# Exploring How a Digitized Program Can Support Parents to Improve Their Children's Nutritional Habits

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**Abstract.** Poor eating habits are one of today's significant menaces to public health. Child obesity is increasing, is a concerning reality, and needs to be appropriately addressed. However, most behavior change programs do not consider the needs of parents and their children, their profiles, and environments in the design of this type of intervention. We present the results of a workshop with dietists and clinical psychologists, professionals that deal with different parents and their children's dietary problems, to understand parents' profiles, attitudes, and perceptions. The main contributions of this study are a set of personas, daily scenarios, and design considerations regarding behavior change programs that can be used to guide the creation of new digital programs. This formative contribution is of interest to researchers and practitioners designing digitized behavior change programs targeted at parents to improve their children's habits.

**Keywords:** Behavior change · Nutrition · Children · Parents · Feeding practices

## 1 Introduction

Eating patterns are established earlier in life and trigger future eating behavior. Parents play an important role in defining children's eating habits [16]. Children with unhealthy nutritional habits are at a higher risk of developing obesity in adults and several associated diseases [17].

Previous studies about children's food intake focus on parents' direct registration of meals or children's direct usage of sensors on forks and plates [4]. Recently, there are already studies focusing on children's food habits improvement throughout their parents [22].


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A program able to effectively change parents feeding and eating behaviors should include more information or strategies besides nutritional ones or meal monitorization. Especially, parents and children's needs should be taken into consideration for improving adherence and engagement [22]. To this end, we need to target users' behavior and analyze their daily routine, motivation to change, and possible obstacles.

In this study, we seek to identify how, why, and when users would adhere to a digital program to change their children's feeding habits. To this end, we considered the need to identify users' characteristics, draw scenarios of their daily lives, and identify possible problems in interacting with a digitized program. For that purpose, we performed a workshop with dietists and clinical psychologists, since they have contact with different parents and children's ecosystems, to understand the following:

1. What impact parents' mental models, motivations and goals have in their willingness to change children's nutritional habits?
2. What influence may parents' daily routines, priorities and barriers have when changing their children's nutritional habits?
3. How and when can a digital platform leverage parents to successfully change their children's habits?

## 2 Related Work

A diet low in fruits and vegetables is one of the challenges facing Western societies today due to its association with increased cardiovascular risk, and certain types of cancer [14]. Simultaneously, we can observe a health improvement and reduce heart problems by reducing saturated fat, and added sugars [5,14].

Children's food intake happens regularly in a home setting [23], with parents being the main responsibles for children eating habits [11]. Therefore, parents are targeted in previous studies as effective agents in positively influencing children's food intake [7]. Nevertheless, the primary constraints are the lack of consistency and permanent engagement in these strategies [6]. As an alternative, studies are positioned on the children's side, providing several ways of feedback to maintain engagement as the usage of lights, music, and photos [2,3,12,13]. However, these approaches might bring unwanted distractions during mealtimes and have questionable efficacy in long-term [10] as they draw too much attention away from the meal itself [10,18].

To aid in surpassing this disengagement, gamified digital health apps to report food intake are common. In App stores (e.g., Google Play Store or Apple Store), we find a range of applications categorized as Nutritional Behavior Change Apps, which encourage people to control food intake. These apps allow the person's education and training maximization to make more conscious food decisions [6].

Therefore, this work presents Lessons Learned based on information gathered with nutrition experts and psychologists regarding parent's profiles and personalization that supplement theory-based approaches to help predict behavior

changes through a proactively planned implementation to control the outcomes adequately.

## 3 Workshop with Psychologists and Dietists

Using a participatory design approach with psychologists and dietists from Portugal, we performed an in person workshop to identify the possible barriers and facilitators to motivate parents to change their children's (from 2 to 6 years old) food habits. We aimed to capture the field experts' vision and extrapolate possible influences for the design process.

### 3.1 Participants

Adding to our research team members (3 clinical psychologists and 1 dietist) we recruited additional participants: 1 dietist, 1 psychologist in public health, and 2 clinical psychologists with experience in behavior change, particularly in nutrition, and in working with parents. We divided participants into four groups of two. Each research team member was matched with an outside participant.

