Received: 1 December 2023 | Revised: 15 February 2024 | Accepted: 21 February 2024

DOI: 10.1111/1750-3841.17022

Journal of Food Science WILEY

ORIGINAL ARTICLE

Health, Nutrition, and Food

Availability and properties of commercially produced food products offered in European public universities: A North–South comparison

Naiara Martinez-Perez[1,2] | **Liv Elin Torheim**[3] | **Marta Arroyo-Izaga**[2,4,5]

[1]Department of Nursing I, Faculty of Medicine and Nursing, University of the Basque Country UPV/EHU, Leioa, Spain

[2]BIOMICs Research Group, Microfluidics & BIOMICs Cluster, Lascaray Research Center, University of the Basque Country UPV/EHU, Vitoria-Gasteiz, Spain

[3]Department of Nursing and Health Promotion, Faculty of Health Sciences, OsloMet—Oslo Metropolitan University, Oslo, Norway

[4]Department of Pharmacy and Food Sciences, Faculty of Pharmacy, University of the Basque Country UPV/EHU, Vitoria-Gasteiz, Spain

[5]Bioaraba, BA04.03, Vitoria-Gasteiz, Spain

Correspondence
Marta Arroyo-Izaga, Department of Pharmacy and Food Sciences, Faculty of Pharmacy, University of the Basque Country UPV/EHU, Paseo de la Universidad 7, 01006 Vitoria-Gasteiz, Spain. Email: marta.arroyo@ehu.eus

Funding information
Erasmus+; Storbyuniversitetet ; Euskal Herriko Unibertsitatea; Eusko Jaurlaritza

Abstract: To date, there are no studies that have compared university food environments (FEs) with different sociocultural contexts. Therefore, we analyzed differences in the availability and properties of commercially produced foods, in a northern and a southern European university (located in Norway and Spain, respectively). A cross-sectional observational study was conducted at OsloMet—Oslo Metropolitan University and at the University of the Basque Country UPV/EHU. The nutritional quality of food products was estimated through the following nutrient profiling models (NPMs): those proposed by the Spanish Agency for Consumer Affairs, Food Safety and Nutrition (AECOSAN), the UK nutrient profiling model (UK NPM), the Norwegian Food and Drink Industry Professional Practices Committee (*Matbransjens Fagligle Utvalg* [MFU]), and a combination of them. In addition, food items were classified using the NOVA system. A total of 251 and 1051 products were identified at OsloMet and the UPV/EHU, respectively. The percentage categorized as low nutritional quality (LNQ) was higher at the UPV/EHU (almost 54.5% of the total products) compared with at OsloMet (almost 40%) ($p < 0.001$). Most of the products were categorized as ultra-processed, and there were no differences in the percentage of ultra-processed foods between the two universities (OsloMet 86.1%, UPV/EHU 83.3%, $p > 0.05$). A higher proportion of LNQ products was found at the UPV/EHU than at OsloMet, probably due to the government policies and actions for creating healthy FEs. Consequently, there is a need to develop interventions to improve the FE at the UPV/EHU, adapted to its sociocultural context.

KEYWORDS
food environment, food processing level, nutrient profiling model, public health, university food

Practical Application: This study reveals north–south differences in terms of the availability of low nutritional quality food products. In particular, a higher proportion of this type of product was found at the University of the Basque Country UPV/EHU than at OsloMet—Oslo Metropolitan University. Our exploratory hypothesis is that this phenomenon is a consequence of the Nordic government policies that have great potential to create healthy FEs.

1 | INTRODUCTION

The food environment (FE) has been defined as "the foods available to people in their surroundings as they go about their everyday lives and the nutritional quality, safety, price, convenience, labeling and promotion of these foods" (Food and Agriculture Organization of the United Nations—FAO, 2016). From a socio-ecological perspective, two key domains within the wider FE construct have been identified: the "external domain" and the "personal domain."

