Explaining Dietary Intake in Adolescent Girls from Disadvantaged Secondary Schools: A Test of Social Cognitive Theory

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Abstract

Much of the research on the determinants of dietary behavior has been guided by Bandura's Social Cognitive Theory (SCT), yet few studies have tested the utility of its proposed structural paths. The aim of this paper was to test the capacity of SCT to explain dietary behaviors in a sample of 357 adolescent girls (13.2 ± 0.5 years) from 12 secondary schools located in low-income communities in New South Wales, Australia. Participants completed validated SCT scales assessing nutrition-related self-efficacy, intention, behavioral strategies, family support, situation, outcome expectations, and outcome expectancies. Participants completed a validated food frequency questionnaire, from which, the percentage of total kilojoules from core-foods, non-core foods and saturated fat were calculated. The theoretical models were tested using structural equation modeling in AMOS. The models explained 48-51% and 13-19% of the variance in intention and dietary behavior, respectively. The models provided an adequate fit to the data, and self-efficacy was positively associated with healthy eating and inversely associated with unhealthy eating. However, the pathway from intention to behavior was not statistically significant in any of the models. While this study has demonstrated the utility of SCT constructs to explain behavior in adolescents girls, the proposed structural pathways were not supported. Further study of the role that implementation intentions play in explaining adolescent girls' dietary behaviors is required.

Introduction

Adolescence marks a complex period of transition between childhood and adulthood (Story, Neumark-Sztainer, & French, 2002). While adolescents have greater nutrient needs compared to other age groups (Sjoberg, Hallberg, Hoglund, & Hulthen, 0000), dietary behaviors deteriorate during this time as a greater proportion of meals and snacks are consumed away from the family (Story, et al., 2002). Adolescents often report excessive consumption of saturated fat, sugar, salt, and sweetened beverages (Harnack, Stang, & Story, 1999) and inadequate consumption of fruit, vegetables (Larson, Neumark-Sztainer, Hannan, & Story, 2007), wholegrains, calcium and iron (Hoelscher, Evans, Parcel, & Kelder, 2002; Larson, et al., 2007). In addition, eating behaviors such as irregular consumption of meals and skipping breakfast become more prevalent during adolescence (Phillips, et al., 2004; Siega-Riz, Carson, & Popkin, 1998; Sjoberg, et al., 0000).

Poor food choices and eating behaviors are considered to be major contributors to the pediatric obesity epidemic (Katz, 2011). Current estimates suggest that approximately 25% of youth in developed nations are classified as overweight or obese and higher levels are typically found among those from disadvantaged backgrounds (Department of Health and Ageing, 2008; Ogden, et al., 2006; Stamatakis, Wardle, & Cole, 2010). There is irrefutable evidence that obesity has short and long-term physiological and psychological consequences for children and adolescents (Gill, et al., 2009; Reilly & Kelly, 2011; Tsiros, et al., 2008). Social and mental health is worse amongst obese adolescents compared with those who are a healthy weight (Wake, et al., 2010) and childhood obesity is a significant predictor of adult obesity and chronic disease (Reilly & Kelly, 2011).

Health behavior theories (e.g. Social Cognitive Theory, Theory of Planned Behavior and Health Belief Model) are helpful for interpreting dietary behaviors among youth (Cerin, Barnett, & Baranowski, 2009) and evidence suggests that theoretically-based interventions are more effective in changing behavior than non-theoretical approaches (Abraham & Michie, 2008; Anderson-Bill, Winett, & Wojcik, 2011). Bandura's Social Cognitive Theory (SCT: 1986) provides a useful framework for explaining why people acquire and maintain health behaviors and has been used

extensively to guide interventions targeting a variety of health behaviors (e.g. smoking, physical activity, diet), across a range of population groups (e.g. children, adolescents and adults) (Baranowski, Perry, & Parcel, 1997). SCT proposes that health behavior change is influenced by environmental factors, personal factors, and attributes of the behavior itself. This interaction is referred to as ‘reciprocal determinism’ as each factor may affect or be affected by the others. Self-efficacy is considered to be the central determinant of behavior in SCT, and refers to an individual’s belief in their ability to perform a specific behavior.

