Research Paper

The Nutrition Society

CAMBRIDGE UNIVERSITY PRESS

Dietary intake according to different patterns of food preparation in children and adults: results from the Portuguese National Food, Nutrition and Physical Activity Survey (IAN-AF 2015/2016)

Mariana Rei[1,2,3] , Daniela Correia[2,3,4] , Duarte Torres[1,2,3] , Carla Lopes[2,3,4] , Ana Isabel A. Costa[5] and Sara SP Rodrigues[1,2,3]

[1]Faculty of Nutrition and Food Sciences, University of Porto, Porto, Portugal; [2]EPIUnit – Epidemiology Research Unit, Institute of Public Health, University of Porto, Porto, Portugal; [3]ITR – Laboratory for Integrative and Translational Research in Population Health, University of Porto, Porto, Portugal; [4]Public Health and Forensic Sciences, Medical Education Department – Faculty of Medicine, University of Porto, Porto, Portugal and [5]CATÓLICA-LISBON School of Business and Economics, Portuguese Catholic University, Lisbon, Portugal

Abstract

Objective: To investigate associations between dietary intake and patterns of food preparation by age group. *Design:* This cross-sectional study analysed dietary intake data from the most recent Portuguese National Food, Nutrition and Physical Activity Survey. Cluster analysis categorised dietary intake based on the source of food preparation. Regression models were used to study the association between dietary daily intake, Healthy Eating Score (HES) and patterns of food preparation. *Setting:* Portugal, using data representative of the Portuguese population. *Participants:* A total of 5005 Portuguese residents aged 3–84 years were included in the analysis. Dietary intake and food preparation patterns were examined by age group. *Results:* The predominant pattern of food preparation was food prepared by restaurants, canteens and other away-from-home establishments (45·9 %, 95 % CI = 43·8, 48·1). Children and adolescents in this pattern had significantly higher intakes of energy and carbohydrates but lower protein intake compared with those consuming predominantly home-prepared foods. Among adults and the elderly, this pattern was associated with higher intakes of energy, saturated fats, trans fats and free sugars and lower fibre intake. Additionally, children and adolescents whose diets predominantly included food prepared away-from-home showed a decrease in HES ($\beta = -0\cdot7$, 95 % CI = $-1\cdot3$, $-0\cdot2$), and adults experienced a greater reduction ($\beta = -1\cdot2$, 95 % CI = $-1\cdot5$, $-0\cdot9$). *Conclusions:* In Portugal, consuming food prepared away from home is associated with poorer dietary quality, with higher energy and unhealthy nutrient intake and lower HES, suggesting a need for interventions focused on promoting healthier food preparation practices.

Inadequate dietary habits are the most preventable risk factor with impact on worldwide non-communicable diseases morbidity and mortality[1,2], reflecting the importance of studying and exploring dietary choices and their determinants. Meanwhile, home cooking practices are declining, while the consumption of food prepared away from home is gaining importance in human diets worldwide[3–6]. Eating out of home has been identified as a risk factor for higher intakes of energy, total and saturated fat, sugar and sodium and lower intakes of fibre and micronutrients, as well as higher intakes of soft drinks, sugar-sweetened beverages (SSB), fruit juices, sweets, beer and other alcoholic beverages and lower intakes of dairy products, fruit, fish and seafood and vegetables[7–11].

Overall, eating out of home usually translates into poorer diet quality. The definition of what constitutes eating out of home, however, lacks methodological consensus. Two distinct definitions have been considered in the literature: (i) all food and beverages consumed away from home, regardless of whether they were prepared at or away from home; and (ii) all food and beverages purchased away from home, irrespective of the consumption place[12]. This lack of a common definition makes direct comparisons of out-of-home intakes across population groups difficult – which, consequently, does not facilitate the design of public health policies to encourage consumers to eat healthier when they are eating out of home. Moreover, meals are often not consumed at the same place where they were prepared; meals consumed at home, for instance, may be acquired from a restaurant, canteen, cafeteria or similar establishments or from takeaway or home delivery services[13,14].

Studies of patterns of food preparation at the population level are geographically limited and mainly focused on adults[4–6,15–21], while studies of their associations with dietary intakes are equally scare[22–30]. In Portugal, one study investigated the time adults spent on food preparation

at home in 2015[31], and another examined adult food intake per location between 1999 and 2003[9,11,12]. More recently, a study identified patterns of food preparation for both adults and children and uncovered their associations with sociodemographics, health status and lifestyle factors[32]. Still, there is a lack of research in Portugal to understand dietary intake based on whether food and beverages were prepared at or away from home. In view of this, the aim of the present study was to investigate associations between dietary intakes and patterns of food preparation – defined as all food and beverages purchased away from home, irrespective of the place of consumption – by age group, drawing from data collected by the most recent National Food, Nutrition and Physical Activity Survey (IAN-AF 2015/2016).

Methods

Study design and participants

This cross-sectional study included participants from the IAN-AF 2015/2016, aged between 3 and 84 years old and with two completed dietary intake assessments (n 5005). The IAN-AF participants were randomly selected from the National Health Registry by multistage sampling and comprised a representative sample of the general (non-institutionalised) resident Portuguese population[33].

Data collection

Data were collected through interviews (8–15 d apart) conducted by trained researchers (with a background in Nutrition or Dietetics), using an electronic platform (You eAT&Move), between October 2015 and September 2016. This period covered the four seasons and included all days of the week (randomly selected), to incorporate seasonal effects and day-to-day variation in food consumption[33]. For children (< 10 years old), food consumption data were collected by two non-consecutive days of 24-h food diaries followed by a face-to-face interview with the main caregivers to gather details related to food description and quantification[33]. For other age groups, food consumption data were collected by two non-consecutive 24-h recalls[33].

The eAT24 module, incorporated in the You eAT&Move platform used to collect and describe food consumption data, utilises the Portuguese food composition table by default for nutrient analysis. Portion sizes were calculated using multiple methods available within this module, specifically the food picture book method (which includes a set of 186 food photo series with six portions each), as well as the household measure photo series. Additionally, other methods such as weight/volume, standard unit and household measure methods were also available. Further details about the IAN-AF protocol and methodology can be found elsewhere[33].

Patterns of food preparation

Dietary intake of participants were previously cluster analysed according to the place of food preparation, allowing the identification of four distinct patterns of food preparation in the Portuguese population[32]: (1) the pattern *At home by themselves* – characterised by having the highest proportion (38·0 %) of intakes from foods and beverages prepared at home by individuals; (2) the pattern *At home by relatives or friends* – characterised by the highest proportion (44·7 %) of intakes from foods and beverages prepared at home by relatives or friends of individuals; (3) the

pattern *By food retail* – characterised by the highest proportion (65·3 %) of intakes of foods and beverages prepared or acquired from food retail operators (including those consumed *in natura*); and (4) the pattern *By restaurants, canteens and other away-from-home establishments* – characterised by the highest proportions of intakes of foods and beverages prepared by restaurants (13·9 %), canteens (10·8 %) and other foodservice establishments (9·6 %).