The external domain includes food availability, prices, vendor and product properties, and marketing and regulation. The personal domain includes food accessibility, affordability, convenience, and desirability. Interactions between these domains and dimensions determine people´s food acquisition and consumption (Caspi et al., 2012; Turner et al., 2018). Thus, the FE can affect people's food purchasing and eating choices, as well as the quality of their diets and, in turn, diet-related health outcomes.

Over the past decades, energy-dense and nutrient-poor food products and ultra-processed have become more available compared to fresh, minimally processed, or unprocessed foods, fostering obesogenic FEs in Europe and globally (Food and Agriculture Organization of the United Nations—FAO, 2016). Conversely, making the environment more conducive to healthy choices has the potential to be a key aspect of a successful obesity prevention intervention (Lake and Townshend, 2006). In particular, organizational FEs, such as schools and worksites, constitute a strategic setting for the implementation of comprehensive strategies, as they provide an appropriate infrastructure for the prevention of obesity and other nutrition-related diseases (Newton et al., 2016). In this sense, universities manage different food and catering establishments that serve a large number of workers and students (Doherty et al., 2011), where the latter group is at a high-risk period for weight gain.

During the transition from high school to university, which coincides with the transition from adolescence to adult life, autonomous decision-making, and personal independence grow (Holm-Denoma et al., 2008), and some of the most important behaviors for adult life are modeled. Thus, university FE should positively influence individual food choices by making the healthy choice the easy choice. Studies conducted so far on campus indicate that these FEs are potentially obesogenic due to the high availability and promotion of energy-rich, nutrient-poor foods (Roy et al., 2016). These types of products are mostly commercially produced foods, that is, industrially manufactured foods, such as sweet or savory snack foods, or sweetened beverages.

To date, few studies have assessed FE at the university level, and these have mainly been carried out in Australian, New Zealand, and Latin America universities (Franco et al., 2020; Roy et al., 2019; Tam et al., 2017). There is a lack of research in European universities that evaluates the FE in depth, and none has compared different European universities. As sociocultural factors (that is, culture, economic variables, and political elements, among others) are decisive in food supply and choice (Chen & Antonelli, 2020), the comparison of tertiary education institutions with a different geographical location and sociocultural context can be of great interest to identify similarities and differences.

Therefore, through this study, we aimed to analyze differences in the availability and properties (nutritional quality and processing level) of commercially produced foods, in a northern European and a southern European university (located in Norway and Spain, respectively). In discussing North–South differences, we attempted to provide plausible explanations considering the role of sociocultural aspects. In addition, we analyzed the agreement level between several nutrient profiling models (NPMs) and, among these NPMs andthe processing level of commercially produced food products sold in the universities mentioned.

Considering the government's measures to promote health and prevent disease through a healthier diet in both countries (Spain and Norway) (Pineda et al., 2022), we hypothesized that the percentage of foods of low nutritional quality (LNQ) and ultra-processed would be higher at the Spanish university than at the Norwegian

university. On the other hand, because of the differences in the criteria of the NPMs, we hypothesized that the percentage of LNQ food products sold at both universities would vary considerably according to the models applied. For this reason, we decided to use a combination of the three selected NPMs. Finally, taking into account the evidence from other studies (Maldonado-Pereira et al., 2022; Martínez Steele et al., 2017) confirming the LNQ of ultra-processed products, we hypothesized that the LNQ food products would be mostly ultra-processed.

2 | MATERIALS AND METHODS

2.1 | Study design and setting

The study is part of a broader investigation in which not only the external but also the personal domain of the FE was analyzed (Martinez-Perez & Arroyo-Izaga, 2021; Martinez-Perez et al., 2022a, 2022b). It is a cross-sectional observational study conducted at two European public universities: OsloMet—Oslo Metropolitan University (located in Norway, northern Europe) and the University of the Basque Country UPV/EHU (located in Spain, southern Europe). Data were recorded at the UPV/EHU during the 2016/17 and 2017/18 academic years, and at OsloMet during the 2019/20 academic year.

