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Intermediate meals and the place of consumption - Which relationship?

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ABSTRACT

Introduction: The distribution of energy and nutrients in 4–6 daily meals may have beneficial health effects. The place where people have their meals is frequently identified as a determinant of food consumption.
Objectives: To evaluate the influence of the place where university employees, have their meals on the adequacy of intermediate meals.
Methods: Data collection was carried out in face-to-face interviews, by a nutritionist that inquired individuals following a 24h recall. Only regular intake days were considered. 399 individuals were surveyed, and data collection was carried out in a Portuguese Public University in the north of Portugal. All ethical procedures were considered and an ethical committee approved the research. Statistical analysis was conducted using SPSS software.
Results: It was observed a relationship between the place where first mid-afternoon meal ($p = 0.004$) and second mid-afternoon meal ($p = 0.006$) were eaten and the adequacy of its energy value. Either consumption at home or food brought from home contribute to a better adequacy of the energy value of meal evaluated.
Conclusion: The place where intermediate meals were eaten seems to influence their adequacy. Reason why it is important to carry out awareness actions related to the topic at workplace, to promote the health and well-being of employees.

1. Introduction

An active lifestyle along with a balanced healthy diet is essential for maintaining health and well-being at all ages (Ha and Kim, 2019). Food consumption is one of the various dimensions of lifestyle and can be an approach to promote health (Papakonstantinou E, Orfanakos N, Farajian P, Anastasia E, Makariti IP, Grivokostopoulos N et al., 2017). Nutritional intake is evaluated based on the average intake and allows the characterization of the diet of individuals (Gregório MJ, Tavares C, Cruz D, Graça P., 2017).

The World Health Organization (WHO) recommends an intake of 10–15% of Proteins, 15–30% of Lipids and 55–75% of Carbohydrates (Gregório MJ, Tavares C, Cruz D, Graça P., 2017). The distribution of energy and nutrients in 4–6 meals a day might have beneficial effects on health (Gregório MJ, Tavares C, Cruz D, Graça P., 2017), depending on the number of meals eaten (Preedy and Watson, 2015). Considering the total of 6 meals: about 20% of the total energy value should correspond to breakfast; 10% for a mid-morning snack; 30–35% to lunch; 10% for an afternoon snack; 20–25% to dinner; and finally 5% for a supper/evening meal (Preedy and Watson, 2015).

Some authors have verified that, in a healthy population, the consumption of 1–2 intermediate meals that are balanced from the energetic and nutritional points of view can help to complete the diet with foods rarely consumed at main meals, such as fruits, and foods rich in vitamins (e.g., folate, such as dark leafy greens, legumes or broccoli), minerals (e.g. nuts) and fibre (e.g. oatmeal) (Marangoni F, Martini D, Scaglioni S, Sculati M, Donini M, Leonardi F et al., 2019). In addition, snacks contribute also for controlling appetite and satiety, as well as eating behaviour, preventing individuals from consuming an excessive amount of food at subsequent meals and making food choices more conscious and healthier, so improving daily energy balance (Clayton ZS, Fusco E, Schreiber L, Carpenter JN, Hooshmand S, Hong MY et al., 2019; Leidy HJ, Todd CB, Zino AZ, Immel JE, Mukherjea R, Shafer RS et al., 2015; Papakonstantinou E, Orfanakos N, Farajian P, Anastasia E, Makariti IP,

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Grivokostopoulos N et al., 2017; Godwin N, Roberts T, Hooshmand S, Kern M, Hong MY., 2019).

The energetic value of foods is an independent variable of their level of satiety. Taking this into account, there is evidence that especially foods rich in protein and fibre have a higher level of satiety than foods high in fat and simple carbohydrates (Leidy HJ, Todd CB, Zino AZ, Immel JE, Mukherjea R, Shafer RS et al., 2015; Godwin N, Roberts T, Hooshmand S, Kern M, Hong MY., 2019; Njike VY, Smith TM, Shuval O, Shuval K, Edshteyn I, Kalantari V et al., 2016). The food composition of intermediate meals must be adapted to the individual's lifestyle (Bucher T, Hartmann C, Rollo ME, Collins CE., 2017). The type and amount of food should be balanced since both influence the energy and nutritional adequacy of the meal (Marangoni F, Martini D, Scaglioni S, Sculati M, Donini M, Leonardi F et al., 2019; Bucher T, Hartmann C, Rollo ME, Collins CE., 2017), which can influence satiety and therefore subsequent intake (Hull S, Re R, Chambers L, Echaniz A, Wickham MSJ., 2015).

