

## Food neophobia and pickiness in young children. How to measure it?

---

Camille Rioux<sup>a,b\*</sup>, Jérémie Lafraire<sup>a</sup>, & Delphine Picard<sup>b</sup>

<sup>a</sup>The Centre for Food and Hospitality Research, Institut Paul Bocuse, 69130 Ecully

<sup>b</sup>Aix Marseille Université, PSYCLE EA3273, 13621 Aix en Provence

**Contact** : camille.rioux@institutpaulbocuse.com

### Abstract

**Background.** The two strongest barriers to increasing children's dietary variety and consumption of fruit and vegetables are food neophobia and pickiness, assumed to be the main kinds of food rejection in children. Accordingly, psychometric tools that provide a clear assessment of food neophobia and pickiness are greatly needed.

**Objective.** We developed and validated a new scale for the assessment of food neophobia and pickiness, thus filling a major gap in the psychometric assessment of food rejection by French children. We concentrated on French children aged 2-7 years, as no such scale exists for this young population, and on the two known dimensions of food rejection, namely food neophobia and pickiness, as the nature of the relationship between them is still unclear.

**Design.** The questionnaire was administered online to two samples ( $N_1=168$ ;  $N_2=256$ ) of caregivers who responded for their children aged between 2 and 7 years. Additionally, a food choice task was administered to 17 children to check the scale's predictive validity.

Main outcome measures/Statistical analysis performed. A factor analysis was performed to investigate the underlying structure of the scale. Internal consistency, test-retest reliability, and convergent discriminant and predictive validity were also assessed.

**Results.** The resulting scale, called the Child Food Rejection Scale (CFRS), included six items relating to food neophobia and five items relating to pickiness. The factor analysis confirmed the two-dimensional structure of the scale. Internal consistency, test-retest reliability, and convergent and discriminant validity were all satisfactory. Moreover, results from the food choice task showed that scores on the CFRS accurately predicted children's attitudes toward new and familiar foods.

**Conclusions.** Taken together, these findings suggest that the CFRS, a short and easy-to-administer scale, represents a valuable tool for studying food rejection tendencies in French children.

**Key-words:** Questionnaire development, Children, Food neophobia, Food pickiness, Reliability, Validity

## 1. Introduction

---

The prevalence of childhood obesity has increased fairly steadily to worrisome levels these past few years. In France, 18% of children aged 3-17 years old are overweight and 3.5 % are obese (INPES, 2012). One of the reasons advanced for this high prevalence is the degradation of dietary habits, including the increased consumption of foods rich in saturated fatty acids at the expense of the consumption of foods rich vitamins and minerals, such as fruits and vegetables (Jacobi, Agras, Bryson, & Hammer, 2003). The strongest barriers to the increase of children dietary variety and consumption of fruits and vegetables are *food neophobia* and *pickiness*, presented as the main kinds of food rejections in children (Dovey, Staples, Gibson, & Halford, 2008).

Food neophobia is defined as the reluctance to eat novel food and is present among omnivore's species (Pliner & Hobden, 1992). Food neophobia appears as the child become mobile, but there is a contention in the literature as to whether food neophobia increases steadily (Cashdan, 1994) or remains stable during early childhood (Adessi, Galloway, Visalberghi and Birch, 2005). Pliner and Hobden (1992) were the first to design a questionnaire to assess food neophobia: The Food Neophobia Scale (FNS), followed by Frank and van der Klaauw (1994) who developed the Food Attitude Scale (FAS). These two questionnaires asked participants to indicate the extent to which they agree or not with statements relative to food choice and consumption. Both these neophobia scales have been since widely adapted and successfully translated into several languages.

