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Application and validation of the Feeding Infants: Behaviour and Facial Expression Coding System (FIBFECS) to assess liking and wanting in infants at the time of complementary feeding

C. Nekitsing [a], J. Madrelle [a], C. Barends [b], C. de Graaf [b], H. Parrott [a], S. Morgan [a], H. Weenen [c], M.M. Hetherington [a,*]

[a] Institute of Psychological Sciences, University of Leeds, Leeds LS2 9JT, UK
[b] Division of Human Nutrition, Wageningen University, Wageningen, The Netherlands
[c] Danone Nutricia Research, 3584CT Utrecht, The Netherlands

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ABSTRACT

Introduction: The aim of this study was to validate a novel tool developed to measure liking and wanting in infants during the weaning period. The Feeding Infants: Behaviour and Facial Expression Coding System (FIBFECS; Hetherington et al., 2016) is an evidence based video coding tool, consisting of 13 items. There are 6 measures of avoidance/approach behaviours (turns head away, arches back, pushes spoon away, crying/fussy, leaning forward and rate of acceptance) to assess wanting and 7 facial expressions (brow lowered, inner brow raised, squinting, nose wrinkling, lip corners down, upper lip raised and gaping) to assess liking. Lower scores on the total scale indicated greater wanting and/or liking. The tool was applied to a recent randomized control trial (Hetherington et al., 2015).

Method: 36 mother–infant dyads took part in the study and were randomised to the intervention or the control group. Infants were filmed on two occasions whilst eating a generally liked vegetable (carrots) and less preferred vegetable (green bean). 72 video extracts were coded by 4 trained researchers with adequate certification scores, each video was coded by at least two coders. Items and scales were tested for discrimination ((1) intervention vs control; (2) liked vs disliked vegetable) and construct validity (correlation with intake and liking assessed by mother and researcher).

Results: Very good discrimination ($p < 0.001$) was obtained for carrots vs green bean for the total score and total negative facial expressions and rejection behaviours ($p = 0.003$). Discrimination for the intervention vs control groups was only obtained for the total rejections and the rate of acceptance ($p < 0.05$). The FIBFECS subscales had good construct validity as these were significantly correlated with intake and liking ratings ($p < 0.01$). Items such as crying/fussy and leaning forward were removed from the scale as well as inner brow raised, squinting and lip corners down, as these do not correlate with other variables. Their removal did not affect the integrity of the scale. The rate of acceptance parameter was found to have potential as a short method to measure wanting in infants.

Conclusion: The present study has demonstrated that the FIBFECS can be used to identify liking and wanting independent of subjective ratings from mothers and researchers, therefore, this tool can be used widely in the study of infant responses to novel foods at the time of weaning. There is potential to develop the tool for infants beyond the period of complementary feeding and to assist in identifying fussy eating in the early stages of development.

1. Introduction

Despite the known benefits of eating fruits and vegetables most children and adults do not meet their daily recommend intakes (Cobiac, Vos, & Veerman, 2010; Guenther, Dodd, Reedy, & Krebs-Smith, 2006; Wolf et al., 2005). A recent study by Fischer, Brug, Tak, Yngve, and te Velde (2011) found that the consumption of fruit in 11 year old schoolchildren improved between 2003–2009, but intake of vegetables had decreased. Low intakes of some vegetables may be due to their bitter taste, unfamiliar texture and low energy content (Krolner et al., 2011; Mennella & Ventura, 2011). However, since eating habits formed in the early years can

* Corresponding author at: Institute of Psychological Sciences, University of Leeds, Leeds LS2 9JT, England, UK.
E-mail address: M.Hetherington@leeds.ac.uk (M.M. Hetherington).

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shape eating behaviour later in life (Nicklaus, Boggio, Chabanet, & Issanchou, 2004; Savage, Fisher, & Birch, 2007; Skinner, Carruth, Bounds, Ziegler, & Reidy, 2002), it is important to expose infants to a variety of vegetables to promote acceptance. Complementary feeding is a sensitive period for developing taste preferences (Harris, 1993; Mennella & Ventura, 2011) therefore, increasing the consumption of vegetables during this time may have long term benefits (Barends, de Vries, Mojet, & de Graaf, 2014; Mennella & Trabulsi, 2012). Liking is strongly associated with intake, therefore, increasing liking for vegetables early on can help to enhance vegetable intake (Bere & Klepp, 2005; Gibson, Wardle, & Watts, 1998; Olsen, Ritz, Kraaij, & Møller, 2012). Infants are willing to accept new foods during complementary feeding (Lange, Visalli, Jacob, Schlich, & Nicklaus, 2011; Schwartz, Chabanet, Lange, Issanchou, & Nicklaus, 2011) but as children get older and food neophobia develops it becomes challenging to encourage children to accept new foods (Caton et al., 2014). Thus, the time to establish liking and wanting for vegetables is during weaning, since infants are willing to try new foods, food preferences are not yet fully established and neophobia has not yet emerged.

1.1. Liking and wanting in infants

According to the Incentive Sensitization Theory (Berridge, 1996; Berridge, Robinson, & Aldridge, 2009; Robinson & Berridge, 1993) food reward comprises of two components: food 'liking' and 'wanting'. Liking is the pleasantness derived from consuming a particular food and wanting is the appetitive motivation. In the context of eating behaviour these constructs are often related and are interdependent. Nevertheless liking and wanting can be measured independently (Berridge, 1996; Garbinsky, Morewedge, & Shiv, 2014; Havermans, 2011, 2012).