In 2004, Bandura (2004) published the structural paths of SCT, whereby perceived self-efficacy is hypothesized to influence health behavior both directly (i.e., a pathway exists from self-efficacy to the behavior) and indirectly, through its effect on goals, outcome expectations, perceived barriers and facilitators. According to the proposed model for the indirect pathway, goals/intentions mediate the relationship between self-efficacy, outcome expectations, barriers/impediments and the health behavior. Goals (intentions to perform the behavior) are considered to be the direct precursor of behavior. The model also includes beliefs about the outcomes of the behavior, which consist of outcome expectations (the perceived costs and benefits of the behavior) and outcome expectancies (perceived importance of the potential costs and benefits of the behavior). Facilitators and impediments (social and environmental factors that may support or impede the targeted health behavior) are also included in the model.

SCT is the most commonly used theoretical framework in interventions to promote physical activity and healthy eating and prevent obesity in youth (Cerin, et al., 2009; Lubans, Foster, & Biddle, 2008; Sharma, 2006). Interventions based on SCT include behavior change techniques (e.g. prompting self-monitoring of behavior) designed specifically to influence the hypothesized determinants of health behavior change (e.g. self-efficacy). For example, these interventions are based on the premise that assisting individuals to develop their self-efficacy for healthy eating and physical activity will enable them to perceive fewer barriers and greater benefits from adopting more healthful behaviors, thus increasing their intention to perform these behaviors.

Dietary self-efficacy refers to an individual's perceived capability to make healthy food choices, despite potential barriers. High dietary self-efficacy in adolescents has been found to be associated with lower consumption of foods high in fat, sugar and fiber and a preference for more unrefined foods, including fruit and vegetables (Rinderknecht & Smith, 2004). In addition, increased levels of self-efficacy and positive outcome expectations result in modification of self-regulatory skills (e.g. planning, self-monitoring, problem solving, goals, self-standards and self-incentives) for maintaining behavior change (Anderson-Bill, et al., 2011).

While much of the research on the determinants of dietary behavior in youth has been guided by SCT (Baranowski, Cerin, & Baranowski, 2009; Cerin, et al., 2009), to the authors' knowledge, no previous study has tested if the structural paths of SCT accurately predict dietary behavior in adolescent girls from disadvantaged backgrounds. This is important because poor nutrition habits are often observed among youth of low socio-economic position (SEP) (Ball, et al., 2009; Rasmussen, et al., 2006; Wouters, Larsen, Kremers, Dagnelie, & Geenen, 2010). Therefore, the aim of this paper was to test the utility of SCT in explaining dietary behavior in a sample of adolescent girls from secondary schools in low-income communities.

Methods

Study design

Baseline data from the Nutrition and Enjoyable Activity for Teen Girls (NEAT Girls) randomized control trial were used for this study (Lubans, et al., 2010). NEAT Girls was a 12-month school-based obesity prevention intervention for adolescent girls from schools in low-income communities. The intervention was based on SCT and included enhanced school sport sessions, interactive seminars, nutrition workshops, lunch-time physical activity sessions, physical activity and nutrition handbooks, parent newsletters, pedometers for self-monitoring and text messaging for social support. Ethics approval for the study was obtained from the University of Newcastle, Australia and the New South Wales (NSW) Department of Education and Training

Human Research Ethics Committees. Written informed consent to participate in the study was obtained from school Principals, parents and students.

Participants

Eligible secondary schools were identified using the Socio-Economic Indices for Areas (SEIFA) index of relative socioeconomic disadvantage. The SEIFA index (1=lowest to 10=highest) summarizes the characteristics of people and households within an area and is developed using data relating to employment, education, financial well-being, housing stress, overcrowding, home ownership, family support, family breakdown, family type, lack of wealth, low income, Indigenous status and foreign birth Government secondary schools within the Hunter and Central Coast regions of NSW, Australia, with a SEIFA index ≤ 5 (lower 50%) met the inclusion criteria. Eligible study participants were adolescent girls in Grade 8 attending one of the 12 recruited schools. Physical Education (PE) teachers, at the participating schools, identified and recruited students who they perceived were disengaged in PE and/or not currently participating in organized team or individual sports. Based on their activity profiles and the potential clustering of health behaviors during adolescence (Plotnikoff, et al., 2009), these students were considered to be at a high risk of obesity.