Food pickiness is defined as the rejection of a substantial amount of foods that are familiar (as well as unfamiliar) to the children (Smith, Roux, Naidoo, & Venter, 2005). Pickiness also includes the consumption of an inadequate amount of food (Rydell, Dahl, & Sundelin, 1995), or may relate to the rejection of certain food textures (Smith *et al.*, 2005) and is sometimes considered to include food neophobia (since food neophobia is defined roughly as the rejection of novel food whereas pickiness is the rejection of a large proportion of familiar as well as unfamiliar foods). In their review, Dovey *et al.* (2008) assumed that the two phenomena are behaviorally distinct because different factors predict the severity and expression of the two constructs. However, other authors argue that these two constructs are clearly related (Wardle & Cooke, 2008) and to date there is no decisive empirical evidence in favor of a robust sharp distinction between food neophobia and pickiness. An additional contention exists

regarding pickiness developmental path. Finally, compared to food neophobia, not much attention has been yet dedicated to picky eating measurement. To date, this construct has usually been assessed through general questionnaires on food habits, which included scales about problematic eating, fussiness, food neophobia, or low enjoyment when eating....

To summarize, clearly, there is still some confusion on the very concept of pickiness (Taylor, Wernimont, Northstone & Emmett, 2015), arguably partly explaining the lack of consensus regarding the relationship between food neophobia and pickiness. This uncertainty is reinforced by the lack of previous (or known) project aimed to design and validate a common scale including pickiness and food neophobia as two possible dimensions of food rejections by children. As pointed out by several authors (e.g., Hollar, Paxton-Aiken, & Fleming, 2013; Laureati, Bergamaschi & Pagliarini, 2015), the availability of assessment scales regarding food neophobia is crucial to the study of childhood eating behaviors and the effectiveness of food education programs or other interventions targeting fruits and vegetables consumption. So far, and as we have reviewed it above, food neophobia has been the target of several assessment scales, which is not true for pickiness. Specifically, no tool has yet been designed to evaluate both food neophobia and pickiness in young children. This is an important gap in the field of childhood eating behavior assessment, which would be worth filling in.

In the present study, we decided to develop and validate a new scale that enables the assessment of food neophobia and pickiness, both assumed dimensions of food rejections, in young French children. We concentrated on French children aged 2- to 7-years old, as no such scale exists for this young population. Moreover, we took special care measuring of all the expected properties of a psychometric instrument, that is to say, internal consistency, but also factorial structure, discriminant and convergent validity, and test-retest reliability (see e.g., Hinkin, 1995). Finally, we believe that designing and testing the validity of a scale, including items relative to food neophobia and items relative to pickiness, would provide insight into the relationships that these two constructs entertain, as well as the nature of their developmental paths.

## 2. Methods

---

*Questionnaire design.* To generate items, we priority reviewed the literature to precisely define the two constructs in consideration and evaluate previous measures (Lafraire, Rioux, Giboreau & Picard, *in*

*preparation*). We then (i) adapted 16 items from existing scales that proved to accurately capture the two phenomena and (ii) created 19 additional items based on their definition. In total 35 items were compiled, so that dismissing some items due to their potential inaccuracy or indistinctness allowed the retention of a sufficient number of items to assure a robust tool (Gehlbach & Brinkworth, 2011).

*Participants.* The 35-item questionnaire was administered online to 168 parents who responded for their child aged between 2 and 7 years old (83 girls and 85 boys). Caregivers rated each item regarding their child behavior on a 5-point Likert-type scale ('strongly disagree', 'disagree', 'neither agree nor disagree', 'agree', 'strongly agree').

*Convergent and discriminant validity.* In order to assess the convergent validity of the scale, each participant also filled online for their child the FAS (see introduction, Frank & van der Klaauw, 1994).

### **3. Results**

---

*Exploratory and confirmatory factor analysis.* For each child a food rejections score ranging from 35 to 175 was calculated based on caregiver's answers, where high scores indicated higher food neophobia and pickiness. The factorial structure of the scale was then investigated with an iterative exploratory factor analysis (EFA) using principal component analysis with varimax rotation, to evaluate the factor structure underlying the set of items and aid in item selection for inclusion on the final scale. The optimum number of factors was determined using a combination of the Kaiser criterion (factors with eigenvalues greater than one should be retained for interpretation; Kaiser,

We chose to administer the FAS to assess convergent validity because this questionnaire has been widely used as measure of attitude towards familiar and new foods. To assess the discriminant validity of the scale, each participant also filled online for their child the French version of the Revised Children's Manifest Anxiety Scale (Turgeon & Chartrand, 2003). The RCMAS asked participants to answer with "yes" or "no" 36 statements related to anxiety and low esteem issue. We chose to administer this scale to assess the discriminant validity because it measure anxiety and not food rejections, but food rejections are sometimes associated with high anxiety toward food items (Galloway, Lee & Birch, 2003).

