

Predictors of outcomes following a brief Portuguese parental nutrition intervention

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Early childhood is largely recognized as a critical period for shaping the child's eating patterns. Although interventions studies that focus on first years of life are increasing, with positive impact, the moderators of treatment gains and the relative importance of each determinant of the change process have been rarely explored. This study aimed to identify potential predictors of outcomes concerning children's healthy and unhealthy eating behaviors after a parental school-based intervention. An intervention longitudinal study with repeated measures at baseline and after participation in the *Red Apple* program was performed. Parents and children were recruited in public and state-funded kindergartens near Lisbon, Portugal. A total of 44 parents of 3- to 6-year-old children agreed to participate in the study and 39 met the inclusion criteria. The *Red Apple* program included four parental group sessions about young children's growth, nutritional guidelines, and positive parental feeding strategies, and adult-child activities and newsletters delivered to caregivers. Data regarding children's dietary intake, food preferences, neophobia/neophilia, parental concerns about the child's weight, and self-efficacy in promoting healthy dietary patterns in children were collected before (T1) and after (T2) the intervention. Higher parental concerns about weight and self-efficacy at T1 significantly predicted children's healthy dietary intake at T2. The only significant contribution for children's unhealthy dietary intake at T2 was the previous consumption of those foods at T1. Interventions that focus on parental cognitive variables might effectively contribute to positive changes in children's dietary intake. Findings also suggest that specific targets of children's diet may pose unlike challenges that respond differently to the mechanisms of influence of the intervention.

Key words: Children's dietary intake, Predictors, Parental concerns about weight, Parental self-efficacy.

Background

The relationship between nutrition and health is especially important in the first years of life when the foundations of the child's physical, cognitive and emotional development begin to be established (Michaelsen, Weaver, Branca, & Robertson, 2000). While a balanced and diversified diet is necessary to assure the healthy growth of the child to its full potential, insufficient, inadequate or excessive intake of certain nutrients at this stage of life may lead to the emergence of various health problems, increasing the risk of infant morbidity (WHO, 2009). Recent

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Portuguese reports have highlighted for worrisome changes in young children's diet, with vegetable intake mainly on soups, and dairy consumption of sugary foods and drinks (Lopes et al., 2014).

Early childhood is increasingly recognized as a critical period for shaping the child's eating patterns because it is a time when maximized control of adults regarding children's dietary quality and behaviors (Golan & Crow, 2004; Patrick & Nicklas, 2005) coexists with the child's increased ability to understand messages about food and to become involved in food choices (Matheson, Spranger, & Saxe, 2002). As such, school- and family-based interventions to promote healthy eating behaviors of young children have increased in the last two decades, with some positive results (Brown, Kelly, & Summerbell, 2007). Interventions that evolve parents as the main targets (Campbell & Hesketh, 2007; Gerards, Sleddens, Dagnelie, Vries, & Kremers, 2011), that motivate parents to engage in positive changes in the child's diet and help them to feel more confident (Hingle, O'Connor, Dave, & Baranowski, 2010) and attend parents throughout the entire process (Golley, Hendrie, Slater, & Corsini, 2011; Pocock, Trivedi, Wills, Bunn, & Magnusson, 2010) are better well succeeded in achieving healthy diet outcomes.

The effectiveness of dietary interventions for children can be enhanced if they are directed by theory-based research, thus facilitating the identification of the determinants of children's food intake and how they interact to influence eating behaviors (McClain, Chappuis, Nguyen-Rodriguez, Yaroch, & Spruijt-Metz, 2009). Earlier studies have reported several environmental and individual correlates of children's eating patterns. Parent's influence on children's food intake occur not only through their feeding practices (Bante, Elliott, Harrod, & Haire-Joshu, 2008; Fisher, Mitchell, Smiciklas-Wright, & Birch, 2002), but also through cognitive processes. Higher parental concerns about the child's weight (Moore, Harris, & Bradlyn, 2012; Swyden et al., 2015) and higher self-efficacy to influence their child's eating behaviors (Campbell, Hesketh, Silverii, & Abbott, 2010; Ice, Neal, & Cottrell, 2014; Parekh et al., 2017) have been associated with the improvement of diet quality in infancy. Children's individual factors, such as food neophobia (e.g., unwillingness to try new or different foods) (Cooke, Carnell, & Wardle, 2006; Cooke, Wardle, & Gibson, 2003) and food preferences (McGowan, Croker, Wardle, & Cooke, 2012), can also determine their eating patterns and diet diversity.