Research to date on liking and wanting in humans has largely focussed on adults (Finlayson, King, & Blundell, 2007; Goldstein et al., 2010; Havermans, Janssen, Giesen, Roefs, & Jansen, 2009; Ouwehand & de Ridder, 2008; Tibboel et al., 2011) and children (Finlayson, Hetherington, King, & Blundell, 2007; Jiang, Schaal, Boulanger, Kontar, & Soussignan, 2013; Kildegaard, Tønning, & Thybo, 2011; Liem & Zandstra, 2009). However tools to assess both liking and wanting in infancy have yet to be developed. This is because liking in infants may be difficult to judge due to their limited capacity to communicate verbally. It is generally assumed that infants will eat more of foods they like and will accept these readily when offered (Hetherington et al., 2016). Therefore, indirect measures of liking and wanting have been extrapolated from intake (weight), duration (Forestell & Mennella, 2007, 2012; Mennella & Beauchamp, 1997; Mennella, Forestell, Morgan, & Beauchamp, 2009; Mennella, Jagnow, & Beauchamp, 2001) and pace of eating (Forestell & Mennella, 2007; Mennella & Beauchamp, 1997; Mennella et al., 2009). These measures can be influenced by hunger, eating traits and situational context (Hetherington et al., 2016). A more direct measure of wanting could be revealed by behaviours such as leaning forward, readiness to accept the food and number of rejections.

Mothers are often asked to make judgments of how much a food is liked by their infant (Forestell & Mennella, 2007; Forestell & Mennella, 2012; Liem, Zandstra, & Thomas 2010; Maier, Chabanet, Schaal, Leathwood, & Issanchou, 2008; Mennella et al., 2001). To limit bias from maternal accounts, perceived liking can also be judged by an external observer (Maier et al., 2008). These judgements are made on the basis of the infant's immediate facial and behaviour responses to food taste or odour rather than relying on maternal ratings from prior experience with that food.

Indirect and subjective measures are useful but also challenging as it is difficult to make comparisons between infants or across studies. Therefore video coding methods have been developed to observe infant responses in detail (Forestell & Mennella, 2007, 2012; Mennella & Beauchamp, 1997; Mennella et al., 2001, 2009; Soussignan, Schaal, Marlier, & Jiang, 1997; Zeinstra, Koelen, Colindres, Kok, & de Graaf, 2009). Expressions of distaste are more obvious and numerous than expressions of liking, these can be examined in direct response to the odour and taste of foods consumed. Rejection behaviours are also quite clear in response to presentation (Forestell & Mennella, 2007; Pliner & Hobden, 1992; Rosenstein & Oster, 1988; Zeinstra et al., 2009). Therefore, the Feeding Infants: Behaviour and Facial Expression Coding System (FIBFECS) was developed from existing literature to capture certain facial expressions typical of distaste (e.g. Soussignan et al., 1997) and acceptance/rejection behaviours which may reflect wanting. In the FIBFECS, indicators of distaste include eye brow lowered, inner brow raised, gaping, squinting, lip corners down and upper lip raised. These expressions are assumed to reflect negatively valenced responses to food odours or tastes representing dislike (Soussignan et al., 1997). The coding system includes rejection behaviours such as turns the head away, arches back, crying/fussing, pushes the food away and slow rates of acceptance. Rejection behaviours are indicative of avoidance when the food is offered, whereas acceptance behaviours such as eagerness to accept the food, leaning forward to take the food are treated as indicators of approach (Hetherington et al., 2016). For the purposes of the validation exercise, it is assumed that facial expressions in response to the presence of food in the mouth represent "liking" whilst approach/avoidance behaviours before the food is tasted represent "wanting".

1.2. Measuring liking and wanting in infancy

To our knowledge video coding tools to characterise liking and wanting in infants are limited; studies have not reported their reliability or validity for wider use. Therefore, the Feeding Infants: Behaviour and Facial Expression Coding System (FIBFECS) was developed to assess different responses to food before the food is tasted and when the food is in the mouth. This temporal distinction allows the observer to note acceptance or rejection behaviours when the food is offered but not yet tasted indicative of "wanting" while facial reactions when the food is accepted and in the mouth is assumed to reflect "liking". This system has acceptable inter-rater reliability and test–retest reliability (see Hetherington et al., 2016). The present study set out to validate the coding tool by testing its applicability within a randomised control trial conducted at the time of complementary feeding in which infants were given a variety of vegetables in milk then cereal using a step-by-step gradual introduction over 24 days or were assigned to a control group receiving no prior exposure to vegetable flavours during the first 24 days of weaning (Hetherington et al., 2015).

To validate the tool infant feeding behaviours and facial expressions were coded using the FIBFECS in response to consuming a generally well liked vegetable (carrot) and less liked vegetable (green bean) during the early phase of complementary feeding. The carrot and green bean were unfamiliar to the control group and familiar to the intervention group through previous exposure (9 times in each case as part of a rota of vegetable exposures over 24 days). The tool was used to assess whether the two types of construct (acceptance/rejection behaviours and facial expressions) could discriminate between the two experimental conditions (intervention vs control) and the two vegetables (green bean vs carrot). It was predicted that acceptance behaviours (wanting) and indicators of liking should correspond to greater intake, whereas rejection behaviours and indicators of distaste should correspond to lower intakes. It was further predicted that if the acceptance/rejection behaviours represented "wanting" then these would be significantly greater for the intervention group compared