Switching Mediterranean Consumers to Mediterranean Sustainable Healthy Dietary Patterns

Grant Agreement No	2133	Project Acronym	SWITCHtoHEALTHY
Project Title	Switching Mediterranean Consumers to Mediterranean Sustainable Healthy Dietary Patterns		
Funding scheme	PRIMA – Partnership for research and innovation in the Mediterranean area		
Project Coordinator	ENCO		
WP Number	5		
Deliverable number	**D5.3**		
Deliverable Title	**Behavioural changes towards long-lasting sustainable eating habits**		
Lead Beneficiary	CREDA		
Start date of the project	01.04.2022	Duration of the project	36 months
Contractual delivery date	28.02.2025 (deadline as stated in the DoA)		
Actual delivery date:	31.03.2025		
Type of Deliverable	R (Document. Report)		
Dissemination level:	CO (Confidential. only for members of the consortium (including the Commission Services)		
Authors:	Kenza Goumeida; Djamel Rahmani; Amèlia Sarroca; José M. Gil Roig (CREDA) Lorena Caldéron; Noemi Boqué (EUT) Metin Güldas; Çağla Erdoğan (BUU)		
Contributors:	CREDA, EUT, BUU		
Version:	1.0		

Disclaimer: The content of this deliverable reflects only the authors' view and PRIMA Foundation is not responsible for any use that may be made of the information contained therein.

The SWITCHtoHEALTHY project is part of the PRIMA Programme supported by the European under the Grant Agreement number 2133 – Call 2021 Section 1 Agrofood IA

History of changes

Version	Author	Date	Comments
0.1	K.Goumeida (CREDA)	10.01.25	Tentative Index
0.2	K.Goumeida (CREDA) D.Rahmani (CREDA)	10.02.25	1st Draft shared with partners
0.3	K.Goumeida (CREDA) D.Rahmani (CREDA)	-	Draft revised by partners
0.4	K.Goumeida (CREDA) D.Rahmani (CREDA)	28.03.25	Final updated version
1.0	ENCO	31.03.25	Quality Assessment and final version

History of changes

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Table of contents

Switching Mediterranean Consumers to Mediterranean Sustainable Healthy Dietary Patterns 1
Executive Summary 6
1. Introduction 7
1.1 Partners involved in the study's measurement assessment before and after the interventions 8
2. Objectives and Hypothesis of the study on behavioural change toward sustainable eating habits 8
2.1 Objectives 8
2.2 Hypothesis 8
3. Data management 9
3.1 Data collection 9
3.2 Data handling, intention to treat (ITT) and analysis 10
4. Data analysis 11
5. Overview of the families' assessment of AMD and behavioural factors changes for the total sample 12
5.1 Pre-assessment of Spanish and Turkish Samples 12
5.1.1 Adherence to Mediterranean diet (AMD) 12
5.1.2 Factors related with families' attitude, behaviour and lifestyle 13
5.2 Post-assessment of Spanish and Turkish Samples 13
5.2.1 Adherence to Mediterranean diet (AMD) 13
5.2.2 Factors related with families' attitude, behaviour and lifestyle 14
5.3 Monitoring and understanding behavioural changes (Total effect) 15
5.3.1 Adherence to Mediterranean diet 15
5.3.2 Factors related with families' attitude, behaviour and lifestyle 18
6. Assessment of Families' AMD and Behavioural Factors Considering the Group Effect *(by Intervention Group)* 21
6.1 Pre-assessment 21
6.1.1 Adherence to Mediterranean diet 21
6.2 Post-assessment 23
6.2.1 Adherence to Mediterranean diet 23
6.3 Monitoring and understanding behavioural change 26
6.3.1 Adherence to Mediterranean diet 26
6.3.2 Factors related with families' attitude, behaviour and lifestyle 31
6.3.3 Factors influencing post-intervention MD adherence 40
7. Assessment of Families' AMD and Behavioural Factors Considering the Intervention Effect 46
7.1 Pre-Assessment 46
7.2 Post assessment 48
7.3 Monitoring and understanding behavioural change 51
7.3.1 Adherence to Mediterranean diet 51
7.3.2 Factors related with families' attitude, behaviour and lifestyle 53
7.3.3 Factors influencing post-intervention MD adherence 59
8. Family Focus Groups on Sustainable Consumption and Behavioral Change 64
Conclusions 68
References 70
Annexes 71
Annex I 71

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

List of Tables

Table. 1 Abbreviation and Acronyms.....
Table. 2 Table. Comparison of Parents' total AMD scores before and after interventions: Spain vs. Turkey .....
Table. 3 Table. Comparison of adolescent's total AMD scores before and after interventions: Spain vs. Turkey
Table. 4 Comparison of Children's total AMD scores before and after interventions: Spain vs. Turkey.....
Table. 5 Comparison of parental behavioural indicators before and after the intervention: Spain vs. Turkey.....
Table. 6 Comparison of adolescents' behavioural indicators before and after the intervention: Spain vs. Turkey
Table. 7 Comparison of children' behavioural indicators before and after the intervention: Spain vs. Turkey .....
Table. 8 Comparison of parental AMD before and after the intervention: Spain vs. Turkey .....
Table. 9 Comparison of adolescents' AMD before and after the intervention: Spain vs. Turkey .....
Table. 10 Comparison of children' AMD before and after the intervention: Spain vs. Turkey.....
Table.11 Comparison of parents' MEDLIFE scores before and after the intervention: Spain vs. Turkey.....
Table.12 Comparison of adolescents' KIDSCREEN scores before and after the intervention: Spain vs. Turkey.....
Table.13 Comparison of children's KIDSCREEN score before and after the intervention: Spain vs. Turkey .....
Table.14 Comparison of parents' PA before and after the intervention: Spain vs. Turkey .....
Table.15 Comparison of adolescents' PA before and after the intervention: Spain vs. Turkey.....
Table. 16 Comparison of children' PA before and after the intervention: Spain vs. Turkey .....
Table.17 Comparison of parents' NK before and after the intervention: Spain vs. Turkey.....
Table.18 Comparison of adolescents' NK before and after the intervention: Spain vs. Turkey .....
Table.19 Comparison of Parents AMD intention before and after the intervention: Spain vs. Turkey .....
Table. 20 Comparison of adolescents' AMD intention before and after the intervention: Spain vs. Turkey....
Table. 21 *Factors Affecting parents' MEDLIFE score Following Interventions in Pooled, Spain, and Turkey*.....
Table. 22 *Factors Affecting parents' MEDLIFE score Following Interventions in Pooled, Spain, and Turkey*.....
Table. 23 *Factors Affecting adolescents' AMD score Following Interventions in Pooled, Spain, and Turkey* ....
Table. 24 *Factors Affecting adolescents' KIDSCREEN score Following Interventions in Pooled, Spain, and Turkey*
Table. 25 *Factors Affecting children's AMD score Following Interventions in Pooled, Spain, and Turkey*.....
Table. 26 *Factors Affecting children's KIDSCREEN score Following Interventions in Pooled, Spain, and Turkey*
Table. 27 Changes in AMD scores by intervention type among parents' sub-sample
Table.28 Changes in AMD scores by intervention type among adolescents' sub-sample.....
Table.29 Changes in AMD scores by intervention type among children's sub-sample.....
Table.30 Changes in MEDLIFE scores by intervention type among parents' sub-sample .....
Table.31 Changes in KIDSCREEN scores by intervention type among adolescents' sub-sample .....
Table.32 Changes in KIDSCREEN scores by intervention type among children's sub-sample .....
Table.33 Changes in PA scores by intervention type among parents' sub-sample.....
Table.34 Changes in PA scores by intervention type among adolescents' sub-sample .....
Table.35 Changes in PA scores by intervention type among children' sub-sample.....
Table.36 Changes in NK scores by intervention type among parents' sub-sample.....
Table.37 Changes in NK scores by intervention type among adolescents' sub-sample .....
Table.38 Changes in AMD intention by intervention type among parents' sub-sample.....
Table.39 Changes in AMD intention by intervention type among adolescents' sub-sample .....
Table.40 Changes in AMD intention by intervention type among adolescents' sub-sample .....
Table.41 Total Scores of the 4 dimensions' summary per snack .....
Table.40 Factors Affecting Parent's AMD score Following Interventions when considering the interventions' effect.....
Table.41 Factors Affecting Parent's MEDLIFE score Following Interventions when considering the interventions' effect .....
Table.42 Factors Affecting adolescents' AMD score Following Interventions when considering the interventions' effect .....
Table.43 Factors Affecting adolescents' KIDSCREEN score Following Interventions when considering the interventions' effect .....
Table.44 Factors Affecting children' AMD score Following Interventions when considering the interventions' effect.....
Table.45 Factors Affecting children' KIDSCREEN score Following Interventions when considering the interventions' effect .....
Table.46 *Total Scores of the 4 dimensions' summary per snack* .....

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

List of Figures

Figure 1: SWITCHtoHEALTHY interventions description. .....
Figure.2 Distribution of the total sample of parents' subsample at the baseline (V1) .....
Figure.3 Distribution of the total AMD of the adolescents and children's sub-samples at the baseline (V1) ..
Figure.4 Distribution of the total sample of parents' subsample at the baseline (V1) .....
Figure.5 Distribution of the total AMD of the adolescents and children's sub-samples after the interventions (V2)
Figure.6 Variation in AMD scores among Spanish parents between baseline (V1) and follow-Up (V2) .....
Figure.7 Variation in AMD scores among Turkish parents between baseline (V1) and follow-Up (V2) .....
Figure.8 AMD (KIDMED) score changes between the study visits in Spanish and Turkish adolescents.....
Figure.9 AMD (KIDMED) score changes between the study visits in Spanish and Turkish children sub-sample
Figure.10 NK score changes among Spanish parent's sub-sample.....
Figure.11 NK score changes among Turkish parent's sub-sample .....
Figure.12 NK score changes among Spanish and Turkish adolescents' sub-sample .....
Figure.13 MEDAS score changes across the intervention groups in Spanish Parents sub-sample .....
Figure.14 MEDAS score changes across the intervention groups in Turkish Parents sub-sample.....
Figure.15 KIDMED score changes across the intervention groups in Spanish adolescents' sub-sample .....
Figure.16 KIDMED score changes across the intervention groups in Turkish adolescents' sub-sample.....
Figure.17 KIDMED score changes across the intervention groups in Spanish children's sub-sample.....
Figure.18 KIDMED score changes across the intervention groups in Turkish children's sub-sample .....
Figure.19 NK score changes across the intervention groups in Spanish parent's sub-sample .....
Figure.20 NK score changes across the intervention groups in Turkish parents sub-sample.....
Figure.21 NK score changes across the intervention groups in Spanish adolescents' sub-sample.....
Figure.22 NK score changes across the intervention groups in Turkish adolescents' sub-sample .....
Figure.23 Changes in AMD scores by intervention type among Spanish parents according to baseline AMD .
Figure.24 Changes in AMD scores by intervention type among Turkish parents according to baseline AMD..
Figure.25 Changes in AMD scores by intervention type among Spanish adolescents according to baseline AMD
Figure.26 Changes in AMD scores by intervention type among Turkish adolescents according to baseline AMD
Graph.27 Changes in AMD scores by intervention type among Spanish children according to baseline AMD
Figure.28 Changes in NK scores by intervention type among Turkish Children according to baseline AMD ....
Figure.29 Changes in NK scores by intervention type among Spanish parents according to the NK baseline..
Figure.30 Changes in NK scores by intervention type among Turkish parents according to the NK baseline...
Figure.31 Snacks evaluated during FGs with adolescents in Spain .....

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Abbreviations and Acronyms

Table 1: Abbreviation and Acronyms

Abbreviation / Acronym	Description
AMD	Adherence to Mediterranean Diet
BMI	Body Mass Index
EPAQ	Early Parenting Attitudes Questionnaire
IG	Intervention Group
MD	Mediterranean Diet
MEDAS	Mediterranean Diet Adherence Score
G	Group
MLRM	Multiple Linear Regression Model
NK	Nutritional Knowledge
KIDMED	Mediterranean Diet Quality Index for children and adolescents
MEDLIFE	Mediterranean Lifestyle Index
MD	Mediterranean Diet
OLS	Ordinary Least Squares
PA	Physical Activity
PRIMA	Partnership for research and innovation in the Mediterranean area
TPB	Theory of Planned Behaviour
V	Visit

Executive Summary

The SWITCHtoHEALTHY study evaluates a structured, family-based intervention designed to enhance adherence to the Mediterranean diet (AMD) among families in Spain and Turkey. Addressing concerns over declining AMD, particularly among younger populations, the three-month intervention applied a learning-through-playing approach, incorporating digital tools, plant-based snacks, and hands-on educational materials. Grounded in behavioural change theories, the study assessed dietary behaviour, attitudes, and knowledge, offering insights for scalable interventions.

Baseline assessments showed moderate AMD levels, with Spanish parents exhibiting higher initial AMD than their Turkish counterparts. Post-intervention analyses revealed significant improvements, especially among Spanish adolescents and Turkish participants across all demographics. Statistical analyses highlighted that individuals with lower initial AMD experienced the greatest improvements, emphasizing the inverse association between baseline adherence and intervention effectiveness. The study identified key behavioural and cultural patterns. Turkish participants demonstrated greater overall improvements in nutrition knowledge and lifestyle adherence, while Spanish participants retained higher absolute AMD scores but showed smaller post-intervention changes. Turkish adolescents and children improved significantly their Mediterranean diet (MD) knowledge, narrowing pre-existing gaps with Spanish participants. Intervention effects varied by demographic group and cultural context. Turkish parents achieved the most substantial AMD gains, reversing Spain's initial advantage, particularly in groups receiving educational and snack-based interventions. Spanish adolescents responded best to app-based interventions, while Turkish adolescents showed consistent improvements across approaches. Physical activity levels, initially higher in Spain, converged post-intervention, especially among younger participants. These findings underscore the need for tailored dietary interventions. Furthermore, this deliverable highlights the necessity of culturally adapted, scalable dietary interventions that target populations with lower baseline AMD. Educational and snack-based strategies proved effective, particularly among younger and initially lower-adherence groups. Future programs should strategically allocate resources to maximize impact, ensuring adaptability to diverse settings such as schools, workplaces, and broader public health initiatives. By identifying key success factors and limitations, this research provides valuable insights for sustainable, behaviourally anchored dietary interventions that promote long-term adherence to the MD.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

1. Introduction

Diet is widely recognized as a fundamental lifestyle behaviour, integral to overall health and quality of life. Adopting healthy eating and lifestyle practices is crucial for improving public health outcomes as well as for the well-being of individuals. Due to its environmental sustainability, cultural acceptability, affordability, and nutritional sufficiency, the MD has become a model of sustainable eating in this regard [(1)]. The MD has been repeatedly associated with longer lifespans and a lower prevalence of degenerative and chronic illnesses; even slight gains in adherence are associated with large decreases in mortality risk.

Nevertheless, current patterns suggest a concerning change in Mediterranean nations in spite of these advantages. A "Western diet," which is heavy in saturated fats, refined grains, simple carbs, and ultra-processed foods, is becoming more and more popular among kids and adolescents, Individual characteristics, family financial situation, and lifestyle choices including increased sedentary behaviour and low physical exercise all have a significant impact on how closely young people follow the MD [(2)],

Traditional Mediterranean food cultures are gradually disappearing as a result of significant nutritional changes being accelerated by cultural and socioeconomic shifts in these areas [(3)]**.** Additionally, preliminary research points to a strong correlation between socioeconomic characteristics and MD adherence, emphasizing the importance of greater parental education levels.

The growing interest in sustainable food systems around the world has further strengthened the MD's standing as a sustainable and healthful eating approach. Tools like the KIDMED and MEDAS questionnaires highlight the usefulness of the MD in current dietary research by evaluating adherence based on the positive scores attributable to nutrients and foods that promote health [(4)].

The transition during adolescence remains particularly difficult, despite the fact that numerous studies have looked at MD adherence across various age groups, showing slight gains in schoolchildren coupled with ongoing worries about overweight and obesity [(4,5)].

Within this paradigm, the SWITCHtoHEALTHY research aims to evaluate how dietary behaviours are affected by a comprehensive, family-level intervention. A learning-through-playing strategy is used in this three-month intervention to promote healthy, sustainable plant-based snacks, interactive digital tools, and hands-on instructional materials.

Notably, the study is conducted in two Mediterranean nations (Turkey and Spain) with unique cultural and lifestyle traits and concentrates on the family as a whole, including adults, adolescents, and children (D4.1).

Supported by theories of behavioural change, including the trans theoretical model, the theory of planned behaviour, and social cognitive theory, the intervention seeks to improve adherence to the MD while also identifying the underlying causes of behaviour change. This information is crucial for expanding effective dietary interventions.

Taken together, this deliverable highlights how crucial family-level behavioural changes are as a means of encouraging sustained adherence to the Mediterranean diet (AMD) and, in turn, enhancing general health outcomes.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

1.1 Partners involved in the study's measurement assessment before and after the interventions

No,	Participant organisation name	Acronym	Country
Partner 1	Centre de Recerca en Economía i Desenvolupament Agroalimentari UPC-IRTA	CREDA	Spain
Partner 2	Fundació Eurecat	EUT	Spain
Partner 3	Bursa Uludag University	BUU	Turkey
Partner 4	University of Parma (UNIPR)	UNIPR	Italy
Partner 5	Departament d'Acció Climàtica, Alimentació i Agenda Rural	DACC	Spain
Partner 6	Regione Campania	RC	Italy
Partner 7	Izmir Provincial Directorate of Culture and Tourism	KTB	Turkey
Partner 8	ENCO SRL	ENCO	Italy

Note: The Moroccan partner (CNESTEN) was initially expected to be included in this deliverable; however, the intervention study was not conducted as planned, as explained in Deliverable D4.2.

2. Objectives and Hypothesis of the study on behavioural change toward sustainable eating habits

2.1 Objectives

The main objective of the project is to promote AMD in the Mediterranean region. Within this framework, the purpose of this deliverable is to assess behavioral changes by analyzing shifts observed in Spanish and Turkish families before and after the implementation of a three-month intervention. these behavioural changes from the first to the second measurement period will be evaluated using data about attitudes, beliefs, knowledge, physical activity in addition to some physical factors allowing for a better understanding of the behavioural change.

Furthermore, this deliverable seeks to explore the underlying factors driving these behavioral changes, facilitating the scaling up of such interventions and the development of transferable models. These models aim to effectively promote dietary behavior changes that can be adapted to different settings, including small scale environments such as restaurants, university or campus canteens, and workplaces, as well as on a broader scale in other countries. In addition to conducting a final round of focus groups (FGs) with selected families to identify the key success factors and main limitations of the implemented interventions, the objective is to obtain a comprehensive overview and a clear understanding of the outcomes.

2.2 Hypothesis

Interventions' effects on AMD have been the subject of numerous research; the results typically show that these interventions have a good effect on eating behaviours [6, 7]. However, a lot of people have started consuming unhealthy foods as a result of modern lifestyles that are marked by rigorous work schedules and less time for cooking at home. Because eating habits are frequently formed at home, this change does not only impact adults but also younger groups. Indeed, studies have indicated that throughout the previous ten years, children and adolescents in Mediterranean nations have been less likely to follow the MD [8]. Understanding how to maintain and improve adherence is crucial given the MD's well-established health advantages, which include its role in avoiding chronic diseases and increasing long-term well-being. Accordingly, the present intervention study seeks to examine changes in AMD among parents, adolescents, and children following the implementation of a structured intervention.

In particular, we aim to assess whether dietary behaviours and attitudes improve as a result of targeted actions designed to improve and promote healthier eating patterns.

This study investigated the following hypotheses:

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

H1: In the three sample groups (parents, adolescents, and children) in Spain and Turkey, AMD will improve following the intervention in comparison to the pre-intervention assessment;

H2: After the interventions, participants in Spain and Turkey will show more favorable attitudes and dietary behaviors;

H3: Participants assigned to the intervention groups will exhibit higher improvements in AMD than those in the control group in both Spain and Turkey, Furthermore, it is anticipated that more interventions within a group will lead to better AMD;

H4: Although both Spain and Turkey are Mediterranean countries, differences exist in people's AMD and their dietary behaviors in the pre and post assessment.

	 App for all family	  Empowerment activities + Educational material	 Snack for in-between meals
Control group (n=20)			
Intervention (INT) group 1 (n=20)			
Intervetnion (INT) group 2 (n=20)			
Intervetnion (INT) group 3 (n=20)			
Intervetnion (INT) group 4 (n=20)			
Intervetnion (INT) group 5 (n=20)			
Intervetnion (INT) group 6 (n=20)			
Intervetnion (INT) group 7 (n=20)			
n	80	80	80

Figure.01 SWITCHtoHEALTHY interventions description.

3. Data management

3.1 Data collection

To achieve the study's objectives, data were collected from families previously recruited for the study,

In Spain, the pre-assessment data collection took place between September 9 and the end of September 2024, covering three sub samples: parents, adolescents, and children.

As mentioned in previous deliverables (D4,2), at the beginning of the study in Spain, a total of 130 families were recruited and randomly assigned to one of the intervention groups (V0) using a full factorial design (Figure 01), Of these, 94 families attended the first intervention visit (V1), which was conducted face to face, At this stage, participants start the intervention process, Following the 3-month intervention period, post-intervention data collection (V2) was conducted with 68 families to assess potential changes in AMD, as well as in participants' attitudes, behaviors, and lifestyles. In this study, the post-assessment data collection followed the same methodology as the pre-assessment and was carried out from December 2 to December 23, 2024.

In Turkey, the study commenced in mid-September 2024, approximately one week after its initiation in Spain, During the first visit, data were collected from 120 families, After the intervention phase, data were collected again from 83 families who remained enrolled in the study until its conclusion. The post-intervention data collection in Turkey took place between December 23th and December 29th 2024.

Both pre and post-intervention data on behavior, lifestyle, attitudes…etc., were gathered through self-administered questionnaires completed during the in person visits at research centres or school facilities (V1 and V2) with the assistance of researchers.

In particular situations, families or individual participants who were unable to attend on site completed the questionnaire at home.

The structure of the questionnaires varied slightly among family members; however, they shared several common sections across parents, adolescents, and children. Adaptations were made to include the correct scale to each age group. The questionnaire for parents included the following factors:

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

- Sociodemographic Information: 13 questions assessing age, gender, origin, background and study level, work and work contract, individual and household income;
- Work-Family Balance and Satisfaction: 8 questions evaluating family tasks and work compatibility;
- Decision-Making in parenting: 2 questions examining parental decision-making processes;
- Physical Activity: based on the International Physical Activity Questionnaire (IPAQ) scale;
- Quality of Life: for assessing well-being and lifestyle factors;
- Attitudes and beliefs regarding the MD;
- Dietary Habits: for evaluating general eating behaviours and perception;
- Food Frequency Questionnaire: A validated scale measuring food consumption patterns;
- MEDLIFE Questionnaire: A validated scale assessing AMD;
- Nutritional Knowledge (NK) Scale: Measuring participants' understanding of nutrition related topics.

For adolescents, the factors examined were largely the same as those assessed for parents, with the exception of the Work-Family Balance and Satisfaction section. Additionally, a new factor regarding relationship with parents was introduced including 2 questions assessing activities shared with the father and mother, Furthermore, the MEDLIFE scale was replaced by the KIDSCREEN Scale, which assesses health related quality of life. The NK scale was adapted to better fit the group of adolescents.

For kids, the survey was modified according to age group, distinguishing between those under the age of eight and those between the ages of 8 and 12 years old, as cognitive abilities vary significantly between these age ranges.

For kids ages 8 to 12, their questionnaire was very similar to the one for teenagers, with a few modifications. The sociodemographic section included only 3 questions regarding age, gender, and educational level. The physical activity section used the IPAQ_C scale, a validated version specifically designed for children. Unlike adolescents, this group did not receive questions on NK.

For children younger than 8 years and aside from the sociodemographic section, 2 questions assessed quality of life by asking about sleep duration and general health perception, Furthermore, one question addressed dietary habits, while another focused on food frequency.

Data on AMD were also collected through the in person assessments using the MEDAS scale for parents and the KIDMED scale for both adolescents and children, along with physical and anthropometric measurements (see D4.2).

3.2 Data handling, intention to treat (ITT) and analysis

After collecting all the data regarding the AMD using the MEDAS and KIDMED scores together with the physical data, in addition to the families' attitudes, behaviour using the self-administered questionnaire.

There was a need for calculating the final scores of AMD from the MEDAS and KIDMED scales knowing that MEDAS consists of 14th item/question, each question is scored with 0 (non-compliant) or 1 (compliant), and the total score (from a total of 14 questions) will be ranged from 0 to 14, so a score of 14 points means maximum adherence. Differently to the MEDAS, the KIDMED scale consists of 16 items where some questions (4 questions) denote a negative connotation to the MD which are scored with −1, while the 12 questions denoting a positive connotation are scored with +1, Therefore, the total score ranges from 0 to 12 being the 12 the highest adherence.

Due to families' dropout, some of them did not have the AMD scores for V2, which could lead to a loss of statistical power. In order to mitigate this issue while maintaining the sample size, we used an imputation method based on the observed trend within each group (intervention or CG), Particularly, for each of the 8 groups defined by applying the full factorial design (See Figure 01).

we calculated the mean AMD score at V1 (M1) and V2 (M2) using only the families with complete data at V1 and V2 time points.

The difference (Δ = M2 - M1) represented the average change in adherence within that group.

For families missing V2 scores, we estimated their missing values by applying the group specific difference (Δ) to their individual V1 scores, if Δ was positive, we added this value to the V1 score; if negative, we subtracted it.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Through this approach we could maintain the overall trend observed in the group while preserving within group variability, reducing bias and retaining statistical power in the analysis.

On the other hand, final scores had been also calculated for the different scales included in the self-administered questionnaire. Specifically, the IPAQ scale for the physical activity for all the participants (parents, adolescents and children), the MEDLIFE scale for parents, the KIDSCREEN scale for adolescents and children in addition to the NK scale for the parents and for adolescents.

From the beginning of the study, each family within the study was assigned with a family code in order to ensure privacy and protect the intellectual property rights that have been defined in the consortium agreement. This also help for facilitating tractability and data merging, as the next step involved combining data based on the family code to create a unified database for parents, including their AMD questionnaire responses, and physical data. Similarly, separate databases were created for adolescents and children, resulting in three distinct datasets for each family: one for parents, one for adolescents, and one for children.

The next stage involved combining datasets based on the family code to create a unified database for each participant group (parents, Adolescents, and children), integrating AMD scores, physical measurements and questionnaire responses together with some physical data like height, weight and Body Mass Index…etc. This resulted in three separate databases, each containing complete information for its respective participant group.

4. Data analysis

The analysis's objectives were to evaluate families' behaviour and AMD before and after the intervention, as well as any changes in AMD and other relevant behavioural factors (Physical Activity “PA”, MEDLIFE, NK and their intention to adopt and follow a healthy MD “AMD_Intention”.

To achieve this, descriptive statistical analyses were carried out in order to give a summary of the main variables and to summarize the characteristics of the study’s population.

For continuous variables, means and standard deviations were reported, whereas frequencies and percentages were used to summarize categorical variables. Furthermore, pre and post-intervention data for every variable were compared using inferential statistical techniques.

The Shapiro-Wilk test was used to assess normality, and when the assumption of normality was not met, non-parametric tests were applied, specifically we used the *Wilcoxon rank-sum test* also known as *Mann-Whitney U test that is mainly applied when paired (Before “V1” and after “V2”) data does not follow a normal distribution,*

On the other hand, paired *t-tests* were utilized for continuous data that were normally distributed.

Since the main outcome variable of this study is AMD, we aimed to visualize participants' AMD scores and their changes after the intervention, To identify any positive or negative shifts, we used graphical representations (scatter plots) to compare AMD score differences between the post-assessment (V2) and pre-assessment (V1), This analysis was conducted first by combining all groups, then stratified by group, intervention, and sub-sample (parents, adolescents, and children), as well as by country.

Existing literature indicates that NK is a significant factor influencing individuals' AMD. For instance, a study shows that individuals with higher NK scores were more likely to adhere to the MD [8]. Similarly, it has been demonstrated that increased NK correlated with a higher AMD. Therefore, scatter plots were generated to illustrate participants' NK scores and their variation after the intervention.

For all the variable of interest for the present study, both Spanish and Turkish samples were compared first of all at both time points (V1 and V2) in a holistic way without considering the intervention groups to see if there are significant differences after that participants receives the implemented interventions.

Afterward, we realised the same analyses taking into consideration the groups (group effect) to which each family had been assigned. Additionally, we checked if there are significant differences within and between Spanish and Turkish samples taking into consideration the interventions (intervention effect), knowing that each of the three interventions had been received by 4 different groups as shown in the Figure 01.

Since Spain and Turkey, both are Mediterranean counties however, they do not have a common culture,

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

lifestyle and behaviour therefore, checking for any relevant differences between both samples at the same time point (V1 or V2) was interesting step to do with the analyses.

Lastly, Multiple Linear Regression Models (MLRM) using the Ordinary Least Squares (OLS) method were estimated to ascertain whether the behaviours of families affected their AMD before and after the intervention, and whether these behaviours might account for changes in AMD.

As indicated by Equation (1), this model allows for investigating the relationship among AMD scores of V2 (AMD_{V2}) and those of V1 (AMD_{V1}) together with additional behavioral measures like the PA, and NK together in addition to a physical outcome being the BMI in this case and some sociodemographic traits like gender and participants' age.

$$Y_i=\beta_0 + \beta_1 X_{1i}+ \beta 2\ X2i +\cdots+ \beta_k X_{ki} + \varepsilon i \qquad \text{Equation (1)}$$

With the dependent variable being the AMD post-assessment scores (Y = **AMD_{V2}**), this model was estimated independently by nation for each of the study's sub-samples (parents, adolescents, and children). In order to examine the pooled effect and derive broader conclusions, the model was then applied to the combined Spanish and Turkish samples, resulting in 6 different models.

Similarly, to the previous models estimated based on equation (1), as a second stage analyses, we estimated the same model but this time being the MEDLIFE post assessment score (**$MEDLIFE_{V2}$**) the dependent variable since the MEDLIFE scale focuses not only on the food habits like the MEDAS however, it allows for having a more comprehensive assessment often with the inclusion of the PA and lifestyle behavioral factors. Hence, the PA had been considered as a covariate in the model. This second stage of the analyses results also in 6 model estimations per sub-sample (parents, adolescents, and children)

5. Overview of the families' assessment of AMD and behavioural factors changes for the total sample

This section presents the analyses of the study sample at baseline and post intervention, focusing on families' AMD and key behavioral factors assessed through validated scales i.e.: MEDAS, MEDLIFE, KIDMED…etc. (See D4.1). The analysis provides an overview of the distribution of AMD scores, along with other relevant behavioral and lifestyle characteristics

5.1 Pre-assessment of Spanish and Turkish Samples

5.1.1 Adherence to Mediterranean diet (AMD)

Three categories are used to categorize participants' AMD: "Low" (0–5), "Moderate" (6–9), and "High" (10–14), since the parents' MEDAS scale total score runs from 0 to 14. The pre-assessment preliminary results for the parents' sub-sample, indicate that 69.61% of Spanish sample had a moderate AMD, 18.23% had high AMD, and 12.15% had low AMD. On the other hand, the majority of Turkish parents within the study had also a moderate AMD with a 67.23 % followed by those with a low adherence 17.23% and the minority are parents with high AMD 15.55% (Figure 02).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

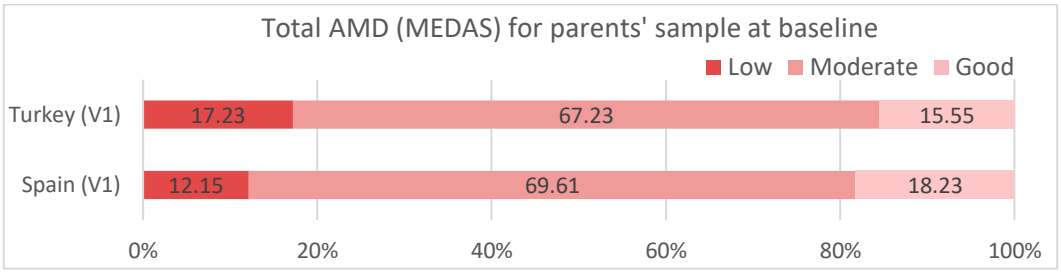


Figure.02 Distribution of the total sample of parents' subsample at the baseline (V1)

The KIDMED scale for measuring the AMD and based on their score, young people could belong to one of the three categories previous categories however the score intervals are not the same as the one of MEDAS, where "Low" is between (0-3), Moderate" (4–7), and "High" (18–12).

