Appetite 113 (2017) 274–283

Contents lists available at ScienceDirect

Appetite

journal homepage: www.elsevier.com/locate/appet

Development of a new in-home testing method to assess infant food liking

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ARTICLE INFO

Article history:
Received 13 April 2016
Received in revised form
27 February 2017
Accepted 3 March 2017
Available online 6 March 2017

Keywords:
Infant
Liking
Eating behaviour
Feeding
Caregiver
Temperament

ABSTRACT

The objective of this study was to develop a new elaborate method to evaluate infants' liking of foods that could be applied at home and to compare the results of this elaborate method with those of a basic method. Mothers of infants aged 4 to 7 (n = 44) and 12–15 months (n = 46) participated in this study. For the basic method, mothers were asked to assess their infant's global liking at the end of a meal. Then, for the elaborate method, mothers received detailed instructions on how to feed their infant, how infants might express like/dislike and when to stop the meal. During the first nine spoons, they were asked to report the presence/absence of positive and negative behaviours after each spoon, and the infant's initial liking was reported after each triplet of spoons. They also assessed their infant's global liking at the end of the meal. Both methods were applied using three commercial familiar baby foods adapted to each age range. In 4-7-month-olds, the elaborate method showed a significant difference across products for liking, whereas the basic method did not show any difference. In 12-15-month-olds, the elaborate method showed more differences across products for liking than the basic method. In both age groups, negative behaviours, despite being less frequently reported, provided better liking discrimination than positive behaviours. In conclusion, the elaborate method produced better product liking discrimination than the basic method by focusing maternal attention on infants' eating behaviours since the first spoons.

1. Introduction

Early childhood is a key period for the development of healthy eating habits (Nicklaus, Boggio, Chabanet, & Issanchou, 2004; Schwartz, Scholtens, Lalanne, Weenen, & Nicklaus, 2011). From the beginning of complementary feeding until the age of 15 months, infants accept most new foods easily, with subtle differences between foods (Lange et al., 2013; Schwartz, Chabanet, Lange, Issanchou, & Nicklaus, 2011). In this context, it is important to characterise infants' acceptance of foods with subtle differences in flavour and texture using a sensitive, reliable and practical method, particularly because food acceptance at an early stage may predict its consumption at later stages (for a review, see Nicklaus & Remy, 2013).

In children, the consumption of a specific food is often correlated with liking (Bere & Klepp, 2005; Gibson, Wardle, & Watts, 1998; Olsen, Ritz, Kraaij, & Møller, 2012), but in infants, liking and intake can be partly disconnected (Schwartz, Issanchou, & Nicklaus, 2009). It is therefore important to evaluate liking in a way that does not reflect only intake. However, verbal-based methods of liking measurement, as generally used in older children, cannot be used in infants. Different types of methods for assessing food liking in infants have been developed. Some methods include behavioural (facial and oral movements) and autonomic (respiration, differential skin temperature) measurements (Soussignan, Schaal, Marlier, & Jiang, 1997). Several studies analyse behaviours from video-recorded feeding sessions (Forestell & Mennella, 2007, 2012; Hetherington et al., 2016; Mennella & Beauchamp, 1997). The Baby Facial Action Coding System (FACS) method was developed to evaluate facial expressions in infants (Oster, 2006) based on Ekman's FACS method of studying facial

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http://dx.doi.org/10.1016/j.appet.2017.03.002
0195-6663/

expressions in adults (Ekman, Friesen, & Hager, 2002). This approach has been used to describe subtle differences in liking levels (Forestell & Mennella, 2012; Mennella & Beauchamp, 1997), but it requires extensive rater training. An easier-to-apply version focusing exclusively on behaviours and negative facial expressions related to liking and disliking was developed to facilitate the learning process and shorten the training period (Hetherington et al., 2016). However, a behavioural analysis approach based on video analysis remains time-consuming and difficult to apply out of the laboratory. In the present study, the objective was to develop an adaptation of behavioural analysis based on the grounds of previous methods, but that could be used by untrained evaluators.

Studies often collect subjective measures of infant liking using rating scales available for measuring consumer liking on a 4-point scale (Lange et al., 2013; Schwartz, Chabanet, et al., 2011), 5-point scale (Gerrish & Mennella, 2001; Sullivan & Birch, 1994) or 9-point scale (Blossfeld, Collins, Kiely, & Delahunty, 2007; Forestell & Mennella, 2007; Maier, Chabanet, Schaal, Issanchou, & Leathwood, 2007; Remy, Issanchou, Chabanet, & Nicklaus, 2013); these may have different anchor labels and may or may not label each point on the scale. Liking scores can be evaluated by external observers and/or mothers (Hetherington et al., 2015; Maier, Chabanet, Schaal, Leathwood, & Issanchou, 2008), and each approach has its own advantages and disadvantages. On the one hand, external observers may have better knowledge of a variety of infant liking cues and may adopt a more consistent approach when judging liking across infants, making the data more comparable. However, they may miss or misinterpret specific cues because they do not know each infant. On the other hand, mothers know their infant's reactions towards foods best and thus may be more sensitive to subtle differences in liking. Nonetheless, mothers may differ in the use of criteria to evaluate their infant's food liking, and feeding methods and conditions may differ greatly if they are not controlled. Additionally, mother and infant personality traits could impact perceived liking during meals (Moding, Birch, & Stifter, 2014). The method proposed in the present study aims at being applied to the evaluation of infant liking by mothers.