Nevertheless, those results are mainly obtained from cross-sectional or longitudinal studies and, less frequently, from intervention studies, where the moderators of treatment gains and the relative importance of each determinant of the change process have been rarely explored. In general, those reports highlight *what was changed* after the intervention, and less *what are the variables* that contribute, and *to what extent*, for those changes, as well as *to whom* these programs work best. One of the few programs with parents of preschool children that examine mediation effects on children's dietary outcomes changes (*Healthy Habits*) concluded that specific parental variables can influence an important proportion of the impact of the intervention. Parental intake of fruits and vegetables (F&V) and parent provision of F&V to their children mediate the intervention effect on the child's F&V 2 months and 12 months after participation in the program. The greatest predictor of an increase in children's F&V intake at 12 months was the same variable at 2 months (Wyse, Wolfenden, & Bisquera, 2015). Although significant intervention effect on children's non-core foods consumption was only found at 2 months' assessment, child's accessibility to those foods at home and parent's feeding practices (e.g., restriction, reward with desserts) were significant mediators of the impact of the program (Fletcher et al., 2013). Although the examination of the mediators of dietary intervention changes in studies with children and adolescents (5-18 years old) is also inconsistent, self-efficacy and expectancies outcomes were been identified as the variables most steadily associated with improvements in the diet (Cerin, Barnett, & Baranowski, 2009).

The Red Apple (Maçã Vermelha) program (Gomes, Barros, Pereira, & Roberto, 2018) is a school-based, low-dosage intervention aimed to promote preschool children's healthy eating behaviors, through modifying parental cognitive determinants related to the child's dietary patterns and modeling parental feeding practices according to the individual characteristics of the child. The program was developed by the authors to intervene in dimensions commonly considered by most cognitive and social-cognitive theories as determinants of health behavior intentions and health behaviors itself: threat appraisal (severity, vulnerability), self-efficacy and behavioral control (internal control factors as skills and information; external control factors as barriers and opportunities) (Ajzen, 1985; Rogers, 1983). The *Red Apple* was delivered to parents in a group format, with four 90 minutes sessions every 2 weeks. Each session focused on one major theme related to the development of healthy eating behaviors during infancy: *Child's growth process, nutrition and health* (1st session), *Healthy eating during preschool years* (2nd session), and *Parental strategies to promote healthy eating behaviors* (3rd and 4th sessions). Adult-child activities were suggested at the end of each session both to parents and kindergarten teachers, as a theme-related homework assignment, inviting them to reflect about the strategies discussed and their potential benefits, and to implement these strategies on their daily interaction with the child. A newsletter was sent to parents a week after each session to highlight the key messages and suggest other related activities.

The purpose of this study was to identify potential predictors of outcomes regarding children's healthy and unhealthy eating behaviors after a brief parental school-based intervention (*Red Apple* program). Specifically, we were interested in understanding how parental cognitions (concerns about the child's weight, self-efficacy) and the child's individual characteristics (healthy and unhealthy eating preferences, food neophilic and neophobic behaviors) observed at baseline (T1), predicted treatment gains immediately after the intervention (T2) regarding children's healthy and unhealthy dietary intake.

Methods

Study design

An intervention longitudinal study with repeated measures at baseline and immediately after the intervention was used.

Participants

Recruitment and data collection was performed between October 2011 and June 2014, in public and state-funded kindergartens near Lisbon, Portugal. Inclusion criteria to participate in this program were defined: (a) parents with children between 2 and 6 years old, (b) identify themselves as the parent who is most involved in child feeding, food preparation and in the purchase of food, (c) have given their consent to participate in the study and have completed the initial evaluation protocol. Although parents of children with severe developmental disabilities were allowed to participate in the intervention program, they were not included for statistical data analysis. In the end, forty-four parents completed the *Red Apple* program; nevertheless, five were excluded because they did not meet the inclusion criteria (two parents of children with developmental impairment and three parents who did not return the evaluation protocol at T2).

Procedure

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving participants were approved by the Research Ethics Committee of the Faculty of Psychology, University of Lisbon, and by the boards of all schools involved.

Initial data collection was performed at different times during the year, considering potential influences of festivities and seasons in children's dietary intake. Information about the study's purposes and the intervention program was presented to parents in a pamphlet, sent home. The informed consent and the evaluation protocol were later sent only to parents who report their interest to collaborate to the kindergarten teacher, with instructions to ensure the correct completion of the instruments and confidentiality of the responses (i.e., delivery to kindergarten teachers in a closed envelope).

After parents' agreement, children's eating preferences were assessed through an individual interview performed by psychology postgraduate students who had received previous training to apply the instrument. The study's purposes and task required was briefly explained to children in the presence of the teacher. After child's verbal assent, the information was collected during approximately 15 to 20 minutes in a separate room in the kindergarten.

The *Red Apple* program was conducted in the schools, with groups of 6 to 8 parents and the class teacher. The schedules were adjusted according to the parent's preferences. The intervention was performed by the first author, with the participation of a nutritionist on the second session. Parents who completed the first two sessions and at least one of the sessions about parental feeding strategies were retained for statistical analysis.

Instruments

Children's dietary intake was assessed through the *Children's Eating Habits Questionnaire* (Gomes, Barros, & Pereira, 2017), where parents reported how often their children consumed specific healthy (i.e., 4 items: soup, fruits, vegetables and fish) and unhealthy (i.e., 5 items: desserts, candies, fast food, sodas and foods with added salt/sugar) foods, on a 4-point Likert scale (never, 1-2 times a week, 3-6 times a week, every day). Item values in each dimension were summed, with higher total score corresponding to more frequent intake of those foods.