At OsloMet, data were registered before the start of the COVID-19 pandemic, at the main campuses in terms of students and staff numbers, which were the Pilestredet and Kjeller campuses. These two campuses had 19,500 students and 2200 staff in the academic year 2019/20, whereas the campus excluded in the present study, the Sandvika campus, had about 500 students and only 1 employee (Oslo Metropolitan University, 2019).

However, at the UPV/EHU, data were registered at its 3 campuses, which had a total of 42,218 students (degree students by campus: Álava/Araba 7163 students, Bizkaia 22,078, Gipuzkoa 10,119; and postgraduate students: Doctoral School located in Bizkaia Campus 2858 students) and 7453 staff (Álava/Araba Campus, 1233; Bizkaia Campus, 4460; and Gipuzkoa Campus, 1760) in the academic year 2016/17.

The method used to record data was an audit, which is the most frequently reported method in the literature for measuring consumer FE (Lytle & Sokol, 2017). In the present study specifically, we used it to assess the availability of products and characterize their properties (nutritional quality and processing level). We chose to focus on these indicators for commercially produced food products offered on campus, as they provide essential information on the FE and can contribute to improving the interpretation of data collected in different realities (Ferreira et al., 2021). Permission to conduct the study was obtained from the Foundation for Student Life in Oslo and Akershus (Studentsamskipnaden i Oslo og Akershus—SiO) and Vice Management of Assets and Contracting of the UPV/EHU.

2.2 | Registration of data at OsloMet

A total of four canteens, three coffee shops, and two vending machines were analyzed at OsloMet. The distribution of food outlets by campus was as follows: eight on the Pilestredet campus (six canteens and two coffee shops) and four on the Kjeller campus (one canteen, one coffee shop, and two vending machines, one for hot drinks, and one for snacks).

The food outlets within Pilestredet and Kjeller campuses were identified, thanks to the information provided by SiO. SiO is a student welfare organization that operates food services on all campuses of the universities of Oslo and Akershus (Norway). The list of foods and drinks and related information (product description, including flavor or ingredient variations, net weight, and brand) were also obtained through SiO (it should be noted that this list did not include hot drinks such as coffee or chocolate).

2.3 | Registration of data at the UPV/EHU

During the period in which data were recorded at the UPV/EHU, a total of 21 companies were subcontracted by the UPV/EHU to provide food services, 18 for cafeterias/restaurants/canteens, 2 for vending machines, and 1 for the supermarket service. The distribution of food outlets by campus was as follows: 16 on the Álava/Araba campus (5 cafeterias/restaurants/canteens and 11 vending machines), 37 on the Bizkaia campus (8 cafeterias/restaurants/canteens, 1 supermarket, and 26 vending machines), and 27 on the Gipuzkoa campus (7 cafeterias/restaurants/canteens and 20 vending machines).

These subcontracted companies did not change during the study period, and nor did the price of the products, except for the prices for three out of seven cafeterias/restaurants/canteens on the campus of Bizkaia. In total, 203 vending machines, 20 cafeterias/restaurants/canteens, and 1 supermarket were analyzed at the UPV/EHU. In the present study, we did not include 24 vending machines that are not usually accessed by undergraduate students because they are in buildings earmarked for research, and 2

cafeterias/restaurants because the companies in charge of these services were not contracted by the UPV/EHU.

Data from cafeterias/restaurants/canteens and the supermarket were obtained through interviews with the staff in charge of these services by a single interviewer, and data from vending machines were recorded by a single observer at the point of sale. In both cases, data were collected through forms developed for this study before data registration (these forms are available from the corresponding author on reasonable request). The following information was recorded: product name (including flavor or ingredient variations, such as barbecue potato chips), brand, net weight, ingredients, and price. However, price data were not included in this manuscript. In the case of vending machines, for the data recording at the UPV/EHU, in addition to the form, photographs also were taken in situ.