The pre-assessment preliminary results for the Spanish adolescents' subsample show that the distribution of the adolescents' AMD within the three categories is more or less going in the same wave as the one of parents where the majority 43.62% have a moderate AMD followed with those with high AMD 39.36% and the 15.96% have a low AMD. For Turkish adolescents, the category of adolescents with moderate AMD still being the important one with 59.17 %, however the proportion of adolescents with a week AMD represent the second highest percentage with 28.33% and only 11.67% have a high AMD. When it comes to children, results indicate that above the half of the Spanish children' sub-sample are belonging to the category of moderate AMD with 53.13%, followed by 34.38% of children with high AMD and 9.38% of children have a low AMD. In Turkey, the 58.33 % of children have moderate AMD followed by the 26.67 % with low AMD and only the 11.67% of children have a high AMD (Figure 03).

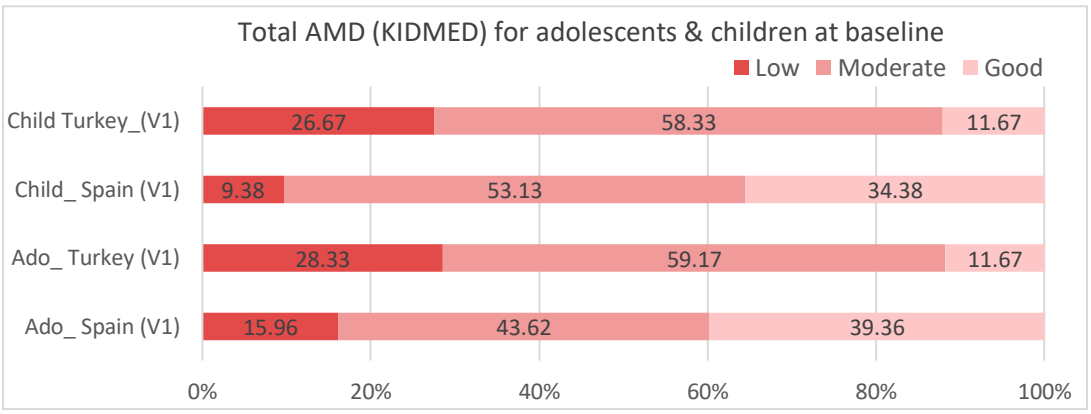


Figure.03 Distribution of the total AMD of the adolescents and children's sub-samples at the baseline (V1)

5.1.2 Factors related with families' attitude, behaviour and lifestyle

Additionally, other behavioral indicators related to dietary habits, physical activity, quality of life, and NK are examined. The results are presented in the form of tables and graphical representations to facilitate interpretation.

5.2 Post-assessment of Spanish and Turkish Samples

5.2.1 Adherence to Mediterranean diet (AMD)

In Spain, post-assessment preliminary results show that the proportion of parents with high AMD increased to 25.82% compared to the first visit, In the meantime, the percentage of people with low and moderate AMD dropped to 9.89% and 64.29%, respectively. In Turkey, from the pre to the post assessment in general, parents' sample tend to increase their AMD where the majority of them 55.81% still having a moderate AMD. The proportion of the parental sample having a high AMD increased to reach the 38.49 % in contrast, the proportion with low AMD decreased to 6.69 % (Figure 04).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

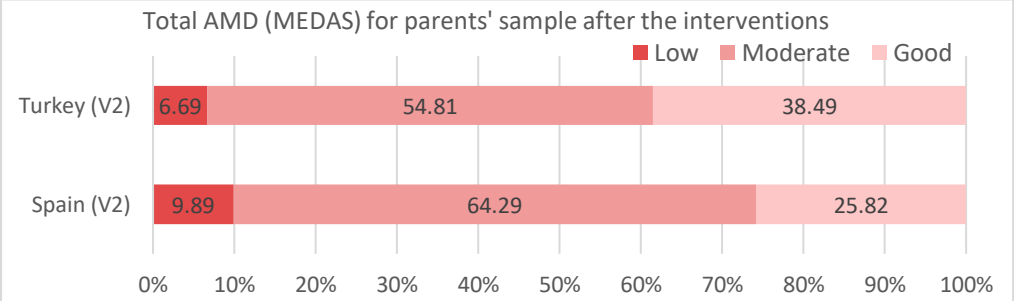


Figure.04 Distribution of the total sample of parents' subsample at the baseline (V1)

Regarding the adolescents, the percentage of Spanish adolescents with high AMD rose to 57.45% following the intervention (V2), but the percentage of adolescents with moderate and poor AMD fell to 31.91% and 9.57%, respectively. For Turkish adolescent sub-sample, the proportion of the adolescent with high AMD increased to 25.83% while the proportion of adolescents with moderate and low AMD decreased to reach the 56.67 % and 16.67% respectively (Figure 05).

The subsample of Children in Spain with moderate and weak AMD decreased to 48.39% and 5.38% respectively while, the proportion of children with AMD increased to 46.26%. Likewise, the proportion of Turkish children with high AMD increased to reach the 32.5% of the subsample, while, the proportion of those with moderate and low AMD decreased slightly to 55% and 12.51% respectively (Figure 05).

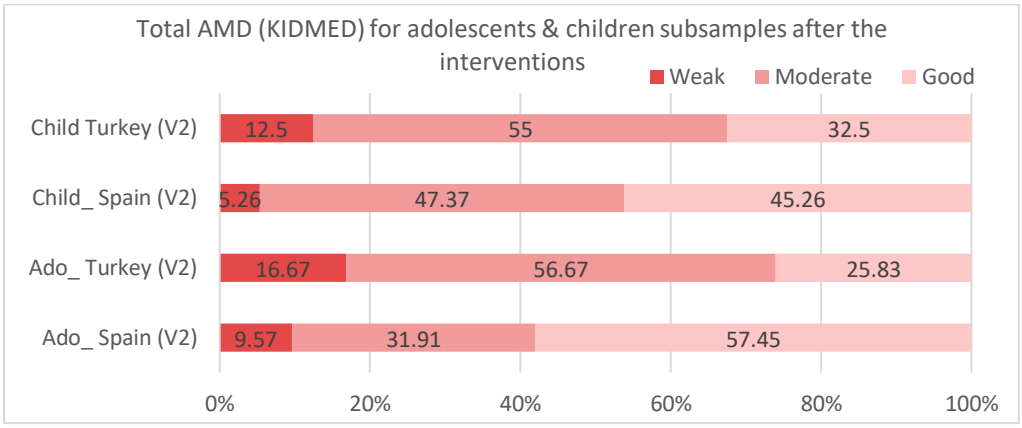


Figure.05 Distribution of the total AMD of the adolescents and children's sub-samples after the interventions (V2)

5.2.2 Factors related with families' attitude, behaviour and lifestyle

Post-intervention analysis of behavioral variables among parents shows that Spanish participants consistently scored higher than Turkish parents across all measures:

MEDLIFE (14.98 vs 13.93, p=0.003), Physical Activity (2110.5 vs 761.26, p=0.000), Nutrition Knowledge (15.59 vs 13.75, p=0.000), and MD Intention (4.31 vs 3.55, p=0.000). Despite the fact that Turkish parents showed baseline enhancement in nearly every variable, country difference remained significant. PA continues to show the most significant discrepancy, with the values of Spanish parents still about three times bigger in comparison to Turkish parents. Generally, these findings show that while both parents' sub-samples showed some enhancements following the interventions, the extremely big baseline difference between Spanish versus Turkish parents continued to persist. On the other hand, post-intervention results for adolescents show Spanish participants maintained higher scores than Turkish adolescents in KIDSCREEN (103.27 vs 98.18, p=0.014) and MD Intention (3.69 vs 3.22, p=0.007). PA differences between both subsamples were no longer significant (2.67 vs 2.51, p=0.121). Notably, Turkish adolescents demonstrated improved NK scores that approached but didn't quite exceed Spanish adolescents' scores (8.62 vs 6.79, p=0.061). These findings indicate that while Spanish adolescents retained advantages in quality of life and dietary intentions, Turkish adolescents showed substantial improvements, particularly in nutrition knowledge.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Analysis of post-intervention data on children's behavior reveals sustained differences between Spain and Turkey. After the implementation of the interventions, Spanish children maintained higher KIDSCREEN scores than Turkish children (113.49 vs 101.93, p=0.000), indicating a continued advantage in health-related quality of life. However, in PA, the difference between countries was no longer significant (2.98 vs 2.85, p=0.285), suggesting that the intervention may have reduced the initial gap. Turkish children showed small improvements in both quality-of-life scores from baseline, while Spanish children's scores were relatively stable. This suggests that the intervention had more effect on Turkish children, particularly in closing the PA gap, although quality of life measures was still different.

5.3 Monitoring and understanding behavioural changes (Total effect)

5.3.1 Adherence to MD

The correlation between the participants' initial AMD (score at V1) on the X-axis and the change in AMD (estimated as V2-V1) on the Y-axis is shown in the scatter plot (Figure 06) of the parents' Spanish sample. While negative values on the Y-axis represent decline in AMD, positive values represent improvement in AMD scores. Participants with little or no change over the course of the two visits are depicted by points close to Y = 0

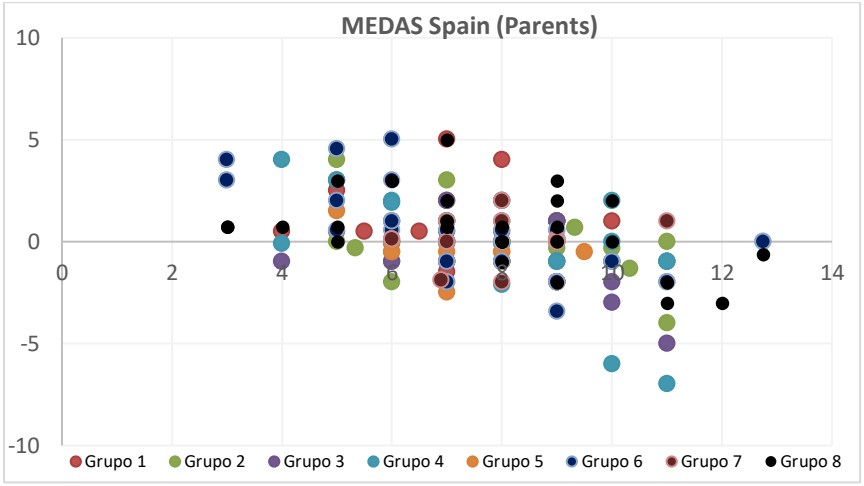


Figure.06 Variation in AMD scores among Spanish parents between baseline (V1) and follow-Up (V2)

Overall, the trend is a slight declining slope, suggesting that Spanish parents with lower initial AMD scores had more heterogeneous changes, positive and negative, those with higher initial scores saw declining compliance. High concentration close to Y = 0 is interesting in the sense that despite their initial score, most parents had relatively consistent AMD scores from the first visit to the second with minimal change.

The subgroup of Spanish parents' respondents, especially those who had higher initial scores for AMD, demonstrated a minimal reduction in adherence, which is consistent with the ceiling effect, which states that subjects who began adopting healthier eating habits had fewer opportunities for improvement or slightly retreated over time (Figure 06).

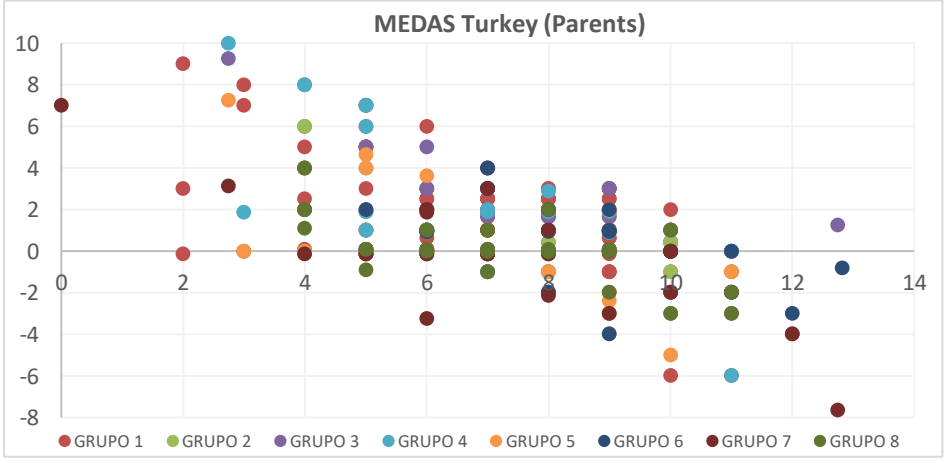


Figure.07 Variation in AMD scores among Turkish parents between baseline (V1) and follow-Up (V2)

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Looking at the Turkish data points of Figure 07, we see a similar pattern to what happened in Spain, but with better overall results. The fact that there is better than negative dots indicates that more parents have changed their eating habits, regardless of where they came from.

There's still that downward trend if you look closely, though it's not as strong as in the Spanish group. What this tells us is that people who were already doing okay in the middle range still got better, just not by huge amounts. However, those who began with unhealthy eating habits, they achieved some truly amazing results. Interestingly, some Turkish parents starting with high initial AMD scores showed steady AMD, others have modest reductions. According to this pattern, high AMD at the beginning may limit the possibility of additional positive change or even cause gradual decreases as a result of lifestyle difficulties or intervention fatigue.

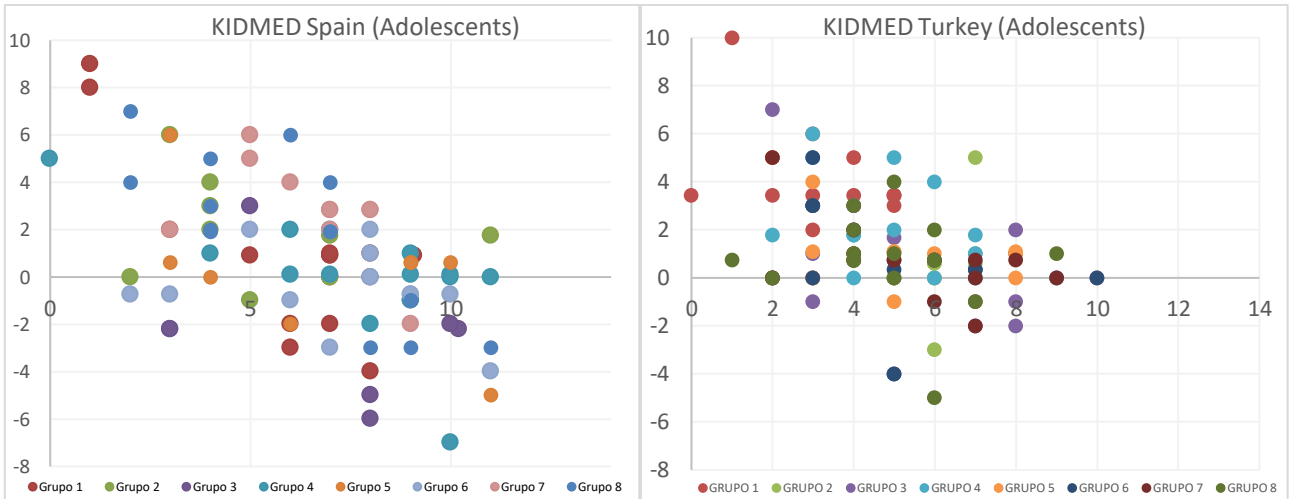


Figure.08 AMD (KIDMED) score changes between the study visits in Spanish and Turkish adolescents

Figure 08 showed a noticeable emerging pattern, with greater variability compared to the parents' samples. We can see that Spanish adolescents with lower initial scores exhibit a wide range of changes, some are improving significantly, while others show a decline, highlighting a more diverse response to the interventions. On the other side, higher initial scores show a little decline over time, indicating that it might become harder to sustain high AMD levels. The clusters around the Y-axis indicate that some adolescents did not change much, but the broader dispersion points indicate a more dynamic behaviour patterns in this age group, which can be influenced by other factors relative to adolescents and their lifestyle.

Compared to the Spanish adolescents. Turkish adolescents' sub-sample shows a more compact spread, with most participants clustered around lower initial scores and small changes. While a concentration near to zero indicates many maintained stable dietary habits, fewer high initial scores and less extreme negative changes suggest a more balanced response, with less evidence of the ceiling effect observed in the Spanish group.

Figure 09 show that children having a low beginning KIDMED scores tended to have more diverse outcomes following the intervention, demonstrating significant improvement, based on the scatter plot of KIDMED score changes within the Spanish sub-sample. Children starting off with better scores, saw less progress or even a modest decrease. The different groups are evenly distributed, though some are more concentrated in the higher score range, possibly indicating differences in intervention responses. Overall, the data suggests that children with poorer initial AMD benefited more, while those with better habits were more likely to maintain or slightly decline.

On the other side of the same graph, the graph for Turkish children, shows a similar structure to the Spanish one but reveals key differences in patterns. Again, there is a wide range of improvements in children with lower initial KIDMED scores (between 2-4), however some still experiencing some declines. But the distribution seems to be more concentrated around the minor AMD changes, indicating that while there are improvements, they typically were more modest compared to the Spanish children. Children with higher beginning scores (around 8-10) primarily exhibit stability, with little negative changes compared to the Spanish sample.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

This allows to understand that Turkish children with higher scores maintained their routines better or they encountered fewer barriers to following a healthy diet. Group distributions seem more intermixed, without a clear pattern of certain groups dominating higher or lower scores. Overall, the interventions appear to have supported slight improvements, especially among children with lower initial scores, though the changes seem less pronounced than in the Spanish sample (Figure 09).

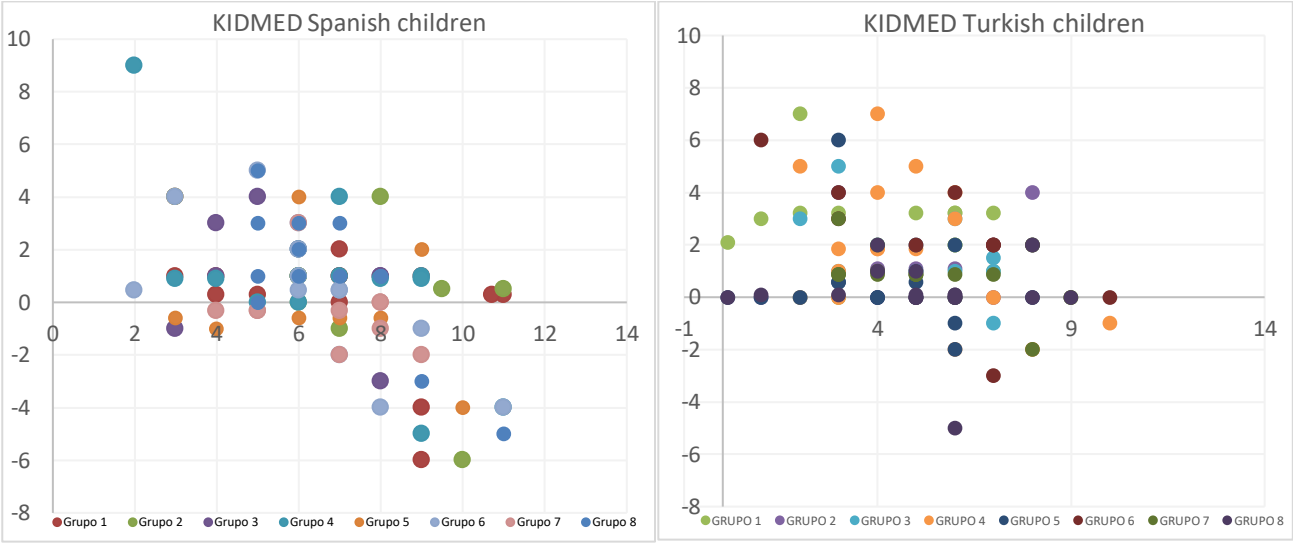


Figure.09 AMD (KIDMED) score changes between the study visits in Spanish and Turkish children sub-sample

Table 2 represents the total AMD scores of the parents' subsample in both countries, which shows that although Spain's parental AMD scores slightly increased after the intervention, this difference between before and after the interventions was not statistically significant. On the other hand, Turkish parents, after receiving the interventions, showed a notable statistically significant improvement in AMD scores with much higher AMD scores than the Spanish ones, indicating that the intervention was especially successful in the Turkish context. As there was no remarkable difference between both countries' baseline AMD scores.

Table 2. Table. Comparison of Parents' total AMD scores before and after interventions: Spain vs. Turkey

Variable	Parents' total AMD							
	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
AMD	7.74 (1.983)	7.82 (1.944)	0.685	7.41 (2.053)	8.32 (2.036)	0.000	0.128	0.009

Note: The cells shaded in gray indicate statistically significant differences at the 5% level ($p < 0.05$). The cells shaded in light red denote marginally significant differences at the 10% level ($0.05 \leq p < 0.10$).

Table 3 represents the results for adolescents' subsample showing that both Spain and Turkey demonstrated statistically significant improvements in AMD scores following the interventions.

Spanish adolescents started with higher baseline AMD scores (6.55) compared to Turkish adolescents (4.87), and this difference was statistically significant. Following the interventions, AMD scores significantly improved in both countries (Turkey to 6.21 and Spain to 7.31), with both gains being statistically significant. Even after the interventions, and despite the overall greater improvement of Turkish adolescents, Spanish counterparts maintained significantly higher AMD scores. The interventions seem to have been more effective for adolescents of both countries which is in contrast to the findings of the parents, with Turkish parent being with a significant improvement.

Table 3. Table. Comparison of adolescent's total AMD scores before and after interventions: Spain vs. Turkey

Variable	Adolescents' total AMD							
	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
AMD	6.55 (2.664)	7.31 (2.687)	0.05	4.87 (2.214)	6.21 (2.333)	0.000	0.000	0.000

Note: The cells shaded in gray indicate statistically significant differences at the 5% level ($p < 0.05$). The cells shaded in light red denote marginally significant differences at the 10% level ($0.05 \leq p < 0.10$).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Looking at the children's performance in other nations paints a different picture. Turkish children's eating habits actually got a whole lot better, with their KIDMED scores jumping from 4.89 all the way up to 6.24 being statistically significant. Spanish children only demonstrated a little and statistically insignificant increase to 7.12 in the post-intervention even having higher baseline AMD scores (6.68 versus 4.89 in Turkey). So while the gap between the two countries definitely shrunk after receiving the interventions, Spanish children still ended up with notably better eating scores than the Turkish kids, even after the intervention concluded (Table 4).

Table. 4 Comparison of Children's total AMD scores before and after interventions: Spain vs. Turkey

Variable	Children' total AMD							
	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
AMD	6.68 (2.254)	7.12 (2.289)	0.192	4.89 (2.197)	6.24 (2.51)	0.000	0.000	0.000

Note: The cells shaded in gray indicate statistically significant differences at the 5% level ($p < 0.05$). The cells shaded in light red denote marginally significant differences at the 10% level ($0.05 \leq p < 0.10$).

5.3.2 Factors related with families' attitude, behaviour and lifestyle

According to the NK SCORE scatter plot for Spanish parents (Figure 10) there is a clear and evident pattern, where parents with higher baseline NK scores (14–20) are not showing a change or even a slight decline, while those with beginning scores between 8–12 show the biggest gains (up to 6 points).

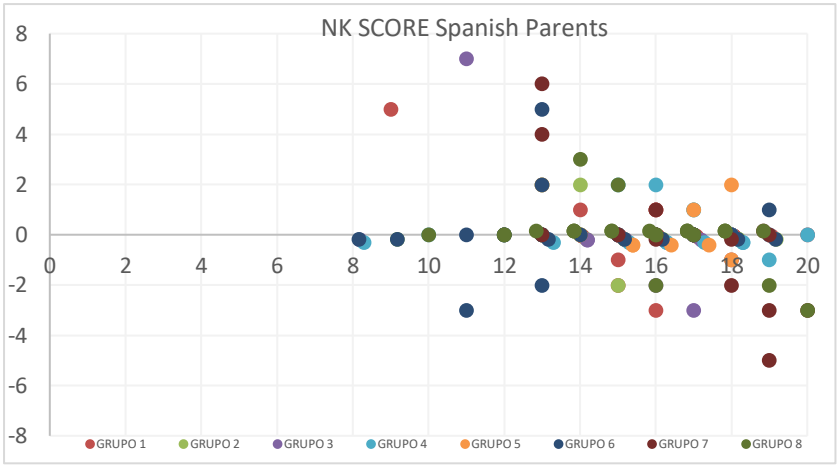


Figure.10 NK score changes among Spanish parent's sub-sample

This implies that the intervention was most effective for participants with poorer initial NK. Notably, the data clusters predominantly on the right side of the graph, with initial scores ranging from 8 and above, indicating that parents' NK was not that bad even before the interventions which is justified by the right-skewed distribution of the data.

This suggest that, the Spanish parent cohort possessed a solid foundation of NK, with the intervention providing the most benefit to those in the middle range of the knowledge spectrum.

In contrast to the Spanish cohort, the same graph for Turkish parents reveals a more diverse response to the intervention. Or scores ranging between (5-20), there is less right-side clustering, suggesting more varied NK scores at baseline. The most notable aspect is the higher degree of variation in results through all initial score ranges, with notable increases (up to 7 points) and significant declines (down to -6 points) occurring at similar starting levels. This polarized pattern suggests that while the intervention effectively improved knowledge for many Turkish parents, other factors may have influenced negative outcomes regardless of baseline knowledge (Figure 11).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

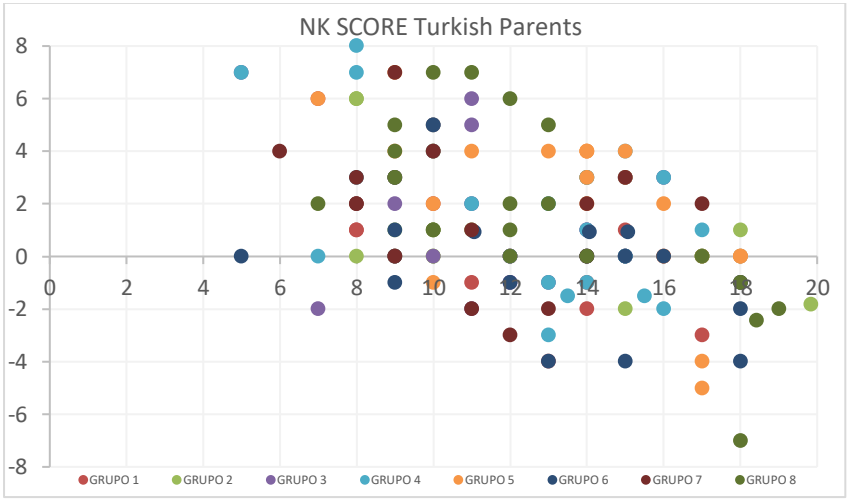


Figure.11 NK score changes among Turkish parent's sub-sample

When examining the NK of adolescents, the Figure 12 for Spanish adolescents reveals a dramatic inverse relationship between initial scores and changes. Adolescents with lower baseline knowledge (0-5) saw impressive gains (5-15 points), whereas those with higher initial scores between (10-20) had significant drop (5-20 points). Compared to parents' group, this marked regression to the mean effect is considerably larger, indicating adolescents' NK was more volatile.

The pattern appears consistent across all intervention groups, indicating this was a general phenomenon rather than group-specific, though the distribution of specific groups varies slightly across the plot.

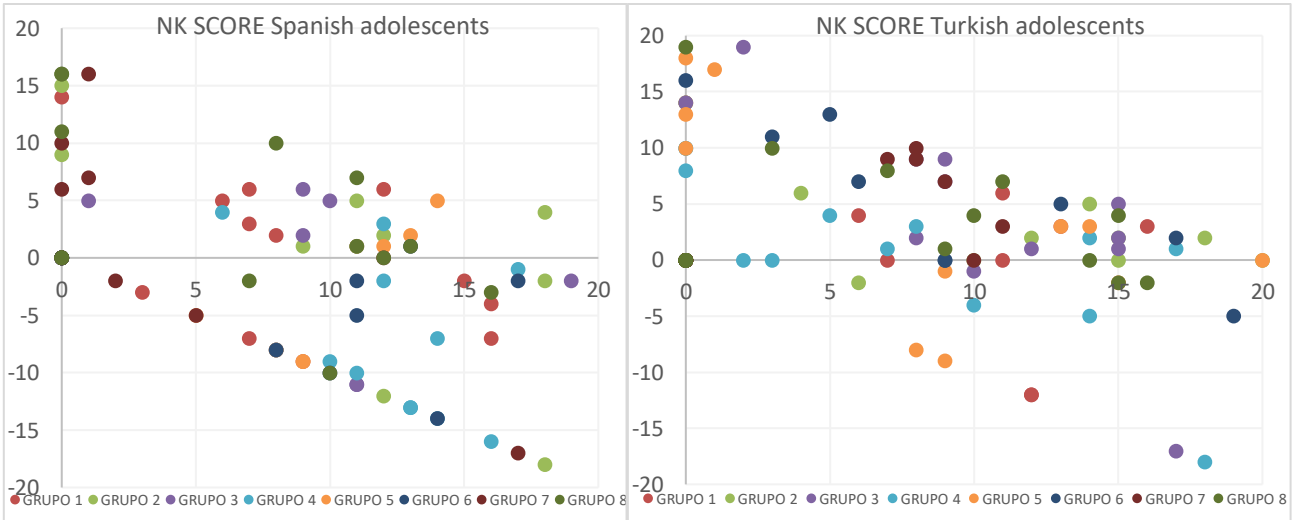


Figure.12 NK score changes among Spanish and Turkish adolescents sub-sample

When examining the NK of Turkish adolescents, the graph reveals a pattern distinct from their Spanish peers. Turkish teens with minimal baseline knowledge (0-5) showed remarkable improvements (10-18 points), while those in the middle score range (5-15) had mixed outcomes.

Unlike Spanish group, Turkish adolescents having high NK scores at baseline experienced less severe declines, implying improved retention of NK. The overall distribution shows stronger clustering in the positive change region for lower baseline scores, suggesting that the interventions were especially effective and successful in filling in knowledge gaps among Turkish adolescents with less NK awareness (Figure 12).

After analysing the visual relationships and distribution patterns displayed in the scatter plots, we now turn our attention to the statistical comparisons for each of the main factors related to behaviour.

This will be for each of the sub-samples (parents, adolescents, and children) between and within both countries. The following tables present the results of mean difference tests, which allow us to quantitatively assess the significance of observed changes across various outcome measures before and after the intervention.

Without any consideration of interventions groups nor intervention effects, results of the table 5 revealed that, for MEDLIFE scale, Turkey parents show a statistically significant increase (12.73 to 13.93, p<0.000),

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

while Spanish parents shows only a marginally significant improvement even that Spanish pre and post scores are higher than the ones of Turkish subsample, in addition to the existence of high significant differences between countries both before and after intervention.

