Switching Mediterranean Consumers to Mediterranean Sustainable Healthy Dietary Patterns

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History of changes

Version	Author	Date	Comments
0.1	BUU	26.01.2023	1st draft
0.2	BUU	29.09.2023	2nd draft
0.3	BUU & CREDA	03.11.2023	3rd draft. Integration of CREDA comments
0.4	BUU & CREDA	05.11.2023	4th draft. Integration of results of subtask 1.3.2. (second round of FGs)
0.5	BUU & CREDA	06.11.2023	5th draft. Integration of results of subtask 1.3.2. (second round of FGs)
0.6	BUU & CREDA	12.11.2023	6th draft. Integration of results of subtask 1.3.2. (second round of FGs)
0.7	EUT	30.11.2023	Scientific review
1.0	ENCO	12.12.2023	Quality assessment and final version

Table 1: History of changes

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Abbreviations and Acronyms

Abbreviation / Acronym	Description
EAN	European Article Number
FG	Focus group
MD	Mediterranean Diet
PA	Physical Activity
WHO	World Health Organization
WP	Work package

Executive Summary

This delirevable constitutes the scientific report of the research carried out in the WP1 Task 1.3, led by Bursa Uludag University. In this task (WP1, Task 1.3.), it was aimed to co-create and validate with the families the different products developed during the project: the snacks, the educational material and the app.

In this regard, it was decided to hold focus group (FG) studies/discussions in three different Mediterranean countries (Türkiye, Spain and Morocco) in order to collect the information from the families regarding awareness of Mediterranean Diet (MD) as a healthy dietary pattern.

The consumer-centered FG activities were conducted on two main targets:

- FGs to detect main barriers for the adherence to MD and preferences of plant-based ingredients for the development of the innovative snacks (M8).
- FGs to validate the snack prototypes developed (Substask 2.2.2) and validate the education material and digital tools developed in WP3 (M18).

In order to have a common structure in the three case studios, a qualitative methodology training was held in M6 meeting by CREDA, to implement the same methodology in the FGs (I) in each country.

The use of semi-structured questions was carried out in the participatory events with families. Health nutrition perception and MD knowledge, barriers for the adherence to MD and approaches and suggestions to the use of digital tools in families were discussed. Their approaches and suggestions in order to help in the co-creation of educational materials, and preferences of ingredients for healthy snacks were determined.

Regarding the perception of healthy nutrition and the MD, Turkish and Spanish participants expressed a common opinion close to what MD stands for, consisting on a perception that it is a combination of various food groups, consumption of large amounts of vegetables and fruits, fresh and nutritional ingredients and stay away from pre-packaged foods. But the main question is what consumers understand for nutritional ingredients and which barriers exist to make proper assumptions and to get a true addherence to MD.

The results of these two FG activities were collected in this deliverable regarding three aspects:

- Family perceptions of healthy nutrition and MD and the barriers to MD adherence
- Healthy snacks perceptions
- Tools to facilitate adherence to the MD and families' regarded perceptions

Participants expressed common views on issues such for instance the need of the digital tools to provide eduactional tips and awareness raising, and to incorporate nutritional information and scalability to special diets, along with recipes containing portion sizes and preparation methods.

This study was carried out within the scope of the European Union PRIMA project titled 'Switching Mediterranean consumers to Mediterranean sustainable healthy dietary patterns' and numbered as SWITCHtoHEALTHY-GA 2133.

2. Introduction

2.1. Scope and objectives of the deliverable

The main objective of Work Package 1 (WP1) in this project is to understand the barriers, drivers, motivations, and eating behaviors related to the MD. The project aims to gain insight into the factors that hinder or facilitate individuals' adherence to long-term Mediterranean-based eating habits. These factors include social, economic, cultural, and heritage-based aspects, among the others. This understanding is the main focus of WP1.

The main task addressed in this deliverable (task 1.3) is organizing consumer centered FGs sessions in 3 mediterranean countries. This task aims to understand the main obstacles that family members face in adhering to the MD and to cocreate and rank the most effective methods to overcome these obstacles.

2.2. Structure of the deliverable

Deliverable 1.3 is composed of five sub-sections:

- The first section is an executive summary presenting the processes, methods, and main results of the FG discussions.
- The section 2 includes the structure of the report along with the task scope and main objectives.
- In section 3, the methods used in the present task are explained in detail.
- The 4th section is the section where the task results are presented. Perceptions about the MD and examples of the Mediterranean food pyramid obtained from the FG studies are included in this section. In addition, the tools, educational materials used by families and children regarding the MD, and the obstacles and facilitators they encounter while using these are also given in this section. In the last part of this section, the healthy snack prototypes chosen by families are detailed.
- The final section describes the main conclusions that can be drawn from the work undertaken in Task 1.3.

3. Materials and Methods

FG interviews were conducted in two stages. The first round of FGs (subtask 1.3.2) was carried out using the qualitative approach of FG. The second set of FG included tasks to validate and select the developed snack prototypes (subtask 1.3.2). FG discussions of the project were held in Türkiye, Spain, and Morocco.

A total of 13 sessions (FGs) were completed with 116 participants. A representation of different social economic strata was present in the FGs, in order to detect the most important socioeconomic barriers for the MD adherence.

Emojis have grown in popularity as a method for digital communication, and several studies have been conducted linking emojis and the emotional response from food stimuli in adults and in children.

The research team chose to use 7-points scale in children to prevent confusion.

In Türkiye, the 9-point Likert hedonic scale was tested on 10 students. Children under the age of 11 were confused to evaluate the 9-points hedonic criteria. The 9-point likert scale has a potential risk for mixed meaning between similar emojis.

For proper development of the FGs in Spain, the researchers explained the semantic meaning of each emoji in the context of the degustation of the snacks and related to each attribute that was evaluated. This is a very important step to be followed with participatory events with children, in order to get

adjusted results in perception. Emojis in the scale were chosen based on previous FGs studies with children aged 8–11 (Gallo et al., 2017; Swaney-Stueue et al., 2018).

The locally produced plant-based ingredients rich in bioactive compounds identified in Task 1.1 were presented to the families to know their level of knowledge of them, and the degree of incorporation of them in their diets. The objective was to list them in priority of knowledge by parents and likeliness of their children, in order to help in product development in WP2. In order to priorize and identify them, the participants were asked to categorize the ingredients in 3 categories: ingredients perceived as healthy (1), favorite ingredients for their children (considered healthy or not) (2) and ingredients known but not perceived as healthy and that are not favourites to their children (3). Ingredients not included in any of the categories were considered as not known.