2.4 | Data processing of commercially produced food supply in outlets of OsloMet and the UPV/EHU

From the data registered in both universities, information on ingredients, ingredient percentage (if available), and nutrition labeling information (if available) were obtained by consulting product labeling and/or the manufacturer's website. Food products sold were categorized according to the document on food in schools developed by the Spanish Agency for Consumer Affairs, Food Safety and Nutrition (AECOSAN) (2010) and the Global Food Monitoring Group food categorization system (Dunford et al., 2012) (Table S1).

Each food product offered was counted once, and only the product categories available at both universities were included in the analysis of the current study. Solid foods and beverages were analyzed separately. Hot drinks were not included in this study, not even those from vending machines, because the amount of added sugar could be variable. Table S2 shows the food and drink categories were excluded from the analysis, as they were only sold at UPV/EHU. No product category was only offered at OsloMet.

An overview of the methods, recorded data, estimated variables, and data derived related to the food supply in outlets at the UPV/EHU and OsloMet are shown in Table 1. Nutritional information on the products sold in outlets from both universities was also obtained from different sources, as follows (in order of preference): nutrition labeling, the manufacturer's website, and/or food composition database from each of the countries.

As far as food composition databases are concerned, for the products offered at OsloMet, Kostholdsplanleggeren (Norwegian Directorate of Health & Norwegian Food Safety Authority, 2023) was used, and for those offered at the UPV/EHU, the DIAL program 2.12 (Ortega et al., 2016). This last program was completed with the food composition tables of Mataix (2009) whenever necessary. In those products in which *trans* fatty acid (TFA) data were not available in the nutrition labeling, nor on the manufacturer's website, or in the food composition databases, they were estimated using the report "Content of *Trans* Fatty Acids in Foods in Spain, 2015" (Spanish Agency for Consumer Affairs, Food Safety and Nutrition [AECOSAN], 2016), and the food composition database of the United States Department of Agriculture, Agricultural Research Service (USDA) (2019).

For both universities, from the nutritional information of each product, the energy content and the following nutrients were estimated: proteins, sugars, dietary fiber, total fat, TFA, saturated fatty acids (SFA), and sodium content. In addition, fruit, vegetable, and nut content were estimated. These data were calculated per 100 g of product.

2.5 | Analysis of the nutritional quality and processing level of the commercially produced food supply in outlets of OsloMet and the UPV/EHU

To indicate the nutritional quality of each food or drink item, the following NPMs were used: those proposed by the Spanish Agency for Consumer Affairs, Food Safety and Nutrition (AECOSAN) (2010), the UK NPM (Department of Health of the United Kingdom, 2011), and those of the Norwegian Food and Drink Industry Professional Practices Committee (Matbransjens Fagligle Utvalg—[MFU] [Norwegian Food and Drink Industry Professional Practices Committee], 2013). The former criteria are those designed for the food supply present in vending machines, canteens, and kiosks in education centers.

The AECOSAN criteria have six components: energy, total fat, SFA, TFA, sugar, and salt. These criteria set the following limits per 100 g or mL of product: in foods ≤400 kcal, ≤15.6 g total fat, ≤4.4 g SFA, ≤1 g TFA, ≤30 g sugar, and ≤1 g salt; and in drinks, ≤100 kcal, ≤3.9 g total fat, ≤1.1 g SFA, ≤0.25 g TFA, ≤7.5 g sugar, and ≤0.25 g salt. Products that were over at least one of the cut-offs were considered LNQ.

These criteria focus on energy density and nutrients that have the potential to negatively affect health or on "at-risk" nutrients, which can be a limitation when analyzing the nutrient profile. For this reason, we also used the UK NPM, which was developed by the UK Food Standards Agency (Department of Health of the United Kingdom, 2011). This instrument is one of the most frequently validated models

TABLE 1 Overview of the methods, recorded data, estimated variables, and data derived related to the commercially produced food supply in outlets at OsloMet—Oslo Metropolitan University and the University of the Basque Country UPV/EHU.