Despite some inconsistent results considering the snacks consumption, the position of some reviews is that at environments where overweight and obesity predominate snacking is a cause of concern due to its inadequacy (Bucher T, Hartmann C, Rollo ME, Collins CE., 2017; Mattes RD., 2018). Since the current controversial whether the impact of snacks on health is positive or negative, choosing healthy snacks can help improve their possible negative effects and contribute to the promotion of nutritionally healthy and balanced diets (Hess JM, Jonnalagadda SS, Slavin JL., 2016). Thus, it becomes important to ensure that the food and beverages consumed contribute to compliance with dietary recommendations (Larson NI, Miller JM, Watts AW, Story MT, Neumark-Sztainer DR., 2016). Differences between body weight and snacks consumption is related to the type of snacks consumed. On the one hand, individuals with an adequate weight tend to consume foods rich in protein, complex carbohydrates and fruits. On the other hand, the majority of snacks consumed by overweight and individuals with obesity tend to be high in fat and/or simple carbohydrates from cakes, crackers, sweets, etc. (Leidy HJ, Todd CB, Zino AZ, Immel JE, Mukherjea R, Shafer RS et al., 2015).

Identifying dietary patterns and foods that promote satiety without significantly increasing total daily energy intake is important to promote healthier eating behaviours. It is well known the results of studies evaluating the impact of nutrient-dense snacks that are richer in protein and fibre that show a reduction or maintenance of weight. However, the results of studies that evaluated the impact of low nutritional value snacks on health (e.g., sugary drinks, sweets, cakes, pizzas, and tasty foods) are controversial (Njike VY, Smith TM, Shuval O, Shuval K, Edshteyn I, Kalantari V et al., 2016; Murakami K, Livingstone MBE., 2016).

Furthermore, it is important to recognise where meals are consumed since the scientific literature reports that snacks purchased outdoor tend to have a less healthy nutritional profile than those consumed at home. Or also prepared at home even though consumed outdoor which may be justified by their advance planning (Myhre JB, Løken EB, Wandel M, Andersen LF., 2015). Presently, there is a growing need for the population to have the possibility of places close to work to have their meals to avoid wasting time. The lack of time to make intermediate meals, the unavailability of healthy foods and the absence of habit of taking food from home to work are the most repeated causes of errors related to the fractioning of meals (Mendes Braga M, Carolina A, Colucci Paternez A., 2011).

Food is more than a biological need; it is also a cultural act. Thus, knowledge of the eating and nutritional habits of a population is crucial for the correct professional exercise of the nutritionist role. Whether in terms of prevention or treatment, as well as in the intervention and design of political strategies based on the assumption of achieving a nutritionally adequate diet for all citizens (Pinhão S, Poínhos R, Franchini B, Afonso C, Teixeira VH, Moreira P et al., 2016). Therefore, it is important to assess the relationship between the nutritional adequacy of intermediate meals and the foods consumed in them considering the place where they are consumed. Knowing the characteristics of foods consumed in different places and it consequences in terms of energy value and nutritional value of meals, foodservice operators can be drivers of diet change, by e.g modifying the supply, e.g. addressing the main need of the consumer which is a quick, affordable and hopefully tasty in the intermediate meal.

2. Objective

To evaluate the influence of the place where university employees have their meals on the nutritional and energetic value adequacy of intermediate meals.