FG discussions were recorded with an audio recording device (except FG done with 2 parents who refused in Morocco). All participants provided written informed consent form before starting the sessions (appendix 1). The FGs audio recordingswere converted into text. Thistranscriptions were analyzed thematically using a deductive approach. In this research, FG debates were used as a data collection tool and titles were created according to the questions asked to the participants. The themes that were exposed from the FG activities were: health nutrition perception and MD, approaches, and suggestions to the use of digital tools in families, approaches and suggestions to the use of educational material, and selection of healthy snacks. Indirectly, researchers recalled on the barriers for a proper adherence of the MD. The FG discussions were held in this direction, and the following questions were asked to the participants and opened for discussion: what is a healthy diet for you?; how often do families consume several groups of ingredients weekly?; would an app that helps create family meals be helpful?; what information would you like to have in an app developed to help create family meals?; which features would interest families most?; what would you expect an app to be useful and liked by your teenagers?; which foods do your children have the most difficulty eating?

3.1. Türkiye

FG discussions in Türkiye were conducted in four different groups consisting of eight people, a moderator and a co-researcher. The first and second groups consisted of parents representing low-middle income families with children under the age of 12. The third and fourth groups included parents representing low-middle income families with children over the age of 12.

Figure 1. Focus Group Meeting in Türkiye

3.2. Spain

The study in Spain was conducted with four different FGs and 47 participants. Three groups consisted of participants in the middle-income group. One of the FGs was developed with 7 people with children aged 12 and above, and 15 families had children under 12 and above 12 year old; 24 children under 12 year old and one of their parents participate in 2 more FGs that aimed specially to identify the likeliness

of nutritionally rich ingedients produced in the Mediterranean region and less consumed in Spain, to validate their inclusion in the prototypes of the snacks to be implemented by WP2.

3.3. Morocco

Three FGs with participants from low-income group and two FGs from middle-high income group were performed in Morocco. The majority of participants were women.

The distribution of participants in FGs according to countries is given in the table below (Table 2).

Table 2. Characteristics and distribution of the participants in the focus group discussion by countries.

COUNTRY	FG	DATE	RESPONSES	INCOME	YEARS
TÜRKİYE	FG1	26.12.2022	8 responses	Middle	<12 years old
	FG2	27.12.2022	8 responses	Low	<12 years old
	FG3	29.12.2022	8 responses	Low	>12 years old
	FG4	06.01.2023	8 responses	Middle	>12 years old
SPAIN	FG1	22.12.2022	7 responses	Middle	<12 years old
	FG2	22.12.2022	7 responses	Middle	> 12 yearsold
	FG3	22.12.2022	24 responses (Obtained in direct surveys and testings in schools)	Low	<12 years old
	FG4	22.12.2022	9 responses	Middle	<12 years old
MOROCCO	FG1	29.03.2023	8 Women 15 Children	Low	5 ≤ 12 years old 10 > 12 years old
	FG2	12.04.2023	8 Women 17 Children	Middle High	15 ≤12 years old 2 > 12 years old
	FG3	23.05.2023	10 Women 30 Children	Low	13 ≤ 12 years old 17 > 12 years old
	FG4	25.05.2023	8 Women 28 Children	Low	14 ≤ 12 years old 14 > 12 years old
	FG5	12.06.2023	1 man, 2women	Middle High	4> 12 years old 3 ≤ 12 years old

The need to include innovative ingredients in the prototypes that were not categorized as prefered for the children but show a great nutritional profile and have a sufficient local production was detected as a key fact. This concern was cause of a change in the methodology applied in FG3, where 4 ingredients (nopal, medlar, grapefruit and sumac) were previosly presented to the participants, to evaluate their willingnes to taste and include it in a snack. Therefore, more questions on validating these ingredients with tasting samples were carried out in FG 3 in Spain.

4. Results

4.1. Perception of healthy nutrition and Mediterranean Diet

FG studies were conducted to gain insights into the perceptions and understanding of healthy nutrition and the MD among participants in Türkiye, Spain, and Morocco. The data collected from these studies provides valuable information that can be used to develop targeted interventions and educational materials to promote healthy eating habits and the MD.

4.1.1. Türkiye

At the beginning of the FG study, Turkish participants were asked about their perceptions of healthy nutrition. Most participants evaluated their perception of healthy nutrition as consuming equal and balanced amounts of each food group, reducing sugar consumption, avoiding pre-packaged foods, and eating without skipping meals. Two participants in the low-income group under the age of 12 stated that they perceived healthy nutrition as consuming fresh, organic, and natural foods. Among the answers given by the participants, excessive consumption of nutrients such as protein, fruits and vegetables were also associated with a healthy diet. However, information on the specific composition of this dietary pattern was limited.

4.1.2. Spain

Spanish participants were asked about the characteristics of the MD. Most of the participants associated the MD with the consumption of fruits and vegetables, fresh nutritional ingredients, and a diet consisting of various food groups. Additionally, not consuming fried foods, avoiding processed foods and consuming less meat were among the answers of the participants.

Snacking describes the food and drinks that we have aside from the three main meals of the day, and can help performing a healthy, balanced diet. They are an important part of the diet and can help improving the adherence to MD adherence, since it's an easy meal that can contribuite to 15-30% of energy intake in children. Therefore, parents were asked on what kind of snacks are provided, in order to facilitate data for the development of WP2 and consider limitations on how to implement all the snacks developed. Table 3 shows the results collected in Spain, validating that fruit is very often part of the snacks, and that the fruit and vegetable blends developed by Delafruit – CNTA can be easily implemented during the intervention phase.

Table 3. Afternoon snacks offered to children below 12 years old (Spain case studio)

Id no	Children ages	Afternoon snacks offered
1	5	Banana, industrial biscuits, bread sticks with cream cheese
2	8,11	Sandwich with sourdough bread with avocado or home-made hummus, bread sticks, carrot sticks, fruit.
3	9	Banana, biscuits
4	3, 6	A piece of fruit. When the old one practices sport, one a week, sandwich with cocoa-hazelnut-sugared spread (Nutella style).
5	5	Rice or corn cakes (died snack made of 100% rice/corn) and fruit cut into pieces (apple, banana, mandarin)
6	7, 10	Banana, biscuits
7	8, 14,18	A piece of fruit (small apple, banana) and sandwich with loaf bread (industrial)

10	6,12	Rice cakes with chocolate or yogurt layer and a small piece of fruit
11	5, 3	Cut fruit in a tupperware or banana
12	9, 12	Sandwiches with cheese, cured pork sausage (chorizo, salami). Once a week with chocolate spread (Nutella kind)
13	6	Sandwich of loaf bread made at home with cheese, tuna with cream cheese spread, hummus. Fruit
14	8	Industrial bakery and a piece of fruit (mostly banana)
15	10	Sandwich of baguette kind bread. Sometimes when don't have the time I buy some corn cakes and a piece of fruit
16	7, 9	Pieces of fruit and cookies (industrial) or bread with cream cheese.
17	6	Mandarin or grapes (when season) and sandwich with cocoa-hazelnut-sugared spread (Nutella style) or bread sticks with cheese