Data-recording methods	Recorded data	Estimated variables	Data derived from recorded and/or estimated variables
Direct recording of data: direct observation and face-to-face interviews, using pre-designed forms, and photographs taken in situ[a] Indirect recording of data through the supplying companies, product labeling and/or manufacturer's website, using pre-designed forms, and food composition databases	Description (including flavor or ingredient variations, such as barbecue or plain potato chips), net weight, brand, ingredients, ingredient percentage (if available), and nutrition labeling information (if available)	Energy, protein, total fat, SFA, TFA, fiber, sugar, sodium and fruit, vegetable, and nut content	Classification according to the type and subtype of food (Dunford et al., 2012; Spanish Agency for Consumer Affairs, Food Safety and Nutrition—AECOSAN, 2010) NPMs: the Spanish Agency for Consumer Affairs, Food Safety and Nutrition—AECOSAN (2010), the UK NPM (Department of Health of the United Kingdom, 2011), and the Matbransjens Fagligle Utvalg (MFU) (2013) criteria NOVA food classification system (Monteiro et al., 2018a)

Abbreviations: AECOSAN, Spanish Agency for Consumer Affairs, Food Safety and Nutrition; MFU, Norwegian Food and Drink Industry Professional Practices Committee; NPM, nutrient profiling model; SFAs, saturated fatty acids; TFAs, *trans* fatty acids.
[a]This method was only used in the UPV/EHU.

(Labonté et al., 2018). In addition to the "at-risk" nutrients, the UK NPM also includes foods and nutrients considered to have a beneficial effect on health (i.e., fruit, vegetables, nuts, protein, and fiber).

The UK NPM uses a simple scoring system wherein points are allocated based on the nutrient content of 100 g of food or drink. To do so, the nutrient content of each food and drink was assessed against a set of published criteria to determine whether it contains certain nutrients above or below particular thresholds. This model has seven components—energy, SFA, sugar, sodium, "fruit, vegetables and nuts", fiber and protein—and provides a single score for any given food product, based on calculating the number of points for "negative" nutrients that can be offset by points for "positive" nutrients or ingredients.

Points were awarded for energy, SFA, sugar, and sodium (total "A" points = [points for energy] + [points for saturated fat] + [points for sugars] + [points for sodium]) and fruit, vegetable, and nut content, fiber, and protein (total "C" points = [points for % fruit, vegetable & nut content] + [points for fiber] + [points for protein]). The amounts of these components were determined from the food labeling (ingredient list, proportion of the ingredients listed on the label that have the highest percentages, and nutrition labeling), manufacturer's website, and/or the dietary assessment that was carried out with the above-mentioned food composition database.

The score for "C" nutrients and ingredients was subtracted from the "A" nutrient score to give a final score. If the score was <4 for foods or <1 for drinks, the product was classified as HNQ. When scores exceeded these limits, however, the product was classified as LNQ (e.g., high-saturated fat, sugar, and/or salt content). Nonetheless, this model also has limitations, as certain foods with high levels of a particular "at-risk" nutrient (e.g., fat), which are also key sources of some micronutrients, may be classified as LNQ. For example, some cheeses may be classified as LNQ, despite being key sources of dietary calcium and riboflavin. To overcome this limitation, we added other criteria in the evaluation of the nutrient profiling, those that are commonly used to regulate the marketing of products of LNQ to children in Norway, which is a self-regulation scheme operated by the industry through their organization, the MFU criteria (Matbransjens Fagligle Utvalg—[MFU] [Norwegian Food and Drink Industry Professional Practices Committee], 2013).

The MFU provides a list of products of LNQ according to their content in one or more of the following components, in most cases per 100 g of product: total fat, SFA, sugar, salt, nutritional density, and energy density. The limits established for each of these components vary according to the type of food. An example is that milk products with more than 15 g added sugar per liter, breakfast cereals with more than 20 g sugar in total per 100 g, and yoghurt with more than 11 g sugar in total per 100 g are classified as LNQ according to the MFU criteria.

