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Cooking Skills and Mediterranean Diet Adherence: Societal Insights from the iMC SALT Trial

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Abstract: Background: Cooking skills represent an important yet often overlooked form of social and cultural capital, influencing dietary quality and health outcomes. As modern societies face growing challenges related to unhealthy eating patterns and a loss of traditional food practices, understanding the societal role of culinary competence becomes critical. This study explored the association between culinary skills, adherence to the Mediterranean diet, and nutritional intake. Methods: Baseline data from 111 adults (60 women; mean age 47.6 ± 10.5 years) participating in the iMC SALT randomized controlled trial (Portugal) were analyzed. Culinary skills were assessed using the Cooking Skills Score, while the dietary intake was evaluated with a Food Frequency Questionnaire and adherence to the Mediterranean diet through the alternative Mediterranean Diet (aMED) Score. Food and beverage processing levels were categorized using the NOVA classification, and the sodium/potassium intake was measured via 24 h urinary excretion. Results: Women demonstrated better culinary skills (5.1 ± 0.9 vs. 4.0 ± 1.1, $p < 0.001$) and greater adherence to the Mediterranean diet (5.1 ± 1.9 vs. 3.8 ± 1.8, $p = 0.001$) than men. Better culinary skills were associated with younger age, larger households, and increased adherence to the Mediterranean diet. Culinary skills significantly explained 27.2% of the variance in the Mediterranean diet adherence. Better culinary skills were linked to a greater energy and protein intake; but a lower sodium and potassium intake. Conclusion: These findings highlight culinary skills as a key societal factor shaping dietary behavior and nutritional intake. Promoting culinary education may offer a powerful strategy to address dietary inequalities, support cultural food heritage, and foster healthier, more resilient societies.

Keywords: cooking skills; food literacy; Mediterranean diet; dietary behaviors; cultural heritage; ultra-processed foods; public health; social determinants of health; nutrition education

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1. Introduction

Lifestyle choices in the 21st century have transformed significantly due to technological advancements, urbanization, and societal changes. While these shifts create new opportunities for global connectivity, they also present global nutrition challenges affecting public health, such as inadequate dietary diversity and the rising prevalence of diet-related non-communicable diseases (NCD) [1]. The NCDs, including cardiovascular diseases, diabetes, cancer, and respiratory diseases, are recognized as a public health concern with economic implications and are intricately linked to lifestyle factors, urbanization, and demographic transitions [2]. In 2015, the 2030 Agenda for Sustainable Development adopted by the United Nations recognized NCDs as a major public health challenge; specifically the Sustainable Development Goal (SDG) 3 includes target 3.4 to reduce premature NCD mortality by one-third by 2030 and an important part of the strategies is to reduce the associated behavioral risk factors like unhealthy diets [3].

Unhealthy diets are a significant public health issue in Portugal, with low consumption levels of fruits, vegetables, and whole grains, along with an excessive intake of salt and sugar, the main dietary factors contributing to the burden of NCD and poor health outcomes [4]. Culinary skills and cooking confidence, or cooking self-efficacy, could significantly influence dietary behaviors and eating at home more frequently. According to the last National Food, Nutrition and Physical Activity Survey (IAN-AF 2015/2016), meals consumed at restaurants—compared to those eaten at home—were associated with poorer dietary quality among children, adolescents, and adults, reflected in higher intakes of energy, fat, trans-fatty acids and saturated fatty acids, and sodium [5].

There is no consensus about the definition of "culinary skills", but it can be defined "as a set of attributes related to the selection and combination of foods and the use of culinary procedures and utensils involved in the planning, organization, and preparation of 'from scratch' meals based on fresh, minimally processed foods, and culinary ingredients" [6], and could be related to other concepts such as the quality of diet and food literacy determinants for NCDs.

Culinary skills are fundamental to the development of healthy eating habits, as they enhance individuals' abilities to navigate and resist unhealthy food environments [7], contribute to improved diets, and are associated with stronger intentions to engage in weight-loss behaviors [8]. A longitudinal study in the USA found that young adults that reported very adequate cooking skills at the age of 18–23 years predicted better nutrition-related outcomes 10 years later, such as more frequent preparation of meals including vegetables and less frequent fast food consumption [9].

The Mediterranean diet, characterized by a high consumption of fruits, vegetables, whole grains, legumes, and the inclusion of healthy fats, particularly olive oil, is associated with numerous health benefits, including a reduced risk of NCDs [10,11]. Beyond its nutritional profile, the Mediterranean diet emphasizes cultural practices such as communal cooking and shared meals [12], highlighting the societal and cultural significance of culinary skills in fostering sustainable, health-promoting eating behaviors.

Despite these insights, there remains limited empirical evidence on the influence of culinary skills on diet quality, particularly regarding adherence to the Mediterranean diet and nutritional intake patterns. In this context, we hypothesized that individuals with better culinary skills would have better diet quality, as measured by adherence to the Mediterranean diet, and improved nutritional intake. This cross-sectional study examined the associations between culinary skills and diet, nutrition and processed foods consumption, providing insights into the potential of culinary education initiatives to address diet-related health inequalities and promote societal well-being.

2. Materials and Methods

2.1. Sample and Study Design

The subjects of this study are the participants involved in the iMC SALT randomized controlled trial conducted in Porto (Portugal) from June 2019 to January 2021 [13], designed to increase salt intake adequacy (trial registration: NCT03974477). Participants were recruited among the staff of the university through the annual mandatory occupational health appointments. The exclusion criteria were pregnancy, hypotensive disorder, renal infection, kidney disease, urinary incontinence, acute coronary syndrome, severe liver disease or heart failure, being a member of the faculty that promotes the study (Faculty of Nutrition and Food Sciences), and not using salt for cooking. A final sample of 114 participants was included on the trial [14]. However, because some questionnaires were incomplete, only 111 participants were considered for this present study. In this cross-sectional analysis, the data collected at the baseline will be considered.

2.2. Culinary Skills

Cooking skills were assessed using the Cooking Skills Scale (CSS) [15], validated for the Portuguese population [16] The respondents were asked to evaluate their own cooking skills on a six-point scale [from strongly disagree (1 point) to strongly agree (6 points)] for these questions: 1. I consider my cooking skills as sufficient; 2. I am able to prepare a hot meal without a recipe; 3. I am able to prepare gratin; 4. I am able to prepare soup; 5. I am able to prepare sauce; 6. I am able to bake cake; 7. I am able to bake bread. Based on these seven items, the mean values were calculated for each person to reflect their cooking skills (Culinary Skills Score, ranging from 1 to 6, meaning the highest values reported better cooking skills). Moreover, confidence, enjoyment, and motivation to start learning to cook were also assessed on a five-point scale.

2.3. Dietary Intake and Mediterranean Diet Score

The dietary intake was assessed by a semiquantitative Food Frequency Questionnaire (FFQ), validated among Portuguese adults and adapted to include various typical Portuguese food items [17,18]. The FFQ administered covers the previous 12 months before inclusion in the study. It includes 82 food items or beverage categories and nine possible options for the frequency of food consumption ranging from never/less than once a month to six or more times per day (never or less than 1 time per month; 1 to 3 times a month; once a week; 2–4 times a week; 5–6 times a week; once a day; 2–3 times per day; 4–5 times per day; and 6 or more times per day). To convert the food intakes into grams, we used the software Food Processor Plus ((Version 27) ESHA Research, Inc., Salem, OR, USA) adapted to the Portuguese population by using the values from the Portuguese Tables of Food Composition for typical Portuguese foods [19]. The nutritional content of local food was taken from standard nutrient tables, whereas the content of commercial food (e.g., pizza and ready-to-eat-food) was derived from labeled ingredients and nutrients. For soup, 26% of this food has been considered for the calculation of the vegetable score considering that the recipe for 350 g of "Juliana soup" requires 90 g of vegetables (excluding potatoes).