Sociodemographic characteristics

Participants' sex, age (grouped as children (3–9 years), adolescents (10–17 years), adults (18–64 years) or elderly (65–84 years)), area of residence (classified as Predominantly Urban, Medium Urban or Predominantly Rural according to the Portuguese National Institute of Statistics' Classification of Urban Areas)[34] and highest education completed (categorised as No Education/Primary Education, Secondary Education or Tertiary Education). In the case of children and adolescents, the highest education completed by their parents was considered.

Diet quality

The Healthy Eating Score (HES) was used to evaluate dietary adequacy. This score, previously used with Portuguese children and adolescents[35], is based on dietary recommendations proposed by the WHO. This score comprises intake information from the following nine groups: (1) FV – fresh fruits, vegetables and legumes; (2) cereals and potatoes – rice, pasta, potatoes, bread and other grains; (3) dairy products – milk, yogurt and cheese; (4) white meat, fish and eggs – eggs, chicken, turkey, rabbit, fresh, dry and canned fish; (5) red and processed meat – for example, pork, beef, ham, sausage, bacon; (6) salty snacks – salty snacks, pizzas and chips; (7) SSB – sugar-sweetened beverages, such as fruit nectars and soft drinks; (8) sugar and honey – added/free sugar, honey, molasses and syrups; (9) sweets – cakes, candies, sweet pastry, chocolate, biscuits and ice cream, breakfast cereals and cereals bars. Groups 1–4 are considered healthier, so lower consumption scored lower and higher consumption scored higher. Contrariwise, the remaining five groups with less/non-healthy foods were assigned inverse scores. The HES final score ranges from 9 to 36, with higher scores translating into healthier and higher-quality diets.

Statistical analysis

All statistics were performed using the R Software version 3.6.3[36], the sample was weighted for the distribution of the Portuguese population using the library 'survey'[37], and the significance level considered was $\alpha = 0.05$. The distribution of the patterns of food preparation was cross-tabulated with the distribution of participants' sex, age group, area of residence and completed education. As less than 0·5 % of children and adolescents were clustered in the pattern of food preparation *At home by themselves*, this pattern was concatenated with the pattern of food preparation *At home by relatives or friends*, to form an overall pattern of food preparation *At home* (specifically, for these age groups). Due to the different number of patterns of food preparation for children and adolescents and for adults and elderly, the subsequent analyses were performed independently per non-adult (< 18 years) and adult (≥ 18 years) participants.

Linear regression models were used to obtain crude and adjusted standardised beta coefficients (β) and the respective 95 % CI, to study the association between the patterns of food preparations and 2-d mean daily intake of energy, of some

Table 1. Distribution of the patterns of food preparation according to sociodemographic characteristics, weighted for the distribution of the Portuguese population (Percentages and 95 % confidence intervals)

		Patterns of food preparation, % (95 % CI)							
		At home by themselves		At home by relatives or friends		By food retail (including food consumed in natura)		By restaurants, canteens and other away-from-home establishments	
	n	%	95 % CI	%	95 % CI	%	95 % CI	%	95 % CI
Total	**5005**	**16·3**	**14·4, 18·2**	**13·7**	**12·0, 15·4**	**24·0**	**21·8, 26·2**	**45·9**	**43·8, 48·1**
Sex									
Women	2613	24·0	21·2, 26·8	7·4	5·5, 9·3	27·6	24·4, 30·8	41·0	37·9, 44·1
Men	2392	8·3	6·6, 9·9	20·4	17·8, 22·9	20·2	17·8, 22·7	51·1	48·5, 53·8
Age group									
Children (3–9 years)	521	0·2	0·0, 0·6	7·6	4·6, 10·7	23·5	17·3, 29·7	68·6	61·2, 76·0
Adolescents (10–17 years)	632	0·0	0·0, 0·1	20·9	16·5, 25·3	22·5	17·7, 27·2	56·6	50·3, 62·8
Adults (18–64 years)	3102	15·2	13·1, 17·3	13·5	11·4, 15·5	22·5	20·2, 24·9	48·8	46·0, 51·6
Elderly (65–84 years)	750	33·4	27·5, 39·3	13·4	9·7, 17·1	30·5	25·2, 35·9	22·7	18·4, 26·9
Area of residence									
Predominantly urban	3650	15·6	13·2, 18·0	12·6	10·6, 14·6	25·0	22·5, 27·5	46·8	44·3, 49·3
Medium urban	863	16·9	14·8, 19·1	17·5	15·1, 19·9	20·1	14·9, 25·4	45·4	41·4, 49·5
Predominantly rural	492	21·7	16·2, 27·2	17·9	13·5, 22·2	21·2	15·3, 27·2	39·2	31·6, 46·8
Education*									
No education/primary	1497	31·5	26·9, 36·1	15·3	12·4, 18·2	23·9	20·0, 27·7	29·4	25·4, 33·4
Secondary	2201	11·1	9·1, 13·0	14·4	11·8, 17·0	25·1	22·3, 28·0	49·4	46·2, 52·7
Tertiary	1291	7·9	5·8, 10·0	10·7	8·3, 13·1	21·7	18·4, 25·0	59·7	55·8, 63·6

n, absolute frequency; %, relative frequency.
*Education completed by parents for participants < 18 years.
The boldface highlights the statistically significant results for the associations under study.

nutrients and of nine HES food and beverage groups and the mean HES. All final models were adjusted for sex, age group, area of residence and education. For fibre, sodium and the nine HES food and beverage groups, the final models were additionally adjusted for total energy intake. Moreover, in adults and elderly, logistic regression models were used to obtain crude and adjusted OR and the respective 95 % CI to study the association between the patterns of food preparation and consuming alcoholic beverages, in particular wine, beer and other alcoholic beverages. The final models were adjusted for total energy intake, sex, age group, area of residence and education.

Results

The most prevalent pattern of food preparation is the pattern *By restaurants, canteens and other away-from-home establishments* (45·9 %, 95 % CI = 43·8, 48·1 %), being mostly adopted by men, younger individuals, residents in urban areas or more educated ones (Table 1).

Dietary intake according to patterns of food preparation in children and adolescents

Table 2 shows the associations between mean daily intake of energy and nutrients and the patterns of food preparation among children and adolescents in Portugal, taking the pattern of preparation *At home* as reference. Adjusted results show that non-adults in the pattern *By food retail* (including food consumed in natura) have significant positive associations for daily intakes of saturated and trans fatty acids (respectively, $\beta = 0.91$ %TEI, 95 % CI = 0·40, 1·42 %TEI and $\beta = 0.14$ %TEI, 95 % CI = 0·06, 0·21 %TEI), total carbohydrate ($\beta = 1.43$ %TEI, 95 % CI = 0·23, 2·63 %TEI) and free sugars ($\beta = 3.34$ %TEI, 95 % CI = 2·14, 4·53 %TEI) and significant negative associations for daily intake of protein ($\beta = -1.82$ %TEI, 95 % CI = −2·50, −1·14 %TEI), fibre ($\beta = -1.7$ g, 95 % CI = −2·5, −0·8 g) and sodium ($\beta = -181$ mg, 95 % CI = −308, −54 mg). Moreover, non-adults in the pattern *By restaurants, canteens and other away-from-home establishments* have significant positive associations for daily intakes of energy ($\beta = 166$ kcal, 95 % CI = 77, 256 kcal) and total carbohydrate ($\beta = 1.52$ %TEI, 95 % CI = 0·45, 2·59 %TEI) and a significant negative association for daily intake of protein ($\beta = -1.45$ %TEI, 95 % CI = −2·06, −0·85 %TEI). No significant associations between other nutrients and the patterns of food preparation were observed.

