and, since these independent variables are standardized values, a single best predictor can be identified.

**Results**

Table I shows the mean consumption per day of fruit and vegetables, and the average amount of routine and sports-related PA. Respondents consumed on average 125 (SD = 96.0) g of fruit and 97 (SD = 100.0) g of vegetables per day. Eighteen percent met the recommendation of 250 g of fruit per day, while 13% met the recommendation of 200 g of vegetables per day. Respondents spent on average 42.3 (SD = 41.6) min/day on routine PA and 34.5 (SD = 46.7) min/day on sports-related PA. A total of 50.3% met the recommendation of being physically active (routine PA and sports-related combined) for at least 60 min/day on every day of the week (Kemper et al., 2000).

The univariate analyses (Table I) showed that adolescents who consumed more fruit and vegetables were more agreeable. Additionally, adolescents who consumed more fruit and vegetables were more open to experience, while adolescents who were more active in sports-related PA were more extraverted. All correlations larger than .10 were statistically significant and effect sizes of the found correlations were small.

In the regression analyses (Table II), Agreeableness and Openness to Experience were positively and significantly associated with vegetable consumption: adolescents who consumed more vegetables were more agreeable and more open to experience. In addition, Extraversion was positively and significantly associated with sports-related PA: adolescents who spent more time in sports-related PA were more extraverted. Finally, Openness to Experience was positively and significantly associated with fruit consumption: adolescents who consumed more fruit were more open to experience. The independent variables explained 6% variance in vegetable consumption and sports-related PA, and 3% variance in fruit consumption. The effect sizes in the multivariate analyses were small, while no significant associations were found for routine PA.

**Discussion**

In modern health psychology, the impact of chronic illness on the psychological development of individuals has received much attention; however, not as much as the inverse relationship, i.e. the impact of personality on healthy behaviors (Van Heck, 1997). With the current increase in unhealthy lifestyles, a stronger focus is needed on prevention, e.g. to halt the current obesity epidemic (Goran et al., 1999). In the present study, we explored the direct association between personality and important health behaviors, i.e. fruit and vegetable consumption, and PA, in a Dutch adolescent sample. Results from both the univariate and multivariate analyses lent some support for our hypotheses. More extraverted adolescents spent more time in sports-related PA. Furthermore, in the univariate analyses, we found that Agreeableness was positively correlated with fruit consumption and vegetable consumption. In the multivariate analyses, Agreeableness remained positively and significantly associated
Table 1. Bivariate correlations between the Big Five dimensions, fruit consumption, vegetable consumption, routine PA, sports-related PA, age and gender

<table>
<thead>
<tr>
<th></th>
<th>Cronbach’s α</th>
<th>Mean (SD)</th>
<th>Extraversion</th>
<th>Agreeableness</th>
<th>Conscientiousness</th>
<th>Emotional Stability</th>
<th>Openness to Experience</th>
<th>Fruit (average g/day)</th>
<th>Vegetables (average g/day)</th>
<th>Routine PA (average min/day)</th>
<th>Sport PA (average min/day)</th>
<th>Gender (0 = boy; 1 = girl)</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extraversion (range 6–42)</td>
<td>0.83</td>
<td>29.10 (7.0)</td>
<td>1</td>
<td>0.235&lt;sup&gt;c&lt;/sup&gt;</td>
<td>-0.102&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.406&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.197&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.049 0.091</td>
<td>0.042 0.105&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.038 0.003</td>
<td>0.073</td>
<td>0.195&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.066 0.021 0.027 0.022</td>
</tr>
<tr>
<td>Agreeableness (range 6–42)</td>
<td>0.81</td>
<td>33.11 (4.7)</td>
<td>1</td>
<td>0.223&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.013</td>
<td>0.415&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.130&lt;sup&gt;c&lt;/sup&gt; 0.187&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.062 0.053</td>
<td>0.081&lt;sup&gt;a&lt;/sup&gt; 0.031</td>
<td></td>
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<tr>
<td>Conscientiousness (range 6–42)</td>
<td>0.84</td>
<td>26.06 (7.0)</td>
<td>1</td>
<td>-0.077</td>
<td>0.122&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.091 0.084</td>
<td>0.003 0.073</td>
<td>0.086 0.101&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td>Emotional Stability (range 6–42)</td>
<td>0.80</td>
<td>25.58 (6.7)</td>
<td>1</td>
<td>-0.024</td>
<td>0.018 0.039</td>
<td>0.000</td>
<td>0.059 -0.177&lt;sup&gt;b&lt;/sup&gt; 0.141&lt;sup&gt;c&lt;/sup&gt;</td>
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<tr>
<td>Openness to Experience (range 6–42)</td>
<td>0.72</td>
<td>28.59 (5.8)</td>
<td>1</td>
<td>0.139&lt;sup&gt;c&lt;/sup&gt; 0.195&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.066</td>
<td>0.021</td>
<td>0.027 0.022</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit (average g/day)</td>
<td>125 (96.0)</td>
<td>1</td>
<td>0.510&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.250&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.141&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.091&lt;sup&gt;a&lt;/sup&gt; 0.034</td>
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<tr>
<td>Vegetables (average g/day)</td>
<td>97 (100.0)</td>
<td>1</td>
<td>0.201&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.137&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.043</td>
<td>0.083</td>
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<tr>
<td>Routine PA (average min/day)</td>
<td>42.3 (41.6)</td>
<td>1</td>
<td>0.292&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.047</td>
<td>0.035</td>
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<tr>
<td>Sport PA (average min/day)</td>
<td>34.5 (46.7)</td>
<td>1</td>
<td>-0.079&lt;sup&gt;a&lt;/sup&gt; 0.186&lt;sup&gt;c&lt;/sup&gt;</td>
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<td>Gender (0 = boy; 1 = girl)</td>
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<tr>
<td>Age</td>
<td>14.8 (2.0)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</table>