### 3.2 Procedure

The entire session had a duration of 2h30. At the beginning, we gave a brief explanation of the session. We divided the workshop into three activities with limited time: *personas*, scenarios, and storyboards. Given the Stakeholders' background, we asked them to characterize patients they have and their difficulties in following an eating behavior change program, either in paper and pencil or digital. In the end, we had a final session debriefing.

***Persona*'s Activity.** The aim was to characterise possible users' profiles (i.e. parents) and their children (i.e. the specific target behaviors). We gave each team cards with possible topics (goals, attitude, priorities, obstacles, motivations, feelings) to aid them in describing each persona. **Scenarios' Activity.** To further characterize these *personas*, we challenge each group to describe each *persona*'s day in detail. This activity could show the difficulties and obstacles to establish a healthy diet and behavioral change. Besides, it enables to envision the toxic habits or barriers families could have in persecuting their goals. It may help to identify the strategies and attitudes of the parents when children fail their expectations. Besides, these scenarios could help extract crucial aspects of parents' relationship, whether they were or not divorced, and grandparents' inclusion in the child's routine.

**Storyboards' Activity.** We asked participants to draw a storyboard considering the *personas* and scenarios just created. The activity included a hypothetical platform (digitized program) to change children's diet and habit behaviors. We used this technique to motivate participants to explore and identify the interactions between *personas*, their scenarios, and the hypothetical platform.

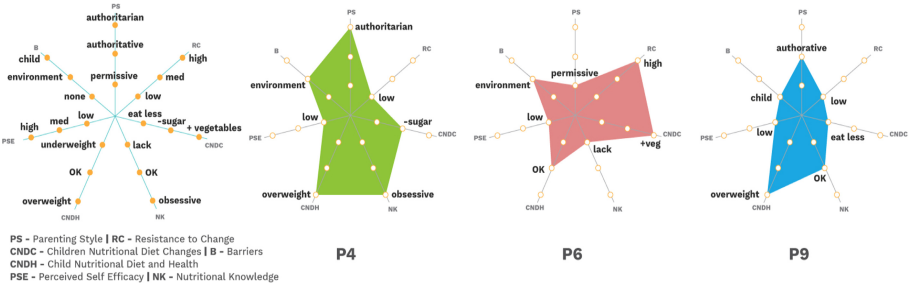


**Fig. 1.** Illustration of the results for *personas* P4, P6 and P9.

This activity could help to highlight relevant aspects that deserve attention for designing: the user experience, believes, and daily routines; possible difficulties and opportunities; trigger events and the solutions to them.

### 3.3 Analyses

We started by looking at the personas created by the participants. Furthermore, we also considered participants' additional notes and the scenarios created to extract prominent themes using open coding. Afterwards, we added to the analysis the storyboards and generated our affinity diagram. Our study generated 10 personas, 9 scenarios, and 10 storyboards which allowed us to identify the heterogeneities of families with children and how their environment influenced children's diet.

## 4 Findings

Throughout the sessions, stakeholders exposed parenting styles, nutritional knowledge, barriers, parent's beliefs and confidence and children's characteristics. Results are illustrated in Fig. 1.

### 4.1 Parenting Styles

Parenting styles are strongly related to parent's adherence to health programs and the responsiveness of their children [21]. We have identified in our results three parenting styles: authoritarian, authoritative, and indulgent or permissive. Authoritarian parents are those with low responsiveness but high demand to their children; their style is rule-based regardless of their child's preferences. *Persona* #4 elucidates this type of attitude; the father is rigid, inflexible, and punishes his son without explaining the reasons beyond it: *"[...] the child asks grandma 200 g of gummies. Afterwards, [the child] has his mouth dirty when he arrives at home and [for that reason] his father punishes him before dinner. Then, they have [a healthy] dinner in silence."*

In the storyboard, P4 brought up challenges to be considered in the design process. P4 seems a little obsessive with a need to control the program as also his environment. This father wants to receive personal notifications with the goals and reflections about the strategies monitored the day before every time he turns his computer ON. This father is a person that likes to be informed; he wants to listen to the contents of each session several times, and for that reason, he prefers to listen to the audio so he could do other things at the same time (e.g., cooking). Besides, as it emerged from the storyboarding and debrief session, this father would constantly need positive reinforcement. The digitized program could include messages and notifications about the achievement of the objectives and activities so far and a progress bar, so the father would be aware of his outcomes and what is missing. So, it is essential to consider such parents who need to receive daily feedback and download materials.

