Efficacy of Nutrition Risk Screening with NutriSTEP (Registered Trademark) in Toddlers and Preschoolers

by

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ABSTRACT

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The purpose of this study was to evaluate the efficacy of the NutriSTEP® program; a nutrition risk screening tool with accompanying educational materials/resources for parents of toddlers and preschoolers. A wait-listed, cluster, randomized controlled trial with a post-test 3-months post-intervention was used. A convenience sample of 137 parents/caregivers were recruited at Ontario Early Years Centres in Southern Ontario. Results were analyzed using generalized estimating equations. Compared to controls, parents who received the NutriSTEP® program significantly \((P < .05)\) increased their nutrition-related knowledge and attitudes towards nutrition-related behaviours. Parents of preschoolers receiving the intervention significantly \((P < .05)\) increased their self-efficacy and intention scores compared to controls. Using a post-test-only design for the NutriSTEP® risk scores, there was not a significant difference \((P = .05)\) between control and intervention groups. The NutriSTEP® program serves as an effective parent-targeted assessment tool and education intervention which can affect changes in determinants of child nutrition risk behaviours.
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1.0 Introduction

In Canada, one third of toddlers and preschoolers are estimated to be at moderate to high nutritional risk (Randall Simpson, Keller, Rysdale, & Beyers, 2008; Randall Simpson, Gumbley, Whyte, Lac, Morra, Rysdale, et al., 2015; Vanderhout, Haresign, & Randall Simpson, 2014); further, 21% of children ages 2 to 5 years are overweight or obese (Shields, 2006). It is well known that poor nutrition is associated with abnormal weight, an increased risk of disease, behavioural problems, poor growth, and developmental delay (American Diabetes Association, 2000; Krebs, Jacobson, & American Academy of Pediatrics Committee on Nutrition Pediatrics, 2003; Monteiro & Victora, 2005). Thus, it is important that children are assessed for nutrition risk early in life before behaviours become engrafted and that interventions are in place to promote a healthy lifestyle for children (Baer & Harris, 1997).

Nutrition screening tools can be an inexpensive and effective means of assisting programs and parents in identifying nutritionally at-risk children (Cunningham, Colavito, & Sutherland, 1997). Such tools can also facilitate nutritional intervention and referral for assessment and treatment (Cunningham et al., 1997). Originally released in 2008, the Nutrition Screening Tool for Every Preschooler (NutriSTEP®) is a valid and reliable 17-item, community-based, parent/guardian-administered questionnaire that identifies attributes of nutritional risk in preschoolers (ages 3-5 years) (Randall Simpson et al., 2008). A Toddler NutriSTEP®, for children 18-35 months of age, was released in 2012 (Randall Simpson et al., 2015). Following screening with the NutriSTEP® questionnaires, it is recommended that parents be provided with four-page educational brochures titled, “How to Build a Healthy Toddler/Preschooler” (Rysdale et al., 2011).

A free online version of NutriSTEP® (Nutri-eSTEP) for both toddlers (18-35 months of age) and preschoolers was launched on the Dietitians of Canada website in October 2013 for greater
outreach and parental access. After completing Nutri-eSTEP, parents are provided with their results, extensive educational feedback messages tailored to their questionnaire responses, and resource links.

NutriSTEP® has been implemented in some Canadian provinces (New Brunswick Public Health, 2012; Ontario Technical Document, 2014), applied in research (Persaud et al., 2013; Randall Simpson et al., 2012; Rysdale et al., 2011; Walton et al., 2015; Watson-Jarvis, Fenton, McNeil, & Campbell, 2011a; Watson-Jarvis, McNeil, Fenton, & Campbell, 2011b), and is currently an accountability indicator in Ontario (Ontario Technical Document, 2014). The widespread use of NutriSTEP® in Canadian jurisdictions has highlighted the need for research investigating the effectiveness of interventions such as nutrition risk screening with NutriSTEP® and the provision of educational materials to parents. While past NutriSTEP® implementation studies, based on parental self-report, have suggested that the NutriSTEP® program (NutriSTEP® plus educational materials) can increase parental nutrition knowledge, awareness, and behaviour change (Randall Simpson et al., 2012; Rysdale et al., 2011), a more objective evaluation of the efficacy of NutriSTEP® has not yet been conducted. The efficacy evaluation for the study described herein, based on the Theory of Planned Behaviour (TPB) Framework (Ajzen, 1991), focused on NutriSTEP® for both toddlers and preschoolers and its accompanying brochures and Nutri-eSTEP feedback.
2.0 Background/Literature Review

2.1 Childhood Nutrition Risk in Canada

The importance of nutrition in early childhood cannot be overemphasized as nutrition affects children’s health, learning, growth, behaviour, and development (Nicklas & Johnson, 2004). Toddlers (ages 18 to 35 months) and preschoolers (ages 3 to 5 years) are at a critical age for developing eating behaviours and learning about foods, the eating environment, and their own food preferences (Birch & Ventura, 2009; Savage, Orlet Fisher & Birch, 2007). Modification of eating behaviours and the promotion of healthy eating in early childhood is especially important as health-related behaviours such as dietary intake, eating habits, and physical activity are often firmly established by school age (Gibson et al., 2012; Skinner, Carruth, Bounds, & Ziegler, 2002; Wofford, 2008).

It is estimated that roughly 10% of Canadian toddlers and preschoolers are at high nutrition risk based on NutriSTEP® scores. For example, data from the NutriSTEP® toddler reliability study of 133 parents in Ontario (Randall Simpson et al., 2015) and Nutri-eSTEP data from approximately 2000 parents across Canada (Vanderhout et al., 2014) suggested that roughly 10% toddlers (7% and 13%, respectively) were at high nutrition risk. Similarly, the number of preschoolers at high nutrition risk was found to be: 5% in the NutriSTEP® reliability study of 140 parents in Ontario (Randall Simpson et al., 2008); 7% based on a study conducted in Calgary, Alberta (n = 437) (Watson-Jarvis et al., 2011a); and 17% based on Nutri-eSTEP data from approximately 2000 parents across Canada (Vanderhout et al., 2014).

Most notable of the NutriSTEP® findings for toddlers was that over 30% of toddlers were: still drinking from a baby bottle with a nipple; spending more than 2 hours watching television or playing video games; and, were not consuming enough grains (Randall Simpson et al., 2015). Common areas of concern for preschoolers were that over 30% of parents reported that they were controlling the amount of food their children consume and that children were not eating enough fruits, vegetables, and grains.
(Randall Simpson et al., 2008). Other research consistently indicates that Canadian children consume fruits and vegetables fewer than five times per day (Black & Billette, 2013; Garriguet, 2006; Glen, Thomas, Loebach, Gilliand, & Gobert, 2013), have low intakes of dietary fibre (Garriguet, 2006), high sodium intakes (Garriguet, 2006), and high intakes of ‘other’ foods (i.e., high fat, high salt, and/or high sugar foods) (Hanning et al., 2007) which do not align with the recommendations of Canada’s Food Guide (Health Canada, 2007).

Other nutritional concerns for young children include food allergies/intolerances (Bangash & Bahna, 2005), micronutrient deficiencies or toxicities (e.g., inadequate vitamin D intake, iron deficiency, intakes of niacin and vitamin A above the tolerable upper intake level with use of supplements) (Christofides, Schauer, & Zlotkin, 2005; Shakur, Tarasuk, Corey, & O’Connor, 2012), and overweight/obesity (Polhamus et al., 2003; Shields, 2006).

Based on the 2004 Canadian Community Health Survey (CCHS), 21% of Canadian children ages 2 to 5 years were overweight or obese (BMI ≥ 85th percentile for age and gender) (Shields, 2006). This is particularly alarming as estimates suggest that 26-41% of obese children will become obese adults (Atkin & Davies, 2000; Monteiro & Victora, 2005). It is well known that obesity and poor nutrition is associated with an increased risk of disease (e.g., hypertension, type 2 diabetes mellitus, dyslipidemia, etc.) (American Diabetes Association, 2000; Monteiro & Victora, 2005; Krebs et al., 2003), making it important that children are assessed for nutrition risk early in life before behaviours become entrenched and that interventions are in place to promote a healthy lifestyle for children.

2.2 Nutrition Risk Screening

Systematic nutrition screening before children are school-aged is recommended in order to identify risk factors and the need for early intervention (Baer & Harris, 1997). Nutrition risk screening is most effective when completed via an easy-to-use, valid and reliable tool that includes factors known to be associated with nutrition problems in order to identify individuals at risk and refer them for
assessment and treatment (“ethical screening”) (American Dietetic Association, 1994; Rush, 1997). Screening for nutrition risk at a young age, when dietary habits are being established, allows professionals to intervene in order to promote healthy behaviours and optimize growth and development (Randall Simpson et al., 2008; Skinner et al., 2002). Addressing concerns and promoting healthy feeding/eating habits and behaviours during the early years has the potential to have an impact on the future health of the population. In addition, screening may be more efficient and cost-effective than nutritional assessment to facilitate interventions and is a critical component of primary health care models (Baer & Harris, 1997).

NutriSTEP® can be a useful tool in understanding and affecting healthy nutrition-related behaviour in young children and families (Randall Simpson et al., 2008; Rysdale et al., 2011). Prior to the development of NutriSTEP®, no valid and reliable, parent-administered nutrition screening tools for toddlers and preschoolers were available (Randall Simpson et al., 2008, 2015).

2.3 NutriSTEP® and its Development

The Nutrition Screening Tool for Every Preschooler (NutriSTEP®) is a valid and reliable 17-item, community-based, parent/guardian administered questionnaire which identifies attributes of nutritional risk in preschoolers (3-5 years) and supports education and skill building (Randall Simpson et al., 2008). A toddler version of NutriSTEP® for children 18-35 months of age was also released in 2012 (Randall Simpson et al., 2015). Since 1997, development of NutriSTEP® has involved almost 3000 parents/guardians of toddlers and preschoolers and more than 50 multi-sectoral partners. The attributes assessed include food and fluid consumption, the feeding environment, physical activity and sedentary behaviour, food security, and physical growth/development. Four-page educational booklets titled, “How to Build a Healthy Toddler” and “How to Build a Healthy Preschooler” were developed for parents as many gaps in parents’ nutritional knowledge were noted during the NutriSTEP® development process (Rysdale, 2008). It is suggested that nutrition resources, such as the educational
booklets, and follow-up recommendations are provided to parents following screening with NutriSTEP® (Rysdale et al., 2011).

Prior to the development of NutriSTEP® in 2008, a valid and reliable community-based nutrition screening tool for toddlers or preschoolers did not exist (Randall Simpson et al., 2008). NutriSTEP® screening was originally implemented using paper copies in settings such as public health units, school boards, primary care settings and in research (Persaud et al., 2013; Watson-Jarvis et al., 2011a, 2011b; McNeil et al., 2011). One challenge with the paper versions of NutriSTEP® is that the outreach to parents is limited by the capacity of community agencies to organize and implement integrated ethical nutrition screening strategies. In October 2013, internet versions of NutriSTEP® (both toddler and preschool) were launched on the Dietitians of Canada (DC) website as part of a Nutri-eSTEP online tool (www.nutritonscreen.ca) after thorough development, guidance, and testing from multiple key informants, parents, and dietitians (Reesor et al., 2014). Nutri-eSTEP has been found to be reliable compared to the paper versions (Carducci et al., 2015). Having free, online access to the screening questionnaires and accompanying results, extensive nutrition education messages, and resource links means more parents have access to the benefits of nutrition screening.

While the preschool version of NutriSTEP® has been implemented in Canadian jurisdictions (New Brunswick Public Health, 2012; Ontario Technical Document, 2014) and in research settings (Persaud et al., 2013; Randall Simpson et al., 2012; Rysdale et al., 2011; Walton et al., 2015; Watson-Jarvis et al, 2001a, 2011b), an evaluation of the efficacy of nutrition risk screening with NutriSTEP® and its accompanying nutrition education resources has not yet been conducted. In past implementation studies, parents perceived an increase in nutrition knowledge and awareness just from the NutriSTEP® screening process (i.e., completing the NutriSTEP® questionnaire alone); some parents mentioned changing their behaviours as well (Rysdale et al., 2011; Randall Simpson et al., 2012). However,
specific measures of changes in knowledge, behaviour, and some of the psychosocial correlates of behaviour have not yet been examined with NutriSTEP®.

2.4 Parental Role/Influence on children’s dietary habits

Parents play a key role in the promotion of healthy eating and dietary behaviours for their children. While multiple factors may influence the nutritional intake of young children, numerous studies have reported that parents generally act as the primary educators and providers and have the most influence on their children’s nutritional intake and development of eating habits (Golan & Crow, 2004a; Golan, Kaufman & Shahar, 2006; Golley, Hendrie, Slater, & Corsini, 2011; Mitchell, Farrow, Haycraft, & Meyer, 2013; Peters, Sinn, Campbell, & Lynch, 2012; Skouteris, McCabe, Swinburn, Newgreen, Sacher, & Chadwick, 2011). Studies have demonstrated that interventions focusing on improving dietary practices in children may be more effective when solely directed at parents rather than at children themselves (Golan, Weizman, Apter, & Fainaru, 1998) or when directed at both children and parents (Golan et al., 2006) even over the long term (Golan & Crow, 2004b). For example, a study by Golan et al. (1998) compared the overall weight-related behavioural change of obese children ages 6-11 through an intervention by either educating only children or only parents and found that the parent-educated group had better adherence to the intervention program with a greater increase in the number of behavioural changes and significantly greater weight loss in children than the child-educated group. Seven years after the intervention, the average child overweight status was significantly lower in the parent-educated group compared to the child-educated group (Golan & Crow, 2004b). Additionally, a recent review on child and adolescent health-related intervention effectiveness concluded that interventions involving parents tend to result in greater health behaviour changes than those directed at children alone (Niemeier, Hektner, & Enger, 2012).

Parents influence their children’s eating and physical activity behaviours through practices such as feeding styles including parental control and regulation of the child’s dietary intake (Carper,
role modeling (Golan et al., 1998; Golan et al., 2006), parental nutrition knowledge (Campbell et al., 2013; Contento et al., 1993; Variyam, Blaylock, Lin, Ralston, & Smallwood, 1999; Zarnowiecki, Sinn, Petkov, & Dollman, 2011), and provision of a healthy environment that facilitates healthy eating and physically active behaviours (Campbell & Crawford, 2001; Campbell et al., 2013; Golan & Crow, 2004a; Golan et al., 2006).

Feeding styles such as parental pressure to eat are associated with lack of responsiveness to internal satiety and hunger cues and self-feeding regulation (Carper et al., 2000). Multiple studies have demonstrated the importance of allowing a child to control food intake. In a study by Johnson and Birch (1994), preschool children were found to be less able to regulate their food intake (after a high calorie preload) if their parents reported greater control over food intake. Similarly, Lee, Mitchell, Smiciklas-Wright, and Birch (2001) compared intake of fat in five-year-old girls and reported that both limiting access to food and parental pressure to finish the food on the plate were associated with a higher intake of fat. Another study reported a negative association between preschooler BMI and parental pressure to eat (Shea et al., 2010). Parents should provide guidance and allow children to make decisions about what and how much to eat (within limits) in order to foster a child’s self-regulation of food intake in response to hunger and satiety cues (Johnson & Birch, 1994).

Parents can also influence their children’s healthful behaviours by acting as role models. Children are more likely to engage in healthy behaviours when parents engage in healthy eating and physical activity behaviours themselves and provide children with healthy food options. For example, Wronniak, Epstein, Paluch, and Roemmich (2005) noted a positive correlation between parent modelling of healthy eating habits and child weight loss during a two-year period. Further, an intervention that targeted only parents and encouraged role modelling was significantly more effective at improving weight-related behaviours in children compared to an intervention targeted only at
children (Golan et al., 1998). It is essential that parents have the skills and knowledge of nutrition and proper child feeding practices in order to provide a healthy home environment, demonstrate healthful behaviours, and encourage healthy eating habits in their children (Peters et al., 2012).

Since parents have a strong influence over what, when, and how much food is offered, interventions that target parents’ perceptions, knowledge, attitudes, and practices associated with children’s eating and weight-related behaviours may be beneficial in the reduction of children’s nutritional risk (Skouteris et al., 2011). Interventions that target parents of young children are also likely to enhance the long-term impact and sustainability of healthy behaviour promotion and nutrition risk prevention efforts (Golan & Crow, 2004b; Golley et al., 2011).