Parents also reported their degree of concern about their child's current weight with a single question answered on a 5-point Likert scale (*almost always, frequently, sometimes, rarely, never*).

Parents' efficacy to encourage children to eat healthy and varied foods and to manage the intake of caloric and nutrient-poor foods was measured with a 4-item questionnaire (*Parental Self-efficacy for Children's Healthy Diet Scale*) developed by the authors (Gomes, Barros, Pereira, & Roberto, 2018). Each item was answered on a 5-point Likert scale (*no certain to highly certain*); for the total score, the answers were summed, with higher values indicating higher self-efficacy. This scale showed acceptable internal consistency ($\alpha=0.74$; inter-item correlation mean [IICM]=0.35) and good test-retest (15-day interval) reliability ($r_s=0.78, p>0.01$).

The *Child Food Neophobia Scale* (Pliner, 1994) is a 10-item questionnaire aimed to assess parent's perceptions of their children's behaviors towards unfamiliar foods. For this study, we used a Portuguese version of the instrument (Gomes, Barros, Pereira, Roberto, & Mendonça, 2018) with two subscales: a Food Neophobia subscale (items 2, 3, 7 e, 8 of the original scale), that refers to child's reactions of reluctance or avoidance towards unfamiliar foods, and a Food Neophilic subscale (items 1, 4, 6 e, 10 of the original scale), that refers to the child's acceptance to try and eat new foods despite their unfamiliar appearance or cultural provenience. The total

score of each subscale was calculated through the sum of the responses in each item (5-point Likert scale), achieving a possible score range of 4-20 in each subscale. Both scales presented an adequate internal consistency ($\alpha=0.81$ and $IICM=0.514$ for Food Neophobia; $\alpha=0.68$ and $IICM=0.354$ for Food Neophilia) and an excellent test-retest reliability coefficients ($rs=0.92$, $p<0.01$ for Food Neophobia; $rs=0.91$, $p<0.01$ for Food Neophilia).

Children's food preferences were measured through an individual interview (Gomes, Barros, Pereira, Roberto, & Mendonça, 2018), in which photographs of 33 foods commonly used in Portuguese gastronomy were shown to the child on a screen. The child rated each picture on a 3-point hedonic facial scale (*I don't like it at all*, *I like it more or less* and *I like it a lot*) according to his/her preferences. The interviewer also noted when the child had not previously tasted a specific food or did not know the food represented in the picture. The total scores were calculated considering two dimensions: healthy foods (i.e., 5 items) and unhealthy food (i.e., 6 items). The answers for items in each subscale were summed, with higher values in each scale corresponding to a higher preference for these foods.

Data analysis

Statistical analyses were performed in IBM SPSS Statistics for Windows, version 23.0 (IBM Corp., Armonk, New York, USA). Mean differences between children's healthy and unhealthy dietary intake at T1 and T2 were examined through paired samples t-tests. Correlational analysis between children's dietary behaviors at T2 and other variables (i.e., parental concerns about the child's weight, parental self-efficacy, children's food neophilic and neophobic behaviors, children's healthy and unhealthy food preferences, healthy and unhealthy children's dietary behaviors at T1) were performed using Pearson and Spearman coefficients. Variables significantly associated with healthy and unhealthy children's dietary intake scores at T2 were considered as potential predictors of change and included in hierarchical linear regression analyses. In each single procedure, healthy or unhealthy food intake at T1 entered in Step 1 of the analysis as an independent variable, followed by each potential predictor in Step 2, to assess the predictors of the outcome at postintervention controlling for the effects of the initial levels of the variable at preintervention. A final model was performed that included all the variables that emerged as significant predictors for each food intake score in the previous regression procedures. Statistical significance of the tests was achieved for $p<0.05$.

Results

Respondent characteristics

Parents that completed the intervention and evaluation protocols at T1 and T2 (Table 1; $N=39$) were mothers (100%) between 25 and 44 years old (89,7%) that had completed more than 12 years of schooling (59,0%). Most children lived with both parents (94,9%) and the percentage of boys and girls in the sample was similar (43,6% and 56,4%, respectively). A small proportion of the children had a chronic health condition (10,5%) and were born preterm (10,5%). The child's mean age is 4,44 years old ($DP=0,882$).

Table 1

Parent's and children's demographic and clinical characteristics

		Parents (N=39)
		n (%)
Kinship	Mother	39 (100)
Age (years)	25-34	14 (35,9)
	35-44	21 (53,8)
	45-54	4 (10,3)
Educational level (years)	Elementary school	3 (7,7)
	Secondary school	13 (33,3)
	Higher school	23 (59,0)
		Children (N=39)
		n (%)
Gender	Feminine	22 (56,4)
	Masculine	17 (43,6)
The child's lives with...	Both parents	37 (94,9)
	Mother	2 (5,1)
Gestation	Preterm	4 (10,3)
	Term	35 (89,7)
Presence of child's chronic health conditions		4 (10,3)
Child's BMI classification ^{a)}	Underweight	3 (7,7)
	Healthy weight	26 (66,7)
	Excessive weight	10 (25,6)

Note. ^{a)} Centers for Disease Control and Prevention's standards, used by Portuguese physicians to determine BMI percentile in children born before March 2014, were used to calculate BMI-for-age percentiles (boys and girls) and nutritional status. Children over the 85th percentile were classified as overweight, those below the 5th percentile as underweight and the remaining subjects as healthy weight.