Finally, the resulting categories after applying the above-mentioned three criteria, the AECOSAN, the UK NPM, and the MFU criteria, were combined as follows: If a product had been classified as LNQ according to the three classifications, it was considered LNQ. The rest of the products were categorized as HNQ. This criterion was agreed

to be more rigorous than the one that would be considered LNQ those products that were classified as such according to only one or two classification systems. Table S2 presents the nutritional profile of the foods and drinks only sold at the UPV/EHU that were excluded from the analysis. Moreover, because the results of the analysis were not entirely consistent across NPMs, the LNQ products "with inconsistent classification," that is, those that were classified as LNQ to only one or two classification systems were analyzed separately.

Additionally, the food or drink items were classified using the NOVA system (Monteiro et al., 2018a), which categorizes foods according to their nature, purpose, and degree of industrial processing. This system distinguishes between the following groups: (i) unprocessed or minimally processed foods, (ii) processed culinary ingredients, (iii) processed foods, and (iv) ultra-processed products. This last group, ultra-processed foods, are formulations made mostly or entirely from substances derived from foods (e.g., casein, lactose, whey, gluten, hydrogenated oils, and maltodextrin, among others) and additives (e.g., color stabilizers, flavor enhancers, non-sugar sweeteners, and emulsifiers, among others), with little if any intact unprocessed or minimally processed.

In the present study, the category "processed culinary ingredients" was not assessed, because this type of product was only offered in the UPV/EHU supermarket. However, these types of products were part of ready-to-eat foods such as salads with dressing sold in the vending machines that met the criteria to be classified as processed foods.

2.6 | Quality management of the data

All data were collected by a single researcher (N.M.-P.) and reviewed by another researcher (M.A.-I.). We used unique outlet identification numbers that were attached to each recording sheet. To check for quality data and derived indices (NPMs and level of processing), subsamples of outlets and products were repeatedly examined. The data set was made available for analysis on a protected central data server. Access to the data is restricted to authorized members of the research team.

2.7 | Sociocultural factors of Norway and Spain

Sociocultural factors of Norway and Spain that could influence food supply and properties of commercially produced food products offered are shown in Table S3. The purpose of this summary is to contextualize the possible influences of these factors on food supply in the universities under study. These sociocultural features were selected based on the Food-EPI monitoring tool (Swinburn et al., 2013; Swinburn et al., nd), which aims to propose a monitoring framework to assess government policies and actions for creating healthy FEs. The key components are classified into "culture," "economic variables," "quality of life," and "political elements."

2.8 | Statistical analysis

The data were analyzed using SPSS for Windows version 24.0 (SPSS Inc.). All descriptive statistics were reported in number and percentage. For bivariate analysis, Chi-square or Fisher´s exact test was used to compare categorical variables. All tests were two-sided, and p-values less than 0.05 were considered statistically significant. The κ coefficient was calculated to investigate the degree of agreement between the three NPMs used (the AECOSAN, the UK NPM, and the MFU criteria) and between these models and NOVA classification. The κ results were interpreted as follows: values ≤ 0 no agreement, 0.1–0.20 none to slight, 0.21–0.40 fair, 0.41–0.60 moderate, 0.61–0.80 substantial, and 0.81–1.00 almost perfect (Landis & Koch, 1977).

3 | RESULTS

3.1 | Availability of commercially produced foods

In total, 251 foods and drinks were identified at OsloMet. The most common products were sweet snacks (48.5% of the solid foods and 32.7% of the total products) and sugar-sweetened carbonated drinks (23.2% of the cold drinks and 7.6% of the total products) (Table 2).

3.2 | Nutritional quality of commercially produced foods

Approximately half of the products did not meet the AECOSAN criteria (53.0%) and the UK NPM criteria (47.4%). Moreover, nearly three quarters (72.9%) did not meet the MFU criteria. The AECOSAN criterion that was most frequently unfulfilled was the SFA (43.2%) content in solid foods and the sugar (31.7%) content in drinks. The combination of the three criteria above-mentioned, the AECOSAN criteria, the UK NPM criteria, and the MFU criteria, showed that 40.2% of the products were classified as LNQ. The percentage of LNQ was higher in solid foods than in drinks for the three NMPs ($p < 0.001$).