2.5 Theory of Planned Behaviour to Examine the Efficacy of NutriSTEP®

Behaviour change interventions implemented and evaluated with a proper understanding and use of a relevant and sound theory are more likely to affect behaviour change than interventions not using theory (Glanz & Bishop, 2010; Lytle & Perry, 2001). The Theory of Planned Behaviour (TPB) (Ajzen, 1991), an extension of the Theory of Reasoned Action (Ajzen & Fishbein, 1980), is among the most influential and widely applied theories for behaviour change studies (Ajzen, 2011b). The TPB can be used to both gain an understanding of determinants of a behaviour and to act as a conceptual framework for evaluating the efficacy of interventions (Ajzen, 2011a). The TPB is a value-expectancy model for deliberate behaviours which assumes that individuals make rational decisions based on beliefs and consider the implications of a behaviour before engaging in it (Ajzen, 1991). According to the theory, three main variables contribute to behavioural intentions which subsequently (along with perceived behavioural control) directly predict actual behaviour (Ajzen, 1991). These include: attitudes toward the behaviour (i.e., positive or negative evaluations of the behaviour and its outcomes), subjective norms (i.e., perceived social pressure to engage in the behaviour), and perceived behavioural control (PBC) (i.e., perceived ease or difficulty in performing the behaviour) (Ajzen, 1991).
The utility of the theory in the prediction of behaviour has been well established (Ajzen, 2011a; Armitage & Conner, 2001; Riebl et al., 2015). For example, in a large meta-analysis (n=185) across all behaviours, the TPB constructs were able to explain 20% of the variance in future measures of actual behaviour (Armitage & Conner, 2001). Research also supports the predictive utility of the TPB for healthy feeding behaviours among children (e.g., Andrews, Silk, & Enelic, 2010; Riebl et al., 2015; Swanson et al., 2011). In a study of maternal feeding behaviour of 2-year-old children, the TPB constructs predicted 57%, 65%, and 64% of the variance in intentions for providing breakfast, cooking from scratch, and for providing a sit-down meal, respectively (Swanson et al., 2011). Additionally, a recent meta-analysis by Riebl et al. (2015) identified 31 studies focusing on various dietary behaviours among children and adolescents including healthy eating and sugary snack and beverage consumption. Approximately 50-60% of the variance in intention and 6-19% of the variance in behaviour was accounted for in these studies.

In evaluation research examining the effectiveness of educational interventions, the TPB model has successfully been used to change behaviours (Hardeman et al., 2002; Kothe, Mullan, & Butow, 2012; Mullan & Wong, 2010; Riebl et al., 2015; Zhang, Shi, Chen, Wang, & Wang, 2009). Zhang et al. (2009) determined the effectiveness of an educational intervention, based on the TPB, on maternal infant feeding behaviours. Mothers in the intervention group had significant improvements in knowledge, attitudes, self-efficacy, intention, subjective norms, and feeding behaviours while these psychosocial variables and feeding behaviours remained relatively unchanged for the control group. In a review of 24 interventions applying the TPB, half of the interventions were effective in changing intentions, and approximately two-thirds were effective in changing behaviour, most often with small effect sizes (Hardeman et al., 2002). A review specifically examining dietary behaviour interventions (e.g., decrease unhealthy snacking, increase healthy eating, and increase fruit/vegetable consumption) in youth, using the TPB, reported beneficial outcomes with all three studies showing significant
differences in some or all of the TPB constructs for the intervention group compared to the control group (Riebl et al., 2015).

The intervention for the current study (NutriSTEP® and its nutrition education components) was evaluated using questionnaires developed and implemented to target key constructs of the TPB (Randall Simpson et al., manuscript in preparation) making it a useful theory to examine the efficacy of NutriSTEP® and its accompanying nutrition education resources.

2.6 Determinants of Dietary Behaviour in Young Children

Parental Knowledge as a Determinant of Healthy Dietary Behaviour

In accordance with the TPB, the assessment of knowledge is directly associated with one’s beliefs which determine attitudes, subjective norms, and perceived behavioural control and subsequently guide intentions and behaviour (Ajzen, Joyce, Sheikh, & Cote, 2011). Among the numerous factors contributing to dietary intake, nutrition knowledge is recognized as a key predictor of dietary behaviour (Parmenter & Wardle, 2000) and is one of the most amendable to improvement (Campbell & Hesketh, 2007), supporting the notion that interventions, such as the NutriSTEP® program, can provide benefits for childhood nutrition. There is strong evidence to suggest that nutrition knowledge is positively associated with healthier dietary habits and food choices (Wardle, Parmenter, & Waller, 2000) such as meeting current dietary recommendations for fruits, vegetables, and fats in adults (Colavito, Guthrie, Hertzler, & Webb, 1996; Wardle et al., 2000). Associations between parental nutritional knowledge and children’s dietary intake have been reported (Contento et al, 1993; Vareyam et al., 1999; Vereecken & Maes, 2010). For example, an association between parental knowledge about dietary fat and lower preschooler in-home fat intake has been reported (Colavito et al., 1996). Campbell et al. (2013) also noted that maternal nutrition knowledge was associated with improved child eating, both directly and through foods available in the home. While the aforementioned studies assessed mainly general parental nutrition knowledge and some assessed knowledge of recommendations,
parental knowledge of proper child feeding practices have also been found to significantly influence a child’s nutritional behaviours (Mitchell et al., 2013; Peters, Parletta, Lynch, & Campbell, 2014). In addition, the provision of information that guides the behaviour of interest by challenging or supporting beliefs in conformation with desired behaviours rather than general nutrition information is more likely to change behaviour (Ajzen, 2011a).

**Parental Attitudes as a Determinant of Healthy Dietary Behaviour**

Attitudes are determined by beliefs about the likelihood of outcomes and their importance (Ajzen, Czasch, & Flood, 2009). Attitudes play a key role in the adoption and maintenance of countless health habits (Hollis, Carmody, Connor, Fey, & Matarazzo, 1986). Individuals with positive attitudes toward nutrition, in particular, generally exhibit healthier dietary practices, healthier weight status, and more favourable cardiovascular indicators (Acheampong & Haldeman, 2013; Hollis et al., 1986).

Parental nutritional attitudes and values are also strongly associated with dietary behaviours of their children (Contento et al., 1993; Scaglioni, Salvioni, & Galimberti, 2008; Vereeken & Maes, 2010). For example, parental attitudes regarding child fruit and vegetable consumption, hours of exercise and screen time have been reported to correspond with parenting practices and children’s behaviours (Stenhammar, Sarkadi, & Edlund, 2007). Parental attitude effects on child behaviour were also seen in child screen use where children (10-12 years) were more likely to be sedentary when parents had less negative attitudes towards screen time and imposed fewer screen use rules on their children (He, Piché, Beynon, & Harris, 2010). Another study on parent diet and health attitudes indicated that the more concerned that parents were about ease of preparation, price, and how well food keeps, the more fat that they and their children consumed (Colavito et al., 1996). The highest intake of ‘junk’ foods in children was associated with both lower nutritional maternal knowledge and lower scores for attitudes related to health and taste (Vereeken & Maes, 2010). Mothers who more highly favoured a child’s health benefits over child taste preferences were more likely to provide healthier foods for their children and
consequently the children’s diets were significantly healthier (Contento et al., 1993). This association remained significant even when controlling for maternal nutrition knowledge, suggesting the strong and independent influence that maternal attitudes can have on a child’s diet (Contento et al., 1993).

Some studies have indicated that nutritional attitudes may be more predictive of eating behaviours than nutritional knowledge (Carruth, Mangel, & Anderson, 1977; Jordan et al., 2008; Schwartz, 1975); however, higher levels of nutrition knowledge have been significantly correlated with more positive attitudes toward healthy eating (Acheampong & Haldeman, 2013; Rastmanesh, Taleban, Kimiagar, Mehrabi, & Salehi, 2007). Educational intervention is an effective means of increasing nutrition knowledge as well as enhancing nutrition attitudes (Sharma, Gernand, & Day, 2008).

**Parental PBC/Self-Efficacy as a Determinant of Healthy Dietary Behaviour**

In addition to attitudes and subjective norms, the TPB as developed by Ajzen (1991), includes PBC; the perceived ease or difficulty of performing behaviours. Previous studies based on the TPB have used the term ‘self-efficacy’ in place of PBC (Fila & Smith, 2006; Zhang et al., 2009), although these terms are not entirely synonymous (Armitage & Conner, 2001). Self-efficacy is defined as one’s confidence in their own ability to perform a behaviour (Bandura, 1977). Ajzen (2002b) argues that PBC and self-efficacy are conceptually related in that PBC is comprised of components that reflect self-efficacy and controllability. Although there is not clear evidence to support a preference for the use of self-efficacy or PCB, after conducting a meta-analysis of 161 studies testing the TPB, Armitage and Conner (2001) advocated towards the use of self-efficacy rather than PBC. They found that while self-efficacy and PBC accounted for comparable proportions of the variance in behaviour, self-efficacy explained more variance in intentions than PBC. They added that self-efficacy can be more clearly defined and operationalized than PBC. Given these reasons, as well as the nature of the measure used, the current study assessed parent self-efficacy rather than PBC. The measure used for the current study
considered parent’s level of confidence in their abilities to effect their child’s health-related behaviours; therefore, the measure is more appropriately referred to as a measure of self-efficacy rather than PBC.

Self-efficacy is an important component in understanding the translation of knowledge to behaviour and is often highly predictive of the uptake and maintenance of health behaviours (Bandura, 1991). Self-efficacy is proposed as the most effective construct towards predicting future behaviour (Whitlock, Orleans, Pender, Allan, 2002; Wingo et al., 2013). Parent self-efficacy has been reported to be a key component in influencing child feeding behaviours (Duncanson, Burrows, Holman, & Collins, 2013). Knowledge, skills, and self-efficacy in encouraging healthy behaviour, healthy child feeding practices, and purchasing and preparing nutritious foods are necessary to establish and promote healthy child dietary behaviours (Cullen et al., 2000). Few studies, however, have examined the associations between parental self-efficacy and child healthy dietary behaviours. One study of 9 to 12 year old children demonstrated that parental self-efficacy concerned with planning and encouraging fruit and vegetable intake was positively associated with the children’s fruit consumption but not vegetable consumption (Cullen et al., 2000). In a study more relevant to NutriSTEP®, higher maternal self-efficacy was significantly associated with a decrease in screen time, an increase in fruit and vegetable consumption, and a decrease in sweets and cake consumption among 1 and 5 year olds (Campbell, Hesketh, Silverii, & Abbott, 2010). One possible reason for the discrepancies between the two studies is that parental self-efficacy and ability to influence a child’s healthy nutrition behaviours declines as the children get older (Campbell et al., 2010), highlighting the importance of early intervention.

**Parental Subjective Norms as a Determinant of Healthy Dietary Behaviour**

Subjective norms relate to perceptions of social pressure to perform specific behaviours. It is concerned with whether or not individuals or groups in which the individual is motivated to comply, will approve or disprove of certain behaviours (Ajzen, 1991). While the relative strength of the TPB constructs in the prediction of intentions is dependent on the type of behaviours being targeted and the
populations being studied (Ajzen, 1991), a meta-analysis of 161 TPB studies for various behaviours and populations, found that the subjective norm construct of the TPB had the weakest relation to intentions (Armitage & Conner, 2001). Even though social pressure can impact people’s actions, the level of weakness seen in behavioural predictability with the subjective norms measure may be due to the idea that many individual’s actions are not primarily driven by perceived social pressure (Trafimow & Finlay, 1996).

However, there is some research to suggest that parent subjective norms related to child dietary intake behaviour can improve through interventions (Sweitzer et al., 2011). In a study of 132 parents of preschoolers evaluating healthy lunch packing behaviours, Likert-type subjective norms questions on whether other people (e.g., teacher, child, people important to the parent, etc.) think the parent should pack one serving of the food in question in their child’s lunch every day were asked (Sweitzer et al., 2011). There were significant interaction effects of time and treatment on subjective norms for fruits, vegetables, and whole grains for the intervention group compared to a comparison group. What’s notable about Sweitzer et al.’s (2011) study is that the intervention specifically included strategies to address parent subjective norms.

Rather than investigating the efficacy of the TPB in predicting children’s nutrition risk behaviours, the current study investigated the efficacy of the NutriSTEP® program based on the logic of the TPB which suggests that intentions and behaviours are directly affected by the TPB constructs. Therefore, it is less critical that all of the TPB constructs be measured. The constructs of attitudes, self-efficacy and intentions, but not subjective norms, were chosen for this study as the NutriSTEP® program was not designed to change parental subjective norms towards their children’s nutrition risk behaviours. In the current study, the NutriSTEP® program was expected to improve parental nutrition knowledge, attitudes, self-efficacy, and intentions, and consequently, change their children’s dietary behaviours.
Parental Intentions as a Determinant of Dietary Behaviour

According to the TPB (Ajzen et al., 2011a), behavioural intentions, whether or not the individual plans to perform a particular behaviour, is the strongest and most direct predictor of future behaviour. The TPB has been applied to various studies of parent feeding practices. While some of these studies have examined behavioural intentions and not actual behaviour, these studies help demonstrate the ability of parental attitudes, perceived behavioural control, and subjective norms to predict feeding intentions (Duncanson et al., 2013; Tipton, 2014). For example, a qualitative study of parent perceptions of child feeding for children ages 2-5 years, noted that high perceived behavioural control (mostly influenced by family, peers, and food advertising) over child feeding was a key component in increasing behavioural intentions to change child feeding practices (Duncanson et al., 2013). Other studies of parent feeding practices have shown that TPB constructs predict behavioural intentions which, in turn, predict behaviours (Andrews et al., 2010; Swanson et al., 2011). For example, a cross-sectional study of mothers of two-year old children reported that perceived behavioural control, attitudes and subjective norms predicted mothers’ feeding intentions (Swanson et al., 2011). Also, perceived behavioural control and intentions predicted maternal feeding behaviours, specifically, providing breakfast daily, preparing meals from “scratch”, and eating meals together as a family. In another study, TPB constructs regarding maternal feeding practices for children ages 2-5 were assessed (Andrews et al., 2010). It was reported that mothers’ attitudes, perceived social norms and perceived behavioural control to provide healthy foods (e.g., fruits and vegetables) and limit unhealthy foods (e.g., sweetened drinks) predicted intentions regarding these behaviours. In addition, intentions predicted behaviour, specifically, mothers’ tracking of their children’s consumption of unhealthy food. Thus, both of these studies suggest that behavioural intentions are an important determinant of behaviours.

2.7 Improving Child Dietary Behaviours through the Provision of Educational Literature to Parents
TPB interventions target behavioural, normative, and/or control beliefs to produce positive intentions among participants who either did not consider performing the behaviour or were reluctant to do so prior to the intervention (Ajzen, 2011a). The NutriSTEP® program involves both nutrition risk screening and the provision of a four-page educational brochure and/or educational feedback messages as provided by Nutri-eSTEP. If a child is suspected to be at nutritional risk, resources and services should be provided and information for a referral to a dietitian or other health professional for intervention may be provided (Nutrition Resource Centre & Randall Simpson, 2015). Simply completing NutriSTEP® screening questionnaires have been previously reported to influence parental nutrition knowledge, awareness, and feeding behaviours (Randall Simpson et al., 2012; Rysdale et al., 2011). The NutriSTEP® screening tools and their accompanying educational resources attempt to modify parental knowledge as well as attitudes and self-efficacy in an effort to influence parent feeding intentions and child nutritional behaviours.

The provision of educational literature such as a leaflet, booklet, newsletter, or brochure, for example, can be considered a basic, inexpensive, readily available type of intervention that can be easily implemented. A recent review by Kadar, Sundblom, and Elinder (2015) looked at the effectiveness of parent support interventions addressing children’s (ages 2-18 years) dietary habits, physical activity, and bodyweight. The authors concluded that interventions that involved only sending information home were generally ineffective and interventions that focused on younger children were more effective than those focused on older children (Kadar et al., 2015).

