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Development of novel tools to measure food neophobia in children

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ABSTRACT

Background: The main tool currently used to measure food neophobia (the *Food Neophobia Scale, FNS*, developed by Pliner & Hobden, 1992) may not remain optimal forever. It was developed around 25 years ago, and the perception and availability of "novel" and "ethnic" foods may have changed in the meantime. Consequently, there is a need for developing updated tools for measuring food neophobia.
Objective: To develop novel tools to measure food neophobia in children.
Design: Based on a review of 13 designs to assess food neophobia and willingness to try unfamiliar foods, a *Food Neophobia Test Tool (FNTT)* was developed. A questionnaire including the FNS, a 19-item FNTT, items about willingness to taste novel foods in different surroundings and a behavioral test was administered to 235 children aged 9–13 years. Reliability and validity of the FNS and FNTT were assessed through calculations of Cronbach's alpha, item-item and item-rest correlations. Comprehension issues related to tools were evaluated based on qualitative observations and finally, behavioral validity was assessed.
Results: A considerable number of children indicated difficulties understanding certain items in the original FNS. FNTT could be reduced to a 6- and 9-item tool with high validity (item-rest coefficients, $r = 0.60–0.80$). Internal consistency of the FNTT (Cronbach $\alpha \geq 0.90$) was higher relative to the FNS (Cronbach $\alpha \geq 0.72$). Scores from the FNTT correlated significantly ($p < 0.05$) with results from the behavioral test confirming construct validity of the FNTT as a measure of neophobic behavior.
Conclusions: Results from this study provide evidence for the FNTT as reliable and valid tool for measuring food neophobia in children aged 9–13 years. Moreover, when modified, the FNS continue to produce reliable and valid results.

1. Introduction

Food neophobia has been associated with several challenges such as restricted food choices, less variety and compromised quality of diets leading to deficit in macro- and micronutrients (Falciglia et al., 2000; Pliner & Sarah-Jeanne, 2006, pp. 1–31). Lower intake of several categories of foods may lead to avoidance of safe and healthy foods anticipated to be disliked rather than unsafe (Nicklaus & Issanchou, 2007; Pliner, Pelchat, & Grabski, 1993). Wardle et al. (2003) found a lower intake of vegetables, fruit and meat in neophobic 2–6 year old children, and Galloway, Lee, and Birch (2003) found that neophobic seven-year-old girls consumed fewer vegetables than their neophilic counterparts. In addition, Falciglia et al. (2000) demonstrated that 8- to 11-year-old neophobic children had lower intakes of vitamin E than neophilic children. Recently, Capiola and Raudenbush (2012) revealed that neophobic individuals experience nutritional deficiency in protein, monounsaturated fats and magnesium, and Siegrist, Hartmann, and Keller (2013) demonstrated a reduced intake of vegetables, salad, poultry and fish in neophobic individuals. Food neophobia also has negative consequences in relation to novel food products entering the market leading to product failure (Barrena & Sánchez, 2013; Henriques, King, & Meiselman, 2009; Winger & Wall, 2006).

Food neophobia is defined as *a reluctance to eat unfamiliar foods* (Pliner & Sarah-Jeanne, 2006). It is hypothesized to be a protective mechanism associated with the omnivore's dilemma: to obtain a varied diet which ensures sufficient amounts of nutrients, humans may need to approach novel foods (Armelagos, 2014; Rozin, 1976). However, in the search for novel food sources, an individual has to protect himself from potentially poisonous foods, thus restricting his diet (Armelagos, 2014). Thus, an individual is simultaneously

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motivated by interest and fear of foods (Siegrist et al., 2013). In a recently published review, Lafraire et al. (2015) discussed the differences between *picky eating*, defined as *unwillingness to eat familiar foods* (Taylor et al., 2015), and food neophobia. They found that the motives underlying the two mechanism remain unclear. Four main reasons for rejection of foods have been proposed: (1) *distaste* – unappetizing taste, smell or texture, (2) *danger* –anticipated negative post-ingestion consequences, (3) *disgust* – unappealing origin or nature of a food (4) *inappropriateness* – a food is not considered edible (Fallon & Rozin, 1983; Rozin & Fallon, 1987). It is unclear whether food neophobia is a result or consequence of dietary behavior (Shepherd & Raats, 2006). It may be considered a *state* (actual behavior) or a *trait* (usual behavior) which can be measured by a questionnaire and/or a food task (Pliner & Sarah-Jeanne, 2006, pp. 1–31; Pliner, 1994; Rubio et al., 2008).

Food choice is influenced by social context (presence or absence of other people), surroundings and appropriateness of foods in given situations, thus it is valuable to assess the willingness to try unfamiliar foods in different surroundings when measuring food neophobia by a food task. Food neophobia is low in infants, peaks in toddlers, then decreases in adolescents, and stabilizes in adulthood (Dovey et al., 2008). Although the level of food neophobia changes through life, it seems to prevail in different populations (Flight, Leppard, & Cox, 2003; Hursti, Koivisto, & Sjöden, 1997; Meiselman, King, & Gillette, 2010).