Intervention effects

The mean comparisons between children's dietary intake at T1 and T2 showed a statistically significant improvement in the frequency of healthy food consumption [$t_{(38)}=-3.701, p=0.001$] from 13.05 ± 1.36 to 13.85 ± 1.25 , and a decrease in the frequency of unhealthy food intake [$t_{(38)}=2.428, p=0.02$] from 8.44 ± 2.45 to 7.85 ± 1.99 , following the *Red Apple* program. Examination of the effect sizes (Cohen's *d*) for both outcomes revealed that these changes reflected small (0.264 for unhealthy food intake) to medium (0.613 for healthy food intake) effects.

Associations between child's healthy and unhealthy food intake and other variables

Table 2 presents the correlations between healthy and unhealthy dietary intake and the variables mentioned above. A more frequent consumption of healthy food by children at T2 was significantly correlated with higher parental self-efficacy, more frequent food neophilic behaviors, higher consumption of healthy food, and lower consumption of unhealthy food by children at T1. Those associations ranked from weak to moderate. Parental concerns about the child's weight were marginally and positively correlated with children's healthy food intake at T2, with a *p*-value of 0.056.

Table 2

Correlations between children's dietary intake (healthy and unhealthy foods) at T2, parental self-efficacy, children's food preferences, children's food neophobia and neophilia, and children's dietary intake at T1

	Child's dietary intake (T2)	
	Healthy foods	Unhealthy foods
Concerns about child's weight	0.258	-0.143
Self-efficacy	0.390**	-0.461**
Preferences for healthy food	-0.160	0.186
Preferences for unhealthy food	-0.211	0.226
Food neophobia	-0.241	0.021
Food neophilia	0.353*	-0.201
Healthy food intake (T1)	0.472**	-0.279
Unhealthy food intake (T1)	-0.405*	0.789**

Note. *Statistical significance at $p < 0.05$, **Statistical significance at $p < 0.01$.

Regarding children's intake of unhealthy foods at T2, two moderate to strong associations were found with parental self-efficacy and children's unhealthy food intake at T1, respectively. Higher intake of unhealthy foods at T2 was correlated with lower parental self-efficacy and a more frequent consumption of unhealthy foods at T1.

Predictors of change in children's healthy and unhealthy food intake following parental intervention

Hierarchical linear regression analyses were run to explore potential predictors of change for children's healthy and unhealthy food intake. Considering children's healthy food intake measured at T2 as outcome, parental self-efficacy, children's food neophilia, and children's unhealthy food intake measured at T1 were included in the regression analysis, as well as parental concerns about the child's weight, because of the marginal results reported above. For children's unhealthy food intake measure at T2, only the parental self-efficacy at T1 was retained as a possible predictor.

In Step 1, healthy food intake at T1 emerged as a significant predictor of the same variable at T2, explained 22,2% of the total variance. Step 2 was repeated separately with four variables: concerns about the child's weight, self-efficacy, food neophilia, and unhealthy food intake at T1 (Table 3).

Table 3

Identification of the predictors of child's healthy food intake at T2: Hierarchical linear regression analysis

Predictors	B	S.E.	β	t	Sig.	ΔR^2	
Step 1	Healthy food intake (T1)	0.434	1.749	0.472	3.253	0.002	0.222**
Step 2	Healthy food intake (T1)	0.459	0.127	0.499	3.600	0.001	0.091*
	Concerns about child's weight	0.324	0.148	0.303	2.189	0.035	
Step 2	Healthy food intake (T1)	0.367	0.132	0.399	2.774	0.009	0.079
	Self-efficacy	0.168	0.083	0.290	2.015	0.051	
Step 2	Healthy food intake (T1)	0.374	0.135	0.406	2.764	0.009	0.056
	Food neophilia	0.112	0.067	0.245	1.664	0.105	
Step 2	Healthy food intake (T1)	0.341	0.141	0.371	2.423	0.021	0.059
	Unhealthy food intake (T1)	-0.133	0.077	-0.263	-1.717	0.095	

Note. *Statistical significance at $p < 0.05$, **Statistical significance at $p < 0.01$.

Controlling for the effects of healthy food intake at T1, the findings suggested that there is a significant impact of parental concerns ($\beta=0.303, p=0.035$) and one marginally significant impact of self-efficacy ($\beta=0.290, p=0.051$) on children's healthy food intake at postintervention. Both children's food neophilia and unhealthy food intake at T1 did not emerge as significant predictors of this outcome.

A final analysis was performed to include both parental concerns about the child's weight and parental self-efficacy as predictors of children's healthy dietary intake (Table 4). Although the proposed model predicted scores on healthy food intake to a statistically significant degree ($p=0.023$), the inspection of individual predictor coefficients suggested that both variables only marginally predicted changes in the variable after the intervention ($\beta=0.272, p=0.052$ for parental concerns; $\beta=0.255, p=0.076$ for self-efficacy). The model accounted for a significant proportion of the total variance (37,4%).