Based on an extensive literature search, seven intervention studies involving parents of preschoolers where dietary-related educational literature was used as the primary intervention have provided promising results (Cotrell et al., 2005; Essery, DiMarco, Rich, & Nichols, 2008; Inglis, Docherty, & Pryke, 2010; Sangster, Eccleston, & Stickney, 2003; Sweitzer et al., 2011; Tabak, Tate, Stevens, Siega-Riz, & Ward, 2012; Wardle et al., 2003). For example, five of the seven studies showed
significant positive effects of dietary-related education literature for more than two measured outcomes (Cotrell et al., 2005; Inglis et al., 2010; Sangster et al., 2003; Sweitzer et al., 2011; & Tebak et al., 2012), and one study showed a significant change in one measured outcome (i.e., decrease in ‘pressure to eat’ scores) for a group receiving twelve 4-page weekly newsletters (Essery et al., 2008). The remaining study was a randomized controlled trial by Wardle et al. (2003) that specifically compared the effects of providing parents of 2-6 year old children with guidelines to expose their children to the target vegetable every day for 14 days (exposure group), ‘5-a-Day’ information and a leaflet containing recommendations on how to increase child vegetable and fruit intake (leaflet group), or no intervention (control group) with the aim of the interventions being to increase the intake of a previously moderately-liked vegetable. While significant improvements in children’s liking, ranking, and voluntary consumption (by 30%) were found in the exposure group, the leaflet and control groups did not have significant effects on any of the outcomes. However, voluntary consumption of the vegetable increased by 15% for the leaflet group compared to a 5% decrease for the control group (Wardle et al., 2003).

In contrast, Inglis et al. (2010) reported the beneficial effects of using leaflets as the primary intervention. In this study, primary care professionals gave leaflets to parents with children under 5 years of age and verbally delivered 3 key messages. The key messages were about the importance of exposing children to food up to 20 times to increase the chances of them voluntarily choosing it, the importance of having a variety of foods, and avoiding telling children to finish all of the food on their plates if they have already eaten as much as they want. While the majority of parents indicated that this information was not new to them, they reported it to be helpful in increasing their confidence in implementing the information, and 47% of parents reported positive behavioural change (Inglis et al., 2010). Since the leaflet was given with verbal reinforcement, it is unclear how effective the leaflet was
by itself. Both studies suggest the importance of providing education about the efficacy of repeated exposure when promoting healthy food choices to children (Inglis et al., 2010; Wardle et al., 2003).

The suitability and simplicity of information provided to parents can also make a difference. Two studies conducted in childcare settings aimed to improve the nutrition quality of lunches provided by parents by distributing relevant information and helpful recommendations to them (Sangster et al., 2003; Sweitzer et al., 2011). Sangster et al. (2003) provided lunch checklists and newsletters with recommendations on number of servings, portion sizes, and limiting unhealthy food habits to 351 parents. Lunch boxes were observed before and after the intervention with results demonstrating a significant average improvement in nutrition lunch box quality including higher calcium foods, more iron-containing foods, and less energy-dense and high fat foods. However, no control group was included (Sangster et al., 2003). A similar study was conducted using a quasi-experimental design where the intervention group received 5 weekly nutrition information handouts, menu and recipe suggestions, goal setting activities, social supports, and some classroom activities for children (Sweitzer et al., 2011). The intervention group showed a significant increase in the average number of servings of whole grains and vegetables but not fruit in children’s lunches versus the comparison group (Sweitzer et al., 2011). Both studies suggest that the nutritional quality of children’s lunches can be improved through the provision of relevant nutritional information and recommendations to parents.

In addition to childcare settings, some home-based interventions have also been found to be effective. In a 4-month study by Tabak et al. (2012), a home-based intervention consisting of four individually tailored newsletters based on parent intervention goals and two motivational phone calls to parents were conducted in order to improve vegetable consumption in preschool children. Parents in the intervention group reported a significantly greater number of vegetable types available in the home, an increase in the number of days per week vegetables and fruits were offered for snacks, and improved self-efficacy compared to the control group (Tabak et al., 2012). Therefore, home-based interventions
have the potential to alter parent feeding practices and home food availability to increase vegetable consumption in preschool children. In another home-based study, Essery et al. (2008) compared the efficacy of providing 12 weekly four-page newsletters or a 52-page booklet or no intervention on child feeding practices of mothers and on preschooler physical activity behaviours. The weekly newsletters were associated with a significant decrease in ‘pressure to eat’, although no changes in behaviour were associated with the booklet containing the same information. It may be that the format of the information provided to the target group makes a difference. For example, in this case, parents may be more likely to read a short weekly newsletter than a book that may just get stored away.

Some studies had poor quality designs which can help to explain why the interventions were not found to be effective. For example, Cottrell et al. (2005) conducted a 4-week randomized controlled trial to evaluate the efficacy of an intervention that provides parental education on diet, body mass index, and physical activity for children ages 4 to 6. Both the treatment and control groups received age-appropriate information on dietary and physical activity guidelines, pedometers, and daily step logs. The treatment group also received age-appropriate health information and information on how to increase physical activity. Children in the treatment group whose BMIs were greater than the 85th percentile were also given information on reducing caloric intake. Intake was measured as the average number of foods consumed weekly including vegetables, fruits, meats, sweets, and bread. Overall, the treatment group was more active and consumed significantly fewer sweets than the control group, although no other significant differences in intake of the remaining food categories were found. The main limitation with this study was that the provision of guidelines and pedometers to both the intervention and control groups resulted in positive changes in both groups, making it difficult to detect a significant difference in the intervention group compared to the control. A positive finding from this study is that the majority of the parents reported reading the information and found it helpful, thereby
suggesting that parents can be receptive to the provision of information as a type of intervention and that behaviour change is possible using this method (Cottrell et al., 2005).

While the use of educational literature as a primary intervention may be less effective than interactive activities, counselling, or group educational sessions (Kadar et al., 2015; Mitchell et al., 2013), the low-cost, readily available, and ease of implementation characteristics of educational literature interventions can make them worthwhile. Overall, research investigating the effectiveness of interventions including nutrition risk screening and the provision of educational materials to parents of toddlers and preschoolers is scarce. Based on available research, mixed results have been reported on the extent to which the provision of educational nutritional information to parents as an intervention is effective. However, many of these studies have reported significant beneficial effects and, at the very least, an increase in parental awareness.

In summary, interventions in which educational information is provided in combination with verbal reinforcement, tailored to the target group, promotes repeated exposure of disliked healthy foods, and positively modifies parental motivations and attitudes towards proper feeding and provision of a healthful home food environment are more likely to be effective than interventions in which educational information is provided without any of these components.

2.8 Evaluation Measures

*History and Development of Knowledge, Attitudes, and Self-Efficacy Measures*

In order to establish a baseline level of each construct and measure changes in each construct, valid, reliable, and appropriate evaluation measures must be used (Contento, Randell, & Basch, 2002). To aid in healthful behaviour change, intervention studies often focus on improving nutrition knowledge (Parmenter & Wardle, 2000). Many nutrition knowledge questionnaires have been developed and used in research to assess knowledge of a variety of populations (Parmenter & Wardle, 2000). However, prior to the development of the NutriSTEP® parent Nutrition Knowledge
Questionnaire (NKQ), a valid and reliable measure of parental nutrition knowledge for toddler and preschooler feeding or eating habits did not exist (Knipping, Sterling, & Randall Simpson, 2012; Mazariegos, Rysdale, & Randall Simpson, 2012). The NKQ measures knowledge of a variety of nutritional aspects as addressed by the NutriSTEP® program (screening tool and educational resources) (Knipping et al., 2012; Mazariegos et al., 2012). It has undergone extensive review and testing and adheres to principles as outlined by Parmenter and Wardle (2000). According to Parmenter and Wardle (2000), content validity, construct validity, internal consistency reliability, and test-retest reliability must be established for a questionnaire to appropriately be considered valid and reliable. The nutrition knowledge questions for the NKQ were first developed in 2011 after an extensive literature review. Key intercept interviews were conducted to refine the questions and, along with expert review, assessed for appropriate content validity to ensure the quality and appropriateness of the content of the questionnaire (Mazariegos et al., 2012). Test-retest reliability was conducted and the 45-item nutrition knowledge questionnaire for toddlers (n = 69) and 37-item NKQ for preschoolers (n = 79) were determined to be reliable using intraclass correlations (ICC) (ICC = 0.769, P < .001; ICC = 0.749, P < .001, respectively) (Knipping et al., 2012). Construct validity was determined by comparing parental nutrition knowledge of 45 parents of preschoolers to the nutrition knowledge of 35 3rd and 4th year university students in the Applied Human Nutrition program at the University of Guelph. Students scored significantly higher than parents on the parental nutrition knowledge questionnaire for preschoolers (Randall Simpson et al., manuscript in preparation). All items were reviewed and questions that were either too easy or too difficult were removed (as per Parmenter and Wardle (2000)). The questionnaires were also made to be consistent between toddlers and preschoolers, with appropriate wording for each group. Key intercept interviews were conducted to determine the most acceptable format and design of the NKQ (Schwenger & Randall Simpson, 2012).
Following the development of the Nutri-eSTEP site, more questions were added based on the site’s feedback messages (Frank, Pike, & Randall Simpson, 2014). In addition to nutrition knowledge, parental self-efficacy and attitudes act as strong mediators and predictors of child dietary behaviours (Vereeken & Maes, 2010; Whitlock et al., 2002; Wingo et al., 2013). Therefore, Frank et al. (2014) developed a questionnaire that also assesses parental attitudes and self-efficacy to provide a more accurate measurement of the effectiveness of the NutriSTEP®/Nutri-eSTEP program. The questionnaires underwent multiple phases of development and testing, beginning with an extensive literature review, questionnaire draft development, expert panel review, key-intercept interviews, and item revision (Frank et al., 2014). Test-retest reliability, internal consistency reliability, and known group construct validity of the newly developed preschooler nutrition Knowledge (43 questions), Attitudes (10 items), and Self-Efficacy (11 items) (KASe) questionnaire was also determined (Randall Simpson et al., manuscript in preparation). Thus, it is evident that the KASe measures have undergone extensive review and testing to ensure appropriateness, reliability and validity.

Development of Intention Questions

According to the TPB (Ajzen, 1991), perceived behavioural control can predict both intentions and behaviour. However, intention to engage in a specific behaviour is the most proximal determinant of actual behaviour (Ajzen, 1991). The TPB has been shown to be a useful predictor of parental intentions to provide healthy options and/or limit unhealthy options for their young children (Andrews et al., 2010; Swanson et al., 2011; Tipton et al., 2014).

For example, Andrews et al. (2010) conducted a study focusing on the predictive ability of the TPB on parental prevention of obesity in preschoolers. The authors assessed behavioural intentions through four 7-point Likert scale items asking parents if they intended to limit their children’s intake of sugar sweetened beverages, limit their children’s TV viewing, control what their children eat, and provide fruits and vegetables for their children (e.g., “I intend to give my child at least 5 servings of
fruits and vegetables each day”) (Cronbach’s $\alpha = .75$). The authors of the study reported that intentions predicted 29% of behaviour (i.e., parent self-reported healthy eating behaviour and tracking of their children’s unhealthy dietary intake) and PBC predicted 12% of behaviour (Andrews et al., 2010).

Another study evaluated the feeding behaviours of disadvantaged mothers of 2 year olds using the TPB to assess three behaviours: ‘having breakfast’, ‘eating food cooked from scratch’, and ‘eating together as a family’ (Swanson et al., 2011). TPB constructs including intentions significantly predicted these 3 behaviours. A 5-point Likert scale was used to rate how strongly participants agreed/disagreed with two questions evaluating participants’ degree of ‘planning’ and ‘wanting’ for each of the behaviours. Internal consistency reliabilities were determined separately for each of the behaviours and ranged from Cronbach’s alpha values of $\alpha = .72$ for ‘intention to provide breakfast’ to $\alpha = .80$ for ‘having a sit down meal’. Correlations between the three behaviours were modest as they were somewhat related but separate constructs ($r = 0.24 - 0.26$) (Swanson et al., 2011).

In a TPB study involving Native American youth, intention to eat healthy was measured using eight items evaluated on a 5-point Likert scale from “strongly agree” to “strongly disagree” (Fila & Smith, 2006). Youth participants were asked about their plans for the next week to “eat healthy”, “not eat junk food”, “eat vegetables”, “eat fruit”, “not eat fast food”, “not drink regular pop”, “eat healthy foods in front of the TV”, and “eat healthy foods to keep a healthy weight everyday” (e.g., “for the next week I plan to eat healthy everyday”). The intention scale presented high internal consistency reliability (Cronbach $\alpha = .84$). Eating behaviour was determined through Likert scale questions assessing dietary intake (e.g. fruits, soft drinks, vegetables) and other eating behaviours. The authors did not find a significant association between intention and eating behavior, although the TPB was predictive of constructs affecting healthy eating intention and behaviour individually (Fila & Smith, 2006). It is possible that low intention-behaviour correlations reflect a tendency for participants to overrate readiness to execute desirable behaviours (Ajzen, Brown, & Carvajal, 2004; Ajzen et al., 2009).
Overall, the number of intention items included in studies measuring comparable behaviours has ranged from two (Tipton, 2014) to eight (Fila & Smith, 2006) and are often evaluated with five- or seven-point scales. Francis et al. (2004) state that a minimum of 3 intention items should be included to ensure adequate internal consistency. TPB studies reviewed by Armitage and Conner (2001) generally used multiple measures of intention by including questions about participants’ intention/plans, desire and/or self-prediction regarding the behaviour and noted the strong correlation between these items. In fact, Ajzen (2002a), the developer of the TPB, suggests assessing behavioural intentions using multiple heads with the same behavioural tail. He proposed the example of “walking on a treadmill for at least 30 minutes each day for the next month” using three different heads: “I intend to …” (extremely likely to extremely unlikely 7-point scale), “I will try to …” (definitely true to definitely false 7-point scale), and “I plan to…” (strongly agree to strongly disagree 7-point scale). Similarly, Armitage and Conner (1999) assessed intention to eat a low-fat diet in adults, using 3 items evaluated on a seven-point bipolar scale from ‘definitely do not’ to ‘definitely do’. These were: ‘I intend to’…; ‘I plan to’…; and ‘I want to’… “eat a low-fat diet over the next month.” In this study, intentions accounted for 57% of the variance in behaviour (Armitage and Conner, 1999). Multi-scales such as this are often preferred by researchers over single item scales to strengthen internal consistency reliability, avoid bias, and reduce measurement error (Ajzen, 2011a). However, according to a study by Darker and French (2009), the problem with using intention questions in this format is that they can seem redundant and odd to participants. Further, most participants could not distinguish between the measures (Darker & French, 2009).

According to a meta-analysis of 185 TPB studies, on average, the TPB explains 27% of the variance in behaviour and 39% of the variance in intentions (Armitage and Conner, 2001). Generally, there is not a perfect relationship between behavioural intentions and actual behaviours but often a significant relationship is found (Armitage and Conner, 2001; Francis et al., 2004). Therefore,
intentions can be used as a proximal measure of behaviour which can allow for determination of the effectiveness of interventions when there is not an available measure of actual behaviour (Francis et al., 2004). It should be noted, however, that in some cases, the intention questionnaire itself has provided participants with new thoughts that could cause behavioural change (Darker & French, 2009).

According to Ajzen (2002a), to strengthen the intention-behaviour relationship and the psychometrics of the measure, the target behaviour must be clearly defined and intention items must be compatible with the behaviour. Based on the literature discussed and guidelines of Ajzen (2002a), intention questions were adapted/developed for use in the current study. Researchers and registered dietitians with pediatric expertise assessed the intention questions for content validity (i.e., content, appropriateness, structure, and clarity). Items deemed irrelevant or unclear were either improved or considered for deletion. Next, a sample of 3 parents from the target population also reviewed the items to assess for structure, readability, clarity, and appropriateness. The toddler and preschool versions of the questionnaire are the exact same. In total, the intention questionnaire comprised of 6 questions for use in the current study.
3.0 Research Objective and Hypotheses

The specific objective of this research was to assess the efficacy of nutrition risk screening with the NutriSTEP® program in toddlers and preschoolers on outcomes including: parental knowledge as the primary outcome, and behaviour with its psychosocial correlates (e.g., attitudes, self-efficacy, intention) as secondary outcomes. It was hypothesized that parents who completed the NutriSTEP® screening and received the accompanying educational materials (i.e., 4-page educational brochure, a 26-page booklet including Nutri-eSTEP’s feedback messages, and links to resources) would see a significantly greater improvement in knowledge, attitude, self-efficacy, intention, and behaviour scores compared to parents in the wait-listed control group.
4.0 Methods

4.1 Participants, Design, and Procedure

To test the efficacy of the NutriSTEP® screening process, a wait-listed cluster randomized controlled trial with a post-test 3 months after the intervention was conducted (Figure 4.1). This study was reviewed and approved by the University of Guelph Research Ethics Board and registered as a clinical trial (ID: NCT02582554; www.clinicaltrials.gov). Participants were conveniently recruited at various Ontario Early Years Centres (OEYCs) in Southern Ontario, Canada. OEYCs are locations where parents/caregivers can visit with their children (birth to 6 years) to take part in programs and activities free of charge; funding is through the Ontario Ministry of Education (http://www.oeyc.edu.gov.on.ca). Each centre was contacted directly as there is no umbrella coordinating organization. Centres were provided with a $50 (Canadian) Chapters gift card as an incentive. Centres that agreed to participate were then randomized as either a control or intervention site where all participants at the site were allocated to the same treatment group (i.e., control or
intervention) to prevent contamination (i.e., participants in the intervention group spreading intervention information to participants in the control group). Posters in the OEYCs and word of mouth were used to advertise the date of our visit to the OEYCs.