Table 3 shows the associations between mean daily intake of some IAN-AF 2015–2016 food and beverage groups, the HES and the patterns of food preparation among children and adolescents in Portugal, taking the pattern of preparation *At home* as reference. Adjusted results show that non-adults in the pattern *By food retail* (including food consumed in natura) have significant positive associations for daily intakes of dairy products ($\beta = 80.4$ g, 95 % CI = 40·4, 120·3 g), salty snacks ($\beta = 14.9$ g, 95 % CI = 4·1, 25·7 g),

Table 2. Associations between mean daily intake of energy and nutrients and the patterns of food preparation in children and adolescents, weighted for the distribution of the Portuguese population (Mean values with their standard errors; standardised beta coefficient and 95 % confidence intervals)

			Children and adolescents (3–17 years)			
			Crude model		Adjusted model*	
	Mean	SE	β	95 % CI	β	95 % CI
Energy (kcal)	**1906**	**24**				
At home	1918	57	ref		ref	
By food retail (including food consumed in natura)	1859	57	20	−89, 128	65	−35, 166
By restaurants, canteens and other away-from-home establishments	1921	34	84	−12, 180	**166**	**77, 256**
Protein (%TEI)	**17·4**	**0·16**				
At home	18·8	0·50	ref		ref	
By food retail (including food consumed in natura)	16·9	0·34	**−1·79**	**−2·46, −1·12**	**−1·82**	**−2·50, −1·14**
By restaurants, canteens and other away-from-home establishments	17·3	0·17	**−1·48**	**−2·07, −0·88**	**−1·45**	**−2·06, −0·85**
Fat (%TEI)	**30·0**	**0·24**				
At home	30·5	0·65	ref		ref	
By food retail (including food consumed in natura)	30·2	0·55	0·36	−0·74, 1·46	0·61	−0·50, 1·71
By restaurants, canteens and other away-from-home establishments	29·7	0·37	−0·31	−1·28, 0·66	−0·01	−0·99, 0·98
SFA (%TEI)	**10·7**	**0·13**				
At home	10·5	0·31	ref		ref	
By food retail (including food consumed in natura)	11·2	0·29	**0·84**	**0·34, 1·35**	**0·91**	**0·40, 1·42**
By restaurants, canteens and other away-from-home establishments	10·5	0·19	0·23	−0·21, 0·68	0·32	−0·13, 0·78
Trans fatty acids (%TEI)	**0·5**	**0·02**				
At home	0·5	0·03	ref		ref	
By food retail (including food consumed in natura)	0·6	0·04	**0·14**	**0·06, 0·21**	**0·14**	**0·06, 0·21**
By restaurants, canteens and other away-from-home establishments	0·5	0·02	0·03	−0·04, 0·09	0·03	−0·03, 0·10
Total carbohydrate (%TEI)	**50·6**	**0·29**				
At home	48·7	0·66	ref		ref	
By food retail (including food consumed in natura)	51·1	0·67	**1·64**	**0·45, 2·84**	**1·43**	**0·23, 2·63**
By restaurants, canteens and other away-from-home establishments	50·9	0·39	**1·82**	**0·77, 2·88**	**1·52**	**0·45, 2·59**
Free sugars (%TEI)	**11·9**	**0·28**				
At home	9·9	0·54	ref		ref	
By food retail (including food consumed in natura)	14·5	0·71	**3·19**	**2·00, 4·38**	**3·34**	**2·14, 4·53**
By restaurants, canteens and other away-from-home establishments	11·4	0·33	0·82	−0·24, 1·87	1·01	−0·05, 2·08
			Model 1**		Model 2**	
Fibre (g)	**16**	**0·3**				
At home	16	0·6	ref		ref	
By food retail (including food consumed in natura)	14	0·6	**−1·6**	**−2·4, −0·8**	**−1·7**	**−2·5, −0·8**
By restaurants, canteens and other away-from-home establishments	17	0·3	0·2	−0·5, 1·0	0·1	−0·7, 0·8
Sodium (mg)	**2789**	**45**				
At home	2994	107	ref		ref	
By food retail (including food consumed in natura)	2559	97	**−207**	**−334, −81**	**−181**	**−308, −54**
By restaurants, canteens and other away-from-home establishments	2824	59	**−114**	**−226, −2**	−73	−187, 41

β, standardised beta coefficient; %TEI, percentage of total energy intake; g, grams; mg, milligrams.
*Model adjusted to sex, age group, area of residence and parents' education.
**For fibre and sodium, model 1 was adjusted for total energy intake, and model 2 was adjusted additionally for sex, age group, area of residence and parents' education.
The boldface highlights the statistically significant results for the associations under study.

Table 3. Associations between mean daily intake of some IAN-AF 2015–2016 food and beverage groups, the Healthy Eating Score (HES) and the patterns of food preparation in children and adolescents, weighted for the distribution of the Portuguese population (Mean values with their standard errors; standardised beta coefficient and 95 % confidence intervals)

			Children and adolescents (3–17 years)			
			Crude model		Adjusted model*	
	Mean	SE	β	95 % CI	β	95 % CI
FV (g)	**264**	**6**				
At home	281	20	ref		ref	
By food retail (including food consumed in natura)	211	14	**−42·1**	**−73·1, −11·1**	**−49·5**	**−79·4, −19·6**
By restaurants, canteens and other away-from-home establishments	279	8	5·9	−21·4, 33·3	−8·4	−35·2, 18·3
Cereals and potatoes (g)	**286**	**6**				
At home	336	15	ref		ref	
By food retail (including food consumed in natura)	239	12	**−79·1**	**−102·6, −55·5**	**−79·3**	**−98·3, −60·3**
By restaurants, canteens and other away-from-home establishments	291	8	**−25·7**	**−46·6, −4·9**	**−32·2**	**−49·2, −15·2**
Dairy products (g)	**346**	**9**				
At home	297	19	ref		ref	
By food retail (including food consumed in natura)	368	19	**102·1**	**60·7, 143·4**	**80·4**	**40·4, 120·3**
By restaurants, canteens and other away-from-home establishments	350	12	**85·5**	**48·9, 122·1**	**53·7**	**17·9, 89·4**
White meat, fish and eggs (g)	**84**	**3**				
At home	114	9	ref		ref	
By food retail (including food consumed in natura)	75	7	**−30·9**	**−43·6, −18·1**	**−31·4**	**−43·9, −19·0**
By restaurants, canteens and other away-from-home establishments	80	3	**−26·5**	**−37·8, −15·2**	**−28·4**	**−39·6, −17·3**
Red meat and processed meat (g)	**76**	**3**				
At home	77	8	ref		ref	
By food retail (including food consumed in natura)	70	5	−8·7	−21·2, 3·8	−5·9	−17·4, 5·6
By restaurants, canteens and other away-from-home establishments	77	4	−3·4	−14·5, 7·6	−1·0	−11·3, 9·3
Salty snacks (g)	**32**	**3**				
At home	18	4	ref		ref	
By food retail (including food consumed in natura)	39	6	**15·3**	**4·1, 26·6**	**14·9**	**4·1, 25·7**
By restaurants, canteens and other away-from-home establishments	32	4	**10·3**	**0·3, 20·2**	9·5	−0·2, 19·2
SSB (g)	**211**	**10**				
At home	158	20	ref		ref	
By food retail (including food consumed in natura)	305	28	**103·2**	**59·4, 147·0**	**112·3**	**72·1, 152·6**
By restaurants, canteens and other away-from-home establishments	189	12	12·4	−26·4, 51·1	18·4	−17·6, 54·5
Sugar and honey (g)	**1·9**	**0·17**				
At home	1·4	0·36	ref		ref	
By food retail (including food consumed in natura)	2·8	0·46	0·21	−0·64, 1·05	0·33	−0·51, 1·17
By restaurants, canteens and other away-from-home establishments	1·7	0·19	−0·32	−1·07, 0·43	−0·33	−1·02, 0·49
Sweets (g)	**104**	**3**				
At home	93	9	ref		ref	
By food retail (including food consumed in natura)	106	7	**16·0**	**1·7, 30·4**	**14·1**	**1·5, 26·7**
By restaurants, canteens and other away-from-home establishments	106	4	**16·6**	**3·9, 29·3**	9·5	−1·8, 20·1
HES	**20**	**0·2**				
At home	22	0·3	ref		ref	
By food retail (including food consumed in natura)	19	0·4	**−2·2**	**−2·8, −1·5**	**−1·8**	**−2·4, −1·2**
By restaurants, canteens and other away-from-home establishments	20	0·2	**−1·3**	**−1·9, −0·7**	**−0·7**	**−1·3, −0·2**