Outcomes

Assessments were conducted by research assistants (RAs) at the participating schools. A protocol manual which included specific instructions for conducting all assessments was used by all RAs. Physical assessments were conducted in a sensitive manner (e.g. weight was measured privately; away from other students) and questionnaires were completed after the physical assessments in exam-like conditions.

Height and weight. Weight was measured in light clothing without shoes using a portable digital scale (Model no. UC-321PC, A&D Company Ltd, Tokyo Japan) to the nearest 0.1kg. Height was recorded to the nearest 0.1 cm using a portable stadiometer (Model no. PE087, Mentone Educational Centre, Australia). Body mass index (BMI) was calculated using the equation

(weight(kg)/height(m)²) and BMI-z scores were calculated using the 'LMS' method (Cole, Bellizzi, Flegal, & Dietz, 2000).

Dietary behavior. Dietary intake was assessed using the Australian Child and Adolescent Eating Survey (ACAES) food-frequency questionnaire (FFQ), previously validated in Australian youth aged 9 to 16 years (Watson, Collins, Sibbritt, Dibley, & Garg, 2009). ACAES is a 135-item, semi-quantitative FFQ and adolescents reported their usual frequency of consumption over the previous six months. Nutrient intakes were computed from the food composition databases of Australian foods using the databases (Australian AusNut, All Foods, Revision 14 and AusFoods, Brands, Revision 5, 1999, Food Standards Australia New Zealand, Canberra, Australia) without modification.

Specific food items were aggregated categorically into food groups corresponding to the Australian national food selection guide, the Australian Guide to Healthy Eating (Smith, Kellet, & Schmerlaib, 1998) and further categorized into two groups, the core foods (low-energy, nutrient-dense items (n = 70) and the non-core or energy-dense, nutrient-poor items (n = 45) (same reference as above). The core foods items included breads and cereals, fruit, vegetables, dairy foods and meat and/or alternatives. The non-core foods were high in fat and /or sugar, and/or salt and are not significant micronutrients sources and included baked snacks (cakes, cookies), candy and sweetened drinks. The percentage of total energy daily kilojoules contributed from core foods, non-core foods and saturated fats were calculated and used as the dependent variables in the analyses.

Social-cognitive scales. The following social cognitive scales related to healthy eating were developed and tested in a separate sample (N = 171) of adolescents (66 = males; 105 = females; mean age = 13.6 ± 1.2 years): self-efficacy, goals (as measured by intention), behavioral strategies, family support, situation (as measured by food availability in the home environment), outcome expectations, and outcome expectancies. A definition for *healthy eating*, guided by current dietary guidelines and recommendations for adolescents was provided as a referent for each of the social cognitive scales (National Health and Medical Research Council, 2003). *Healthy eating* was

considered to include: eating at least three serves of fruit and four serves of vegetables each day, choosing foods low in fat and added sugar, and monitoring portion sizes. Although other definitions for healthy eating exist, the dietary behaviors included in the referent have been linked to ill-health in youth (Burt, Ekland, Morgan, Larkin, & Guire, 1988; Liu, et al., 2000; Olsen & Heitmann, 2009; St-Onge, Keller, & Heymsfield, 2003). Reliability properties for these scales ranged from 0.65 to 0.69 for internal consistency and 0.81 to 0.89 for test-retest repeatability (ICC).

- 1) Self-efficacy was operationalized as an individuals' confidence in their ability to adopt, maintain and overcome barriers to healthy eating. The scale was rated on a 5-point Likert scale (1 = *Strongly disagree* to 5 = *Strongly Agree*) and included six items. The internal consistency (α) and test-retest reliability (ICC) were 0.65 and 0.89 (95% CI = 0.85 to 0.92), respectively. Example item- "*I find it easy to choose a healthy snack when I eat between meals – e.g. fruit, reduced fat yoghurt*".
- 2) Intentions are essentially proximal goals (Bandura, 2004) and were operationalized in the current study as an individuals' intention to eat healthily. The scale was rated on a 4-point Likert scale (1 = *Not at all true of me* to 4 = *Very true of me*) and included five items ($\alpha = 0.71$, ICC = 0.83 (95% CI = 0.77 to 0.87)). Example item: "... *do you intend to choose reduced-fat foods and drinks whenever you have a choice?*".
- 3) Behavioral strategies are self-management strategies used by individuals to support healthy eating. The scale was rated on a 5-point Likert scale (1 = *Never* to 5 = *Always*) and included six items [$\alpha = 0.75$, ICC = 0.88 (95% CI = 0.84 to 0.91)]. Example item- "*Did you do things to make eating fruits and vegetables more enjoyable (e.g. try a new recipe)?*".
- 4) The family support scale included items relating to social influences that reinforce healthy eating through encouragement and role modeling. The scale was rated on a 5-point Likert scale (1 = *Never* to 5 = *Always*) and included five items [$\alpha = 0.68$, ICC = 0.89, (95% CI = 0.85 to 0.92)]. For example: "...*how often do your parents prepare a healthy home-cooked dinner for you?*".