Parents who expressed interest were screened for eligibility (see Appendix A). Eligibility criteria included: parent/full-time caregiver of a child (ages 1.5-5 years); able to read and write English at a Grade 6 level; willing to return for a second visit; and, not having previously participated in a University of Guelph nutrition study (to eliminate those who may have previously participated in NutriSTEP® studies). Those who met the criteria provided written informed consent to participate in the study (see Appendix B) and completed a general demographic form (Appendix C). Next, during the same 3-month timeline, both groups completed the pre-test questionnaires on paper in the following order: knowledge (Appendix D), attitudes, self-efficacy and intentions (Appendix E) (with identical questions for toddlers and preschoolers). The intervention group also completed the NutriSTEP® screening questionnaire prior to completing the pre-test questionnaires; children aged 18-35 months completed the Toddler NutriSTEP® (Appendix F) and those aged 3-5 years completed the Preschool NutriSTEP® (Appendix G). After these pre-test measures, the intervention group also received NutriSTEP®/Nutri-eSTEP’s accompanying education materials (i.e., the 4-page “How to Build a Healthy Toddler/Preschooler” brochures (www.nutristep.ca), a 26-page Nutri-eSTEP feedback information booklet (age-dependent) based on the feedback messages from the Nutri-eSTEP site (www.nutritionscreen.ca) and links to additional resources). Once participants completed the questionnaires, researchers collected the forms and questionnaires, checked the questionnaires for completion, and provided participants with $5 (Canadian) as an incentive.

Approximately three months later, the research team returned to the OEYCs for follow-up and both treatment groups completed a post-test which started with NutriSTEP® screening and then completion of the knowledge, attitudes, self-efficacy, and intention questionnaires. Next, researchers
collected and checked the questionnaires for completion and provided participants with a $20 (Canadian) grocery gift card as an incentive. For ethical reasons, the wait-listed control group also received the remainder of the intervention (NutriSTEP®/Nutri-eSTEP’s accompanying education materials) after the post-test.

The 3-month time interval is based on a parenting intervention trial that was able to find changes in child nutrition risk behaviours after 3 months as measured via NutriSTEP® as one of the outcomes (Walton et al., 2015). Three months is also enough time to allow for parents to have forgotten their previous responses (Streiner & Norman, 2008).

The paper versions of the toddler and preschool NutriSTEP®, knowledge, attitudes, self-efficacy, and intention questionnaires were used for this study. However, to help with participant retention, the questionnaires were also made available online through Qualtrics (Qualtrics, Provo, UT, USA, 2016) via the University of Guelph for the post-test and participants who were unable to return for the second visit in person were provided the option to complete the questionnaires online (all questionnaires, with the exception of the intentions questions, have been determined to be reliable for paper vs online completion (Carducci et al, 2015; Randall Simpson et al., manuscript in preparation).

4.2 Intervention

The intervention consisted of NutriSTEP® screening and its supplementary nutrition education materials which included: the “How to Build a Healthy Toddler” or “How to Build a Healthy Preschooler” brochures; a 26-page information booklet consisting of feedback information that parents would normally receive after completing NutriSTEP® online (via Nutri-eSTEP); and, links to additional resources such as access to registered dietitians and more information through EatRight Ontario and Dietitians of Canada.

During the pre-test, NutriSTEP® screening was only completed by the intervention group because it is considered part of the intervention as just filling out the NutriSTEP® questionnaire has
previously been reported anecdotally to increase knowledge and change behaviour (Randall Simpson et al., 2012; Rysdale et al., 2011).

During the development of the original NutriSTEP®, it became apparent that nutrition education for parents was needed (Rysdale, 2008). In response, 4-page brochures titled "How to Build a Healthy Toddler" and “How to Build a Healthy Preschooler" were developed (www.nutristep.ca). These brochures were tested for content and design by registered dietitians with pediatric experience and by parents of preschoolers who were involved in the development of NutriSTEP®. "How to Build a Healthy Toddler/Preschooler" are 4-page brochures that have key messages relevant to the questions on the NutriSTEP® questionnaires. Recommendations from Canada's Food Guide (Health Canada, 2007) are included as well as suggestions for credible nutrition resources. As part of the NutriSTEP® program, it is recommended that the brochure be given to parents following screening with NutriSTEP® (Rysdale et al., 2011).

As part of the Nutri-eSTEP® platform, parents receive feedback messages based on their responses to each question on the NutriSTEP® questionnaire. The messages are based on information in the "How to Build a Healthy Toddler" and “How to Build a Healthy Preschooler" brochures, Canada’s Food Guide (Health Canada, 2007), and other resources. The messages were developed by a registered dietitian and a senior Applied Human Nutrition student, aligned with the Practice-based Evidence in Nutrition (PEN) database, reviewed by experts in nutrition from across Canada and also by parents. Links to credible nutrition resources are also provided as well as contact information for provincial dietitian services such as EatRight Ontario (www.eatrightontario.ca). For this study, the feedback messages from the Nutri-eSTEP site were provided to participants as printed 26-page booklets as part of the treatment (separate versions for toddlers and preschoolers were used).

4.3 Measures

All measures at pre-test and post-test were self-reported.
**Demographics**

A demographic form, which was adapted from Statistics Canada (Statistics Canada, 2001), and has been used in all NutriSTEP® research (Carducci et al., 2015; Randall Simpson et al., 2008, 2012, 2015; Rysdale et al., 2011), was used in this study. Participants reported information on age, gender, first language, birth country, marital status, and education level. Information collected about the child in question included age, gender, and birth country. Information on household income and number of people in the household (including number of adults and number of children) was also requested.

**Knowledge**

The Nutrition Knowledge Questionnaires (NKQ) are valid and reliable 43 item questionnaires that assess parental knowledge and are specifically tailored to either toddler or preschooler nutrition and feeding practices addressed in NutriSTEP® questionnaires, Nutri-eSTEP feedback messages, and related nutrition education resources (Randall Simpson et al, manuscript in preparation). Each question has 3 to 5 response options with most items including a “not sure” option scored as zero to prevent correct guesses. The questionnaire is scored as the number of correct responses (1 point each), with a maximum score of 43. Internal consistency reliability was good (α = .72). Known-group construct validity was established as third and fourth year university nutrition students (n = 43, 31 ± 4) scored significantly higher (P < .05) than parents (n = 48, 29 ± 6) on the nutrition knowledge questionnaire. Test-retest reliability for parents (n = 42) was established with significant Intraclass Correlation (ICC) (0.80, P < .001) between the two scores (first administration 29 ± 6; second administration 30 ± 5) (Randall Simpson et al, manuscript in preparation)

**Attitudes and self-efficacy**

The Attitudes and Self-Efficacy Questionnaire (ASEQ) was developed in 2014 with the questions based on a literature review, review by an expert RD panel (n = 5), and key-intercept interviews with 12 parents of young children (Randall Simpson et al., manuscript in preparation). Each
question has a 5-point Likert-type response option (strongly agree = 5 to strongly disagree = 1) that is used to generate a numerical score. For certain items, “strongly disagree” is the most appropriate response and requires recoding to correct the scoring for the direction of the statement. There are 10 questions on attitudes with a maximum score of 50 for the questionnaire. Test-retest reliability of the attitude questionnaire was established for 42 parents with significant Interclass Correlation (ICC) (ICC = 0.86, \( P < .001 \)) between the two scores (40 ± 4 (first administration) vs 40 ± 4 (second administration)). Internal consistency reliability of the attitudes questionnaire was questionable (\( \alpha = .60 \)). There are 11 self-efficacy questions with a maximum score of 55 for the questionnaire. Test-retest reliability of the self-efficacy questionnaire was established for 42 parents with significant Interclass Correlation (ICC) (ICC = 0.70; \( P < .001 \)) between the two administrations (47 ± 5 (first administration) vs 48 ± 4 (second administration)). Internal consistency reliability of the self-efficacy questionnaire was good (\( \alpha = .86 \)) (Randall Simpson et al., manuscript in preparation).

**Intentions**

There are 6 intention items; each has a 5-point Likert-type scale similar to the attitudes and self-efficacy questionnaires where response options range from strongly agree to strongly disagree with a maximum possible score of 30. The intention questionnaire includes items related to various nutrition risk constructs such as intake, feeding practices, sedentary behaviours, and physical activity. Items were based on the intention questionnaire development guidelines of Ajzen (2002a) and adapted from intention questionnaires used by Fila and Smith (2006) with good internal consistency reliability (\( \alpha = .84 \)) and Andrews et al. (2010) (\( \alpha = .75 \)). The intention questionnaire was tested for content validity with parents, researchers, and registered dietitians with pediatric expertise prior to use in this study. All of the items included the prefix, “I plan to”. As an example, one of the item statements was, “I plan to limit my child’s screen time to less than 1 hour each day.”

**Child Nutrition Risk Behaviour**
The NutriSTEP® screening questionnaires (toddler and preschool versions), while part of the intervention, were also used to measure child nutrition risk behaviours. The NutriSTEP® questionnaires each consist of 17 items focusing on various nutrition attributes, including food group and fluid intake, physical growth, physical activity, sedentary behaviour, food security and the feeding environment (Randall Simpson et al., 2008, 2015). Each question has 2 to 5 response options ranging in score from 0 (no risk) to 4 (risk). Summed scores for the questionnaires provide an indication of level of nutrition risk (max possible risk score = 68) (Randall Simpson et al., 2008, 2015). The questionnaires were tested for criterion validity where risk scores on NutriSTEP® and registered dietitian risk scores were significantly correlated (toddler version: \( r = 0.67, P < .000, \) Randall Simpson 2015; preschool version: \( r = 0.48, P = .01, \) Randall Simpson et al., 2008) and the area under the Receiver Operating Characteristic (ROC) curve was 82.7% and 81.5% for the high risk rating and 84.6% and 73.8% for moderate risk rating for toddlers and preschoolers, respectively (Randall Simpson et al., 2008, 2015). High values for the area under the ROC curve indicates that the measured risk via NutriSTEP® is consistent with the measured risk via registered dietitians. Both the toddler and preschool NutriSTEP® questionnaires have adequate to excellent agreement on items and are reliable between administrations (ICC = 0.951, \( F = 20.53, P < .001; \) Randall Simpson et al., 2015) (ICC = 0.89, \( F = 16.7, P < .001; \) Randall Simpson et al., 2008), respectively.

4.4 Statistical Analysis

Data from the paper questionnaires were coded in duplicate in an Excel spreadsheet and online data were downloaded from Qualtrics (Qualtrics, Provo, UT, USA, 2016) available at the University of Guelph. The NKQ and NutriSTEP® Qualtrics data were manually coded in duplicate and all duplicates were compared to ensure accuracy. The remaining data for attitudes, self-efficacy, and intentions were downloaded from the Qualtrics site in an automatically correctly coded format. All of the final coded data were combined into one spreadsheet. Data were analyzed using IBM SPSS Statistics Version 23. A
$P$ value < .05 was considered statistically significant in all analyses. Descriptive statistics were performed on the demographics of the sample. Chi-squared tests and t-tests were conducted to compare the final control and intervention groups and the final toddler and preschooler groups on demographic data. They were also used to compare completers to drop-outs on demographic data and baseline measures for each of the constructs. For the chi-squared tests, demographic characteristics with multiple groups were dichotomized such that: parent education was dichotomized to post-secondary graduate yes or no; household income was dichotomized to greater than or less than $60,000; and, country of birth for both parents and children were dichotomized to born in Canada or in another country.

Participants' total scores for each questionnaire were calculated and all data were checked for normality prior to analysis. Since random assignment occurred at the site level, generalized estimating equations (GEE) were used to assess differences in change between the control and intervention groups (Zeger & Liang, 1986) for outcomes of knowledge, attitudes, self-efficacy, and intentions. Basic GEE analyses controlling only for baseline scores and adjusted GEE analyses controlling for baseline scores and other covariates that were significantly different between the control and intervention groups at baseline and that are known to be important influential factors were conducted. To assess the difference in behaviour (i.e., NutriSTEP® score) between the control and intervention groups, an independent samples t-test was conducted on the post-test NutriSTEP® risk scores. Additionally, a paired samples t-test was conducted to compare the intervention group’s mean NutriSTEP® scores at baseline to follow-up.
5.0 Manuscript to Submit for Publication

Efficacy of Nutrition Risk Screening with NutriSTEP® in Toddlers and Preschoolers

5.1 Abstract

Objective: To evaluate the efficacy of the NutriSTEP® program among parents of toddlers and preschoolers.

Design: Wait-listed, cluster randomized controlled trial with a post-test 3-months post-intervention.

Setting: Seventeen Ontario Early Years Centres within 150 kilometers of Guelph, Ontario, Canada.

Participants: A convenience sample of 137 parents/primary caregivers.

Intervention: NutriSTEP® program (nutrition risk screening tool and accompanying nutrition education materials).

Main Outcome Measures: Primary outcome was parental nutrition-related knowledge. Secondary outcomes included child nutrition risk scores and parental psychosocial correlates (attitudes, self-efficacy, and intentions).

Analysis: Generalized estimating equations were used to examine the effect of the intervention.

Results: Compared to parents in the control group, parents who received the intervention significantly increased their nutrition related knowledge \( (P = .04) \) and attitudes \( (P = .03) \) toward nutrition-related behaviours. Parents of preschoolers also significantly increased their self-efficacy \( (P = .02) \) and intentions \( (P = .01) \). Using a post-test-only design for the NutriSTEP® risk scores, there was not a significant difference \( (P = .05) \) between control and intervention groups.

Conclusions and Implications: The NutriSTEP® program serves as an efficacious parent-targeted assessment tool and education intervention which can change determinants of child nutrition risk behaviours.

Key Words: nutrition, NutriSTEP®, Nutri-eSTEP, screening, preschoolers, toddlers, parents
5.2 Introduction

Toddlers (ages 18 to 35 months) and preschoolers (ages 3 to 5 years) are at a critical age for developing eating behaviours and food preferences (Birch & Ventura, 2009; Savage et al., 2007). Modification of eating behaviours and the promotion of healthy eating in early childhood are important as health-related behaviours such as dietary intake, eating habits, and physical activity are often firmly established by school age (Gibson et al., 2012; Skinner et al., 2002; Wofford, 2008). In Canada, roughly one third of toddlers and preschoolers are at moderate to high nutritional risk (Randall Simpson et al., 2015; Randall Simpson et al., 2008; Vanderhout et al., 2014) and 21% of children ages 2 to 5 years are overweight or obese (Shields, 2006).

Nutrition screening tools can be inexpensive and effective means of identifying nutritionally-at-risk children (Baer & Harris, 1997; Cunningham et al., 1997). These tools can also facilitate nutritional intervention and referral for assessment and treatment (Cunningham et al., 1997). Addressing concerns and promoting healthy feeding/eating behaviours during the early years can impact the future health of the population (Baer & Harris, 1997). The NutriSTEP® questionnaires are valid and reliable 17-item, community-based, parent-administered questionnaires that identify attributes (i.e., food and fluid consumption, the feeding environment, physical activity and sedentary behaviour, food security, and physical growth/development) of nutritional risk in toddlers and preschoolers (Randall Simpson et al., 2008, 2015).

