

EVALUATION OF A PLANNED BEHAVIOR THEORY-BASED INTERVENTION PROGRAMME TO PROMOTE HEALTHY EATING¹

HARALAMBOS TSORBATZOUDIS

*Sport Psychology Laboratory
Aristotle University of Thessaloniki*

Summary.—The objective of the study was to test the effectiveness of an intervention program based on the theoretical framework of the Theory of Planned Behavior, with the addition of attitude strength and role identity. The aim was to alter adolescents' healthy eating attitudes and behaviour. In the sample were 335 high school students, who were divided into intervention and control groups. The intervention lasted 12 weeks and included posters and lectures promoting healthy eating. The measures included a questionnaire assessing the hypothesis and a food frequency questionnaire which measured eating habits. Analysis showed the intervention was effective in improving attitudes toward healthy eating and attitude strength, intention, perceived behavioral control, and healthy eating behaviour, but not effective in predicting subjective norms and role identity. Results provide evidence that intervention changed attitudes toward a behavior in a school setting.

There is considerable evidence that the dietary intakes of adolescents are often inadequate. Research endeavour has confirmed that nutrition-related chronic disease is increasing in adolescent populations. For example, obesity and cardiovascular disease in children and adolescents indicate that nutrition-related problems are becoming a significant cause of morbidity and mortality in youth (Berenson, Srinivasan, & Bao, 1997; Van Horn & Kavey, 1997; Troiano & Flegal, 1998). There is a consensus on the important role of healthy eating on the overall health. However, there are some open questions of what constitutes healthy eating. Conner, Norman, and Bell (2002, p. 194) defined healthy eating as a diet "low in fat, high in fiber, and high in fruit and vegetable consumption." Other researchers underlined the reduction of average total energy intake, total fat, saturated fat, and the qualitative improvement of eating habits (Munoz, Krebs-Smith, Ballard-Barbah, & Cleveland, 1997). Despite the importance ascribed to healthy eating, studies are few (Godin & Kok, 1996; Hoelscher, Evans, Parcel, & Kelder, 2002). Experimental studies in which variables of healthy eating have been manipulated are scarce.

Michie and Abraham (2004) reviewing interventions to change health behaviours suggest the development of effective, theoretically based change

¹Address correspondence to Dr. Haralambos Tsorbatzoudis, Aristotle University of Thessaloniki, Department of Physical Education and Sport Science, Sport Psychology Laboratory, Thessaloniki 54124, Greece or e-mail (lambo@phed.auth.gr).

techniques across behavioural domains. One of the prominent theories used to explain the mechanisms underlying the adoption of healthy behaviours is the theory of planned behavior. This view is an extension of Ajzen and Fishbein's (1980) theory of reasoned action, which includes voluntary behaviours. One premise is that the most important predictor of behaviour is the individual's intention to execute that behaviour. Behavioural intention is predicted by three variables: attitudes towards the activity, subjective norms, and perceived behavioural control. Attitudes towards the activity refer to the positive or negative evaluation of the activity by the individual (personal element), whereas subjective norms include the pressure posited to the individual by the social environment to perform a specific activity (social element). Perceived behavioral control represents the individual's perceptions of the extent to which performing a behaviour is under control. Based on previous research, Sheeran, Trafimow, and Armitage (2003) estimated that intention explained between 19% and 38% of the variance in behaviour. Also, attitudes and subjective norms explained between 33% and 50% of the variance in intention, while perceived behavioral control explained an additional 13% of the variance in behaviour.

The meta-analyses conducted by Armitage and Conner (2001), and Hausenblas, Carron, and Mack (1997) indicated that, if individuals form a strong intention to perform a behaviour, then performance is probable. Intention is largely influenced by attitudes towards the activity and perceived behavioural control, while the role of subjective norms is moderate.

Research has indicated that this theory provided a useful framework for the prediction and better understanding of behaviour in several life settings, such as health (obesity, eating habits, etc; Armitage & Conner, 1999, 2001; Conner, Sheeran, Norman, & Armitage, 2000; Armitage, Norman, & Conner, 2002) and exercise (Hausenblas, *et al.*, 1997; Brenes, Strube, & Storaandt, 1998). Conner, *et al.* (2002) indicated that intention could predict eating behaviour even after six years.