- 5) Situation refers to an individual's perception of their environment (Baranowski, Perry, & Parcel, 2002) and was measured using four items related to the availability of food in the home environment. The scale was rated on a 5-point Likert scale (1 = *Strongly disagree* to 5 = *Strongly Agree*) [$\alpha = 0.79$, ICC = 0.81 (95% CI = 0.75 to 0.86)]. Example item- "*At home, fruit is always available to eat – e.g. fresh, canned or dried*".
- 6) Outcome expectations were operationalized as the anticipated benefits of healthy eating and were measured using five items rated on a 6-point Likert scale (1 = *Strongly disagree* to 6 = *Strongly Agree*). For example: "*Healthy eating can help me to control my weight*" [$\alpha = 0.72$, ICC = 0.84 (95% CI = 0.79 to 0.88)].
- 7) Outcome expectancies refer to the value placed on anticipated outcomes of healthy eating and were rated on a four-point Likert scale (1 = *Not at all important* to 4 = *Extremely important*). . For example: "*How important is controlling your weight to you?*" [$\alpha = 0.65$, ICC = 0.89 (95% CI = 0.87 to 0.92)].

Analysis

Univariate normality, means, standard deviations and bivariate correlations were calculated using SPSS 19.0 software (IBM, SPSS Inc. Chicago, IL). To correct for the clustering of effects at the school level, each variable was regressed onto the school variable and the unstandardized residuals were used in all analyses (Cohen & Cohen, 1983; Dishman, et al., 2006). Structural equation models were examined using maximum likelihood analysis (MLE) in AMOS 19.0 (Small Waters Corp., Chicago IL) with single indicator latent variables to account for measurement error and minimize model parameters (Bollen, 1989). Because MLE relies on assumptions of normality, the initial step was to check Mardia's multivariate coefficient value (Mardia, 1970). As the value indicated multivariate non-normality (i.e., >3), the MLE method in conjunction with the bootstrapping procedure was employed and bias corrected regression coefficients are reported.

A number of models were tested using a combination of variables to determine the most parsimonious SCT model [based on Bandura's (2004) more recent conceptualization of the model].

Model fit was assessed using multiple indices, including two incremental fit indexes- the comparative fit index (CFI) and the Tucker-Lewis Index (TLI) and one absolute fit index- the root mean square of approximation (RMSEA). CFI and TLI scores > 0.90 and RMSEA values smaller than 0.08 have traditionally been used to indicate good model fit (Bollen, 1989). While Hu and Bentler (1999) have proposed alternative model fit values (CFI and TLI, > 0.95 ; RMSEA, < 0.06), others have argued against using these higher cut-off criteria (Marsh, Hau, & Wen, 2004). Following the testing of Bandura's SCT, we tested the utility of a revised model that was determined *a priori* to include behavioral strategies and a direct pathway from situation (i.e., environmental perceptions) to dietary behavior.

Results

Descriptives

The sample included 357 adolescent girls from 12 secondary schools. The majority of participants were Australian born (97.8%), spoke English at home (98.6%), and acknowledged their cultural background as Australian (85.4%). A large number of participants were classified as overweight (26.1%) and obese (16.8%). Three hundred and fifty one and 326 girls provided useable FFQ data to generate saturated fat intake and core/non-core food values, respectively. Descriptive statistics and bivariate correlations are reported in Table 1 and 2, respectively. All of the social cognitive variables were associated with a dietary outcome (i.e., saturated fat intake or core foods, non-core foods) in the bivariate correlations except for outcome expectations.