The degree of adherence to the traditional Mediterranean diet was assessed through the alternative Mediterranean Diet (aMED) Score [20], a score developed based on the Mediterranean-Diet Scale by Trichopoulou [21]. The aMED score was calculated for each participant based on the estimation of the food consumption measured with FFQ. The items included in this score were nine: vegetables, fruits, legumes, nuts, whole grains, fish, red meat and processed meat, ethanol, and the ratio of monounsaturated fatty acids to saturated fatty acids (MUFA/SFA). Vegetables, legumes, fruits, nuts, whole grains, and fish, considered as beneficial components, were assigned a value of 1 when the consumption of the subjects was above the sex-specific median, while when the consumption was below the median, they were assigned a value of 0. Red meat and processed meats, considered detrimental components, were assigned a value of 1 when the consumption of the subjects was below the sex-specific median or assigned a value of 0 when they were above the median. Alcohol was the only component in which the score was assigned according to the cut off; a value of 1 was assigned to men whose consumption was 5–25 g/day and women who consumed 5–15 g/day. Finally, the MUFA/SFA was used to assess the quality of the fat intake, giving a value of 0 to the participants whose MUFA:SFA ratio was below the sex-specific median and a value of 1 to participants whose ratio was at or above the median. So, the total score of a participant ranged from 0 (a minimal adherence to the traditional Mediterranean diet) to 9 (a maximum adherence). A low adherence to the Mediterranean diet has been considered when the score was between 0–3; a moderate adherence 4–5, or a high adherence 6–9.

2.4. Dietary Intake Classified by Food Process Level

Dietary intakes were characterized using one 24 h dietary recall administrated by trained researchers using a photographic book and household measures to quantify the portion sizes [22]. The nutritional composition of the 24 h dietary recall was assessed using an adapted Portuguese version of the nutritional analysis software Food Processor Plus (ESHA Research Inc., Salem, OR, USA). Then, the food and beverage items were categorized using the NOVA classification according to the degree and purpose of processing, into four groups: unprocessed and minimally processed foods, processed culinary ingredients, processed foods, and UPF [23]. The first NOVA group consists of unprocessed or minimally processed foods, including the natural edible food parts of plants, animals, fungi, algae, and water. The processes they normally undergo have the main purpose of preservation. The second NOVA group consists of processed culinary ingredients derived directly from nature or from group 1 food by pressing, refining, grinding, milling, and spray drying. They are typically used to prepare, cook, or season unprocessed or minimally processed foods. Generally, in these groups, the quantities are underestimated due to the difficulties that participants have in estimating the amounts used for cooking and the participants most often report the meals without specifying the ingredients of the recipe or report the consumption of the ready-to-eat meals and away-from-home meals. The culinary ingredients included in this category were mainly sugar and butter. Discretionary salt was not included since it was not reported.

The third NOVA group consists of processed foods; these are usually made by adding ingredients from the second group to foods from the first group to increase the durability or palatability. Some foods included in this group were breads, cheeses, canned fish, beer, cider, and wine. The fourth NOVA group consists of UPF and drink products; these are industrial formulations made from processed substances extracted or refined from whole foods and additives, with a small proportion of or even no group 1 foods. These products are attractive, convenient, hyper-palatable, cheap, ready-to-consume or to heat, have a long shelf-life, and are highly competitive with foods that are naturally ready to consume and freshly prepared meals. Ingredients only found in UPF include additives with the purpose of imitating sensory qualities (e.g., ice-cream, chocolate, candies, margarines and spreads, and cookies). For each participant, the proportion of unprocessed and minimally processed foods, processed culinary ingredients, processed foods, and UPF in total energy (%kcal/day) and in total weight (%g/day) of food and beverages consumed was calculated.

2.5. 24-Urinary Sodium and Potassium

The 24 h urinary excretion of sodium and potassium is recognized as the most accurate method to assess the dietary intake of these minerals. The parameters analyzed were sodium (by indirect potentiometry), potassium (by indirect potentiometry), and creatinine (by photometry). The validity of the 24 h urine samples was assessed considering the ratio of urinary creatinine (mg/day) to body weight (kg) and samples were excluded for females when the creatinine (mg/d/kg) was <10.8 and >25.2 and for males when the creatinine (mg/d/kg) was <14.4 and >33.6 [24].

2.6. Anthropometric Variables

Height (SECA 213 portable stadiometer, Hamburg, Germany) was measured according to international standard procedures. With participants wearing light clothing and without shoes, their body composition (fat mass), their body mass index, and their weight were assessed using a Tanita MC180MA body composition analyzer (Tanita, Arlington Heights, IL, USA).

2.7. Sociodemographic Characteristics

Sociodemographic characteristics (sex, age, marital status, and education) were assessed using the sociodemographic questionnaire based on the WHO STEPS questionnaire [25].

2.8. Ethics

Ethical approval was provided by the Ethics Committee of the Centro Hospitalar Universitário São João (Approval Code: 11/2019, Approval Date: 15 February 2019) and good clinical practices regarding clinical trials with intervention were followed.

2.9. Statistical Analysis

Statistical analysis was performed using IBM SPSS Statistics for Windows, version 23.0 (IBM SPSS, Inc., Chicago, IL, USA). Differences were considered statistically significant when $p < 0.05$.

The normality of the variables was assessed using the Kolmogorov–Smirnov statistical test. Descriptive statistics were used for the sociodemographic, culinary skills, and dietary variables characterization presenting frequencies or as mean ± standard deviation. The differences between the sexes were analyzed by the Mann–Whitney U-test for continuous variables and an χ^2 test for categorical variables.

The Spearman rank correlation was performed to examine the relationship between the culinary skills score and the sociodemographic and dietary variables. Multiple linear regression was performed to analyze the association between culinary skills and the Mediterranean diet adherence, with 95% confidence intervals.

Cluster analysis was conducted to classify participants into distinct groups based on their culinary skills and adherence to the Mediterranean diet. Two variables were included in the analysis: the Mediterranean Diet Adherence Score and the Culinary Skills Score. Prior to clustering, both variables were standardized (z-scores). The analysis was performed using Ward's method. The squared Euclidean distance was used as the measure of dissimilarity between participants. The number of clusters was determined to be three, based on an inspection of the dendrogram and consideration of theoretical and practical interpretability. The final clusters represented distinct participant profiles, characterized by variations in Mediterranean diet adherence and culinary skills. These clusters were used for subsequent analyses to explore the differences in dietary intake performing one-way ANOVA test.

3. Results

The sample included 111 adults (60 women) with a mean age of 47.6 ± 10.5 years (Table 1). Women scored higher in culinary skills than men (5.1 ± 0.9 vs. 4.0 ± 1.1, $p < 0.001$) and also showed greater adherence to the Mediterranean diet (5.1 ± 1.9 vs. 3.8 ± 1.8, $p = 0.001$). Additionally, the sodium and potassium intake levels and the sodium-to-potassium ratio estimated from 24 h urinary excretion, were lower in women. The

Mediterranean diet adherence in this sample was 30.6% with low adherence, 35.1% with moderate adherence and 34.2% with high adherence. The adherence to this dietary pattern was better in women ($p = 0.001$).

Three participants reported not knowing how to cook, and men scored higher in their willingness to learn (scale between 0 to 5 points) than women (Figure 1). However, men were less confident in their cooking abilities (average 3.9 points vs. 4.3 points) and expressed a greater desire to improve their cooking skills (average 4.5 points vs. 4.1 points), without statistically significant differences. Overall, an enjoyment of cooking was similarly positive across both sexes, with an average score of 3.7 points.