Theodorakis (1994) based on previous research by Raden (1985) and Charng, Piliavin, and Callero (1988), and on findings in physical activity contexts (Theodorakis, Bagiatis, & Goudas, 1995), argued that the influence of attitudes towards the activity and subjective norms on intention is mediated by strength of attitude and role identity. Variables in strength of attitude may involve the individual's confidence, certainty, importance, knowledge, and information about the activity. Role identity refers to the integration of a repeated behaviour into the self-concept of the individual, as a dimension of self.

The consistency in the literature on the effectiveness of prediction of these variables on behaviour suggested researchers could alter behaviour by manipulating these variables. Studies conducted in various settings have

shown that intervention programs can change attitudes toward exercise (Brodie & Birtwistle, 1990; Patterson & Faucette, 1990; Smith & Biddle, 1999), educational issues (Rizzo & Vispoel, 1992), and other healthy behaviours (for review see Godin & Kok, 1996).

As far as healthy eating is concerned, Hoelscher, *et al.* (2002) highlighted the necessity of changing eating habits of adolescents. In their review of adolescent nutrition interventions, only six of the 17 studies used a specific theoretical framework. The most dominant theory was social cognitive theory (Bandura, 1986), whereas the PRECEDE model (Predisposing, Reinforcing, and Enabling Causes in Educational Diagnosis and Evaluation), and the 'Process of Nutrition Education' Model were also used (Nicklas, Johnson, Myers, Fariis, & Cunningham, 1998). When interventions were theory-based, significant changes in behaviour occurred.

Not only theory-based explanations have assisted better understanding of nutritional behaviour but also improved methods of assessment used specifically with the young population. This reflects increased interest in diets of children and adolescents and the possible relation between such diets and adulthood diseases. The majority of these methods suggest that food-frequency questionnaires provide enough accuracy in studies of adolescents to assess the relation of individual diets to subsequent health outcomes (Rockett & Colditz, 1997). It seems, therefore, such questionnaires are promising for diagnostic purposes and as a basis for further epidemiological research.

Although the relation between dietary changes and adolescence chronic disease seems complex, present results emphasize the role of imbalance between energy intake and expenditure. In addition, the rapidly increasing prevalence of obesity in childhood and adolescence led to focus not only on high risk individuals, e.g., already obese, but to use of more population-based approaches. Under these conditions schools seem potentially important for conducting interventions because they offer access to large populations of students and provide opportunity to institutionalize programs in communities (Gortmaker, Peterson, Wiecha, Sobol, Dixit, Fox, & Laird, 1999). However, theory-based research applied in a school context and research based on elaborated nutritional assessment methods is limited.

Thus, it appears that the use of the Theory of Planned Behavior with the addition of attitude strength and role identity might enhance the focus of interventions to increase individuals' healthy eating behaviours. Therefore, the purpose of the present study was to examine the effectiveness of an intervention program based on this theoretical framework. In other words, the educational outcome of this program was expected to be changes in attitudes and dietary intake.

METHOD

Participants

The sample of 335 students (M age=14.8 yr., $SD=.8$) included 179 boys (M age=14.9 yr., $SD=.7$) and 156 girls (M age=14.6 yr., $SD=.7$). Four students did not report their ages. At the time of the study, the students were attending five schools in a city of northern Greece. The students of three public schools were assigned to the intervention group ($n=172$, M age=14.9 yr. $SD=.7$), while the students of the other two served as the control group ($n=163$, M age=14.7 yr., $SD=.8$). After the end of the intervention two classes ($n=111$) were randomly selected from each school to participate in a follow-up measure ($n=58$ students from the intervention and $n=53$ students from the control group, respectively).

Measures

Based on an extended model, measures included intention, attitudes toward behaviour, subjective norms, perceived behavioural control, role identity, and attitude strength. These constructs have been used to study attitude and behaviour in Greek samples (Theodorakis, 1994; Theodorakis, *et al.*, 1995; Bebetos, Papaioannou, & Theodorakis, 2003; Kosta, 2003; Tabaki, Barkoukis, & Rodafinos, 2004). Item formulation took into account Ajzen's suggestions (2002).² Kosta (2003), examined the psychometric properties of these scales and reported Cronbach α s $>.69$. Values for the present sample appear in Table 1 below.

Intention.—For the evaluation of subjects' intention three items were used, 'I intend/I will try/I am determined to eat healthy in the next three months'. Responses were given on a 7-point scale with anchors of 1=very unlikely and 7=very likely for the first item and 1=disagree and 7=agree for the other two items.