β, standardised beta coefficient; g, grams; FV, fresh fruits, vegetables and legumes; SSB, nectars and soft drinks.
*Model adjusted to total energy intake, sex, age group, area of residence and parents' education.
The boldface highlights the statistically significant results for the associations under study.

SSB ($\beta = 112.3$ g, 95 % CI = 72.1, 152.6 g) and sweets ($\beta = 14.1$ g, 95 % CI = 1.5, 26.7 g) and significant negative associations for daily intake of FV ($\beta = -49.5$ g, 95 % CI = −79.4, −19.6 g), cereals and potatoes ($\beta = -79.3$ g, 95 % CI = −98.3, −60.3 g) as well as white meat, fish and eggs ($\beta = -31.4$ g/d, 95 % CI = −43.9, −19.0 g). Furthermore, non-adults in the pattern *By restaurants, canteens and other away-from-home establishments* have a significant positive association for daily intake of dairy products ($\beta = 53.7$ g, 95 % CI = 17.9, 89.4 g) and significant negative associations for daily intake of cereals and potatoes ($\beta = -32.2$ g, 95 % CI = −49.2, −15.2 g) and white meat, fish and eggs ($\beta = -28.4$ g, 95 % CI = −39.6, −17.3 g). No significant associations between other food groups and the patterns of food preparation were observed.

Finally, both children and adolescents falling the pattern *By food retail (including food consumed in natura)* or the pattern *By restaurants, canteens and other away-from-home establishments* have significant negative association for HES (respectively, $\beta = -1.8$, 95 % CI = −2.4, −1.2 and $\beta = -0.7$, 95 % CI = −1.3, −0.2).

Dietary intake according to patterns of food preparation in adults and elderly

Table 4 shows the associations between mean daily intake of energy and nutrients and the patterns of food preparation among adults and elderly in Portugal, taking the pattern of preparation *At home by themselves* as reference. Adjusted results show that all adults in the pattern *At home by relatives or friends* have significant positive associations for daily intakes of fat ($\beta = 0.92$ %TEI, 95 % CI = 0.13, 1.71 %TEI), saturated and trans fatty acids (respectively, $\beta = 0.61$ %TEI, 95 % CI = 0.26, 0.96 %TEI and $\beta = 0.05$ %TEI, 95 % CI = 0.02, 0.08 %TEI) and free sugars ($\beta = 1.02$ %TEI, 95 % CI = 0.35, 1.68 %TEI) and a significant negative association for daily intake of fibre ($\beta = -1.4$ g, 95 % CI = −2.0, −0.7 g). Those in the pattern *By food retail (including food consumed in natura)* have significant positive associations for saturated and trans fatty acids (respectively, $\beta = 0.82$ %TEI, 95 % CI = 0.54, 1.11 %TEI and $\beta = 0.08$ %TEI, 95 % CI = 0.05, 0.11 %TEI), total carbohydrate ($\beta = 1.00$ %TEI, 95 % CI = 0.19, 1.80 %TEI) and free sugars ($\beta = 1.95$ %TEI, 95 % CI = 1.41, 2.50 %TEI) and significant negative associations for daily intakes of protein ($\beta = -0.43$ %TEI, 95 % CI = −0.84, −0.01 %TEI), fibre ($\beta = -1.3$ g, 95 % CI = −1.9, −0.8 g) and sodium ($\beta = -123$ mg, 95 % CI = −200, −46 mg). Additionally, adults and elderly in the pattern *By restaurants, canteens and other away-from-home establishments* have significant positive associations for daily intakes of energy ($\beta = 95$ kcal, 95 % CI = 37, 153 kcal), fat ($\beta = 1.53$ %TEI, 95 % CI = 0.90, 2.15 %TEI), saturated and trans fatty acids (respectively, $\beta = 0.98$ %TEI, 95 % CI = 0.70, 1.26 %TEI and $\beta = 0.05$ %TEI, 95 % CI = 0.02, 0.08 %TEI) and free sugars ($\beta = 1.74$ %TEI, 95 % CI = 1.26, 2.31 %TEI) and significant negative associations for daily intakes of total carbohydrate ($\beta = -1.65$ %TEI, 95 % CI = −2.43, −0.87 %TEI) and fibre ($\beta = -2.2$ g, 95 % CI = −2.7, −1.6 g). No significant associations between other nutrients and the patterns of food preparation were observed.

Tables 5 and 6 show the associations between mean daily intake of some IAN-AF 2015–2016 food and beverage groups, consuming alcoholic beverages, the HES and the patterns of food preparation among adults and elderly in Portugal, taking the pattern of preparation *At home by themselves* as reference. Adjusted results show that adults in the pattern *At home by relatives or friends* have a significant positive association for daily intake of SSB ($\beta = 25.7$ g, 95 % CI = 4.7, 46.7 g) and a significant negative association for

daily intake of FV ($\beta = -49.1$ g, 95 % CI = −73.0, −25.2 g). Adults in the pattern *By food retail (including food consumed in natura)* have significant positive associations for daily intake of dairy products ($\beta = 81.7$ g, 95 % CI = 64.6, 98.8 g), SSB ($\beta = 56.0$ g, 95 % CI = 38.8, 73.1 g) and sweets ($\beta = 12.4$ g, 95 % CI = 6.2, 18.4 g) and significant negative association for daily intake of FV ($\beta = -37.8$ g, 95 % CI = −57.3, −18.2 g), cereals and potatoes ($\beta = -54.1$ g, 95 % CI = −65.0, −43.3 g) and white meat, fish and eggs ($\beta = -13.7$ g, 95 % CI = −21.7, −5.6 g). Moreover, those in the pattern *By restaurants, canteens and other away-from-home establishments* have significant positive associations for daily intake of red and processed meat ($\beta = 9.1$ g, 95 % CI = 2.5, 15.6 g), salty snacks ($\beta = 11.6$ g, 95 % CI = 6.7, 16.5 g), SSB ($\beta = 56.2$ g, 95 % CI = 39.6, 72.9 g) and sweets ($\beta = 9.6$ g, 95 % CI = 3.5, 15.6 g) and significant negative associations for daily intake of FV ($\beta = -68.8$ g, 95 % CI = −87.8, −49.9 g) and cereals and potatoes ($\beta = -48.0$ g, 95 % CI = −58.4, −37.4 g). These adults and elderly also have significant higher odds of consuming alcoholic beverages such as spirits and liquors (OR = 1.82, 95 % CI = 1.11, 2.99). No significant associations between other food groups and the patterns of food preparation were observed.