3. Methods

A cross-sectional observational study was conducted. Data collection was performed during labour hours. 399 individuals were surveyed, and data collection was carried out in a Portuguese Public University in the north of Portugal. Participants were recruited in their work-site, reason why the sample was obtained for convenience. The collection was carried out in face-to-face interview by a nutritionist. Individuals were questioned about their food consumption in the previous 24 hours. 24 hours recall is a pre-validated instrument. It has the advantage of being quick to administer and as the interview refers to the previous day, respondents are more likely to remember what they ingested. The use of an uninformed collection method minimizes the respondent's tendency to modify food intake. At the same time, sociodemographic data were collected. The research project has been approved by ethical commission, with the CEFADE opinion 25.2014, and a free and informed consent form was obtained from all participants (Schoeller D, Plantenga M., 2017). In the selection of data for this project, only the normal feeding days were considered.

Based on the surveys collected over the previous 24 hours, the manual "Pesos e Porções de Alimentos" (Food Weights and Portions - translated) was used to estimate the amount of food consumed, converting them into nutrients using the Portuguese Food Composition Table (Goios A, Amaral T, Afonso C, Oliveira A, Costa A, Nogueira J et al., 2016; INSA_pt, 2020). In the case of foods that were not present in this list, food labels available on the Continente® Online website were used.

Data were processed in the Statistical Package for the Social Sciences (SPSS) version 23 for Windows. Descriptive statistics were used to calculate means, standard deviations, and frequencies, as well as analytical statistics to assess the relationship between the variables. The ANOVA test was used to analyse the relationship between cardinal variables and nominal. A critical significance level of 0.05 was considered to rule out the null hypothesis.

In the analysis is presented the information of the percentage of energy value (% of EV), as the percentage of total daily energy intake for each meal. The adequacy of this energy value considers the recommendations previously identified (Preedy and Watson, 2015).

4. Results

4.1. Sample characterization

A total of 399 individuals were surveyed, of which 66.5% were female and the average age 43 years old. Approximately 31% were teachers and 69% were non-teachers, and regarding academic qualifications, the majority had an academic qualification higher than a degree.

4.2. Characterization of food consumption

Breakfast, lunch and dinner are the most consumed meals (Table 1). In addition to the main meals, 87.7% of the individuals reported the

Table 1
Frequency of meals consumed by employees.

Type of meals	N (%)
Breakfast	394 (98.7)
Mid-morning snack	273 (68.4)
Lunch	397 (99.5)
Mid-afternoon snack 1	350 (87.7)
Mid-afternoon snack 2	90 (23.1)
Dinner	397 (99.5)
Evening Meal	122 (31)

consumption of at least one intermediate meal during the afternoon.

Of the most consumed meals, breakfast and dinner were mostly eaten at home. Lunch is mainly brought from home and consumed at work, as well as purchased on-site (Table 2).

Only 36.3% of individuals consume vegetables either at lunch or at dinner. About 36% of respondents consume vegetables only at lunch, 27.7% only at dinner. However, 27.2% do not consume at all. Soup consumption was more frequent at dinner (44.2%) than at lunch (33.7%).

4.3. Relationship between having intermediate meals and the adequacy of the % of the EV of the subsequent meal

A relationship was found between the variables under study ($p < 0.001$), observing that those who eat the intermediate meal achieve better adequacy of the subsequent meal (Graphs 1, 2 and 3).

4.4. Assessment of the adequacy of the % of the energy value of intermediate and subsequent meals according to the place of intake

There is a significant relationship ($p = 0.004$) between the place of intake of the mid-afternoon meal nº 1 and the adequacy of the EV of this meal (Graph 4). The same applies to mid-afternoon meal nº 2 ($p = 0.006$) (Graph 5). In both situations, consumption at home or food brought from home contributes to better adequacy of the energy value of this meal. The same is not true for the influence of the energy value of the subsequent meal for any of the evaluated meals.