4.1.3. Morocco

Moroccan parents were asked which foods their children had the most difficulty eating. Parents stated that their children had difficulty eating vegetables, fish, meat (texture) and sour fruit. They stated that mothers try to make their children eat foods such as vegetables by adding them to cakes. The participants from Morocco were surveyed regarding their understanding and view of the MD. Interestingly, all the female participants were not familiar with the specifics of the MD. However, when discussing healthy nutrition, many emphasized a diet rich in fish (more than red meat and chicken), natural butter, and various vegetables prepared in ways like boiling, steaming, and fresh, especially for those with lower incomes. They also mentioned preferences for homemade dishes, farm chicken, pulses, oat, traditional foods, olive oil, dried fruits, barley and durum wheat, corn, barley soups for breakfast, and a diet that includes a variety of food groups. The emphasis was on reducing sugar intake and opting for fresh, organic, and seasonal natural foods while avoiding pre-packaged and fried foods, particularly among women with lower incomes. Additionally, low-income women preferred couscous, tajine, and traditional dishes. In contrast, some middle-income participants highlighted the importance of proteins from fish, starches, pasta, eggs, fruits, and legumes. Interestingly, one woman from a lower income group defined a healthy diet as consuming tea with low sugar and durum bread. On the other hand, one woman from a higher middle-income group stressed the importance of avoiding edible oil, and another woman from a middle-high-income group emphasized avoiding milk. Lastly, a woman from a middle-high income group associated excessive nutrient consumption, such as protein, with a healthy diet.

None of the participants comented on physical activity as part of the MD. This is an interesting output to make effort by SwitchtoHealthy project and to implement in educational material and technological tools developed in WP3.

4.2. Mediterranean Diet Awareness by Food Pyramid Activity

An activity was held to raise awareness about the MD and to determine the current food habits of families. In this activity, Turkish and Moroccan participants placed visuals of food consumed by their children (those who have more than one child will choose only one child) in the pyramid picture in front of them, according to the frequency of consumption (consumed frequently at the bottom and consumed less frequently towards the top; Figure 2 and 4). Moroccan and Turkish participants were asked to place these food items in the pyramid considering the food consumed by the whole family and also regarding the snacks that children have outside and inside the home. Figure 2 shows the frequency of consumption of processed products and sweets is low in Turkish families. However, contrary to the MD pattern, it was observed that red meat and eggs consumption was more frequent than fruits and vegetables and was almost at the bottom of the pyramid. Moroccan participants stated

that the foods they consume least are sweets. However, the consumption of animal protein-containing foods such as fish, chicken and eggs were at the same level than fuits and vegetables (Figure 4). Participants in Spain were asked to fill in the pyramid according to what they thought MD was. Spanish consumption of food groups of the families participating in the FGs is showed in Figure 3, as a reflection of the average response collected during the participatory events. These results from Spain show a pretty accurate knowledge of MD patterns.

