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Associations among measures of energy balance related behaviors and psychosocial determinants in urban upper elementary school children

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ABSTRACT

Background: Childhood obesity prevention is a pressing issue. Understanding the relationships among eating and physical activity behaviors and potential psychosocial determinants of behavior will help us design more effective interventions. This study aimed to examine such relationships in a large sample of urban elementary school children.

Methods: Fifth grade students in 20 recruited New York City public schools completed a validated questionnaire on six "do more" (fruits and vegetables and physical activity) and "do less" (sweetened beverages, processed packaged snacks, fast food and sedentary behavior) energy balance related behaviors (EBRBs) and psychosocial determinants of behavior from social cognitive and self-determination theories. Correlations among behaviors and hierarchical linear model analyses of the relationship between psychosocial determinants and behaviors were conducted for those with complete data ($n = 952$).

Results: The "do more" and the "do less" behaviors were significantly correlated within categories ($p < 0.01$). "Do more" food-related behaviors were correlated with physical activity but so were sports drinks, while the "do less" food-related behaviors tended to be correlated to sedentary behavior ($p < 0.01$). "Do more" behaviors were associated with self-efficacy and habit strength, and "do less" behaviors with outcome expectations, self-efficacy, habit strength, and behavioral intention.

Conclusions: Interventions can address the healthy and less healthy clusters of behaviors together, focusing on strategies to enhance their self-efficacy and habit strength for the "do more" behaviors and outcome expectations to motivate intention to choose fewer "do less" behaviors, along with enhancing self-efficacy and habit. Research can examine these determinants as potential mediators of change in intervention.

1. Introduction

Childhood obesity is a pressing issue in the United States, where one third of children are overweight or obese (Ogden, Carroll, Kit, & Flegal, 2014). Consequences highly associated with obesity range from high blood pressure, Type 2 diabetes, and depression experienced in childhood, to chronic diseases such as stroke and various cancers experienced when children become adults (Daniels, Jacobson, McCrindle, Eckel, & Sanner, 2009; Ogden, Carroll, Curtin, Lamb, & Flegal, 2010; Ogden et al., 2014). Black and Hispanic individuals and those of lower socioeconomic status in the U.S. are disproportionately affected by obesity at all ages (Wang & Beydoun, 2007), and youths who reside in economically distressed urban neighborhoods have higher rates of obesity than those who do not live in these conditions (Ogden et al., 2010; Ogden et al., 2014; Singh, Kogan, & van Dyck, 2010; Story et al., 1999; Thorpe et al., 2004).

Interventions to address these health issues generally aim to improve individual behaviors and the collective environment, as the rapid population level increase in obesity and chronic disease risk suggests these as causal agents instead of a genetic shift. The research literature and recommendations by government and expert committees for encouraging energy balance have identified

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several behaviors as particularly important to address for childhood obesity prevention and health promotion: intakes of fruits and vegetables, sweetened beverages, processed, packaged snacks, and fast food, and physical activity and sedentary behavior (Barlow & Expert committee, 2007; Springer, Hoelscher, Castrucci, Perez, & Kelder, 2009; U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2015). These are often referred to as energy balance related behaviors (EBRBs).

Interventions are more likely to be effective at changing behaviors when they target specific behaviors and the appropriate motivators and facilitators of behavior change, collectively referred to here as determinants of behavior change, from valid social psychological and ecological theories (Baranowski, Cullen, Nicklas, Thompson, Baranowski, 2003; Baranowski, Lin, Wettter, Resnicow, & Hearn, 1997; Contento et al., 1995; Rothman, 2004). This study in a large sample of low income, urban, upper elementary school children in the U.S has two aims 1) to provide an understanding of the relationships of individual EBRBS to each other and 2) describe relationships between EBRBs and determinants of change. This age range was chosen because children at this age are beginning to make food choices on their own and understanding their behaviors and associated determinants will be helpful for designing interventions.

In terms of the first aim, while there is increasing evidence that physical activity and sedentary behavor are two different sets of behaviors (Taveras et al., 2007), studies have not examined the relationships among dietary energy-balance related behaviors to identify which, if any, are highly related and how these related groups or sets of dietary EBRBs are related to the physical activity and sedentary behaviors. Studies tend to focus on individual dietary behaviors. For example, one study found physical activity to be correlated with fruit and vegetable intake in adolescents (Fernandes et al., 2011). One study examined the relationship between screen time and the Healthy Eaing Index score found it to be negativly associated with lower quality diet in children and adults (Sisson, Shay, Broyles, & Leyva, 2012). This score is based on the total diet. If there are relationships among subsets of dietary behaviors as well, it may be more effective to develop interventions directed at several behaviors that are highly correlated rather than at one behavior at a time.