Lastly, all adults falling the pattern *At home by relatives or friends*, the pattern *By food retail (including food consumed in natura)* or the pattern *By restaurants, canteens and other away-from-home establishments* have significant negative association for HES (respectively, $\beta = -0.5$, 95 % CI = −0.8, −0.1 and $\beta = -0.5$, 95 % CI = −0.8, −0.2 and $\beta = -1.2$, 95 % CI = −1.5, −0.9).

Discussion

Studies exploring dietary intakes based on distinct patterns of food preparation are still scarce, especially those using national representative samples covering children and adult diets[26,28–30]. Therefore, the present study represents an important attempt to close this gap by performing a cross-sectional analysis of the IAN-AF 2015/2016 data to investigate associations between dietary intakes and patterns of food preparation, previously uncovered in the Portuguese population[32]. Its findings indicate that children and adolescents eating more foods prepared or acquired from food retail operators have higher intakes of saturated and trans fatty acids, total carbohydrate and free sugars and lower intakes of protein, fibre and sodium than those eating more foods prepared at home. Moreover, they have higher intakes of dairy products, salty snacks, SSB and sweets and lower intakes of FV, cereals and potatoes, white meat, fish and eggs. Similarly, children and adolescents eating more foods prepared by restaurants, canteens and other foodservice establishments have higher intakes of energy and total carbohydrate and lower intakes of protein. They also have higher intakes of dairy products and lower intakes of cereals and potatoes, white meat, fish and eggs. In children (aged 5–12 years) from the Republic of Ireland, the findings are comparable: the percentage of energy from protein was significantly higher at home, while the percentage of energy from fat was significantly higher outside the home[28]. Additionally, they have significantly higher intakes of fibre at home than at other people's homes or outside the home[28]. In the United Kingdom, children (aged 1·5–18 years) eating takeaway meals at home at least weekly have significantly higher intakes of energy than those eating takeaway meals at home rarely; however, the same association was not found regarding the frequency of consumption of meals out[26].

The results of the present study also indicate that adults and elderly eating more foods prepared at home by relatives or friends

Table 4. Associations between mean daily intake of energy and nutrients and the patterns of food preparation in adults and elderly, weighted for the distribution of the Portuguese population (Mean values with their standard errors; standardised beta coefficient and 95 % confidence intervals)

			Adults and elderly (18–84 years)			
			Crude model		Adjusted model*	
	Mean	SE	β	95 % CI	β	95 % CI
Energy (kcal)	**1895**	**19**				
At home by themselves	1680	32	ref		ref	
At home by relatives or friends	2104	55	**372**	**294, 450**	35	−38, 108
By food retail (including food consumed in natura)	1750	28	**87**	**21, 152**	−54	−114, 6
By restaurants, canteens and other away-from-home establishments	2005	29	**332**	**272, 393**	**95**	**37, 153**
Protein (%TEI)	**18·3**	**0·13**				
At home by themselves	18·0	0·27	ref		ref	
At home by relatives or friends	18·5	0·23	**0·50**	**0·01, 0·99**	0·19	−0·31, 0·70
By food retail (including food consumed in natura)	17·9	0·23	−0·20	−0·61, 0·21	**−0·43**	**−0·84, −0·01**
By restaurants, canteens and other away-from-home establishments	18·5	0·18	**0·42**	**0·04, 0·80**	−0·02	−0·42, 0·39
Fat (%TEI)	**29·7**	**0·24**				
At home by themselves	28·8	0·50	ref		ref	
At home by relatives or friends	29·5	0·54	0·59	−0·18, 1·36	**0·92**	**0·13, 1·71**
By food retail (including food consumed in natura)	28·8	0·36	0·60	−0·04, 1·25	0·22	−0·42, 0·87
By restaurants, canteens and other away-from-home establishments	30·7	0·30	**2·23**	**1·63, 2·83**	**1·53**	**0·90, 2·15**
SFA (%TEI)	**9·4**	**0·09**				
At home by themselves	8·4	0·16	ref		ref	
At home by relatives or friends	9·3	0·23	**0·52**	**0·17, 0·86**	**0·61**	**0·26, 0·96**
By food retail (including food consumed in natura)	9·5	0·15	**1·01**	**0·72, 1·30**	**0·82**	**0·54, 1·11**
By restaurants, canteens and other away-from-home establishments	9·9	0·12	**1·32**	**1·06, 1·59**	**0·98**	**0·70, 1·26**
Trans fatty acids (%TEI)	**0·4**	**0·01**				
At home by themselves	0·3	0·01	ref		ref	
At home by relatives or friends	0·4	0·02	**0·05**	**0·02, 0·09**	**0·05**	**0·02, 0·08**
By food retail (including food consumed in natura)	0·4	0·01	**0·10**	**0·07, 0·13**	**0·08**	**0·05, 0·11**
By restaurants, canteens and other away-from-home establishments	0·4	0·01	**0·09**	**0·06, 0·11**	**0·05**	**0·02, 0·08**
Total carbohydrate (%TEI)	**46·1**	**0·28**				
At home by themselves	47·2	0·57	ref		ref	
At home by relatives or friends	45·5	0·59	**−1·82**	**−2·78, −0·86**	−0·09	−1·07, 0·90
By food retail (including food consumed in natura)	48·4	0·48	0·31	−0·5, 1·11	**1·00**	**0·19, 1·80**
By restaurants, canteens and other away-from-home establishments	44·5	0·35	**−2·90**	**−3·65, −2·16**	**−1·65**	**−2·43, −0·87**
Free sugars (%TEI)	**7·7**	**0·14**				
At home by themselves	6·1	0·26	ref		ref	
At home by relatives or friends	7·0	0·37	**0·78**	**0·13, 1·43**	**1·02**	**0·35, 1·68**
By food retail (including food consumed in natura)	8·5	0·30	**2·17**	**1·62, 2·71**	**1·95**	**1·41, 2·50**
By restaurants, canteens and other away-from-home establishments	8·2	0·22	**2·17**	**1·67, 2·68**	**1·79**	**1·26, 2·31**
			Model 1**		Model 2**	
Fibre (g)	**18**	**0·2**				
At home by themselves	18	0·4	ref		ref	
At home by relatives or friends	19	0·5	**−1·7**	**−2·4, −1·1**	**−1·4**	**−2·0, −0·7**
By food retail (including food consumed in natura)	18	0·4	**−1·5**	**−2·0, −0·9**	**−1·3**	**−1·9, −0·8**
By restaurants, canteens and other away-from-home establishments	18	0·3	**−2·3**	**−2·8, −1·8**	**−2·2**	**−2·7, −1·6**