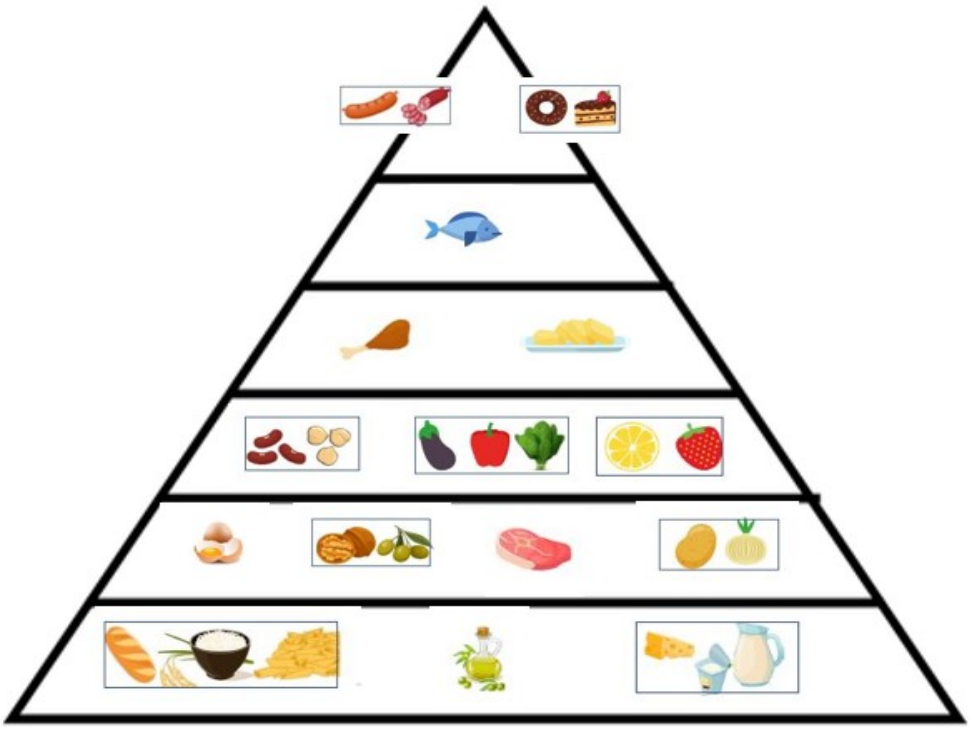

Figure 2. Food items most frequently consumed by Turkish participants

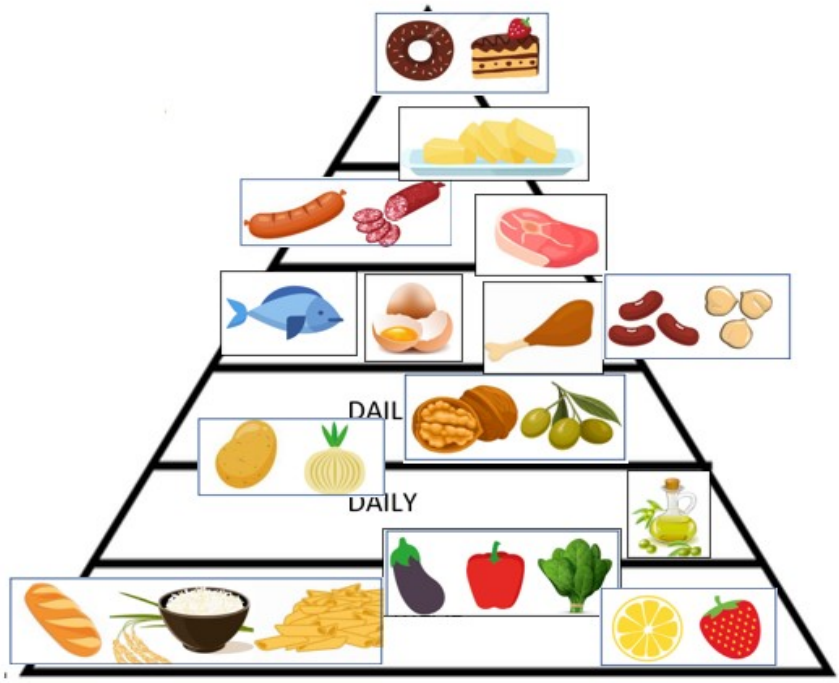

Figure 3. MD pyramid representation according to participants of FGs in Spain

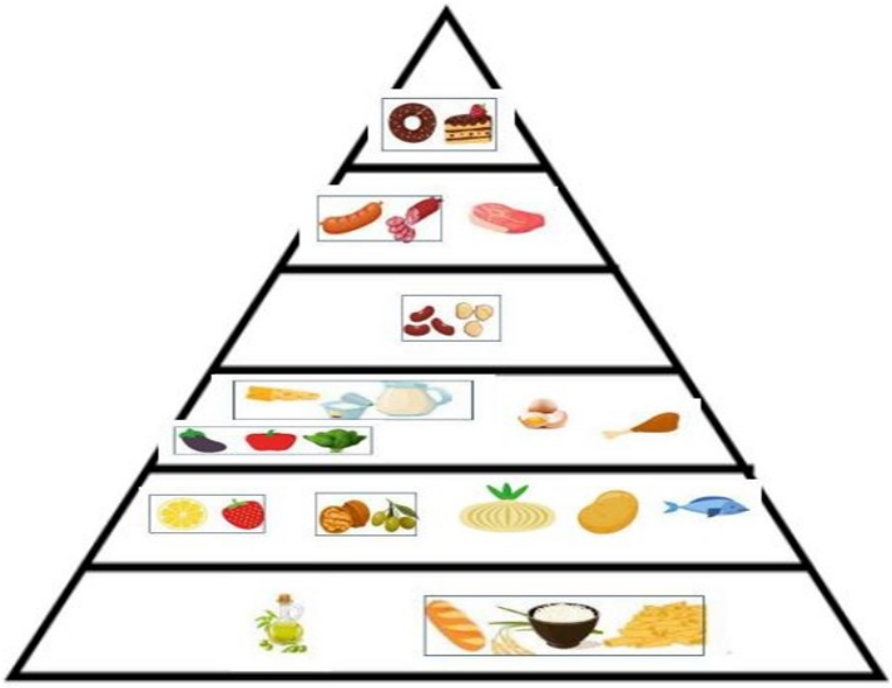

Figure 4. Food items most frequently consumed by Moroccan participants

4.3. Main obstacles to MD adherence

In FGs discussions, the main barriers to MD adherence were evaluated. The biggest obstacles to adherence to the MD were determined as follows:

- Lack of education and awareness among family members,
- Having different food preferences among family members,

- Members of the family have limited time to follow the MD (preparation of meals, cooking, etc.),
- Difficulty to follow needs of MD,
- Cultural and traditional barriers,
- Children's technology addiction,
- Negative environmental influences (peer, social media, etc.),
- Difficulties of using digital tools for MD management.
- Price.
- Time to prepare MD dishes.

4.4. Tools to facilitate adherence to the MD and families' perceptions.

The objective of FG methodology is learning of shared knowledge from all participants, as well as practices followed or apps used related to food behavior, in order to help in the design and development of the different products that will be used during the intervention and be sure that are aligned with the real needs of the families from Mediterranean countries and can really overcome the identified barriers.

4.4.1. Use of digital tools

For a proper result, the moderators in each country pointed out that the degree knowledge of digital tools is not important and never is assumed that participants and common people are digitally literate. This aimed to skip a main barrier that can be digital technology access, since families of middle and high income have a better access to digital technology and also more frequently have the skills required to used them, as compared to individuals who have lower socioeconomic income.

Questions regarding the expectations of the content of the digital tools were directed to participants. In this respect, the FG study aimed to identify what aspects of food behaviour, nutritional facts and other components might be included and personalised in the App developed in Task 3.1, and so inform to avoid barriers in the development of the digital and educational tools (WP3). All the implementations were better analyzed in the second FG studies (Subtask 1.3.2) that took place in M18 in Spain and Türkiye. Finally, all this material generated and validated will be evaluated in the intervention phase of SWITCHtoHEALTHY.

4.4.1.1. Türkiye

The issue of the use of digital tools (APP, computer programs, etc.) in Turkish families was discussed only with groups with children aged 12 and over. While only 4 of 16 participants (25%) stated that they could use the application, one participant was undecided. Most of the participants who said that the use of the application was not appropriate, stated that they were working so they did not have time to spare using any application. In addition, most of the participants who thought negatively about the application thought that this was because everyone in the family had different food preferences, so the application would not be sufficient to suggest different meals. Other opinions about why the application will be difficult to use are; it is stated that it is difficult to determine a nutrition style in families where there are family members with different interests, especially those who are interested in sports, it is tedious to enter information one by one for previously used calorie counting applications, and it is difficult for family members to eat at a common time. Participants who thought positively about using the application stated that the application would provide great convenience for cooking, that it would help them in the meal preparation phase, and that they could create their shopping lists according to the application. While answering this question, participant 7 in the low-income group stated that their answer might not be appropriate by saying "I don't think it is a subject that men are very interested in." When asked what you think would be good if the application included the following: most of the participants emphasized that the application should play role as a reminder and warning tool. While a few participants stated that they should be warned if they don' t drink enough water, some others suggested that the app should be integrated with a software that has an ability to

give suggestions regarding exercise with healthy lifestyles. Speaker 3 from the group of middle-income families said, "…systems are moving towards artificial intelligence" and added a pharese like "here's what's in your fridge?" which means an app equipped with a food stock controlling programme for fridge should be a good tool to manage kitchen. According to Speaker 3 the App should be able to make menus and recipe suggesstions from food available in the home kitchen.

Three different options were presented to Turkish participants; information on recipes including portion sizes and preparation methods (1), nutritional information for special diets (e.g. allergies, intolerances, religious diets) (2), daily tips on nutrition and sustainability issues (3), the question "Which one interests you the most?" was answered. 8 Turkish participants stated that they would be more interested in nutrition and sustainability issues in the form of tips, 6 participants stated that they would be more interested in information containing portion sizes and preparation methods, and 2 participants stated that they would be more interested in information containing special diets. It was determined that only 2 of the participants' children used the applications for a short period of time. Participants stated that social media platforms (such as TikTok) can be used to encourage their children's application use, short videos on the internet can be effective, and especially children's peer groups or famous people they love can be used for this, visually. In the FG discussions held at Morocco, participants were presented with three different options and asked the same question. All Moroccan participants selected information about recipes, including portion sizes and preparation methods, and nutritional information for special diets (e.g. allergies, intolerances, diabetes, hypertension…) as the options that would be of most interest to them. Eight Moroccan participants also cited information about nutrition and sustainability issues in the form of tips as the option that was most interested in by them.

4.4.1.2. Spain

In the FG meeting held in Spain, it was confirmed that smartphones are the digital tool better used and that TV is usually not on when having meals together, although it is often when people eat alone. This is a positive recall, since Mediterranean culture aims to have conversation around meals, and families emphatized that usally dinner time is for sharing childrens activities during the day. The technological option more exposed by participants when eating alone is the use of smartphones and checking of social media.