Table 1. Sample characteristics.

	Total *n* **= 111**	**Men** *n* **= 51**	**Women** *n* **= 60**	*p*
Age years (mean ± SD)	47.6 ± 10.5	49.1 ± 11.1	46.4 ± 9.9	0.261 [a]
Educational level				
Basic education %	5.5	6	5	0.553 [b]
Secondary education %	6.4	4	8.5	
University education %	88.1	90	90	
Marital status				
Single %	17.4	16	18.6	0.846 [b]
Married %	67.9	72	64.4	
Divorced %	11.9	10	13.6	
Widower %	2.8	2	3.4	
Household persons (number)	3.0 ± 1.2	2.9 ± 1.0	3.1 ± 1.3	0.208 [a]
Children in household Yes %	45.9	38	54.2	0.092 [a]
BMI	26.0 ± 4.1	27.3 ± 3.6	25.0 ± 4.3	0.001 [a]
Body fat %	26.2 ± 7.0	22.4 ± 5.1	29.4 ± 6.8	<0.001 [a]
Culinary Skills (six-point scale) (mean ± SD)				
I consider my cooking skills as sufficient	4.7 ± 1.4	4.2 ± 1.5	5.1 ± 1.1	0.002 [a]
I am able to prepare a hot meal without a recipe	5.6 ± 0.9	5.5 ± 0.9	5.6 ± 0.9	0.340 [a]
I am able to prepare gratin	5.1 ± 1.4	4.8 ± 1.5	5.4 ± 1.2	0.062 [a]
I am able to prepare soup	5.2 ± 1.4	4.8 ± 1.6	5.6 ± 1.1	0.001 [a]
I am able to prepare sauce	3.7 ± 2.0	2.9 ± 1.8	4.5 ± 1.8	<0.001 [a]
I am able to bake cake	4.4 ± 1.9	3.2 ± 2.0	5.4 ± 1.1	<0.001 [a]
I am able to bake bread	3.4 ± 2.0	2.8 ± 1.9	3.9 ± 2.0	0.007 [a]
Culinary Skills Score (0–6 points)	4.6 ± 1.1	4.0 ± 1.1	5.1 ± 0.9	<0.001 [a]

Table 1. *Cont.*

	Total n = 111	Men n = 51	Women n = 60	p
Dietary intake (mean ± SD)				
Energy (kcal/d)	2096.8 ± 710.2	2130.6 ± 680.3	2091.7 ± 740.7	0.516 [a]
Protein (g/d)	103.3 ± 39.4	103.4 ± 36.2	103.4 ± 42.3	0.970 [a]
Carbohydrates (g/d)	236.2 ± 81.2	232.0 ± 75.4	239.7 ± 86.3	0.985 [a]
Fat (g/d)	83.6 ± 39.3	84.9 ± 38.8	82.6 ± 40.0	0.881 [a]
Vegetables (g/d)	257.1 ± 175.5	246.4 ± 139.2	266.1 ± 201.9	0.871 [a]
Fruit (g/d)	304.0 ± 195.0	264.0 ± 165.3	337.9 ± 212.6	0.043 [a]
Pulses (g/d)	46.0 ± 44.3	48.7 ± 47.5	43.6 ± 41.7	0.690 [a]
Nuts (g/d)	27.4 ± 51.2	29.5 ± 57.4	25.6 ± 45.7	0.497 [a]
Whole grains (g/d)	37.9 ± 38.7	38.8 ± 42.2	37.2 ± 35.8	0.666 [a]
Fish (g/d)	88.2 ± 56.2	84.3 ± 47.7	91.5 ± 62.6	0.597 [a]
Red and processed meat (g/d)	45.9 ± 30.7	50.4 ± 28.8	42.2 ± 32.1	0.046 [a]
Alcohol (g/d)	6.1 ± 9.1	9.7 ± 11.1	3.1 ± 4.4	<0.001 [a]
MUFA/SFA	1.7 ± 0.5	1.7 ± 0.5	1.7 ± 0.5	0.832 [a]
Mediterranean Diet Score (0–9 points)	4.5 ± 1.9	3.8 ± 1.8	5.1 ± 1.9	0.001 [a]
Sodium (mg/d)	3229.1 ± 1301.9	3859.0 ± 1291.3	2645.0 ± 1014.6	<0.001 [a]
Potassium (mg/d)	2657.9 ± 758.9	2964.8 ± 795.0	2373.3 ± 602.8	<0.001 [a]
Na/K	1.3 ± 0.6	1.4 ± 0.6	1.2 ± 0.5	0.031 [a]
NOVA 1 (% g/d)	80.9 ± 13.0	79.4 ± 14.3	82.1 ± 11.8	0.438 [a]
NOVA 2 (% g/d)	0.3 ± 0.5	0.2 ± 0.2	0.4 ± 0.6	0.041 [a]
NOVA 3 (% g/d)	8.5 ± 8.5	10.8 ± 10.8	6.6 ± 5.2	0.087 [a]
NOVA 4 (% g/d)	10.3 ± 10.4	9.6 ± 10.0	10.9 ± 10.8	0.560 [a]
NOVA 1 (% kcal/d)	52.7 ± 19.0	54.7 ± 17.9	51.0 ± 19.9	0.298 [a]
NOVA 2 (% kcal/d)	2.6 ± 6.0	1.4 ± 2.0	3.6 ± 7.9	0.027 [a]
NOVA 3 (% kcal/d)	21.5 ± 14.6	23.4 ± 16.4	19.8 ± 12.7	0.316 [a]
NOVA 4 (% kcal/d)	23.3 ± 16.9	20.5 ± 13.9	25.7 ± 18.9	0.240 [a]

[a] Mann-Whitney U test, [b] Pearson Chi-Square.

The subjects with better culinary skills have a lower age, a higher number of persons in the household, and better Mediterranean diet adherence (Figure 2). Culinary skills increased with the increasing adherence to the Mediterranean diet, as well as the consumption of nuts (g/d), the consumption of foods from the NOVA 2 group (kcal/d) and the consumption of protein adjusted for the total energy intake ($\rho = 0.35$, $p < 0.001$) and the fat adjusted for the total energy intake ($\rho = 0.22$, $p = 0.025$). No correlation was found between the culinary skills score and the energy intake ($\rho = 0.01$, $p = 0.953$), and an inverse correlation was found for the carbohydrates adjusted for the total energy intake ($\rho = -0.20$, $p = 0.040$).