Following the completion of NutriSTEP® questionnaires, it is recommended that parents be provided with related nutrition information and information on additional resources for further guidance, assessment, and/or treatment via four-page educational brochures titled, “How to Build a Healthy Toddler” or “How to Build a Healthy Preschooler” (www.nutristep.ca) or via feedback messages tailored to parent responses if the online version of NutriSTEP® (Nutri-eSTEP; www.nutritionscreen.ca) is used. NutriSTEP® may be a useful tool for understanding nutrition risk.
behaviour changes, addressing nutrition concerns with parents; further, its use in public health settings can provide data for monitoring and surveillance and aid in program development (Randall Simpson et al., 2008; Rysdale et al., 2011). NutriSTEP® has been implemented in some Canadian provinces (New Brunswick Public Health, 2012; Ontario Technical Document, 2014), applied in research (Persaud et al., 2013; Randall Simpson et al., 2012; Rysdale et al., 2011; Walton et al., 2015; Watson-Jarvis et al., 2011a, 2011b), and the preschool version is currently used as an accountability indicator in Ontario (Ontario Technical Document, 2014).

Prior to the development of NutriSTEP®, a valid and reliable community-based nutrition screening tool for young children did not exist (Randall Simpson et al., 2008); as such, research investigating the effectiveness of interventions including nutrition risk screening and the accompanying provision of educational materials to parents is scarce. While there is anecdotal evidence that the NutriSTEP® program can increase parental nutrition knowledge, awareness, and improve behaviours (Randall Simpson et al., 2012; Rysdale et al., 2011), an objective evaluation of the efficacy of NutriSTEP® has not yet been conducted.

The evaluation for this study was conducted based on the Theory of Planned Behaviour (TPB) framework (Ajzen, 1991), which is among the most influential and widely applied theories for behaviour change studies (Ajzen, 2011b). According to the theory, three main variables contribute to behavioural intentions, which subsequently predict behaviours (Ajzen, 1991). These variables include: attitudes (i.e., positive or negative evaluations of the behaviour and its outcomes), subjective norms (i.e., perceived social pressure to engage in the behaviour), and perceived behavioural control (PBC) (i.e., perceived ability to perform the behaviour) (Ajzen, 1991). Although the terms PBC and self-efficacy are not entirely synonymous with self-efficacy defined as one’s confidence in their own ability to perform a behaviour (Bandura, 1977), some researchers have opted for the use of self-efficacy over PBC (Fila & Smith, 2006; Zhang et al., 2009). After conducting a meta-analysis of 161 studies testing
the TPB, Armitage and Conner (2001) advocated towards the use of self-efficacy given that it explained more variance in intentions than PBC. They added that self-efficacy can be more clearly defined and operationalized than PBC.

In addition to the TPB constructs, nutrition knowledge (the primary outcome for the current study) is recognized as a key predictor of dietary behaviour (Parmenter & Wardle, 2000) and is one of the most amendable to improvement (Campbell & Hesketh, 2007), supporting the notion that interventions, such as NutriSTEP®, can provide benefits for childhood nutrition. The TPB has been successfully used in evaluation research examining the effectiveness of educational interventions to change behaviours (e.g., infant feeding, unhealthy snacking, increasing vegetable and fruit consumption in youth) (Mullan & Wong, 2010; Zhang, Shi, Chen, Wang, & Wang, 2009); however, few studies related to nutrition behaviour interventions in early childhood exist.

Knowledge, attitudes, self-efficacy and intentions, but not subjective norms, were chosen for the current study as the NutriSTEP® program was not designed to change parental subjective norms towards their children’s nutrition risk behaviours. Further, across a range of TPB studies, subjective norms are often found to be the weakest predictors of intentions (Armitage & Conner, 2001; Riebl et al., 2015).

The specific objective of this research is to evaluate the efficacy of nutrition risk screening with NutriSTEP®. The primary outcome variable was the score on a Nutrition Knowledge Questionnaire (NKQ) (Randall Simpson et al., 2016 in preparation). Secondary outcome variables were scores on an attitudes and self-efficacy questionnaire (ASEQ) (Randall Simpson et al., 2016 in preparation), scores on intention questions, and scores on the NutriSTEP® questionnaires. It was hypothesized that there would be significantly greater improvement in scores for the primary and secondary outcomes for the intervention group relative to the wait-listed control group.

5.3 Methods
Participants, Design, and Procedure

To test the efficacy of the NutriSTEP® screening process, a wait-listed cluster randomized controlled trial with a post-test at 3 months post-intervention was conducted. This study was reviewed and approved by the University of Guelph Research Ethics Board and is registered as a clinical trial (ID: NCT02582554; www.clinicaltrials.gov). Participants were conveniently recruited at 17 Ontario Early Years Centres (OEYCs) in Southern Ontario, Canada. OEYCs are provincially funded locations where parents/caregivers can visit with their children (birth to 6 years) to take part in programs and activities free of charge (http://www.oeyc.edu.gov.on.ca). Centres that agreed to participate were randomized as either a control or intervention site where all participants at the site were allocated to the same group (i.e., control or intervention) to prevent spreading of intervention information to participants in the control group.

Parents/caregivers were eligible to participate if they were the primary caregiver of a child between the ages of 1.5-5 years, could read English at or above a Grade 6 level, willing to return for a second visit, and had not previously participated in a University of Guelph childhood nutrition study. All participants completed a consent form, demographic form, and questionnaires assessing nutrition knowledge, attitudes, self-efficacy, and intentions. The intervention group also completed the NutriSTEP® questionnaires prior to completing the pre-test questionnaires. After the pre-test measures, the intervention group received NutriSTEP®’s accompanying education materials.

Approximately 3 months later, the research team returned to the OEYCs for follow-up and both the control and intervention groups completed a post-test starting with NutriSTEP® screening and then completion of the knowledge, attitudes, self-efficacy, and intention questionnaires. For ethical reasons, the wait-listed control group also received the education materials after the post-test. To help with participant retention, the questionnaires were also made available online through Qualtrics (Qualtrics, Provo, UT, USA, 2016) for the post-test so that participants could still complete the questionnaires if
they were unable to return for the second visit in person. The 3-month time interval is based on a study where a parenting intervention was able to result in changes in NutriSTEP® risk scores after 3 months (Walton et al., 2015). Three months is also enough time to allow parents to forget their previous responses (Streiner & Norman, 2008).

**Intervention**

The intervention consisted of NutriSTEP® screening and its supplementary nutrition education materials which include the “How to Build a Healthy Toddler” or “How to Build a Healthy Preschooler” brochures. These 26-page information booklets consist of feedback information (separate versions for toddlers and preschoolers) that parents would normally receive after completing NutriSTEP® online (Nutri-eSTEP), and links to additional resources such as access to registered dietitians and more information through EatRight Ontario and Dietitians of Canada. During the pre-test, NutriSTEP® screening was only completed by the intervention group because it is considered part of the intervention as just filling out the NutriSTEP® questionnaire has previously been reported anecdotally to increase knowledge and change behaviour (Randall Simpson et al., 2012; Rysdale et al., 2011).

**Measures**

All measures at pre-test and post-test were self-reported.

**Demographics.** A demographic form, used in previous NutriSTEP research® (Carducci et al., 2015; Randall Simpson et al., 2008, 2012, 2015; Rysdale et al., 2011) was used to collect information on the parent participant’s age, gender, first language, birth country, marital status, and education level. Information collected about the child in question included age, gender, and birth country. Information on household income and number of people in the household (including number of adults and number of children) was also requested.
**Knowledge.** The NKQs are valid and reliable 43-item questionnaires that assess parental knowledge and are specifically tailored to either toddler or preschooler nutrition and feeding practices addressed with NutriSTEP® (Randall Simpson et al, manuscript in preparation). Each question has 3 to 4 response options with most items including a “not sure” option scored as zero to prevent correct guesses. The questionnaire is scored as the number of correct responses (1 point each), with a maximum score of 43. Internal consistency reliability was acceptable ($\alpha = .72$), and test-retest reliability (Intraclass Correlation [ICC] 0.80, $P < .001$) and known-group construct validity ($P < .05$) were established for parents (Randall Simpson et al., manuscript in preparation).

**Attitudes and self-efficacy.** The Attitudes and Self-Efficacy Questionnaire (ASEQ) contains 10 attitude items and 11 self-efficacy items, each with a 5-point Likert-type response option (strongly agree = 5 to strongly disagree = 1) that is used to generate a numerical score (maximum score = 50 for attitudes and 55 for self-efficacy). For attitude items 1, 4, and 8-10, reverse scoring is used where “strongly disagree” is the most appropriate response and requires recoding to correct the scoring for the direction of the statement. Test-retest reliabilities for parents were, ICC = 0.85, $P < .001$ for the attitudes questions and ICC = 0.70, $P < .001$ for the self-efficacy questions. Internal consistency reliability for the attitudes questionnaire was questionable ($\alpha = .60$), while internal consistency reliability for the self-efficacy questionnaire was good ($\alpha = .86$) (Randall Simpson et al., manuscript in preparation).

**Intentions.** There are 6 intention items that were developed for this study; each has a 5-point Likert-type scale similar to the ASEQ where response options range from strongly agree to strongly disagree with a maximum possible score of 30. Items were adapted from intention questionnaires developed by Fila and Smith (2006) ($\alpha = .84$) and Andrews et al. (2010) ($\alpha = .75$). The intention questionnaire was reviewed for content validity by parents, researchers, and registered dietitians with pediatric expertise prior to use in this study. The intention items included the separate topic areas related to NutriSTEP® (e.g., screen time vs. number of servings of food groups vs. physical activity).
Based on results from the current study, the internal consistency reliability for the 6 intention items was found to be poor (α = .55 at visit 1 and α = .63 at visit 2) as the items were not highly correlated (r = .01 to r = .46).

**Child Nutrition Risk Behaviour.** The NutriSTEP® screening questionnaires (toddler and preschool versions), while part of the intervention, were used to measure child nutrition risk behaviours (Randall Simpson et al., 2008, 2015). Each question on the 17-item valid and reliable NutriSTEP® questionnaires (www.nutristep.ca) has 2 to 5 response options ranging in score from 0 (no risk) to 4 (risk) with the highest possible total risk score being 68 (Randall Simpson et al., 2008, 2015).

Criterion validity was established comparing NutriSTEP® risk scores and registered dietitian risk scores (toddler version: r = 0.67, P < .0001, Randall Simpson, 2015; preschool version: r = 0.48, P = .01, Randall Simpson et al., 2008). The NutriSTEP® questionnaires have adequate to excellent agreement on items and are reliable with 2 to 4 weeks between administrations (ICC = 0.95, P < .001; Randall Simpson et al., 2015) (ICC = 0.89, P < .001; Randall Simpson et al., 2008) for both toddler and preschooler versions, respectively.

**Statistical Analysis**

Data were analyzed using IBM SPSS Statistics Version 23. A significance level of .05 was used to identify statistically significant in all analyses. Descriptive statistics were computed for all demographic variables. Chi-squared tests and t-tests were conducted to compare baseline demographic data of the final control and intervention groups and to compare completers to drop-outs with respect to demographic variables.

Since random assignment occurred at the site level, generalized estimating equations (GEE) were used to assess post-test differences between the control and intervention groups (Zeger & Liang, 1986) for outcomes of knowledge, attitudes, self-efficacy, and intentions. Basic GEE analyses controlling only for baseline scores, and adjusted GEE analyses controlling for baseline scores and
other covariates that were significantly different between the control and intervention groups at baseline were conducted. To assess the difference in post-test behaviour (i.e., NutriSTEP® score) between the control and intervention groups, an independent samples t-test was conducted on the post-test NutriSTEP® risk scores. Additionally, a paired samples t-test was conducted to compare the mean NutriSTEP® scores of the intervention group at baseline to follow-up.

5.4 Results

A total of 166 parents/caregivers were recruited at 19 OEYC site visits (control = 10, intervention = 9) within a 150 kilometer radius of Guelph, Ontario, Canada. Of these, 138 participants completed the follow-up post-test; however, one intervention participant was excluded from analysis due to incomplete data (Figure 1). Analyses of complete data for 137 participants comprising 66 parents in the intervention group and 71 parents in the control group were conducted. The retention rate was therefore 83%. There was no significant difference ($P = .17$) in the number of dropouts for the intervention group (n = 17) compared to the control group (n = 11). The average time (mean ± SD) of completion between the pre-test and post-test was 2.8 ± 0.3 months.

**Participant demographic characteristics**

The majority of parent participants were Canadian born (75%) and were female (93%). Demographic characteristics for participants who completed the study are presented in Table 1.

**Differences between the final control and intervention groups on demographics**

Participants in the control and intervention groups of the final sample (n=137) were comparable on most demographic characteristics reported. However, the two groups were significantly different in terms of child age category, with the control group having a higher percentage of preschoolers than the intervention group (63% vs 44% respectively; $\chi^2 = 5.21$, $P = .02$). Parent country of birth was also significantly different between the control and intervention groups where the intervention group had a
larger proportion of parents born outside of Canada compared to the control group (32% vs. 11% respectively; $\chi^2 = 9.08, P = .003$).

**Differences between completers and drop-outs on demographics and baseline questionnaire scores**

Those who completed the study were not significantly different from drop-outs in all areas except parent education and baseline knowledge scores, where the group that completed the study had a significantly greater proportion of parents who graduated post-secondary school compared to drop-outs (77% vs 54% respectively; $\chi^2 = 6.48, P = .01$). At baseline, the group that completed the study (NKQ = 71%) scored significantly ($P = .003$) higher on the knowledge questionnaire compared to drop-outs (NKQ 65%).

**Change in determinants of nutrition behaviour scores.**

Results of the unadjusted GEE analyses conducted for each of the outcomes (i.e., knowledge, attitudes, self-efficacy, and intentions), including the intervention effect and controlling for the outcome’s respective baseline scores are presented in Table 2. In the unadjusted model, there was a significant effect ($\hat{\beta} = 0.8, SE = 0.4, P = .04$) of the intervention on attitude scores. The intervention group had greater attitude scores than the control group at post-test. For the primary outcome, knowledge, there was not a significant effect ($\hat{\beta} = 1.3$, standard error (SE) = 0.7, $P = .06$) of the intervention. There was also no significant effect of the intervention on self-efficacy or intentions.

Since child age category and parent country of birth were significantly different between the control and intervention groups at baseline, and because they have been previously identified in NutriSTEP® research as important influential factors (Randall Simpson et al., 2015), they were controlled for in the adjusted GEE analyses (Table 2). This led to a decreased sample size of 132 due to missing data on parent country of birth. Adjusted GEEs investigating the effects of the intervention on each of the outcome scores revealed a significant treatment group by child age category interaction effect ($P = .04$ and $P = .001$) for both self-efficacy and intentions, respectively. Consequently, the
adjusted GEE results were divided to provide intervention effect results for parents of toddlers and preschoolers separately for both self-efficacy and intentions. There was no significant treatment group by child age category interaction for knowledge and attitude scores so the interaction term was not included in the adjusted model for these analyses.

Based on the adjusted GEE analyses, it appears that the intervention had significant effects on knowledge ($\hat{\beta} = 1.6$, SE = 0.8, $P = .04$) and attitudes ($\hat{\beta} = 1.0$, SE = 0.5, $P = .03$), such that at 3-months post intervention, the intervention group had significantly greater improvements in nutrition knowledge and attitude scores than the control. The intervention also had a significant effect ($\hat{\beta} = 1.9$, SE = 0.8, $P = .02$) on self-efficacy scores for parents of preschoolers where the intervention group showed greater self-efficacy scores compared to the control group, but no significant intervention effect ($\hat{\beta} = -0.8$, SE = 0.8, $P = .30$) was found for self-efficacy scores for parents of toddlers. Likewise, the intervention had a significant effect ($\hat{\beta} = 1.3$, SE = 0.5, $P = .01$) on intention scores for parents of preschoolers where the intervention group had a greater intention scores compared to the control group, but no significant intervention effect ($\hat{\beta} = 0.3$, SE = 0.4, $P = .46$) was found for intention scores for parents of toddlers.

**Change in NutriSTEP® scores**

NutriSTEP® risk scores were measured at baseline for the intervention group and at follow-up for both the intervention and control groups. Final NutriSTEP® risk scores were not significantly different between the control (14.4 ± 6.0) and intervention (15.1 ± 6.4) groups, t(135) = -0.696; 95% CI = -2.84 to 1.36; $P = .49$. Though the NutriSTEP® risk scores decreased from baseline (16.0 ± 6.9) to follow-up (15.1 ± 6.4) for the intervention group (t(65) = 1.97, 95% CI = -0.01 to 1.80), it was not significant ($P = 0.05$).