TABLE 2 Differences in nutritional profile of commercially produced food products sold in food outlets at OsloMet—Oslo Metropolitan University and the University of the Basque Country UPV/EHU.

Type of product	*n* (%)[a]			Percentage not meeting the criteria, LNQ											
				AECOSAN criteria[c], %			UK NPM[d], %			MFU[e], %			AECOSAN + UK NPM + MFU[f], %		
	OM	EHU	*p*[b]	OM	EHU	*p*[b]	OM	EHU	*p*[b]	OM	EHU	*p*[b]	OM	EHU	*p*[b]
Solid foods															
Fruit and fruit derivatives	8 (3.2)	56 (5.3)	0.158	50.0	16.1	**0.047**	37.5	12.5	0.102	37.5	12.5	0.102	37.5	12.5	0.102
Dairy products															
Yogurts	18 (7.2)	23 (2.2)	**<0.001**	–	–	–	5.9	8.7	1.000	52.9	56.5	0.051	–	–	–
Other dairy products[g]	18 (7.2)	37 (3.5)	**<0.001**	–	78.4	**<0.001**	16.7	83.8	**<0.001**	83.3	83.8	1.000	–	67.6	**<0.001**
Nuts	6 (2.4)	56 (5.3)	0.050	83.3	72.7	1.000	–	29.1	0.326	83.3	87.3	1.000	–	29.1	0.326
Salty snacks	19 (7.6)	185 (17.6)	**<0.001**	68.4	95.3	**<0.001**	21.1	66.5	**<0.001**	36.8	89.2	**<0.001**	21.1	63.8	**<0.001**
Sandwiches	3 (1.2)	31 (2.9)	0.116	100.0	90.3	1.000	100.0	41.9	0.094	100.0	96.8	1.000	100.0	41.9	0.094
Sweet snacks	82 (32.7)	384 (36.5)	0.250	81.7	95.3	**<0.001**	84.1	88.8	0.239	96.3	100.0	**0.005**	76.8	86.7	**0.023**
Sweets and chewing gums															
With added sugars	11 (4.4)	14 (1.3)	**<0.001**	90.9	92.9	1.000	90.9	85.7	1.000	100.0	100.0	–	90.9	85.7	1.000
With sweeteners	5 (2.0)	37 (3.5)	0.219	40.0	–	**0.012**	40.0	–	**0.012**	100.0	100.0	–	40.0	–	**0.012**
Total of solid foods	169 (67.3)	822 (78.2)	**<0.001**	61.5	81.0	**<0.001**	56.2	66.3	**0.013**	81.1	88.7	**0.007**	50.3	63.7	**<0.001**
Drinks															
Bottled water	3 (1.2)	18 (1.7)	0.562	–	–	–	–	–	–	–	–	–	–	–	–
Carbonated drinks															
With added sugars	19 (7.6)	29 (2.7)	**<0.001**	84.2	82.8	1.000	89.5	89.7	1.000	100.0	100.0	–	84.2	82.8	1.000
With added sugars and sweeteners	1 (0.4)	9 (0.9)	0.453	–	55.6	1.000	100.0	66.7	1.000	100.0	100.0	–	–	–	1.000
With sweeteners	16 (6.4)	11 (11.0)	**<0.001**	–	–	–	–	–	–	100.0	100.0	–	–	–	–

(Continues)

TABLE 2 (Continued)