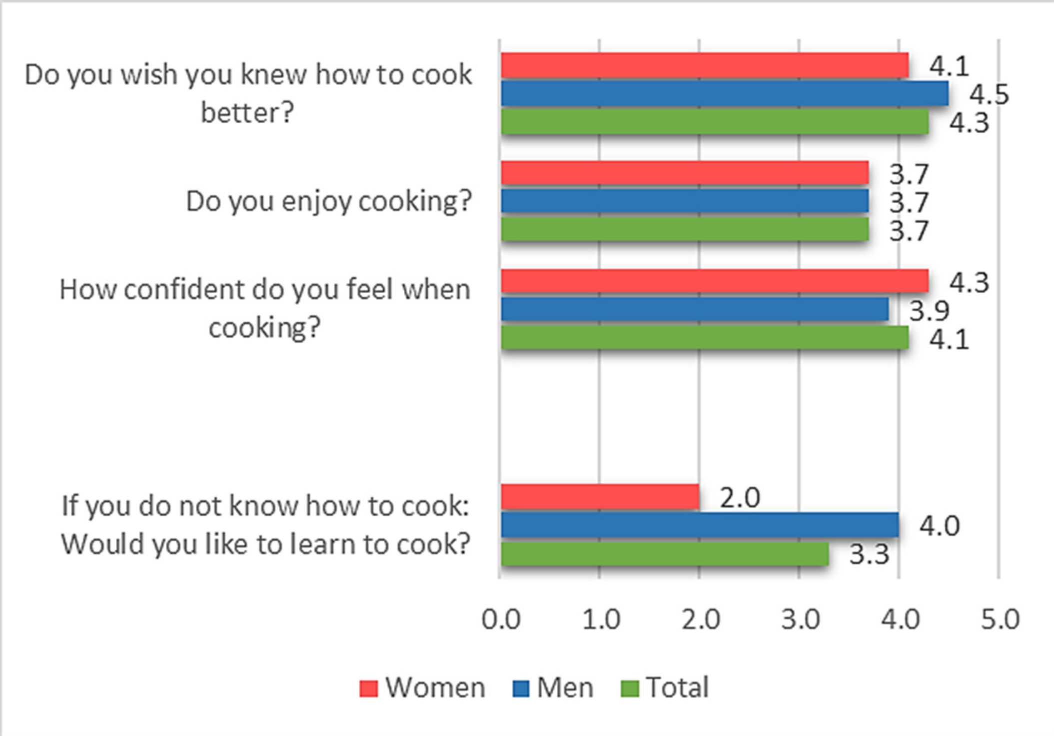

Figure 1. Culinary predisposition, enjoyment, and confidence.

The positive association between culinary skills and a Mediterranean diet adherence was significant, with culinary skills explaining 27.2% of the variance in the Mediterranean diet adherence (R^2 = 0.272) (Table 2). Each one-point increase in culinary skills was associated with a 0.27-point increase in the Mediterranean diet adherence (B = 0.272, p = 0.004). When the association was adjusted for the age and number of persons in the household, the overall model still remained significant, with an adjusted R^2 = 0.310, indicating an independent positive association.

Table 2. Association between culinary skills and Mediterranean diet adherence.

	β	*p*	95% CI
Model 1	0.272	0.004	0.150; 0.788
Model 2	0.299	0.003	0.180; 0.845

Model 1—unadjusted model (linear regression model); Model 2—adjusted model for age and number of persons on household.

The one-way ANOVA revealed significant differences between the clusters in energy, protein, sodium, and potassium (Table 3). Post hoc Tukey tests showed that individuals with high cooking skills and high Mediterranean diet adherence (Cluster 3) had significantly higher energy intake (Cluster 2 vs. Cluster 3, $p < 0.001$), higher protein intake (Cluster 1 vs. Cluster 3, $p = 0.014$), and lower sodium (Cluster 2 vs. Cluster 3, $p = 0.006$) and potassium intake (Cluster 1 vs. Cluster 3, $p = 0.016$; Cluster 2 vs. Cluster 3, $p = 0.001$).

	Culinary Skills Score	Age (y)	Household persons (n)	Mediterranean Diet Score	Vegetables (g/d)	Fruit (g/d)	Pulses (g/d)	Nuts (g/d)	Whole grains (g/d)	Fish (g/d)	Red and processed meat (g/d)	Alcohol (g/d)	MUFA/SFA	Carbohydrates (g/1000 kcal)	Protein (g/1000 kcal)	Fat (g/1000 kcal)	Na (mg/1000 kcal)	K (mg/1000 Kcal)	Na:K	NOVA 1 (% g/d)	NOVA2 (% g/d)	NOVA3 (% g/d)	NOVA4 (% g/d)	NOVA1 (% kcal/d)	NOVA2 (% kcal/d)	NOVA3 (% kcal/d)	NOVA4 (% kcal/d)
Culinary Skills Score	1.00																										
Age (y)	**-0.19**	1.00																									
Household persons (n)	**0.26**	-0.08	1.00																								
Mediterranean Diet Score	**0.23**	0.09	0.03	1.00																							
Vegetables (g/d)	0.03	0.13	0.12	**0.51**	1.00																						
Fruit (g/d)	0.02	0.12	-0.03	**0.55**	**0.27**	1.00																					
Pulses (g/d)	0.07	-0.03	-0.07	**0.45**	**0.37**	**0.31**	1.00																				
Nuts (g/d)	**0.21**	-0.02	0.10	**0.56**	**0.19**	0.18	**0.22**	1.00																			
Whole grains (g/d)	0.02	0.16	0.04	**0.44**	**0.31**	**0.26**	0.16	0.12	1.00																		
Fish (g/d)	0.16	0.00	0.08	**0.43**	**0.28**	0.14	**0.31**	**0.29**	0.00	1.00																	
Red and processed meat (g/d)	0.01	-0.10	**0.30**	-0.05	**0.23**	-0.07	**0.23**	0.12	-0.09	**0.27**	1.00																
Alcohol (g/d)	-0.19	**0.37**	-0.03	-0.02	0.01	**-0.23**	0.08	0.09	-0.05	0.06	**0.23**	1.00															
MUFA/SFA	0.03	0.10	-0.04	**0.53**	**0.22**	**0.22**	0.03	**0.55**	0.13	0.11	-0.13	0.03	1.00														
Carbohydrates (g/1000 kcal)	**-0.20**	0.03	**-0.21**	-0.01	0.01	**0.42**	0.08	**-0.41**	**0.23**	**-0.24**	**-0.43**	**-0.44**	**-0.28**	1.00													
Protein (g/1000 kcal)	**0.35**	-0.02	0.10	-0.01	-0.01	**-0.22**	0.05	0.06	-0.05	**0.43**	**0.24**	0.01	**-0.26**	**-0.36**	1.00												
Fat (g/1000 kcal)	**0.22**	-0.17	**0.22**	0.12	0.01	-0.16	**-0.23**	**0.52**	-0.06	0.05	**0.27**	0.06	**0.49**	**-0.73**	-0.06	1.00											
Na (mg/1000 kcal)	-0.15	0.05	-0.02	**-0.47**	**-0.28**	**-0.37**	-0.16	**-0.20**	**-0.25**	**-0.27**	-0.01	0.08	-0.06	-0.09	-0.03	-0.01	1.00										
K (mg/1000 Kcal)	-0.17	0.17	-0.10	**-0.48**	**-0.29**	**-0.25**	-0.18	**-0.33**	-0.16	**-0.37**	**-0.24**	0.05	**-0.21**	0.11	0.04	**-0.24**	**0.56**	1.00									
Na:K	-0.02	-0.06	0.07	-0.05	-0.01	-0.17	-0.04	0.11	-0.11	0.10	0.19	0.05	0.17	**-0.26**	-0.01	**0.26**	**0.59**	**-0.28**	1.00								
NOVA 1 (% g/d)	0.11	0.18	0.09	0.17	**0.24**	0.19	**0.23**	0.16	0.17	0.02	-0.01	-0.16	0.08	0.14	0.01	-0.05	-0.06	0.03	-0.08	1.00							
NOVA2 (% g/d)	0.13	0.01	0.10	-0.04	-0.08	-0.10	**-0.23**	-0.03	-0.03	0.06	0.09	0.01	-0.13	-0.10	-0.01	0.14	-0.12	**-0.21**	0.09	-0.07	1.00						
NOVA3 (% g/d)	-0.16	0.16	-0.01	-0.15	-0.13	-0.18	**-0.22**	**-0.20**	-0.08	-0.05	-0.17	**0.33**	0.06	-0.11	-0.18	0.01	0.16	0.03	0.13	**-0.52**	0.12	1.00					
NOVA4 (% g/d)	0.03	**-0.36**	-0.08	-0.07	**-0.20**	-0.03	-0.15	0.02	-0.15	0.01	0.13	-0.10	-0.15	-0.06	0.09	0.10	-0.03	-0.08	0.03	**-0.74**	0.04	-0.10	1.00				
NOVA1 (% kcal/d)	-0.12	0.09	-0.05	0.00	0.11	0.06	**0.24**	-0.03	0.06	-0.07	-0.06	-0.05	-0.09	**0.26**	-0.04	**-0.24**	0.00	0.12	-0.13	**0.67**	**-0.24**	**-0.44**	**-0.48**	1.00			
NOVA2 (% kcal/d)	**0.19**	0.04	0.04	0.02	-0.06	-0.09	-0.15	0.00	0.03	0.06	0.04	0.05	-0.14	-0.10	0.03	0.10	-0.17	-0.19	0.03	0.05	**0.88**	0.10	-0.10	-0.18	1.00		
NOVA3 (% kcal/d)	-0.10	0.15	0.11	-0.09	-0.12	-0.05	**-0.28**	-0.12	0.03	-0.10	**-0.19**	0.14	**0.21**	-0.10	**-0.23**	0.13	0.16	0.06	0.14	**-0.33**	0.11	**0.79**	-0.15	**-0.45**	0.06	1.00	
NOVA4 (% kcal/d)	0.15	**-0.28**	0.02	-0.01	-0.08	-0.02	-0.02	0.16	-0.16	0.15	**0.27**	-0.04	-0.11	-0.17	0.15	0.14	-0.11	**-0.20**	0.06	**-0.46**	0.10	**-0.19**	**0.73**	**-0.63**	-0.03	**-0.26**	1.00