Attitudes Toward Behaviour.—Attitudes toward physical activity participation were measured by the statement, 'I think healthy eating is...'. Responses were given on five bipolar adjectives (harmful–beneficial, difficult–easy, unimportant–important, unpleasant–pleasant, unnecessary–necessary, and bad–good). The participants responded on a 7-point scale. Low scores indicate negative attitudes.

Subjective norms.—Normative beliefs were estimated on three items. Responses to the stem, 'If I ate healthily it would be approved by my...', were rated for three referents: (a) parents and relatives, (b) friends, and (c) teachers. Responses were given on a 7-point scale with anchors of 1=not at all and 7=very much.

Perceived Behavioral Control.—Control beliefs were measured by three questions using responses on anchors of 1 and 7 as follows: (a) 'If I wanted to, I could eat healthily for the next three months' (1=very unlikely and 7=likely); (b) 'How much control do you believe you have over eating healthily for the next three months' (1=very little control and 7=complete control'), and (c) 'For me eating healthily for the next three months would be...'. (1=impossible and 7=possible).

Role Identity.—Role identity was assessed using three statements for healthy eating: 'I would feel that I would lose something, if I could not eat healthily for the next three months', 'Healthy eating for the next three months is an important part of my life', and 'Healthy eating is an expression of who I am'. Responses were rated on a 7-point Likert-type scale using anchors of 1=disagree and 7=agree.

Attitude Strength.—Attitude strength was assessed with six statements on a 7-point Likert-type scale: (a) 'How certain are you that you will eat healthy over the next three months?' Responses were based on anchors of 1=very uncertain and 7=very certain. (b) 'To eat healthily over the next three months is one of my priorities' was rated with anchors of 1=strongly disagree and 7=strongly agree. (c) 'I have the will needed to eat healthily over the next three months', responses were given using anchors of 1=strongly disagree and 7=strongly agree. (d) 'Do you really believe that you will eat healthily over the next three months?' was rated using 1=absolutely not and 7=absolutely yes.

Healthy eating habits.—Healthy eating habits were assessed using the Greek Adolescents' Food Frequency Questionnaire (Kosta, 2003). The food frequency approach asks subjects to report the usual consumption of each food from a list of foods and food groups. Kosta's questionnaire is based on the Youth Adolescent Food Frequency Questionnaire (Rockett, Wolf, & Colditz, 1995; Rockett, Breitenbach, Frazier, Witschi, Wolf, Field, & Colditz, 1997; Rockett & Colditz, 1997) and has been enriched with 20 Greek dishes to satisfy cultural-ethnic variations in food preference and choice reported in other studies (Borrad, McPherson, Nichaman, Pillow, & Newell, 1989; Pérez-Rodrigo & Aranceta, 1997). The questionnaire presents 12 food categories (cereal and cereal products, milk and milk products, eggs, fats and oils, meat and meat products, fish and fish products, vegetables, fruits, nuts, sugar and snacks, refreshments and alcoholic drinks). Examples of the Greek foods and dishes added were Greek yogurt (yogurt made up with sheep and cow's milk and contains gratin), and feta (white cheese, made with sheep and cow's milk). Each food was accompanied by the appropriate serving portion, according to the Greek Ministry of Health. An energy analysis (kj/d) was used based on the food tables provided by Holland, Welch, Unwin, Buss, Paul, and Southgate (1995) and Trichopoulou (1992). The analysis has

²Ajzen, I. (2002) Constructing a TpB Questionnaire: conceptual and methodological considerations. <http://www-univ.oit.umass.edu/raizen/polft/tpb.measurement>.

focused on total energy intake given evidence that they played a special role in obesity (Anderson & Rössner, 1989; Rocket, *et al.*, 1997; Gortmaker, Peterson, Wiecha, Sobol, Dixit, Fox, & Laird, 1999). Reproducibility and validity of the questionnaire has been satisfactory for 24-hr. recalls (Kosta, 2003).

