

Food Neophobia in Preschool Children

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Food neophobia is generally considered as the reluctance to eat or the avoidance of new foods. Neophobia is not a permanent aversion to new food; acceptance can be promoted by repeated exposure or modeling the intake of the rejected food product. The study followed a number of 168 children aged between 2 and 5 years. The parents of the children filled a questionnaire regarding the physiological medical data of the children, the feeding habits (quantitative and qualitative). Neophobia was measured using the Child Food Neophobia Scale (CFNS). The study pursued the association between neophobia and the sex of the patient, the quality of the food products, the children's diet (presence of fruits, vegetables), the weight of the patients, the duration of breastfeeding, the education level of the mother. Girls present higher scores on the CFNS scale than the boys. Children whose mothers have higher education were susceptible to having a higher variety of fruits in their diet. Children with a higher score on the CFNS scale and those with siblings were susceptible to having a lower variety of fruits and dairy products in their diet and a higher intake of fast-food products. The results highlight the necessity for early exposure of the children to a high variety of nutrient foods and the need to educate the parents with regard to the strategies needed in order to overcome food neophobia.

Keywords: *food neophobia, preschool children, Child Food Neophobia Scale*

Food neophobia is generally considered as the reluctance to eat or the avoidance of new foods, which can result in restricted feeding habits [1]. Neophobia somewhat overlaps the group of fussy-agitated eaters, who consume a variety of inadequate foods by rejecting both familiar and unfamiliar food products. There are numerous variables that influence the onset of eating disorders: age, personality, social influences, parental feeding practices, environment and culture. In the case of neophobia, the acceptance of new foods can be promoted by repeated exposure to the food or modeling the intake of the rejected food product. Unlike neophobia, the period cannot be overcome in fussy-agitated eaters by repeated exposure to foods [2].

There are numerous instruments to determine neophobia, some adapted to age groups (Food Situation Questionnaire (FSQ), Food Neophobia Questionnaire (FNQ), Teacher-administered Taste-Test Tool (TTT) and WillTry Instrument, Food Attitude Scale (FAS), Variety Seeking Tendency Scale (VARSEEK) etc) [3]. One of the instruments that are most used at this moment in order to evaluate neophobia and the desire to try unfamiliar aliments is the Child Food Neophobia Scale (CFNS), developed by Pliner and Hobden (1994), which we have also used in our study. CFNS was used on a large scale and it has provided reliable results [4-6].

The aim of this study was to determine the presence of food neophobia in preschool children and its correlation with the personal physiological characteristics of the children and of the family and with the children's diet.

Experimental parts

Material and method

The study followed 168 children aged between 2 and 5 years, who were hospitalized in the 1st Pediatrics clinic of the District Emergency Hospital of Craiova with acute diseases and who were not registered with allergies. The children's parents filled a questionnaire regarding the physiological medical data of the children, feeding habits (quantitative and qualitative). The study pursued the association between neophobia and the sex of the patient, the quality of the food products, the children's diet (intake of fruits, vegetables, meat), the weight of the patients, the duration of breastfeeding, food diversification, the education level of the mother, the marital status, the presence of neophobia in one of the parents.

Neophobia was measured using the Child Food Neophobia Scale (CFNS) (Pliner P 1994), adapted to the age group by removing the items which do not correspond to the age of the child (e.g., ethnic food looks ugly to me). This calculating instrument was validated, showing good internal consistency. The scale contains 6 questions: My child doesn't trust new foods; If my child doesn't know what is in a food, (s)he won't try it; My child is afraid to eat things (s)he has never had before; My child will eat almost anything (inversed score); My child is very particular about the foods (s)he will eat; My child is constantly sampling new and different foods (inversed score), in which parents give

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scores ranging from 1 to 4, where 1 means “I don’t agree”, and 4 means “I strongly agree”. Thus the high scores indicate a high parental perception for the presence of neophobia in children.

The analysis of the data was carried out with the help of IBM SPSS version 22. Covariates were selected from the characteristics of the mother and child, in order to include them in the regression models based on a significant association ($p \leq 0.05$), with at least one of the consequent variables.