Regarding the parental PA, Turkey shows a statistically significant decrease (796.01 to 761.26, p=0.015), while Spain's decrease is not significant. Spain maintains significantly higher PA levels throughout. Therefore, there is a clear significant difference between parents' PA scores between countries both at pre or post assessment. For NK, only Turkey shows a high significant improvement, with Spain showing minimal change however, it maintains significantly higher NK scores throughout. When it comes to parents' intention to follow a healthy MD, Spain shows a significant decrease (4.48 to 4.31, p=0.023), while Turkey shows a significant increase (3.15 to 3.55, p=0.039). Significant differences exist between countries throughout (Table5).

Table. 5 Comparison of parental behavioural indicators before and after the intervention: Spain vs. Turkey

Variables	Total effect (parents)							
	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
MEDLIFE	14.29 (3.183)	14.98 (2.553)	0.064	12.73 (2.949)	13.93 (2.963)	0.000	0.000	0.003
PA	2912.01 (3438.61)	2110.5 (1446.775)	0.318	796.01 (1443.354)	761.26 (793.295)	0.015	0.000	0.000
NK	15.51 (2.474)	15.59 (2.54)	0.577	12.29 (3.476)	13.75 (3.171)	0.000	0.000	0.000
ADM_ Intention	4.48 (0.632)	4.31 (0.71)	0.023	3.15 (1.606)	3.55 (1.398)	0.039	0.000	0,000

Note: The cells shaded in gray indicate statistically significant differences at the 5% level (p < 0.05). The cells shaded in light red denote marginally significant differences at the 10% level (0.05 ≤ p < 0.10).

Table. 6 Comparison of adolescents' behavioural indicators before and after the intervention: Spain vs. Turkey

Variables	Total effect (adolescents)							
	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
KIDSCREEN	104.98 (13.143)	103.27 (13.035)	0.425	93.95 (13.124)	98.18 (10.767)	0.030	0.00	0.014
PA	2.68 (0.674)	2.67 (0.572)	0.897	2.37 (0.662)	2.51 (0.624)	0.174	0.004	0.121
NK	7.76 (6.024)	6.79 (6.924)	0.313	6.19 (6.399)	8.62 (7.54)	0.010	0.052	0.061
ADM _Intention	3.86 (0.719)	3.69 (0.805)	0.285	2.71 (1.172)	3.22 (1.028)	0.003	0.000	0.007

Note: The cells shaded in gray indicate statistically significant differences at the 5% level (p < 0.05). The cells shaded in light red denote marginally significant differences at the 10% level (0.05 ≤ p < 0.10).

The comparison of adolescents' behavioral factors before and after the intervention reveals noticeable variations and clear tends between Spain and Turkey. In terms of quality of life, PA, NK, and AMD intention, Spain exhibit negligible changes across all variables with no statistically significant differences.

However, Turkish adolescents showed significant changes in many factors, where the scores related to KIDSCREEN decreased, and both NK and AMD intention improved significantly (p=0.010 and p=0.003 respectively). Despite the lower baseline scores, Turkish adolescents had greater behavioural response, indicating that interventions have reduced the pre-existing gaps between the countries. These results imply that the intervention's effectiveness differ by cultural context, with Turkish adolescents showing more noticeable improvements in nutrition-related behaviours (Table 6).

Considering the total sample effect of each children's sample, analyses of behavioral indicators revealed that Spain and Turkey exhibit different patterns of response to the interventions.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Spanish children demonstrated negligible changes in most measures without statistically significant differences in NK, PA, and quality of life measured by the KIDSCREEN scale. On the other hand, Turkish children demonstrated more noticeable improvements, especially in areas related to nutrition, where both NK and AMD intention improved significantly. As was seen with adolescents, for children, the intervention appears to have been more successful in closing pre-existing differences between countries. These results imply that cultural context and baseline characteristics influenced intervention outcomes for children as well, with Turkish children demonstrating higher behavioral responsiveness to the interventions despite having low scores at baseline, especially in nutrition-related behaviors (Table7).

Table.7 Comparison of children' behavioural indicators before and after the intervention: Spain vs. Turkey

	Total effect (children)							
Variables	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
KIDSCREEN	114.56 (9.347)	113.49 (10.138)	0.586	98.18 (14.595)	101.93 (11.743)	0.126	0.000	0.000
PA	2.91 (0.72)	2.98 (0.691)	0.553	2.63 (0.735)	2.85 (0.689)	0.061	0.026	0.285

6. Assessment of Families' AMD and Behavioural Factors Considering the Group Effect *(by Intervention Group)*

6.1 Pre-assessment

6.1.1 Adherence to MD

The analysis of AMD scores at pre-assessment in parent's sample and per intervention group show some interesting and intriguing trends across groups in Spain and Turkey.

In Spain, the AMD scores at baseline ranged from 7.28 to 8.30, where G2 had the highest AMD (8.30), followed by G7 and G3, while G5 HAD the lowest average score (7.28).

The Turkish sample showed a similar trend, with scores ranging from 6.84 to 8.46. The G2 showed the highest AMD score (8.46), followed by G6, and G4 with the lowest adherence (6.84).

The data shows no statistically significant differences between corresponding groups in Spain and Turkey when comparing baseline scores between countries as shown by all p-values in the "Before vs Before" column exceeding 0.05. The comparison between G7 in both countries approached statistical significance, with Spanish parents showing a higher AMD score (8.22) than their Turkish counterparts (7.28). These findings suggest that before any intervention, parents from both countries demonstrated comparable levels of AMD across all study groups, providing a relatively even baseline for subsequent intervention assessment (Table8).

However, there are distinct differences in the pre-assessment analysis for AMD among adolescents per group of intervention between Spain and Turkey. The baseline AMD scores of Spanish adolescents were consistently higher (ranging from 5.4 to 7.57) than those of their counterparts (ranging from 4.12 to 5.84). G4 showed the highest AMD in Spain (7.57), while G2 had the highest in Turkey (5.84).

Notably, statistically significant differences were observed between the countries in four Groups (G1, G4, G5, and G6), all favouring higher adherence among Spanish adolescents.

These findings establish that prior to any intervention, Spanish adolescents generally maintained better AMD than Turkish adolescents, creating an uneven baseline for subsequent intervention assessment (Table12).

When it comes to children, the analysis of the study's main outcome (AMD) when taking into consideration the effect of group reveals a clear pattern of differences at baseline.

Children from Spain and Turkey are consistently different the ones from the other based on their AMD scores at baseline. In comparison to their Turkish counterparts, Spanish children pronounced stronger baseline AMD across all the groups with ranges between 6.25 -7.125 and 4.196-5.75 respectively. G3 and G6 showed more comparable scores between countries, whereas G1, G2, and G5 show the most changes (p=0.013, p=0.019, and p=0.006 respectively).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

These baseline differences imply that cultural dietary patterns most likely influenced initial AMD, with Spanish children generally having higher AMD levels at baseline (Table 13).

6.1.2 Factors related with families' attitude, behaviour and lifestyle

MEDLIFE for parents

When it comes to people's behavior, results of pre-intervention MEDLIFE scores for parents show intriguing patterns between Spanish and Turkish families. The baseline mean scores of the MEDLIFE scale for Spanish parents ranged from 12.36 to 16.41, while Turkish parents showed similar scores ranging from 11.33 to 13.57. G7 showed the highest baseline score for Spanish parents (16.41), while Turkish parents in G8 achieved their highest baseline score (13.57). Notable differences appeared in G4 (Spain: 14.41, Turkey: 11.79, p=0.007) and G5 (Spain: 14.40, Turkey: 11.33, p=0.010), with Spanish parents showing substantially higher adherence to Mediterranean lifestyle habits even before any intervention (Table 11).

According to these baseline outcomes and compared to the Turkish parents, Spanish parents generally had higher Mediterranean lifestyle adherence, with statistically significant differences observed in several intervention groups.

KIDSCREEN for ADOLESCENTS

Prior to interventions results of table 12 reveal significant differences between Spanish and Turkish adolescents. The baseline scores of KIDSCREEN for Spanish adolescents were consistently higher (102.16-111.12) than those of Turkish adolescents (89.00-99.77). The most noticeable differences appeared in G1 (Spain: 109.4, Turkey: 90.66, p=0.000) and G3 (Spain: 111.12, Turkey: 93.75, p=0.001), indicating significant country-specific differences in adolescents' health-related quality of life before any intervention.

KIDSCREEN for Children

Prior to interventions, the KIDSCREEN mean scores of children suggest significant differences between Spanish and Turkish subsamples. The scores at baseline for Spanish children were consistently higher than to those of Turkish counterpart. Within Spain, G2 had the highest pre-intervention score (117.00), while Group 6 had the lowest (113.33). In Turkey, there was a more noticeable variation in in baseline scores whereas, the G4 exhibit the highest mean score (115.26), and G5 had the lowest one (97.90) (Table 13).

PA for PARENTS

The PA results prior to the intervention show significant distinctions between Spain and Turkey. When comparing Spanish parents to their Turkish counterparts, with especially high scores showed in G1 G4, and G6. On the other hand, Turkish parents of all groups reported lower PA levels and G4 demonstrating the lowest values. This suggest that, before the intervention, Spanish parents were generally more physically active, potentially due to lifestyle or environmental factors influencing habitual activity (Table 14).

PA for adolescents

The baseline PA measurements reveal interesting patterns across the eight intervention groups of the adolescents' subsample. In Spain, G6 had the lowest initial PA level (2.256 ± 0.569) while G3 had the highest (3.004 ± 0.561). Turkish adolescents had more consistent baseline PA values, ranging from 2.194 ± 0.740 in G1 to 2.554 ± 0.698 in G6. Across all the intervention groups, Spanish adolescents had baseline PA levels much greater than their Turkish counterparts. However, these cross-country differences were not statistically significant according to the before vs. before p-values, with the exception of G3 (p=0.044), implying that Spanish adolescents in this specific group showed significantly higher PA levels at baseline than Turkish participants in the corresponding group (Table 15).

PA for children

During the pre-intervention stage, PA levels assessed via the IPAC scale for children demonstrated fairly uniform baseline scores across all eight groups in Spain and Turkey. In Spain, the highest score before intervention was noted in G7 (3.53 ± 0.33), whereas Turkey's highest initial score was recorded in G6 (2.98 ± 0.604). When comparing the pre-intervention scores between countries, no statistically significant differences were detected (p>0.05), although Spanish children generally exhibited slightly higher baseline physical activity levels than their Turkish counterparts.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

G7 showed the largest disparity between countries before intervention, with Spanish children scoring significantly higher than Turkish children (3.53 vs 2.182, p=0.000) (Table 16).

NK for parents

The evaluation of the NK before receiving the intervention reveals significant baseline disparities between Spanish and Turkish parents in all groups. Los padres españoles mostraron consistentemente puntajes NK iniciales más altos, siendo G7 quien presentó el mayor conocimiento base (16.57 ± 2.40), mientras que los padres turcos en G5 tuvieron los puntajes más altos previos a la intervención entre los participantes turcos (13.87 ± 3.40). In most groups, statistical analysis showed noticeable differences between countries, with groups 1, 2, 3, 4, 7, and 8 (all $p<0.05$) having the most important differences. Given that Spanish parents had better NK scores at baseline, giving them a deeper understanding of dietary concepts compared to their Turkish counterparts, it implying notable cross-cultural differences in basic NK (Table 17).

NK for Adolescents

Initial evaluation of adolescents' NK revealed contrasting baseline knowledge between Spanish and Turkish youth. Spanish adolescents in G4 demonstrated the most substantial nutritional comprehension (10.429 ± 5.273), while Turkish adolescents in G3 exhibited the highest preliminary scores among their national cohort (9.231 ± 5.732). Interestingly, no statistically significant disparities emerged when comparing pre-intervention measurements between countries (all $p>0.05$), suggesting that despite cultural differences, adolescents in both regions possessed comparable nutritional understanding prior to educational interventions. The differing parity among countries is importantly different from parental data, suggesting that generational influences may play a more significant role in cross-cultural NK acquisition more significantly than other factors (Table 18).

AMD intention for Parents

Examination of baseline AMD intention metrics revealed pronounced deviations between Spanish and Turkish parents. Spanish participants consistently demonstrated stronger initial intention toward AMD across all intervention categories, with G5 exhibiting the highest preliminary commitment (4.595 ± 0.456). Turkish parents displayed considerably lower baseline intention scores, with G7 showing their highest pre-intervention measurement (3.564 ± 1.117). Statistical analysis confirmed significant cross-national differences in multiple cohorts, specifically G3, 4, 5, and 8 (all $p<0.05$), highlighting substantial cultural variations in dietary predispositions. The marked contrast between countries suggests that Spanish parents commenced the study with inherently stronger inclinations toward Mediterranean dietary patterns, potentially reflecting deeper cultural embeddedness of these eating habits within their familial traditions. (Table 19).

AMD intention for Adolescents

Initial assessment of adolescents' AMD intention revealed substantial cross-cultural variations. Spanish youth displayed consistently higher baseline commitment toward MD practices across all intervention categories, with G3 exhibiting the strongest preliminary intention (4.125 ± 0.562). Turkish adolescents demonstrated considerably lower baseline disposition toward Mediterranean eating patterns, with G5 showing their highest pre-intervention measurement (2.944 ± 1.213). Statistical analysis confirmed significant inter-country discrepancies in multiple cohorts, specifically G 1, 3, 4, 6, 7, and 8 (all $p<0.05$), underscoring fundamental differences in adolescents' dietary predilections between nations. This pronounced disparity suggests that Spanish adolescents entered the study with inherently stronger inclinations toward Mediterranean dietary behaviors, potentially reflecting deeper cultural integration of these eating habits within their developmental environment (Table 20).

6.2 Post-assessment

6.2.1 Adherence to MD

Post-intervention AMD scores for parents considering for the group effect reveal interesting patterns between Spanish and Turkish families. After the intervention, Spanish parents displayed AMD scores ranging from 6.78 to 8.32, while Turkish parents showed generally higher scores ranging from 7.18 to 9.39. Several notable differences emerged between countries.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

The most significant differences appeared in G1 (Spain: 7.93, Turkey: 9.39, p=0.001) and G3 (Spain: 7.12, Turkey: 9.11, p=0.003), with Turkish parents showing substantially higher adherence.

G7 and G8 also showed significant differences (p=0.029 and p=0.030 respectively), though less pronounced. Interestingly, Spanish parents in G5 scored lower than their Turkish counterparts (6.78 vs 7.71, p=0.076), though this difference was not statistically significant. These findings suggest that the intervention may have been more effective at improving AMD among Turkish parents compared to Spanish parents, potentially narrowing or even reversing the initial cultural dietary differences observed at baseline (Table 8).

Post-intervention ADM scores for adolescents with consideration of the intervention groups reveal distinct patterns between both subsamples. After the intervention, Spanish adolescents exhibited ADM scores ranging from 4.82 to 9.33, while Turkish adolescents showed scores ranging from 5.25 to 7.56.

Group 7 showed the highest score for Spanish adolescents (9.33) with a statistically significant improvement from baseline (p=0.004), while Turkish adolescents in G1 achieved their highest score (7.56) with a significant improvement (p=0.00). The G4 showed a significant improvement for Turkish adolescents (Before: 5.00, After: 6.76, p=0.016) but virtually no change for Spanish adolescents. The G6 was the only group where Spanish adolescents scored higher than Turkish adolescents after intervention (6.71 vs 5.25).

Therefore, we suggest that interventions' effectiveness varied between countries, with certain groups showing more pronounced improvements in one country versus the other.

Furthermore, results of table 10 show that post-intervention AMD scores reveal varied patterns between children of both countries. Spanish children's scores ranged from 6.36 to 7.85, with G8 showing the highest value (Table 9).

Turkish children's scores ranged from 4.74 to 7.75, with G6 achieving the highest score and showing significant improvement (p=0.043). Turkish children in G1 demonstrated remarkable progress (4.26 to 7.28, p=0.003), while G5 was unique in showing a decline for Spanish children (7.12 to 6.52).

Overall, Turkish children exhibited more statistically significant improvements across multiple intervention groups compared to Spanish children, suggesting differing intervention effectiveness between the two countries (Table 10).

6.2.2 Factors related with families' attitude, behaviour and lifestyle

MEDLIFE for parents

Post-intervention MEDLIFE scores reveal notable differences between countries. Spanish parents maintained relatively high Mediterranean lifestyle adherence (13.31-16.70) compared to Turkish parents (12.26-16.27). The highest post-intervention scores were observed in Group 7 for Spanish parents (16.70) and Group 8 for Turkish parents (16.27). Significant differences between-country emerged in G1 (Spain: 15.31, Turkey: 13.50, p=0.036), G4 (Spain: 14.93, Turkey: 12.26, p=0.003), G5 (Spain: 16.22, Turkey: 12.70, p=0.01), and G8 (Spain: 14.68, Turkey: 16.27, p=0.027), with G8 being the only instance where Turkish parents achieved higher post-intervention scores than their Spanish counterparts (Table 11).

KIDSCREEN for adolescent

Post-intervention KIDSCREEN scores maintained similar patterns between countries. Spanish adolescents continued showing higher scores (95.66-108.90) than Turkish adolescents (93.11-100.57), though the gap narrowed in some groups. G1 still demonstrated significant differences (Spain: 108.90, Turkey: 93.11, p=0.003). Interestingly, most groups in both countries showed minimal score changes following intervention, suggesting limited impact on adolescents' health-related quality of life measures across both cultural *contexts (Table 12).*

KISCREEN for Children

After that children subsample received the implemented interventions, the KIDSCREEN scores changed differently across groups and between countries. In Spain, most groups maintained relatively stable scores, with some minor decreases, as seen in G1 (from 115.6 to 109.3). In Turkey, scores also remained stable for most groups, with slight improvements in some cases, such as G3 (from 101.6 to 104.09). However, the statistical significance of these changes varies, suggesting that the intervention may have had different

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

impacts depending on the group and country.

Comparing pre- and post-intervention results, Spain continued to show generally higher scores, while Turkey exhibited smaller changes in children's perceived well-being (Table 12).

PA for (parents)

After the interventions results of the parental PA reveal mixed trends in PA levels across both countries. In Spain, a general decrease in PA is observed across most groups, notably in G1 and G4. Meanwhile, Turkish parents in some groups, such as G2 and G8, experienced slight increases in PA, though their overall levels remained lower than those in Spain. The observed changes suggest that the intervention may have had varying effects depending on pre-existing PA habits, with Turkish parents showing small improvements while Spanish parents exhibited a decline (Table 14).

PA for (adolescents)

Following the interventions, several noteworthy changes occurred in both countries. In Spain, most groups showed slight decreases in PA levels, with G6 experiencing the most substantial reduction (from 2.256 to 2.005). Interestingly, G1 showed a marginal increase (from 2.495 to 2.703). The Turkish cohort displayed more variable responses to interventions, with notable increases in G1 (2.194 to 2.351) and 7 (2.199 to 2.495). When examining post-intervention differences between countries, G6 showed a statistically significant difference ($p=0.027$), suggesting that the intervention may have affected Spanish and Turkish adolescents differently in this group. The lack of significant p-values for most after vs. after comparisons indicates that despite different intervention responses, the final PA levels remained largely comparable between countries. Within each country, none of the interventions produced statistically significant changes in PA levels, as indicated by the p-values within the Spain and Turkey columns (Table 15).

PA for children

Post-intervention measurements revealed varied outcomes across the intervention groups of children subsample. In Spain, G3 demonstrated the highest post-intervention score (3.721 ± 0.206), while in Turkey, G6 maintained the highest activity levels (3.028 ± 0.403). Comparing post-intervention results between countries showed no statistically significant differences in most groups. However, G7 continued to display a significant difference between countries after intervention (3.478 vs 2.682, $p=0.003$), with Spanish children maintaining higher physical activity levels than Turkish children. The post-intervention PA results suggests that certain interventions may have produced different effects depending on cultural or environmental factors specific to each country (Table 16).

NK for parents

Following the interventions, post-assessment results continued to show higher NK scores among Spanish parents compared to Turkish parents across most groups. The highest post-intervention score in Spain was observed in G7 (16.538 ± 1.854), while Turkish parents in Group 5 achieved the highest post-intervention score (15.625 ± 2.946). Cross-country comparison of post-intervention results revealed persistent significant differences in G1, 3, and 7 ($p\leq0.010$). Notably, the gap between Spanish and Turkish parents' NK scores narrowed in several groups post-intervention, particularly in G2, 4, and 8, where previously significant differences were no longer statistically significant, suggesting that certain interventions may have helped reduce the initial knowledge disparity (Table 17).

NK Adolescents

Terminal assessment following intervention implementation unveiled shifting dynamics in adolescents' NK.

Turkish youth broadly outperformed their Spanish counterparts, with Turkish adolescents in G3 achieving the zenith of nutritional literacy (13.154 ± 6.78). Conversely, Spanish adolescents in G8 recorded their national

maximum (9.643 ± 7.11). Notably, G6 exhibited a statistically significant disparity between countries after intervention implementation ($p=0.009$), with Turkish adolescents demonstrating markedly superior nutritional knowledge. This represents a remarkable inversion of the pre-intervention pattern, where Spanish youth initially displayed slight advantages across most groups, suggesting differential receptivity to educational content between the adolescent populations (Table 18).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

AMD intention Parents

Subsequent to intervention implementation, post-assessment results continued to demonstrate that Spanish parents had superior commitment to MD practices compared to the Turkish parent subsample. G5 maintained the highest intention scores among Spanish participants (4.711 ± 0.434), while Turkish parents in G7 achieved their maximum (3.711 ± 1.221). Significant inter-country disparities persisted in G3, 5, 6, and 7 (all $p<0.05$), though the magnitude of these differences fluctuated across intervention categories. Notably, Spanish parents in G8 experienced a decline in AMD intention despite receiving the comprehensive intervention package, whereas Turkish parents in this same group demonstrated substantial improvement. This divergent response pattern indicates that intervention effectiveness may interact with pre-existing cultural attitudes toward dietary practices in complex and sometimes counterintuitive ways (Table 19).

AMD intention Adolescents

Moreover, post-assessment data continued to show Spanish adolescents maintaining higher AMD intention compared to their Turkish counterparts, even if the differences are smaller. G3 preserved the highest intention scores among Spanish participants (3.944 ± 0.712), while Turkish adolescents in G8 achieved their cohort's maximum (3.636 ± 0.781). Interestingly, the stark statistical differences observed at baseline were substantially reduced, with only G1 approaching significance ($p=0.082$). This convergence of intention scores suggests that interventions may have helped bridge the initial cross-cultural gap, particularly by elevating Turkish adolescents' commitment to MD practices while Spanish participants maintained relatively stable, albeit slightly diminished, intention levels (Table 20).

6.3 Monitoring and understanding behavioural change

6.3.1 Adherence to MD

Looking at the MEDAS score charts (Figure 13) for Spanish parents across the eight different intervention groups (G1-G8), generally, there is a several notable patterns emerging. Overall, the eight graphs display varying patterns of change in AMD across different baseline score ranges. Most groups show a mixture of positive and negative changes, with initial MEDAS scores typically ranging from 4-14 points.

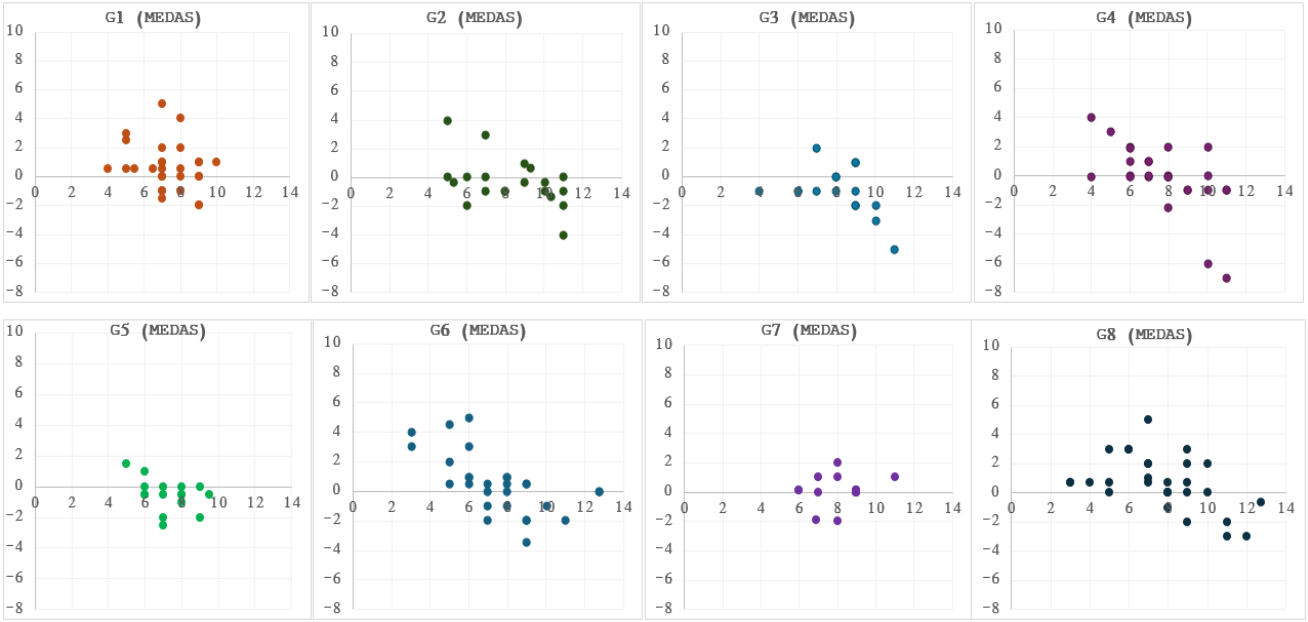


Figure.13 MEDAS score changes across the intervention groups in Spanish Parents sub-sample

The distribution of dots suggests that parents began the study with moderate AMD. The intervention effects can be categorized into three distinct patterns. First, the *Improvement-focused*: G1 and G6 demonstrate notable positive changes, particularly effective for parents with lower to middle initial scores, suggesting these approaches successfully enhanced AMD among less adherent participants. *Regression patterns*: G4 and G5 display negative correlations where higher initial scores correspond with more substantial declines, indicating possible regression effects among initially high-adhering parents.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Stabilizing effect: G2, G3, G7, and G8 show more balanced distributions with changes clustering around zero, particularly G8 which appears to maintain rather than transform dietary habits.

The Turkish parents' AMD score scatter plots across the eight intervention groups show more pronounced patterns compared to the Spanish cohort, with initial scores typically ranging from 2-12 points, suggesting generally lower baseline AMD. These groups can be categorized into three clear response patterns:

Strong positive correlation: mainly the G1 and G4 showing remarkably similar downward-sloping patterns with substantial positive changes (4-9 points) for lower initial scores, demonstrating these interventions were highly effective for participants with poor baseline AMD. *Mixed response*: G2, G3, G6, and G8 display more scattered distributions with moderate positive changes predominating, particularly in the middle score ranges, indicating broadly beneficial but less dramatic intervention effects. *Distinct negative correlation*: G5 and G7 (bottom left and middle-right) show clear inverse relationships between initial scores and changes, with G7 displaying the most pronounced negative trend where higher initial scores correspond with consistent declines.

The Turkish parents' data reveals more defined intervention effects than the Spanish sample, with clearer patterns of improvement among initially low-adhering participants, suggesting the interventions may have been particularly well-suited to address lower baseline AMD in this parents' sub-sample (Figure 14).

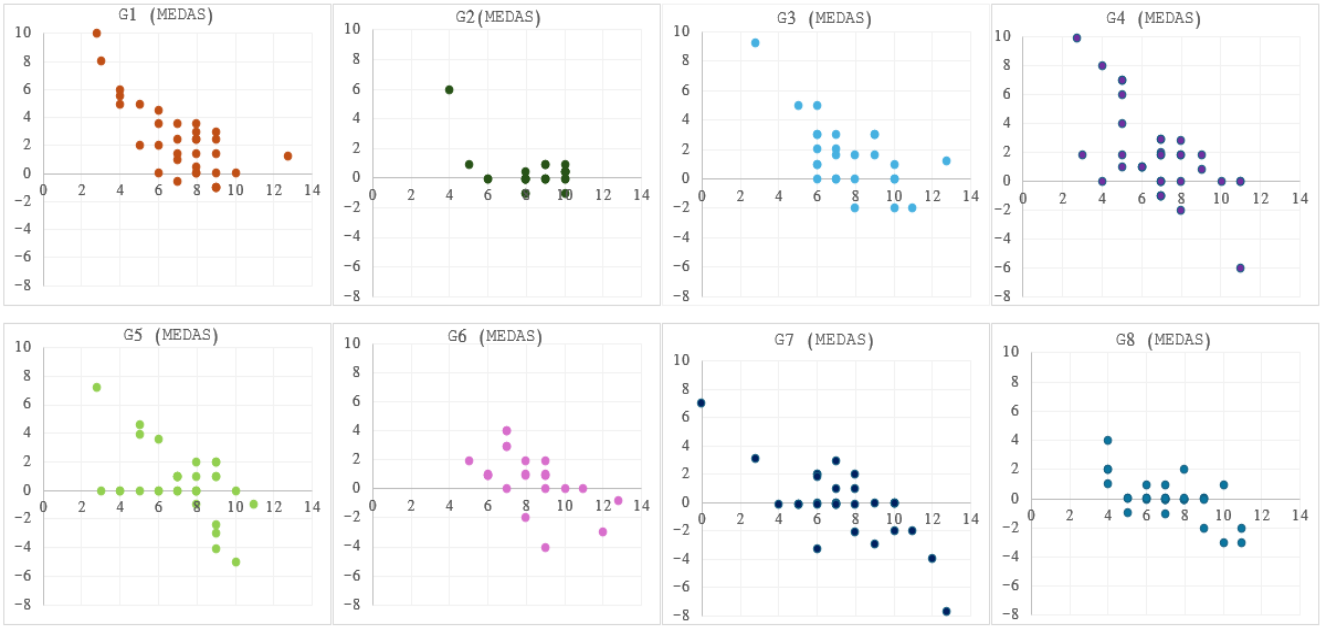


Figure.14 MEDAS score changes across the intervention groups in Turkish Parents sub-sample

Looking at KIDMED score changes across Spanish adolescent intervention groups (Figure 15), most began with moderate AMD (scores 4-14). Group patterns reveal distinct intervention effects: G1 shows clear negative correlation where lower initial scores improved dramatically (6-8 points) while higher scores declined. G2 and G3 show mixed results with moderate improvements in lower ranges. G4 displays minimal changes regardless of baseline. G5 and G8 demonstrate positive changes (2-6 points) across various initial scores, while G7 shows consistent improvements specifically among middle-range participants. The varied response patterns across groups suggest differential effectiveness of interventions, with some particularly beneficial for adolescents with lower baseline AMD principles.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

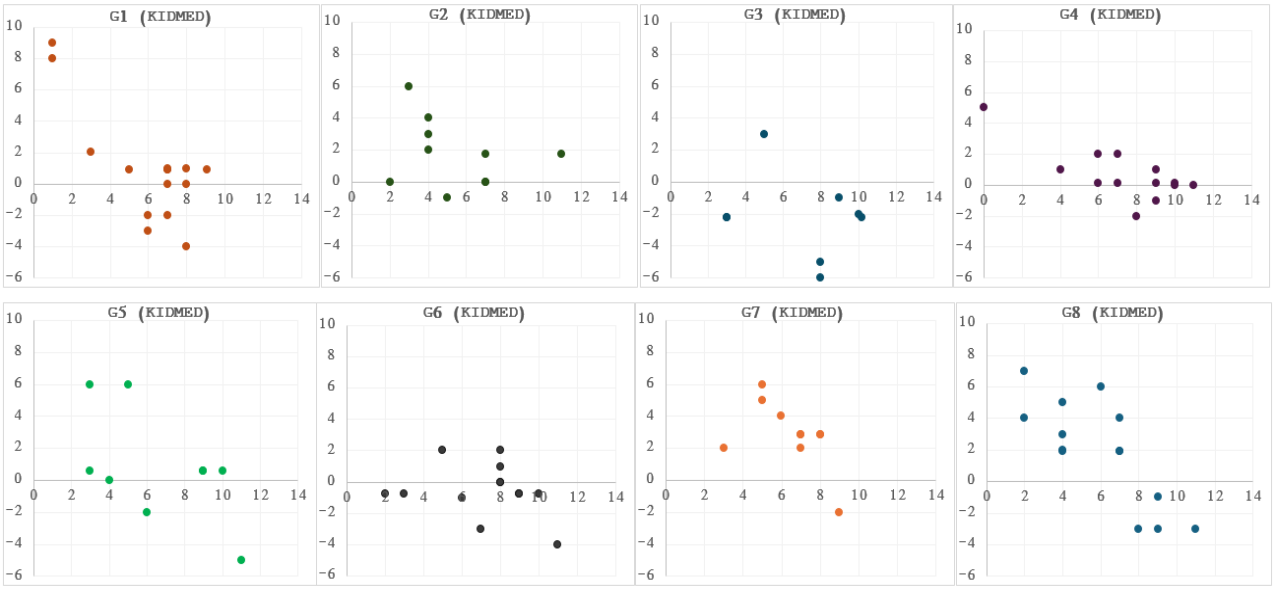


Figure.15 KIDMED score changes across the intervention groups in Spanish adolescents' sub-sample

Shifting our focus from Spanish to Turkish cohorts, the KIDMED score patterns among Turkish adolescents reveal distinctive intervention outcomes. Most Turkish teens started with moderate MD adherence (scores 2-12), slightly lower than their Spanish peers. The intervention effects vary across groups: G 1 exhibits predominantly positive shifts (2-10 points), especially among those with limited initial adherence.