Table 4

Final model for prediction on children's healthy food intake at T2: Hierarchical linear regression analysis

Predictors		B	S.E.	β	<i>t</i>	Sig.	ΔR^2
<i>Step 1</i>	Healthy food intake (T1)	0.434	1.749	0.472	3.253	0.002	0.222**
<i>Step 2</i>	Healthy food intake (T1)	0.398	0.128	0.433	3.109	0.004	0.060*
	Concerns about child's weight	0.291	0.144	0.272	2.012	0.052	
	Self-efficacy	0.147	0.081	0.255	1.829	0.076	

Note. *Statistical significance at $p<0.05$, **Statistical significance at $p<0.01$.

Regarding unhealthy food intake (Table 5), in Step 1, the same variable at T1 was a significant predictor, explaining 62,3% of the total variance. Parental self-efficacy was included in Step 2, but this cognitive variable did not emerge as a significant predictor of changes after intervention.

Table 5

Identification of the predictors of children's unhealthy food intake: Hierarchical linear regression analysis

Predictors		B	S.E.	β	<i>t</i>	Sig.	ΔR^2
<i>Step 1</i>	Unhealthy food intake (T1)	0.637	0.082	0.789	7.816	0.000	0.623**
<i>Step 2</i>	Unhealthy food intake (T1)	0.590	0.091	0.731	6.467	0.000	0.013
	Self-efficacy	-0.108	0.105	-0.127	-1.127	0.267	

Note. *Statistical significance at $p<0.05$, **Statistical significance at $p<0.01$.

Discussion

The present study aimed to examine whether parental cognitive variables (concerns about the child's weight and self-efficacy) and children's characteristics (food preferences and food neophobia/neophilia) predicted children's healthy and unhealthy food intake after a brief parental intervention. Two major findings can be summarized. First, the *Red Apple* program effectively increased healthy and decreased unhealthy children's food intake as reported by parents. This is an encouraging result, given the low dosage of the intervention and the mean scores at baseline

for both outcomes, which suggest that this group of children had already moderate to good dietary patterns before the intervention. Earlier reviews concluded that, compared with interventions exclusively based on nutritional education, behavioral interventions that target parents as the main agents of change seem to be more successful in promoting effective and long-lasting changes in children's eating patterns (Hingle et al., 2010; Nixon et al., 2012). The effect size for changes between T1 and T2 was higher for healthy dietary intake, which could suggest that either the strategies used were more effective in promoting the intake of this type of food, or that decreasing the child's consumption of sugary and fat foods is more challenging for parents.

Secondly, few potential predictors for children's healthy (self-efficacy, food neophilia, parental concerns, unhealthy food intake at T1) and for unhealthy food intake (self-efficacy) following the parental intervention, achieved significant results in the hierarchical regression analyses. For healthy dietary intake, the final model, with both parental concerns and self-efficacy combined, significantly predicted the scores at T2, indicating that children whose parents were more concerned about the child's weight and who perceived themselves as better able to influence the child's diet before the intervention, showed higher intake of healthy foods at the end of the program. An earlier study concluded that parents more concerned about their child's weight were more likely to report efforts to improve their child's diet, through increasing chicken and fish consumption (Moore et al., 2012). Parental self-efficacy was previously found to be associated (Campbell et al., 2010; Ice et al., 2014; Parekh et al., 2017) or to predict (Ice et al., 2014; Parekh et al., 2017) preschool children's intake of fruits and vegetables. Although the individual contributions of the variables achieved only a marginal p-value, and a considerable percentage of variance in healthy food intake at T2 remains to be explained, the potential value of these results should not be neglected since the small sample size may have limited the statistical power of the analyses.

Our findings point to the importance of parental cognitive factors on treatment gains regarding the promotion of their child's healthy eating behaviors. It is possible that higher concerns about the child's weight, suggesting a higher perception of risk at baseline, enhances the parents' receptivity to the strategies conveyed in the intervention, specifically those directed to offer a more diversified and balanced diet. On the other hand, when the parents perceive themselves already as moderately efficient in influencing their child's eating patterns, they may be more willing to use the strategies proposed during the program and thus achieve better results. Both parental recognition of the child's weight as a health problem (Rhee, DeLago, Arscott-Mills, Mehta, & Davis, 2005) and perceived self-efficacy (Hildebrand & Betts, 2009) have been previously acknowledged as relevant cognitive determinants of health behavior at a preparation/action stage of change (Prochaska & Velicer, 1997). The absence of results regarding children's neophobia/neophilia and food preferences might indicate that the program effectively increased healthy foods intake, independently of these individual characteristics of the child, showing that even children that are more neophobic can profit from small changes in parental strategies.