Figure 2. Correlation heatmap (significant correlations $p < 0.05$ at bold), ρ Spearman correlation coefficient. Red cells are positive correlations and blue cells are negative correlations.

Table 3. Cluster analysis of socioeconomic, dietary, and nutritional intake characterization of groups based on their culinary skills and adherence to the Mediterranean diet.

Dependent Variable	Cluster 1 Low Cooking Skills Low MedDiet n = 40	Cluster 2 Medium Cooking Skills Low MedDiet n = 33	Cluster 3 High Cooking Skills High MedDiet n = 35	F (df1, df2)	*p*-Value	Post Hoc Significant Pairs
Women n (%)	12 (30)	16 (48.5)	30 (85.7)			
Culinary Skills Score	3.3 ± 0.7	5.1 ± 0.5	5.5 ± 0.5	141.1 (2, 105)	**<0.001**	**Cluster 1 vs. Cluster 2, *p* < 0.001** **Cluster 1 vs. Cluster 3, *p* < 0.001** **Cluster 2 vs. Cluster 3, *p* = 0.024**
Mediterranean Diet Score	4.2 ± 1.8	2.9 ± 1.0	6.3 ± 1.1	51.3 (2, 105)	**<0.001**	**Cluster 1 vs. Cluster 2, *p* = 0.001** **Cluster 1 vs. Cluster 3, *p* < 0.001** **Cluster 2 vs. Cluster 3, *p* < 0.001**
Age (years)	51.1 ± 10.7	43.7 ± 11.6	47.1 ± 7.9	4.9 (2, 105)	**0.009**	**Cluster 1 vs. Cluster 2, *p* = 0.007** Cluster 1 vs. Cluster 3, *p* = 0.212 Cluster 2 vs. Cluster 3, *p* = 0.345
Energy (kcal/d)	2142.8 ± 738.8	1753.5 ± 524.6	2408.0 ± 699.5	8.3 (2, 104)	**<0.001**	**Cluster 1 vs. Cluster 2, *p* = 0.040** Cluster 1 vs. Cluster 3, *p* = 0.207 **Cluster 2 vs. Cluster 3, *p* < 0.001**
Protein (g/1000 kcal)	46.3 ± 8.2	49.3 ± 8.4	51.6 ± 7.3	0.2 (2, 104)	**0.019**	Cluster 1 vs. Cluster 2, *p* = 0.252 **Cluster 1 vs. Cluster 3, *p* = 0.014** Cluster 2 vs. Cluster 3, *p* = 0.462
Carbohydrates (g/1000 kcal)	117.6 ± 19.5	111.4 ± 16.4	109.2 ± 17.4	0.3 (2, 104)	0.112	Cluster 1 vs. Cluster 2, *p* = 0.309 Cluster 1 vs. Cluster 3, *p* = 0.111 Cluster 2 vs. Cluster 3, *p* = 0.866
Fat (g/1000 kcal)	37.0 ± 8.0	39.4 ± 6.0	40.7 ± 6.7	1.0 (2, 104)	0.071	Cluster 1 vs. Cluster 2, *p* = 0.304 Cluster 1 vs. Cluster 3, *p* = 0.063 Cluster 2 vs. Cluster 3, *p* = 0.737
Sodium (mg/1000 kcal)	1696.7 ± 786.8	1992.6 ± 1156.1	1291.0 ± 612.1	0.9 (2, 99)	**0.008**	Cluster 1 vs. Cluster 2, *p* = 0.338 Cluster 1 vs. Cluster 3, *p* = 0.138 **Cluster 2 vs. Cluster 3, *p* = 0.006**
Potassium (mg/1000 kcal)	1434.2 ± 558.3	1590.1 ± 601.4	1084.2 ± 337.7	2.8 (2, 99)	**0.001**	Cluster 1 vs. Cluster 2, *p* = 0.419 **Cluster 1 vs. Cluster 3, *p* = 0.016** **Cluster 2 vs. Cluster 3, *p* = 0.001**
Na/K	1.2 ± 0.5	1.3 ± 0.7	1.2 ± 0.6	0.3 (2, 100)	0.717	Cluster 1 vs. Cluster 2, *p* = 0.752 Cluster 1 vs. Cluster 3, *p* = 1.000 Cluster 2 vs. Cluster 3, *p* = 0.762
NOVA 1 (% g/d)	80.6 ± 14.3	79.1 ± 14.7	9.2 ± 1.6	3.3 (2, 105)	0.751	Cluster 1 vs. Cluster 2, *p* = 0.879 Cluster 1 vs. Cluster 3, *p* = 0.953 Cluster 2 vs. Cluster 3, *p* = 0.733
NOVA 2 (% g/d)	0.3 ± 0.3	0.2 ± 0.3	0.4 ± 0.7	2.0 (2, 105)	0.392	Cluster 1 vs. Cluster 2, *p* = 0.943 Cluster 1 vs. Cluster 3, *p* = 0.556 Cluster 2 vs. Cluster 3, *p* = 0.396
NOVA 3 (% g/d)	9.6 ± 9.0	10.1 ± 10.5	6.3 ± 4.9	3.1 (2, 105)	0.126	Cluster 1 vs. Cluster 2, *p* = 0.970 Cluster 1 vs. Cluster 3, *p* = 0.208 Cluster 2 vs. Cluster 3, *p* = 0.157
NOVA 4 (% g/d)	9.5 ± 11.1	10.5 ± 10.9	11.8 ± 9.4	0.3 (2, 105)	0.629	Cluster 1 vs. Cluster 2, *p* = 0.905 Cluster 1 vs. Cluster 3, *p* = 0.601 Cluster 2 vs. Cluster 3, *p* = 0.868
NOVA 1 (%kcal/d)	55.2 ± 21.2	52.5 ± 15.9	47.9 ± 17.8	1.7 (2, 105)	0.244	Cluster 1 vs. Cluster 2, *p* = 0.808 Cluster 1 vs. Cluster 3, *p* = 0.217 Cluster 2 vs. Cluster 3, *p* = 0.577
NOVA 2 (%kcal/d)	1.8 ± 2.1	1.4 ± 1.9	4.4 ± 10.2	4.9 (2, 105)	0.086	Cluster 1 vs. Cluster 2, *p* = 0.945 Cluster 1 vs. Cluster 3, *p* = 0.168 Cluster 2 vs. Cluster 3, *p* = 0.106