Intervention

The guidelines for designing effective healthy eating interventions (Hoelscher, *et al.*, 2002) were taken into account. These refer to the specification of the objectives, selection of the sample, methods, and strategies used to influence the attitude component, design and implementation of the intervention, and its monitoring and evaluation. The purposes of the intervention program were (a) to enhance knowledge needed by students to understand broad, contemporary food and nutrition issues, such as the appropriate consumption of various food categories, fruits and vegetables, nutritional needs over the lifespan, etc.; (b) to develop positive thoughts and emotions for healthy eating and negative ones for inactivity and unhealthy lifestyles; (c) to encourage students to embrace a healthy eating lifestyle; and (d) to make the students familiar with self-assessment of dietary intake and feedback techniques. The intervention lasted 12 wk. Similar interventions have been extended 8 to 16 weeks (Anderson, Cox, McKellar, Reynolds, Lean, & Mela, 1998; O'Loughlin, Paradis, Meshfedjian, & Kishchuk, 1998; Rankins, Weatherspoon, Cook, Reed, Shuford-Law, Davis, Kissinger, & Ralston, 1999). The specific features of the intervention were lectures and posters, as suggested in previous studies (see Brubaker & Wickersham, 1990; Kerr, Eves, & Carrol, 2001). Similar features have been also used in an intervention to promote participation in physical activity in a school context (Tsorbatzoudis, under review).

Lectures.—After a systematic review of studies applying the Theory of Planned Behavior, Hardeman, Johnston, Johnston, Bonetti, Wareham, and Kinmonth (2002) argued that persuasion and information were the most frequently used behavioural change methods, followed by goal setting and rehearsal of skill used. Based on this assertion, three 45-min. lectures were presented to the students of the intervention group by the researcher. The first one took place at the first week of the intervention and provided information regarding the benefits of healthy eating and the negative consequences of inactivity and unhealthy lifestyle, such as obesity, etc. Also, important factors for behavioural change such as personal beliefs and values, attitudes, motivations and environmental factors as well as personal control and responsibility factors were investigated and discussed. The second lecture took place in the fourth week of the intervention with specialized procedures of personal goal-setting and kinds of behavioural management, i.e., specify realistic goals, evaluate yourself, draw up a behavioural contract, and clarify de-

cision-making processes. The third lecture occurred in the eighth week of the intervention and provided information on possible strategies in change of behaviour and following a healthy eating program effectively, i.e., tips for proper eating, such as 'do not eat late at night, set personal goals for improvement, check your improvement', 'record in a diary for a week the frequency of talking about healthy eating', etc.). The concept of 'average intake', which is essential for food frequency questionnaires (Field, Peterson, Gortmaker, Cheung, Rocket, Fox, & Colditz, 1999), has also been discussed and examples given. Finally, connections between food and present and future health as well as between dietary practices and the physical and social environment were made. The lectures were followed by an interactive discussion with the students to clarify misconceptions regarding healthy eating and healthy lifestyles. Students were given the presentation material and written instructions for further study. Similar strategies have been used to promote positive norms and self-efficacy and to undermine negative attitudes toward condom use (Fisher, Fisher, Misovich, Kimple, & Malloy, 1996). Students in the control group followed the regular school program.

Posters.—There are sound theoretical reasons from operant conditioning that poster prompts are effective cues to action (Kerr, *et al.*, 2001). Two A2-size posters (60 × 42 cm) were hung on the announcement board of each class every month. The announcement board was next to the blackboard, so students could observe the posters during both class hour and breaks. Also, two posters were hung on the announcement board of the gym. The posters were created to stimulate mainly the cognitive, emotional, and behavioural aspects of subjects' attitudes. For example, one poster presented information regarding unhealthy eating, e.g., it showed an opened mouth bingeing large quantities of unhealthy foods such as fried potatoes, sweets, beverages, etc., while the message of the second poster was the regulation of the amount of food (the pyramid of healthy foods). Some of the posters aimed to enhance perceptions of threat by emphasizing the risks of eating unhealthily, while others focused on encouraging messages. Furnishing controversial messages has been also tested previously with satisfactory results (see meta-analysis Kelly, Bond, & Abraham, 2001).