The G3 and G4 show consistent gains (1-6 points) across all baseline levels, while G5 demonstrates remarkable uniformity with consistent modest improvements (1-2 points). Unlike the Spanish sample, Turkish adolescents display fewer dramatic declines, with G6, G7, and G8 showing generally favorable trends, particularly in mid-range participants. This pattern suggests the interventions may have resonated more effectively within the Turkish cultural context, producing more consistently positive changes in AMD regardless of starting point (Figure 15).

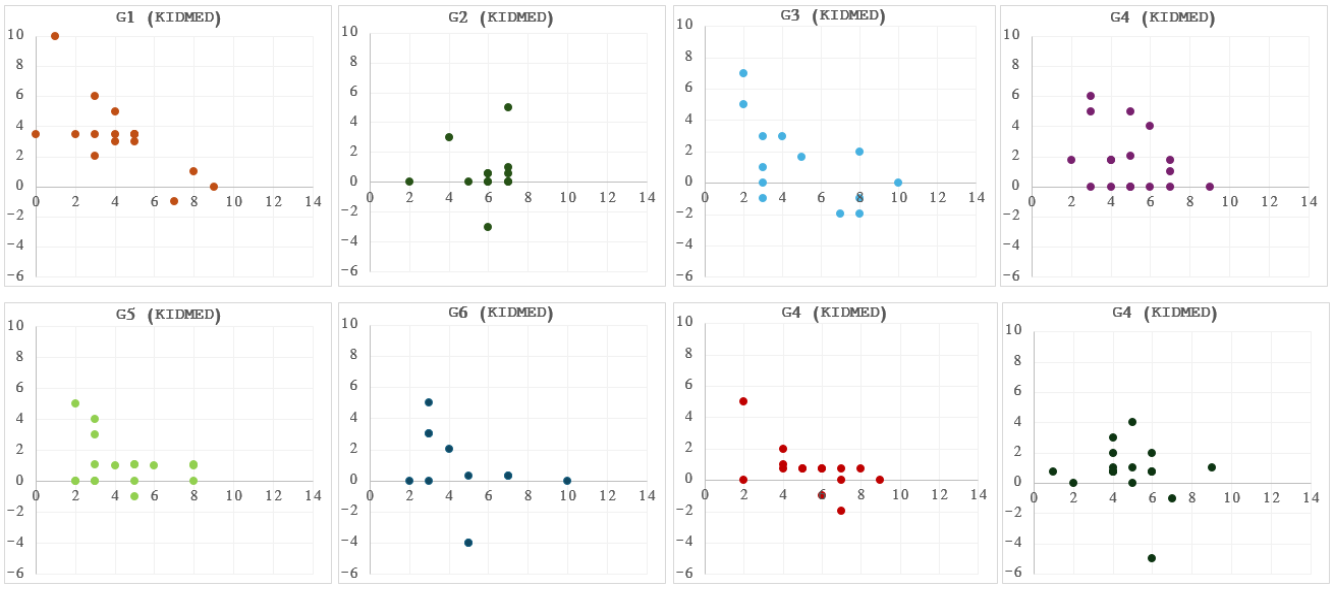


Figure.16 KIDMED score changes across the intervention groups in Turkish adolescents' sub-sample

Examining the AMD patterns among children reveals distinct differences between the Spanish and Turkish cohorts. Looking at the KIDMED score changes across intervention groups, both populations show interesting response patterns worthy of analysis. Turkish children (Figure 17) demonstrate predominantly positive KIDMED score changes across most intervention groups, with initial scores ranging from 2-8 points. Groups 1-4 and 6 show particularly strong improvements of 2-7 points, with G 4 and 6 achieving nearly universal positive outcomes among Turkish children (Figure 16).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

While Groups 4 and 8 show consistent improvements of 2-5 points, other groups present mixed results with several participants experiencing no change or modest declines. Groups 5 and 7 include some notable negative changes (-4 to -6 points) among children with higher initial scores. According to these scatter plots, Turkish children responded more uniformly positively to the interventions compared to their Spanish counterparts, though both populations showed greatest improvements among those with lower baseline AMD. This pattern suggests potential differences in cultural receptivity to dietary interventions or varying familiarity with MD principles between the two sub-samples.

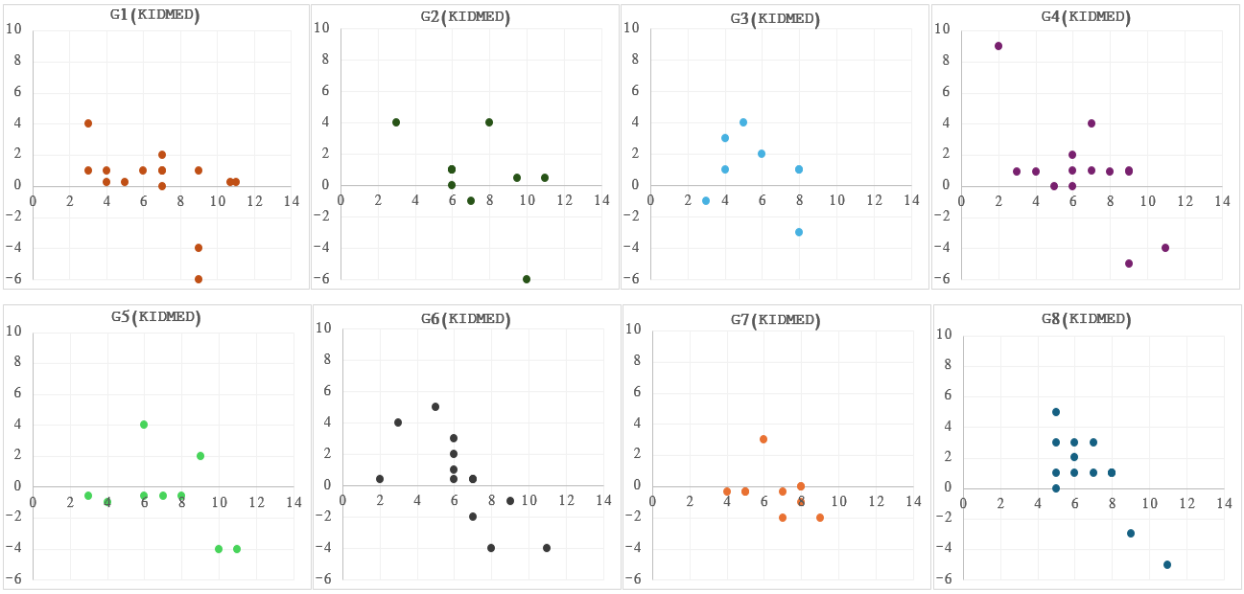


Figure.17 KIDMED score changes across the intervention groups in Spanish children's sub-sample

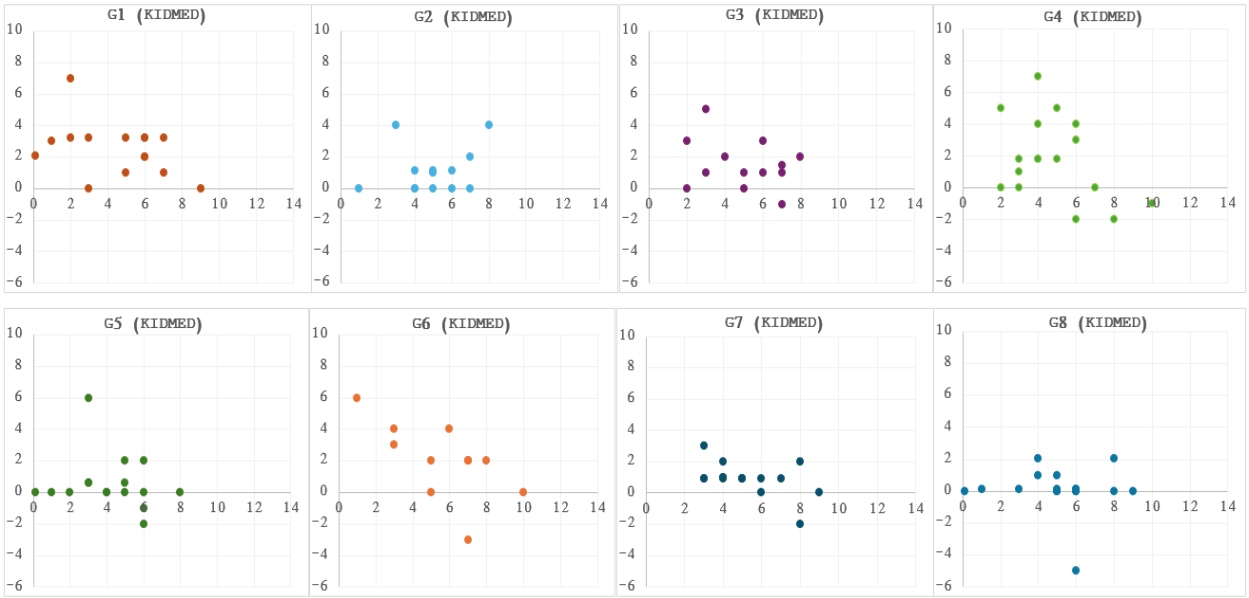


Figure.18 KIDMED score changes across the intervention groups in Turkish children's sub-sample

AMD for Parents

Furthermore, we examined the AMD scores considering for the intervention groups for the three subsample (parents, adolescents and children). Results of table reveal significant differences in intervention effects

between countries. In Spain, parents showed modest fluctuations across groups, with the most notable improvements in G6 (7.518 to 8.034, p=0.386) and G8 (7.716 to 8.25, p=0.397), though none reached statistical significance. Turkish parents, in contrast, demonstrated more substantial and statistically significant positive shifts in G1 (7.167 to 9.398, p=0.000), G3 (7.125 to 9.117, p=0.005), and G4 (6.846 to 8.671, p=0.005).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

This divergent pattern suggests that interventions may have been more effective at improving AMD among Turkish parents compared to Spanish counterparts, potentially due to differences in baseline dietary habits or cultural receptiveness to dietary interventions. When comparing the post-intervention outcomes between countries, significant differences emerged in G1, G3, 7, and G8 (p=0.0017, 0.0039, 0.0298, and 0.0302 respectively), indicating that while Turkish parents showed greater magnitude of improvement, the intervention effects varied considerably across different interventions in both populations (Table 8).

Table.8 Comparison of parental AMD before and after the intervention: Spain vs. Turkey

	AMD (parents)							
	Spain			Turkey			**Before vs Before (p-value)**	**After vs After (p-value)**
	Before	**After**	**p-value**	Before	After	p-value		
Group 1	7.34 (1.983)	7.93 (1.893)	0.910	7.16 (2.167)	9.39 (1.611)	0.000	0.857	0.001
Group 2	8.3 (2.146)	7.967 (2.029)	0.617	8.46 (1.655)	8.82 (1.532)	0.326	0.964	0.131
Group 3	8.12 (1.784)	7.12 (1.857)	0.131	7.47 (1.942)	9.11 (1.847)	0.005	0.249	0.003
Group 4	7.76 (2.084)	7.66 (1.95)	0.852	6.84 (2.12)	8.67 (2.318)	0.005	0.111	0.130
Group 5	7.28 (1.291)	6.78 (1.291)	0.282	7.21 (2.076)	7.71 (2.182)	0.332	0.850	0.076
Group 6	7.51 (2.416)	8.03 (1.98)	0.386	7.95 (1.718)	8.94 (1.882)	0.082	0.414	0.078
Group 7	8.22 (1.307)	8.32 (1.754)	0.750	7.28 (2.163)	7.18 (1.917)	0.749	0.072	0.029
Group 8	7.71 (2.487)	8.25 (2.224)	0.397	7.18 (1.96)	7.20 (1.529)	0.751	0.332	0.030

Note: The cells shaded in gray indicate statistically significant differences at the 5% level ($p < 0.05$). The cells shaded in light red denote marginally significant differences at the 10% level ($0.05 \leq p < 0.10$).

AMD for Adolescents

Table. 9 Comparison of adolescents' AMD before and after the intervention: Spain vs. Turkey

AMD (Adolescents)								
Groups	**Spain**			**Turkey**			**Before vs Before (p-value)**	**After vs After (p-value)**
	Before	**After**	**p-value**	**Before**	**After**	**p-value**		
Group 1	6.00 (2.486)	6.91 (2.279)	0.391	4.12 (2.604)	7.56 (1.909)	0.000	0.036	0.393
Group 2	5.4 (2.633)	7.15 (2.904)	0.133	5.84 (1.463)	6.44 (2.41)	0.451	0.443	0.331
Group 3	7.02 (2.958)	4.82 (3.465)	0.104	4.76 (3.295)	6.35 (2.463)	0.176	0.104	0.466
Group 4	7.57 (2.928)	7.67 (2.378)	0.963	5.00 (1.837)	6.76 (2.204)	0.016	0.003	0.202
Group 5	6.66 (3.122)	7.48 (3.06)	0.505	4.18 (1.94)	5.27 (2.124)	0.143	0.038	0.105
Group 6	7.23 (2.619)	6.71 (2.75)	0.776	4.75 (2.301)	5.24 (2.895)	0.644	0.022	0.133
Group 7	6.5 (1.78)	9.33 (1.915)	0.004	5.53 (2.1)	6.28 (1.894)	0.313	0.238	0.001
Group 8	6.00 (2.746)	7.90 (2.055)	0.091	4.82 (1.845)	5.551 (2.42)	0.332	0.231	0.013

Note: The cells shaded in gray indicate statistically significant differences at the 5% level ($p < 0.05$). The cells shaded in light red denote marginally significant differences at the 10% level ($0.05 \leq p < 0.10$).

Regarding adolescents' AMD scores results of table 9 reveals contrasting intervention effects between countries. In Spain, G7 showed significant improvement (6.5 to 9.33, p=0.004) with G8 approaching significance (6.00 to 7.90, p=0.091), while G3 declined notably (7.02 to 4.82, p=0.104).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Turkish adolescents demonstrated more consistent positive changes, with significant improvements in G1 (4.12 to 7.56, p=0.00) and G4 (5.00 to 6.76, p=0.016). Post-intervention comparisons showed significant differences in G7 and G8 (p=0.001, p=0.013), with Spanish adolescents achieving higher final scores despite similar interventions. These patterns suggest cultural context and baseline dietary habits substantially influence intervention effectiveness, with certain approaches proving more successful in specific populations.

AMD for Children

Examination of children's AMD scores reveals marked differences in intervention outcomes between countries. Turkish children demonstrated more robust improvements, with statistically significant increases in G1 (4.26 to 7.28, p=0.003), G4 (4.82 to 6.67, p=0.032), and G6 (5.75 to 7.75, p=0.043). In contrast, Spanish children exhibited more modest changes across groups, with the largest improvement in G8 (6.85 to 7.85, p=0.133), though none reached statistical significance. Interestingly, G5 in Spain showed a slight decline (7.12 to 6.52, p=0.69). Post-intervention analysis revealed a significant difference only in G8 (p=0.003), with Spanish children maintaining higher adherence despite similar interventions. These patterns suggest interventions may yield greater impact in populations with lower baseline AMD, as evidenced by Turkish children's more pronounced positive responses (Table 10).

Table. 10 Comparison of children' AMD before and after the intervention: Spain vs. Turkey

Groups	AMD (Children)							
	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
Group 1	6.78 (2.621)	6.98 (2.573)	0.83	4.26 (2.693)	7.28 (2.583)	0.003	0.013	0.752
Group 2	7.25 (2.395)	7.75 (2.574)	0.658	5.00 (1.871)	6.10 (2.628)	0.231	0.019	0.147
Group 3	5.75 (2.053)	6.75 (2.55)	0.402	5.00 (2.041)	6.50 (2.217)	0.086	0.424	0.815
Group 4	6.57 (2.533)	7.47 (2.48)	0.351	4.82 (2.157)	6.67 (2.603)	0.032	0.047	0.391
Group 5	7.12 (2.85)	6.52 (3.025)	0.69	4.19 (2.087)	4.74 (2.504)	0.508	0.006	0.119
Group 6	6.38 (2.329)	6.82 (2.022)	0.608	5.75 (2.491)	7.75 (2.05)	0.043	0.517	0.27
Group 7	6.70 (1.636)	6.36 (1.767)	0.667	5.25 (1.915)	6.12 (1.66)	0.176	0.059	0.731
Group 8	6.85 (1.791)	7.85 (1.61)	0.133	5.12 (2.297)	5.211 (2.673)	0.921	0.029	0.003

Note: The cells shaded in gray indicate statistically significant differences at the 5% level ($p < 0.05$). The cells shaded in light red denote marginally significant differences at the 10% level ($0.05 \leq p < 0.10$).

The varying effectiveness across groups indicates that intervention strategies should be tailored to specific cultural contexts and baseline dietary patterns to maximize improvements in children's adherence to MD principles.

6.3.2 Factors related with families' attitude, behaviour and lifestyle

NK among parents serves as a critical foundation for family dietary habits and children's food choices.

When examining the NK patterns across the eight intervention groups of the Spanish parental subsample, we observe several notable response patterns from base line to after receiving the interventions. Looking at Figure 19, most Spanish parents began with relatively good NK, with initial scores predominantly clustering between 10-20 points across all groups, indicating solid baseline understanding before the intervention. The response patterns vary distinctly: G1 and G5 show more varied outcomes with some notable improvements despite already reasonable initial scores. G2, G3, G4, and G6 display modest changes centered around zero, suggesting maintenance of existing knowledge.

G7 and G8 demonstrate negative correlations where parents with higher initial scores experienced more pronounced declines.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Most groups exhibit a subtle downward trend consistent with regression to the mean, though with varying intensity across groups. These patterns highlight how different the study's interventions yielded to distinct outcomes, with some better suited for knowledge enhancement while others primarily reinforced existing NK among Spanish parents.

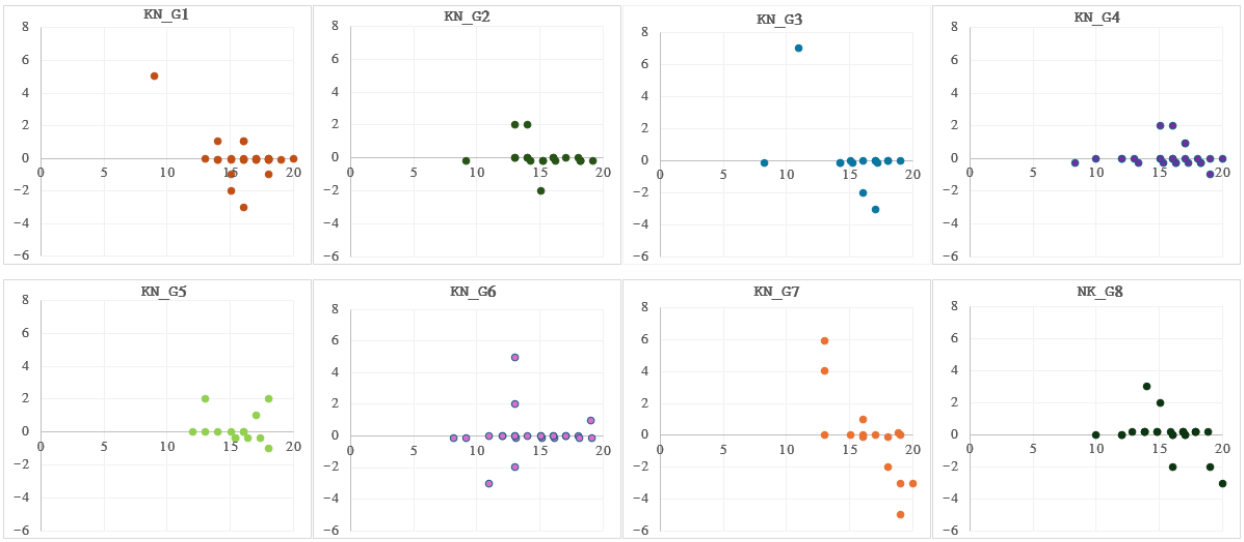


Figure.19 NK score changes across the intervention groups in Spanish parent's sub-sample

Looking at the Figure 20, Turkish parents displayed a wide range of initial NK, with scores distributed more evenly between 5-20 points across all groups, suggesting more varied baseline nutritional understanding compared to their Spanish counterparts.

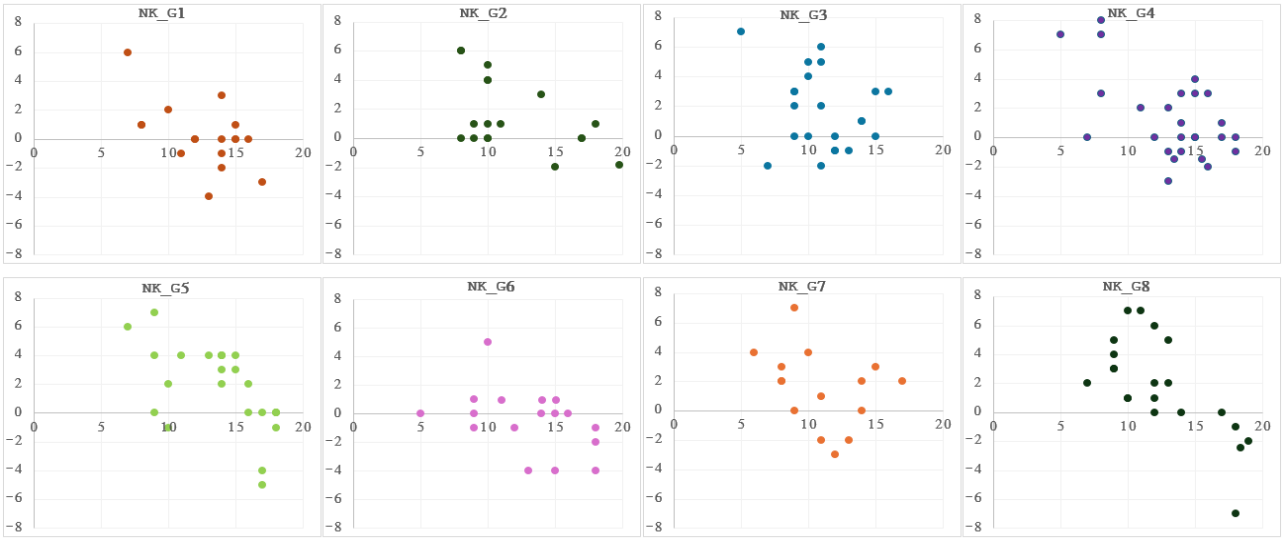


Figure.20 NK score changes across the intervention groups in Turkish parents sub-sample

The response patterns show notable group differences: G3 and G8 demonstrate more positive outcomes with several participants showing substantial improvements (4-7 points) regardless of initial scores. On the other hand, G2 and G4 show interesting bidirectional changes where some participants improved while others declined despite similar starting points. Groups 1, 5, 6, and 7 display more scattered distributions with less distinct patterns, though G5 shows a slight negative correlation between initial NK scores and changes. Most groups exhibit greater variability in outcomes compared to the Spanish sample, suggesting that the implemented interventions allow for a more diversely NK scores. This pattern indicates that cultural factors may influence how interventions are received and integrated (NK), with the Turkish cohort showing both more dramatic improvements and declines across different parents' intervention groups.

On the other hand, Spanish adolescents show a mixed response patterns across the intervention groups. In general, there is a considerable variability in response within each group.

There's a predominant trend toward slight knowledge decline or maintenance rather than substantial improvement.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Most participants started with moderate to good baseline NK score (between 5-15 points), and the intervention effects varied considerably. The most common pattern is a negative correlation between initial scores and change, meaning that participants with higher initial knowledge typically showed greater declines (especially evident in groups G4 and G6. Only a few groups, particularly G5 and portions of G7 and G8 demonstrated noticeable knowledge improvements. Most groups exhibit the statistical phenomenon of regression to the mean, where extreme initial scores tend to move toward the average in follow-up measurements (Figure 21).

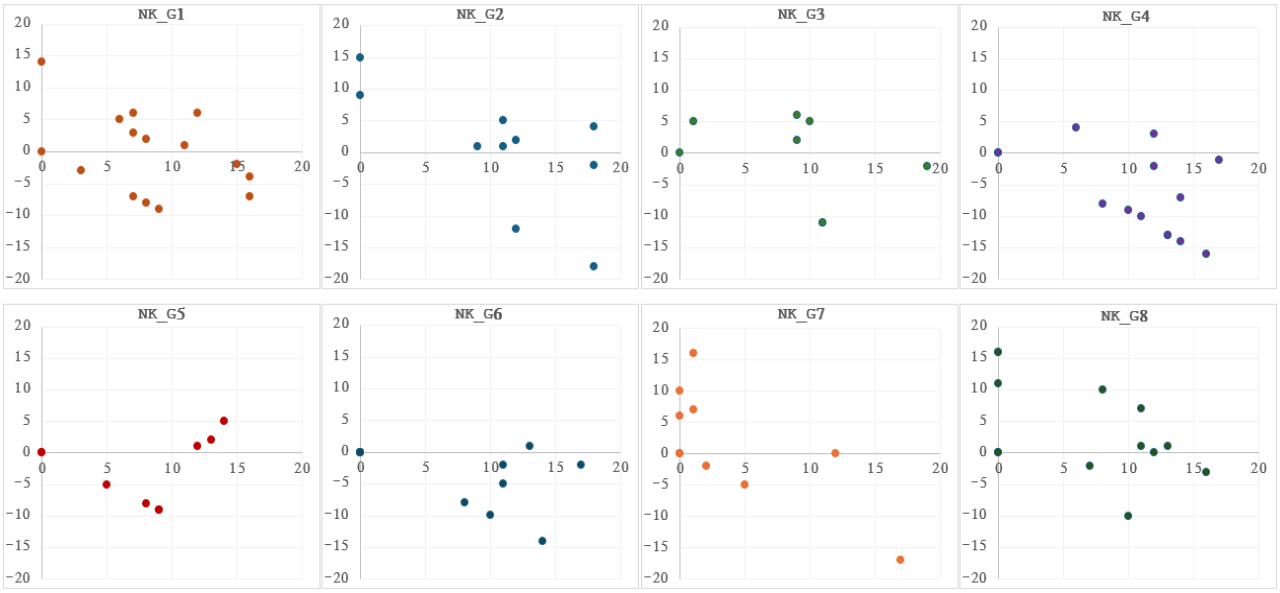


Figure.21 NK score changes across the intervention groups in Spanish adolescents' sub-sample

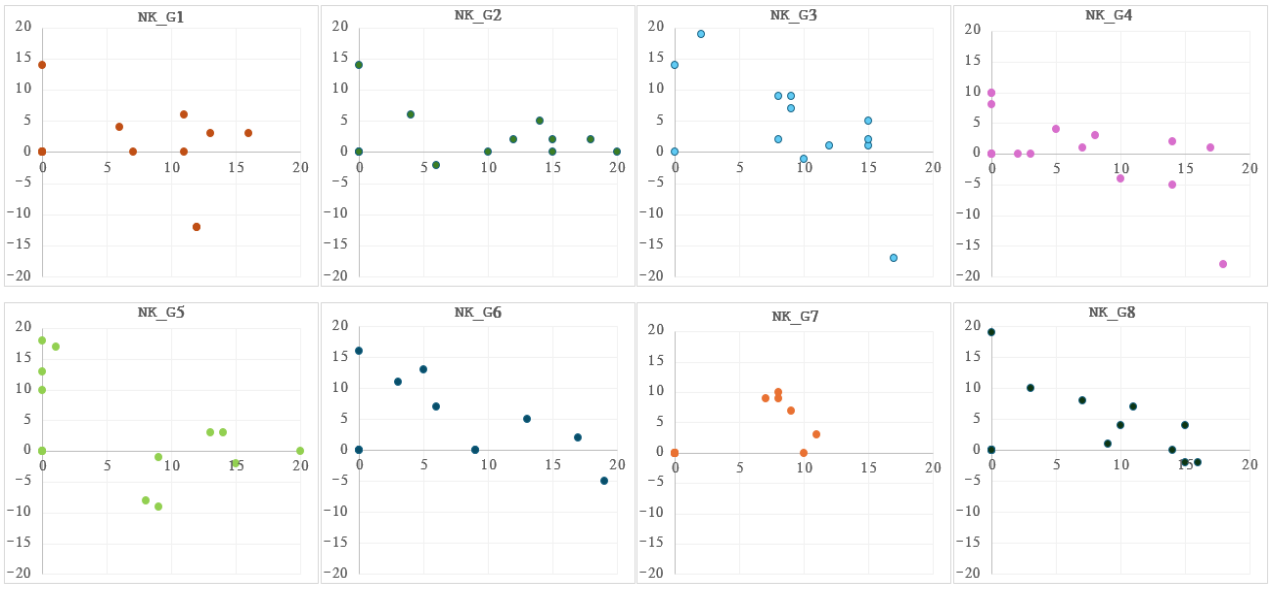


Figure.22 NK score changes across the intervention groups in Turkish adolescents' sub-sample

Turkish adolescents' subsample exhibits a markedly different pattern from the Spanish one where, there's a more positive response to the interventions, with many groups showing improvements rather than declines. The G3, G4, and G7 demonstrate consistent positive changes in NK across various initial scores. The initial knowledge scores appear more varied but generally concentrated in the 5-15-point range. While some groups, particularly G4 and G6 still show the negative correlation pattern seen in the Spanish sample, this is less pronounced overall. There appears to be less within-group variability in several Turkish groups compared to their Spanish counterparts (Figure 22).

MEDLIFE for Parents

Examination of MEDLIFE scores before and after the interventions within and between both countries revealed distinctive patterns of Mediterranean lifestyle adaptation between the two parental populations (Table 11).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

In Spain, modest improvements were observed across most intervention groups, with G5 demonstrating the most substantial positive trajectory (14.40 to 16.22), though it did not achieve statistical significance.