The FGs also collected responses on which educational material should be rellevant in the App, in order to analyse the limitations that actually are found by families in the existing nutrition and food consumption tools. The practices suggested by the participants, as well as some Apps already existing and used by them, were mentioned. They expressed that the barrier regarding "knowledge of the statement of true healthy food" can be experienced during shopping in grocery stores, therefore some information linked to Apps that scann EAN barcodes of food products could be included. Interest on healthy recipes with a nutritionist personalized meal plan, a shopping list with grams linked to the diet recommender adapted to the whole family and the possibility of posting pictures with "realfooders" was collected. All participants showed interest on nutritional tips, not only for parents but also for the adolescents, in order to better understand the current barrier of nutrition knowledge (like which way of cooking the ingredients are better, which ingredients should be skiped or cooked together tho generate nutrition synergies). Many were likely to include good advice on better eating habits and accurate information on food value and macronutrient information. Concern on calories information was recalled by 6 participants, about the fact that adolescents are very worried about weight and counting calories, so they believed that this may be a barrier for a true MD adherence. In this relation it was showed the need of *"Content moderation, security filters to avoid nonhealthy tips like how to lose weight easily, or anything that can be related with eating disorders*" or *"Nutritional information avoiding the kcal content in order to avoid obsession on calories".*

PA was recalled in the content of educational material, although it was not recalled in the definition that families provided on MD in the first phase of FGs. Parents expect some advice on activities away from technology for their adolescents and children.

The need of linking some social media to the App, in order to share recipes and emphatize the role of adolescents, was collected and linked to the need of having visually attractive options of healthy meals (Instagram kind). As well the possibility to share recipes. Some parents expressed that *"recipes with short videos make it more entertaining and easier to follow for the whole family"* but pointing out that *"You can only upload videos when healthy habits are proven to be followed through the App".* That was related with the need of bidirectionality recalled, meaning the possibility to get recipes and tips, but also share them with other users.

Another limitation for them is legumes/pulses consumption. It was recalled the need to have tips to cook attractive recipes using pulses "besides the traditional ones that are not atrractive to children and hummus". Consumption of pulses is an important barrier detected during the FGs, as well as the time needed for cooking and skill needs. Making easy to follow recipes, short time consuming and a good logistics (batch cooking) are considered as good solutions for these barriers collected. All these aspects recall on an important barrier that was detected during the several FGs, which is the cooking skills. It was detected a big difference on eating habits to a better Mediterranean adherence fore those parents that showed cooking skills.

Also, some parents showed interest on information on activities that families can do on free time linked to food behavior, like visits to farms or actuallyzed information on exhibitions that take place in the region.

Other suggestions in the FG discussions held in Spain were:

- The app should display weekly hours spent in physical activity.
- Hours of sleep for adolescents, related to the moment they stop using smartphones and screens. Maybe a wearable sensor that can be used for analyzing quality of sleep.
- Options to help with the shopping list related with the meal recommender. Also possibility to add information of food storage at home related to cooking tips to use those ingredients or tips to change ingredients from recipes (dry storage, refrigerator).
- Including topics related to climate action, important to young people (food waste and family economy).

4.4.1.3. Morocco

In the FG meetings held in morocco, smartphones were the digital tool most used followed by TV. Nowadays, adolescents are more exposed to new technologies and to use smartphones while eating to check whatsapp and follow social media (tik-tok, facebook…). TV viewing is common when having meals together, although it is often when families people eat lunch alone during weekdays.

All parents expressed their interest on having nutritional information: healthy recipes with grams, special programs like for instance to lose weight (low calories esp. for adolescent girls), to increase muscle mass (adolescent boys), for people with allergies, with diabetes, with cancer, with autism…, the healthy way of cooking dishes that keep the nutritional content, and also to know the macro/micronutrients content of foods and Kcal.

Moroccan parents' views on the use of digital tools at home were discussed. Parents were asked about the features they would like to have in the application so that their children gain better eating habits. It turns out that parents are looking for a variety of features and benefits from an app that helps their children adapt to healthier eating habits. Parents' expectations from the application were as follows:

- Comprehensive and age-appropriate nutrition information, details explaining the importance of healthy eating habits to children,
- Tips and suggestions to increase the consumption of healthy foods by children,
- Creative and healthy lunch ideas for children,
- Meal planning features, suggested recipes and shopping lists,

- The ability to track the child's food intake, monitor nutritional progress and identify deficiencies or excesses,
- Comprehensive allergen information, especially involving children's food allergies or sensitivities,
- Games, quizzes, prizes and virtual badges to teach children healthier eating habits with interactive features,
- Application security, privacy, and parental control features,
- User-friendly interface and clear graphics with clear instructions,
- Possibility of personalization and customization, personal information and personalized diet recommendations,
- Integration with physical activity, dietary recommendations appropriate to sports needs,
- They recommended monitoring and tracking daily food intake.

In summary, parents are looking for an app that encourages their children to eat healthier and makes the process of planning and tracking their eating habits easier. Beyond providing children with tutorials and guidance on nutrition, the app should provide practical tools and features to make navigation easier for children and parents to use. The app should prioritize providing a fun, informative, personalized, and safe environment for children.

4.4.2. Approach and suggestions for the use of educational materials

Turkish families agreed that schools have a lot to do in creating and maintaining a healthy diet. Most of the participants said that the educational materials could have an impact on their children, only one participant stated that their children would not be affected, and one participant stated that he had no idea about it. Participants also expressed their opinion that this could be more effective, especially from an early age. One of the participants stated that the interactive nature of the educational material could provide him with better motivation, and that nutrition education, especially for primary school children, could be improved in this way. Speaker 8 emphasized that educational activities are very important in improving children's nutrition habits by expressing, "We should constantly remind people that there should be a local goods week in schools, just like in our time, and activities should be done together."

Spanish families expressed the need of some schools to help incorporating food value and knowledge in earlier stages, and specially the need of tips and empowering on cooking skills. Althoug some admitted that parent should be in charge of this education, there was a discussion about the time needed for that, and the lack of skills by some of the parents. This was detected as an opportunity to be implemented in the educational activities and educational material. Recalling on how this information may be introduced in the education material generated, some added that they found interesting more nutritional knowledge related to the cooking skills, the value of food and proximity production, as a method to make more interesting and holistic the educational material. Some expressed the need “to know what activities can be done outside and inside town, related with the production of food and visit of landfields, as well as cooking activities”, “in Barcelona there are many activities but it’s hard to follow everything and getting to know what is going on”.

Moroccan families stated that it is important to prepare educational materials for foods that their children have difficulty eating. They suggested that vegan recipes could be included in this material and children's attention could be attracted with colorful tables. Among the suggestions were providing fun recipes suitable for children and ideas to present them in a creative way, including attractive and simple recipes, and not boring the material. In addition, it was stated that the material, which may include recipes for gaining muscle for boys and recipes for a better body shape and conditioning for girls, may be of interest. It was suggested that this educational material could also be included on the website and in Tik Tok videos.