Table 3. *Cont.*

Dependent Variable	Cluster 1 Low Cooking Skills Low MedDiet n = 40	Cluster 2 Medium Cooking Skills Low MedDiet n = 33	Cluster 3 High Cooking Skills High MedDiet n = 35	F (df1, df2)	*p*-Value	Post Hoc Significant Pairs
NOVA 3 (%kcal/d)	22.4 ± 14.8	23.4 ± 15.4	19.1 ± 13.9	0.4 (2, 105)	0.448	Cluster 1 vs. Cluster 2, $p = 0.957$ Cluster 1 vs. Cluster 3, $p = 0.596$ Cluster 2 vs. Cluster 3, $p = 0.456$
NOVA 4 (%kcal/d)	20.6 ± 16.8	22.8 ± 14.9	28.6 ± 17.8	0.3 (2, 105)	0.108	Cluster 1 vs. Cluster 2, $p = 0.840$ Cluster 1 vs. Cluster 3, $p = 0.098$ Cluster 2 vs. Cluster 3, $p = 0.322$

significant correlations $p < 0.05$ at bold.

4. Discussion

Our hypothesis that better culinary skills would be positively associated with greater adherence to the Mediterranean diet and improved nutritional intake was confirmed. This study found that individuals with better culinary skills demonstrated significantly greater adherence to the Mediterranean diet and a healthier nutritional intake profile, including higher energy and protein intake and lower sodium intake. The findings from this study highlight the significant associations between culinary skills, diet quality, and nutritional intake, providing compelling evidence for the potential benefits of culinary education interventions to improve dietary habits and health outcomes.

Better reported culinary skills were found on subjects with greater adherence to the Mediterranean diet. Similarly, a study conducted among Portuguese adolescents found that those with better cooking skills were more likely to adhere to the Mediterranean diet [26]. In our study, the positive correlation between culinary skills and adherence to the Mediterranean diet underscores the critical role of cooking proficiency in promoting healthier eating patterns. The explanatory power of culinary skills on Mediterranean diet adherence ($R^2 = 0.272$, adjusted $R^2 = 0.310$) is notable, emphasizing that even modest improvements in cooking skills could lead to meaningful dietary behavior changes. From a societal perspective, promoting culinary skills could thus serve as a powerful public health intervention to foster healthier eating patterns and address diet-related non-communicable diseases.

These results suggest that enhancing culinary skills through education can lead to healthier dietary practices. However, the relationship between culinary skills and diet can be complex, and must be viewed within a broader context that includes psychological, social, and environmental dimensions. Findings show that the determinants of home cooking are more complex than simply possessing cooking skills and that potential positive associations between cooking, diet, and health require further confirmation [27]. Furthermore, Lavelle et al. argue that food skills, which encompass a broader range of competencies beyond cooking, are essential for improving diet-related health outcomes [28]. This comprehensive perspective underscores that culinary skill development alone, though vital, is insufficient without addressing the broader food literacy spectrum including meal planning, budgeting, and grocery shopping.

Gender differences observed in this study, with women exhibiting significantly better culinary skills and Mediterranean diet adherence, reflect persistent gendered divisions in domestic food labor. This finding is consistent with previous sociological research emphasizing the maternal role in family cooking and the transmission of culinary knowledge to children is constructed as a maternal duty [29]. This suggests that gender-specific approaches may be necessary when designing culinary education programs. For instance, targeting men with initiatives to boost cooking confidence and skill development might bridge the gap and enhance dietary adherence. Findings suggest that culinary skills should not be singular targets of interventions designed to improve diet; but targeting specific sub-groups of the population e.g., males and those with limited education might be more fruitful [30].

The clustering analysis revealed that individuals with better culinary skills and better Mediterranean diet adherence also had significantly higher energy and protein intakes, without the differences found in the carbohydrate and fat intake. McGowan et al. [30] found in a sample of 1049 adults aged 20–60 years drawn from the Island of Ireland that perceived cooking skills significantly contributed to the dietary quality, particularly in relation to lowering the saturated fat intake. The evidence related to culinary skills assessment and nutritional intake is scarce; however, the relationship with the improvements in fruit and/or vegetable intake is reported in several studies [31,32]. An interesting study with 18,460 adults from a Canadian Community Health Survey (CCHS) have highlighted that adults with poor cooking skills were less likely to have an adequate fruit and vegetable intake (≥5 servings per day) or very good general health or mental health and more likely to have obesity compared to advanced cooking skills [31]. The possible explanation could be that individuals with better culinary skills and greater adherence to the Mediterranean diet exhibited higher energy intakes with the increased consumption of nutrient-dense, whole foods typical of the Mediterranean dietary pattern, which can be more energy-rich but offer superior nutritional quality compared to highly processed foods, for example olive oil. Both women and men were classified as overweight (BMI 25–29.9), yet the lower BMI observed in women alongside their greater cooking competence and diet quality suggests that culinary skills and dietary patterns may play a critical role in moderating body weight and metabolic health despite differences in energy intake. These findings highlight the complex relationship between energy consumption, food quality, cooking ability, and obesity risk. They underscore the value of promoting culinary skills and Mediterranean dietary adherence as effective strategies to improve diet quality and prevent non-communicable diseases.

Our results present a significant relation between the culinary skills score and the consumption of foods from the NOVA 2 group (consisting of processed culinary ingredients, typically used to prepare, cook, or season), but no relevant associations were found with ultra-processed foods. Otherwise, Fernandez et al. showed that not only are cooking skills important, but the quality of ingredients also matter, since the subjects that cooked with highly processed foods were less likely to have an adequate fruit and vegetable intake, suggesting that limiting the use of processed foods in addition to improving cooking skills are potential intervention targets to promote better health and diet outcomes [31].

The results showed that individuals with better adherence to the Mediterranean diet and better cooking skills have a lower sodium intake. This could be partially explained by differences in food choices, with women potentially favoring foods lower in sodium, since women have lower sodium and potassium intake, although energy intake did not differ significantly between women and men, greater adherence to Mediterranean Diet and greater culinary skills. Recent research still emphasizes the importance of reinforcing the efforts to reduce dietary sodium intake to improve public health [33], and the average sodium intake of the subjects of this study was above the WHO's recommended limit of <2000 mg/day [34] (average intake 3229.1 ± 1301.9 mg/d). The reduction of the sodium intake through hands-on kitchen education has been advoked by "Culinary Medicine", an emerging interdisciplinary discipline, that aims to empower healthcare professionals and communities on how to prepare healthy meals. This hands-on kitchen education approach empowers individuals to reduce their sodium intake and improve their health through plant-forward diets, enhancing food literacy and flavor, offering disease-specific cooking modules, and providing culturally tailored nutrition education [35]. Findings from intervention studies reinforce the effectiveness of cooking classes in lowering sodium intake. A cluster randomized trial developed in China, where most dietary salt comes from salt and high-salt condiments that are added during cooking, targets home cooks and family members and was effective in lowering salt intake and blood pressure [36]. In Japan, cooking classes for housewives effectively reduced salt intake after a 2-month intervention [37].

While the direct relationship between cooking skills and potassium intake hasn't been widely studied, it is plausible that improved cooking skills likely lead to the increase in vegetable consumption [38,39] which can contribute to a higher potassium intake, given that many vegetables are rich in this mineral. However, our results indicate that the average potassium intake (2657.9 $\pm$ 758.9 mg/d) falls significantly below the recommended 3510 mg/day [40], and better culinary skills do not correlate with an increased potassium intake. Other studies have also found no association between an adherence to the Mediterranean diet and the potassium intake [41,42], suggesting further investigation is needed to determine if culinary education can enhance potassium levels in diets.