Teachers of Physical Education

A leaflet was administered to these teachers of the intervention group that included tips for healthy eating and active lifestyle, reinforcement strategies, and promotion of self-attributions. Teachers were instructed to provide this information to students during class. The actual number of nutrition and physical activity lessons that students received during the intervention ranged from 32 to 38 and is comparable to a similar intervention conducted by Gortmaker, Cheung, Peterson, Chomitz, Cradle, Dart, Fox, Bullock, So-

bol, Colditz, Field, and Laird (1999). Teachers were also instructed to accentuate values and standards of health improvement and exercise behavior (for similar recommendations see Gortmaker, Peterson, Wiecha, Sobol, Dixit, Fox, & Laird, 1999; Sallis, Patrick, Frank, Pratt, Wechsler & Galuska, 2000), well-suited to students' cognitive development (abstract thinking; Piaget, 1969) and also useful in such a questionnaire (Field, *et al.*, 1999). The content of the leaflet and the recommendations of values were explained to the teachers in two 2-hr. seminars. Past research has shown that teachers' knowledge and training was particularly effective in promoting healthy behaviours (Gortmaker, Peterson, Wiecha, Sobol, Dixit, Fox, & Laird, 1999).

Procedure

The students completed the questionnaires three times: (a) at the beginning of the second semester of the academic year, (b) 12 wk. after the first measurement, at completion of the intervention, and (c) 2 mo. after the intervention (a follow-up measure). Trained personnel and the teachers supervised the procedure. Both oral and written instructions were given to students about how to complete the questionnaire. They were reassured of the confidentiality of their responses. Further, the introduction stated the importance of remaining attentive while completing the questionnaire. At the end of the follow-up measure interactive discussions in two classes were held, and experiences of students' and teachers' participation in the intervention program were collected. Students of the control group participated in typical physical education classes. Because dietary patterns vary seasonally (Gortmaker, Peterson, Wiecha, Sobol, Dixit, Fox, & Laird, 1999), data were collected at the same time for both intervention and control students so the season of measurement for baseline and outcome variables should not bias estimates of intervention effects.

The study was conducted with permission of the Greek Ministry of Education and with the agreement of students and the school administration. In particular, formal consent was obtained from school directors to involve the teacher and students in the study. Students were asked to participate, were given details of their required involvement, and were assured about their right to withdraw.

RESULTS

Descriptive Statistics, Cronbach Alpha and Correlations

Table 1 contains scale means, standard deviations for the intervention and control groups and also reliability coefficients alpha for the total scale.

At the end of the follow-up measure interactive discussions in two classes were held. The qualitative data collected from students and teachers provided information that their experience was positive. They found informa-

TABLE 1
ADJUSTED SCALE MEANS AND STANDARD ERRORS OF SECOND WAVE COVARIANCE ANALYSES
CONTROLLING FOR FIRST WAVE VALUES AND CRONBACH α FOR TOTAL SAMPLE

Scale	Intervention Group		Control Group		Total Sample α
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	
Intention	13.85	0.37	11.82	0.37	.79
Attitude	27.63	0.34	26.03	0.34	.71
Subjective Norms	13.59	0.36	14.21	0.36	.62
Perceived Behavioral Control	15.32	0.30	14.08	0.30	.75
Role Identity	14.03	0.44	13.07	0.44	.74
Attitude Strength	17.67	0.48	15.28	0.48	.84
Total Energy Intake	7872.2	178.3	8616.4	161.2	

tion interesting, helpful, and easily applicable. Most students expressed their intention to be more aware in the future about nutritional habits and interest in continuing to use goal-setting and diary keeping.

The Pearson product-moment correlations of ratings on the planned behavior variables are presented in Table 2. In both measurements, low to medium correlations emerged (*r*s ranged from .18 to .69). The Subjective Norms gave low ratings correlations with rated Intention and Attitudes in the first measurement. Low correlations at the second measurement were noted for Role Identity and Intention, Attitude and Perceived Behavioral Control whereas these variables were uncorrelated with ratings on Subjective Norms. The highest correlations were found between Attitude Strength and Perceived Behavioral Control at both measurement times.

TABLE 2
PEARSON PRODUCT-MOMENT CORRELATIONS FOR TWO TIMES AND CRONBACH α
FOR THE FIRST (α^*) AND THE SECOND (α^\dagger) MEASUREMENTS

	α^*	<i>r</i>						α^\dagger
		1	2	3	4	5	6	
1. Intention	.89		.43	.23	.44	.23	.66	.87
2. Attitude	.73	.44		.27	.57	.21	.49	.70
3. Subjective Norm	.66	.27	.19		.23	.08	.32	.64
4. Perceived Behavioral Control	.74	.55	.56	.20		.18	.66	.76
5. Role Identity	.78	.53	.39	.30	.40		.31	.78
6. Attitude Strength	.89	.62	.46	.26	.69	.58		.88

Note.—Correlations $> .18$ are statistically significant at $p < .01$. First measurement below the diagonal, second measurement above the diagonal.