(Continued)

Table 4. (*Continued*)

			Adults and elderly (18–84 years)			
			Crude model		Adjusted model*	
	Mean	SE	β	95 % CI	β	95 % CI
Sodium (mg)	**3179**	**40**				
At home by themselves	2952	69	ref		ref	
At home by relatives or friends	3616	109	3	–88, 95	–29	–124, 65
By food retail (including food consumed in natura)	2858	60	**–128**	**–204, –52**	**–123**	**–200, –46**
By restaurants, canteens and other away-from-home establishments	3321	61	–63	–135, 8	–55	–130, 20

β, standardised beta coefficient; %TEI, percentage of Total Energy Intake; g, grams; mg, milligrams.
*Model adjusted to sex, age group, area of residence and education.
**For fibre and sodium, models 1 were adjusted for total energy intake and models 2 were adjusted additionally for sex, age group, area of residence and education.
The boldface highlights the statistically significant results for the associations under study.

Table 5. Associations between mean daily intake of some IAN-AF 2015–2016 food and beverage groups, the Healthy Eating Score (HES) and the patterns of food preparation in adults and elderly, weighted for the distribution of the Portuguese population (Mean values with their standard errors; standardised beta coefficient and 95 % confidence intervals)

			Adults and elderly (18–84 years)			
			Crude model		Adjusted model*	
	Mean	SE	β	95 % CI	β	95 % CI
FV (g)	**368**	**6**				
At home by themselves	398	10	ref		ref	
At home by relatives or friends	386	15	**–25·4**	**–49·1, –1·6**	**–49·1**	**–73·0, –25·2**
By food retail (including food consumed in natura)	368	11	**–33·8**	**–53·8, –13·9**	**–37·8**	**–57·3, –18·2**
By restaurants, canteens and other away-from-home establishments	349	8	**–50·8**	**–69·2, –32·2**	**–68·8**	**–87·8, –49·9**
Cereals and potatoes (g)	**297**	**5**				
At home by themselves	306	10	ref		ref	
At home by relatives or friends	380	13	**64·6**	**48·0, 81·3**	7·2	–6·0, 20·5
By food retail (including food consumed in natura)	257	5	**–47·4**	**–61·4, –33·5**	**–54·1**	**–65·0, –43·3**
By restaurants, canteens and other away-from-home establishments	290	6	**–13·1**	**–26·0, –0·1**	**–48·0**	**–58·4, –37·4**
Dairy products (g)	**224**	**5**				
At home by themselves	195	8	ref		ref	
At home by relatives or friends	194	11	–8·6	–29·2, 12·0	–11·4	–32·3, 9·5
By food retail (including food consumed in natura)	283	11	**85·1**	**67·9, 102·4**	**81·7**	**64·6, 98·8**
By restaurants, canteens and other away-from-home establishments	212	6	8·2	–7·8, 24·2	–9·6	–26·2, 6·9
White meat, fish and eggs (g)	**109**	**2**				
At home by themselves	107	5	ref		ref	
At home by relatives or friends	125	7	**24·4**	**14·5, 34·3**	3·8	–6·0, 13·6
By food retail (including food consumed in natura)	90	4	–7·9	–16·2, 0·4	**–13·7**	**–21·7, –5·6**
By restaurants, canteens and other away-from-home establishments	114	3	**15·3**	**7·6, 23·0**	–0·9	–8·7, 6·9
Red meat and processed meat (g)	**80**	**2**				
At home by themselves	58	3	ref		ref	
At home by relatives or friends	99	5	**31·6**	**22·7, 40·5**	5·4	–2·9, 13·6
By food retail (including food consumed in natura)	60	3	0·7	–6·7, 8·2	–6·4	–13·1, 0·4
By restaurants, canteens and other away-from-home establishments	94	3	**29·7**	**22·8, 36·6**	**9·1**	**2·5, 15·6**
Salty snacks (g)	**23**	**1**				
At home by themselves	13	2	ref		ref	
At home by relatives or friends	19	5	4·9	–1·1, 11·0	1·3	–4·8, 7·5

(*Continued*)

Table 5. (Continued)

| | | | Adults and elderly (18–84 years) | | | |
| | | | Crude model | | Adjusted model[*] | |
	Mean	SE	β	95 % CI	β	95 % CI
By food retail (including food consumed in natura)	18	2	**7·7**	**2·6, 12·8**	4·6	−0·4, 9·6
By restaurants, canteens and other away-from-home establishments	31	2	**20·4**	**15·7, 25·2**	**11·6**	**6·7, 16·5**
SSB (g)	**102**	**5**				
At home by themselves	32	4	ref		ref	
At home by relatives or friends	108	15	**66·5**	**45·3, 87·7**	**25·7**	**4·7, 46·7**
By food retail (including food consumed in natura)	105	11	**73·0**	**55·2, 90·7**	**56·0**	**38·8, 73·1**
By restaurants, canteens and other away-from-home establishments	129	8	**98·1**	**81·6, 114·6**	**56·2**	**39·6, 72·9**
Sugar and honey (g)	**7·3**	**0·29**				
At home by themselves	7·4	0·54	ref		ref	
At home by relatives or friends	7·6	0·65	**1·36**	**0·29, 2·43**	0·68	−0·41, 1·78
By food retail (including food consumed in natura)	7·2	0·48	−0·07	−0·96, 0·82	0·12	−0·78, 1·01
By restaurants, canteens and other away-from-home establishments	7·3	0·41	0·31	−0·52, 1·14	0·16	−0·71, 1·02
Sweets (g)	**69**	**2**				
At home by themselves	47	3	ref		Ref	
At home by relatives or friends	69	6	**9·8**	**1·6, 18·0**	3·7	−3·9, 11·4
By food retail (including food consumed in natura)	69	3	**17·3**	**10·4, 24·2**	**12·4**	**6·2, 18·6**
By restaurants, canteens and other away-from-home establishments	79	3	**26·8**	**20·4, 33·1**	**9·6**	**3·5, 15·6**
HES	**20**	**0·1**				
At home by themselves	21	0·2	ref		Ref	
At home by relatives or friends	21	0·2	0·0	−0·3, 0·4	**−0·5**	**−0·8, −0·1**
By food retail (including food consumed in natura)	20	0·2	−0·2	−0·6, 0·1	**−0·5**	**−0·8, −0·2**
By restaurants, canteens and other away-from-home establishments	20	0·1	**−0·5**	**−0·8, 0·3**	**−1·2**	**−1·5, −0·9**

β, standardised beta coefficient; g, grams; FV, fresh fruits, vegetables and legumes; SSB, nectars and soft drinks.
*Model adjusted to total energy intake, sex, age group, area of residence and education.
The boldface highlights the statistically significant results for the associations under study.