Predicting energy from saturated fats

Based on the results from the bivariate correlations and the model fit indices, the final model (Figure 1) included outcome expectancies rather than outcome expectations. The inclusion of both family support and situation did not improve the model fit indices and following further testing, family support was the only barrier/facilitator variable retained in the model. The model explained 51% of the variance in intention and 13% of the variance in the percentage of energy intake from saturated fats. The model fit indices suggested an excellent fit to the data [$\chi^2 = 2.4$, $df = 2$, $p = 0.30$,

TLI = 0.99, CFI = 1.00 and RMSEA = 0.02 (90% CI = 0.00 to 0.11]. The pathways from self-efficacy ($\beta = -0.29, p = 0.003$) and outcome expectancies ($\beta = -0.22, p = 0.011$) to percentage intake from saturated were both statistically significant. In addition, the pathways from self-efficacy ($\beta = 0.61, p = 0.002$) and outcome expectancies ($\beta = 0.33, p = 0.001$) to intention were statistically significant. The pathway from intention to behavior was not significant.

Predicting energy from core foods

The model (Figure 2) explained 48% of the variance in intention and 19% of the variance in percentage energy contributed from core foods. The model fit indices suggested an excellent fit to the data [$\chi^2 = 3.8, df = 2, p = 0.15$, TLI = 0.97, CFI = 0.99 and RMSEA = 0.05 (90% CI = 0.00 to 0.13)]. There was a significant model pathway from self-efficacy ($\beta = 0.46, p = 0.001$) to percentage energy intake from core foods. The pathway from intention to behavior was not significant.

Predicting energy from non-core foods

The model (Figure 3) explained 48% of the variance in intention and 18% of the variance in percentage energy contributed from non-core foods. The model fit indices were identical to those explaining percentage energy from core foods [$\chi^2 = 3.8, df = 2, p = 0.15$, TLI = 0.97, CFI = 0.99 and RMSEA = 0.05 (90% CI = 0.00 to 0.13)]. There was a significant inverse association between self-efficacy and percentage energy from non-core foods ($\beta = -0.46, p = 0.001$). The other model pathways were almost identical to those in the previous model.

Revised model predicting energy intake from core foods

The revised model explained 45% and 20% of the variance in intention and behavior, respectively. The model represented an excellent fit to the data [$\chi^2 = 6.8, df = 5, p = 0.24$, TLI = 0.99, CFI = 1.00 and RMSEA = 0.03 (90% CI = 0.00 to 0.09)]. There was a significant model pathway from self-efficacy ($\beta = 0.42, p = 0.002$) to percentage energy intake from core foods. Pathways from self-efficacy to intention ($\beta = 0.46, p = 0.001$) and behavioral strategies ($\beta = 0.55, p = 0.002$) were also significant. The pathway from intention to behavioral strategies was statistically

significant ($\beta = 0.31, p = 0.01$). The pathways from situation and intention to dietary behavior were not statistically significant.

Discussion

The aim of this paper was to test the utility of Bandura's (2004) SCT model to explain usual dietary behavior in adolescent girls from schools in low-income communities. The SCT models explained 13-19% of the variance in dietary behavior (i.e., percentage energy from saturated fat, core foods and non-core foods). The models explaining healthy (i.e., core foods) and unhealthy (i.e., non-core foods) eating patterns were similar, and the best model fit indices were reported for percentage of total energy intake from saturated fat. Although the models provided adequate representations of the data, the pathway from intention to behavior was not significant in any of the models and therefore, do not support the structural pathways (between goals and behavior) as proposed by Bandura (2004). The role that implementation intentions play in closing the gap between positive goals and actual behavior is discussed.

In both SCT and Theory of Planned Behavior (TPB), goals/intention(s) are considered to be the direct antecedent of behavior and a recent review concluded that dietary intentions were one of the strongest psychosocial correlates of behavior in youth (McClain, Chappuis, Nguyen-Rodriguez, Yaroch, & Spruijt-Metz, 2009). Although intention was inversely associated with percentage energy intake of saturated fats and non-core foods and positively associated with percentage intake from core foods in the bivariate correlations, the path analysis did not support this construct's role or indeed, the direct effect of intention on behavior in the hypothesized models. The associations between intention and dietary behavior were not statistically significant in the final models, indicating that once self-efficacy is adjusted for, intention does not predict behavior. This finding suggests that although girls might have good intentions to eat healthfully, unless they have strong dietary self-efficacy, it is unlikely that these intentions will translate into behavior.