Effects of Intervention

To examine differences between intervention and control groups on ratings of Intention, Attitudes Toward Behavior, Perceived Behavioral Control, Subjective Norms, Role Identity, Attitude Strength, and Healthy Eating Habits multivariate analyses of covariance were computed. To control for initial

differences, these variables assessed before the intervention were used as covariates in each analysis. Wherever significant differences emerged, follow-up analyses of covariance were computed. Observed power for both sets of analyses was also given. These statistical procedures have been suggested for use, when the dependent variables were intercorrelated (Bühl & Zöfel, 2002).

Analysis of rated Intention showed that, after adjusting for initial differences ($F_{1,311}=14.49$, $p<.001$, $d=.96$, there were statistically significant between-group differences ($F_{1,311}=23.44$, $p<.001$, $d=.99$). The subjects in the intervention group had more positive intentions than those in the control group.

The analysis of covariance of means on Attitudes Toward Exercise with the first measure as a covariate ($F_{1,311}=10.51$, $p<.001$, $d=.89$) showed statistically significant differences in such attitudes ($F_{1,311}=13.91$, $p<.001$, $d=.96$). Subjects in the intervention group reported more positive attitudes toward exercise than those in the control group.

The analysis of covariance for Perceived Behavioral Control indicated that, after adjusting for differences on the first measure ($F_{1,311}=7.79$, $p<.001$, $d=.79$), there were statistically significant differences between the two groups ($F_{1,311}=6.28$, $p<.001$, $d=.70$). Subjects in the intervention group had a higher mean on Perceived Behavioral Control than those in the control group.

After adjusting for differences on the first measure ($F_{1,314}=11.92$, $p<.001$, $d=.93$), Strength of Attitudes, there were statistically significant between-group differences ($F_{1,314}=11.25$, $p<.001$, $d=.91$). The subjects in the intervention group had a higher mean on Attitude Strength after the application of the intervention than that of the control group. After adjusting for differences on the first measure ($F_{1,311}=9.07$, $p<.001$, $d=.85$), there were statistically significant between-group differences ($F_{1,311}=5.07$, $p<.05$, $d=.66$) on total energy intake. Compared to the control group, participants in the intervention group had a lower mean. The analyses of covariance indicated no statistically significant differences between the groups on Subjective Norms and Role Identity ($F_{1,311}=1.43$, $p>.05$; $F_{1,311}=2.26$, $p>.05$, respectively).

Follow-up Study

The analysis of covariance was used again to test for possible differences between the two groups in the third measure (2 mo. after the intervention and the second measure). No significant differences on any of the variables were assessed after adjusting for possible initial differences ($F_{1,105}=1.11$, 1.50, 2.63, .72, 1.34, and 2.30 for Intention, Attitude Toward Behavior, Subjective Norms, Perceived Behavioral Control, Role Identity, and Attitude Strength, respectively). This means students of the intervention group compared with those of the control group continued to have a higher mean on the variables than at the time of the second measurement. Total energy

intake, a follow-up measure, suggested the effect was still positive, although the value was no longer statistically significant ($F_{1,105}=.16$, $p>.05$).

DISCUSSION

The present study was designed to examine the effectiveness of an intervention program based on planned behavior theory in changing high school students' attitudes toward healthy eating. Analysis indicated significant changes on measures of students' attitudes, attitude strength, perceived behavioral control, intention, and healthy eating habits but not those for subjective norms and role identity. More specifically, appropriateness of responses to the scales were indicated by Cronbach α as the values of internal consistency were satisfactory except that for use of a subjective norm. That value was medium.

Weak to moderate correlation coefficients were evident among scores on the planned behavior variables at the first and the second measurements. More specifically, scores on Subjective Norms correlated low with ratings of Intention and Attitudes as both first and second measurements. Additionally, Subjective Norms ratings correlated low with those representing Role Identity, Perceived Behavioral Control, and Attitude Strength at both measurement times, indicating the particular role of this variable in the model. Although stronger correlations among variables were expected, their magnitudes were similar to those of another study examining participation in physical activity (Jackson, Smith, & Conner, 2003).