We also identified authoritative parents who try to handle different patterns of behavior and negotiate with the child. This parenting style is related to a high level of demand and rules with high responsiveness to the child in the medium term. They also may exclude going to someplace that could induce some unhealthy temptation to the child, for instance: *"They go to the park and the child asks for an ice cream, and the parents want a cup of coffee, but they do not go to the coffee shop to not expose the child to temptation" - P9.* These parents are already making some efforts to change their children's diet, but they would need guidance to overcome their major obstacle, environmental barriers, as we will refer to later.

Another observed parenting style was indulgent or permissive. This style fosters an environment of acceptance, affection, and dialogue but in contrast with authoritarian, they do not impose rules, and children may have inadequate nutritional habits [21], as in P3: *"[Father] got up at 12h to get prolonged fasting - the son starts school at 13h30. Son woke up at 10 am, eats unhealthy cereals, and watches TV until 12h."*

**Lesson Learned 1: Design Tailored Program Considering Parenting Styles.** The program should provide tailored messages, according to parenting styles, advice, and training on how to change their child's behavior (e.g., setting rules) and increase authoritative parenting practices. This has been targeted as essential for successful interventions, but still, research in this domain are scarce [20].

**Lesson Learned 2: Design Tailored Notifications Considering Parenting Styles.** Give parent's enough options to ease their interaction with the app that supports their parenting style. Parents could select at which time and day and in which device do they want to receive app's notifications, timing between notifications, timing of snoozing, saving data when some disruption happens after x minutes, etc. As our findings indicate some parenting styles would need to receive notifications each day (e.g.: permissive) while others will just need weekly notifications, for instance authoratarian.

### 4.2 Nutritional Knowledge

Nutritional knowledge was another theme from our analyses that may also impact parents willing to change their children's nutritional habits. In this context, nutritional knowledge is the understanding of the health risks and benefits of health practices and the information needed to perform the behavior change. Our results highlighted that parents have different attitudes to follow a program depending on the *children's nutritional diet and health*. Two *personas* had their child facing serious nutritional problems, and children should eat less and better. This simulates what often happens at the doctor, psychologist, or dietist. Some parents are not aware of the risks of having nutritional problems like obesity or/and do not perceive their child as obese (e.g., *P9*). Parental nutrition knowledge also plays a role in the development of child obesity since parents must have a good working knowledge of healthy foods and age-appropriate portion sizes in order to improve food shopping, preparation, and delivery for their children [19].

On the one hand, we identified in our results the recreation of parents with lack of knowledge which is highly correlated with child obesity [19]. For instance, P5 simulates those parents that have an obese child and exhibit a lack of knowledge in two dimensions, consequences of unhealthy food and consequences of obesity. Stakeholders referred that *"P5 consider that the child is healthy and that the pediatrician exaggerates a little. They think the child will learn to choose by himself and will stop eating so much."*

During storyboarding it arose the issue of how to tailor messages/program content for those parents that already have good nutritional knowledge and practice. For instance, the mother recreated in *Persona* 9 already has good nutrition habits and attitudes. So, when participating in sessions to change nutritional behaviour, she will be willing to receive information that perfectly fits her needs, as for instance, strategies to guide the child eating behavior. However, if a session is not related to her current problem, such session would be seen as useless by her and she could quit.

**Lesson Learned 3: Tailor Guided Nutritional Knowledge.** Identify parents' nutritional knowledge and tailor notifications to perfectly fit their needs (e.g. strategies to employ with the children, grandparents, etc.) to avoid boredom or the sensation of lack of personalization.

Identify those parents who misunderstand nutritional habits and consequences in the long term and promote nutritional knowledge: tailored notifications of healthy foods and age-appropriate portion sizes to improve food shopping, preparation, and delivery for their children.

### 4.3 Perceived Self-efficacy

People's confidence in their ability to perform a behavior that leads to an outcome is named perceived self-efficacy [1]. To change the eating behavior, parents first need to identify which behavior needs to be changed and recognize its importance, but also they need to have the confidence and readiness to accomplish it.