Previous studies have noted the discord between intentions and actual dietary behavior (Kumanyika, et al., 2000). Gollwitzer (1999) first introduced the concept of implementation

intentions and explained why they may represent an opportunity to close the gap between good intentions and behavior. Goal driven behavior is highly dependent upon psychological resources, such as memory, attention and self-control (Adriaanse, Vinkers, De Ridder, Hox, & De Wit, 2011). When these resources are diminished (e.g. when an individual is tired or busy), individuals find it difficult to ensure that their goal-directed intentions translate into behavior. Unlike intentions that simply specify a desired outcome (e.g. “I want to eat less sugary foods), implementation intentions specify the ‘where’, ‘when’ and ‘how’ of goal-directed behavior (Adriaanse, et al., 2011). For example, an individual intending to reduce their consumption of sugary foods, may set themselves the goal of cleaning their teeth straight after dinner three nights a week to reduce their temptation of having desert. Studies have demonstrated that encouraging individuals to use implement self-regulation strategies helps to increase fruit and vegetable intake in adults (Stadler, Oettingen, & Gollwitzer, 2010). Few studies have explored the role that implementation intentions play in determining dietary behavior in adolescents. In the current study, behavioral strategies were associated with healthy eating in the bivariate correlations, but they were not included in the SEMs, as this was not consistent with the structural pathways as proposed by Bandura (2004).

Both family support and situation (i.e., food availability in the home environment) were considered as potential barriers/facilitators to healthy eating in adolescents. Both variables were associated with diet in the bivariate correlations but only family support was included in the final model. Kremers and colleagues (2003) found that fruit consumption and fruit-specific cognitions were most favorable among adolescents who were being raised with an authoritative parenting style. Not surprisingly, a number of studies have shown that availability of fruit and vegetables food at home is associated with intake in children (Blanchette & Brug, 2005; Reinaerts, de Nooijer, Candel, & de Vries, 2007), even when they have a low preference for fruit and vegetables (Weber Cullen, et al., 2003).

Interestingly, SCT does not include a direct pathway from barriers/facilitators (e.g. environment, social support) to behavior. Instead, they are hypothesized to exert their influence on

behavior through intention. Adolescents may have more independence than children when it comes to what they eat, yet the food available in their homes will still supply most of their energy intake (French, Story, Neumark-Sztainer, Fulkerson, & Hannan, 2001). Social support and availability of food at home are major facilitators (or barriers) of healthy eating in youth (Rasmussen, et al., 2006) and contrary to the SCT structural pathways, it is plausible that they may act independently of intention. Contrary to the findings from the current study, Tak et al (2011) found that intention and habit strength partly mediated the associations between home environmental factors (e.g. availability, accessibility, parental modeling, and parental rules) and soda consumption. The authors concluded that the home environment had both direct and indirect influences on soda consumption in youth. It is possible that adolescents are more aware of the consequences of drinking soda and this is a more goal driven behavior than avoiding foods high in saturated fat and energy dense non-core foods.

Self-efficacy was one of the strongest correlates of dietary intake (i.e., percentage energy from saturated fat, core foods and non-core foods) and was associated with behavior in all of the models. These findings are consistent with previous studies that have demonstrated the importance of self-efficacy in explaining adolescents' dietary behaviors in both cross-sectional and longitudinal studies (Ball, et al., 2009; Pearson, Ball, & Crawford, 2011; Rasmussen, et al., 2006). For example, a recent large scale Australian study found that self-efficacy for increasing fruit consumption was positively associated with change in fruit and vegetable consumption, while self-efficacy for decreasing energy-dense, nutrient-poor food intake was inversely related to change in energy-dense snack consumption (Pearson, et al., 2011). Strategies to increase adolescents' self-efficacy for healthy eating are justified and should address the actual and the perceived barriers to following or adopting a healthy eating plan.