Children's unhealthy dietary intake after intervention was not significantly predicted by parental self-efficacy at T1. This result contrasts with several earlier cross-sectional studies reporting that parents with higher self-efficacy had children with lower intake of sodas, snacks, and candies (Campbell et al., 2010; Parekh et al., 2017). In our study, the larger variance in unhealthy food intake at T2 was explained by the same variable at T1 itself, approximately 3 times more than the contribution of healthy food intake at T1 for T2. These results may indicate that, although possible to change, unhealthy dietary patterns are a more stable dimension, possibly more influenced by innate biological mechanisms, as the predisposition to accept sweet and salty foods, or by the post-ingestion effects of high-fat foods (Birch, 1998). As such, effective changes on children's consumption of sugary and fatty foods can be more difficult to achieve during preschool years,

when the innate preference for these foods has already been reinforced by repeated exposure, pointing to the need for an earlier intervention (namely, during the transition for omnivorous diet) by postponing or reducing the offer of these foods.

It is important to note several limitations of this study. As mentioned before, this work was conducted with a small sample, which may partially explain less conclusive results. Further studies with larger samples are needed to confirm the proposed models and clarify other contributions for the remaining variance. Additionally, the results may not be replicable in samples in which parents are more reluctant to participate or less interested in such programs or with children with an unhealthier diet or excessive weight.

Implications for practice

The present study emphasizes the role of parental cognitive variables, such as parental concerns about weight and self-efficacy, on the development of children's healthy eating patterns. As such, programs that help parents to recognize the risks associated with excessive weight and to understand how they can effectively promote healthy eating patterns in their child might contribute to positive changes in children's diet. Interventions similar to the *Red Apple* program can be more effective with parents who are already moderately concerned about the child's weight and confident about their own ability to promote healthy eating during infancy. Further decisions regarding the content, the dosage of the intervention, and the moment to intervene must be considered to overcome the difficulties found in changing children's unhealthy food intake.

References

- Ajzen, I. (1985). From intention to actions: A theory of planned behavior. In J. Kuhl & J. Beckman (Eds.), *Action-control: From cognition to behavior* (pp. 11-39). Heidelberg, Germany: Springer.
- Bante, H., Elliott, M., Harrod, A., & Haire-Joshu, D. (2008). The use of inappropriate feeding practices by rural parents and their effect on preschoolers' fruit and vegetable preferences and intake. *Journal of Nutrition Education and Behavior*, *40*, 28-33. Retrieved from <https://doi.org/10.1016/j.jneb.2007.02.007>
- Birch, L. L. (1998). Development of food acceptance patterns in the first years of life. *Proceedings of the Nutrition Society*, *57*, 617-624.
- Brown, T., Kelly, S., & Summerbell, C. (2007). Prevention of obesity: A review of interventions. *Obesity Reviews*, *8*, 127-130. Retrieved from <https://doi.org/10.1111/j.1467-789X.2007.00331.x>
- Campbell, K., & Hesketh, K. (2007). Strategies which aim to positively impact on weight, physical activity, diet and sedentary behaviours in children from zero to five years: A systematic review of the literature. *Obesity Reviews*, *8*, 327-338. Retrieved from <https://doi.org/10.1111/j.1467-789X.2006.00305.x>
- Campbell, K., Hesketh, K., Silverii, A., & Abbott, G. (2010). Maternal self-efficacy regarding children's eating and sedentary behaviours in the early years: Associations with children's food intake and sedentary behaviours. *International Journal of Pediatric Obesity*, *5*, 501-508. Retrieved from <https://doi.org/0.3109/17477161003777425>
- Cerin, E., Barnett, A., & Baranowski, T. (2009). Testing theories of dietary behavior change in youth using the mediating variable model with intervention programs. *Journal of Nutrition Education and Behavior*, *41*, 309-318. Retrieved from <https://doi.org/10.1016/j.jneb.2009.03.129>