Five out of the 10 *personas* represented persons not confident in the treatment success, and 3 of them have the intention and motivation to follow a program to change their children's nutritional habits. The lack of perceived self-efficacy is an important predictor of failure, as indicated in studies with adults to lose weight [8]. However, intention and motivation could moderate this factor.

In the storyboard, several issues related to reduced confidence emerged. For instance, parents would quickly lose interest in the activities and expect results without putting in too much effort. To mitigate this, parents could have a high success rate in the digitized program's activities and several messages with positive reinforcement. Stakeholders referred that parents would need to feel that they have the conditions to do so and that they are in the right way, which can be reinforced by the program.

**Lesson Learned 4: Increase Confidence in Behavioral Change and in Self-efficacy.** To create a positive attitude towards the recommended behavior and increase self-efficacy to perform the behavior, we obtained several insights from our results. For example: a) Display the success rate, progress bar and provide positive reinforcement. b) Refocus on positive outcomes to the detriment of failures. c) Provide suggestions to improve their conditions to behavior change (time and money-saving). d) Provide examples and facts of people that were able to change their children's nutritional behavior.

### 4.4 Barriers

Barriers have an high implication in the perceived self-efficacy of parents and consequently to adherence and program compliance. Specifically, P2, P6, and P9 had a critical barrier that could impede their effort to change the behavior. The family eating *environment* and daily routines could be influencing unhealthy nutrition behaviors. In these three cases, the *grandmother* was responsible for children's school-home transportation and cooking unhealthy meals, which is a persistent barrier. Studies highlight that grandparents may have inappropriate perceptions, knowledge (nutritional facts) and behavior (for e.g. overfeeding, indulging children by excusing children to eat healthy food, and by considering that over weighted children are more healthy, happy and strong [9,15]. For these reasons, the digitized program could guide parents in approaching their family to integrate healthy nutritional habits.

Besides, parents perceived capability also strongly depends on *children characteristics* as temperament, eating traits, and learned behaviors. For instance, parents that attribute the problem to stable child characteristics, as P2 - in which parents have the perception that they have tried everything unsuccessfully and that the child would not change her temperament - would possibly lead to some disbelief about changing their child eating behavior.

**Lesson Learned 5: Awareness of Possible Environmental Barriers.** Help parents identify environmental barriers, such as school eating menus, peers influence, grandparents eating habits). Moreover, guide parents with strategies to overcome such barriers. This could be done by giving specific and tailored messages to communicate with family (e.g., grandparents) and school communities to engage them as part of the change to healthy behaviors, e.g., what to say, printing graphs of progress, goals, and objectives of the weeks.

Help parents understand which characteristics of the children are stable and unchangeable and which are prone to modifications. Give parents strategies to shape children's personalities.

In sum, parents may have great resistance to treatment due to their lack of confidence and self-efficacy in changing their child's eating behavior due to their attribution to their stable characteristics or grandparents' nutritional habits.

## 5 Discussion

Our motivation in this study comes from the need to complement previous interdisciplinary knowledge regarding professionals' information, tailored feedback, and how the parents play a crucial role in influencing child eating behaviors [16,22] . Our work identified specific factors that influence parents' readiness and confidence to participate in these programs for changing their young children eating habits. Our findings highlight the heterogeneity between parents. Furthermore, we elucidate the role different parental styles, goals, motivations, nutritional knowledge, and perceived barriers have when designing digitized programs.

However, our results could be limited because they do not consider parents' and children's perspectives which it would be our next step in the future. Future work should address this topic to increase knowledge and help understand what should be considered when building these application types.

In sum, all the workshop activities helped in abstracting the possible solutions that should be considered when designing applications for improving young children's diets throughout their parents.

## 6 Conclusion

This work contributes to revealing the ecosystem that influences children's food habits and their implications for practitioners and researchers in developing digitized programs to change young children's nutritional habits. Furthermore, this work revealed the need of further explorations with grandparents, parents, and school caregivers to understand the environment that surrounds children profoundly. Hence, there is a need to unfold such complex subjects to develop personalized and tailored programs capable of introducing fundamental changes in the child's eating habits.

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