By contrast, Turkish parents exhibited more pronounced enhancements in Mediterranean lifestyle adherence, with G8 achieving statistically significant improvement (13.57 to 16.27, p=0.000) and G3 also showing significant positive change (13.04 to 15.00, p=0.023).

This asymmetrical response pattern suggests differential intervention effectiveness based on cultural context, with Turkish parents appearing more receptive to lifestyle modifications despite lower baseline scores. Notably, the comprehensive intervention package G8 yielded particularly transformative results among the Turkish cohort while producing minimal change among Spanish participants, highlighting the complex interaction between intervention intensity and cultural predispositions. These findings underscore the importance of culturally-calibrated approaches when implementing Mediterranean lifestyle promotion programs across diverse populations.

Table.11 Comparison of parents' MEDLIFE scores before and after the intervention: Spain vs. Turkey

Groups	MEDLIFE							
	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
Group 1	13.70 (3.331)	15.31 (2.697)	0.113	13.16 (3.092)	13.50 (2.526)	0.749	0.623	0.036
Group 2	12.36 (3.585)	14.25 (2.463)	0.105	13.22 (1.927)	13.94 (2.758)	0.337	0.407	0.737
Group 3	14.80 (1.317)	13.55 (1.878)	0.144	13.04 (3.154)	15.00 (3.024)	0.023	0.103	0.196
Group 4	14.41 (2.917)	14.93 (2.435)	0.479	11.79 (2.904)	12.26 (2.692)	0.618	0.007	0.003
Group 5	14.40 (2.757)	16.22 (3.232)	0.267	11.33 (3.06)	12.70 (3.29)	0.241	0.010	0.01
Group 6	13.61 (2.953)	14.58 (1.676)	0.155	13.20 (2.569)	13.66 (2.223)	0.621	0.676	0.235
Group 7	16.41 (3.988)	16.70 (2.627)	0.946	13.33 (3.539)	14.64 (3.177)	0.209	0.044	0.108
Group 8	15.08 (3.088)	14.68 (2.54)	0.712	13.57 (2.675)	16.27 (1.882)	0.000	0.150	0.027

KIDSCREN for adolescents

Examination of the KIDSCREEN adolescent scores is presented in table 12 and it reveals distinct within-country intervention effects. In Spain, adolescents exhibited mixed responses, with minimal changes in most groups; G7 and G8 showed the most notable decreases (102.5 to 95.66 and 102.92 to 97.81), while G2 and G3 demonstrated modest improvements (106.44 to 107.11 and 111.12 to 107.16), though none reached statistical significance. Turkish adolescents, conversely, displayed more consistent positive trends across nearly all groups, with the most substantial improvements in G7 (89.00 to 100.57, p=0.140) and G5 (95.00 to 100.33, p=0.402).

This contrasting pattern suggests differential intervention responsiveness between countries, with Turkish adolescents generally demonstrating greater well-being improvements following interventions compared to their Spanish counterparts, potentially indicating that intervention strategies may be more impactful in contexts with lower baseline well-being scores, though the absence of statistically significant p-values limits definitive conclusions about intervention effectiveness in either population.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Table.12 Comparison of adolescents' KIDSCREEN scores before and after the intervention: Spain vs. Turkey

KIDSCREEN_Ado								
Groups	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
Group 1	109.4 (11.262)	108.90 (10.812)	0.912	90.66 (7.937)	93.11 (8.192)	0.479	0.000	0.003
Group 2	106.44 (12.115)	107.11 (12.414)	0.909	99.77 (13.746)	100.3 (13.317)	0.967	0.426	0.413
Group 3	111.12 (7.809)	107.16 (10.647)	0.436	93.75 (8.335)	95.63 (10.576)	0.804	0.001	0.107
Group 4	102.16 (10.684)	103.20 (9.496)	0.815	90.66 (20.46)	96.69 (11.198)	0.445	0.099	0.144
Group 5	103.55 (12.7)	103.20 (11.454)	0.960	95.00 (15.238)	100.33 (12.412)	0.402	0.241	0.874
Group 6	104.66 (14.798)	101.42 (13.277)	0.640	96.33 (12.903)	100.22 (10.952)	0.535	0.155	0.873
Group 7	102.5 (20.512)	95.66 (18.511)	0.515	89.00 (11.605)	100.57 (12.394)	0.140	0.063	0.667
Group 8	102.92 (12.606)	97.81 (15.899)	0.599	93.90 (8.384)	98.81 (8.035)	0.166	0.191	0.767

KIDSCREN for Children

Similar analysis had been done for children sample. Results of the KIDSCREEN data are summarized in table13 that reveals distinct wellbeing patterns between children of both countries. Spanish children maintained relatively stable quality of life scores across intervention groups, while Turkish children showed modest improvements, particularly in G2 and G5. Baseline comparisons demonstrated significantly higher initial well-being in Spanish children across all intervention groups, most notably in G4 (p=0.001) (Figure 13).

Table.13 Comparison of children's KIDSCREEN score before and after the intervention: Spain vs. Turkey

KIDSCREEN_Children								
Groups	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
Group 1	115.6 (9.009)	109.3 (12.499)	0.172	96.22 (11.692)	97.22 (9.654)	0.824	0.006	0.033
Group 2	117.00 (8.779)	116.55 (10.039)	0.885	100.6 (11.664)	104.10 (11.484)	0.306	0.008	0.054
Group 3	114.16 (7.468)	111.00 (7.071)	0.738	101.6 (13.794)	104.09 (11.031)	0.502	0.038	0.429
Group 4	115.00 (8.746)	116.66 (7.394)	0.813	92.69 (15.526)	97.69 (11.078)	0.456	0.001	0.001
Group 5	114.33 (8.664)	112.00 (1.0)	1.000	97.09 (12.284)	102.00 (10.176)	0.305	0.026	0.088
Group 6	113.33 (10.815)	114.88 (8-313)	0.803	103.25 (12.045)	104.75 (11.436)	0.712	0.053	0.074
Group 7	111.75 (7.126)	111.2 (17.683)	0.714	101.80 (18.24)	103.66 (19.086)	0.854	0.212	0.371
Group 8	115.50 (14.323)	114.00 (8.287)	0.771	102.87 (12.506)	104.00 (13.229)	0.700	0.091	0.124

Note: The cells shaded in gray indicate statistically significant differences at the 5% level ($p < 0.05$). The cells shaded in light red denote marginally significant differences at the 10% level ($0.05 \leq p < 0.10$).

Post-intervention analysis showed these cross-national differences persisted but diminished for several groups, especially G3 and G7 (p=0.429 and p=0.371), suggesting differential intervention responsiveness based on cultural context.

Groups 1 and 4 maintained significant post-intervention differences between countries (p=0.033 and p=0.001), indicating varying cultural sensitivity among intervention approaches.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

The convergence of outcomes in G3, G7, and G8 suggests these particular strategies may be more effective at promoting children's well-being across diverse populations (Figure 13).

PA for Parents

Examination of PA trajectories revealed remarkable contrasts in parental exercise patterns across intervention conditions (Table 14). Spanish parents exhibited mixed responses, with G7 showing the most favorable progression (2356.68 to 2599.90 MET-minutes/week), though not reaching statistical significance.

Table.14 Comparison of parents' PA before and after the intervention: Spain vs. Turkey

Groups	PA							
	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
Group 1	3257.94 (4855.725)	1999.54 (1783.418)	0.408	538.41 (780.254)	565.41 (617.844)	0.408	0.000	0.000
Group 2	2171.47 (1613.145)	2074.95 (1261.277)	0.908	888.80 (931.07)	869.55 (894.277)	0.908	0.003	0.001
Group 3	1931.4 (2025.883)	1761.52 (1337.883)	0.9287	601.16 (746.491)	892.88 (787.366)	0.928	0.004	0.106
Group 4	3771.61 (4104.036)	1796.93 (921.439)	0.1738	850.23 (2543.363)	333.24 (398.886)	0.173	0.000	0.000
Group 5	2350.92 (1714.834)	2065.05 (903.764)	0.9497	834.18 (1677.194)	601.27 (723.019)	0.949	0.000	0.000
Group 6	3335.42 (4286.64)	2351.28 (1488.812)	0.65	1309.96 (1474.543)	1030.66 (1055.591)	0.650	0.012	0.007
Group 7	2356.68 (1880.014)	2599.9 (1112.375)	0.1546}	457.73 (564.377)	680.92 (586.457)	0.154	0.000	0.000
Group 8	3105.12 (2985.87)	2269.90 (1902.53)	0.3601	825.52 (940.872)	1188.02 (880.164)	0.360	0.000	0.027

Note: The cells shaded in gray indicate statistically significant differences at the 5% level ($p < 0.05$). The cells shaded in light red denote marginally significant differences at the 10% level ($0.05 \leq p < 0.10$).

Conversely, several Spanish cohorts experienced concerning declines, particularly Group 4 (3771.61 to 1796.93 MET-minutes/week, p=0.173). Turkish participants demonstrated a distinctly different pattern, with G8 achieving the most substantial improvement (825.52 to 1188.02 MET-minutes/week, p=0.360) while G3 and G7 also showed modest increases. Curiously, G5 in Turkey experienced a considerable decrease in physical activity levels (834.18 to 601.27 MET-minutes/week, p=0.949), suggesting potential intervention specific challenges in the Turkish context. These divergent patterns highlight the complex interplay between cultural factors and intervention design.

PA for adolescents

Analysis of the comparative behavioral changes in adolescents' PA levels are presented in the table 15, we can see a nuanced intervention effects within and between countries. In Spain, most groups exhibited slight decreases in PA levels, with the most marked reduction observed in Group 6 (Δ= - 0.251), contrasting with the modest increase in G1 (Δ= +0.208). Turkish adolescents demonstrated a different pattern of response, with notable improvements in G7 (Δ=+0.296) and G1 (Δ=+0.157). The most significant between-country difference emerged in G6 (p=0.027), suggesting culturally distinct responses to this particular intervention approach. Interestingly, despite G3 showing baseline differences (p=0.044), post-intervention differences were not statistically significant (p=0.104), indicating potential convergence of PA behaviors.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Table.15 Comparison of adolescents' PA before and after the intervention: Spain vs. Turkey

PA ADOLESCENTS								
Groups	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
Group 1	2.49 (0.568)	2.70 (0.426)	0.317	2.19 (0.74)	2.35 (0.443)	0.593	0.275	0.088
Group 2	2.55 (0.698)	2.48 (0.557)	0.824	2.34 (0.838)	2.21 (0.694)	0.727	0.571	0.369
Group 3	3.00 (0.561)	2.94 (0.517)	0.841	2.36 (0.698)	2.56 (0.383)	0.410	0.044	0.104
Group 4	2.85 (0.602)	2.82 (0.58)	0.920	2.31 (0.712)	2.58 (0.796)	0.395	0.06	0.420
Group 5	2.79 (0.59)	2.58 (0.75)	0.569	2.36 (0.602)	2.60 (0.499)	0.308	0.123	0.942
Group 6	2.25 (0.569)	2.00 (0.43)	0.328	2.55 (0.698)	2.52 (0.414)	0.928	0.294	0.027
Group 7	2.94 (0.937)	2.84 (0.628)	0.810	2.19 (0.305)	2.49 (0.63)	0.285	0.06	0.341
Group 8	2.75 (0.694)	2.87 (0.465)	0.656	2.48 (0.542)	2.54 (0.781)	0.854	0.304	0.244

Note: The cells shaded in gray indicate statistically significant differences at the 5% level ($p < 0.05$). The cells shaded in light red denote marginally significant differences at the 10% level ($0.05 \leq p < 0.10$).

PA for Children

The results of the PA in children considering for the intervention groups effect are shown in table 16. The longitudinal analysis revealed differential intervention effects on behavioral change between countries. In Spain, Group 3 showed the most substantial positive change in PA levels (from 2.52 to 3.721, p=0.075), while G6 exhibited a concerning decrease (from 3.178 to 2.521, p=0.074). In Turkey, G7 demonstrated the only statistically significant improvement (from 2.182 to 2.682, p=0.018), suggesting this particular intervention combination was especially effective in the Turkish context. Notably, the comprehensive intervention package (G8) did not yield significant improvements in either country, contrary to expectations. These findings indicate that behavioral change in PA responds differently to specific intervention combinations depending on cultural context, with single or dual interventions sometimes outperforming the full intervention package.

Table. 16 Comparison of children' PA before and after the intervention: Spain vs. Turkey

PA CHILDREN								
Groups	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
Group 1	2.87 (0.766)	2.76 (0.407)	0.682	2.62 (0.914)	2.82 (0.746)	0.609	0.509	0.812
Group 2	2.81 (0.705)	3.18 (0.698)	0.301	2.44 (0.665)	2.68 (0.731)	0.453	0.260	0.144
Group 3	2.52 (0.746)	3.72 (0.206)	0.075	2.80 (0.891)	3.01 (0.837)	0.593	0.522	0.273
Group 4	2.72 (0.579)	2.78 (0.566)	0.886	2.70 (0.747)	2.85 (0.692)	0.604	0.907	0.834
Group 5	2.53 (0.717)	3.09 (0.353)	0.252	2.58 (0.779)	2.92 (0.832)	0.342	0.902	0.744
Group 6	3.17 (0.731)	2.52 (0.86)	0.074	2.98 (0.604)	3.02 (0.403)	0.878	0.551	0.148
Group 7	3.53 (0.33)	3.47 (0.361)	0.789	2.18 (0.259)	2.68 (0.327)	0.018	0.000	0.003
Group 8	2.80 (0.812)	3.24 (0.85)	0.329	2.70 (0.666)	2.80 (0.787)	0.781	0.777	0.300

Note: The cells shaded in gray indicate statistically significant differences at the 5% level ($p < 0.05$). The cells shaded in light red denote marginally significant differences at the 10% level ($0.05 \leq p < 0.10$).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

NK for parents

Longitudinal analysis of NK scores for parents revealed different patterns of knowledge acquisition between countries. In Spain, minimal changes were observed across all groups ($p>0.05$), suggesting that interventions had limited impact on already relatively high baseline knowledge.

Conversely, Turkish parents showed more pronounced improvements, with statistically significant increases in Group 8 (11.714 to 14.227, $p=0.020$) and marginally significant improvements in G2 and 3 ($p=0.058$ and $p=0.053$, respectively). This differential response pattern indicates that interventions may have been more effective at enhancing NK in contexts where baseline literacy was lower. Interestingly, G8, which received the comprehensive intervention package, demonstrated the most substantial improvement among Turkish parents, suggesting that the full intervention spectrum was particularly beneficial in the Turkish context where initial knowledge gaps were more pronounced (Table 17).

Table.17 Comparison of parents' NK before and after the intervention: Spain vs. Turkey

Groups	NK (parents)							
	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
Group 1	15.94 (2.487)	16.21 (1.931)	0.858	12.5 (2.936)	12.83 (2.479)	0.848	0.000	0.000
Group 2	14.81 (1.722)	15.35 (2.39)	0.357	11.5 (3.312)	13.57 (3.271)	0.058	0.009	0.920
Group 3	16.40 (2.221)	15.6 (2.72)	0.398	11.13 (2.696)	12.86 (3.27)	0.053	0.000	0.010
Group 4	15.70 (2.733)	15.72 (2.937)	0.795	13.16 (3.608)	14.53 (2.946)	0.257	0.022	0.110
Group 5	15.20 (2.15)	15.64 (2.023)	0.722	13.87 (3.405)	15.62 (2.946)	0.061	0.423	0.443
Group 6	14.33 (2.401)	14.36 (3.328)	0.804	12.93 (3.918)	12.72 (3.461)	0.898	0.362	0.158
Group 7	16.57 (2.409)	16.53 (1.854)	0.921	11 (3.117)	12.53 (3.399)	0.218	0.000	0.003
Group 8	15.33 (2.934)	15.65 (2.208)	0.620	11.71 (4.027)	14.22 (2.707)	0.020	0.012	0.074

Note: The cells shaded in gray indicate statistically significant differences at the 5% level ($p < 0.05$). The cells shaded in light red denote marginally significant differences at the 10% level ($0.05 \leq p < 0.10$).

NK Adolescents

The NK change within adolescents is presented in the table 18. Results shows illuminated striking divergences in adolescent knowledge transformation. Spanish adolescents exhibited a concerning deterioration in nutritional literacy across multiple groups, with G4 showing a statistically significant decline (10.429 to 4.286, $p=0.018$) and G5 and 6 demonstrating substantial reductions despite failing to reach statistical significance.

In contrast, Turkish adolescents manifested consistent improvement across all intervention cohorts, with G3 approaching statistical significance in its positive progression (9.231 to 13.154, $p=0.056$). These diametrically opposed developmental pathways suggest fundamental differences in adolescent engagement with nutritional knowledge and education, potentially reflecting distinct cultural attitudes toward dietary knowledge. The comprehensive intervention package of G8 yielded modest improvements in both countries, though neither achieved statistical significance, highlighting the complex nature of adolescents' NK.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Table.18 Comparison of adolescents' NK before and after the intervention: Spain vs. Turkey

NK Adolescents								
Groups	**Spain**			**Turkey**			**Before vs Before (p-value)**	**After vs After (p-value)**
	Before	**After**	**p-value**	**Before**	**After**	**p-value**		
Group 1	8.33 (5.08)	8.13 (6.3)	0.785	5.50 (6.088)	5.88 (7.393)	0.967	0.183	0.394
Group 2	10.90 (6.624)	11.40 (7.011)	0.900	8.76 (7.452)	11.00 (7.692)	0.467	0.593	0.975
Group 3	8.75 (6.018)	8.00 (7.407)	0.873	9.23 (5.732)	13.15 (6.78)	0.056	0.970	0.108
Group 4	10.42 (5.273)	4.28 (6.044)	0.018	5.76 (6.572)	6.47 (5.746)	0.584	0.067	0.268
Group 5	7.77 (5.191)	5.22 (7.981)	0.405	5.56 (6.938)	8.31 (8.122)	0.381	0.395	0.359
Group 6	6.00 (6.54)	3.14 (5.545)	0.240	6.75 (6.771)	10.83 (7.259)	0.177	0.748	0.009
Group 7	3.80 (5.959)	5.30 (6.255)	0.873	3.53 (4.565)	6.06 (7.878)	0.439	0.590	0.927
Group 8	6.28 (6.018)	9.64 (7.11)	0.114	5.88 (6.489)	8.76 (7.87)	0.321	0.884	0.886

Note: The cells shaded in gray indicate statistically significant differences at the 5% level ($p < 0.05$). The cells shaded in light red denote marginally significant differences at the 10% level ($0.05 \leq p < 0.10$).

AMD intention for Parents

Longitudinal analysis of AMD intention trajectories shows distinct response patterns between Spanish and Turkish samples (Table 19). Spanish parents exhibited relatively stable intention metrics with minor fluctuations, though G2 showed a marginally significant decline (4.63 to 4.167, p=0.0519). Conversely, Turkish parents demonstrated more substantial positive shifts, with Group 8 achieving statistically significant improvement (2.727 to 3.742, p=0.042) and G3 approaching significance (2.492 to 3.348, p=0.0508). This asymmetrical developmental pattern suggests that intervention efficacy may be inversely related to baseline intention levels, with greater improvements observed among participants who entered the study with lower initial commitment to Mediterranean dietary patterns. The comprehensive intervention package applied to G8 yielded particularly beneficial results for Turkish parents despite their lower baseline intention, indicating that combining the three interventions may be especially valuable for populations with less established MD traditions.

Table.19 Comparison of Parents AMD intention before and after the intervention: Spain vs. Turkey

AMD INTENTION (Parents)								
Groups	**Spain**			**Turkey**			**Before vs Before (p-value)**	**After vs After (p-value)**
	Before	After	p-value	Before	After	p-value		
Group 1	4.43 (0.543)	4.12 (0.847)	0.130	4.05 (1.524)	4.14 (1.415)	0.851	0.672	0.191
Group 2	4.63 (0.441)	4.16 (0.737)	0.051	3.37 (1.825)	3.49 (1.541)	0.899	0.116	0.327
Group 3	4.35 (0.85)	4.44 (0.709)	0.875	2.49 (1.424)	3.348 (1.442)	0.050	0.000	0.012
Group 4	4.57 (0.484)	4.40 (0.702)	0.464	3.28 (1.525)	3.80 (1.276)	0.206	0.001	0.087
Group 5	4.59 (0.456)	4.71 (0.434)	0.430	2.72 (1.647)	3.22 (1.512)	0.263	0.001	0.000
Group 6	4.44 (0.625)	4.27 (0.635)	0.273	3.47 (1.587)	3.01 (1.416)	0.360	0.088	0.001
Group 7	4.20 (0.93)	4.43 (0.575)	0.434	3.56 (1.117)	3.71 (1.221)	0.650	0.067	0.044
Group 8	4.61 (0.636)	4.24 (0.771)	0.062	2.72 (1.664)	3.74 (1.234)	0.042	0.000	0.171

Note: The cells shaded in gray indicate statistically significant differences at the 5% level ($p < 0.05$). The cells shaded in light red denote marginally significant differences at the 10% level ($0.05 \leq p < 0.10$).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

AMD intention Adolescents

When it comes to adolescents, table 20 revealed distinct patterns of change between the two adolescent populations. While Spanish youth experienced slight declines in intention scores across all intervention groups, none of these changes reached statistical significance. In contrast, Turkish adolescents showed consistent improvements across all groups, with G8 displaying a significant increase (2.606 to 3.636, p=0.036) and G7 showing a trend toward significance (2.857 to 3.476, p=0.080). These contrasting trends suggest that intervention effectiveness may be inversely related to baseline intention levels, with greater positive changes occurring among those with lower initial commitment. The comprehensive intervention package in G8 appeared particularly beneficial for Turkish adolescents, indicating that multifaceted educational strategies may be more effective for populations with less established Mediterranean dietary habits. These findings underscore the need to adapt nutritional interventions to cultural and developmental factors specific to adolescent groups.

Table. 20 Comparison of adolescents' AMD intention before and after the intervention: Spain vs. Turkey

ADM INTENTION (Adolescents)								
	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
Groups	Before	After	p-value	Before	After	p-value		
Group 1	4.00 (0.816)	3.78 (0.62)	0.462	2.407 (1.164)	2.85 (1.082)	0.414	0.003	0.082
Group 2	4.11 (0.687)	3.63 (0.841)	0.224	3.00 (1.491)	3.33 (1.089)	0.582	0.109	0.835
Group 3	4.12 (0.562)	3.94 (0.712)	0.511	2.75 (0.878)	3.39 (1.094)	0.133	0.001	0.356
Group 4	3.75 (0.878)	3.56 (0.832)	0.593	2.50 (1.46)	3.07 (0.964)	0.252	0.021	0.139
Group 5	3.40 (0.434)	3.40 (0.365)	0.943	2.94 (1.213)	3.08 (0.986)	0.761	0.129	0.825
Group 6	3.75 (0.944)	3.71 (0.78)	0.864	2.59 (1.278)	2.96 (1.513)	0.583	0.031	0.424
Group 7	3.867 (0.549)	3.66 (0.919)	0.955	2.85 (0.424)	3.47 (0.742)	0.080	0.003	0.711
Group 8	3.89 (0.551)	3.78 (1.167)	0.814	2.60 (1.298)	3.63 (0.781)	0.036	0.006	0.457

Note: The cells shaded in gray indicate statistically significant differences at the 5% level ($p < 0.05$). The cells shaded in light red denote marginally significant differences at the 10% level ($0.05 \leq p < 0.10$).

6.3.3 Factors influencing post-intervention MD adherence

Looking at the three estimated models that examines the factors influencing the AMD among participants after receiving the interventions (all the sample, Spanish, and Turkish ones) controlling for group effect are presented in the Table 21.

In general, results show that the analyses show distinctive patterns across the three estimated models. When we consider the whole sample taking into consideration both countries (Model 1), AMD at baseline shows a positive association (β=0.162), implying consistency in dietary patterns. Gender has a negative effect (β=-0.0914), while age shows minimal impact (β=0.001). The coefficient related to the G5 which received the app and the educational material is significant with negative effect (β=-1.058, p<0.05), suggesting this combination was not effective at changing dietary patterns across the full sample. Moreover, BMI differences and the ones related to the PA showed low impacts, with very small coefficients.

When considering only the Spanish sample, results indicate that there is a positive strong association (β=0.333) between the AMD at baseline (AMD1) and the one after the interventions (AMD2) meaning that AMD after receiving the intervention is mainly explained by their baseline AMD. Gender shows a positive effect (β=0.105), unlike the pooled sample indicating that the older is the participant, the high his AMD, suggesting that old people knows more about AMD and they are used to it. G3 (β=-1.263, p<0.1) and G5 (β=-1.203, p<0.05) both demonstrate significant negative effects, with G5 showing strong statistical significance. This suggest that Educational material and empowerment activities does not improve the Spanish parents' AMD.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

When it comes to Turkish sample, the results of the same model did not show any significant effect of the AMD after the interventions.

Table.21 Factors Affecting parents' MEDLIFE score Following Interventions in Pooled, Spain, and Turkey

VARIABLES	(1) Pool OLS	(2) Spain OLS	(3) Turkey OLS
AMD1	0.162	0.333***	0.00841
	(0.103)	(0.112)	(0.163)
Gender	-0.0914	0.105	-0.402
	(0.262)	(0.336)	(0.431)
Edaddelvoluntarioa1	0.00191	0.0144	0.0109
	(0.0309)	(0.0509)	(0.0541)
BMIdiff	-0.0648	-0.0113	-0.0330
	(0.102)	(0.117)	(0.286)
PAdiff	-2.19e-05	-3.02e-05	0.000303
	(5.47e-05)	(5.16e-05)	(0.000277)
kndiff	-0.00158	0.00573	-0.0434
	(0.0190)	(0.0217)	(0.0496)
2.Group_INT1	-0.397	-0.657	0.286
	(0.479)	(0.607)	(0.683)
3.Group_INT1	-0.182	-1.263*	0.866
	(0.522)	(0.682)	(0.684)
4.Group_INT1	-0.635	-1.014	0.392
	(0.594)	(0.755)	(0.814)
5.Group_INT1	-1.068**	-1.203**	-0.471
	(0.432)	(0.567)	(0.588)
6.Group_INT1	-0.142	-0.547	1.221
	(0.565)	(0.682)	(1.028)
7.Group_INT1	-0.132	-0.357	0.719
	(0.493)	(0.654)	(0.696)
8.Group_INT1	-0.248	0.0432	-0.371
	(0.443)	(0.547)	(0.553)
Constant	7.047***	5.136**	7.331**
	(1.771)	(2.454)	(3.196)
Observations	180	101	79
R-squared	0.073	0.197	0.150

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

On the other hand, since we collected data on the MEDLIFE scale that measures the AMD in addition to the other factors like lifestyle…etc. In order to confirm the finding, we estimated the same previous model and results are shown in the table 21.

The whole sample regression model estimation using the MEDLIFE score after receiving interventions makes both the MEDFLIDE 1 and the G8 coefficients positive and significant at 1% and 5% respectively. This means that again, the post assessment scores of MEDLIFE are mostly explained by the same ones before the interventions. Moreover, the combination of all the tools within the study affected positively peoples' AMD with improving their Mediterranean lifestyle when the considered sample is the whole one of both countries together. On the other hand, looking at the Spanish OLS model (Model 2), the most notable significant effect is the one observed in G5, with a coefficient of β=3.335 ($p<0.05$) meaning that Spanish parents who received the app and the educational material with empowerment activities showed a significant increase in their scores of MEDLIFE compared to the CG. While the difference in the BMI variable show a negative association β= -0.473 ($p<0.1$) with less statistical significance. This suggests that changes in BMI between visits have a slightly negative impact on dietary patterns among Spanish parents.

Regarding the Turkish sample of parents, results of the model 3 confirm the finding that the MEDLIFE at baseline indicate a strong positive and significant association (β=0.403, $p<0.01$), meaning that it strongly predicts the subsequent scores of the same after receiving the intervention. The G5 and G8 showed some interesting fining regarding the interventions applied for these two groups. Specifically, G5 had a significant negative effect (β=-1.800, $p<0.05$), suggesting that the combination of application with the educational material effectively reduced scores.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

However, the combination of the three interventions within the G8 is showing a large positive and significant effect (β=2.810, p<0.05), suggesting that the effect of all the interventions together is largely positive and significant (β=2.810, p<0.05) which increased the parents' AMD and increase MEDLIFE scores.

Table.22 Factors Affecting parents' MEDLIFE score Following Interventions in Pooled, Spain, and Turkey

VARIABLES	(1) Pool OLS	(2) Spain OLS	(3) Turkey OLS
Medlife_score1	0.376***	0.0996	0.403***
	(0.108)	(0.205)	(0.130)
Gender	-0.327	-0.965	0.400
	(0.495)	(0.933)	(0.661)
Edaddelvoluntarioa1	0.0148	-0.0576	0.0256
	(0.0482)	(0.122)	(0.0742)
BMIdiff	-0.207	-0.473*	0.411
	(0.177)	(0.236)	(0.444)
kndiff	0.0198	0.102	-0.0334
	(0.0737)	(0.185)	(0.0882)
2.Group_INT1	-0.0503	-0.422	0.470
	(0.839)	(1.410)	(0.958)
3.Group_INT1	0.415	-0.495	1.128
	(0.840)	(1.260)	(1.141)
4.Group_INT1	-0.359	0.326	-0.313
	(0.870)	(1.451)	(1.056)
5.Group_INT1	-0.766	3.335**	-1.800*
	(1.002)	(1.533)	(0.951)
6.Group_INT1	0.357	0.409	0.813
	(0.713)	(1.293)	(0.897)
7.Group_INT1	1.294	2.008	1.779
	(0.943)	(1.391)	(1.235)
8.Group_INT1	1.743**	2.117	2.810**
	(0.806)	(1.519)	(1.110)
Constant	8.509***	15.95***	7.173
	(2.636)	(5.874)	(4.502)
Observations	129	51	78
R-squared	0.295	0.357	0.453

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Doing the same thing for the Adolescents of both countries together, finding of the table indicate that AMD after receiving the interventions is predicted by the AMD1 baseline variable, which exhibits a strong positive and significant correlation (β=0.349, p<0.01). On the other hand, noteworthy results are shown in two groups.

Educational material intervention received by adolescents of the G3 successfully lowered their AMD (β=-1.579, p<0.05). Similar to the parents' results, a negative effect (β=-1.433, p<0.05) is also seen in the G5 suggesting that the combination of empowerment activities and educational materials with the app was not increasing adolescents' AMD which could be explained by the fact of having too many activities to do.