- Cooke, L., Carnell, S., & Wardle, J. (2006). Food neophobia and mealtime food consumption in 4-5 year old children. *International Journal of Behavioral Nutrition and Physical Activity*, 3, 14. Retrieved from <https://doi.org/10.1186/1479-5868-3-14>
- Cooke, L., Wardle, J., & Gibson, E. L. (2003). Relationship between parental report of food neophobia and everyday food consumption in 2-6-year-old children. *Appetite*, 41, 205-206. Retrieved from [https://doi.org/10.1016/S0195-6663\(03\)00048-5](https://doi.org/10.1016/S0195-6663(03)00048-5)
- Fisher, J. O., Mitchell, D. C., Smiciklas-Wright, H., & Birch, L. L. (2002). Parental influences on young girls' fruit and vegetable, micronutrient, and fat intakes. *Journal of the American Dietetic Association*, 102, 58-64. Retrieved from [https://doi.org/10.1016/S0002-8223\(02\)90017-9](https://doi.org/10.1016/S0002-8223(02)90017-9)
- Fletcher, A., Wolfenden, L., Wyse, R., Bowman, J., McElduff, P., & Duncan, S. (2013). A randomised controlled trial and mediation analysis of the 'Healthy Habits', telephone-based dietary intervention for preschool children. *International Journal of Behavioral Nutrition and Physical Activity*, 10, 43-54. Retrieved from <https://doi.org/10.1186/1479-5868-10-43>
- Gerards, S., Sleddens, E. F., Dagnelie, P. C., Vries, N. K., & Kremers, S. P. (2011). Interventions addressing general parenting to prevent or treat childhood obesity. *International Journal of Pediatric Obesity*, 6, e28-e45. Retrieved from <https://doi.org/10.3109/17477166.2011.575147>
- Golan, M., & Crow, S. (2004). Parents are key players in the prevention and treatment of weight-related problems. *Nutrition Reviews*, 62, 39-50. Retrieved from <https://doi.org/10.1301/nr.2004.jan.39-50>
- Golley, R., Hendrie, G. A., Slater, A., & Corsini, N. (2011). Interventions that involve parents to improve children's weight-related nutrition intake and activity patterns-what nutrition and activity targets and behaviour change techniques are associated with intervention effectiveness?. *Obesity Reviews*, 12, 114-130. Retrieved from <https://doi.org/10.1111/j.1467-789X.2010.00745.x>
- Gomes, A. I., Barros, L., & Pereira, A. I. (2017). Predictors of parental concerns about child weight in parents of healthy-weight and overweight 2-6 year olds. *Appetite*, 108, 491-497. Retrieved from <https://doi.org/10.1016/j.appet.2016.11.008>
- Gomes, A. I., Barros, L., Pereira, A. I., & Roberto, M. S. (2018). Effectiveness of a parental school-based intervention to improve young children's eating patterns: A pilot study. *Public Health Nutrition*, 21, 2485-2496. Retrieved from <https://doi.org/10.1017/S1368980018000952>
- Gomes, A. I., Barros, L., Pereira, A. I., Roberto, M. S., & Mendonça, M. (2018). Assessing children's willingness to try new foods: Validation of a Portuguese version of the Child's Food Neophobia Scale for parents of young children. *Food Quality and Preference*, 63, 151-158. Retrieved from <https://doi.org/10.1016/j.foodqual.2017.09.002>
- Hildebrand, D. A., & Betts, N. M. (2009). Assessment of stage of change, decisional balance, self-efficacy, and use of processes of change of low-income parents for increasing servings of fruits and vegetables to preschool-aged children. *Journal of Nutrition Education and Behavior*, 41, 110-119. Retrieved from <https://doi.org/10.1016/j.jneb.2008.09.007>
- Hingle, M., O'Connor, T., Dave, J., & Baranowski, T. (2010). Parental involvement in interventions to improve child dietary intake: A systematic review. *Preventive Medicine*, 51, 103-111. Retrieved from <https://doi.org/10.1016/j.ypmed.2010.04.014>
- Ice, C. L., Neal, W. A., & Cottrell, L. (2014). Parental efficacy and role responsibility for assisting in child's healthful behaviors. *Education and Urban Society*, 46, 699-715. Retrieved from <https://doi.org/10.1177/0013124512468004>
- Lopes, C., Oliveira, A., Afonso, L., Moreira, T., Durão, C., Severo, M., . . . Barros, H. (2014). *Consumo alimentar e nutricional de crianças em idade pré-escolar: Resultados da coorte geração 21 [Food and nutritional intake of preschool children: Results from the 21 generation cohort]*. Porto: Instituto de Saúde Pública da Universidade do Porto.