The decline in correlations noted among measures of Role Identity and the other planned behavior variables at the second measurement indicated that the intervention did not affect this variable. Contrary to this finding, Beetsos, *et al.* (2003), examining university students' attitudes and behaviours toward smoking and exercise, reported high correlations among scores on Role Identity and Intention, Perceived Behavioral Control and Attitude Strength and medium correlations with students' attitudes toward smoking. The pattern of correlation coefficients among the rest of these variables was similar to that observed earlier by Theodorakis, *et al.* (1995).

According to the Theory of Planned Behavior, these attitudes refer to cognitive and emotional components. Hence, the postintervention improvement suggested for students' attitudes implied that the use of posters and lectures contributed to changes in these attitudes toward healthy eating. These strategies aimed to enhance knowledge and relevant information about the benefits of healthy eating and the negative outcomes of sedentary and unhealthy lifestyle. However, the relative importance of presenting the positive effects of healthy eating and of providing information and tips (cognitive component) versus showing the negative outcomes of an unhealthy lifestyle (emotional component) was not separately tested in the present

study. There also was no external measure of responses to posters and lectures, which could pinpoint effectiveness.

Generally, the combination of strategies was related to changes in students' mean attitudes towards the adoption of a healthy eating lifestyle. The effectiveness of the intervention was also suggested by the improvement on the measure of Attitude Strength. These strategies not only were associated with students' perceptions of healthy eating but also were reported by students to increase their confidence, certainty, belief in, and willingness to try. This might indicate some stability for the mean changes in attitude in the present study and observations by prior researchers (Krosnick, Boninger, Chuang, Berent, & Carnot, 1993).

Based on these, present findings suggest interventions for change of high school students' attitudes should incorporate strategies which enhance interest in information and knowledge of benefits of healthy eating and outcomes of unhealthy lifestyle. However, following Michie and Abraham's suggestion (2004), experimental examination of particular techniques separately and in combination is required to identify the critical change-generating processes in the intervention.

Additionally, the intervention seemed to enhance students' Perceived Behavioural Control. The tips for healthy eating and other related healthy behaviours, i.e., weight control, seemed to contribute to improvement in the students' perceptions of their ability to control their behaviour. These strategies may promote students' feelings of competence to adopt a certain eating lifestyle. Although parents control to a large extent the nutritional habits of their children, students of this age have certain freedom to choose everyday nutrition.

Moreover, the intervention enhanced students' intention to adopt a healthy eating lifestyle. Research using hypotheses from the Theory of Planned Behavior has consistently showed that Intention is the strongest predictor of behaviour (Godin & Kok, 1996; Armitage & Conner, 2001; Conner, *et al.*, 2002) and that Intention was most strongly predicted by measures of Attitude, Subjective Norms, and Perceived Behavioral Control (Conner, Kirk, Cade, & Barrett, 2001). The intervention did affect students' intention as differences in dietary total energy intake per day reflected healthier eating. In other words, these findings point to psychological processes in redirection of healthy behavior after this intervention. The mean energy intake was comparable to those of national surveys in the USA (U.S. Department of Agriculture, 1993). Similar results were reported by Gortmaker, Peterson, Wiecha, Sobol, Dixit, Fox, and Laird (1999) and Gortmaker, Cheung, Peterson, Chomitz, Cradle, Dart, Fox, Bullock, Sobol, Colditz, Field, and Laird (1999) who found among girls a lower increase in estimated energy intake per day over the two school years only among intervention participants, not controls.

Regarding total energy intake in the present study the follow-up assessments indicated that change observed at the end of the intervention were not of longer duration, even though some students reported continuing to use goal-setting and diary keeping. Stabilization of modified dietary patterns is a multifaceted process so school-based nutrition intervention should focus not only on giving nutritional information, but also on development of skills and behaviours related to food preparation and food preservation and storage (Pérez-Rodrigo & Aranceta, 1997). Other researchers noted the importance of a family-based intervention and extended school-based nutrition intervention including parental participation and extracurricular activities such as cooking skills and workshop activities in different school subjects (Epstein, Valoski, Wing, & McCurley, 1994; Hopper, Gruber, Munoz, & MacConnie, 1996; Gortmaker, Peterson, Wiecha, Sobol, Dixit, Fox, & Laird, 1999). Such elements may enhance the effectiveness of an intervention. To succeed is more likely when nutrition education themes are incorporated into the school curriculum actively involving teachers, family, and other community professionals (Contento, 1995).

On the other hand, these results indicated this intervention was not effective in changing these subjective norms and students' use of role identity.