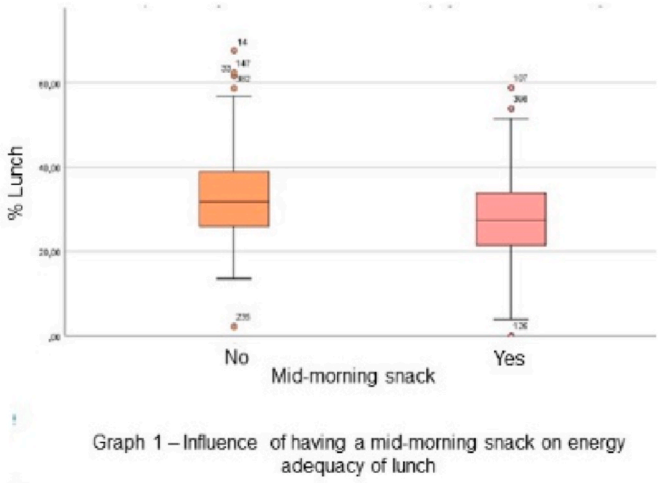
4.5. Relationship between the nutritional composition of intermediate meals and the place of intake

Place of intake influence fibre intake in mid-morning and mid-afternoon nº1 ($p < 0.001$ and $p = 0.26$, respectively) (Graph 6 and 7). However, the same does not apply to mid-afternoon nº2 ($p = 0.701$).

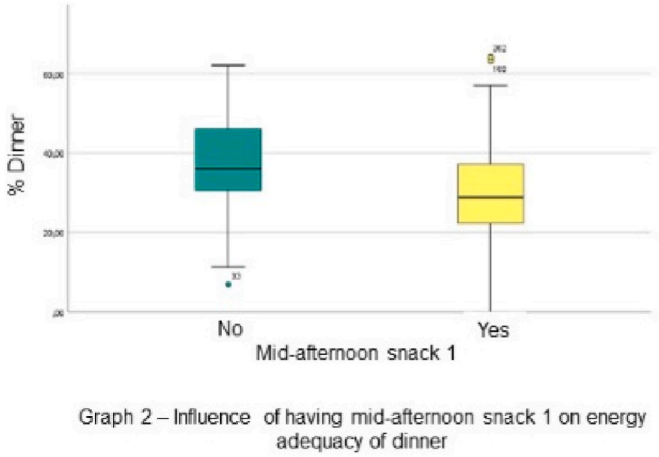
Regarding protein, it was possible to determine that there is

Table 2
Frequency of meals consumed by employees according to place.

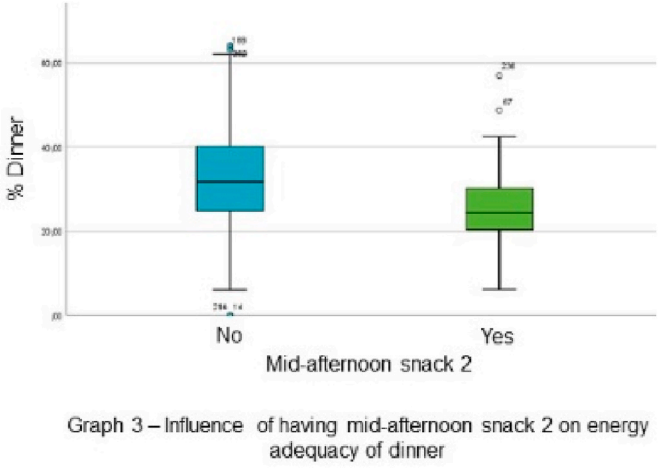
Meals	Place			
	Home	Brought from home	Bought at work	Coffee shop or Restaurant
	N (%)			
Breakfast	336 (85.3)	17 (4.3)	29 (7.4)	12 (3.0)
Mid-morning snack	13 (4.7)	176 (64.0)	79 (28.7)	7 (2.5)
Lunch	62 (15.6)	139 (34.9)	149 (37.4)	48 (12.1)
Mid-afternoon snack 1	58 (16.6)	219 (62.6)	63 (18.0)	10 (2.9)
Mid-afternoon snack 2	53 (57.0)	29 (31.2)	6 (6.5)	3 (3.2)
Dinner	384 (96.7)	3 (0.8)	2 (0.5)	4 (1.0)
Evening Meal	123 (100)	0	0	0



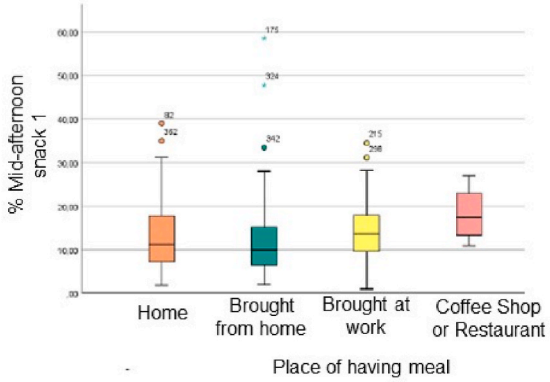
Graph 1. Influence of having a mid-morning snack on energy adequacy of lunch.