have higher intakes of total fat, saturated and trans fatty acids and free sugars and lower intakes of fibre compared with adults and elderly eating more foods prepared at home by themselves. They also have higher intakes of SSB and lower intakes of FV. Furthermore, those eating more foods prepared or acquired from food retail operators have higher intakes of saturated and trans fatty acids, total carbohydrate and free sugars and lower intakes of protein, fibre and sodium, as well as higher intakes of dairy products, SSB and sweets and lower intakes of FV, cereals and potatoes, white meat, fish and eggs. Lastly, adults and elderly eating more foods prepared by restaurants, canteens and other foodservice establishments have higher intakes of energy, total fat, saturated and trans fatty acids and free sugars and lower intakes of total carbohydrate and fibre. They also have higher intakes of red and processed meat, salty snacks, SSB, sweets and alcoholic beverages such as spirits and liquors and lower intakes of FV and cereals and potatoes. Findings from other countries are quite comparable: in adults (aged ≥ 20 years) from the USA, cooking dinner at home rarely (0–1 times per week) is associated with higher intakes of energy, carbohydrates, fat and sugar but lower intakes of fibre than cooking dinner at home more frequently (6–7 times per week), and it is also associated with eating more fast-food meals as well as frozen/ready-to-eat meals[22]. In Korean adults (aged 20–64 years), eating two or more meals per day prepared outside home reflects into higher intakes of energy, protein and fat and lower intakes of fibre and micronutrients (such as phosphorus, potassium, niacin and vitamin C – highly presented in FV) than eating two or more meals per day prepared at home[24]. In the United Kingdom, adults (aged ≥ 18 years) who eat meals out or takeaway meals at home at least weekly have higher intakes of energy[26], while adults (aged 29–64 years) who eat home-cooked meals more frequently have higher intakes of fruit and vegetables[25]. In adults (aged 18–64 years) from the Republic of Ireland, eating more food prepared at home reflects into higher intakes of fibre, while eating more food prepared outside the home reflects into higher intakes of alcohol and a contribution of fat to energy above the recommendations[29,30].

Overall, in Portuguese children and adolescents, the pattern of food preparation associated with poorer diet quality was the pattern *By food retail* (including food consumed in natura), while in Portuguese adults and elderly, it was the pattern *By restaurants, canteens and other away-from-home establishments*. This study thus highlights that consuming food and beverages prepared away from home reflects in unhealthier and lower-quality diets among

Table 6. Associations between consuming alcoholic beverages and the patterns of food preparation in adults and elderly, weighted for the distribution of the Portuguese population (Numbers and percentages; odds ratios and 95 % confidence intervals)

| | Adults and elderly (18–84 years) | | | | | |
| | | | Crude model | | Adjusted model* | |
	n	%	OR	95 % CI	OR	95 % CI
All alcoholic beverages	**2849**	**74·0**				
At home by themselves	499	66·9	ref		ref	
At home by relatives or friends	427	82·8	**2·39**	**1·51, 3·77**	1·35	0·80, 2·25
By food retail (including food consumed in natura)	696	67·1	0·86	0·63, 1·15	0·77	0·57, 1·06
By restaurants, canteens and other away-from-home establishments	1227	79·1	**1·67**	**1·22, 2·29**	1·22	0·88, 1·71
Wine	**2661**	**69·1**				
At home by themselves	477	63·9	ref		ref	
At home by relatives or friends	413	80·0	**2·18**	**1·38, 3·43**	1·46	0·89, 2·40
By food retail (including food consumed in natura)	644	62·0	0·86	0·65, 1·15	0·83	0·61, 1·13
By restaurants, canteens and other away-from-home establishments	1127	72·6	**1·41**	**1·05, 1·88**	1·19	0·87, 1·61
Beer	**616**	**16·0**				
At home by themselves	59	7·9	ref		ref	
At home by relatives or friends	92	17·8	**2·13**	**1·30, 3·49**	0·79	0·46, 1·35
By food retail (including food consumed in natura)	149	14·4	1·26	0·78, 2·04	0·94	0·57, 1·57
By restaurants, canteens and other away-from-home establishments	316	20·4	**2·66**	**1·71, 4·15**	1·41	0·88, 2·26
Other alcoholic beverages	**506**	**13·1**				
At home by themselves	61	8·2	ref		ref	
At home by relatives or friends	69	13·4	**2·46**	**1·28, 4·73**	1·57	0·70, 3·53
By food retail (including food consumed in natura)	109	10·5	1·30	0·82, 2·07	1·12	0·68, 1·84
By restaurants, canteens and other away-from-home establishments	267	17·2	**2·64**	**1·72, 4·04**	**1·82**	**1·11, 2·99**

n, absolute frequency; %, relative frequency.
*Model adjusted to total energy intake, sex, age group, area of residence and education.
The boldface highlights the statistically significant results for the associations under study.

Portuguese non-adults and adults. Evidence from other countries with adult populations support our findings: in adults (aged ≥ 20 years) from the USA, cooking more frequently at home is associated with higher Healthy Eating Index-2015 score[23], and in adults (aged ≥ 19 years) from the United Kingdom, eating more home-prepared food is associated with higher odds of being in the quintile most accordant with the Dietary Approaches to Stopping Hypertension (DASH) diet[27]. Also, in a population-based cohort study of adults (aged 29–64 years) from the United Kingdom, eating more frequently home-cooked meals is associated with higher adherence to DASH and Mediterranean diets[25]. Nevertheless, as far as authors know, there is a lack of evidence regarding associations between patterns of food preparation and diet-quality scores (such as Healthy Eating Index-2015 score, DASH and Mediterranean Diet Score) in nationwide non-adult populations.

Strengths and limitations

This study used data from a representative sample, enabling a wider application of the findings. It is important to note that the data used was gathered by the IAN-AF 2015/2016, which might not accurately portray the current dietary status of the Portuguese population. Still, these data remain the most recent and comprehensive dietary data that are available for the country. Furthermore, despite the potential for residual confounding, regression models were adjusted to account for several relevant potential confounders.

Conclusion

Eating more foods prepared at home is associated with healthier and higher-quality dietary intakes; however, within the Portuguese population, the consumption of food prepared away from home prevails. Overall, eating more foods prepared away from home is associated with higher intakes of energy, saturated and trans fatty acids and free sugars and lower intakes of protein, fibre and sodium. It is also associated with higher intakes of dairy products, salty snacks, SSB and sweets and with lower intakes of FV, cereals and potatoes and white meat, fish and eggs. Moreover, in adults and elderly, it is associated with higher intakes of red meat and processed meat as well as alcoholic beverages such as spirits and liquors. Hence, in upcoming public health nutrition initiatives and dietary guidelines, there should be a greater emphasis on advocating for home cooking as a way of fostering healthier dietary choices as well as on ensuring the nutritional quality of food service meals, which could be much improved, for situations when it is not possible to cook and eat meals at home.