In FG discussions, Moroccan families, like Turkish families, stated that schools have important duties in nutrition education. Parents stated that teachers' suggestions in schools (education about the benefits of consuming various food groups, vegetables, fish and meat, etc.) are taken into consideration more than parents' suggestions, and that children are more willing when they come home. They wanted schools to monitor and implement healthy choices instead of unhealthy foods. They stated that it could be suggested preparing meals for children in schools, to encourage parents to prepare healthy local meals for their children parental awareness (workshops, messages, e-mails) and healthy snack ideas. Participants also stated that teachers can be positive role models (showing them how to enjoy vegetables, cooking classes, etc.). Participants "In Morocco, years ago cooking classes were organized as part of the "women's education programme", to teach children (especially girls) potential cooking skills, to introduce different recipes; cooking classes used to take place in interaction with teachers and peers. Unfortunately, these activities have been abandoned or cancelled. He expressed that they hope these activities will return to schools again. They also emphasized that there should be educational programs where children can participate in school garden programs where activities such as planting plants, watering, and garden maintenance are carried out (with the participation of children in the process from planting to dinner.

4.5. Cocreation and validation of the healthy plant-based snacks

4.5.1. Selection of ingredients for the development of healthy snacks

In FG round 1 conducted in Türkiye, only participants with children under the age of 12 participated. Participants chose three or four ingredients from the presented fruits, vegetables, dried fruits and nuts, for the development of healthy snacks. The ingredients chosen by the participants are listed in the table below (Table 4).

Table 4. Turkish participants' choices regarding healthy snack ingredients

Ingredients	n(%)
Banana	11(21,1)
Walnut	6(11,5)
Date	6(11,5)
Almond	5(9,6)
Pear	5(9,6)
Peach	4(7,6)
Dry Grape	4(7,6)
Mulberry	3(5,7)
Chestnut	3(5,7)
Carrot	2(3,8)
Apricot	1(1,9)
Peanut	1(1,9)
Fig	1(1,9)

In Spain, 2 FGs on preference of ingredients were run considering the whole list of products and it was asked to parents about the level of knowledge of the ingredients and degree of incorporation of them in their children diet. Regarding this, they classified foods depending on the ingredients perceived as healthy, the favourite ingredients for their children and the ones perceived as healthy but not liked by their children. Ingredients needed to be chosen depending on their classification which was divided in 4 cathegories in order to assure a proper representation of each cathegory for the final development of snacks prototypes. Cathegories were as follow and were represented with different colours of post-its:

- Vegetables: 8 options
- Fruits + sumac: 10 options
- Nuts: 3 options (one had to be priorized)
- Cereals + pulses + tubers: 9 options

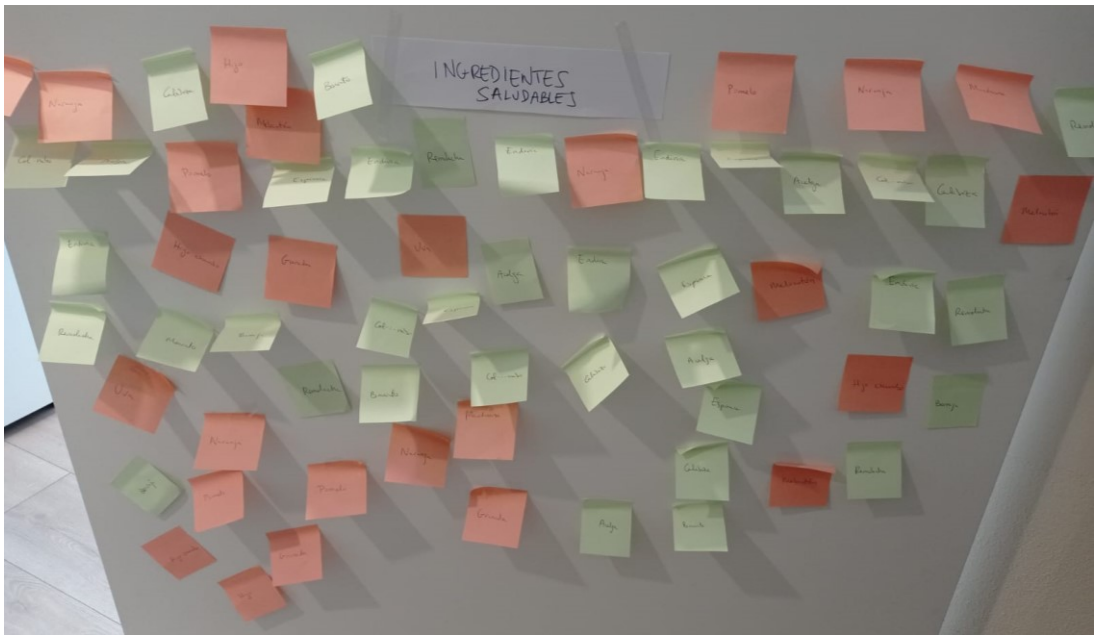

Figure 5. Ingredients percieved as halthy for participants of FG1. M9 (Spain)

Helthy innovative fruits rich in micronutrients were not choosen, therefore FGs 3 and 4 used a different methodology. This new method allowed to recall the willingness to try ingredients that not were categorized as prefered for the children in FG1 and FG2 but show a great nutritional content as well as a sufficient local production. Changing food behaviour is one of the current key societal challenges, not only in a nutritional way but also seeking more sustainable production and consumption. Results of this methodology are showed in table 5, where sumac and nopal where the better considered options of innovative ingredients.

Table 5. Willingness to incorporate bioactive ingredients in snacks

Ingredient	**Sumac**	**Grapefruit**	**Medlar**	**Nopal**
Number of afirmative answers	41	35	33	41
% of willingness to incoporate ingredients	100%	85%	80%	100%

In Morocco, 5 FGs on preference of ingredients were held considering the whole list of local products given and it was asked to parents about child ingredient preferences and their suggestions/preferences for healthy snack prototypes.

They were asked to classify ingredients depending on their perception/knowledge as healthy, the favourite for their children and the ones perceived as healthy but not liked by their children, by using different colours of post-its.

The first group, which included low-income group participants, stated their piorities as follows: apple followed by orange (fruits), almond followed by peanut (nuts) and wheat followed by barley (cereals). For innovative ingredients, they were very interested in carob, citrus zest, anis, fennel, and chickpea flour. It was stated that hemp (cannabis) seeds were not preferred. They also expressed their opinion that the snacks should be covered in dark chocolate.

For the second FG: banana as first choice followed by mandarin (fruits), peanut and wheat. Women were very interested in adding beet, chickpea flour, and dates in the snack. For the innovative ingredients, mothers were interested on adding anis, cinnamon, citrus zest and a little of cannabis seeds. Also, they expressed their feeling that the snack should be coated with dark chocolate.

For the third FG: first choice was banana followed by apple (fruits), almond, beetroot, chickpeas, oats and wheat, citrus peel, chocolate, anise and cinnamon.