Graph 2. Influence of having mid-afternoon snack 1 on energy adequacy of dinner.



Graph 3. Influence of having mid-afternoon snack 2 on energy adequacy of dinner.



Graph 4 – Influence of energy adequacy of mid-afternoon snack 1 on energy adequacy of this meal

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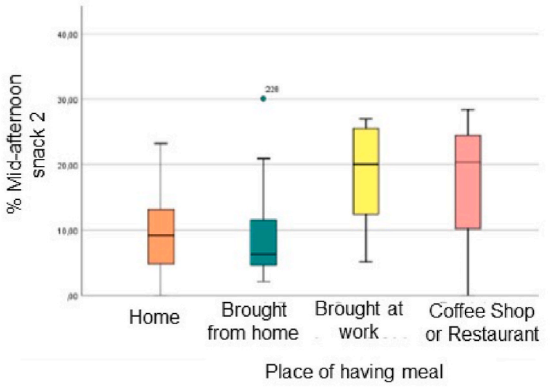

Graph 5 – Influence of energy adequacy of mid-afternoon snack 2 on energy adequacy of this meal

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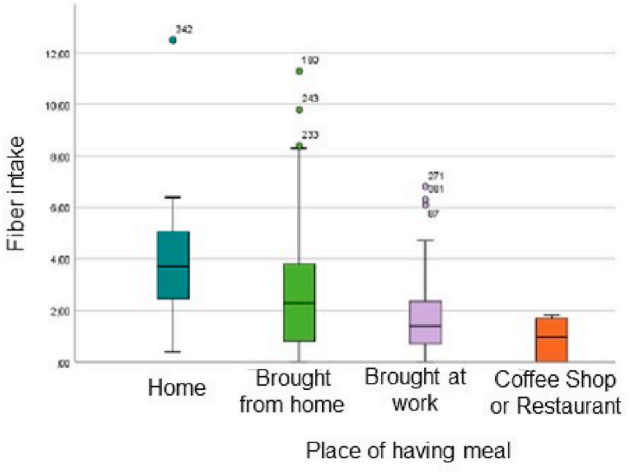

Graph 6 – Influence of place of having mid-morning snack on fiber intake in this meal

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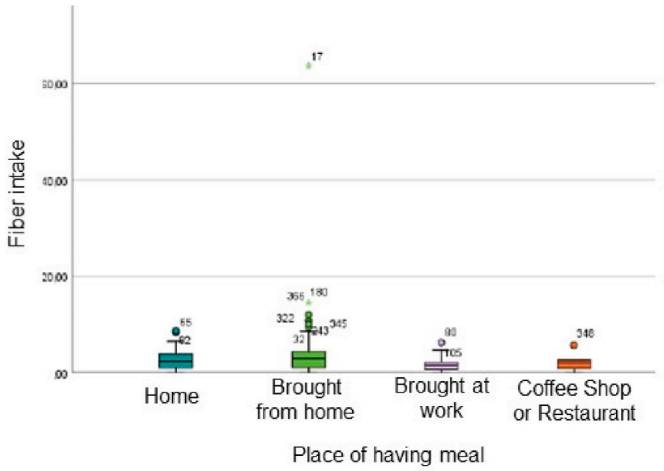


Graph 7 – Influence of place of having mid-afternoon 1 on fiber intake in this meal