**5.5 Discussion**

Although NutriSTEP® has been widely used over the past eight years, this is the first time an evaluation of the efficacy of NutriSTEP® has been conducted. Results of this study suggest that
NutriSTEP® screening and the accompanying resources can be efficacious in improving determinants of behaviour. After controlling for baseline scores, parent country of birth and child age category, significant improvements in knowledge and attitudes for parents of toddlers and preschoolers, and self-efficacy and intentions for parents of preschoolers were seen in the intervention group compared to the control group after ~3 months, as hypothesized. These are novel findings indicating that both screening tools and the provision of educational materials to parents can improve determinants of child nutrition behaviours.

Based on previous research, there is strong evidence to suggest that nutrition knowledge, the primary outcome for this study, is a key predictor of dietary behaviour (Wardle et al., 2000), and associations between parental nutritional knowledge and children’s dietary intake have been reported (Contento et al., 1993; Variyam et al., 1999; Vereecken & Maes, 2010). While nutrition knowledge has consistently been previously found to improve post-intervention compared to controls (Haire-Joshu, Elliot, Caito, Hessler, Nanney, Hale, Boehmer, et al., 2008; Horodynski & Stommel, 2005; Sweitzer et al., 2011), intervention research targeting parents that assesses changes in TPB constructs have been less consistent in showing improvements, often finding significant improvements in some construct outcomes, but not others (Harvey-Berino & Rourke, 2003; Horodynski & Stommel, 2005; Sweitzer et al., 2011). Further, research evaluating less rigorous interventions (e.g., the provision of educational literature to parents) measuring construct outcomes is scarce and methods are often not comparable to the current study. Thus, the significant findings of the current study are particularly noteworthy given that the primary aim of the current study was to improve parental knowledge, yet knowledge, as well as all of the remaining measured determinants of behaviour significantly improved for either the whole sample or for parents of preschoolers compared to controls – findings that are comparable to or, in some cases, better than more intensive interventions.
The finding that the NutriSTEP® program had a significant intervention effect on self-efficacy and intention scores for parents of preschoolers, but not for parents of toddlers is interesting. Although self-efficacy is often highly predictive of behavioural intentions, and subsequently, the uptake and maintenance of health behaviours (Bandura, 1991), literature involving interventions targeting parents of young children and measuring nutrition-related determinants of behaviours as outcomes is limited. There is very little research comparing toddlers to preschoolers. One cross-sectional study (Campbell et al., 2010) comparing maternal self-efficacy for 1-year-old children (n = 60) to 5-year-old children (n = 80) reported that mothers of 1-year-old children had significantly higher self-efficacy scores for limiting unhealthy foods (e.g., sweet snacks, ice cream, confectionary) and for limiting television viewing compared to mothers of 5-year-olds. The authors suggested that a mother’s confidence in her ability to influence children’s eating and television viewing likely declines when the children are somewhere between 1 and 5 years of age. Contrary to this finding, the current study did not reflect a significant difference (\( P = .29 \)) between parent self-efficacy scores for the toddler and preschooler age groups at baseline. However, at baseline, intention scores for parents of toddlers were significantly greater (\( P = .008 \)) than scores for parents of preschoolers, suggesting that parents of toddlers may be more likely to “plan” to change nutrition risk behaviours. Although this does not explain why parents of preschoolers showed an improvement in self-efficacy and intention scores and parents of toddlers did not, it does highlight important differences in these two constructs for parents of toddlers versus preschoolers.

Just three studies testing interventions involving parents of young children and measuring determinants of child nutrition-related behaviours were found through an extensive literature search (Harvey-Berino & Rourke, 2003; Horodynski & Stommel, 2005; Sweitzer et al., 2011). Of these, the two studies involving parents of toddlers (18-35 months of age) (Harvey-Berino & Rourke, 2003; Horodynski & Stommel, 2005) found that the interventions improved some behaviours such as
decreased restrictive child feeding practices (Harvey-Berino & Rourke, 2003) and decreased television viewing during mealtimes (Horodynski & Stommel, 2005). Horodynski and Stommel (2005) also found a significant increase in parent toddler feeding knowledge compared to control. However, neither of these two studies targeting parents of toddlers found significant differences between control and intervention groups for parent self-efficacy. Harvey-Berino and Rourke (2003) also did not find a significant difference in parent’s behaviour change intention between the control and intervention groups and the other toddler study did not measure parent intentions (Horodynski & Stommel, 2005).

The remaining study targeting parents of preschoolers (3-5 years old) (Sweitzer et al., 2011) found that, compared to controls, their intervention designed to improve lunch packing behaviours of parents significantly improved scores on some determinants of behaviour (i.e., knowledge, outcome expectations, subjective norms), but did not significantly improve parent’s PBC or behavioural intentions. Given that there is no previous evidence to suggest that interventions targeting parents of preschoolers may be more effective in terms of increasing parent self-efficacy and intentions towards child nutrition behaviours compared to interventions targeting parents of toddlers, more research in this area is needed.

At post-test, the intervention group did not have significantly different NutriSTEP® nutrition risk scores than the control group. Further, there was a small, non-significant \( (P = 0.05) \) decrease in NutriSTEP® risk scores from baseline to follow-up for the intervention group. It may be that the 3-month timeline was not long enough to observe significant changes in NutriSTEP® risk behaviours or that the intervention itself was not substantial enough to see behaviour changes, or perhaps a combination of these two. These results are consistent with previous research evaluating the impact of a more rigorous (i.e., in-class group sessions) parent-targeted intervention on NutriSTEP® child nutrition risk behaviours, such that researchers saw a greater decline in nutrition risk behaviour scores for the
intervention group compared to the control group after 3 months, but as with the current study, these differences were not significant \( P = .26 \) (Walton et al., 2015).

The findings of the current study should be considered in conjunction with its strengths and limitations. The post-test-only design and the intervention-group-only designs used to test the NutriSTEP® nutrition risk scores are weak research designs succumbed to many threats to validity (e.g., history, maturation, testing effect, selection). Additionally, a wait-listed control group design was used where participants in the control group knew they were not receiving the intervention and may have found information on their own. Moreover, no data were collected on the uptake of the information by parents in the current study, so it is uncertain whether or not parents read the materials given to them. However, had we collected this data, participants who did not read the materials would not have been excluded from the analysis as this mirrors the characteristic NutriSTEP® implementation where parents may or may not read the accompanying information provided to them.

Another limitation is the generalizability of the results as comparison of the findings may be limited to populations with similar characteristics to this study. The convenience sample that was recruited had higher levels of education than the Canadian average (Statistics Canada, 2011). Also, the prevalence of intervention participants with high NutriSTEP® risk scores at baseline (3.6%) is low compared to other NutriSTEP® (Randall Simpson et al., 2008; 2015) and Nutri-eSTEP (Vanderhout et al., 2014) studies, which might suggest that a greater proportion of our sample was already meeting many current recommendations (i.e., Canada’s Food Guide (Health Canada, 2007), screen time, physical activity, etc.). Further, although randomization was used, the control group had a greater proportion of preschoolers and more parents born in Canada compared to the control. To address this limitation in part, these two differences were controlled for in the adjusted model analysis. Finally, given the poor internal consistency reliability for the intentions questionnaire, findings should be interpreted with caution for this construct. It should also be noted that less reliable measures tend to
decrease the statistical power (i.e., probability of detecting a difference of a certain magnitude) compared to more reliable measures (Devellis, 2012).

Some strengths of the current study included the recruitment of participants from multiple sites within a 150 km radius of Guelph, Ontario, which is a considerably wide geographical range for this type of study. The retention rate of 83% was also high. Furthermore, the intervention was implemented similar to how NutriSTEP®/Nutri-eSTEP would be executed normally in an effort to make the findings as relevant to the real world as possible.

**Implications for research and practice.** This study is one of the first to provide evidence that determinants of child nutrition risk behaviours can be modified through the use of nutrition risk screening and supporting educational literature. Not only are the NutriSTEP® questionnaires valid and reliable assessment tools (Randall Simpson et al., 2008; 2015), but these tools, in combination with their educational feedback literature, serve as a parent-targeted education intervention which can effect changes in determinants of child nutrition behaviours. Further, screening has been previously shown to be more efficient and cost effective to implement than assessment to facilitate interventions and is a critical component of primary health care models (Baer & Harris, 1997). This study also provides evidence for the usefulness of the Theory of Planned Behavior (Ajzen, 1991) constructs as outcome measures for evaluating interventions targeting nutrition risk behaviours of toddlers and preschoolers.

This intervention took place over a short period of only 3 months which may not be long enough to observe changes in the behaviours assessed with NutriSTEP®; future studies should include more reliable attitudes and intentions measures, more diverse samples and longer intervention periods to assess the impact on children’s nutrition risk behaviours.

**5.6 Conclusions**

This research provides evidence that NutriSTEP® and the accompanying education information were efficacious in improving nutrition related determinants of behaviour such as parental knowledge,
attitudes, self-efficacy, and intentions in the population studied. Overall, this study demonstrates the ability of NutriSTEP® to serve as a parent targeted education intervention and assessment tool which can effect changes in determinants of child nutrition behaviours.

5.7 Acknowledgements

This study was funded by the Canadian Foundation for Dietetic Research. We gratefully acknowledge the staff and participants from Ontario Early Years Centres. We would also like to thank Jeanna Rex for her assistance in coordinating the research site visits and data collection, as well as the contribution of the research assistants.

5.8 Conflict of Interest:

Janis Randall Simpson receives royalties from the sale of the versions of NutriSTEP® that have scoring options for use by implementers of the NutriSTEP® screening program at: www.Flintbox.com. All other authors have no competing interests to disclose.

5.9 References


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### 5.10 Tables

**Table 1.** Demographic characteristics of participants who completed the NutriSTEP® efficacy
randomized controlled trial

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Whole Sample</th>
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<tr>
<td></td>
<td>Control</td>
<td>Intervention</td>
<td>Total</td>
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<tr>
<td>N</td>
<td>71</td>
<td>66</td>
<td>137</td>
</tr>
<tr>
<td>mean ± SD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parent Age (years)</td>
<td>33.6 ± 3.9</td>
<td>33.3 ± 5.4</td>
<td>33.5 ± 4.7</td>
</tr>
</tbody>
</table>
Table 2. Mean (± SD) pre-test and post-test outcome scores and results of unadjusted and adjusted GEE analyses on outcome scores after 3 months for the NutriSTEP® efficacy study.

<table>
<thead>
<tr>
<th># of people in household</th>
<th>4.2 ± 0.9</th>
<th>4.0 ± 0.9</th>
<th>4.1 ± 0.9</th>
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</thead>
<tbody>
<tr>
<td># Adults in household</td>
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<tr>
<td># Children in household</td>
<td>2.1 ± 0.7</td>
<td>1.9 ± 0.9</td>
<td>2.0 ± 0.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Child Age Category*</th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toddler</td>
<td>26 (36.6)</td>
<td>37 (56.1)</td>
<td>63 (46.0)</td>
</tr>
<tr>
<td>Preschooler</td>
<td>45 (63.4)</td>
<td>29 (43.9)</td>
<td>74 (54.0)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Child Sex</th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
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<tr>
<td>Male</td>
<td>37 (52.1)</td>
<td>27 (40.9)</td>
<td>64 (46.7)</td>
</tr>
<tr>
<td>Female</td>
<td>31 (43.7)</td>
<td>36 (54.5)</td>
<td>67 (48.9)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Parent Sex</th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
</tr>
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<tr>
<td>Male</td>
<td>2 (2.8)</td>
<td>7 (10.6)</td>
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</tr>
<tr>
<td>Female</td>
<td>69 (97.2)</td>
<td>59 (89.4)</td>
<td>128 (93.4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
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<th>Marital Status</th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
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</thead>
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<td>61 (92.4)</td>
<td>126 (92.0)</td>
</tr>
<tr>
<td>Single/Separated</td>
<td>5 (7.0)</td>
<td>4 (6.1)</td>
<td>9 (6.6)</td>
</tr>
</tbody>
</table>

<table>
<thead>
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<th>Parent Education</th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
</tr>
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<tbody>
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<td>2 (3.0)</td>
<td>4 (2.9)</td>
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<td>10 (7.3)</td>
</tr>
<tr>
<td>Some College/Uni. grad</td>
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<td>8 (12.1)</td>
<td>17 (12.4)</td>
</tr>
<tr>
<td>College/Uni. grad</td>
<td>55 (77.5)</td>
<td>49 (74.2)</td>
<td>104 (75.9)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Household Income ($)</th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 30,000</td>
<td>6 (8.5)</td>
<td>4 (6.1)</td>
<td>10 (7.3)</td>
</tr>
<tr>
<td>30,000 – 59,999</td>
<td>15 (21.1)</td>
<td>16 (24.2)</td>
<td>31 (22.6)</td>
</tr>
<tr>
<td>60,000 – 89,999</td>
<td>21 (29.6)</td>
<td>22 (33.3)</td>
<td>43 (31.4)</td>
</tr>
<tr>
<td>≥ 90,000</td>
<td>24 (33.8)</td>
<td>19 (28.8)</td>
<td>43 (31.4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Country Born (parent)*</th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Canada</td>
<td>61 (85.9)</td>
<td>42 (63.6)</td>
<td>103 (75.2)</td>
</tr>
<tr>
<td>% Other</td>
<td>8 (11.3)</td>
<td>21 (31.8)</td>
<td>29 (21.2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Country Born (child)</th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Canada</td>
<td>66 (93.0)</td>
<td>58 (87.9)</td>
<td>124 (90.5)</td>
</tr>
<tr>
<td>% Other</td>
<td>3 (4.2)</td>
<td>3 (4.6)</td>
<td>6 (4.4)</td>
</tr>
</tbody>
</table>

*Significant at P < .05
**Percentages may not add up to 100 if participants chose not to provide the demographic information

Table 2. Mean (± SD) pre-test and post-test outcome scores and results of unadjusted and adjusted GEE analyses on outcome scores after 3 months for the NutriSTEP® efficacy study.
<table>
<thead>
<tr>
<th></th>
<th>Total % Score (mean ± SD)</th>
<th>( \hat{\beta} ) (SE)</th>
<th>Sig.</th>
<th>( \hat{\beta} ) (SE)</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Knowledge</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>71.4 (8.1)</td>
<td>69.8 (10.7)</td>
<td>74.0</td>
<td>75.8 (11.9)</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Attitudes</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Average Score on 5-point Likert scale scored 1-5 (mean ± SD)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.2 (0.4)</td>
<td>4.0 (0.4)</td>
<td>4.2</td>
<td>4.2 (0.4)</td>
<td>No change</td>
</tr>
<tr>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>4.4 (0.4)</td>
<td>4.4 (0.4)</td>
<td>4.4</td>
<td>4.4 (0.4)</td>
<td>No change</td>
</tr>
<tr>
<td></td>
<td>4.3 (0.4)</td>
<td>4.3 (0.4)</td>
<td>4.5</td>
<td>-0.1</td>
<td>0.2</td>
</tr>
<tr>
<td><strong>Self-efficacy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>4.2 (0.5)</td>
<td>4.0 (0.5)</td>
<td>4.2</td>
<td>4.1 (0.5)</td>
<td>0.0</td>
</tr>
<tr>
<td>P</td>
<td>3.8 (0.5)</td>
<td>3.9 (0.4)</td>
<td>3.9</td>
<td>4.2 (0.5)</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Intentions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>4.2 (0.5)</td>
<td>4.0 (0.5)</td>
<td>4.2</td>
<td>4.1 (0.5)</td>
<td>0.0</td>
</tr>
<tr>
<td>P</td>
<td>3.8 (0.5)</td>
<td>3.9 (0.4)</td>
<td>3.9</td>
<td>4.2 (0.5)</td>
<td>0.1</td>
</tr>
</tbody>
</table>

*Significant at P < .05
*a Adjusted for age category, parent birth country, and controlled for baseline scores
*b Due to a significant treatment*age category interaction effect for both self-efficacy and intentions, adjusted GEE results were divided to provide separate intervention effect results for parents of toddlers (T) and parents of preschoolers (P)

CG = Control group
IG = Intervention group
5.11 Figures

*Estimated as number of parents who read advertisements or were asked if they would like to participate by site staff is unknown.

Figure 6.0. Flow of participants at various stages of the NutriSTEP® efficacy study
6.0 Extended Results and Discussion

This section is an extension of the results previously presented in the manuscript, for the purposes of the thesis.

Participant demographic characteristics

Demographic characteristics for participants, by age category and treatment group, who completed the study are presented in Table 6.0.