Results and discussions

Table 1
GENERAL CHARACTERISTICS OF THE CHILDREN AND MOTHERS IN THE STUDY

Child's characteristics	Range	Average
Age (years)	2.4 - 5	3.6 ± 0.6
Weight at birth (g)	2300 - 4100	3001.08 ± 285.6
Current weight (kg)	12 - 22	16.5 ± 1.9
Boys	-	97
Breastfeeding (months)	0 - 14	5 ± 2.6
Diversification (months)	4 - 7	5.8 ± 0.7
Mother's characteristics		
Mother's age (years)	17 - 44	28.14 ± 5
Marital status	-	149
Multiparous	-	71
Level of education	frequent	%
illiterate	7	4.2
college	17	10.1
middle school	32	19.0
high school	85	50.6
post-secondary school	8	4.8
elementary	19	11.3

The study followed a number of 168 children (97 F – 57.7%; 71 M – 42.3%). The age of the subjects ranged from 2.4 to 5 years, with a global average of 3.6 years \pm 0.6 years, slightly higher in girls (3.6 years vs. 3.5 years). The weight at birth (g) varied from 2300 to 4100 g, on average 3001.8 ± 285.6 g, significantly higher ($p = 0.001$) for boys (3088.3 g vs. 2938.5 g). The current weight (kg) varied from 12 to 22 kg, on average 16.5 ± 1.9 kg, with no significant differences between sexes (boys – 16.7 kg vs. 16.3 kg girls) (Table 1).

Breastfeeding lasted for up to 14 months, the average being 5 ± 2.6 months, significantly higher ($p = 0.009$) for boys (cca. 6 months vs. 4.5 months girls). Food diversification started between 4 and 7 months, without significant differences between sexes (5.8 ± 0.7 months, $p > 0.05$). Mother's level of education did not influence the moment of food diversification (Table 1).

Mother's age varied between 17 and 44 years, with an average of 28.14 ± 5 years, without significant differences between sexes. The “married” status was reported by a number of 149 mothers (cca. 89%). As far as the level of education is concerned, the most predominant was high school, cca. 51% of the mothers having graduated this type of studies.

As far as the children's diet is concerned, meat is consumed daily by 79.8% of the children, vegetables by 83.3%, dairy products by 86.9%, and fruits by 32.7% of the children (Table 2).

Table 2
CHILDREN'S DIET BY FOOD GROUPS

		Children frequency	%
Consumption frequency meat	3/week	14	8.3
	4/week	20	11.9
	daily	134	79.8
	Total	168	100.0
Consumption cereals	yes	98	58.3
	no	70	41.7
	Total	168	100.0
Consumption frequency dairy products	1/week	1	0.6
	2/week	4	2.4
	3/week	12	7.1
	4/week	5	3.0
	daily	146	86.9

	Total	168	100.0
Consumption frequency fruits	1/week	1	0.6
	2/week	11	6.5
	3/week	54	32.1
	4/week	47	28.0
	daily	55	32.7
	Total	168	100.0
Consumption frequency vegetables	3/week	12	7.1
	4/week	15	8.9
	5/week	1	0.6
	daily	140	83.3
	Total	168	100.0

The CFNS score varied between 6 and 23, with an average of 14.5 ± 3.9 (Table 3). The variation was significant between sexes ($p = 0.000$) (16.1 ± 3.4 F vs. 12.3 ± 3.5 M) and in relation to the level of education ($p = 0.000$), the maximum score being registered for children whose mothers had no studies (20 ± 2.6), the minimum score for children whose mothers had college studies (12.2 ± 3.3). Statistically significant differences in the CFNS score were registered in relation to the presence and number of siblings ($p = 0.010$), the minimum score was registered for those without brothers/sisters (14 ± 3.6 vs. 18.3 ± 2.1 for 2-/3 siblings). We did not register any significant association between the CFNS score and children's weight at birth, breastfeeding or the moment when solid foods were introduced.

Overall, slight positive correlations were registered with the child's age ($r = 0.273$, $p = 0.000$) (Table 3) and the presence of siblings ($r = 0.223$, $p = 0.004$) (Table no. 4). Furthermore, neophobia scores are higher in children whose mothers have a low level of education ($r = -0.493$, $p = 0.00$) (Table 4) or one of the parents is neophobic ($r = 0.483$, $p = 0.004$); CFNS is higher in the case of parents with neophobia (19.2 ± 2.1 mother vs. 18.6 ± 3 father, vs. 13.6 ± 3.5 children with parents without neophobia). Indirectly, CFNS is associated with low consumption of fruits ($r = -0.514$, $p = 0.000$) and dairy products ($r = -0.161$, $p = 0.038$) and high consumption of fast-food products ($r = 0.483$, $p = 0.000$). (Table 5)

Table 3
CORRELATIONS ASSOCIATED TO THE CHILD OVERALL

		age	W at birth	Current W	Breast-feeding	diversification
CFNS score	r – correlation coefficient	0.273**	-0.078	0.148	0.066	0.033
	p	0.000	0.317	0.055	0.397	0.668
	Number of subjects	168	168	168	168	168