Research has highlighted that developing cooking skills has long-term benefits for the improvement of dietary behaviors and health outcomes [9]. Furthermore, cooking skills programs have been associated with food literacy, particularly in improving confidence and self-efficacy in cooking and increasing the fruit and vegetable consumption. Notably, such interventions yield greater benefits for vulnerable, low-socioeconomic backgrounds, highlighting their potential to reduce health disparities [43]. To maximize these benefits, culinary skills education could be integrated into school curricula from an early age to establish healthy habits or at the universities. Additionally, targeted interventions could be offered for specific populations, such as pregnant individuals, through prenatal support programs. Community health workers could be trained to deliver cooking skill interventions within local communities and workplaces, increasing the reach and sustainability. Furthermore, policies that incentivize health institutions to incorporate cooking classes into preventive care, and support for funding community-based culinary education programs, could facilitate broader implementation. These specific strategies aim to strengthen the effectiveness and accessibility of cooking skills programs, thereby contributing to improved public health outcomes.

This study has several strengths, including the use of validated instruments to assess culinary skills and dietary intake, and the application of the NOVA classification to categorize food processing levels, providing a comprehensive evaluation of the participants' food choices. The focus on culinary skills as a societal factor influencing the diet quality adds valuable insight to the limited literature connecting food literacy, cultural practices, and public health outcomes. However, some limitations must be acknowledged. The cross-sectional design limits causal inferences, and the relatively small and geographically restricted sample may affect the generalizability of the findings. Self-reported measures of dietary intake and cooking skills are subject to recall and social desirability biases. Future research should explore longitudinal designs, diverse populations, and interventions to further clarify the role of culinary skills in shaping dietary behaviors and health across different social contexts.

5. Conclusions

This study underscores the critical role of culinary skills as a societal determinant of dietary behaviors and nutritional intake. Our findings highlight that fostering culinary competence can contribute meaningfully to promoting healthier eating patterns, particularly greater adherence to the Mediterranean diet. Integrating cooking skills education into broader nutrition and public health strategies offers a promising, practical approach to improving diet quality, reducing the burden of non-communicable diseases, and enhancing overall societal well-being. Furthermore, culinary education initiatives have the potential not only to support individual health outcomes but also to preserve cultural food practices, address social inequalities in food literacy, and empower communities toward more resilient and sustainable food systems. Future interventions should consider targeted approaches that address structural barriers to cooking, particularly among vulnerable and underserved populations, to maximize their impact on health equity.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Abbreviations

The following abbreviations are used in this manuscript:

CSS	Cooking Skills Scale
DOAJ	Food Frequency Questionnaire
aMED	Alternative Mediterranean Diet Score

References

1. Muonde, M.; Olorunsogo, T.O.; Ogugua, J.O.; Maduka, C.P.; Omotayo, O. Global nutrition challenges: A public health review of dietary risks and interventions. *World J. Adv. Res. Rev.* **2024**, *21*, 1467–1478. [CrossRef]
2. Omotayo, O.; Maduka, C.P.; Muonde, M.; Olorunsogo, T.O.; Ogugua, J.O. The rise of non-communicable diseases: A global health review of challenges and prevention strategies. *Int. Med. Sci. Res. J.* **2024**, *4*, 74–88. [CrossRef]
3. Singh Thakur, J.; Nangia, R.; Singh, S. Progress and challenges in achieving noncommunicable diseases targets for the sustainable development goals. *FASEB Bioadv.* **2021**, *3*, 563–568. [CrossRef]
4. Graça, P.; Gregório, M.J.; de Sousa, S.M.; Brás, S.; Penedo, T.; Carvalho, T.; Bandarra, N.M.; Lima, R.M.; Simão, A.P.; Goiana-da-Silva, F. A new interministerial strategy for the promotion of healthy eating in Portugal: Implementation and initial results. *Health Res. Policy Syst.* **2018**, *16*, 1–16. [CrossRef] [PubMed]
5. Silva, M.; Rodrigues, S.S.P.; Correia, D.M.; Rei, M.C.C.; Severo, M.; Costa, A.I.A.; Torres, D.P.M.; Lopes, C.M.M. Eating out of home in Portugal: Characterisation and effects on dietary intake. *Br. J. Nutr.* **2024**, *132*, 169–181. [CrossRef]
6. Teixeira, A.R.; Bicalho, D.; Slater, B.; Lima, T.D.M. Systematic review of instruments for assessing culinary skills in adults: What is the quality of their psychometric properties? *PLoS ONE* **2021**, *16*, e0235182. [CrossRef] [PubMed]
7. Arslan, S.; Selcuk, K.T.; Sahin, N.; Atan, R.M. The relationship between food and cooking skills, and eating behaviors in people with overweight or obesity. *Int. J. Obes.* **2023**, *47*, 60–66. [CrossRef]