Table 6.0. Demographic characteristics of participants who completed the NutriSTEP® efficacy randomized controlled trial by age category and treatment group

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Control</th>
<th>Intervention</th>
<th>Total</th>
<th>Control</th>
<th>Intervention</th>
<th>Total</th>
<th>Control</th>
<th>Intervention</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>26</td>
<td>37</td>
<td>65</td>
<td>45</td>
<td>29</td>
<td>74</td>
<td>71</td>
<td>66</td>
<td>137</td>
</tr>
<tr>
<td><strong>Child Age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Months</td>
<td>26.5 ± 5.6</td>
<td>25.7 ± 5.4</td>
<td>26.0 ± 5.3</td>
<td>3.7 ± 0.8</td>
<td>3.5 ± 0.6</td>
<td>3.6 ± 0.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Parent Age (years)</strong></td>
<td>32.6 ± 4.0</td>
<td>33.2 ± 5.4</td>
<td>33.0 ± 4.9</td>
<td>34.2 ± 3.8</td>
<td>33.4 ± 5.5</td>
<td>33.9 ± 4.1</td>
<td>33.6 ± 3.9</td>
<td>33.3 ± 5.4</td>
<td>33.5 ± 4.7</td>
</tr>
<tr>
<td>### of people in household</td>
<td>3.8 ± 0.7</td>
<td>3.7 ± 0.7</td>
<td>3.7 ± 0.7</td>
<td>4.4 ± 0.9</td>
<td>4.4 ± 1.1</td>
<td>4.4 ± 0.9</td>
<td>4.2 ± 0.9</td>
<td>4.0 ± 0.9</td>
<td>4.1 ± 0.9</td>
</tr>
<tr>
<td># Adults in household</td>
<td>2.0 ± 0.4</td>
<td>2.0 ± 0.4</td>
<td>2.0 ± 0.4</td>
<td>2.1 ± 0.5</td>
<td>2.0 ± 0.3</td>
<td>2.1 ± 0.4</td>
<td>2.1 ± 0.5</td>
<td>2.0 ± 0.3</td>
<td>2.1 ± 0.4</td>
</tr>
<tr>
<td># Children in household</td>
<td>1.8 ± 0.6</td>
<td>1.6 ± 0.6</td>
<td>1.7 ± 0.6</td>
<td>2.3 ± 0.7</td>
<td>2.4 ± 1.0</td>
<td>2.3 ± 0.8</td>
<td>2.1 ± 0.7</td>
<td>1.9 ± 0.9</td>
<td>2.0 ± 0.8</td>
</tr>
<tr>
<td>n (%)</td>
<td>11 (42.3)</td>
<td>9 (24.3)</td>
<td>20 (31.7)</td>
<td>11 (42.2)</td>
<td>11 (37.9)</td>
<td>44 (59.5)</td>
<td>37 (52.1)</td>
<td>27 (40.9)</td>
<td>64 (46.7)</td>
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<tr>
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<td>11 (42.3)</td>
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<td>20 (31.7)</td>
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<td>11 (37.9)</td>
<td>44 (59.5)</td>
<td>37 (52.1)</td>
<td>27 (40.9)</td>
<td>64 (46.7)</td>
</tr>
<tr>
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<td>12 (46.2)</td>
<td>25 (67.6)</td>
<td>37 (58.7)</td>
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</tr>
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<td>56 (89.9)</td>
<td>43 (95.6)</td>
<td>27 (93.1)</td>
<td>70 (94.6)</td>
<td>65 (91.5)</td>
<td>61 (92.4)</td>
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<td>6 (9.5)</td>
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<td>1 (3.4)</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; High school grad</td>
<td>1 (3.8)</td>
<td>1 (2.7)</td>
<td>2 (3.2)</td>
<td>1 (2.2)</td>
<td>1 (3.4)</td>
<td>2 (2.7)</td>
<td>2 (2.8)</td>
<td>2 (3.0)</td>
<td>4 (2.9)</td>
</tr>
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<td>4 (6.3)</td>
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<td>2 (6.9)</td>
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<td>4 (5.6)</td>
<td>6 (9.1)</td>
<td>10 (7.3)</td>
</tr>
<tr>
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<td>5 (13.9)</td>
<td>6 (9.5)</td>
<td>8 (18.3)</td>
<td>8 (18.3)</td>
<td>9 (12.7)</td>
<td>8 (12.1)</td>
<td>4 (6.1)</td>
<td>17 (12.4)</td>
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<tr>
<td>College/Uni. grad</td>
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<td>47 (74.6)</td>
<td>36 (80.0)</td>
<td>21 (72.4)</td>
<td>57 (77.0)</td>
<td>55 (77.5)</td>
<td>49 (74.2)</td>
<td>104 (73.9)</td>
</tr>
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<td></td>
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</tr>
<tr>
<td>&lt; 30,000</td>
<td>3 (11.5)</td>
<td>2 (5.4)</td>
<td>5 (7.9)</td>
<td>3 (6.7)</td>
<td>2 (6.9)</td>
<td>5 (6.8)</td>
<td>6 (8.5)</td>
<td>4 (6.1)</td>
<td>10 (7.3)</td>
</tr>
<tr>
<td>30,000 – 59,999</td>
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<td>9 (24.3)</td>
<td>12 (19.0)</td>
<td>12 (26.7)</td>
<td>7 (24.1)</td>
<td>19 (25.7)</td>
<td>15 (21.1)</td>
<td>16 (24.2)</td>
<td>31 (22.6)</td>
</tr>
<tr>
<td>60,000 – 89,999</td>
<td>8 (30.8)</td>
<td>13 (35.1)</td>
<td>21 (33.3)</td>
<td>13 (28.9)</td>
<td>9 (31.0)</td>
<td>22 (29.7)</td>
<td>21 (29.6)</td>
<td>22 (33.3)</td>
<td>43 (31.4)</td>
</tr>
<tr>
<td>Over 90,000</td>
<td>11 (42.3)</td>
<td>10 (27.0)</td>
<td>21 (33.3)</td>
<td>9 (31.0)</td>
<td>22 (29.7)</td>
<td>24 (33.3)</td>
<td>19 (28.8)</td>
<td>18 (27.2)</td>
<td>39 (28.8)</td>
</tr>
<tr>
<td>Country Born (parent)</td>
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</tr>
<tr>
<td>% Canada</td>
<td>21 (80.8)</td>
<td>22 (59.5)</td>
<td>43 (68.3)</td>
<td>40 (88.9)</td>
<td>20 (69.0)</td>
<td>60 (81.1)</td>
<td>61 (85.9)</td>
<td>42 (63.6)</td>
<td>103 (75.2)</td>
</tr>
<tr>
<td>% Other</td>
<td>4 (15.4)</td>
<td>14 (37.8)</td>
<td>18 (28.6)</td>
<td>4 (8.9)</td>
<td>7 (24.1)</td>
<td>11 (14.9)</td>
<td>8 (11.3)</td>
<td>21 (31.8)</td>
<td>29 (21.2)</td>
</tr>
<tr>
<td>Country Born (child)</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Canada</td>
<td>25 (96.2)</td>
<td>31 (83.8)</td>
<td>56 (89.9)</td>
<td>41 (91.1)</td>
<td>27 (93.1)</td>
<td>68 (91.9)</td>
<td>65 (93.0)</td>
<td>58 (87.9)</td>
<td>124 (90.5)</td>
</tr>
<tr>
<td>% Other</td>
<td>1 (3.8)</td>
<td>7 (16.2)</td>
<td>9 (14.1)</td>
<td>3 (6.7)</td>
<td>3 (9.9)</td>
<td>2 (2.9)</td>
<td>2 (3.0)</td>
<td>3 (4.4)</td>
<td>6 (4.4)</td>
</tr>
</tbody>
</table>

*Percentages may not add up to 100 if participants chose not to provide the demographic information*


**Differences between the final toddler and preschooler groups on demographic characteristics**

The toddler and preschooler groups were not significantly different on most of the reported demographic characteristics. However, the groups differed significantly in terms of child gender with a greater proportion of females in the toddler group compared to the preschooler group (64.9% vs. 40.5% respectively; $\chi^2=7.654, P = .006$). Not surprisingly, the number of people in the household was significantly greater for preschoolers (4.4 ± 0.9) compared to toddlers (3.7 ± 0.7), $t(133) = 4.669; 95\%$ CI = 0.40 to 0.98; $P < .001$. Likewise, the mean number of children in the household for the preschooler group (2.3 ± 0.8) was significantly greater than the toddler group (1.7 ± 0.6), $t(133) = 4.777; 95\%$ CI = 0.36 to 0.88; $P < .001$.

**Differences between completers and drop-outs on demographics and baseline questionnaire scores**

Completers were not different from drop-outs on all characteristics measured except parent education and baseline knowledge scores (Table 6.1).

**Table 6.1.** Demographic characteristics of completers compared to drop-outs for the NutriSTEP® efficacy randomized controlled trial
Internal consistency reliabilities of measures

Internal consistency reliabilities of the measures were calculated based on questionnaire scores from the current study. The internal consistency reliabilities for the knowledge questionnaire based on visits 1 and 2 were questionable (α = 0.62 and 0.65, respectively). The internal consistency reliabilities for attitudes for visit 1 and 2 were poor (α = 0.56 and 0.55, respectively). For the self-efficacy questionnaire, for visits 1 and 2, the internal consistency reliabilities were good (α = 0.77 and 0.81, respectively). Given the intention questions used for the current study were not highly correlated (r =
.01 to r = .46) as they were all related to NutriSTEP® but focussed on separate topic areas (e.g., screen
time vs. number of servings of food groups vs. physical activity), it is not surprising that the internal
consistency reliability for the 6 intention questions was poor (α = 0.55 at visit 1 and α = 0.63 at visit 2).

Additional Limitations

Given the intervention group received both NutriSTEP® and the accompanying education
materials, the individual effects of NutriSTEP® screening and the educational materials remains
unclear. Having separate intervention groups for the educational materials alone and NutriSTEP®
screening alone would have required substantially more participants and more resources. This Research
was conducted with the intervention group receiving both NutriSTEP® screening and the
accompanying nutrition education materials as it is recommended that the educational materials be
provided to parents following screening with NutriSTEP® (Rysdale et al., 2011).
7.0 References


enfant/8061-eng.htm


8.0 Appendix

Appendix A: NutriSTEP® Efficacy Study Eligibility Screening Questionnaire

![UNIVERSITY of GUELPH](image)

Department of Family Relations and Applied Nutrition
College of Social and Applied Human Sciences

**Nutrition Education for Parents/Caregivers of Toddlers/Preschooler**

Eligibility Questionnaire

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent/caregiver of a toddler (18-35 months) or preschooler (3-5 years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parent/caregiver reads and speaks English at or above a Grade 6 level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parent has participated in previous pediatric nutrition research at U of G</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix B: NutriSTEP® Efficacy Study Consent Form

Nutrition Education for Parents/Caregivers of Toddlers/Preschoolers

Consent Form

Signature of Parent/Legal Guardian

- I, ________________________, have read the information for Nutrition Education for Parents/Caregivers of Toddlers/Preschoolers. My questions have been answered to my satisfaction, and I am therefore providing informed consent on behalf of myself and my child as indicated by my signature below.

- I know that I am free to stop taking part in the study at any time and that my confidentiality will be protected.

- I have been given a copy of this form.

___________________________________  __________________________________
Name of Participant (Please print)  Name of Witness (Please print)

___________________________________  __________________________________
Signature of Participant:  Signature of Witness

Date: ____________________

We will be contacting you just before the second visit. Please provide either your phone number or an e-mail address where we can contact you.

__________________________________
I would like to receive a summary of the results of the study either by mail or by e-mail

Yes □  No □

If yes, please give your mailing or email address: ________________________________
Nutrition Education for Parents/Caregivers of Toddlers/Preschoolers

Participant Background Form

We are interested in obtaining some information about you and your family in order to better understand who is participating in our research. Please complete the following questions to provide us with some background information on your child and family. Provide only one response for each question. Feel free to not answer certain questions if they make you uncomfortable.

Please do not put your name on this paper.

1. a) How old is your toddler _______ (months) or preschooler _______ (years) in this study?
   b) What is the gender of this child?     ______________
   c) Does your toddler/preschooler have a medical condition diagnosed by a doctor? [ ] Yes      [ ] No
      If Yes, please describe____________________________________________________________

2. For the following people, what is the language they first learned as a child, the country they were born in, and ethnic or cultural background?

<table>
<thead>
<tr>
<th></th>
<th>Mother</th>
<th>Father</th>
<th>Your Toddler/Preschooler</th>
</tr>
</thead>
<tbody>
<tr>
<td>First language</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country born in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethnic or cultural</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Background (e.g.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Nations,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italian, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Age and Gender
   a) Your age: ____________
   b) Are You: _____________________

4. Your Marital Status:

5. a) How many PEOPLE live in your household (include all adults and children) ____________
   b) How many ADULTS live in your household? ____________
   c) How many CHILDREN live in your household? ____________

6. What is YOUR highest level of education?
   [ ] Elementary
   [ ] Some High School
   [ ] Graduated High School
   [ ] Some College/University
   [ ] Graduated College/University
7 What is your TOTAL household income after taxes?
[ ] less than $15,000  [ ] $30,000-$59,999  [ ] $90,000 or more
[ ] $15,000-$29,999  [ ] $60,000-$89,999  [ ] don’t know

Thank you for your input!
Appendix D: NutriSTEP® Parent Nutrition Knowledge Questionnaire*

*To avoid parent confusion, separate versions for toddlers and preschoolers were used for the study where it specifically stated either “toddlers” or “preschoolers” rather than “toddlers/preschoolers” as shown below. Questions that were slightly different between age groups are depicted using the superscript “T” for toddler and “P” for preschooler.

Nutrition Education for Parents/Caregivers of Toddlers/Preschoolers

Knowledge Questionnaire

- This is a knowledge questionnaire on toddler/preschooler nutrition and physical activity
- Toddlers are children 18-35 months of age and preschoolers are children 3-5 years of age
- Circle or check one answer per question, unless otherwise indicated

A. Dietary Recommendations

A1. Do health experts (such as dietitians, nurses, physicians) recommend that toddlers/preschoolers eat more or eat less of these foods?

Check (✓) one answer per line

<table>
<thead>
<tr>
<th>Food Group</th>
<th>More □</th>
<th>Less □</th>
<th>Not sure □</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit juice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Fibre Foods (such as whole grain bread,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>oats)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meat Alternatives (such as beans, lentils, tofu)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A2. Health experts recommend that meals for toddlers/preschoolers include a variety of foods from_____ food groups.

- a. 2-3
- b. 3-4
- c. 4-5
- d. Not sure

A3. Health experts recommend that snacks for toddlers/preschoolers include a variety of foods from_____ food groups.