*Test-retest reliability.* To evaluate the reliability of the scale, 44% ( $N=74$ ) of the original sample underwent a retest procedure. These parents twice completed the 35-item version of the scale with a four-week delay.

1960) and the Cattell's scree plot criterion (scree plot for eigenvalues is used to determine the point at which the last significant drop takes place; Cattell, 1966). This iterative exploratory analysis yielded to an 11-item scale with a 2-dimension solution model with factor loadings rather strong on the expected latent factors. A confirmatory analysis using the maximum likelihood method, was then conducted to test the two-factor model's fit to the 11-items scale, in which items N1, N2, N4, N6, N7, N10 loaded on the first latent factor named *food neophobia* and items S3, S4, S5, S6, S10 loaded on the second latent factor named *food pickiness*. Figure 1 displays the path diagram yielded by the CFA for the two-factor solution.

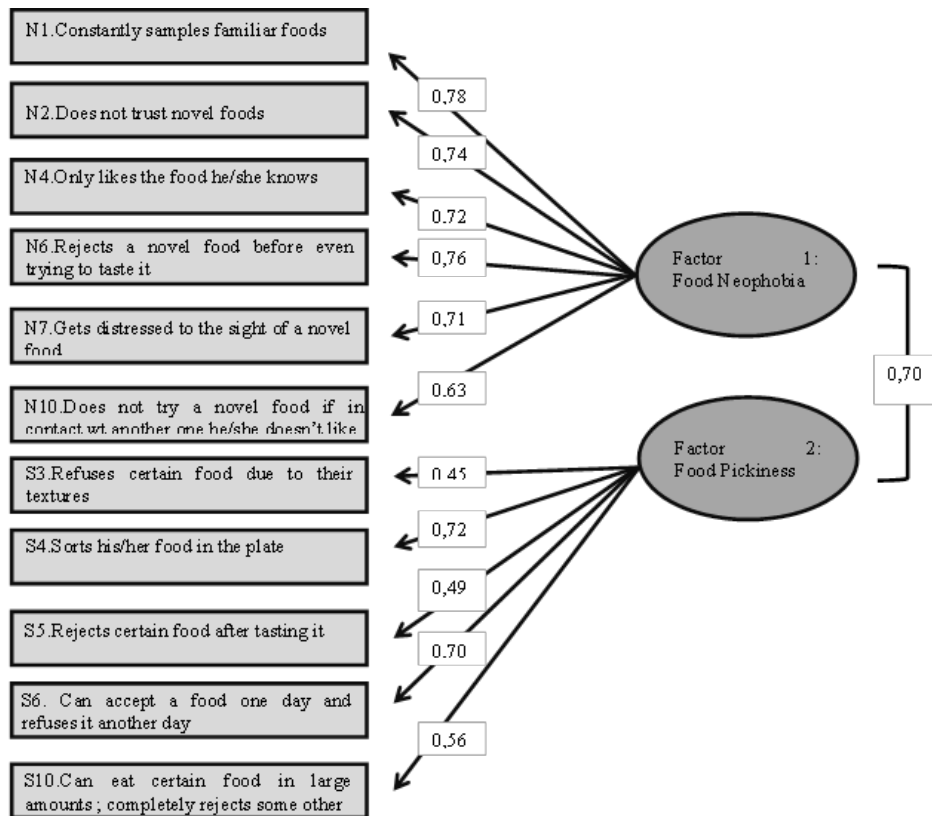


Figure 1. Path diagram yielded by the confirmatory factorial analysis

Figure 1 shows satisfactory factor loadings for each latent factor (range: 0.49-0.78), and a strong correlation between the two latent factors ( $r=0.70$ ). The CFA yielded acceptable goodness-of-fit indices:  $GFI=0.932$ ,  $CFI=0.954$ ,  $RMSEA=0.0639$  and  $\chi^2/df=1.67$  as recommended by Jackson, Gillaspay & Purc-Stephenson (2009). Thus, the two-factor model was fully relevant. We then conducted a series of psychometric analyses on the retained set of items (11).