Table 4
CORRELATIONS ASSOCIATED TO THE FAMILY OVERALL

		mother's age	education	married	siblings	Parents with neophobia
CFNS score	r – correlation coefficient	0.073	-0.493**	-0.022	0.223**	0.492**
	p	0.350	0.000	0.774	0.004	0.000
	Number of subjects	168	168	168	168	168

Table 5
CORRELATIONS ASSOCIATED TO THE QUALITY OF THE CHILD'S DIET/OVERALL

		fruits	vegetables	meat	dairy products	sweets	fast-food
CFNS score	r – correlation coefficient	-0.514**	0.060	-0.138	-0.161*	-0.027	0.483**
	p	0.000	0.443	0.075	0.038	0.728	0.000
	Number of subjects	168	168	168	168	168	168

When the analysis was layered taking into consideration gender composition, the relation was highlighted only for girls (CFNS – age $r = 0.408$, $p = 0.000$; CFNS – siblings $r = 0.231$, $p = 0.023$)

In girls we highlighted a weak positive relation to the duration of breastfeeding ($r = 0.220$, $p = 0.030$), children's current weight, ($r = 0.344$, $p = 0.001$) (Table 6), presence of siblings ($r = 0.231$, $p = 0.023$) and an intense inversed relation to the mother's level of education ($r = -0.640$, $p = 0.000$) (Table 7). Thus, the high neophobia scores of the girls are associated to longer breastfeeding, larger current weight, the presence of a sibling and a lower level of

education of the mother. For the boys, we highlighted a weak inversed relation to the mother's level of education ($r = -0.234$, $p = 0.049$)

Children's neophobia is correlated with the parents' neophobia in both sexes, but especially in the case of the girls ($r = 0.508$, $p = 0.00$) (Table 7).

The CNFS analysis in relation to the quality of the diet (Table no. 8) highlighted a medium positive connection to the habit of fast-food consumption ($r = 0.483$, $p = 0.000$) and respectively a medium negative connection to the habit of fruits consumption ($r = -0.514$, $p = 0.000$). Thus, children with high neophobia scores consume less fruits and more fast-food products. Furthermore, girls with neophobia consume less dairy products ($r = -0.259$, $p = 0.010$), while neophobic boys consume less sweets ($r = -0.335$, $p = 0.04$).

Table 6
CORRELATIONS ASSOCIATED TO THE CHILD / BATCHES BY SEX

sex			age	W at birth	Breast-feeding	Current W	introd. of solid foods	diversification
f	CFNS score	r – correlation coefficient	0.408**	0.081	0.220*	0.344**	0.113	0.038
		p	0.000	0.432	0.030	0.001	0.270	0.711
		Number of subjects	97	97	97	97	97	97
m	CFNS score	r – correlation coefficient	-0.018	0.028	0.162	0.007	-0.119	0.065
		p	0.879	0.814	0.178	0.955	0.324	0.591
		Number of subjects	71	71	71	71	71	71

Table 7
CORRELATIONS ASSOCIATED TO THE FAMILY / BATCHES BY SEX

sex			mother's age	education	married	siblings	Parents with neophobia
f	CFNS score	r – correlation coefficient	0.025	-0.640**	-0.049	0.231*	0.508**
		p	0.806	0.000	0.631	0.023	0.000
		Number of subjects	97	97	97	97	97
m	CFNS score	r – correlation coefficient	0.049	-0.234*	-0.042	0.008	0.315**
		p	0.687	0.049	0.726	0.949	0.008
		Number of subjects	71	71	71	71	71

Table 8
CORRELATIONS ASSOCIATED TO THE QUALITY OF THE CHILD'S DIET / BATCHES BY SEX

sex			fruits	vegetables	meat	dairy products	sweets	fast-food
f	CFNS score	r – correlation coefficient	-0.521**	0.000	-0.226*	-0.259*	0.187	0.554**
		p	0.000	0.999	0.026	0.010	0.067	0.000
		Number of subjects	97	97	97	97	97	97
m	CFNS score	r – correlation coefficient	-0.315**	-0.072	-0.127	0.036	-0.335**	0.256*
		p	0.007	0.553	0.290	0.764	0.004	0.031
		Number of subjects	71	71	71	71	71	71