8. Wolfson, J.A.; Bleich, S.N. Is cooking at home associated with better diet quality or weight-loss intention? *Public Health Nutr.* **2015**, *18*, 1397–1406. [CrossRef]
9. Utter, J.; Larson, N.; Laska, M.N.; Winkler, M.; Neumark-Sztainer, D. Self-perceived cooking skills in emerging adulthood predict better dietary behaviors and intake 10 years later: A longitudinal study. *J. Nutr. Educ. Behav.* **2018**, *50*, 494–500. [CrossRef]
10. Dominguez, L.J.; Di Bella, G.; Veronese, N.; Barbagallo, M. Impact of Mediterranean Diet on Chronic Non-Communicable Diseases and Longevity. *Nutrients* **2021**, *13*, 2028. [CrossRef]
11. Dinu, M.; Pagliai, G.; Casini, A.; Sofi, F. Mediterranean diet and multiple health outcomes: An umbrella review of meta-analyses of observational studies and randomised trials. *Eur. J. Clin. Nutr.* **2018**, *72*, 30–43. [CrossRef] [PubMed]
12. Castro-Quezada, I.; Román-Viñas, B.; Serra-Majem, L. The Mediterranean diet and nutritional adequacy: A review. *Nutrients* **2014**, *6*, 231–248. [CrossRef]
13. Gonçalves, C.; Silva-Santos, T.; Abreu, S.; Padrão, P.; Graça, P.; Oliveira, L.; Esteves, S.; Norton, P.; Moreira, P.; Pinho, O. Innovative equipment to monitor and control salt usage when cooking at home: iMC SALT research protocol for a randomised controlled trial. *BMJ Open* **2020**, *10*, e035898. [CrossRef]
14. Silva-Santos, T.; Moreira, P.; Pinho, O.; Padrão, P.; Abreu, S.; Esteves, S.; Oliveira, L.; Norton, P.; Rodrigues, M.; Ndrio, A.; et al. Impact of an Innovative Equipment to Monitor and Control Salt Usage during Cooking at Home on Salt Intake and Blood Pressure—Randomized Controlled Trial iMC SALT. *Nutrients* **2022**, *14*, 8. [CrossRef]
15. Hartmann, C.; Dohle, S.; Siegrist, M. Importance of cooking skills for balanced food choices. *Appetite* **2013**, *65*, 125–131. [CrossRef] [PubMed]
16. Kowalkowska, J.; Poínhos, R.; Rodrigues, S. Cooking skills and socio-demographics among Portuguese university students. *Br. Food J.* **2018**, *120*, 563–577. [CrossRef]
17. Lopes, C.; Aro, A.; Azevedo, A.; Ramos, E.; Barros, H. Intake and adipose tissue composition of fatty acids and risk of myocardial infarction in a male Portuguese community sample. *J. Am. Diet. Assoc.* **2007**, *107*, 276–286. [CrossRef] [PubMed]
18. Lopes, C. Alimentação e Enfarte Agudo do Miocárdio: Estudo Caso-Controlo de Base Comunitária. Ph.D. Thesis, Universidade do Porto, Porto, Portugal, 2000.
19. Dias, M.G.; Fernandes, P.; Oliveira, L. Atualização da Tabela Portuguesa da Composição de Alimentos. In Proceedings of the 8ª Reunião Anual PortFIR, Lisboa, Portugal, 30 October 2015; INSA: 2015.
20. Fung, T.T.; McCullough, M.L.; Newby, P.; Manson, J.E.; Meigs, J.B.; Rifai, N.; Willett, W.C.; Hu, F.B. Diet-quality scores and plasma concentrations of markers of inflammation and endothelial dysfunction. *Am. J. Clin. Nutr.* **2005**, *82*, 163–173. [CrossRef]
21. Trichopoulou, A.; Kouris-Blazos, A.; Wahlqvist, M.L.; Gnardellis, C.; Lagiou, P.; Polychronopoulos, E.; Vassilakou, T.; Lipworth, L.; Trichopoulos, D. Diet and overall survival in elderly people. *BMJ* **1995**, *311*, 1457–1460. [CrossRef]
22. Marques, M.; Pinho, O.; Almeida, M.D.V.D. *Ingredientes e valor nutricional de porções do Manual de Quantificação de Alimentos*; Universidade do Porto: Porto, Portugal, 1999.
23. Monteiro, C.A.; Cannon, G.; Levy, R.; Moubarac, J.-C.; Jaime, P.; Martins, A.P.; Canella, D.; Louzada, M.; Parra, D. NOVA. The star shines bright. *World Nutr.* **2016**, *7*, 28–38.
24. World Health Organization. *CARDIAC Study Protocol and Manual of Operations*; World Health Organization: Geneva, Switzerland, 1986.
25. World Health Organization. *STEPS Instruments for NCD Risk Factors (Core and Expanded Version 1.4): The WHO STEPwise Approach to Surveillance of Noncommunicable Diseases (STEPS)*; World Health Organization: Geneva, Switzerland, 2001.
26. da Rocha Leal, F.M.; de Oliveira, B.M.P.M.; Pereira, S.S.R. Relationship between cooking habits and skills and Mediterranean diet in a sample of Portuguese adolescents. *Perspect. Public Health* **2011**, *131*, 283–287. [CrossRef]
27. Mills, S.; White, M.; Brown, H.; Wrieden, W.; Kwasnicka, D.; Halligan, J.; Robalino, S.; Adams, J. Health and social determinants and outcomes of home cooking: A systematic review of observational studies. *Appetite* **2017**, *111*, 116–134. [CrossRef] [PubMed]
28. Lavelle, F.; Bucher, T.; Dean, M.; Brown, H.M.; Rollo, M.E.; Collins, C.E. Diet quality is more strongly related to food skills rather than cooking skills confidence: Results from a national cross-sectional survey. *Nutr. Diet.* **2020**, *77*, 112–120. [CrossRef]
29. da Silva Oliveira, M.S.; Unsain, R.A.F.; Sato, P.D.M.; Ulian, M.D.; Scagliusi, F.B.; Cardoso, M.A. "Because I saw my mother cooking": The sociocultural process of learning and teaching domestic culinary skills of the Western Brazilian Amazonian women. *Food Foodways* **2022**, *30*, 310–330. [CrossRef]
30. McGowan, L.; Pot, G.K.; Stephen, A.M.; Lavelle, F.; Spence, M.; Raats, M.; Hollywood, L.; McDowell, D.; McCloat, A.; Mooney, E.; et al. The influence of socio-demographic, psychological and knowledge-related variables alongside perceived cooking and food skills abilities in the prediction of diet quality in adults: A nationally representative cross-sectional study. *Int. J. Behav. Nutr. Phys. Act.* **2016**, *13*, 111. [CrossRef]
31. Fernandez, M.A.; Maximova, K.; Fulkerson, J.A.; Raine, K.D. Associations between cooking skills, cooking with processed foods, and health: A cross-sectional study. *Appl. Physiol. Nutr. Metab.* **2023**, *49*, 330–339. [CrossRef]
32. Reicks, M.; Kocher, M.; Reeder, J. Impact of cooking and home food preparation interventions among adults: A systematic review (2011–2016). *J. Nutr. Educ. Behav.* **2018**, *50*, 148–172.e141. [CrossRef]

33. Moreira, P.; Gonçalves, C. Reducing Dietary Sodium and Improving Human Health 2.0. *Nutrients* **2023**, *15*, 4965. [CrossRef]
34. WHO. *Guideline: Sodium Intake for Adults and Children*; World Health Organization: Geneva, Switzerland, 2012.
35. Razavi, A.C.; Dyer, A.; Jones, M.; Sapin, A.; Caraballo, G.; Nace, H.; Dotson, K.; Razavi, M.A.; Harlan, T.S. Achieving Dietary Sodium Recommendations and Atherosclerotic Cardiovascular Disease Prevention through Culinary Medicine Education. *Nutrients* **2020**, *12*, 3632. [CrossRef]
36. Zhang, X.; Zhang, P.; Shen, D.; Li, Y.; He, F.J.; Ma, J.; Yan, W.; Gao, Y.; Jin, D.; Deng, Y. Effect of home cook interventions for salt reduction in China: Cluster randomised controlled trial. *BMJ* **2023**, *382*, e074258. [CrossRef]
37. Takada, T.; Imamoto, M.; Fukuma, S.; Yamamoto, Y.; Sasaki, S.; Uchida, M.; Miura, Y.; Shimizu, S.; Nihata, K.; Fukuhara, S. Effect of cooking classes for housewives on salt reduction in family members: A cluster randomized controlled trial. *Public Health* **2016**, *140*, 144–150. [CrossRef] [PubMed]
38. Hasan, B.; Thompson, W.G.; Almasri, J.; Wang, Z.; Lakis, S.; Prokop, L.J.; Hensrud, D.D.; Frie, K.S.; Wirtz, M.J.; Murad, A.L. The effect of culinary interventions (cooking classes) on dietary intake and behavioral change: A systematic review and evidence map. *BMC Nutr.* **2019**, *5*, 29. [CrossRef] [PubMed]
39. Metcalfe, J.J.; Prescott, M.P.; Schumacher, M.; Kownacki, C.; McCaffrey, J. Community-based culinary and nutrition education intervention promotes fruit and vegetable consumption. *Public Health Nutr.* **2022**, *25*, 437–449. [CrossRef] [PubMed]
40. WHO. *Guideline: Potassium Intake for Adults and Children*; World Health Organization: Geneva, Switzerland, 2012.
41. Viroli, G.; Gonçalves, C.; Pinho, O.; Silva-Santos, T.; Padrão, P.; Moreira, P. High Adherence to Mediterranean Diet Is Not Associated with an Improved Sodium and Potassium Intake. *Nutrients* **2021**, *13*, 4151. [CrossRef]
42. Vasara, E.; Marakis, G.; Breda, J.; Skepastianos, P.; Hassapidou, M.; Kafatos, A.; Rodopaios, N.; Koulouri, A.A.; Cappuccio, F.P. Sodium and potassium intake in healthy adults in Thessaloniki Greater Metropolitan Area—The salt intake in Northern Greece (sing) study. *Nutrients* **2017**, *9*, 417. [CrossRef]
43. Garcia, A.L.; Reardon, R.; McDonald, M.; Vargas-Garcia, E.J. Community interventions to improve cooking skills and their effects on confidence and eating behaviour. *Curr. Nutr. Rep.* **2016**, *5*, 315–322. [CrossRef]