For the fourth FG: regarding fruits, orange was the most preferred by children followed by watermelon. Also, almond and peanut, beetroot, chickpea, wheat, anise and fennel, dark chocolate, and dates were the preferred ingredients identified by the group 4.

4.5.2. Validation results of the FGs second phase

Information and results taken from the first round of FGs were transferred to leaders of tasks 3.1, 3.2, and Subtask 2.2.2 and were discussed in the WP2 and WP3 meetings held during the following months. A discussion with all partners was held during M12's meeting.

Following all the implementations generated by partners, Subtask 1.3.2 (Validation of food prototypes and tools) runs FGs using qualitative and quantitative methodology to analyze the most appetizing, attractive, and healthy plant-based snacks developed in Task 2.2. They were developed using the blind test methodology of sensorial analysis, with the participation of parents and children (aged below 12) different than the ones that participated in the FGs of Subtask 1.3.1. Terms of appearance, taste, texture, and overall liking were ranked using a 7-point hedonic scale adapted with emoji icons to make it easier for children (Appendix 2 and 3). The Likert point scale allows to collect a quantitative result, conducting a ranking of the prototypes, as well as qualitative information is recalled. All the results obtained will be very relevant to evaluate the pre-industrial scale-up of food prototypes (Task 2.3).

4 FGs were carried out in Türkiye in M19. Participants from 4 different regions of Bursa attended the FG. Voluntary consent was obtained in writing from the children participating in FG and their parents. Participants were informed that the data would be stored only as research data. A total of 24 children and 16 parents participated in the study (Table 6). Data were collected anonymously. Each participant tried 9 different prototypes and evaluated the associated 7-point hedonic scale. Data from the study was used to decide which prototypes to develop further.

Table 6. Participants of FG in Türkiye

Focus Groups	Religion of Bursa	Participants	Collected By
1st Group	BUU Campus	8 children 6 parents	Ayla İrem and Meryem

2nd group	City Center	4 children 3 parents	Çağla
3rd group	Nilufer Town	4 children 3 parents	Sümeyye
4th group	Karacabey Town	8 children 4 parents	Süleyman

Prototype studies in Türkiye were completed and the results were sent to WP2 partners. According to the tasting results in the second stage of the FGs, the prototypes that received the highest scores from the children were 4, 7, 8 and 9. The highest scores from parents were determined as 4, 6, 5 and 8. Scores equivalence to likert scales rated 1 to 7 are found in appendix 2 and 3. All of the prototypes chosen by children contain high fiber content (Table 7). The description and composition of each prototype can be found in Deliverable 2.2.

Table 7. Results of punctuation of each snack in Türkiye

PROTOTYPE	CHILDREN	TASTE CHILDREN	ADULTS	CHILDREN+ ADULTS
1	3,83	3,37	3,90	3,86
2	3,22	3,04	3,40	3,31
3	3,95	3,46	4,32	4,14
4	4,52	4,00	5,02	4,77
5	4,49	4,00	4,86	4,67
6	4,41	4,00	4,89	4,65
7	4,68	4,42	4,49	4,59
8	4,69	4,54	4,67	4,68
9	4,77	4,58	4,52	4,64

2 FGs took place in Spain in M19. Participants of the FGs were children recruited via school notifications to families. School made difusion of the participatory event. They all volunteered and signed a consent form according to they are aware of not reciving any compensation for this participation, and also allowing all the data to be analysed anonimously. Those children whose parents didn't take part of the degustation of snacks prototypes, were required to bring the Consent form signed in order to participate. Two chidren could not take part because of not having it signed.

Data were collected anonymously, and in compliance with General Data Protection Regulation (GDPR). Volunteer participants were 21 children (ages 5 to 11) and 9 parents, they all gave consent to participate in the study and were given a unique identification number.

Each participant tasted 5 prototypes. Samples and participants where randomized in order to have the same representation of qualifications per atribute per each prototypre reference (#1 to #8). The objective was to identify and quantify the global perception of each prototype and each atribute, in order to take decision on which 4 prototypes have to be developed and scaled in Task 2.3. In order to avoid deviations in taste, the prototype less sweet was told to be tasted first for those participants having the sample. No nutritional composition and content of the samples was shared with participants.

Figure 6. Participants of FG1 (M19) in Spain

Table 8 shows the average results obtained by children, adults and the average of the total of participants. Taste punctuation in children is showed individually in the table since taste is considered as the main attribute influencing repeated consumption of food items.

Table 8. Results of puntuations of each snack in Spain

	CHILDREN	TASTE CHILDREN	ADULTS	CHILDREN + ADULTS
1	5,3	4,6	5,3	5,3
2	6,4	6,3	5,8	6,1
3	5,4	5,6	5,2	5,3
4	4,4	4	4,8	4,6
5	3,8	3,5	5	4,4
6	4,3	4,1	4,8	4,6
7	5,5	5,4	5,3	5,4
8	4,8	5,1	5,7	5,2

The analytical Hierarchical Analysis has not been included because children don't help in the buying decisions, and they are less inclined in appreciate healthy attributes. FGs and priorization of snacks was focused on the perception by children, although the final decision has been taken considering also the nutritional content of the prototypes and specifically the importance of protein content recalled by parents participating in the FGs for validation of snacks and technological tools.

On the other hand, the prototypes and advanced education materials coming from WP3 were also evaluated in Spanish FGs, and all comments were transferred to excel sheets to be shared with leaders of WP3 T.3.1 and T.3.2. Some of the comments were:

- The need to solve some programming problems
- The likeliness to have tips pop-ups every 2-3 days but being able to consult any information or tip on nutrition any time using the App
- The need to avoid iteration of meals during the week
- The need to adapt the type pf fish to the consumptions of fish that families consume more often (subsitution of codfish)
- Options for the non-dairy that are rich in calcium
- Add pictures

- Visibility of recipes more inctuitive, and more attractive
- Tips on shopping list related to the meal recommender for the whole family.
- Batch cooking tips

These will also be validated in the FGs in the other countries to ensure the developments and tools are understandable and accomplish with the expectations of families. This will be very relevant to prevent the barriers collected during the first round of FGs.

Conclusions

This report aims to explain and present the process, findings, and main insights of collaborative studies on the development and validation of family-centered solutions for the unique needs of children and adolescents. The results of FG sessions held in Türkiye, Spain, and Morocco were discussed in this context.
Turkish, Spanish, and Moroccan participants' perceptions, preferences, and suggestions regarding healthy nutrition, the MD, the use of digital tools, educational materials, and healthy snacks were presented comprehensively.

Turkish participants associated a healthy diet with eating balanced, choosing low-sugar foods, avoiding processed foods, and doing regular meals. It was emphasized that Turkish participants have a positive perspective on digital tools. Spanish participants, on the other hand, show great interest in the MD and think that this diet is suitable for healthy lifestyles. Moroccan participants' knowledge of the MD was found to be scarce, and how they defined a healthy diet varied. Participants from the 3 countries believe that digital tools and effective educational materials play an important role in increasing health awareness.