Table 9
QUALITY OF DIET IN RELATION TO THE PRESENCE OF NEOPHOBIA AMONG THE PARENTS

DIET							
Parents' neophobia		Fruits p=0.000	vegetables	meat	dairy products	sweets	fast-food p=0.000
0	Mean	4.78	6.46	6.39	6.51	6.96	0.038
	Std. Deviation	1.824	1.257	1.315	1.325	0.51	0.06
	N	138	138	138	138	138	138
1 (father+)	Mean	3.38	6.14	5.67	6.43	6.76	0.117
	Std. Deviation	1.431	1.590	1.770	1.434	1.09	0.13
	N	21	21	21	21	21	21
2 (mother+)	Mean	3.11	6.67	6.56	5.89	7.00	0.099
	Std. Deviation	0.928	1.000	1.333	2.261	0.00	0.12
	N	9	9	9	9	9	9

Fruit consumption and fast-food products are significantly different from a statistical point of view ($p < 0.005$) in relation to the parent's neophobia. Thus, fruit consumption is maximum in parents without neophobia, fast-food products consumption is high in children with neophobic fathers, and sweets consumption is high in mothers with neophobia (Table 9).

Food neophobia is defined as the reluctance to eat unfamiliar foods [7]. Numerous studies regarding neophobia have been carried out, but the mechanisms which determine food rejection have not yet been clearly identified [8]. Initially, a hypothesis was issued that in the genetic code of man there is the necessity to search the food source for the survival of the species, but he has to protect himself from potentially poisonous foods, thus limiting the diet, also known as "Omnivore's dilemma" [9-10]. Sensitive children and those with elevated sensory capacities can have a higher capacity to develop an eating disorder [11].

Genes influence behavioral traits during the childhood, including food behavior. Studies suggest that between 69 and 78% of the cases of neophobia are genetic in nature [12-13], while the rest are due to environmental factors.

Children are born with a biological predisposition for sweet foods and for the avoidance of bitter foods such as certain vegetables. Epidemiological data suggest that the mother's diet influences the flavor of breast milk, therefore children who are breastfed get familiarized early on with certain foods (plants, cereals, fruits, etc.) [14-15]. Food experiences of the future babies begin in utero, but only the infants who are breastfed are familiarized with various flavors by the repeated and continuous exposure to a large variety of flavors that takes place during breastfeeding. Thus, the food habits of children who have been breastfed are healthier compared to the food habits of children who have been fed formula [16].

The peak of food neophobia is between 2 and 5 years old, when children begin to explore the surrounding environment under the guidance of the parents, and it continues to drop during childhood, the teenage years and the mature years [17-18]. Discussions with regard to the role played by sex or background in the onset of neophobia are contradictory and have not found a common ground.

The results of the studies suggest that everyday food preferences of children of preschool age are strongly associated to food neophobia, but not to age, sex, weight or breastfeeding history [19]. In other studies, neophobic mothers breastfeed for a shorter period of time, and the father's feeding was correlated with the duration of breastfeeding and the introduction of solid foods, [20] while Cooke's study from 2005 suggests there is a differentiation between the food preferences of girls and boys that have the same age [21]. The results of our study show that neophobia is present especially in girls and children whose mothers have a lower level of education, but it is not correlated with breastfeeding history, weight at birth or current weight.

Neophobia has a big impact on the quality of a diet [8]. The increase in food neophobia is associated with a reduced food variety and a poorer „index of healthy food“, due to the increase in discretionary foods (concentrated juices, fast-food products) [22-23]. Children present a higher degree of anxiety and negative reactivity to food. Food neophobia has been associated with lower preferences for all food groups, but especially for vegetables, fish and fruits [3, 5, 24]. They can also present deficits in the intake of proteins, monounsaturated fats, magnesium and vitamin E [22]. In our study, higher neophobia scores were associated with low consumption of fruits, dairy products and vegetables and an increase in the consumption of fast-food products. Furthermore, children's food neophobia was correlated with the presence of neophobia in one of the parents, which underlines the close relation between family history and food preferences, an idea that has been also suggested in the studies of Galloway AT [6, 25].

Individualized behavioral interventions, focused on early exposure to foods, could lead to the attenuation of food neophobia [26]. These interventions are counterproductive if the child is pressed to consume certain foods, and the parents feel frustrated [6, 27]. Children's fear of trying new foods was reduced by increasing the availability of such foods at home and having the parents tasting them [26, 28].

A limitation of this study is the fact that both children's food consumption and food neophobia have been valued by the parents, which leads to subjectivism. Thus, parents can report a higher consumption of discretionary foods than the real one, or they can answer more negatively about the child's availability to try new foods.

Conclusions

The results highlight the association of neophobia with a low consumption of fruits, dairy products and vegetables and an increase in the consumption of fast-food products, which indicates the necessity for the early detection of neophobia and early exposition of children to a large variety of nutrient foods. Furthermore, parents have to be educated with regards to the necessary strategies in order to overcome food neophobia and to promote models of healthy eating.

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Intrat in redactie: 7.03.2019