Outcome expectancies were more strongly associated with behavior than outcome expectations and were subsequently included in the SEMs. The difference between outcome expectations and expectancies is rarely tested in empirical studies. The distinction is important

because individuals may recognize the benefits of healthy eating (i.e., outcome expectations), but unless they consider those benefits to be of value (i.e., outcome expectancies), it is unlikely that they will be motivated to eat healthfully. Interestingly, we found a significant inverse association between outcome expectancies and percentage energy from saturated fat, but there was no relationship between outcome expectancies and energy intake from core/non-core foods. This finding suggests that adolescent girls, who recognize the importance of eating healthfully, avoid foods that are high in fat, but this does not appear to influence their consumption of non-core foods, such as those that are high in sugar. Perhaps the immediate benefits of consuming these non-core foods (e.g. satiation, pleasure, ease etc) make it difficult for adolescents to resist these foods. Alternatively, adolescents may be less aware of the foods that are considered non-core foods, and consequently eat these without considering their low nutrient value and high energy content. These findings require further exploration to determine if adolescents recognize what are non-core foods and if they require cognitive behavioral training (e.g. goal setting, barrier identification) to reduce their consumption of these foods.

In our revised SCT model we included a direct pathway from situation to behavior and added behavioral strategies. Although the model fit indices suggested an excellent fit to the data and additional variance was explained, the pathways from behavioral strategies and situation, to dietary behavior were not statistically significant. These findings reinforce the important role self-efficacy plays in determining adolescent girls' dietary behaviors. It should be noted that behavioral strategies were used as a proxy for implementation intentions and it is possible that a more accurately operationalized measure would yield stronger results. Alternatively, it is likely that there are additional psychological, social and environmental determinants of dietary intake that were not measured in this study. We did not assess the quality of food available in schools and the neighborhood characteristics, both of which have been identified as determinants of adolescents' dietary behavior (Poti & Popkin, 2011). Socio-ecological models of health behavior that include relevant environmental characteristics (e.g. proximity and density of fast food outlets) and policy

(e.g. school-canteen policy) may need to be considered for future research examining adolescent girls' dietary behaviors.

Strengths and limitations

The strengths of this include the unique application of theory to drivers of eating behaviors in an under-served population. This appears to be the first study to test the utility of Bandura's (2004) re-conceptualized SCT model to explain usual dietary behavior in adolescent girls from disadvantaged backgrounds. However, there are some limitations that should be noted. First, this study was cross-sectional and therefore causality cannot be determined. Second, dietary intake was assessed using a FFQ, which may explain the weak associations between social cognitive constructs and dietary outcomes (Black & Cole, 2001). It is recommended that future research testing dietary behavior theory consider using alternative methods of dietary intake, such as multiple interviewer administered 24-hour recalls. Finally, peer influence was not included in the hypothesized model. Although peer level variables have been found to be associated with dietary behavior in adolescents (e.g. Wouters, et al., 2010), a recent study found that social support for healthy eating from friends was less important than support and observation from family (Ball, et al., 2009).

Conclusions

Evidence suggests that dietary behaviors deteriorate during adolescence and poor nutrition habits are often observed among youth from disadvantaged backgrounds (Ball, et al., 2009; Rasmussen, et al., 2006; Wouters, et al., 2010). Considering the high levels of obesity among youth, especially those from disadvantaged backgrounds (Department of Health and Ageing, 2008; Ogden, et al., 2006; Stamatakis, et al., 2010), there is an urgent need to improve our understanding of dietary behaviors in this cohort. SCT provides a framework for understanding health behavior and designing obesity prevention interventions. Consistent with SCT, self-efficacy was strongly associated with percentage energy from saturated fat, core foods and non-core foods. Consequently, supporting adolescents to improve their self-efficacy for healthy eating is an important health promotion priority.

While this study has demonstrated the utility of SCT constructs to explain behavior in adolescents girls, the proposed structural pathways were not supported. In both TPB and SCT, intention is considered to be the direct antecedent of health behavior. In this study, the association between intention and behavior was not significant after controlling for self-efficacy. Further exploration of the role that implementation intentions play in bridging the dissonance between intention and behavior is clearly warranted. Future studies are needed to expand the SCT and explore the function of implementation intentions in determining adolescent dietary behavior in cross-sectional, longitudinal and experimental studies. Implementation intentions represent behavioral strategies that can be taught and learned, therefore representing potential mechanisms to assist adolescents in adopting healthy behavior change within youth interventions.

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