Analyzing the variables affecting the AMD of the Spanish adolescents (Model 2), none of the variables included in the model nor the intervention groups reached statistical significance. However, when it comes to their Turkish counterpart, there are several statistically significant effects. The AMD at baseline variable show a strong positive and highly significant association (β=0.518, p<0.01), confirming that baseline AMD could be the best predictor of eventual AMD after receiving the interventions.

results within G3, G5, G7, and G8 shows a significant shift in the adolescents' dietary patterns, with a negative effect. These results suggest that Turkish adolescents were more responsive to the interventions compared to the overall sample and the Spanish subsample. The fact of receiving the educational material as an intervention seem to reduce the adolescents' AMD in all combinations (alone or combined with one or two other interventions).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Table.23 Factors Affecting adolescents' AMD score Following Interventions in Pooled, Spain, and Turkey

VARIABLES	(1) Pool OLS	(2) Spain OLS	(3) Turkey OLS
AMD1	0.349***	0.125	0.518***
	(0.0815)	(0.135)	(0.111)
Gender1	-0.166	-0.136	0.389
	(0.421)	(0.745)	(0.549)
Edad1	0.0901	-0.117	0.0672
	(0.133)	(0.295)	(0.167)
PA_diff	0.274	0.667	0.385
	(0.398)	(0.709)	(0.533)
NK_diff	0.0125	0.0159	0.0126
	(0.0298)	(0.0590)	(0.0352)
BMI_diff	0.0931	-0.309	0.227
	(0.150)	(0.420)	(0.199)
2.Group_INT1	-0.324	-0.388	-0.893
	(0.804)	(1.323)	(0.891)
3.Group_INT1	-1.579*	-1.269	-2.037**
	(0.873)	(1.557)	(0.979)
4.Group_INT1	0.373	0.643	-0.161
	(0.790)	(1.547)	(0.913)
5.Group_INT1	-1.433*	-0.700	-2.216**
	(0.862)	(1.947)	(0.890)
6.Group_INT1	-1.230	0.959	-2.444*
	(0.880)	(1.287)	(1.239)
7.Group_INT1	0.0727	1.928	-2.077**
	(0.970)	(1.403)	(1.035)
8.Group_INT1	-0.146	1.066	-1.733*
	(0.836)	(1.257)	(0.978)
Constant	3.916*	7.769*	3.817
	(2.280)	(4.408)	(2.940)
Observations	134	59	75
R-squared	0.205	0.163	0.401

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Replicating the same models using the KIDSCREEN as dependent variable which is the equivalent one of the MEDLIFE for the parents 'case, results are presented in Table 24

When taking into consideration the total sample of adolescents, results indicate that initial score of KIDSCREEN shows a positive with highly significant relationship (β=0.663, p<0.01), implying that baseline KIDSCREEN strongly predict subsequent scores. Furthermore, none of the study's intervention groups reached statistical significance, indicating that although baseline scores are predictive, the effects of the interventions were not consistent throughout the sample.

Regarding the Spanish sample, KIDSCREEN at baseline again demonstrates strong positive highly significant association (β=0.701, p<0.01).

Similar to the pooled model, none of the intervention groups show statistically significant effects, suggesting that the interventions did not have a significant effect on the KIDSCREEN scores after receiving the interventions. On the other hand, when it comes to adolescents from Turkey the baseline score of the KIDSCREEN still maintaining a positive and highly significant association (β=0.681, p<0.01), similar to both other models. The most remarkable finding in this model is the significant positive effect of G7 (β=8.276, p<0.1) who received both the educational material and the healthy snack, indicating that the combination of the healthy snack together with the educational activities allow for improving of the KIDSCREEN scores at post assessment (Table 24).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Table.24 Factors Affecting adolescents' KIDSCREEN score Following Interventions in Pooled, Spain, and Turkey

VARIABLES	(1) Pool OLS	(2) Spain OLS	(3) Turkey OLS
KIDSCREEN_score1	0.663***	0.701***	0.681***
	(0.0726)	(0.215)	(0.0744)
Gender1	1.091	-1.002	1.736
	(1.713)	(2.884)	(2.035)
Edad1	-0.0553	-0.983	0.529
	(0.565)	(1.393)	(0.598)
NK_diff	0.169	0.0493	0.263
	(0.111)	(0.231)	(0.159)
BMI_diff	-0.150	0.425	-0.0753
	(0.464)	(1.081)	(0.471)
2.Group_INT1	1.795	1.880	2.125
	(2.661)	(3.987)	(3.898)
3.Group_INT1	0.0295	-0.298	0.917
	(2.907)	(4.823)	(4.067)
4.Group_INT1	0.772	1.311	0.579
	(2.612)	(4.025)	(3.759)
5.Group_INT1	2.875	2.294	4.061
	(2.251)	(4.187)	(3.029)
6.Group_INT1	3.459	5.136	2.995
	(3.144)	(6.894)	(3.602)
7.Group_INT1	0.855	-5.988	8.276*
	(4.477)	(7.858)	(4.338)
8.Group_INT1	-0.106	-2.141	3.013
	(2.588)	(5.635)	(3.550)
Constant	33.68**	44.09	21.99*
	(13.84)	(39.96)	(12.10)
Observations	135	59	76
R-squared	0.476	0.458	0.540

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Similar model had been estimated for the children subsample and the results are shown in the Table 25.
Following the same strategy, first of all, we took into consideration the whole subsample of children of both countries together. The finding indicates that the AMD score at baseline shows a significant positive effect ((β=0.384, p<0.01), indicating that this variable has a strong relationship with the outcome score of AMD. This means that the AMD of children is mostly explained by the same at baseline. The Gender shows a negative effect (β=-1.091). This suggests that girls tend to have lower scores than boys, and this effect is likely statistically significant.
In Spain AMD baseline scores show a positive effect (β=0.206, p>0.05), though not statistically significant however the effect of the Gender variable is noticeable, with girls having lower scores than boys (β=-1.672, p>0.05), though this falls short of statistical significance at conventional levels.
For the intervention groups, Spain shows some interesting positive patterns especially, for the G6, G7, and G8 however none of them reached the statistical significance.
On the last column we have the finding for the children of Turkey and only the AMD variable at baseline show a positive and statistically significant effect confirming previous findings suggesting that AMD scores of baselines are the better to explain the participant's adherence. It shows a strong, statistically significant positive effect (β=0.574, p<0.01). The gender effect is smaller than in Spain (β=-0.680, p>0.05) and not statistically significant.
Even without having any statistical significance, all intervention groups in Turkey among children are showing a negative coefficient, suggesting different intervention effectiveness compared to Spain. This highlights potential cultural differences in reception of these interventions (Table 25).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Table.25 Factors Affecting children's AMD score Following Interventions in Pooled, Spain, and Turkey

VARIABLES	(1) Pool OLS	(2) Spain OLS	(3) Turkey OLS
AMD1	0.384***	0.206	0.574***
	(0.125)	(0.225)	(0.150)
Gender1	-1.001**	-1.672*	-0.680
	(0.452)	(0.921)	(0.639)
Edad1	0.333	-0.0880	0.366
	(0.210)	(0.558)	(0.286)
BMI_diff	0.189	-0.157	0.324
	(0.176)	(0.820)	(0.245)
PA_diff	0.00548	0.0682	0.0553
	(0.348)	(0.515)	(0.668)
2.Group_INT1	0.0372	1.397	-2.205
	(1.147)	(1.555)	(2.275)
3.Group_INT1	-0.775	-0.268	-2.515
	(1.280)	(2.192)	(2.463)
4.Group_INT1	0.603	1.712	-1.381
	(1.251)	(1.791)	(2.378)
5.Group_INT1	-1.567	-1.091	-3.407
	(1.275)	(1.715)	(2.406)
6.Group_INT1	0.391	2.183	-1.817
	(1.195)	(1.602)	(2.411)
7.Group_INT1	-0.406	0.545	-1.999
	(1.087)	(1.733)	(2.238)
8.Group_INT1	-0.157	2.008	-2.806
	(1.167)	(1.592)	(2.177)
Constant	1.819	6.166	2.414
	(2.348)	(4.825)	(3.826)
Observations	99	40	59
R-squared	0.285	0.290	0.371

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Always for children, but this time we estimated the same models using the KIDSCREEN variable after the interventions as dependent variable including the baseline scores of the same variable as a covariate in the regression model, results are shown in the table 26. Regression results when considering the total sample of the children show that KIDSCREEN1 at baseline shows a strong positive effect (β=0.774, p<0.01), implying a significant association with the outcome variable which is the same variable after receiving the interventions KIDSCREEN2. Children girls seem to have a lower adherence and Mediterranean lifestyle than their counterparts of boys which is shown by the significant negative effect (β=-2.809, p<0.10). Furthermore, some of the intervention groups exhibit favorable outcomes. Both G3 (educational content) and G7 (educational material + snack) had a positive statistically significant effects (β=6.214, p>0.05) and β=8.022, p<0.10) respectively. While, the G6 (app + snack) exhibits a noteworthy favorable impact (β=4.743, p<0.10). This model explains 67.9% of the variation where (R-squared=0.679).

When it comes to Spanish children, similar results are found regarding the KIDSCREEN score variable at baseline, since it remains significant with a slightly different coefficient (β=0.634, p<0.01). In contrast, Gender, age, BMI and the intervention groups do not show any statistical significance, suggesting that interventions do not have a significant impact on children's adherence and their lifestyle and wellbeing.

On the other hand, the estimated regression model for the Turkish subsample of children shows a completely different results where the interventions seem to have effect on children's AMD and their lifestyle and wellbeing The baseline score of the KIDSCREEN still showing similar findings as the 1st and the 2nd model. G3 receiving educational material shows a high, significant positive effect (β=13.24, p<0.01) and G5 receiving app and the educational material (β=10.14, p<0.05) too. Furthermore, the results of G6 who received the combination of app and snack (β=9.954, p<0.05) is also positive and significant, and G8 (all interventions) (β=9.346, p<0.10) all show large, significant positive effects.

This means that these interventions and combinations are effective to children's AMD and lifestyle and wellbeing across Turkish participants.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Table.26 Factors Affecting children's KIDSCREEN score Following Interventions in Pooled, Spain, and Turkey

VARIABLES	(1) Pool OLS	(2) Spain OLS	(3) Turkey OLS
KIDSCREEN_score1	0.774***	0.634***	0.765***
	(0.0631)	(0.152)	(0.0852)
Gender1	-2.809*	-3.943	-3.250
	(1.573)	(2.515)	(2.116)
Edad1	-0.339	-0.730	-0.162
	(0.662)	(1.401)	(0.927)
BMI_diff	-0.881	-0.624	-1.246*
	(0.586)	(1.752)	(0.669)
2.Group_INT1	4.247	1.310	9.545**
	(2.689)	(3.630)	(4.506)
3.Group_INT1	6.214*	-3.798	13.24**
	(3.440)	(4.094)	(5.083)
4.Group_INT1	4.081	2.767	7.905*
	(2.803)	(4.572)	(3.942)
5.Group_INT1	4.254	-1.750	10.14**
	(2.963)	(4.388)	(4.519)
6.Group_INT1	4.743*	1.951	9.954*
	(2.764)	(3.623)	(4.949)
7.Group_INT1	8.022*	5.687	12.00
	(4.424)	(3.701)	(8.120)
8.Group_INT1	3.667	0.926	9.346*
	(3.435)	(5.387)	(4.830)
Constant	26.53**	50.37***	20.44
	(10.24)	(17.52)	(12.64)
Observations	94	38	56
R-squared	0.679	0.518	0.659

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

7. Assessment of Families' AMD and Behavioural Factors Considering the Intervention Effect

7.1 Pre-Assessment

The baseline analysis of AMD scores in parent's sample when considering the effect of the three interventions each of the three interventions was received by 4 groups as presented in the Figure 01.

At baseline, both Spain and Turkey demonstrated comparable AMD scores across all intervention categories with no statistically significant differences between countries (p=0.9641 for APP, p=0.4432 for EDU, p=0.0599 for SNACK). Spain showed slightly lower scores (8.30) for the parents who received the APP as intervention compared to Turkey (8.46), while Spain had marginally higher AMD scores when it comes to the parents group who received who received the educational intervention (EDU) (7.70 vs 7.325) and healthy snack intervention (SNACK) scores (7.75 vs 7.26). Though the SNACK category approached statistical significance (p=0.0599), it remained above the significance threshold. These baseline measurements indicate that parents' sample from both countries began with similar AMD levels, establishing a reliable foundation for evaluating the effectiveness of the subsequent interventions (Table 27).

Regarding adolescents, there were notable differences in AMD scores between Spanish and Turkish adolescents. Spanish adolescents demonstrated higher initial scores across all interventions, with particularly significant differences in the second intervention (EDU) (6.835 vs 4.448, p=0.007) and SNACK intervention (6.843 vs 5.033, p=0.000). For the APP intervention, Spanish adolescents scored 5.40 compared to Turkish adolescents' 5.846, though this difference was not statistically significant (p=0.443). These baseline disparities indicate that Spanish adolescents generally began with higher AMD than their Turkish counterparts, establishing different starting points for measuring intervention effectiveness which confirms the previous findings (Table 28).

Likewise, initial measurements of the outcome of interest in this study for children revealed substantial disparities in AMD between children from Spain and Turkey.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Spanish youth exhibited markedly higher baseline AMD scores across all interventions, with statistically significant differences for the APP intervention (7.25 vs 5.00, p=0.019), EDU intervention (6.42 vs 4.55, p=0.007), and SNACK intervention (6.62 vs 5.19, p=0.001). These pronounced initial gaps indicate that Spanish children also commenced the study with considerably stronger MD habits than their Turkish peers. (Table 29).

The pre-assessment measurement of the sample's follows of Mediterranean lifestyle, the MEDLIFE analysis summarized in table 30 revealed distinct patterns among Spanish and Turkish parents before interventions commenced. Spanish parents consistently demonstrated higher baseline MEDLIFE scores across all interventions compared to their Turkish counterparts, with particularly pronounced disparities in the educational (14.6 vs 12.152, p=0.003) and snack intervention (14.712 vs 12.88, p=0.001).

For application intervention recipients, Spanish parents scored 12.364 versus 13.222 for Turkish parents, though this difference lacked statistical significance (p=0.407).

Similarly, but for adolescents, the KIDSCREEN measurements revealed substantial differences between Spanish and Turkish adolescents prior to intervention implementation. Spanish adolescents consistently displayed higher baseline wellbeing scores across intervention groups, with particularly significant disparities in the educational (107.11 vs 94.37, p=0.002) and snack intervention groups (102.53 vs 92.59, p=0.001). For App intervention recipients, Spanish adolescents scored 106.44 compared to 99.77 for Turkish adolescents, though this difference wasn't statistically significant (p=0.426). This highlight that both Spanish parents and adolescents initially practiced Mediterranean lifestyle behaviors more thoroughly than Turkish counterparts, creating different starting points for measuring the impact of the interventions (Table 31).

On the other side, the PA pre-measurements revealed dramatic differences between Spanish and Turkish parents before interventions commenced. Spanish parents demonstrated substantially higher initial PA levels across all intervention groups compared to their Turkish counterparts, with highly significant differences observed in application intervention groups (2171.47 vs 888.80, p=0.032), educational intervention groups (2133.93 vs 725.44, p=0.000), and snack intervention groups (3202.60 vs 873.43, p=0.000).

These pronounced baseline disparities indicate that Spanish parents entered the study with markedly higher physical activity levels than Turkish parents, establishing vastly different starting points for measuring intervention impacts.

Regarding adolescents' subsample, measurements of table 34 highlighted notable variations between Spanish and Turkish adolescents prior to intervention deployment. Spanish youth exhibited consistently higher baseline activity metrics across all intervention groups compared to their Turkish peers, with statistically significant contrasts observed in the educational intervention cohort (2.891 vs 0.637/2.399, p=0.009) and snack intervention cohort (2.695 vs 0.599/0.838, p=0.046). For application intervention recipients, Spanish adolescents registered 2.555 compared to Turkish values of 0.838/2.365, though this distinction lacked statistical significance (p=0.571). These preliminary activity indicators suggest Spanish adolescents entered the study with considerably more active lifestyles than their Turkish counterparts, establishing divergent reference points for assessing intervention efficacy.

Furthermore, for children the pre-assessment results revealed notable differences between Spanish and Turkish children before that the interventions started. While Spanish children demonstrated slightly higher initial PA levels in groups receiving the APP (2.81 vs 2.44) and those who received the SNACK (3.06 vs 2.69) intervention, Turkish children showed marginally higher scores in EDU intervention groups (2.68 vs 2.52). These differences reached statistical significance only for the SNACK intervention (p=0.024), while remaining non-significant for APP (p=0.260) and EDU (p=0.571) interventions. These baseline variations indicate that children from both countries entered the study with somewhat different starting points, though the disparities were less pronounced than observed in parents (Table 35).

The NK pre-measurements revealed substantial differences between Spanish and Turkish parents. Spanish parents demonstrated significantly higher initial NK across all intervention groups compared to their Turkish counterparts, with highly significant differences observed in APP intervention groups (14.81 vs 11.50, p=0.009), EDU intervention groups (15.80 vs 12.56, p=0.000), and SNACK intervention groups (15.42 vs 12.28, p=0.000).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

These pronounced baseline disparities indicate that Spanish parents entered the study with markedly superior nutritional knowledge than Turkish parents, establishing substantially different starting points for measuring the potential impact of the various interventions.

Analysing the NK scores before the interventions among adolescents, exactly as the case for the parents even with adolescents it is always a comparable baseline scores between Spanish and Turkish youth. Spanish adolescents recorded mean NK values of 10.9 for APP, 8.23 for EDU, and 6.846 for SNACK intervention categories, while their Turkish counterparts registered scores of 8.769, 7.207, and 5.44 respectively. Statistical analysis confirmed no significant inter-country differences at baseline across intervention types (APP: p=0.593; EDU: p=0.571; SNACK: p=0.192). These findings suggest that despite numerical variations, adolescents from both nations commenced the study with relatively equivalent nutritional knowledge foundations, providing a balanced platform for evaluating intervention efficacy.

Examination of baseline AMD intentions within parents' subsample controlling or the intervention effect revealed notable disparities between parental groups from Spain and Turkey. Spanish parents consistently demonstrated stronger initial AMD intentions across all interventions, with considerably higher scores in APP (4.63 vs 3.37), EDU (4.47 vs 2.61), and SNACK (4.47 vs 3.21) intervention classifications. Statistical analysis confirmed highly significant pre-intervention differences in both EDU and SNACK categories (p=0.000), while the APP comparison approached but did not reach significance (p=0.116) (Table 38) Similarly, and among adolescents' subsample, results indicate that Spanish youth exhibited considerably stronger baseline AMD intentions across all intervention classifications: APP (4.11 vs 3.00), EDU (3.74 vs 2.84), and SNACK (3.81 vs 2.61) compared to their Turkish peers. Statistical analysis confirmed significant pre-intervention disparities in both EDU (p=0.002) and SNACK (p=0.000) categories, while the APP comparison approached but remained just outside conventional significance thresholds (p=0.109) (Table 39).

These preliminary findings illustrate substantially meaningful cultural variations and different starting positions regarding dietary intentions, with both Spanish parents and adolescents exhibiting markedly stronger pre-existing commitment to MD patterns before any interventions were administered.

7.2 **Post assessment**

Following interventions, notable differences emerged between parents' AMD scores of both countries. In Spain, parents who received the APP decreased their scores to 7.967, while Turkey showed improvement to 8.82, though this difference wasn't statistically significant (p=0.1311). On the other hand, the parents who received the EDU intervention revealed significant differences post-intervention with Spain decreasing to 6.953 while Turkey increased to 8.33, resulting in a highly significant difference between countries (p=0.0016). For the those who received the SNACK as intervention, Spanish parents increased their AMD to 8.049 and Turkey to 7.938, with no significant difference between countries post-intervention (p=0.569). These findings suggest differential effectiveness of the interventions between the two countries, with Turkey generally showing more positive outcomes across all intervention types.

Moreover, when it comes to children, interesting patterns emerged in the post-intervention scores. Spanish adolescents who received the APP intervention showed greater improvement (7.15) compared to Turkish adolescents (6.446), though the difference between countries was not statistically significant (p=0.331). Furthermore, Spanish adolescents who received the second intervention (EDU) decreased their scores of AMD slightly to 6.235 while Turkish adolescents improved to 5.758, with no significant difference between countries (p=0.515). Regarding the SNACK intervention, adolescents of both countries showed improvements, with Spanish adolescents reaching 7.818 and Turkish adolescents 6.011, resulting in a highly significant difference between countries (p=0.000). This suggests varied effectiveness of different interventions between the two countries.

On the other hand, applying the same analysis to the children's subsample, the evaluation unveiled intriguing shifts in dietary adherence.

For the App intervention, Spanish children's scores rose modestly to 7.75 while Turkish children's scores increased to 6.10, with no statistically significant difference between nations post-intervention (p=0.147).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Regarding educational materials, Spanish children showed minimal change (6.63) while Turkish youth improved to 5.53, again with no significant cross-country difference (p=0.167).
The healthy snack intervention yielded improvements in both countries (Spain: 7.19, Turkey: 6.33), maintaining a statistically significant difference between countries (p=0.046).
When it comes to Mediterranean lifestyle and after the implementation of the interventions, the MEDLIFE scores exhibited interesting transformations. Parents receiving the App intervention showed modest improvements in both countries (Spain: 14.25, Turkey: 13.94), with no significant cross-cultural difference (p=0.737). Within the educational intervention cohort, Spanish parents' scores increased slightly to 14.889 while Turkish parents showed more substantial improvement to 13.80, though the between-country difference remained non-significant (p=0.231). Most notably, the snack intervention yielded improvements in both countries (Spain: 15.088, Turkey: 14.1), maintaining a statistically significant difference between countries (p=0.038).
Following the same trajectory, the KIDSCREEN scores for adolescents showed unexpected patterns of change. Adolescents receiving the App intervention exhibited marginal changes in both countries (Spain: 107.11, Turkey: 100.3), maintaining similar levels with no significant cross-cultural difference (p=0.413). For the Educational and empowerment activities' intervention, Spanish adolescents' scores decreased slightly to 105.36 while Turkish adolescents showed a modest increase to 98.08, narrowing the gap between countries (p=0.150). Most notably, the snack intervention yielded a decline in Spanish adolescents' scores to 99.76 while Turkish adolescents experienced improvements to 98.75, eliminating the previously significant difference between countries (p=0.777).
Similarly, KIDSCREEN data revealed subtle yet meaningful shifts in children's lifestyle and wellbeing metrics. Within the App intervention cohort, Spanish children experienced a slight decrease to 116.55 while Turkish children showed modest improvement to 104.1, narrowing but not eliminating the between-country gap (p=0.054). For educational intervention, Spanish children's scores decreased marginally to 111.6 while Turkish children improved to 103.09, reducing the cross-cultural difference but maintaining borderline significance (p=0.073).
The snack intervention cohort demonstrated a similar pattern with Spanish children showing slight improvement to 114.37 and Turkish children advancing to 101.83, maintaining a highly significant difference between nations (p=0.000). These post-intervention measurements reveal complex response patterns that differ from those observed in AMD measures. Moreover, it suggests differential intervention effects based on initial wellbeing status.
Regarding the measurement of the PA among parents in both countries, the PA results presented in table 33 showed interesting shifts in parental PA patterns. Within the APP intervention, Spanish parents' PA levels decreased slightly to 2074.95 while Turkish parents' scores dropped marginally to 869.55, maintaining a highly significant difference between countries (p=0.001). Educational intervention recipients showed a similar pattern with Spanish parents decreasing to 1913.28 and Turkish parents increasing slightly to 740.73, preserving a significant cross-cultural difference (p=0.000). The snack intervention group exhibited reductions in both countries (Spain: 2218.82, Turkey: 791.80), maintaining significant between-country differences (p=0.000).
Upon the end of the intervention period, PA measurements revealed subtle shifts in adolescent movement patterns. Adolescents participating in the APP intervention demonstrated minimal fluctuations in both countries (Spain: 2.487, Turkey: 0.694/2.584), maintaining comparable cross-country distinctions (p=0.369). Within the educational intervention group, Spanish adolescents' activity decreased slightly to 2.778 while Turkish participants showed modest changes to 0.438/2.543, with between-country differences no longer reaching statistical significance (p=0.301). Similarly, adolescents receiving the snack intervention exhibited minimal changes (Spain: 2.675, Turkey: 0.67/0.694), eliminating previously significant cross-cultural differences (p=0.384).
These post-intervention metrics suggest that interventions had minimal impact on increasing PA levels in both parents and adolescents' populations.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Similarly, the post-measurements demonstrated shifts in PA levels across both children's populations. Particularly, Spanish children receiving both APP and EDU interventions exhibited increased scores of (3.18 from 2.81) and (3.34 from 2.52) respectively, with the latter showing statistically significant improvement (p=0.030).

Similarly, Turkish children displayed elevated scores across all intervention types: APP (2.68 from 2.44), EDU (2.97 from 2.68), and SNACK (2.84 from 2.69), though none reached statistical significance. Notably, post-intervention comparisons between countries revealed no significant differences (APP: p=0.144, EDU: p=0.334, SNACK: p=0.574), suggesting that interventions may have helped harmonize PA levels between Spanish and Turkish children.

Another interesting variable which is the NK exhibited shifts in results of both countries, albeit with different patterns. Spanish parents showed modest increases across intervention types: APP (15.35 from 14.81), EDU (15.62 from 15.80), and minimal change in SNACK (15.43 from 15.42), though none reached statistical significance. In contrast, Turkish parents demonstrated more substantial and statistically significant improvements in EDU (14.30 from 12.56, p=0.012) and SNACK (13.67 from 12.28, p=0.018) interventions, with marginally significant improvement in APP (13.57 from 11.50, p=0.058). Post-intervention comparisons revealed that while Spanish parents still maintained higher absolute scores, the gap narrowed considerably, with significant differences persisting only in the SNACK intervention (15.43 vs 13.67, p=0.000).

The conclusion of interventions yielded intriguing developments in adolescents' nutritional literacy. Spanish youth exhibited mixed outcomes with modest improvement in APP intervention groups (11.4 from 10.9), but unexpected declines in EDU (6.529 from 8.235) and SNACK (5.615 from 6.846) categories. Conversely, Turkish adolescents demonstrated consistent knowledge enhancement across all intervention types: APP (11.00 from 8.769), EDU (10.483 from 7.207, p=0.069), and SNACK (7.869 from 5.443, p=0.07), with the latter two approaching statistical significance. Remarkably, post-intervention comparisons showed nearly identical knowledge levels between countries across all intervention categories (APP: p=0.975; EDU: p=0.095; SNACK: p=0.105), suggesting a convergence of nutritional understanding despite divergent trajectories.

Moreover, regarding the intention to follow a healthy dietary pattern in the parents' subsample, Table show distinct responses emerging between the two countries within the study.

Spanish parents exhibited mixed outcomes with a decrease AMD intention in APP intervention group (4.16 from 4.63), but improvements in EDU (4.57 from 4.47, p=0.036) and SNACK (4.32 from 4.47) intervention, with statistical significance achieved only in the EDU intervention. Turkish participants, meanwhile, demonstrated consistent improvement across all interventions: APP (3.49 from 3.37), EDU (3.28 from 2.61, p=0.036), and SNACK (3.59 from 3.21), with significant enhancement in the EDU intervention. Despite these improvements among Turkish participants, post-intervention comparisons continued to show statistically significant differences between countries in EDU and SNACK categories (both p=0.000), indicating persistent cross-cultural variations in AMD intentions.

For adolescents, the 3 months' intervention period yielded contrasting outcomes between both countries. Spanish youth demonstrated unexpected declines across all intervention types: APP (3.63 from 4.11), EDU (3.69 from 3.74), and notably SNACK (3.68 from 3.81, p=0.006), with the latter reaching statistical significance. Conversely, Turkish adolescents exhibited consistent and substantial improvements throughout all interventions: APP (3.33 from 3.00), EDU (3.23 from 2.84), and particularly SNACK (3.27 from 2.61, p=0.011), with significant enhancement in the SNACK intervention. Post-intervention comparisons revealed a striking convergence of intention scores, with differences between countries becoming non-significant for APP (p=0.835) and EDU (p=0.362), while narrowing considerably for SNACK (p=0.067), suggesting a harmonization of MD adherence intentions across cultural groups.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

7.3 Monitoring and understanding behavioural change

7.3.1 Adherence to Mediterranean diet

Across all three interventions (app-based, educational materials/empowerment activities, and healthy snack provision), we observe a consistent negative correlation between AMD baseline scores and change in AMD between the V2 and V1, parents with higher initial AMD typically showed smaller gains or greater declines. The app-based intervention produced the widest range of outcomes (-4 to +6 points), while educational materials showed a more compressed range of effects. The healthy snack intervention appeared most effective for parents with lower baseline AMD scores. All interventions clustered around minimal change (0 to -2 points) for parents with moderate initial AMD (6-12 points), suggesting limited overall impact on AMD regardless of intervention type. This pattern aligns with regression to the mean, where extreme initial values tend to move toward the average in subsequent measurements (Figure 23).

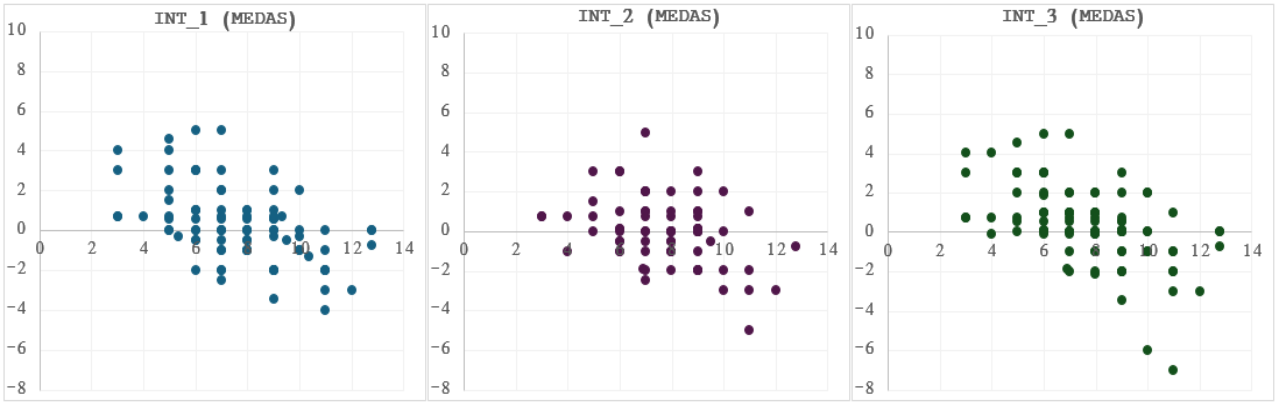


Figure.23 Changes in AMD scores by intervention type among Spanish parents according to baseline AMD

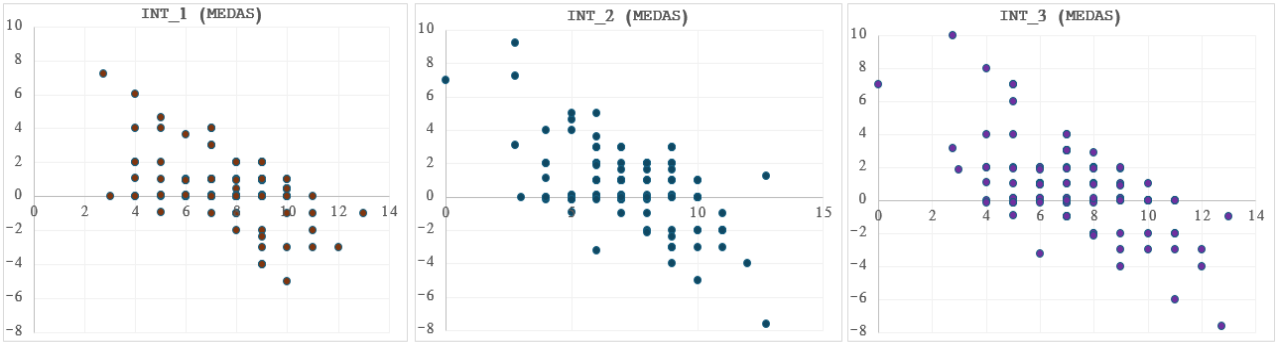


Figure.24 Changes in AMD scores by intervention type among Turkish parents according to baseline AMD

Turkish parents showed more favorable responses to all three interventions compared to the Spanish cohort, though the same negative correlation between baseline AMD and change persists. The educational materials/empowerment activities (INT_2) produced the most consistent positive results across various baseline levels, while the app-based intervention (INT_1) and healthy snack provision (INT_3) were particularly effective for those with lower initial knowledge. Unlike the Spanish sample, Turkish parents exhibited fewer instances of minimal change, suggesting the interventions had more meaningful impact on the Turkish parents despite the statistical tendency toward regression to the mean (Figure 24).