On the other hand, the idea that the role of schools could be used more effectively came to the fore in participants from Morocco and Türkiye. In addition, they felt convinced that the educational material would be effective on changing the habits of their children. The quality of the educational material, starting nutrition education at an early age, and encouraging healthy choices by schools were among the suggestions of the participants. Parents from Spain demonstrated their agreement with the role of schools and schools canteens in primary school, but showed a concern on the secondary school. Therefore, they argued that educational materials on secondary schools and digital tools at home may be effective to achieve healthier dietary habits for the whole family, but specially for teenagers.

Regarding the identified barriers to MD adherence were as follows: lack of education and awareness among family members, different food preferences, family members having limited time to follow the MD, limited time for cooking at home, difficulty adapting to the MD, cultural and traditional barriers, children's technology addiction, harmful environmental influences (friends, social media, etc.), and difficulties using digital tools.

Finally, these FGs have supported the development and selection of snacks that will be used in the nutritional intervention in order to fulfil the needs and preferences of mediterranen families with children.

In conclusion, it was observed that regional differences affect healthy nutrition approaches, and that digital tools and educational materials can play an important role in increasing health awareness. These findings emphasized the importance of using regional characteristics effectively when developing healthy lifestyle and nutrition programs.

References

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Appendix

Appendix 1

BURSA ULUDAĞ UNIVERSITY
INFORMED VOLUNTEER CONSENT FORM FOR FOCUS GROUP DISCUSSION

Please take the time to read this document carefully.

We invite you to the focus group discussion that will be held within the scope of the project titled "Transitioning Mediterranean Consumers to Mediterranean Sustainable Healthy Nutrition Models" carried out by the faculty members of Bursa Uludağ University Faculty of Health Sciences. Before you decide whether to participate in this focus group interview, you need to know why and how the interview will be held. Therefore, it is of great importance to read and understand this form. Take the time to read the information below carefully. If you wish, discuss this information with your family and/or relatives. If there are things you do not understand or are not clear to you, or if you would like more information, ask us.

Participating in this study is entirely voluntary. You have the right not to participate in the study. Your participation in the focus group discussion will be interpreted as your consent to participate. Do not be under anyone's pressure or suggestion when answering the questions you will be asked. The information obtained from these forms will be used entirely for research purposes.

The questions in this interview consist of approximately five questions and take approximately 45 minutes.

Purpose of the Research: It is aimed to transition Mediterranean consumers to Mediterranean sustainable healthy nutrition models.

Information about the Interview (in a format understandable to the Participant)

This focus group interview includes questions about your child's nutritional model. A voice recorder will be used during the meeting and the conversations will be recorded. The interview includes open-ended questions that will be directed to you by the moderator. This meeting will take approximately 45 minutes.

Person approving to participate in the study and his/her signature:

Appendix 2

SENSORY ANALYSIS SCALE FOR CHILDREN

PROTOTYPE 1	VERY BAD	REALLY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	REALLY GOOD	VERY GOOD
Appareance							
Texture							
Taste							
Overall acceptablity							

PROTOTYPE 2	VERY BAD	REALLY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	REALLY GOOD	VERY GOOD
Appareance							
Texture							
Taste							
Overall acceptablity							

PROTOTYPE 3	VERY BAD	REALLY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	REALLY GOOD	VERY GOOD
Appareance							
Texture							
Taste							
Overall acceptablity							

PROTOTYPE 4	VERY BAD	REALLY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	REALLY GOOD	VERY GOOD
Appareance							
Texture							
Taste							
Overall acceptablity							

PROTOTYPE 5	VERY BAD	REALLY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	REALLY GOOD	VERY GOOD
Appareance							
Texture							
Taste							
Overall acceptablity							

PROTOTYPE 6	VERY BAD	REALLY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	REALLY GOOD	VERY GOOD
Appareance							
Texture							
Taste							
Overall acceptablity							

PROTOTYPE 7	VERY BAD	REALLY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	REALLY GOOD	VERY GOOD
Appareance							
Texture							
Taste							
Overall acceptablity							

PROTOTYPE 8	VERY BAD	REALLY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	REALLY GOOD	VERY GOOD
Appareance							
Texture							
Taste							
Overall acceptablity							

PROTOTYPE 9	VERY BAD	REALLY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	REALLY GOOD	VERY GOOD
Appareance							
Texture							
Taste							
Overall acceptablity							

Appendix 3

SENSORY ANALYSIS SCALE FOR ADULTS

PROTOTYPE 1	VERY BAD	REALLY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	REALLY GOOD	VERY GOOD
	1	2	3	4	5	6	7
Appareance							
Texture							
Taste							
Overall acceptablity							

PROTOTYPE 2	VERY BAD	REALLY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	REALLY GOOD	VERY GOOD
	1	2	3	4	5	6	7
Appareance							
Texture							
Taste							
Overall acceptablity							

PROTOTYPE 3	VERY BAD	REALLY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	REALLY GOOD	VERY GOOD
	1	2	3	4	5	6	7
Appareance							
Texture							
Taste							
Overall acceptablity							

PROTOTYPE 4	VERY BAD	REALLY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	REALLY GOOD	VERY GOOD
	1	2	3	4	5	6	7

Appeareance							
Texture							
Taste							
Overall acceptablity							

PROTOTYPE 5	**VERY BAD**	**REALLY BAD**	**BAD**	**NEITHER GOOD NOR BAD**	**GOOD**	**REALLY GOOD**	**VERY GOOD**
	1	**2**	**3**	**4**	**5**	**6**	**7**
Appeareance							
Texture							
Taste							
Overall acceptablity							

PROTOTYPE 6	**VERY BAD**	**REALLY BAD**	**BAD**	**NEITHER GOOD NOR BAD**	**GOOD**	**REALLY GOOD**	**VERY GOOD**
	1	**2**	**3**	**4**	**5**	**6**	**7**
Appeareance							
Texture							
Taste							
Overall acceptablity							

PROTOTYPE 7	**VERY BAD**	**REALLY BAD**	**BAD**	**NEITHER GOOD NOR BAD**	**GOOD**	**REALLY GOOD**	**VERY GOOD**
	1	**2**	**3**	**4**	**5**	**6**	**7**
Appeareance							
Texture							

Taste							
Overall acceptablity							

PROTOTYPE 8	**VERY BAD**	**REALLY BAD**	**BAD**	**NEITHER GOOD NOR BAD**	**GOOD**	**REALLY GOOD**	**VERY GOOD**
	1	**2**	**3**	**4**	**5**	**6**	**7**
Appareance							
Texture							
Taste							
Overall acceptablity							

PROTOTYPE 9	**VERY BAD**	**REALLY BAD**	**BAD**	**NEITHER GOOD NOR BAD**	**GOOD**	**REALLY GOOD**	**VERY GOOD**
	1	**2**	**3**	**4**	**5**	**6**	**7**
Appareance							
Texture							
Taste							
Overall acceptablity							