In the laboratory, conditions are well controlled and monitored: meal instructions can guide mothers on the pace of feeding, on how to present the spoon to the infant (Lundy et al., 1998) and on how to terminate the meal (Forestell & Mennella, 2012; Gerrish & Mennella, 2001; Hetherington et al., 2015; Mennella, Nicklaus, Jagolino, & Yourshaw, 2008). However, in-home studies present two advantages: they can be performed with few constraints on the participants and infants are in their usual environment with their usual feeder, in an ecologically-valid situation. Thus, we attempted to develop a method applicable by mothers at home.

In summary, the first objective of this study was to develop a method based on the evaluation of facial expressions and behaviours that could be applied at home by mothers to evaluate their infants' liking of food products at two developmental stages: at the initiation of complementary feeding and after the first birthday, i.e., when foods with more complex textures are introduced. The second objective was to compare this method with a basic method that is currently often used to assess food liking in infants at these stages, in order to evaluate whether this elaborate method is able to provide information about infants' behaviours and to better discriminate liking among products than the basic method. Additionally, mother and infant personality traits were assessed to ensure that any differences in the liking evaluations obtained from the two methods were not due to trait variation. We hypothesized that, at both ages, mothers would produce more discriminant liking scores among the food product sets using the elaborate method due to the additional information and guidance provided than with the basic method.

2. Materials and methods

2.1. Overall study design

Infants' liking of three baby foods was assessed by the mothers of 4–7 or 12-15-month-old infants on separate days using two methods: a basic method then an elaborate method. The design is outlined in Fig. 1. The performance of both methods was determined by running analysis of variance and post-hoc comparisons; in particular, the number of significant pair comparisons was considered.

2.2. Participants

Mother-infant pairs were recruited in Dijon and Paris, France. In Dijon, leaflets and posters were distributed in health care professionals' consultation rooms, pharmacies and day-care centres. The study was also advertised to the members of an internal consumer database (PanelSens, CNIL declaration no. 1148039). In Paris, a market research agency was solicited to conduct this study in collaboration with our research team. Infants in two age groups were targeted: 4–7 months and 12–15 months. The criteria for infant inclusion were as follows: not born premature ($\geq$37 gestational weeks), no chronic diseases or food allergies, never fed hydrolysate formulas, and not introduced to complementary foods before 4 months or after 6 months. In the 4–7-mo group, infants were required to have been exposed to complementary foods at least for two weeks and not longer than two months before the beginning of the study. In the 12–15-mo group, infants were required to accept spoon feeding. A power calculation determined that a minimum of 40 participants per age group was needed in order to conclude that a difference of 1 point was significant given a standard deviation of 1.9 at $p = 0.05$ for a power of 0.90 (Remy et al., 2013).

This study was conducted according to the guidelines established in the Declaration of Helsinki; the study protocol was approved by the local ethics committee (Comité de Protection de Personnes Est I Bourgogne, no. 2014/30). Written and informed consent was obtained from both parents. At the end of the study, parents received a 40€ voucher.

2.3. Food selection

Several criteria were taken into account to select three commercial infant foods for each age group. To evaluate the sensitivity of the two methods, products with different expected liking levels were selected: two similar *a priori* liked products and one *a priori* disliked product. The product sets were chosen to be among common foods given in France for each age range, assuming that most infants would be familiar with either the study foods or similar foods to avoid neophobic or surprise reactions. Familiarity with the foods was recorded during visit 1 with a food frequency questionnaire covering the previous month. The product sets used in the study for each age group are presented in Table 1.

For the 4–7-mo group, product selection was based on previous research (Hetherington et al., 2015; Mennella et al., 2008). Carrot puree was chosen as the *a priori* liked product and green bean puree as the *a priori* disliked product. The two recipes (described below) for carrot puree were selected due to perceptible differences in basic tastes.

For the 12–15-mo group, product selection was based on liking the main vegetable in the food offered rather than on the fishy or meaty component of the dish because it usually represents only approximately 10% w/w of the total quantity. Considering the preference for sweetness over bitterness observed in 12-month-