- a. 1-2
- b. 2-4
- c. Snacks should not be encouraged
- d. Not sure
A4. Offering snacks to toddlers/preschoolers can spoil their appetites for meals.
   a. True
   b. False
   c. Not sure

A5. Which drink do health experts recommend that toddlers/preschoolers have with meals?
   a. 100% juice
   b. Milk
   c. Flavoured beverages such as pop or fruit drinks
   d. Not sure

A6. For toddlers/preschoolers, how much fruit juice per day is advised by health experts?
   a. Less than 1 cup (250 mL)
   b. Less than 1 ½ cups (375 mL)
   c. Less than 2 cups (500 mL)
   d. Not sure

A7\textsuperscript{T}. For toddlers 2 years and older, how many servings of grain products do health experts recommend offering per day? A serving could be 1 slice of bread or 125 ml (½ cup) cooked rice.
   a. 2 servings
   b. 3 servings
   c. 4 servings
   d. Not sure

A7\textsuperscript{P}. For preschoolers, how many servings of grain products do health experts recommend offering per day? A serving could be 1 slice of bread or 125 ml (½ cup) cooked rice.
   a. 1-2 servings
   b. 2-3 servings
   c. 3-4 servings
   d. Not sure

A8\textsuperscript{T}. For toddlers 2 years and older, how many servings of vegetables and fruit do health experts recommend offering per day? A serving could be 125 ml (½ cup) of broccoli or 1 apple.
   a. 3 servings
   b. 4 servings
   c. 5 servings
   d. Not sure

A8\textsuperscript{P}. For preschoolers, how many servings of vegetables and fruit do health experts recommend offering per day? A serving could be 125 ml (½ cup) of broccoli or 1 apple.
   a. 2-3 servings
   b. 3-4 servings
   c. 4-5 servings
   d. Not sure

A9. For toddlers 2 years and older/preschoolers, how many servings of meat, fish, poultry or alternatives (such as beans, lentils, tofu) do health experts recommend offering per day? A serving could be 125 ml (1/2 cup or 2.5 ounces) of cooked meat or 2 eggs.
   a. 1 serving
   b. 2 servings
   c. 3 servings
d. Not sure

A10. For toddlers 2 years and older/preschoolers, how many servings of milk and alternatives do health experts recommend offering per day? A serving could be 250 ml (1 cup) of milk, 175 g (3/4 cup) yogurt or 50 g (1 ½ oz) hard cheese.
   a. 1 serving
   b. 2 servings
   c. 3 servings
   d. Not sure

A11. Toddlers/preschoolers who do not drink cow’s milk can drink any type of fortified soy beverage as an alternative.
   a. True
   b. False
   c. Not sure

A12. Which of the following is the healthiest breakfast?
   a. Cereal with milk
   b. Hard-boiled egg, whole wheat toast, milk
   c. Yogurt and strawberries
   d. Not sure

A13. Which of the following is the healthiest lunch?
   a. Pasta with tomato sauce, broccoli, and 100% juice
   b. Pasta with tomato sauce, oatmeal cookie and milk
   c. Pasta with tomato and meat sauce, broccoli and milk
   d. Not sure

A14. Health experts recommend that some nutritious high fat foods in their diets such as hard cheese and nut butters be included in the diets of toddlers/preschoolers.
   a. True
   b. False
   c. Not sure

A15. Which of the following fish is low in mercury and recommended by health experts to be eaten twice a week?
   a. Fresh tuna
   b. Salmon
   c. Not sure

A16. Most toddlers/preschoolers do NOT need to take a multivitamin every day. An example is Flintstones™.
   a. True
   b. False
   c. Not sure

A17. What type of milk do health experts recommend for preschoolers/toddlers under the age of 2 years if they are not breastfed?
   a. Low fat milk such as skim, 1%, or 2% milk
   b. Whole homogenized milk (3.25%)
   c. Any type
   d. Not sure
A18. Brown-coloured breads are always a healthier choice than light-coloured breads
   a. True
   b. False
   c. Not sure

A19. Which of the following would experts recommend as the healthiest snack for toddlers/preschoolers?
   a. Pre-packaged oatmeal chocolate chip cookie
   b. Whole grain toast with jam
   c. Whole grain toast with nut butter
   d. They are all equally healthy options

A20. Which of the following is a good food source of vitamin D for toddlers/preschoolers?
   a. Water
   b. Milk
   c. 100% Fruit Juice
   d. Foods are not good sources of vitamin D

A21. Which types of vegetables do experts consider most important to eat at least once daily?
   a. Dark green vegetables (ex: Broccoli, Spinach, Green peas)
   b. Orange vegetables (ex: Carrots, Pumpkin, Sweet potato)
   c. Both a and b
   d. Not sure

A22. Children need iron for healthy growth and brain development. Which of the following is NOT a major source of iron?
   a. Chicken
   b. Kidney beans
   c. Celery
   d. Beef

B. Feeding Toddlers/Preschoolers

B1. A feeding schedule for meals and snacks is not necessary for toddlers/preschoolers because they let their parents know when they want to eat.
   a. True
   b. False
   c. Not sure

B2. A toddler/preschooler should decide whether to eat and how much to eat.
   a. True
   b. False
   c. Not sure

B3. It is normal for a toddler/preschooler to reject a new food 10-15 times.
   a. True
   b. False
   c. Not sure
B4. For toddlers/preschoolers under the age of 4 years, which of the following food is most likely to cause choking?
   a. Raw baby carrots
   b. Whole grapes
   c. Both a & b
   d. Not sure

B5. Parents can help their toddlers/preschoolers eat well by:
   a. Eating with them at the table
   b. Encouraging them to eat what is on their plate
   c. Serving them larger portions
   d. Not sure

B6. Bribing a toddler/preschooler to eat more could lead to under eating or over eating.
   a. True
   b. False
   c. Not sure

B7. Which of the following methods would be helpful for increasing a child’s vegetable intake?
   a. Occasionally puree vegetables and incorporate them into meals
   b. Eat more vegetables yourself
   c. Both a and b
   d. Replace other food groups with vegetables during meals

B8. Which of the following is a good method of saving money when shopping for healthy foods?
   a. Buy grains, pasta, and cereals in bulk
   b. Buy and freeze meats when they are on sale
   c. Both a and b
   d. Buy prepared or pre-packaged foods

B9T. Toddlers learn to enjoy healthy food by watching their parents eat them too.
   a. True
   b. False
   c. Not sure

B9P. Children are more likely to eat healthy foods that they help to prepare
   a. True
   b. False
   c. Not sure

B10. When a child is gaining more weight than expected, a parent should:
   a. Put the child on a diet
   b. Use rewards to reduce eating
   c. Encourage the child to eat less
   d. Consult a physician or registered dietitian

B11. Which of the following would be the best method to increase a child’s weight?
   a. Allow the child to decide how much to eat from the foods a parent offers
   b. Tell the child how much to eat from the foods a parent offers
   c. Use rewards to increase eating
   d. Not sure
C. Growing and Playing

C1. According to health experts, the time spent by toddlers/preschoolers in front of a TV or computer should be:
   a. At most, 1 hour a day
   b. At most, 2 hours a day
   c. At most, 3 hours a day
   d. Not sure

C2. A toddler's/preschooler’s height and weight need to be measured yearly to know if he/she is growing well.
   a. True
   b. False
   c. Not sure

C3. A toddler/preschooler might be taller or shorter, lighter or heavier than others but may still be growing at a rate that is right for him/her.
   a. True
   b. False
   c. Not sure

C4. What is the recommended amount of daily physical activity for toddlers/preschoolers?
   a. 30 minutes
   b. 60 minutes
   c. 120 minutes
   d. 180 minutes

C5. Which of the following statements regarding screens (for example: TV, computer, video games) is FALSE?
   a. Children who watch more TV are typically less physically active
   b. Children who eat in front of the TV are likely to eat healthy foods
   c. Children should spend an hour or less each day watching a screen
   d. Limiting screen time can have both physical and social benefits

C6. Which of the following are benefits associated with adequate physical activity?
   a. Healthy body weight
   b. Improved social skills
   c. Improved coordination, learning, and attention
   d. All of the above

C7. Which of the following is TRUE regarding childhood growth and nutrition?
   a. A growth chart can help determine if a preschooler is growing properly
   b. Nutrition has no effect on a child’s growth
   c. It is always unhealthy for a child to be larger than his/her peers
   d. All children should grow at a similar rate

THE END
Appendix E: NutriSTEP® Parent Attitudes, Self-Efficacy (Beliefs), and Intentions Questionnaire

Nutrition Education for Parents/Caregivers of Toddlers/Preschoolers

Nutrition Attitudes, Beliefs and Intentions Questionnaire

This is a questionnaire on parental attitudes, beliefs and intentions about toddler/preschooler nutrition and physical activity

- Toddlers are children 18-35 months of age and preschoolers are children 3-5 years of age
- Circle or check one answer per question, unless otherwise indicated

A. Attitudes Questions
- The following questions have no right or wrong answer
- Select the response that is most applicable to you

A1. Pressuring a child to eat less is a healthy way to get a child to lose weight
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree

A2. My child should decide how much to eat from the healthy foods I offer at meal and snack times.
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree

A3. I should allow my child to choose foods he/she enjoys from the healthy choices I provide.
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree

A4. Getting a child to eat foods to meet his/her calorie needs is more important than encouraging him/her to eat healthy foods.
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
e. Strongly Disagree

A5. Eating meals as a family is important to me.
   a. Strongly Agree
   b. Agree
   c. Neutral
   a. Disagree
   b. Strongly Disagree

A6. My own eating habits affect my child’s eating habits
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree

A7. It is important for my child to eat a wide variety of foods within a food group
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree

A8. It is too expensive to include healthy foods in every meal.
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree

A9. I would be concerned if my child was heavier than his/her peers of the same height.
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree

A10. As long as I provide healthy foods for my child, his/her mealtime surroundings are not important.
    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

B. Belief Questions
   • The following questions have no right or wrong answer
   • Select the response that is most applicable to you
B1. I am confident that I can be a physically active role model for my child
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree

B2. I am confident that I can offer my child the recommended amounts of foods from each food group on a daily basis.
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree

B3. I believe that I am able to limit how often my child eats "fast foods".
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree

B4. I am confident that I can provide my child with safe foods that will lower the risk of choking and gagging.
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree

B5. I believe that I can make sure my child is hungry at mealtime by planning snacks at appropriate times.
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree

B6. I am confident that I can limit the number of meals eaten in front of the TV.
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree

B7. I am confident that I can choose healthy foods by reading and comparing nutrition fact labels.
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree
B8. I am confident that I can offer and make healthy meals and snacks for my child.
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree

B9. I am confident that I can make healthy meals that my child will like to eat
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree

B10. I am confident that my family can eat meals together often.
    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

B11. If I were concerned about my child’s eating habits, I would know where to get help.
    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

C. Intention Questions

- The following questions have no right or wrong answer
- The questions ask about what you are planning to do in the next 3 months.
- Select the response that is most applicable to you.

C1. I plan to offer my child fruits and vegetables at least 5 times a day.
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree

C2. I plan to offer my child grain products at least 5 times a day.
   Examples are bread, bagel, bun, cereal, pasta, rice, roti and tortillas.
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree
C3. I plan to limit my child’s "fast food" intake to once a month or less.
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree

C4. I plan to always let my child decide what to eat from the food I provide.
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree

C5. I plan to limit my child’s screen time to less than 1 hour each day.
   Examples of screens include television, computers and electronic tablets.
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree

C6. I plan to encourage my child to participate in a total of at least 3 hours of physical activity each day.
   Examples include active playing, walking, running and dancing.
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly Disagree

THE END
Appendix F: Toddler NutriSTEP®

Nutrition Education for Parents/Caregivers of Toddlers

Nutrition Behaviour Questionnaire for Parents of Toddlers

Instructions

- Below are questions about your toddler (18-35 months old) eating and other habits.
- Please complete the questions yourself or with the help of others who take care of your child.
  - Check (✓) only one answer for each question.
  - Think about your child's usual habits when answering each question.

1. My child usually eats grain products:
   Examples are bread, bagels, buns, roti, tortillas, crackers, hot or cold cereals, pasta, and rice.

   □ More than 5 times a day
   □ 4-5 times a day
   □ 2-3 times a day
   □ Less than 2 times a day

2. My child usually has milk products:
   Examples are breastmilk, formula, white or chocolate milk, cheese, yogurt, milk pudding and milk substitutes such as fortified soy beverages.

   □ More than 3 times a day
   □ 3 times a day
   □ 2 times a day
   □ Once a day or less
3. My child usually eats vegetables and fruit:
   *These can be fresh, frozen or canned.*
   - [ ] More than 4 times a day
   - [ ] 3 to 4 times a day
   - [ ] 2 times a day
   - [ ] Once a day
   - [ ] Not at all

4. My child usually eats meat, fish, poultry or alternatives:
   *Alternatives can be eggs, peanut butter, tofu, nuts, and cooked beans, chickpeas and lentils.*
   - [ ] More than 2 times a day
   - [ ] 2 times a day
   - [ ] Once a day
   - [ ] A few times a week
   - [ ] Not at all

5. My child usually eats restaurant or take-out "fast foods":
   *Examples are pizza, hamburgers, hot dogs, chicken fingers, fish sticks and French fries.*
   - [ ] 3 or more days a week
   - [ ] 2 days a week
   - [ ] 1 day a week or less
   - [ ] Not at all

6. My child usually drinks juice or flavoured beverages:
   *Flavoured beverages can be fruit drinks, pop, Kool-Aid or sports drinks.*
   - [ ] More than 4 times a day
   - [ ] 3 to 4 times a day
   - [ ] 2 times a day
   - [ ] Once a day
   - [ ] Not at all
7. I have difficulty buying food to feed my child because food is expensive:

☐ Most of the time
☐ Sometimes
☐ Rarely
☐ Never

8. My child has problems chewing, swallowing, gagging or choking when eating:

☐ Most of the time
☐ Sometimes
☐ Rarely
☐ Never

9. My child feeds his/her self at meals and snacks:

☐ Always
☐ Most of the time
☐ Sometimes
☐ Rarely
☐ Never

10. My child drinks from a baby bottle with a nipple:

☐ Always
☐ Most of the time
☐ Sometimes
☐ Rarely
☐ Never

11. My child is hungry at mealtimes:

☐ Always
☐ Most of the time
☐ Sometimes
☐ Rarely
☐ Never
12. My child usually eats meals and snacks:

- Less than 2 times a day
- 2 times a day
- 3 to 4 times a day
- 5 to 6 times a day
- More than 6 times a day

13. I let my child decide how much to eat:

- Always
- Most of the time
- Sometimes
- Rarely
- Never

14. My child eats meals or snacks while watching TV, or being read to, or playing with toys:

- Always
- Most of the time
- Sometimes
- Rarely
- Never

15. My child usually watches TV, or uses the computer, or plays video games:

- 4 or more hours a day
- 3 hours a day
- 2 hours a day
- 1 hour a day
- Less than 1 hour a day

16. I am comfortable with how my child is growing:

- Yes
- No

17. My child:
☐ Should weigh more
☐ Is about the right weight
☐ Should weigh less
☐ Not sure
Appendix G: Preschooler NutriSTEP®

Nutrition Education for Parents/Caregivers of Preschoolers

Nutrition Behaviour Questionnaire for Parents of Preschoolers

Instructions

- Below are questions about your preschool child’s (3-5 year old) eating and other habits.
- Please complete the questions yourself or with the help of others who take care of your child.
  - Check (√) only one answer for each question.
  - Think about your child’s usual habits when answering each question.

1. My child usually eats grain products:
   Examples are bread, bagel, bun, cereal, pasta, rice, roti and tortillas.
   
   □ More than 5 times a day
   □ 4-5 times a day
   □ 2-3 times a day
   □ Less than 2 times a day

2. My child usually has milk products:
   Examples are white or chocolate milk, cheese, yogurt, milk puddings or milk substitutes such as fortified soy beverages.

   □ More than 3 times a day
   □ 3 times a day
   □ 2 times a day
   □ Once a day or less
3. My child usually eats fruit:

- More than 3 times a day
- 3 times a day
- 2 times a day
- Once a day
- Not at all

4. My child usually eats vegetables:

- More than 2 times a day
- 2 times a day
- Once a day
- Not at all

5. My child usually eats meat, fish, poultry or alternatives:

   *Alternatives can be eggs, peanut butter, tofu, nuts, or dried beans, peas and lentils.*

- More than 2 times a day
- 2 times a day
- Once a day
- A few times a week
- Not at all

6. My child usually eats “fast food”:

- 4 or more times a week
- 2-3 times a week
- Once a week
- A few times a month
- Once a month or less
7. I have difficulty buying food to feed my child because food is expensive:
   - □ Always
   - □ Most of the time
   - □ Sometimes
   - □ Rarely
   - □ Never

8. My child has problems chewing, swallowing, gagging or choking when eating:
   - □ Always
   - □ Most of the time
   - □ Sometimes
   - □ Rarely
   - □ Never

9. My child is not hungry at mealtimes because he/she drinks all day:
   - □ Always
   - □ Most of the time
   - □ Sometimes
   - □ Rarely
   - □ Never

10. My child usually eats:
    - □ Less than 2 times a day
    - □ 2 times a day
    - □ 3 to 4 times a day
    - □ 5 times a day
    - □ More than 5 times a day

11. I let my child decide how much to eat:
    - □ Always
    - □ Most of the time
    - □ Sometimes
12. My child eats meals while watching TV:
   - □ Always
   - □ Most of the time
   - □ Sometimes
   - □ Rarely
   - □ Never

13. My child usually takes supplements:
    Examples are multivitamins, iron drops, cod liver oil.
    - □ Always
    - □ Most of the time
    - □ Sometimes
    - □ Rarely
    - □ Never

14. My child:
    - □ Needs more physical activity
    - □ Gets enough physical activity

15. My child usually watches TV, uses the computer, and plays video games:
    - □ 5 or more hours a day
    - □ 4 hours a day
    - □ 3 hours a day
    - □ 2 hours a day
    - □ 1 hour or less a day

16. I am comfortable with how my child is growing:
☐ Yes
☐ No

17. My child:

☐ Should weigh more
☐ Is about the right weight
☐ Should weigh less