<sup>a</sup><sub>p < 0.05</sub>, <sup>b</sup><sub>p < 0.01</sub>, <sup>c</sup><sub>p < 0.001</sub>. Small effect sizes are underlined; medium effect sizes are in bold; large effect sizes are in italics.
with vegetable consumption. Contrary to our hypotheses, Openness to Experience was also positively associated with both fruit consumption and vegetable consumption. The standardized regression coefficients for the Big Five dimensions ranged from 0.09 to 0.13 and explained 3–6% variance in behavior, although for sports-related PA this is mainly due to the effects of gender and age in the regression equation. Studies focusing on personality associations with other health behaviors, such as risky sexual behavior (Miller et al., 2004) and oral self-care (Kressin et al., 1999), have reported similar findings in terms of standardized regression coefficients and explained variance.

The low amount of explained variance and the values of the standardized regression coefficients seem somewhat disconcerting, and call the practical relevance of personality assessment in health behavior into question, especially when comparing our results with studies that focus on more proximal determinants of health behavior, e.g. studies based on the TPB. The TPB explains some 30% variance in self-reported behavior, with standardized regression coefficients usually ranging from 0.20 to 0.50 (Godin and Kok, 1996; Armitage and Conner, 2001). Concepts used in TPB, such as attitude and intention, are behavior specific and dynamic in nature, whereas personality dimensions are stable over time and situations (West and Graziano, 1989; Roberts and DelVecchio, 2000). It has been argued (Conner et al., 2000; Rhodes et al., 2004) that social cognitive variables lack temporal stability in measurement, which has been acknowledged by Ajzen (Ajzen, 2002) to be a principle limitation in the TPB. Indeed, a study in the exercise domain (Courneya and McAuley, 1993) found that intention was unstable even over a 2-day duration, suggesting a more stable construct, such as personality, is needed to explain and predict health behaviors over time (Rhodes et al., 2004). In addition, the act of eating is known to be complex, and to involve many ‘decisions’ at environmental, psychological, psychosocial and behavioral levels (Baranowski et al., 2003). For instance, when one is consuming vegetables (behavioral), vegetables need to be available (environmental), one should have a positive attitude and intention (psychosocial) towards vegetable consumption, and perhaps one should be psychologically inclined towards vegetable consumption.

Our results showed that Agreeableness was associated with vegetable consumption. This may seem plausible, since vegetable consumption is likely to take place at the dinner table where parental influence may be strong. For instance, parents may actively encourage vegetable consumption by setting family eating rules (Nicklas et al., 2001). Since Agreeableness consists of such traits as compliance, more agreeable adolescents may be more prone to obey these rules. Openness to experience revealed the strongest effects on fruit and vegetable consumption in terms of standardized regression coefficients. Although contrary to our hypotheses, a recent study (Goldberg and Strycker, 2003).

Table II. Standardized regression coefficients from multiple regression analyses with fruit consumption, vegetable consumption, and routine and sports-related PA as dependent variables, and Extraversion, Agreeableness, Conscientiousness, Emotional Stability and Openness to Experience as independent variables

<table>
<thead>
<tr>
<th></th>
<th>Extraversion</th>
<th>Agreeableness</th>
<th>Conscientiousness</th>
<th>Emotional Stability</th>
<th>Openness to Experience</th>
<th>Gender¹</th>
<th>Age²</th>
<th>R²</th>
<th>F²</th>
<th>F (d.f.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit</td>
<td>0.004</td>
<td>0.075</td>
<td>0.061</td>
<td>0.017</td>
<td>0.101</td>
<td>0.058</td>
<td>0.03</td>
<td>0.03</td>
<td>4.43</td>
<td>6</td>
</tr>
<tr>
<td>Vegetables</td>
<td>0.026</td>
<td>0.122b</td>
<td>0.042</td>
<td>0.032</td>
<td>0.130b</td>
<td>0.084⁴</td>
<td>0.06</td>
<td>0.06</td>
<td>8.33</td>
<td>6</td>
</tr>
<tr>
<td>Routine PA</td>
<td>0.024</td>
<td>0.035</td>
<td>-0.011</td>
<td>-0.018</td>
<td>0.042</td>
<td>0.000</td>
<td>0.00</td>
<td>0.00</td>
<td>0.83</td>
<td>5</td>
</tr>
<tr>
<td>Sport PA</td>
<td>0.085a</td>
<td>0.070</td>
<td>-0.054</td>
<td>-0.043</td>
<td>-0.031</td>
<td>-0.135⁵</td>
<td>-0.186</td>
<td>0.06</td>
<td>0.06</td>
<td>8.07</td>
</tr>
</tbody>
</table>