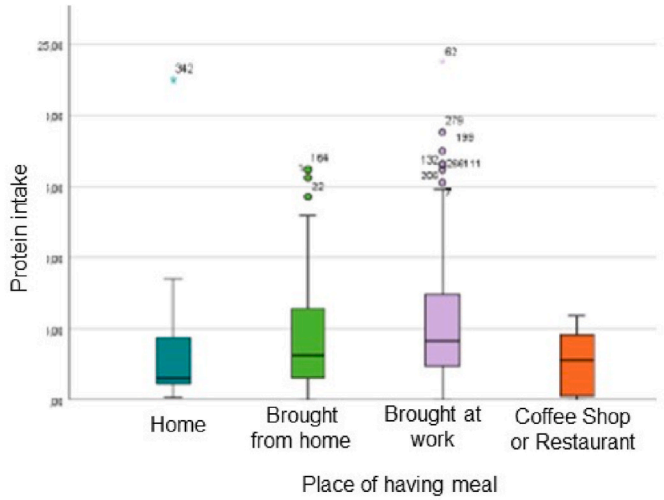
Graph 7. Influence of place of having mid-afternoon 1 on fiber intake in this meal.

statistical significance between the location of mid-morning and mid-afternoon meal nº1 ($p = 0.019$ and $p = 0.036$, respectively) and protein intake at those same meals (Graph 8 and 9). The same is not true for mid-afternoon nº2.

The consumption of simple carbohydrates seems to be not influenced by the place of having meals.

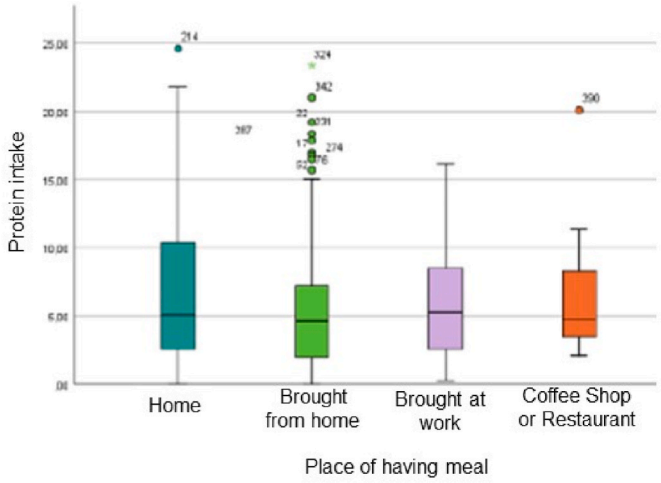
5. Discussion

The results about the most consumed meals are in agreement with those obtained by Hassen W. et al. (Si Hassen W, Castetbon K, Tichit C, Péneau S, Nechba A, Ducrot P et al., 2018) in French adults where the most consumed meals were breakfast, lunch, and dinner, followed by one of the mid-afternoons snacks. This was similarly described by Barnes et al. (Barnes TL, French SA, Harnack LJ, Mitchell NR, Wolfson J., 2015) in an adult population in Minnesota, where more than 80% of individuals consumed at least one snack a day.



Graph 8 – Influence of place of having mid-morning snack on protein intake in this meal

Graph 8. Influence of place of having mid-morning snack on protein intake in this meal.



Graph 9 – Influence of place of having mid-afternoon snack 1 on protein intake in this meal

Graph 9. Influence of place of having mid-afternoon snack 1 on protein intake in this meal.

Although there are food and nutritional recommendations for the number of meals to be eaten per day, it was possible to observe that a large part of the respondents does not eat intermediate meals. Which can contribute to inadequacy of energy and nutritional value in the main meals, namely by the fact that people would be hungrier if they didn't have a snack in between (Leidy HJ, Campbell WW., 2011). Some authors found that individuals who did not consume snacks between main meals ingested a subsequent meal with a higher energy value, which is in agreement with the results obtained in the present study (Leidy HJ, Todd CB, Zino AZ, Immel JE, Mukherjea R, Shafer RS et al., 2015; Leidy HJ, Campbell WW., 2011).