Looking at the three graphs of AMD scores per intervention among Spanish adolescents, we can see that the three interventions show a negative correlation between baseline KIDMED scores and change in scores, meaning adolescents with lower initial adherence experienced greater improvements.

The app-based intervention (INT_1) shows the strongest effect for low-baseline participants. Educational materials/empowerment activities (INT_2) produced more consistent positive results across baseline levels. Healthy snack provision (INT_3) shows similar patterns but with more variability.

These patterns suggest the interventions were effective for improving AMD, particularly among adolescents with initially poor dietary habits (Figure 25).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

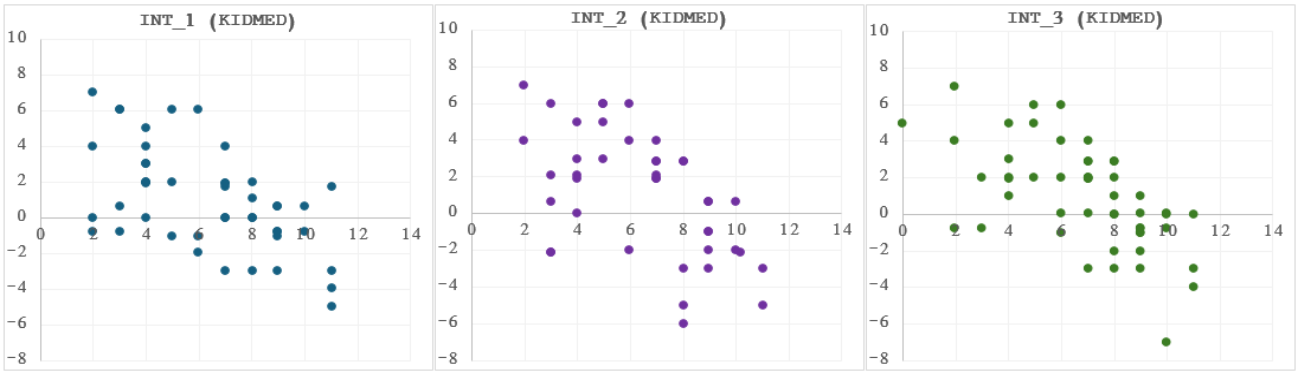


Figure.25 Changes in AMD scores by intervention type among Spanish adolescents according to baseline AMD

Regarding the Turkish adolescents, all three interventions show a negative correlation between baseline and changes in KIDMED scores, those with lower initial adherence improved more. The Turkish cohort displayed more moderate effects than the Spanish sample, with changes concentrated in a narrower range.
Turkish adolescents who already had good AMD maintained stable habits across all interventions. This clearly conveys the key patterns: the negative correlation, the more moderate and concentrated effects compared to Spanish adolescents, and the stability among those with good baseline AMD (Figure 26).

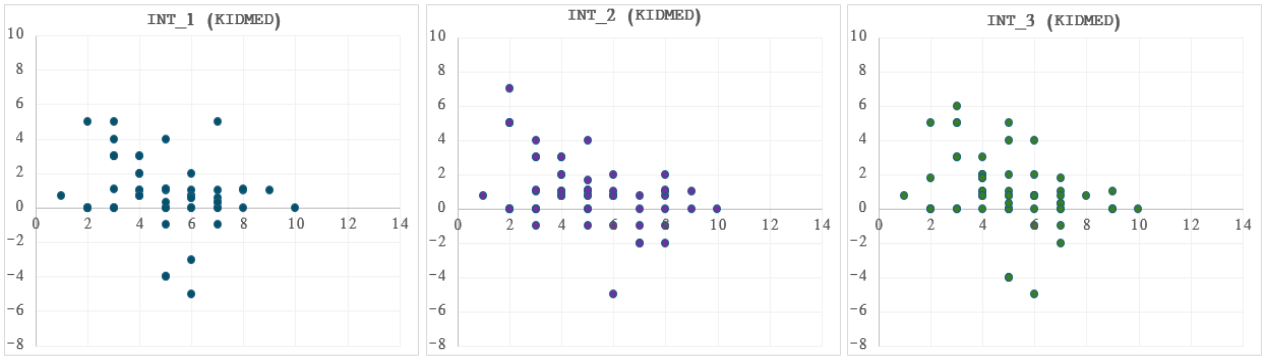


Figure.26 Changes in AMD scores by intervention type among Turkish adolescents according to baseline AMD

When it comes to the subsample of children, results revealed that across all three interventions, Spanish children showed stronger and more varied responses than Turkish children. For Spanish children, the app-based intervention (INT_1) and educational materials (INT_2) produced particularly notable improvements for those with low baseline scores, with some individuals showing gains of 4-6 points ssuggesting that Spanish children's responses to the interventions were more predictable based on their starting adherence levels (Figure 27).
In contrast, Turkish children's responses to all three interventions were more moderate, typically showing smaller positive changes (mostly 1-3 points) regardless of the intervention type.

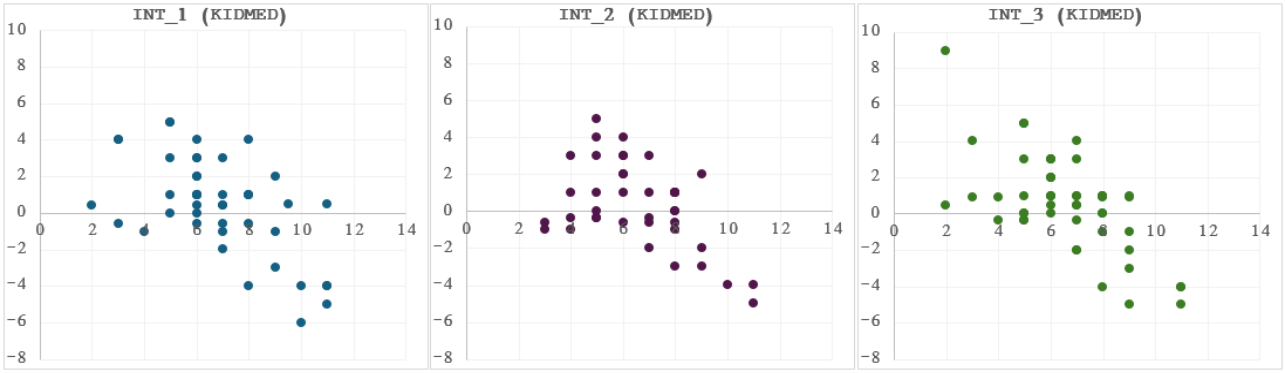


Figure.27 Changes in AMD scores by intervention type among Spanish children according to baseline AMD

The educational materials intervention (INT_2) appears slightly more consistent for Turkish children, with fewer negative outcomes.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

For both populations, healthy snack provision (INT_3) shows similar patterns to the other interventions but with slightly more variability in the Spanish cohort. Overall, while all interventions were effective for both groups, the Spanish children demonstrated more dramatic improvements across all intervention types compared to the more modest, consistent responses seen in Turkish children (Figure 28).

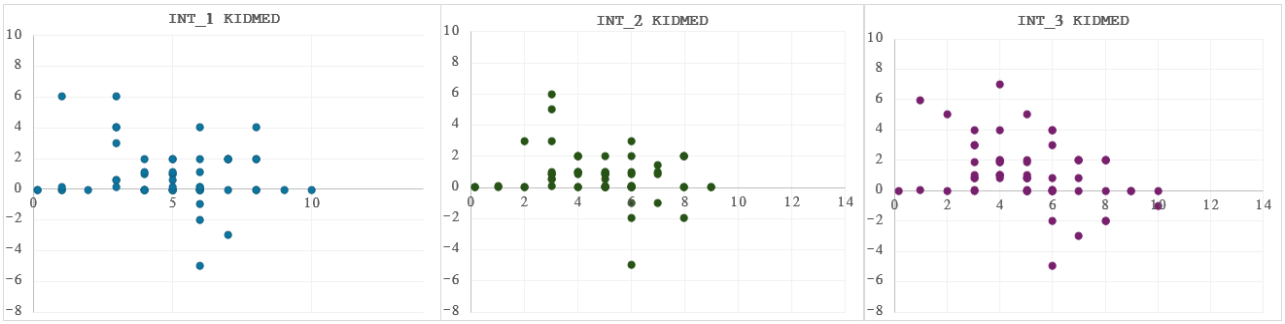


Figure.28 Changes in AMD scores by intervention type among Turkish children according to baseline AMD

7.3.2 Factors related with families' attitude, behaviour and lifestyle

Regarding the Spanish parents, all three interventions show a negative correlation between baseline knowledge and changes in NK scores, with those having lower initial knowledge improving more. INT_2 (educational material) produced the most variable results with both the highest gains and some notable decreases. INT_1 (app) showed consistent modest improvements with fewer outliers. INT_3 (healthy snack) demonstrated scattered results with several outliers in both directions. Across all interventions, parents with already high baseline NK showed smaller changes or slight decreases, suggesting a ceiling effect (Figure 29).

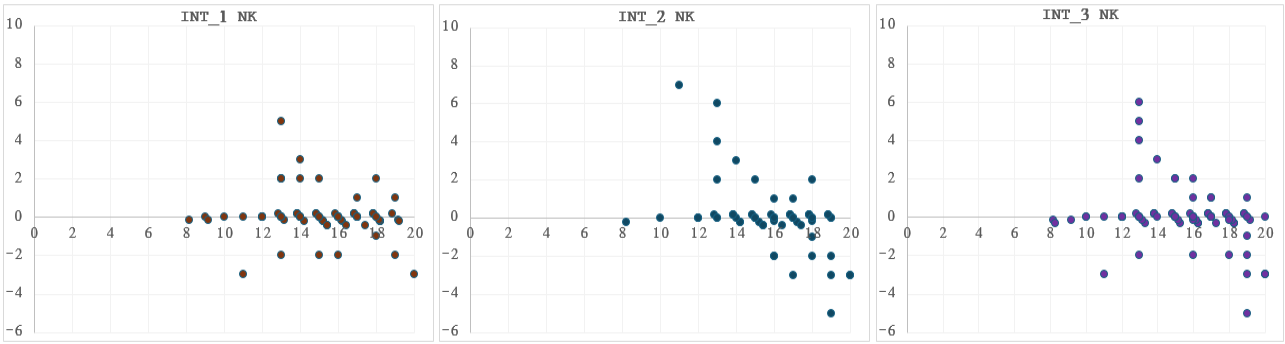


Figure.29 Changes in NK scores by intervention type among Spanish parents according to the NK baseline

Regarding the Turkish parents, all three interventions reveal a negative correlation those with lower baseline knowledge gained more. Results of the INT_1 (app) graph produced the most varied results (-7 to +8 points), while all interventions showed substantial improvements for parents with initially low knowledge. Those with high baseline scores consistently showed minimal changes across all intervention types (Figure 30).

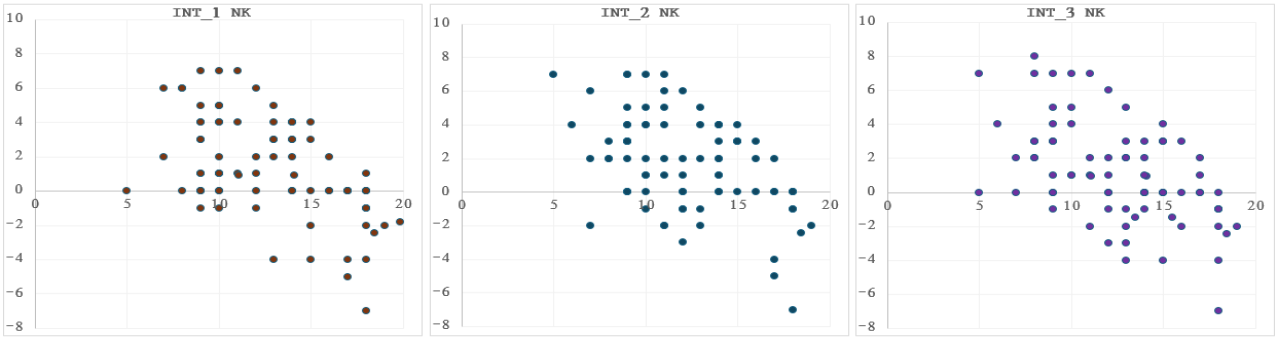


Figure.30 Changes in NK scores by intervention type among Turkish parents according to the NK baseline

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

AMD for parents

The intervention effects varied meaningfully between countries. In Spain, educational intervention (EDU) measures showed a marginally significant decrease (p=0.064), while healthy snack intervention (SNACK) measures increased non-significantly, and application intervention (APP) scores declined non-significantly. Conversely, Turkey demonstrated significant improvements in both educational interventions (p=0.0126) and healthy snack interventions (p=0.0295), with a non-significant increase in application intervention scores. This divergent pattern suggests that interventions, particularly the educational materials and healthy snack components, may have been more effectively implemented or culturally appropriate in Turkey. The combined intervention groups (particularly group 8 with all interventions) likely contributed to these improvements in Turkey, while Spain's results were more mixed (Table 27).

Table.27 Changes in AMD scores by intervention type among parents' sub-sample

Interventions	AMD (Parents)							
	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
APP	8.30 (2.146)	7.96 (2.029)	0.617	8.46 (1.655)	8.82 (1.532)	0.326	0.964	0.131
EDU	7.70 (1.591)	6.95 (1.583)	0.064	7.32 (2.005)	8.33 (2.142)	0.012	0.443	0.001
SNACK	7.75 (2.173)	8.04 (1.995)	0.326	7.26 (2.027)	7.93 (2.073)	0.029	0.059	0.569

Note: The cells shaded in gray indicate statistically significant differences at the 5% level (p < 0.05). The cells shaded in light red denote marginally significant differences at the 10% level (0.05 ≤ p < 0.10).

The same analyses had been done for adolescents' subsample and the results are presented in the table 28. The intervention effects revealed distinctive patterns of change within each country. In Spain, the APP intervention produced a non-significant increase in AMD scores(p=0.133), while the EDU intervention resulted in a non-significant decrease (p=0.579). However, the SNACK intervention showed a marginally significant improvement (p=0.053). In contrast, Turkey demonstrated significant improvements in both EDU (p=0.047) and SNACK (p=0.015) interventions, with a non-significant increase in APP scores. These findings suggest that while the healthy snack intervention was effective in both countries, the educational materials were particularly impactful for Turkish adolescents who started with lower baseline scores. The differences in intervention effectiveness highlight the importance of considering cultural context and baseline adherence levels when designing dietary interventions for adolescent populations.

Table.28 Changes in AMD scores by intervention type among adolescents' sub-sample

AMD (Adolescents)								
Interventions	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
APP	5.40 (2.633)	7.15 (2.904)	0.133	5.84 (1.463)	6.44 (2.41)	0.451	0.443	0.331
EDU	6.83 (2.956)	6.23 (3.437)	0.579	4.44 (2.599)	5.75 (2.306)	0.047	0.007	0.515
SNACK	6.84 (2.611)	7.81 (2.414)	0.053	5.03 (1.975)	6.01 (2.364)	0.015	0.000	0.000

Note: The cells shaded in gray indicate statistically significant differences at the 5% level (p < 0.05). The cells shaded in light red denote marginally significant differences at the 10% level (0.05 ≤ p < 0.10).

The trajectory of dietary behaviour modifications within children population exhibited is presented in the table 29. Among Spanish children, none of the interventions produced statistically significant changes, though modest numerical improvements were observed across all interventions (APP: p=0.658, EDU: p=0.830, SNACK: p=0.165). In contrast, Turkish children demonstrated a significant positive response to the snack intervention (p=0.007), with non-significant numerical improvements in the other areas. This divergence in response patterns suggests that children with lower baseline AMD (Turkish cohort) benefited more substantially from the interventions, particularly the snack component. The findings underscore the value of tailoring dietary programs to initial adherence levels and cultural backgrounds, with potentially greater impact opportunities among populations starting from lower baseline metrics.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Table.29 Changes in AMD scores by intervention type among children's sub-sample

AMD (Children)								
Interventions	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
APP	7.25 (2.395)	7.75 (2.574)	0.658	5.00 (1.871)	6.10 (2.628)	0.231	0.019	0.147
EDU	6.42 (2.502)	6.63 (2.705)	0.830	4.55 (2.07)	5.53 (2.501)	0.112	0.007	0.167
SNACK	6.62 (2.078)	7.19 (2.033)	0.165	5.19 (2.174)	6.33 (2.424)	0.007	0.001	0.046

Note: The cells shaded in gray indicate statistically significant differences at the 5% level (p < 0.05). The cells shaded in light red denote marginally significant differences at the 10% level (0.05 ≤ p < 0.10).

The progression of lifestyle adaptations manifested differently within each cultural context. Among Spanish parents, all three interventions produced modest, non-significant improvements in MEDLIFE scores (application: p=0.105, educational: p=0.929, snack: p=0.315). In stark contrast, Turkish parents exhibited statistically significant enhancements following both educational (p=0.016) and snack (p=0.007) interventions, with non-significant improvement after the application intervention. This divergence suggests that populations with lower baseline Mediterranean lifestyle adherence (Turkish parents) derived substantially greater benefits from the structured interventions. The educational and snack interventions proved particularly transformative for Turkish parents, demonstrating that intervention effectiveness may correlate inversely with initial adherence levels. These findings emphasize the importance of considering baseline cultural practices when designing lifestyle modification programs (Table 30).

Table.30 Changes in MEDLIFE scores by intervention type among parents' sub-sample

Interventions	MEDLIFE (parents)							
	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
APP	12.36 (3.585)	14.25 (2.463)	0.105	13.22 (3.585)	13.94 (2.758)	0.337	0.407	0.737
EDU	14.60 (2.113)	14.88 (2.908)	0.929	12.15 (2.113)	13.80 (3.337)	0.016	0.003	0.231
SNACK	14.71 (3.28)	15.08 (2.43)	0.315	12.88 (3.28)	14.10 (2.91)	0.007	0.001	0.038

Note: The cells shaded in gray indicate statistically significant differences at the 5% level (p < 0.05). The cells shaded in light red denote marginally significant differences at the 10% level (0.05 ≤ p < 0.10).

The trajectory of lifestyle and wellbeing indicators for adolescents' subsample revealed counterintuitive patterns across both populations (Table 31). For Spanish adolescents, all three interventions produced slight decreases in KIDSCREEN scores, with the snack intervention approaching statistical significance (p=0.053) in its negative direction. Turkish adolescents showed small, non-significant improvements across all intervention types. This divergent pattern suggests that interventions primarily focused on dietary habits may have complex or even potentially adverse effects on broader wellbeing measures for adolescents already reporting high baseline quality of life.

Table.31 Changes in KIDSCREEN scores by intervention type among adolescents' sub-sample

KIDSCREEN (Adolescentes)								
Interventions	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
APP	106.44 (12.115)	107.11 (12.414)	0.133	99.77 (13.746)	100.3 (13.317)	0.967	0.426	0.413
EDU	107.11 (11.067)	105.36 (10.652)	0.579	94.37 (12.028)	98.08 (11.56)	0.332	0.002	0.150
SNACK	102.53 (14.331)	99.76 (13.915)	0.053	92.59 (14.26)	98.75 (10.29)	0.028	0.001	0.777

Note: The cells shaded in gray indicate statistically significant differences at the 5% level (p < 0.05). The cells shaded in light red denote marginally significant differences at the 10% level (0.05 ≤ p < 0.10).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Conversely, the modest improvements among Turkish adolescents with lower baseline scores indicate potential wellbeing benefits from these interventions in certain contexts. These findings highlight the importance of considering potential psychosocial impacts when implementing diet-focused interventions, particularly among adolescent populations where body image and social factors may mediate responses to food-related programs.

The evolution of children's wellbeing indicators throughout the intervention period revealed intriguing differences between populations.

Spanish children, who began with high baseline scores, showed minimal fluctuations across all intervention types, with slight decreases in two groups and a marginal increase in the snack intervention group. None of these changes approached statistical significance.

Conversely, Turkish children demonstrated consistent, though statistically non-significant, improvements across all intervention groups. This pattern suggests a potential ceiling effect among Spanish children who initially reported very high wellbeing, while Turkish children with lower baseline scores had greater opportunity for improvement. Importantly, unlike the adolescent cohort where some negative trends emerged, children's responses appeared more stable or positive, suggesting that dietary interventions may interact differently with wellbeing perceptions at different developmental stages. These findings emphasize the importance of baseline wellbeing status when evaluating intervention effects on quality of life measures (Table 32).

Table.32 Changes in KIDSCREEN scores by intervention type among children's sub-sample

KIDSCREEN (children)								
Interventions	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
APP	117.00 (8.799)	116.55 (10.039)	0.658	100.6 (11.664)	104.1 (11.484)	0.306	0.008	0.054
EDU	114.25 (7.712)	111.6 (3.647)	0.830	99.23 (12.899)	103.09 (10.421)	0.198	0.001	0.073
SNACK	113.86 (10.223)	114.37 (9.95)	0.165	98.91 (14.724)	101.83 (13.053)	0.476	0.000	0.000

Note: The cells shaded in gray indicate statistically significant differences at the 5% level ($p < 0.05$). The cells shaded in light red denote marginally significant differences at the 10% level ($0.05 \leq p < 0.10$).

The evolution of PA measures throughout the study period demonstrated limited effectiveness of the interventions for enhancing PA behaviors especially for parents' subsample. Spanish parents showed non-significant decreases in PA levels across all intervention types (APP: p=0.908, EDU: p=0.775, SNACK: p=0.295), with the most substantial decrease observed in the snack intervention group. Turkish parents exhibited mixed responses with minimal changes that were not statistically significant (APP: p=1.000, EDU: p=0.200, SNACK: p=0.626). These findings suggest that interventions primarily focused on dietary habits had limited transfer effects to physical activity behaviors. The significant pre-existing differences between Spanish and Turkish parents' PA levels persisted throughout the study, indicating that cultural factors or structural differences in lifestyle patterns may have stronger influences on PA than the specific interventions implemented. These results highlight the challenge of increasing PA through primarily nutrition-focused interventions and suggest that more targeted PA-specific strategies may be needed.

Table.33 Changes in PA scores by intervention type among parents' sub-sample

PA (parents)								
Interventions	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
APP	2171.47 (1613.145)	2074.95 (1261.277)	0.908	888.80 (931.07)	869.55 (894.277)	1.000	0.032	0.001
EDU	2133.93 (1860.893)	1913.28 (1118.517)	0.775	725.44 (1318.157)	740.73 (760.385)	0.200	0.000	0.000
SNACK	3202.60 (3534.477)	2218.62 (1470.149)	0.295	872.43 (1709.508)	791.80 (827.498)	0.626	0.000	0.000

Note: The cells shaded in gray indicate statistically significant differences at the 5% level ($p < 0.05$). The cells shaded in light red denote marginally significant differences at the 10% level ($0.05 \leq p < 0.10$).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

The trajectory of adolescent PA behaviors throughout the study period reflected minimal responsiveness to the implemented interventions.

Spanish adolescents demonstrated slight, non-significant decreases in activity levels across all intervention categories (APP: p=0.824, EDU: p=0.626, SNACK: p=0.896).

Similarly, Turkish youth showed inconsistent and statistically negligible fluctuations across all intervention groups (APP: p=0.727, EDU: p=0.179, SNACK: p=0.317). This lack of meaningful change suggests that interventions primarily targeting Mediterranean dietary habits had limited crossover effects on adolescent PA behaviors.

Interestingly, the significant pre-existing activity disparities between Spanish and Turkish adolescents diminished by the study conclusion, primarily due to small decreases among Spanish participants rather than substantial improvements among Turkish youth.

These outcomes underscore the challenge of modifying established activity routines through dietary-focused

interventions and suggest that adolescent PA may require more direct, movement-specific strategies tailored to different cultural contexts and baseline activity levels (Table 34).

Table.34 Changes in PA scores by intervention type among adolescents' sub-sample

PA adolescents								
Interventions	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
APP	2.55 (0.698)	2.48 (0.557)	0.824	2.344 (0.838)	2.219 (0.694)	0.727	0.571	0.369
EDU	2.89 (0.569)	2.77 (0.628)	0.626	2.365 (0.637)	2.584 (0.438)	0.179	0.009	0.301
SNACK	2.69 (0.73)	2.67 (0.609)	0.896	2.399 (0.599)	2.543 (0.67)	0.317	0.046	0.384

Note: The cells shaded in gray indicate statistically significant differences at the 5% level (p < 0.05). The cells shaded in light red denote marginally significant differences at the 10% level (0.05 ≤ p < 0.10).

When it comes to children, results of table 35 show a clear behavioural change regarding the PA demonstrated by distinct patterns across intervention types and countries. The EDU intervention yielded the most substantial impact in Spain, producing a statistically significant increase (2.52 to 3.34, p=0.030), while the APP intervention generated moderate though non-significant improvements in both countries (Spain: 2.81 to 3.18; Turkey: 2.44 to 2.68). Interestingly, the SNACK intervention produced divergent outcomes, with a slight decrease in Spain (3.06 to 2.94) contrasted with a modest increase in Turkey (2.69 to 2.84). These observations suggest that educational approaches were particularly effective for Spanish children, while intervention effectiveness varied considerably between the two cultural contexts, highlighting the importance of tailored approaches for different populations.

Table.35 Changes in PA scores by intervention type among children' sub-sample

PA children								
Interventions	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
APP	2.81 (0.705)	3.18 (0.698)	0.301	2.44 (0.665)	2.68 (0.731)	0.453	0.260	0.144
EDU	2.52 (0.697)	3.34 (0.437)	0.030	2.68 (0.821)	2.97 (0.815)	0.272	0.571	0.334
SNACK	3.06 (0.694)	2.94 (0.789)	0.509	2.69 (0.666)	2.84 (0.6)	0.314	0.024	0.574

Note: The cells shaded in gray indicate statistically significant differences at the 5% level (p < 0.05). The cells shaded in light red denote marginally significant differences at the 10% level (0.05 ≤ p < 0.10).

Similar to the rest of behavioural factors, the trajectory of NK displayed some differences between the two countries. Where, Turkish parents exhibited more pronounced and statistically significant improvements across all intervention types, particularly in EDU (+1.74 points, p=0.012) and SNACK (+1.39 points, p=0.018) interventions, suggesting greater responsiveness.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Conversely, Spanish parents showed minimal gains, potentially indicating ceiling effects due to their higher baseline knowledge.

These differential response patterns highlight that those interventions may yield more substantial benefits for populations with lower initial knowledge levels which confirms the results found previously in the total and per group analyses (Table 36).

Table.36 Changes in NK scores by intervention type among parents' sub-sample

Interventions	NK (Parents)							
	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
APP	14.81 (1.722)	15.35 (2.39)	0.357	11.50 (3.312)	13.57 (3.271)	0.058	0.009	0.092
EDU	15.80 (2.215)	15.62 (2.367)	0.703	12.56 (3.351)	14.30 (3.372)	0.012	0.000	0.149
SNACK	15.42 (2.674)	15.43 (2.788)	0.715	12.28 (3.733)	13.67 (3.162)	0.018	0.000	0.000

Note: The cells shaded in gray indicate statistically significant differences at the 5% level ($p < 0.05$). The cells shaded in light red denote marginally significant differences at the 10% level ($0.05 \leq p < 0.10$).

Regarding adolescents, the evolution of their NK throughout the study period manifested distinctly contrasting patterns between both samples. Turkish adolescents exhibited substantial knowledge acquisition across all intervention frameworks, with particularly notable gains in EDU (+3.276 points) and SNACK (+2.426 points) categories, both approaching statistical significance (p=0.069 and p=0.07 respectively). This consistent upward trend contrasts sharply with the unexpected regression observed among Spanish participants in two intervention categories. The counterintuitive decline in Spanish scores warrants further investigation into potential methodological variables or cultural factors that might explain this phenomenon. Nevertheless, the convergence of final scores between countries suggests that appropriately tailored interventions may effectively harmonize NK across diverse adolescent populations, potentially compensating for initial disparities or cultural differences (Table 37).

Table.37 Changes in NK scores by intervention type among adolescents' sub-sample

Interventions	NK (Adolescents)							
	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
APP	10.90 (6.624)	11.40 (7.011)	0.909	8.76 (7.452)	11.00 (7.692)	0.467	0.593	0.975
EDU	8.23 (5.437)	6.52 (7.609)	0.502	7.20 (6.581)	10.48 (7.813)	0.069	0.571	0.095
SNACK	6.84 (6.254)	5.61 (6.601)	0.292	5.44 (6.112)	7.86 (7.267)	0.07	0.192	0.105

Note: The cells shaded in gray indicate statistically significant differences at the 5% level ($p < 0.05$). The cells shaded in light red denote marginally significant differences at the 10% level ($0.05 \leq p < 0.10$).

On the other side, the change in dietary adherence intentions throughout the study period exhibited fascinating intervention-specific dynamics. The educational intervention proved most effective overall, generating statistically significant improvements in both Spanish (+0.10 points, p=0.036) and Turkish (+0.67 points, p=0.036) parental groups. While Spanish parents maintained higher absolute intention scores, Turkish participants demonstrated more substantial relative gains, suggesting greater responsiveness to the interventions despite lower baseline intentions. Interestingly, the application-based intervention yielded minimal impact in either country, potentially indicating limitations in digital approaches for enhancing AMD intentions (Table 38).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Table.38 Changes in AMD intention by intervention type among parents' sub-sample

Interventions	AMD Intention (Parents)							
	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
APP	4.63 (0.441)	4.16 (0.737)	0.899	3.37 (1.825)	3.49 (1.541)	0.899	0.116	0.327
EDU	4.47 (0.687)	4.57 (0.593)	0.036	2.61 (1.534)	3.28 (1.464)	0.036	0.000	0.000
SNACK	4.47 (0.676)	4.32 (0.677)	0.125	3.21 (1.526)	3.59 (1.301)	0.125	0.000	0.000

Note: The cells shaded in gray indicate statistically significant differences at the 5% level (p < 0.05). The cells shaded in light red denote marginally significant differences at the 10% level (0.05 ≤ p < 0.10).

For adolescents, the path of dietary adherence intentions over the
study duration showed intriguing opposite trends among different nationalities
Turkish adolescents demonstrated remarkable improvement across all intervention frameworks, with particularly notable gains in SNACK (+0.66 points, p=0.011) and EDU (+0.39 points) intervention groups. This steady upward trend stands in stark contrast to the unexpected decline seen among Spanish participants across every type of intervention, most significantly in the SNACK intervention group (-0.13 points, p=0.006). This counterintuitive decline among Spanish youth warrants deeper exploration into potential cultural factors, intervention reception differences, or measurement considerations. Nonetheless, the striking alignment of final intention scores across countries emphasizes how well-designed interventions could successfully address cross-cultural disparities in dietary intentions, potentially allowing for more consistent strategies in promoting AMD among varied adolescent groups (Table 39).