¹P < 0.05, ⁵P < 0.01, ⁶P < 0.001.

We adjusted for age and/or gender when these were significantly associated with the behavioral outcomes. Small effect sizes are underlined; medium effect sizes are in bold; large effect sizes are in italics.
2002) found Openness to Experience to be positively associated with fiber consumption. These authors stated that this association should be understood in the present context: our current environment is considered to be obesogenic (WHO, 2003), making the consumption of an unhealthy diet easy and accessible. Individuals who are more open to experience might be more likely to eat foods that are not readily available. Furthermore, studies in the field of food neophobia have found positive associations between experience seeking, which is a subtrait of Openness to Experience, and the consumption of novel foods (Otis, 1984; Pliner and Hobden, 1992). Since humans are born with an innate dislike of sour tastes (Desor et al., 1975; Rosenstein and Oster, 1988), children and adolescents that are more open to experience are perhaps more likely to consume sour foods. Indeed, a recent study (Liem, 2004) showed that boys who had a preference for sour taste consumed more fruits. Our finding that Extraversion was associated with sports-related PA is in line with previous studies among adults (Rhodes et al., 2002, 2003).

The theoretical models most commonly applied to explain health behaviors primarily focus on the more proximal social cognitive determinants, such as attitude, subjective norm and perceived behavioral control (Ajzen, 1991). These social cognitions may be better modifiable through interventions (Glanz et al., 2002), but such interventions are not always successful in inducing behavior change (Hardeman et al., 2002; Baranowski et al., 2003). This may, in part, be due to the fluctuations in the levels of these social cognitions (Rhodes et al., 2004). It has been suggested that ‘interventions will likely benefit from consideration of one’s personality along with social cognitions until we better understand the mechanisms responsible for these fluctuations’ (Rhodes et al., 2004). Although these authors have focused on the exercise domain, our results provide some suggestion that a similar consideration could apply in the diet domain, more specifically fruit and vegetable consumption in adolescents.

The TPB proposes that the relation between personality and behavior is mediated by social cognitive factors and intention. Recent studies, however, have indicated that social cognitions do not always fully mediate personality influences (Courneya et al., 1999; Conner and Abraham, 2001) and cultural/physical environment influences (De Bruijn et al., 2005) on PA. Conceptually, a mediating variable explains how or why an independent variable affects the outcome variable. This intermediary connection makes a previous significant association between the independent variable and outcome variable less strong and less significant (partial mediation) or non-existent (total mediation) (Baron and Kenny, 1986; Kraemer et al., 2001). The direct association found between personality and fruit and vegetable consumption provides some evidence for the first prerequisite for mediation, and warrants further research to establish if social cognitions mediate personality influences on other adolescent health behaviors, including diet.

Some comments should be made regarding the limitations of our study. Of the adolescents approached, 80% of the first sample and 83% of the second sample did not participate in the study. Although no formal non-response analysis was conducted, girls (both samples) and older adolescents (first sample) were more likely to participate. The now obligatory informed consent procedure, involving adolescents as well as their parents, may make low response rates more probable. A more stringent concern is that non-response might be personality related. The dimensions of Agreeableness and Conscientiousness contain traits related to compliance and dutifulness respectively, which may make adolescents high on either or both of these dimensions more likely to participate. Prevalence rates of adolescents high in Agreeableness and Conscientiousness may thus have been overestimated in our sample, but it is unlikely that the validity of the found relationships between personality and health behavior is affected by the potentially selective response. Nevertheless, additional research in different adolescent samples is needed to support our findings.

Furthermore, although the Big Five dimensions have achieved considerable popularity in the field of personality psychology, some concerns regarding the Big Five dimensions have been expressed.
(Block, 1995a,b). For instance, a recent study (Scholte and De Bruyn, 2004) suggested that personality in early adolescents might also be adequately explained in terms of three dimensions, while Shiner (Shiner, 1998) proposed a taxonomy based on four dimensions. Although it has been claimed that the Big Five dimensions are not fully developed (Goldberg and Saucier, 1995), they provide a practical utility and a common language (Barbaranelli et al., 2003) for research in the personality domain.

## Acknowledgements

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