**Convergent and discriminant validity.** Results from Pearson's coefficient indicated that Food rejections scores were significantly highly correlated with FAS scores ( $r=0.70$ ,  $p$ -Value<0.001). Additionally, as with FAS score, Food rejections scores were significantly and positively correlated with RCMAS scores as indicated by Spearman's coefficient ( $r=0.27$ ,  $p$ -Value<0.001). These correlations attested the convergent and discriminant validities.

**Test-retest reliability.** Statistical analyses indicated that scores obtained at the test session were highly correlated to score obtained at the retest session (all Pearson's coefficients  $r > 0.5$ ). This finding indicated that the food rejections scale had satisfactory test-retest reliability.

**Variations in food rejections scores according to children age and gender.** Finally, results from mean comparison using a  $t$ -test showed that boys and

girls did not differ significantly on food rejections scores ( $t=0.71$ ,  $p$ -value=0.94, ns). Additionally, Pearson's coefficient indicated that food rejections scores were no significantly correlated with age ( $r=-0.05$ ,  $p=0.50$ , ns).

#### 4. Discussion

First, our findings indicated that the 11-item food rejection scale, named the French Children Rejections Scale (FCRS), displayed good psychometric properties. Reliability, measured through internal consistency and test-retest reliability was satisfactory, with coefficients comparable to those found in previous research on children food neophobia or pickiness. Additionally the construct validity of the FCRS was adequate as attested to by measures of convergent and discriminant validities.

Second, factor analyses supported the two-dimension structure of the scale, hence the distinction between food neophobia and pickiness in young children. There was however a strong positive correlation between these two kinds of food rejections, implicating that they are noticeably related. In this view a child with high neophobia (respectively pickiness) level is likely to displays a high pickiness (respectively neophobia) level as well. These finding are in line with the claims of Wardle & Cooke (2008).

Third, we found no evidence that food rejections varied across age or gender. The absence of children's gender difference in food rejections scores is consistent with previous results in young children food rejections (see Xue *et al.*, 2015). This finding is noticeable since by the teenage years there are generally clear gender differences in terms of attitudes towards foods and rejections. It would be hence interesting to track the developmental path of gender differences across the years. Concerning the correlation between food rejections and age, the pattern found here is consistent with the view proposed by Adessi *et al.* (2005), that food rejections rise rapidly around the age of two, when the child is susceptible to ingest toxic compounds because of his/her growing mobility, and remain quite stable until 6-7 years old. It is also consistent with the developmental evolution of temperamental inhibition (i.e. tendency to experience distress and to withdraw from unfamiliar situations, people, or environments; Fox, Henderson, Marshall, Nichols, & Ghera, 2005) in early childhood (Rigal, Chabanet, Issanchou & Monnery-Patris, 2012).

Food neophobia and pickiness are major public health issues and we believe to have successfully developed an efficient tool to evaluate them in young French children through their caregivers. However the fairly low responses rate to the online-questionnaire resulted in a small sample size and led us to presume that it was mainly filled by families with a greater interest in issues of eating and nutrition, hence not representative of the national population. Additionally, it would seem that the subscale for neophobia is more robust than that for pickiness. Pickiness is a construct which is still not well defined and further studies are much needed to better grasp this construct. Nevertheless, the French Children Rejections Scale (FCRS) represents a valuable tool to study childhood food habits and the effectiveness of interventions aiming to increase their consumption of fruits and vegetables.

### Acknowledgements

The authors would like to acknowledge the financial support from the Fondation Daniel et Nina Carasso. We are grateful to parents for their helpful collaboration.

### References

Adessi, E., Galloway, A. T., Visalberghi, E., & Birch, L. L. (2005). Specific social influences on the

acceptance of novel foods in 2–5-year-old children. *Appetite*, *45*(3), 264–271.

Cashdan, E. (1994). A sensitive period for learning. *Human Nature*, *5*(3), 279–291.

Cattell, R. B. (1966). The scree test for the number of factors. *Multivariate Behavioral Research*, *1*, 245-276.