It should be noted that the intervention program targeted students' attitudes but was not extended to their social environment and the pressure posited there, so, it would be overly optimistic to expect that parents' and peers' evaluation about healthy eating or the adolescents' perceptions about this would be affected. Given their important role, significant interventions should incorporate the proximal social environment of the target population, e.g., provide information to parents about the benefits of healthy eating and the negative outcomes of unhealthy lifestyle. As parents, to a large extent, control the eating habits of their children (breakfast, lunch, and dinner time, quality of food, etc.), their knowledge and attitudes toward healthy eating should be supported so they could better assist becoming agents of change in their children's eating habits. This proposition might be partly supported regarding work with adolescents on saturated fat (Baranowski & Hearn, 1997; Kelleher, Fallon, McCarthy, Dineen, O'Donnell, Killian, Hope, Bluett, Varley & McDonagh, 1999). The parents influenced their children's choices both by direct encouragement and by acting as models (Berg, 2002). Researchers should extend interventional efforts to the family.

Theodorakis (1994) defined role identity as the integration of a repeated behaviour to the self. If an individual is not systematically involved in healthy eating, this behaviour is not likely to be part of his self. However, researchers suggested (Thoits & Virshup, 1997) that role identity may be a multifaceted construct, representing several components, e.g., personal, role,

and social identities, so different strategies might be used with these components of self. Moreover, the duration of intervention might have been too brief. The above suggestions could be incorporated as different strategies targeting various facets of identities over a longer period.

Whether such intervention affects students' actual behaviour is strongly related to influence on their intention to adopt a healthy eating lifestyle. While the Theory of Planned Behavior includes Intention as the strongest predictor of behaviour, incorporating other social cognitions may yield better control and change of different facets of healthy eating behaviour. Such models could be Bandura's Self-efficacy (1986) and the Transtheoretical Model (Prochaska & DeClemente, 1983; Prochaska, DeClemente, & Norcross, 1992). The latter highlights psychological readiness for change by identifying preparatory psychological changes which precede behaviour change (Michie & Abraham, 2004), and providing a framework for better understanding of why short periods may not be useful in changing behaviour. The former approach (Bandura, 1997, 1998) has been successfully used to generate behavioural change through verbal persuasion, modeling, selective attention, and sequential mastery experiences. Support for Bandura's model of self-efficacy has been also found in a structured intervention designed to increase quitting amongst smokers through giving information on outcome and self-efficacy-enhancing (Dijkstra & De Vries, 2001), and also in an intervention to decrease obesity by improving dietary intake, reducing television watching, and increasing physical activity (Gortmaker, Cheung, Peterson, Chomitz, Cradle, Dart, Fox, Bullock, Sobol, Colditz, Field, & Laird, 1999). However, although Michie and Abraham (2004) recognized the difficulty in identifying particular techniques critical to effectiveness, they claimed a new approach is needed to evaluating theory-based techniques to make progress towards a theory-based technology of behavioural change.

Although the present study describes an intervention that allows replication and both theoretically and statistically important findings, caution should be given in overinterpreting the results. First of all the present intervention did not fully meet all the criteria required to judge the external validity of intervention evaluations proposed by Glasgow, Bull, Gillette, Klesges, and Dziewaltowski (2002). For example, they suggested differentiating between intended and unintended consequences. Second, weight-loss behaviors among schoolmates in the study, such as dieting to lose weight, exercising to lose weight, taking diet pills to lose weight, etc. have not been controlled systematically. Third, differences in maturation tempo between boys and girls was not assessed. Fourth, given age and sex differences in interpretations of healthy and unhealthy eating (Povey, Conner, Sparks, James, & Shepherd, 1998), issues in social conformity to what is healthy for this age

group must be taken into account. Attention should be given in further studies.

To summarize, the intervention as applied in the present study was somewhat effective in changing attitudes about their behaviour strength, intention, perceived behavioural control and actual behavior, but not for subjective norms and role identity. It seems that poster presentation with controversial messages and persuasive communications targeting beliefs about the salient outcomes of a behaviour are a good way to increase healthy eating intentions and behaviour. Studies using the features of this intervention to modify the cognitive and emotional components of attitudes would be strengthened by including the target group's social environment if long-term changes in healthy eating behaviour are to be achieved. The Theory of Planned Behavior offers a good framework for this study but other aspects would broaden coverage to provide a more comprehensive understanding of behavioural change.

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