References

1. GBD 2017 Diet Collaborators (2019) Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* **393**, 1958–1972.
2. Roth GA, Abate D, Abate KH, *et al.* (2018) Global, regional, and national age-sex-specific mortality for 282 causes of death in 195 countries and territories, 1980–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* **392**, 1736–1788.
3. Fanzo J & Davis C (2019) Can diets be healthy, sustainable, and equitable? *Curr Obes Rep* **8**, 495–503.
4. Möser A (2010) Food preparation patterns in German family households. An econometric approach with time budget data. *Appetite* **55**, 99–107.
5. Smith LP, Ng SW & Popkin BM (2013) Trends in US home food preparation and consumption: analysis of national nutrition surveys and time use studies from 1965–1966 to 2007–2008. *Nutr J* **12**, 45.
6. Díaz-Méndez C & García-Espejo I (2014) Eating practice models in Spain and the United Kingdom: a comparative time-use analysis. *Int J Comp Sociol* **55**, 24–44.
7. Lachat C, Nago E, Verstraeten R, *et al.* (2012) Eating out of home and its association with dietary intake: a systematic review of the evidence. *Obes Rev* **13**, 329–346.
8. Gesteiro E, García-Carro A, Aparicio-Ugarriza R, *et al.* (2022) Eating out of home: influence on nutrition, health, and policies: a scoping review. *Nutrients* **14**, 1265.
9. Naska A, Katsoulis M, Orfanos P, *et al.* (2015) Eating out is different from eating at home among individuals who occasionally eat out. A cross-sectional study among middle-aged adults from eleven European countries. *Br J Nutr* **113**, 1951–1964.
10. Orfanos P, Naska A, Trichopoulou A, *et al.* (2009) Eating out of home: energy, macro- and micronutrient intakes in 10 European countries. The European Prospective Investigation into Cancer and Nutrition. *Eur J Clin Nutr* **63**, S239–S262.
11. Orfanos P, Naska A, Rodrigues S, *et al.* (2017) Eating at restaurants, at work or at home. Is there a difference? A study among adults of 11 European countries in the context of the HECTOR* project. *Eur J Clin Nutr* **71**, 407–419.
12. Orfanos P, Naska A, Trichopoulos D, *et al.* (2007) Eating out of home and its correlates in 10 European countries. The European Prospective Investigation into Cancer and Nutrition (EPIC) study. *Public Health Nutr* **10**, 1515–1525.
13. Jekanowski MD (1999) Causes and consequences of fast food sales growth. *Food Rev* **22**, 11–16.
14. Guthrie JF, Lin BH & Frazao E (2002) Role of food prepared away from home in the American diet, 1977–1978 *v.* 1994–1996: changes and consequences. *J Nutr Educ Behav* **34**, 140–150.
15. Virudachalam S, Long JA, Harhay MO, *et al.* (2014) Prevalence and patterns of cooking dinner at home in the USA: National Health and Nutrition Examination Survey (NHANES) 2007–2008. *Public Health Nutr* **17**, 1022–1030.
16. Powell LM, Nguyen BT & Han E (2012) Energy intake from restaurants: demographics and socioeconomics, 2003–2008. *Am J Prev Med* **43**, 498–504.
17. Choi I, Kim WG & Yoon J (2017) Energy intake from commercially-prepared meals by food source in Korean adults: analysis of the 2001 and 2011 Korea National Health and Nutrition Examination Surveys. *Nutr Res Pract* **11**, 155–162.
18. Méjean C, Lampuré A, Si Hassen W, *et al.* (2018) Influence of food preparation behaviors on 5-year weight change and obesity risk in a French prospective cohort. *Int J Behav Nutr Phys Act* **15**, 120.
19. Méjean C, Si Hassen W, Gojard S, *et al.* (2017) Social disparities in food preparation behaviours: a DEDIPAC study. *Nutr J* **16**, 62.
20. Mills S, Adams J, Wrieden W, *et al.* (2018) Sociodemographic characteristics and frequency of consuming home-cooked meals and meals from out-of-home sources: cross-sectional analysis of a population-based cohort study. *Public Health Nutr* **21**, 2255–2266.
21. Adams J, Goffe L, Brown T, *et al.* (2015) Frequency and socio-demographic correlates of eating meals out and take-away meals at home: cross-sectional analysis of the UK national diet and nutrition survey, waves 1–4 (2008–2012). *Int J Behav Nutr Phys Act* **12**, 51.
22. Wolfson JA & Bleich SN (2015) Is cooking at home associated with better diet quality or weight-loss intention? *Public Health Nutr* **18**, 1397–1406.
23. Wolfson JA, Leung CW & Richardson CR (2020) More frequent cooking at home is associated with higher Healthy Eating Index-2015 score. *Public Health Nutr* **23**, 2384–2394.
24. Lee KW, Song WO & Cho MS (2016) Dietary quality differs by consumption of meals prepared at home *v.* outside in Korean adults. *Nutr Res Pract* **10**, 294–304.
25. Mills S, Brown H, Wrieden W, *et al.* (2017) Frequency of eating home cooked meals and potential benefits for diet and health: cross-sectional analysis of a population-based cohort study. *Int J Behav Nutr Phys Act* **14**, 109.
26. Goffe L, Rushton S, White M, *et al.* (2017) Relationship between mean daily energy intake and frequency of consumption of out-of-home meals in the UK National Diet and Nutrition Survey. *Int J Behav Nutr Phys Act* **14**, 131.
27. Clifford Astbury C, Penney TL & Adams J (2019) Home-prepared food, dietary quality and socio-demographic factors: a cross-sectional analysis of the UK National Diet and nutrition survey 2008–2016. *Int J Behav Nutr Phys Act* **16**, 82.
28. Burke SJ, McCarthy SN, O'Neill JL, *et al.* (2007) An examination of the influence of eating location on the diets of Irish children. *Public Health Nutr* **10**, 599–607.

29. O'Dwyer NA, Gibney MJ, Burke SJ, *et al.* (2005) The influence of eating location on nutrient intakes in Irish adults: implications for developing food-based dietary guidelines. *Public Health Nutr* **8**, 258–265.

30. O'Dwyer NA, McCarthy SN, Burke SJ, *et al.* (2005) The temporal pattern of the contribution of fat to energy and of food groups to fat at various eating locations: implications for developing food-based dietary guidelines. *Public Health Nutr* **8**, 249–257.

31. Perista H, Cardoso A, Brázia A, *et al.* (2016) *The Use of Time by Men, Women in Portugal.* CESIS – Centro de Estudos para a Intervenção Social, CITE – Comissão para a Igualdade no Trabalho e no Emprego. https://www.cesis.org/admin/modulo_news/ficheiros_noticias/20170201143128-1inutbooken.pdf (accessed April 2024).

32. Rei M, Correia D, Torres D, *et al.* (2025) Patterns of food preparation in children and adult diets, and their associations with demographic and socio-economic characteristics, health and nutritional status, physical activity, and diet quality. *J Nutr Sci* **14**, e10.

33. Lopes C, Torres D, Oliveira A, *et al.* (2018) National Food, Nutrition, and Physical Activity Survey of the Portuguese General Population (2015–2016): protocol for design and development. *JMIR Res Protoc* **7**, e42.

34. INE (2014) Statistical Divisions – Classification of Urban Areas: Instituto Nacional de Estatística, Statistics Portugal. https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_cont_inst&INST=6251013&xlang=en (accessed April 2024).

35. Vilela S, Muresan I, Correia D, *et al.* (2020) The role of socio-economic factors in food consumption of Portuguese children and adolescents: results from the National Food, Nutrition and Physical Activity Survey 2015–2016. *Br J Nutr* **124**, 591–601.

36. Team RC (2020) *R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing.* Vienna, Austria: Team RC.

37. Lumley T (2004) Analysis of complex survey samples. *J Stat Softw* **9**, 1–19.