On another point of view, when intermediate meals were consumed, and were rich in fibre especially in the morning, they seem to reduce the subsequent energy intake. The same was not observed for the remaining macronutrients, in both intermediate meals. Robust scientific evidence states that foods rich in protein and fibre have a higher level of satiety than those high in fat and simple carbohydrates (Leidy HJ, Todd CB, Zino AZ, Immel JE, Mukherjea R, Shafer RS et al., 2015; Godwin N, Roberts T, Hooshmand S, Kern M, Hong MY., 2019; Njike VY, Smith TM, Shuval O, Shuval K, Edshteyn I, Kalantari V et al., 2016).

In line with other authors (Murakami K, Livingstone MBE., 2016; Barnes TL, French SA, Harnack LJ, Mitchell NR, Wolfson J., 2015) no relationship was observed between the consumption of intermediate meals and the classification of BMI.

Food consumption locations differ between daily meals. When eaten at work, breakfast is mostly taken at a snack bar, although the vast majority take it at home or take food to eat at work. Intermediate meals consist mainly of food brought from home, followed by food purchased at the snack bar. The food products most consumed in these places also tend to be different and include coffee, cakes, pastries, and chocolates. While those brought from home are fruit, cookies, and yogurts. In this way, consumption at home or food brought from home contributes to better adequacy of the energy and nutritional value of this meal, perhaps since it is a more rational choice and it is not made impulsively and spontaneously (Myhre JB, Løken EB, Wandel M, Andersen LF., 2010).

Fibre and protein consumption in these meals is higher when food is brought from home to work, possibly for the same reason. These differences may be due to availability an important determinant of food consumption (Contento IR., 2011), revealing that the act of taking food to the workplace leads to healthier and more balanced eating practices. So, should be a behaviour to be stimulated and encouraged. Even so, the adequacy of food availability at points of sale should also be considered.

It can be seen from the results of this study and, also, according to other authors that the most consumed foods in the middle of the afternoon, not only by the Portuguese population but also by the English, French and Norwegian, are fruit, dairy products, bread, pastry products, cookies, among other options (Myhre JB, Løken EB, Wandel M, Andersen LF., 2015; Si Hassen W, Castetbon K, Tichit C, Péneau S, Nechba A, Ducrot P et al., 2018; Murakami K, Livingstone MBE., 2016). These results may contribute to a better definition of programs that aim to help improve the nutritional status of populations of workers, highlighting the crucial role that the realization of intermediate meals plays in the adequacy of food consumption.

6. Conclusion

The lack of intermediate meals eaten by respondents contributes to the inadequacy of energy and nutritional value in main meals. However, when these are performed with previously chosen and nutritionally adequate foods, namely when they were brought from home, they contribute to better adequacy of the subsequent food intake. So, should be a behavior to be stimulated and encouraged. Notwithstanding, the adequacy of food availability at points of sale should also be something to be taken into account and a point on which the institution should act in collaboration with health entities to promote health. Thus, it is important to carry out awareness-raising actions on this topic, promoting the health and well-being of employees, benefiting them, as well as the institution.

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Implications for gastronomy

This research contributes to the gastronomy field due to analyse the influence of intermediate meals on quality of food consumption, with nutritional concerns. It was observed a relationship between the place where first mid-afternoon ($p = 0.004$) and second mid-afternoon meal ($p = 0.006$) meal were eaten and the adequacy of its energy value. Either consumption at home or food brought from home contribute to a better adequacy of the energy value of meal evaluated. The different places where intermediate meals were eaten seems to influence their adequacy to promote the health and well-being of employees, reason why it is important to carry out awareness actions related to the topic at workplace. This work reinforces the investment on gastronomy and food science issues of study, and could contribute to recognise the potential role that foodservice could play through providing e.g. fibre rich products, innovate with sustainable products without animal sourced foods, or reformulate those they have now.

CRediT author statement

JPML; AR: Conceptualization, Methodology. MR; ME; JPML: Data curation, Writing- Original draft preparation. MR; ME: Visualization, Investigation. **JPML; AR**: Supervision. **JPML**: Software, Validation. **JPML**: Writing- Reviewing and Editing.

Declaration of competing interest

There is no conflict of interest to declare.

Data availability

Data will be made available on request.

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