Table.39 Changes in AMD intention by intervention type among parents' sub-sample

Interventions	AMD intention (Adolescents)							
	Spain			Turkey			Before vs Before (p-value)	After vs After (p-value)
	Before	After	p-value	Before	After	p-value		
APP	4.11 (0.687)	3.63 (0.841)	0.649	3.00 (1.491)	3.33 (1.089)	0.582	0.109	0.835
EDU	3.74 (0.607)	3.69 (0.623)	0.069	2.84 (1.04)	3.23 (1.027)	0.209	0.002	0.362
SNACK	3.81 (0.735)	3.68 (0.921)	0.006	2.61 (1.203)	3.27 (1.037)	0.011	0.000	0.067

Note: The cells shaded in gray indicate statistically significant differences at the 5% level (p < 0.05). The cells shaded in light red denote marginally significant differences at the 10% level (0.05 ≤ p < 0.10)

7.3.3 Factors influencing post-intervention MD adherence

In order to figure out the variables that affect parent's AMD when controlling for interventions, we estimated three regression models where, the results are shown in the table 40. In the first model, the parents' sample considered for the analyses was the one of both countries together where, AMD at baseline has a minor connection with the outcome variable which is the AMD after the interventions, as evidenced by its substantial positive influence (β=0.168, p<0.10). none of the rest of the variables is showing a statistical significance knowing that that the three intervention effects had a negative relationship with the parents' AMD variable however, they did not reach a statistical significance.
Regarding the Spanish sample, the baseline scores of the AMD is still showing a positive and high significant effect β=0.336, p<0.01) but stronger than the one of the pooled model. The educational activities together with the empowerment activities, had a significant negative effect on parents' AMD after receiving the interventions (β=-1.232, p<0.05), while the first intervention being the application (β=-0.654, p>0.10) and the third one being the snack (β=-0.422, p>0.10) show negative but non-significant effects.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Table.40 Factors Affecting Parent's AMD score Following Interventions when considering the interventions' effect

VARIABLES	(1) Pool OLS	(2) Spain OLS	(3) Turkey OLS
AMD1	0.168*	0.336***	-0.00884
	(0.101)	(0.111)	(0.170)
Gender1	-0.116	0.101	-0.380
	(0.260)	(0.333)	(0.427)
Edaddelvoluntarioa1	-0.00120	0.0163	-0.00786
	(0.0314)	(0.0494)	(0.0541)
BMIdiff	-0.0652	-0.0204	0.0425
	(0.0964)	(0.105)	(0.302)
PAdiff	-1.47e-05	-3.11e-05	0.000262
	(5.47e-05)	(5.42e-05)	(0.000288)
kndiff	-0.00217	0.00679	-0.0612
	(0.0190)	(0.0203)	(0.0579)
1.INT1	-0.406	-0.654	0.407
	(0.473)	(0.592)	(0.668)
2.INT1	-0.580	-1.232**	0.300
	(0.421)	(0.518)	(0.603)
3.INT1	-0.318	-0.422	0.417
	(0.391)	(0.485)	(0.569)
Constant	7.167***	5.015**	8.281**
	(1.761)	(2.382)	(3.248)
Observations	180	101	79
R-squared	0.051	0.170	0.057

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

This suggest that the educational material as intervention had not an impact on improving parents' AMD.

In the last column, after that Turkish parents' received the intervention, we found that their AMD is not explained by the one they had at baseline which is not the case for the two previous models (1 and 2). Furthermore, none of the other variables is reaching a statistical significance allowing for making some conclusions.

Estimation of the same models had been done using the MEDLIFE variable after receiving the intervention as the dependent variable and the same variable at baseline is included in the model as a covariate. Results of table 41, specifically of the pooled model, indicate that very significant positive influence is seen by Medlife_score1 (baseline) (β=0.393, p<0.01), suggesting that baseline MEDLIFE scores are predictive of post-intervention ratings. Moreover, the difference in BMI variable shows a significant negative effect (β=-0.306, p<0.05), indicating that lower MEDLIFE scores are linked to higher BMIs. The third intervention being the one of healthy snack exhibits the highest favorable effect for interventions (β=0.798, p>0.10), however it is not statistically significant. Regarding the subsample of Spanish parents (model 2) indicate that, the baseline score of MEDLIFE remains positive but not significant (β=0.188, p>0.10). Furthermore, none of the other variable is exhibiting a statistical significance except the intervention of receiving the healthy snack (β=1.170, p<0.10), suggesting that this intervention was particularly effective for Turkish parents.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Table. 41 Factors Affecting Parent's MEDLIFE score Following Interventions when considering the interventions' effect

	(1)	(2)	(3)
VARIABLES	Pool OLS	Spain OLS	Turkey OLS
Medlife_score1	0.393***	0.188	0.480***
	(0.107)	(0.200)	(0.131)
Gender1	-0.430	-1.212	0.295
	(0.493)	(0.979)	(0.641)
Edaddelvoluntarioa1	0.0116	-0.0600	0.0173
	(0.0474)	(0.113)	(0.0658)
BMIdiff	-0.306**	-0.533**	0.0288
	(0.149)	(0.235)	(0.364)
kndiff	0.0173	0.0844	-0.0338
	(0.0794)	(0.205)	(0.0979)
1.INT1	0.0350	-0.0348	0.366
	(0.820)	(1.379)	(0.838)
2.INT1	-0.0942	1.601	-0.116
	(0.746)	(1.345)	(0.800)
3.INT1	0.798	1.249	1.170*
	(0.655)	(1.124)	(0.700)
Constant	8.425***	14.84***	6.585
	(2.554)	(5.362)	(3.992)
Observations	129	51	78
R-squared	0.246	0.233	0.305

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Looking at adolescent's sample, and similar to previous findings, the model 1 considering the whole sample of adolescents show that the AMD at baseline shows a strong significant positive effect (β=0.347, p<0.01), implying that baseline AMD scores are predictive of post-intervention scores. A slight positive effect (β=0.408, p>0.10) which is not significant statistically is shown by the difference in the PA variable. None of the other variables is showing a statistical significance except the intervention 2 being the educational activities having a negative.

significant effect (β=-1.490, p<0.05), meaning that this intervention was not benefic to improve adolescent' AMD and instead it decreases it (Table 42). For the Spanish sample it was an overestimated model showing any significant effect. In contrast, the subsample of Turkish adolescents' AMD is mainly explained by their initial adherence (β=0.561, p<0.01), the difference in PA shows a positive effect (β=0.611, p>0.10) similar to the Spanish model without reaching the statistical significance. Furthermore, the educational activities intervention had a significant negative effect (β=-1.743, p<0.05), stronger than in the pooled model, suggesting the negative impact that had this intervention on the AMD of Turkish adolescents. The snack intervention also shows a negative effect (β=-1.255, p>0.10) though not statistically significant (Table 42).

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Table.42 Factors Affecting adolescents' AMD score Following Interventions when considering the interventions' effect

VARIABLES	(1) Pool OLS	(2) Spain OLS	(3) Turkey OLS
AMD1	0.347***	0.102	0.561***
	(0.0802)	(0.123)	(0.102)
Gender1	-0.0958	-0.0743	0.345
	(0.405)	(0.715)	(0.531)
Edad1	0.0923	-0.125	0.168
	(0.126)	(0.282)	(0.157)
PA_diff	0.408	0.608	0.611
	(0.400)	(0.691)	(0.515)
NK_diff	0.00456	0.0352	-0.0134
	(0.0278)	(0.0446)	(0.0329)
BMI_diff	0.0282	-0.234	0.149
	(0.141)	(0.362)	(0.206)
1.INT1	-0.286	-0.356	-0.701
	(0.789)	(1.257)	(0.875)
2.INT1	-1.490**	-0.897	-1.747**
	(0.742)	(1.425)	(0.774)
3.INT1	-0.191	1.186	-1.255
	(0.664)	(1.065)	(0.758)
Constant	3.859*	7.894*	1.977
	(2.201)	(4.181)	(2.655)
Observations	134	59	75
R-squared	0.180	0.148	0.347

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Similarly, but using the KIDSCREEN variable after the interventions as dependent variable which is the equivalent of the MEDIFE for parents give the following results presented in the table 43. Findings related to the pooled model when considering all the adolescents of both countries that we have within the study, suggest more or less some similarities. Baseline KIDSCREEN scores are robust predictor of post-intervention outcome (β=0.663, p<0.01). This indicate a considerable stability in KIDSCREEN metrics over time, regardless of interventions.

Table.43 Factors Affecting adolescents' KIDSCREEN score Following Interventions when considering the interventions' effect

VARIABLES	(1) Pool OLS	(2) Spain OLS	(3) Turkey OLS
KIDSCREEN_score1	0.663***	0.712***	0.665***
	(0.0700)	(0.218)	(0.0752)
Gender1	1.199	-1.267	2.605
	(1.551)	(2.712)	(1.898)
Edad1	-0.0118	-0.710	0.183
	(0.535)	(1.399)	(0.568)
NK_diff	0.155	-0.127	0.293**
	(0.102)	(0.166)	(0.134)
BMI_diff	-0.0161	0.345	0.0546
	(0.428)	(1.174)	(0.404)
1.INT1	1.805	1.469	1.745
	(2.603)	(3.864)	(3.773)
2.INT1	1.592	0.553	1.701
	(2.081)	(3.603)	(2.827)
3.INT1	1.194	-0.769	2.592
	(1.922)	(3.475)	(2.559)
Constant	33.04**	39.74	28.62**
	(13.31)	(40.32)	(12.93)
Observations	135	59	76
R-squared	0.467	0.420	0.512

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Within Spanish adolescent sample, baseline KIDSCREEN still being the unique predictor (β=0.712, p<0.01) of the adolescents AMD and lifestyle and wellbeing, with an even more pronounced effect than in the pooled model. The Gender variable demonstrates a negative relationship (β=-1.267, p>0.10), indicating a potential trend toward lower scores for girls, however, it does not reach the statistically significant.

In contrast to previous models, apart from the baseline score of KIDCREEN (β=0.665, p<0.01), Turkish adolescents' Mediterranean lifestyle is positively and high significantly affected by the difference in their NK from baseline to the post assessment (β=0.293, p<0.05). The significant relationship between NK improvements and outcomes in Turkey suggests potentially different pathways to wellbeing across cultural contexts (Table 43).

When it comes to children subsample, and controlling for the intervention effects, results of the regression model estimations are shown in the table below.

When taking into consideration the total sample of the children of both countries (pooled OLS), results indicate that baseline AMD1 is a strong predictor of post-intervention AMD scores (β=0.377, p<0.01).

Table.44 Factors Affecting children' AMD score Following Interventions when considering the interventions' effect

	(1)	(2)	(3)
VARIABLES	**Pool OLS**	**Spain OLS**	**Turkey OLS**
AMD1	0.377***	0.167	0.557***
	(0.120)	(0.202)	(0.139)
Gender	-1.039**	-1.464*	-0.820
	(0.421)	(0.859)	(0.620)
Edad1	0.338	0.00197	0.394
	(0.206)	(0.498)	(0.268)
BMI_diff	0.213	-0.115	0.362
	(0.177)	(0.790)	(0.239)
PA_diff	-0.0744	0.0555	0.0501
	(0.304)	(0.446)	(0.583)
1.INT1	0.0550	1.432	-2.153
	(1.125)	(1.450)	(2.195)
2.INT1	-1.183	-0.552	-3.018
	(1.173)	(1.707)	(2.284)
3.INT1	0.172	1.680	-1.914
	(1.066)	(1.409)	(2.133)
Constant	1.834	5.464	2.287
	(2.259)	(4.315)	(3.510)
Observations	99	40	59
R-squared	0.267	0.246	0.345

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

This suggests that measures of AMD were significantly consistent throughout the study period. After adjusting for other variables, we noticed that Gender shows a significant negative association (β=-1.035, p<0.05), showing that girls in this kid population have lower AMD scores than boys. Difference in the BMI does not approach statistical significance, although it does reveal a slight positive correlation (β=0.213, p>0.10).

Within Spanish children, baseline initial AMD show a weaker relationship (β=0.167, p>0.10) than the one observed in the 1st model. Gender exhibit a negative association (β=-1.464, p<0.10), suggesting Spanish girls may experience notably lower AMD scores than boys. Spanish children show unique and nonintervention responses, since none of the three intervention reaches the statistically significance.

Regarding Turkish children, and apart from the baseline of AMD, none of the rest of variables is reaching a statistically significant effect. Turkish children exhibit the strongest baseline AMD relationship (β=0.557, p<0.01), indicating high stability in their AMD measurements.

Estimating the same models but now considering the KIDSCREEN variable at post assessment as a dependent variable and the same at baseline as a covariate, findings are presented in the table 45.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

According to the children's pooled model, baseline score of KIDSCREEN variable is a very good predictor of post-intervention KIDSCREEN measurements (β=0.769, p<0.01). This strong relationship imply that children's quality of life indicators remained relatively stable during the development of the study. Additionally, after controlling for other variables, the Gender variable for example is showing a strong positive correlation (β=3.266, p<0.05), suggesting that girls in this kid population had much higher KIDSCREEN scores than boys. Both intervention 2 and 3 being the educational material and the healthy snack respectively are very noteworthy, exhibiting a significant positive association. Educational activities intervention has a sizable positive impact (β=5.227, p>0.10), while INT3 (β=5.057, p<0.10) achieve statistical significance.

The second column of the table represent the results of the same model, considering only for the Spanish children. Findings confirms the findings on the baseline score of the KIDSCREEN in explaining the outcome of KIDSCREEN after receiving the interventions. Furthermore, Gender exhibit a strong negative association (β=-4.532, p<0.10), suggesting that Spanish girls may experience significantly lower KIDSCREEN scores than boys. The rest of variable are not showing any statistical significance.

Table.45 Factors Affecting children' KIDSCREEN score Following Interventions when considering the interventions' effect

VARIABLES	(1) Pool OLS	(2) Spain OLS	(3) Turkey OLS
KIDSCREEN_score1	0.769***	0.606***	0.764***
	(0.0637)	(0.129)	(0.0860)
Gender1	-3.266**	-4.532*	-3.447
	(1.482)	(2.545)	(2.061)
Edad1	-0.363	-0.879	-0.283
	(0.633)	(1.202)	(0.854)
BMI_diff	-0.881	-0.856	-1.253*
	(0.619)	(1.692)	(0.710)
1.INT1	4.401	1.359	9.552**
	(2.670)	(3.465)	(4.559)
2.INT1	5.227*	-2.707	11.49**
	(2.787)	(3.642)	(4.395)
3.INT1	5.057*	2.916	9.562**
	(2.650)	(3.041)	(4.581)
Constant	27.38***	55.11***	21.80*
	(9.780)	(16.63)	(11.74)
Observations	94	38	56
R-squared	0.669	0.495	0.647

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Turkish children show a strong baseline KIDSCREEN relationship (β=0.764, p<0.01), which is similar to the pooled model. On the other hand, the Gender variable shows a negative but non-significant effect (β=-3.447, p>0.10).

while, the difference in BMI demonstrates a significant negative association (β=-1.253, p<0.10), suggesting weight increases may adversely affect KIDSCREEN scores in Turkish children.

Comparing the two previous models, Turkish children demonstrates an extraordinarily large positive intervention effects across all intervention types. The educational material (β=11.49, p<0.05), the healthy snack (β=9.562, p<0.05), and INT1 (β=9.552, p<0.05), all reaching statistical significance with substantial magnitudes. This model explains 64.7% of outcome variation (R-squared=0.647).

8. Family Focus Groups on Sustainable Consumption and Behavioral Change

The agri-food system is the first GHG emitting sector of the global economy. Concern for health is increasing, but the concept of sustainability is ambiguous in the minds of consumers, considering dimensions related to health, environmental sustainability and social norms.

The concept of sustainable diet identifies a dietary pattern that is linked to consumers Health and planet Health.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

During the interventions and after analyzing first results of MEDAS/KIDMED SCORES, a limitation on the preference for eating pureed snacks was detected, and therefore the final FGs focused on the preferences of adolescents for snacks and the influence that sustainability syllabus may have on their decisions. Although during the intervention it was the group of children the one that had the implementation of the snacks, adolescents are a very important group because they have power of decision.

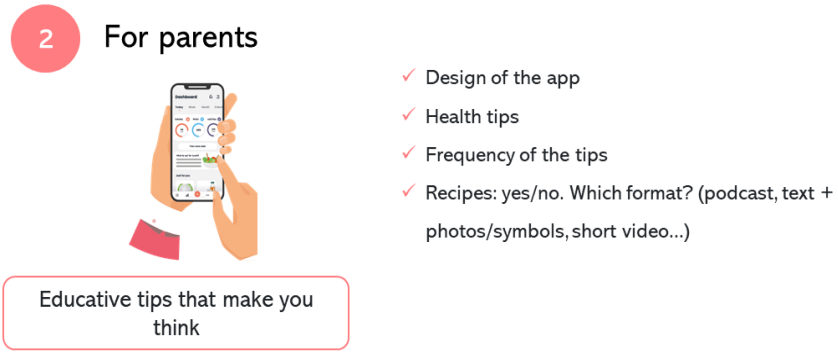
Changing consumption patterns is essential to ensure the sustainability of the food sector. Adolescence is a critical period for the foundation of sustainable and healthy habits, and the exchange between parents and adolescents can have a great influence on food purchases in households. With the aim of empowering adolescents in this stage of cognitive and emotional maturity, increasing their impact on healthy habits of the entire family unit, and ensuring more sustainable consumption of future generations, a qualitative exploratory study was developed in Spain, based on a participatory workshop in an institute.

The session was organized in 2 parallel outcomes, each one directed by one researcher from CREDA.

1) Barriers of the App for a better adherence to MD, focused to parents.
2) Barriers and facilitators for a better choice of snacks in adolescents.

For the first outcomes, 9 images for advertising in the App were shown to parents and they were asked to prioritise results (see annex 1).

The objective of the session was to analyse the impact of providing information on sustainability and health on the adoption of sustainable consumption, and overcoming barriers to behavioural changes. This results serve as data for future food policies that influence lifestyle patterns that combat the global climate and food security crisis. Introducing sustainability sessions along the syllabus for children and adolescents, may be a good tool to prevent Health problems and the actual impact of agri-food Systems.



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

Barriers and facilitators of the App for a better AMD

To evaluate barriers of the App, the use of semi-structured questions was carried out in the participatory events with parents (n=9). Images of 8 different tips (total 9 images) where shared to parents and were asked to prioritise the content. Thus, 9 adults were involved in the session.

The prioritisation results: in order from more liked and less liked 1,3 and 4,2 and 5, 8, 7, 6, with differences on just 1,4 point in average punctuation between the less voted and the most voted (see Annex 1). Issues exposed and collected as interesting as App content short information with a link to a more extended information were: portion of food groups in meals and examples, emotional facts from the educational material collected in D3.4, health recommendations related to prevention of CVD and other food related non-communicable diseases (for example information on healthy and easy snacks and nutritional and environmental impact from UPF), more information on portions and combinations to substitute meat products.

During the discussion, the following barriers were collected as more recurrent and important:

1. Uncertainty about the achievable results of the implementation. The inconsistency of some of the recipes and ingredients suggested by the App were the main reason for this barrier.
2. Perception of the new "healthy eating" resource as kitchen-focused. More resources on batch cooking or easy to prepare foods that require short time.
3. Hectic daily life serving as a barrier to long-term use of a digital resource.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

As a solution and facilitators for the App succession were:

1. Easy to navigate format and tools including easy to prepare recipes with just a few ingredients, related to the nutritional, sustainable and healthy tips where one of the main tools to overcome these barriers.
2. Seasonal tips as an inspiration and effective reminder
3. Research and food security legislation related tips, as an interesting resource for better food habits and specially linked to food waste prevention.
4. Flexibility of the recipes with possible substitutions with what is in the fresh and staple storage at households.

This brings opportunities for data base of recipes linked to the facts exposed previously and evaluated and discussed by participants. Physical activity, healthy snacking and water reminders (with pop-ups). The frequency better liked by participants of the tips and pop-ups, where 1 every 3 days.

Barriers and facilitators for adapting healthy snacks

After visit 2, many of the families exposed the limitation of the poached format for snacks in Spain. Most of the children have healthy habits in breakfast at school, since many public education schools in Barcelona Metropolitan an Area forbid unhealthy snacks at school, and there is a wide implementation in the public services on healthy eating behaviours. Suggestions at school are pieces of fruits and sandwiches. The poached format was not the best solution for a healthy snack in the afternoon, because children and adolescents are used to eat solid snacks.

But there is a great limitation on healthy snacks when adolescents have the opportunity to choose and buy their afternoon snack. Therefore, CREDA implemented a dynamic where adolescents evaluated 10 different snacks on 4 different dimensions: social norm, taste, healthiness, environmental sustainability. In order to understand what

social norm means, there was a previous briefing with participants on the meaning of that aspect.

Participants were 8 adolescents that had not participated in the trial. An informed consent form was provided and signed for the adolescents and their parents. Gender equity was representative with 4 girls and 4 boys.

The snacks presented where: potato chips, corn chips with chia and seeds, apple + nuts, cereal bar low in sugars, chocolate croissant, sandwich with sundried tomato paste, bread with chocolate and hazelnut cream low in sugars, hummus with bread sticks, chocolate mini doughnuts (industrial), cheese sandwich with tomato and olive oil. The adolescents evaluated first all the snacks options, regarding only pictures of the snacks (Figure 31). Each dimension had a score from +5, to -5, regarding the positive or negative perception. All adolescents voted individually.



Figure. 31 Snacks evaluated during FGs with adolescents in Spain

After the first scoring, adolescents where given a short 20 minutes' presentation on environmental impact of foods. Regarding the FSC, seasonality, packaging... There was a short discussion of 15 minutes and many concerns on healthiness were also detected and responded by the main researcher. A small sandwich with sundried tomato spread and healthy chocolate spread were shared with the participants (parents and children). After this instruction and tasting, adolescents voted again the pictures.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

This time they could check the nutritional content of each Snack (regarding proteins, sugar content, saturated fats, and fibre) and Climate Change impact (kg CO2e). They were asked to vote again and results were as **Error! Reference source not found.**46 shows.

Table 46. Total Scores of the 4 dimensions' summary per snack

	Potato chips	Chia and seeds chips	Apple and nuts	Cereal bar low in sugar	Chocolate croissant	Sandwich sundried tomato	Bread + chocolate nut spread low sugars	Hummus +bread sticks	Mini chocolate doughnuts	Cheese sandwich
TOTAL p1	23	14	94	45	34	30	59	46	14	91
TOTAL p2	-5	-3	97	50	6	58	77	41	-10	85
diff p2-p1	-28	-17	3	5	-28	28	18	-5	-24	-6
diff p2-p1(average)	**-3.5**	**-2.125**	**0.375**	**0.625**	**-3.5**	**3.5**	**2.25**	**-0.625**	**-3**	**-0.75**

Results are very good. All the unhealthy snacks that have a great environmental impact and healthy impact and are not related to MD, got a very lower score difference between p2 and p1. All industrial products (potato chips, chia chips, mini doughnuts). Hummus with bread sticks got a lower punctuation regarding sustainability, this was argued because of the impact of the packaging. Cheese sandwich also got a lower score, regarding the environmental impact of cured cheese. Chocolate croissant got a lower score specially regarding healthiness. Finally, all the healthy snacks got a low better punctuation, with the best result for the sundried tomato Sandwich, which after the presentation was positively considered regarding taste and social norm. This results are very positive regarding the educational material created during the study with the objective to be Shared with schools and be implemented in the syllabus.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Conclusions

This study, part of the *Switching Mediterranean Consumers to Mediterranean Sustainable Healthy Dietary Patterns* project, offers key insights into the effectiveness of targeted interventions in promoting adherence to the MD among families in Spain and Turkey. By assessing behavioral changes and identifying drivers of sustainable eating habits, it aims to develop adaptable intervention models for broader implementation. It also compared MD interventions between Spanish and Turkish families, revealing fascinating cultural differences in outcomes.

Dietary Adherence and Intervention Impact

Baseline assessments showed that Spanish participants, particularly parents, had higher initial AMD levels than their Turkish counterparts, though moderate adherence was common in both countries. Post-intervention, improvements were observed across all groups, with Spanish adolescents showing the most pronounced positive changes, while Turkish participants demonstrated more consistent gains. Statistical analyses confirmed significant AMD improvements among all Turkish demographic groups and Spanish adolescents, whereas Spanish parents and children exhibited modest, non-significant changes, likely due to their higher starting adherence, leaving less room for improvement. Notably, individuals with lower initial AMD scores showed the greatest progress, reinforcing the importance of considering baseline dietary patterns when designing interventions.

Behavioral Changes and Cross-Cultural Patterns

Beyond dietary adherence, distinct behavioral response patterns emerged between countries. Turkish participants experienced greater overall improvements, particularly in MEDLIFE scores and nutrition knowledge, despite starting with lower baseline values. Spanish parents maintained higher absolute scores but exhibited minimal changes. Adolescents and children in Turkey significantly improved their nutrition knowledge and MD intention, narrowing pre-existing gaps with Spanish participants. These findings suggest that intervention effectiveness is often inversely related to baseline proficiency, those with more room for growth benefit the most.

Intervention-Specific Effects

Intervention outcomes varied across demographic groups and cultural contexts. Turkish parents showed stronger improvements, particularly in groups G1 and G3, effectively reversing Spain's initial advantage. Among adolescents, Spanish youth responded best to G7, while Turkish adolescents showed the greatest gains in G1 and G4. Similarly, Turkish children outperformed their Spanish counterparts in intervention response. These trends highlight the need for culturally tailored interventions, as populations with lower initial adherence tend to experience greater benefits.

Behavioral Response to Intervention Types

Turkish participants consistently demonstrated substantial improvements across multiple behavioral factors, particularly in nutrition knowledge and lifestyle adherence, with G3 and G8 being especially effective. Spanish participants, despite higher baseline scores, showed more modest changes, with some adolescent groups experiencing declines in nutritional knowledge. Physical activity levels remained higher among Spanish participants, though the gap narrowed post-intervention, particularly among younger participants.

Pre- and Post-Intervention Effects Across Groups

Pre-intervention assessments highlighted significant cross-country differences in AMD adherence, with Spanish adolescents and children exhibiting higher baseline scores. Spanish participants also demonstrated stronger initial commitment to MD principles, particularly in educational and snack-based interventions. Post-intervention, Turkish parents showed significant gains, especially in EDU and SNACK interventions, while Spanish parents displayed mixed responses, with some AMD declines. Adolescents responded differently based on intervention type—Spanish youth improved more with APP and SNACK interventions, whereas Turkish adolescents benefited across all intervention types.

This comprehensive analysis of intervention effects across different age groups and geographical contexts reveals several important patterns.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Our findings demonstrate that while baseline measurements consistently predict post-intervention outcomes across all models, the effectiveness of specific interventions varies substantially between Spanish and Turkish populations. These cross-cultural differences in intervention response highlight the importance of considering contextual factors when designing and implementing health promotion programs for diverse populations

Key Insights for Future Interventions

Findings emphasize the inverse relationship between baseline adherence and intervention effectiveness, reinforcing that populations with lower initial AMD may gain the most from structured interventions. Educational and snack-based strategies were particularly effective in improving knowledge and intentions, especially among Turkish participants. Meanwhile, app-based interventions showed variable success, working best among younger participants.

Finally, these findings highlight the importance of culturally sensitive intervention designs that account for baseline dietary habits and behavioral factors to maximize impact. While the study partially confirms the 1st hypothesis, with AMD improving in most cases, this was not consistent across all groups. The 2nd hypothesis is also partially supported, as positive changes in dietary behaviors and attitudes were observed, albeit with some variability. The 3rdhypothesis, however, is not confirmed, as the control group in Turkey exhibited high AMD scores, and intervention effects within the Spanish sample were not consistently superior. The 4th hypothesis is validated, as differences in AMD and dietary behaviors between Spain and Turkey were evident in both pre- and post-assessments. However, the estimated regression models did not yield strong statistical significances in most cases due to the limited number of observations at each time point, a consequence of the high dropout rate throughout the study. This limitation restricts the generalizability of the findings on a larger scale. Moving forward, MD promotion programs should strategically allocate resources to populations with the greatest need, ensuring interventions are tailored to demographic and cultural contexts for maximum effectiveness.

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

References

1. Mouratidou, N,, Vasilopoulou, A,, & Dimitriou, K, (2022), Mediterranean diet as a sustainable eating model: Environmental, cultural, and nutritional perspectives, *Journal of Sustainable Nutrition, 14*(2), 105–120, https://doi,org/10,1234/jsn,2022,105120

2. McEvoy, C, T,, Moore, S,, Erwin, C,, Kontogianni, M,, Wallace, S, M,, Appleton, K, M,, ,,, & Woodside, J, V, (2022), Trial to Encourage Adoption and Maintenance of a MEditerranean Diet (TEAM-MED): a randomised pilot trial of a peer support intervention for dietary behaviour change in adults from a Northern European population at high CVD risk, *British Journal of Nutrition*, *128*(7), 1322-1334 https://doi.org/10.1017/S0007114521003986

3. Grosso G,, Galvano F, Mediterranean diet adherence in children and adolescents in southern Europe, NFS Journal 2016, Elsevier https://doi.org/10.1016/j.nfs.2016.02.004

4. Baladia, E, e, (2022), Adherencia a un patrón de Dieta Mediterránea, hábitos de consumo y práctica de actividad física recreativa en población española: Estudio transversal RECREA-DIET, , Revista Española de Nutrición Humana y Dietética, 26(1), 30-40. https://dx.doi.org/10.14306/renhyd.26.1.1416

5. García-Hermoso, A, e, (2020), Is adherence to the Mediterranean diet associated with healthy habits and physical fitness? A systematic review and meta-analysis including 565 421 youths, British Journal Of Nutrition, 128(7), 1433-1444. https://doi.org/10.1017/S0007114520004894

6. Recio-Rodriguez, J. I., Garcia-Ortiz, L., Garcia-Yu, I. A., Lugones-Sanchez, C., Olmo, E. Z. D., Bolibar, B., ... & Maderuelo-Fernandez, J. A. (2022). Effectiveness of a multiple health-behaviour-change intervention in increasing adherence to the Mediterranean diet in adults (EIRA study): a randomized controlled hybrid trial. *BMC public health*, *22*(1), 2127. https://doi.org/10.1186/s12889-022-14590-y

7. Ramírez Gallegos, I., Marina Arroyo, M., López-González, Á. A., Vicente-Herrero, M. T., Vallejos, D., Sastre-Alzamora, T., & Ramírez-Manent, J. I. (2024). The Effect of a Program to Improve Adherence to the Mediterranean Diet on Cardiometabolic Parameters in 7034 Spanish Workers. *Nutrients*, *16*(7), 1082. https://doi.org/10.3390/nu16071082

8. Bawaked, R. A., Gómez, S. F., Homs, C., Casas, R., Cárdenas, G., Fitó, M., & Schröder, H. (2018). Association of eating behaviors, lifestyle, and maternal education with adherence to the Mediterranean diet in Spanish children. *Appetite, 130*, 279–285. https://doi.org/10.1016/j.appet.2018.08.024

9. Aureli, V,, & Rossi, L, (2022), Nutrition knowledge as a driver of adherence to the Mediterranean diet in Italy, Frontiers in nutrition, 9, 804865. https://doi.org/10.3389/fnut.2022.804865

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

Annexes

Annex I

1



2



3



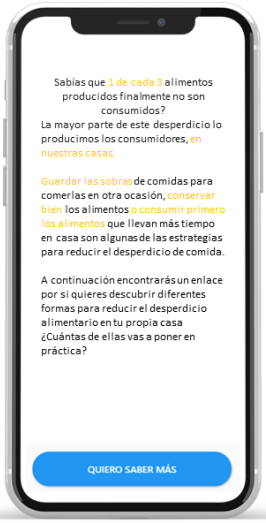
4



5



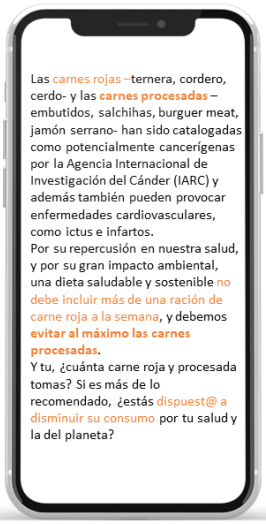
6



7



8



© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions

© 2023, SWITCHtoHEALTHY. All rights reserved. Licensed to the PRIMA Foundation and the EU under conditions