Dovey, T. M., Staples, P. A., Gibson, E. L., & Halford, J. C. G. (2008). Food neophobia and 'picky/fussy' eating in children: A review. *Appetite*, *50*(2-3), 181-193.

Fox, N. A., Henderson, H. A., Marshall, P. J., Nichols, K. E., & Ghera, M. M. (2005). Behavioral inhibition: linking biology and behavior within a developmental framework. *Annual Review of Psychology*, *56*, 235-62.

Frank, R. A., & van der Klaauw, N. J. (1994). The contribution of chemosensory factors to individual differences in reported food preferences. *Appetite*, *22*, 101-123.

Galloway, A. T., Lee, Y., & Birch, L. L. (2003). Predictors and consequences of food neophobia and pickiness in young girls. *Journal of the American Dietetic Association*, *103*(6), 692-698.

Gehlbach, H., & Brinkworth, M. E. (2011). Measure twice, cut down error: A process for enhancing the validity of survey scales. *Review of General Psychology*, *15*(4), 380-387.

Hinkin, T. R. (1995). A review of scale development practices in the study of organizations. *Journal of Management*, *21*(5), 967–988.

Hollar, D., Paxton-Aiken, A., & Fleming, P. (2013). Exploratory validation of the Fruit and Vegetable Neophobia Instrument among third- to fifth-grade students. *Appetite*, *60*, 226-230.

INPES (2012). Parce qu'à ses débuts, l'obésité infantile ne se voit pas, il faut la dépister le plus tôt possible.

Jackson, D. L., Gillaspy, J. A., & Purc-Stephenson, R. (2009). Reporting practices in confirmatory factor analysis: An overview and some recommendations. *Psychological Methods*, *14*, 6–23.

Jacobi, C., Agras, W. S., Bryson, S., & Hammer, L. D. (2003). Behavioral validation, precursors, and concomitants of picky eating in childhood. *Journal of the American Academy of Child and Adolescent Psychiatry*, *42*(1), 76-84.

Kaiser, H. F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement*, *20*, 141-151.

Lafraire, J., Rioux, C., Roque, J., Giboreau, A., & Picard, D. (in preparation). Food rejections in

children: Cognitive and social/environmental factors involved in food neophobia and picky/fussy eating behavior.

Laureati, M., Bergamaschi, V., & Pagliarini, E. (2015). Assessing childhood food neophobia: Validation of a scale in Italian primary school children. *Food Quality and Preference*, *40*, 8-15.

Pliner, P., & Hobden, K. (1992). Development of a scale to measure the trait of food neophobia in humans. *Appetite*, *19*(2), 105-120.

Rigal, N., Chabanet, C., Issanchou, S., & Monnery-Patris, S. (2012). Links between maternal feeding practices and children's eating difficulties. Validation of French tools. *Appetite*, *58*(2), 629-637.

Rydell, A.-M., Dahl, M. & Sundelin, C. (1995). Characteristics of school children who are choosy eaters. *The Journal of Genetic Psychology: Research and Theory on Human Development*, *156*(2), 217-299.

Smith, A. M., Roux, S., Naidoo, N. T., & Venter, D. J. L. (2005). Food choices of tactile defensive children. *Nutrition*, *21*(1), 14-19.

Taylor, C. M., Wernimont, S. M., Northstone, K., & Emmet, P. M. (2015) Picky/fussy eating in children: review of definitions, assessment, prevalence and dietary intakes. *Appetite*, *in Press*

Turgeon, L., & Chartrand, E. (2003). Reliability and validity of the revised children's manifest anxiety scale in a French-Canadian sample. *Psychological Assessment*, *15*(3), 378-383.

Wardle, J., & Cooke, L. (2008). Genetic and environmental determinants of children's food preferences. *The British Journal of Nutrition*, *99 Suppl 1*(February 2008), S15-21.

Xue, Y., Lee, E., Ning, K., Zheng, Y., Ma, D., Gao, H., ... Zhang, Y. (2015). Prevalence of picky eating behaviour in Chinese school-age children and associations with anthropometric parameters and intelligence quotient. A cross-sectional study. *Appetite*, *91*, 248-255.