Implementing targeted health strategies may assist in decreasing diet-related concerns associated with food neophobia. Focus in such health strategies should be on changing neophobic behavior towards healthy foods while at the same time preventing exposure to unhealthy foods. Implementation of these strategies requires methods to determine food neophobia in a potential target group. Assessment of the diet and neophobic level in individuals would enable researchers to evaluate the extent of the diet-related concerns and develop health strategies targeted neophobic populations.

The method currently used most widely to investigate food neophobia is the *Food Neophobia Scale (FNS)* developed by researchers in Canada around 25 years ago (Pliner & Hobden, 1992). It has been used widely and provided reliable results (Galloway et al., 2003; Knaapila et al., 2007; Mustonen, Oerlemans, & Tuorila, 2012; Olabi et al., 2009; Ritchey et al., 2003; Rubio et al., 2008). The FNS consists of 10 items (statements) concerning neophobic behavior, which subjects indicate agreement/disagreement with. However, in the majority of the Western world, the availability of novel foods has markedly increased, and the interpretation of what "novel" foods are has changed since the FNS was developed. Ritchey et al. (2003) found that excluding 2 or 4 items from the FNS improved the method when used in several countries and Cooke, Haworth, and Wardle (2007) used a revised version including only 4 items believed to best capture attitude to *novel* foods. It may be speculated that the FNS fails to fully capture what is considered novel foods at present because the meaning of words related to novel foods have changed. Ex- and import of foods has increased markedly during the last 25 years, so "ethnic" foods may no longer be considered novel, for instance in urban areas it is possible to get pizza, Indian food and sushi, which have become part of an everyday diet. As an example, results from a "Mass Experiment" with 19,336 children conducted in Denmark in 2015 underline this by demonstrating that seaweed, which is mostly found in sushi in Denmark, is familiar to around 50% of the children (Skovlund et al., 2015). It is therefore questioned whether all items in the FNS continues to be valid and reliable. Critical assessment of the utility of items in the FNS and development of new tools with updated items to measure food neophobia is therefore necessary.

The purpose of this work is to create valid, reliable and currently relevant tools to measure trait food neophobia and investigate how willing 9 to 13-year-old children are to taste unfamiliar foods. More specifically, our aim was to create a new *Food Neophobia Test Tool (FNTT)* for this specific age group of children. It may also be used among children of other age groups and adults, but validation that is outside the scope of this paper. While administering the FNS to children, our research group has previously observed comprehension issues related to items (unpublished) when administered to children. These are desirable to eliminate. Finally, we assess willingness to try unfamiliar foods in different surroundings and reasons for rejection of foods in accordance with the theory of Fallon and Rozin (1983), Rozin & Fallon (1987).

2. Methods

2.1. Participants

This study consists of a pilot and main study conducted with different study populations. We recruited children in fourth through sixth grade (9–13 years old) by sending an invitation letter to public elementary schools in Copenhagen, Denmark. We selected this target group to ensure we included a representative sample of all the age groups within the participants recruited. Moreover, we selected this age group, because children from the age of 7 acquire language and reading skills, which enables the children to complete the test individually (Piaget, Tomlinson, & Tomlinson, 1929; de Leeuw, Borgers, & Smits, 2004). The procedures were in accordance with the Helsinki declaration and parents gave written consent. Formal ethical approval is not required and thus not possible to obtain in Denmark. Participants in the pilot study included 25 children aged 9–10 years (13 males and 12 females; mean age = 9.9 years, SD = 0.0). It has been proposed that 100 to 200 participants are required for scale construction (Spector, 1992). In the main study 235 children aged 9–13 years participated (110 males and 124 females; mean age = 10.9 years, SD = 1.0). The sample used in this study was consequently sufficiently large for construction of the FNTT.

2.2. Instrument development and administration

2.2.1. Scale items

Development of the FNTT was based on *reflexive index* or *scale* construction. A reflexive index *measures effects of a phenomenon indirectly by assessing indicators (items) of a phenomenon*. The indicators derive from the same phenomenon and therefore covariate. Inclusion of several indicators increases the probability of constructing a valid and reliable measurement of the phenomenon, as potential bias in each indicator equals out (Andersen, Hansen, & Klemmensen, 2012).

Items, which were relevant for measuring food neophobia in children, were identified based on a literature review of 13 designs developed previously to measure neophobia and willingness to try unfamiliar foods in subjects (Damsbo-Svendsen, Frøst, & Olsen ,2017). This resulted in a total of 134 items, which was further reduced by excluding items, which were irrelevant in relation to children, investigated several topics in one single item and/or contained relatively long formulations. Finally, new items were added by the authors, when items modified from previous studies did not cover relevant topics sufficiently. The FNTT encompassed 19 items at this developmental stage. Moreover, to identify the influence of surroundings on children's willingness to try novel foods, items concerning rated acceptance of novel foods in different surroundings were included. These were inspired by items in the WillTry Instrument developed by Thomson et al. (2010).