- Matheson, D., Spranger, K., & Saxe, A. (2002). Preschool children's perceptions of food and their food experiences. *Journal of Nutrition and Education Behavior*, *34*, 85-92.
- McClain, A. D., Chappuis, C., Nguyen-Rodriguez, S. T., Yaroch, A. L., & Spruijt-Metz, D. (2009). Psychosocial correlates of eating behavior in children and adolescents: A review. *International Journal of Behavioral Nutrition and Physical Activity*, *6*, 54-74. Retrieved from <https://doi.org/10.1186/1479-5868-6-54>
- McGowan, L., Croker, H., Wardle, J., & Cooke, L. J. (2012). Environmental and individual determinants of core and non-core food and drink intake in preschool aged children in the United Kingdom. *European Journal of Clinical Nutrition*, *66*, 322-328. Retrieved from <https://doi.org/10.1038/ejcn.2011.224>
- Michaelsen, K. F., Weaver, L., Branca, F., & Robertson, A. (2000). *Feeding and nutrition of infants and young children: Guidelines for the WHO european region, with emphasis on the former Soviet countries*. Copenhagen, Denmark: WHO Regional Publications.
- Moore, L., Harris, C., & Bradlyn, A. (2012). Exploring the relationship between parental concern and the management of childhood obesity. *Maternal & Child Health Journal*, *16*, 902-908. Retrieved from <https://doi.org/10.1007/s10995-011-0813>
- Nixon, C., Moore, H., Douthwaite, W., Gibson, E., Vogeles, C., Kreichauf, S., . . . Summerbell, C. (2012). Identifying effective behavioural models and behaviour change strategies underpinning preschool and school-based obesity prevention interventions aimed at 4-6-year-olds: A systematic review. *Obesity Reviews*, *13*, 106-117. Retrieved from <https://doi.org/10.1111/j.1467-789X.2011.00962.x>
- Parekh, N., Henriksson, P., Delisle Nyström, C., Silfvernagel, K., Ruiz, J. R., Ortega, F. B., . . . Löf, M. (2017). Associations of parental self-efficacy with diet, physical activity, body composition, and cardiorespiratory fitness in Swedish preschoolers: Results from the MINISTOP trial. *Health Education & Behavior*, *1*, 1-9. Retrieved from <https://doi.org/10.1177/1090198117714019>
- Patrick, H., & Nicklas, T. (2005). A review of family and social determinants of children's eating patterns and diet quality. *Journal of the American College of Nutrition*, *24*, 83-92. Retrieved from <https://doi.org/10.1080/07315724.2005.10719448>
- Pliner, P. (1994). Development of measures of food neophobia in children. *Appetite*, *23*, 147-163. Retrieved from <https://doi.org/10.1006/appe.1994.1043>
- Pocock, M., Trivedi, D., Wills, W., Bunn, F., & Magnusson, J. (2010). Parental perceptions regarding healthy behaviours for preventing overweight and obesity in young children: A systematic review of qualitative studies. *Obesity Reviews*, *11*, 338-353. Retrieved from <https://doi.org/10.1111/j.1467-789X.2009.00648.x>
- Prochaska, J. O., & Velicer, W. F. (1997). The transtheoretical model of health behavior change. *American Journal of Health Promotion*, *12*, 38-48.
- Rhee, K., DeLago, C., Arscott-Mills, T., Mehta, S., & Davis, R. K. (2005). Factors associated with parental readiness to make changes for overweight children. *Pediatrics*, *116*, e94-e101. Retrieved from <https://doi.org/10.1542/peds.2004-2479>
- Rogers, R. W. (1983). Cognitive and physiological processes in fear appeals and attitude change: A revised theory of protection motivation. In J. R. Cacioppo & R. E. Petty (Eds.), *Social psychology: A source book* (pp. 153-176). New York: Guilford Press.
- Swyden, K., Sisson, S. B., Lora, K., Weedn, A., Sheffield Morris, A., DeGrace, B., & Copeland, K. A. (2015). Relationship between parental perception and concern for child weight and influence on obesogenic parenting practices. *Advances in Pediatric Research*, *2*, 12-21. Retrieved from <https://doi.org/10.12715/apr.2015.2.12>
- WHO. (2009). *Infant and young child feeding: Model chapter for textbooks for medical students and allied health professionals*. Geneva, Switzerland: World Health Organization Press.
- Wyse, R., Wolfenden, L., & Bisquera, A. (2015). Characteristics of the home food environment that mediate immediate and sustained increases in child fruit and vegetable consumption: Mediation analysis from the

Preditores dos resultados de uma breve intervenção parental para promoção da alimentação saudável em crianças portuguesas

Os primeiros anos de vida têm sido reconhecidos com um período crítico para moldar os padrões alimentares da criança. Embora os estudos de intervenções direcionados a crianças pequenas tenham aumentado, com resultados positivos, os moderadores dos ganhos da intervenção e a importância relativa de cada determinante do processo de mudança têm sido raramente explorados. Este estudo teve como objetivo identificar possíveis preditores dos resultados obtidos após uma intervenção parental em contexto escolar, relativamente aos comportamentos alimentares saudáveis e não saudáveis de crianças pré-escolares. Foi realizado um estudo quasi-experimental e longitudinal, com medidas repetidas avaliadas antes e após a participação no programa *Maçã Vermelha*. Os pais e as crianças foram recrutados em jardins de infância do ensino público e de Instituições Particulares de Segurança Social da região de Lisboa. Um total de 44 pais de crianças entre os 3 e os 6 anos aceitaram participar no estudo, e 39 cumpriram os critérios de inclusão. O programa *Maçã Vermelha* incluiu quatro sessões grupais sobre o crescimento e a saúde das crianças pré-escolares, as orientações nutricionais para esta fase de desenvolvimento, e as práticas parentais alimentares mais eficazes. Entre sessões, foram entregues newsletters e atividades para realizar com as crianças. Foi solicitado aos pais que preenchessem instrumentos sobre a criança (consumo de alimentos saudáveis e não saudáveis, preferências alimentares, comportamentos neofóbicos/neofílicos) e sobre si (preocupação com o peso da criança, autoeficácia na promoção de uma alimentação saudável) antes (T1) e depois (T2) da intervenção. Índices mais elevados de preocupação com o peso e de autoeficácia em T1 previram significativamente o consumo de alimentos saudáveis em T2. A única contribuição significativa para o consumo de alimentos não saudáveis em T2 foi o consumo anterior desses alimentos em T1. As intervenções focadas nas variáveis cognitivas dos pais podem contribuir para mudanças positivas no consumo alimentar das crianças pequenas. Os resultados também sugerem que alvos específicos da dieta da criança podem apresentar desafios diferentes, que respondem diferentemente aos mecanismos de influência da intervenção.

Palavras-chave: Ingestão alimentar da criança, Preditores, Preocupação parental com o peso da criança, Autoeficácia parental.

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