In terms of the second aim, theory provides a framework by which to examine the relationships among psychosocial determinants (theory variables) and to assess the impact of the various determinants on behavior change (Baranowski, Anderson, & Carmack, 1998; Baranowski, Cerin, & Baranowski, 2009; Baranowski, Cullen, & Baranowski, 1999; Contento, 2008).

The theories most often used in the dietary and physical activity areas are variations of the theory of planned behavior (TPB) (Ajzen, 1991)/reasoned action approach (Fishbein & Ajzen, 2010) and social cognitive theory (SCT) (Bandura, 1986, 2004). The theory of planned behavior/reasoned action approach proposes that the most immediate determinant of behavior change is behavioral intention. Behavioral intention is in turn influenced by attitudes towards the behavior, which are largely determined by beliefs about the expected outcomes of the behavior (outcome expectations) and social norms. Perceived control over the behavior or self-efficacy influences both intention and the behavior itself. The *extended* theory proposes that behavioral intentions are translated into behaviors through the development of implementation plans similar to goal setting in social cognitive theory (Gollwitzer, 1999). Some models in include habit strength as well (Brug, de Vet, de Nooijer, & Verplanken, 2006).

SCT proposes, in brief, that personal, behavioral, and environmental factors work in a dynamic and reciprocal fashion to influence behavior. The sense of ability to exert personal influence over one's environment as well as over one's own behaviors is described as personal agency (Bandura, 2001). Behavior change is enhanced by: beliefs that the outcome of taking action will be beneficial (outcome expectations); proactive commitment to take action (goal intention); self-efficacy (individuals' confidence in their ability to organize and execute particular behaviors); and self-regulation of behavior through self-assessment and goal-setting processes.

More recently, the usefulness of self-determination theory (SDT) (Deci & Ryan, 2000) has also been investigated for health behavior change (Ryan, Patrick, Deci, & Williams, 2008). In its simplest terms, self-determination theory proposes that individuals have innate psychological needs for autonomy, competence, and relatedness, which, when satisfied, enhance their autonomous motivation and well-being. There are some overlapping determinants among these theories, such as outcome expectations, self-efficacy, and behavioral or goal intentions. In addition, TPB has now added implementation intentions as a determinant which is similar to goal-setting in SCT. Thus, there has been increasing call for interventions to integrate variables from various theories based on evidence of their predictive value for behavior change (Baranowski et al., 1998; Baranowski et al., 2009; Institute of Medicine, 2002).

To develop effective childhood obesity prevention interventions it is crucial, of course, to identify and understand the specific psychosocial determinants that are correlated with individual or groups of EBRBs in order to effectively address determinants of behavior change interventions to increase likelihood of changing behavior.

Many studies have been conducted to date to examine such correlates of eating behaviors in children and adolescents but they usually each addressed one behavior (e.g. fruits and vegetables) or a limited set of behaviors, and a limited set of psychosocial determinants. One review identified 77 studies conducted in many countries which examined the following dietary behaviors in separate studies: fruit, juice and vegetable intake, fat in the diet, total energy intake, sweetened beverages, sugary snacks, total fiber, other more healthy and less healthy intake (McClain, Chappuis, Nguyen-Rodriguez, Yaroch, & Spruijt-Metz, 2009). A variety of psychosocial variables from many theories were used in these studies. Across all the dietary behaviors, the most consistently supported correlates were: perceived modeling (SCT), dietary intentions (TPB), social norms (TPB), liking and preferences (outcome expectations from both SCT and TPB). A review of 98 studies promoting fruit and vegetable consumption (some overlapping those above) found that age, gender, socio-economic position, preferences, parental intake, and home availability/accessibility were most consistently associated with intake (Rasmussen et al., 2006).

In terms of physical activity behaviors, a focus group study found that enjoyment, prevention of boredom, mental health benefits, and freedom from parental control were related to active play (Brockman, Jago, & Fox, 2011). A systematic review of SDT and physical activity found that autonomous forms of motivation had moderate, positive associations with physical activity while controlled forms of motivation had only weak associations (Owen, Smith, Lubans, Ng, & Lonsdale, 2014). Again, the studies examined only a limited number of determinants in relation to physical activity.

This study adds to the literature by examining the associations among EBRBs and between potential psychosocial determinants and these behaviors. SCT, SDT and select variables of TPB have been used together in previous work (Contento, Koch, Lee, & Calabrese-Barton, 2010) and provided a useful model for examining these associations in this study. Understanding these associations will help researchers and practitioners choose the appropriate behaviors and determinants of these behaviors that have the greatest chance of reducing childhood obesity risk. Further, studying low-