Type of product	*n* (%)[a]		*p*[b]	Percentage not meeting the criteria, LNQ											
				AECOSAN criteria[c], %			UK NPM[d], %			MFU[e], %			AECOSAN + UK NPM + MFU[f], %		
	OM	EHU		OM	EHU	*p*[b]	OM	EHU	*p*[b]	OM	EHU	*p*[b]	OM	EHU	*p*[b]
Without added sugars or sweeteners (soda)	2 (0.8)	2 (0.2)	0.119	–	50.0	1.000	–	50.0	1.000	–	100.0	0.333	–	50.0	1.000
Dairy drinks	18 (7.2)	47 (4.5)	0.078	66.7	80.9	0.323	22.2	70.2	**<0.001**	–	36.2	**0.002**	–	34.0	**0.003**
Juices	10 (4.0)	71 (6.8)	0.103	10.0	69.0	**0.001**	10.0	36.6	0.153	–	19.7	0.197	–	1.4	1.000
Milk	2 (0.8)	15 (1.4)	0.429	–	100.0	–	–	33.3	1.000	–	–	–	–	–	–
Non-carbonated drinks															
With added sugars	9 (3.6)	19 (1.8)	0.082	–	15.8	0.530	11.1	47.4	0.098	100.0	100.0	–	–	10.5	1.000
With sweeteners	1 (0.4)	1 (0.1)	0.271	–	–	–	–	–	–	100.0	100.0	–	–	–	–
Vegetable drinks	1 (0.4)	7 (0.7)	0.624	–	–	–	–	14.3	1.000	–	–	–	–	–	–
Total of drinks	82 (32.7)	229 (21.8)	**<0.001**	35.4	52.4	**0.008**	29.3	46.7	**0.006**	56.1	44.5	0.072	19.5	21.4	0.719
Total of products	251	1051	**<0.001**	53.0	74.8	**<0.001**	47.4	62.0	**<0.001**	72.9	79.1	**0.035**	40.2	54.5	**<0.001**

Abbreviations: AECOSAN, Spanish Agency for Consumer Affairs, Food Safety and Nutrition; EHU, University of the Basque Country UPV/EHU; LNQ, product of low nutritional quality; MFU, Norwegian Food and Drink Industry Professional Practices Committee; NPM, nutrient profiling model; OM, OsloMet—Oslo Metropolitan University.

[a]Percentages with respect to the total of products for each university (only the product categories available at both universities are included in this table).

[b]χ^2 test or the Fisher exact test was used to assess differences between universities, significant *p*-values are highlighted in bold.

[c]Spanish Agency for Consumer Affairs, Food Safety and Nutrition—AECOSAN (2010).

[d]Department of Health of the United Kingdom (2011).

[e]Matbransjens Fagligle Utvalg (MFU) (2013).

[f]The three NPMs were combined as follows: If a food or drink had been classified as LNQ according to the Spanish Agency for Consumer Affairs, Food Safety and Nutrition—AECOSAN (2010), the UK NPM (Department of Health of the United Kingdom, 2011) and the Matbransjens Fagligle Utvalg (MFU) criteria (2013), it was considered LNQ.

[g]"Other dairy products": custard, cream caramel, cheese, pudding, and so on.

A total of 1051 foods and drinks were identified at the UPV/EHU. The most common products were sweet snacks (46.7% of the solid foods and 36.5% of the total products), followed by salty snacks (22.5% of the solid foods and 17.6% of the total products), and juices (31.0% of the drinks and 6.8% of the total products) and sugar-sweetened carbonated drinks (12.7% of the drinks and 2.7% of the total products).

At the UPV/EHU, nearly three quarters of the total commercially produced food products were classified as LNQ according to the AECOSAN criteria (74.8%), the UK NPM criteria (62.0%), and the MFU criteria (79.1%). The combination of the three criteria above-mentioned showed that 54.5% of the products were classified as LNQ. Similar to the offer at OsloMet, the percentage of LNQ was higher in solid foods than in drinks for the three NMPs ($p < 0.001$). The AECOSAN criteria that solid foods most frequently did not meet were the energy (53.8%) and total fat content (55.1%); and in drinks, the sugar content (50.7%).

The analysis of differences in the nutritional profile of commercially produced foods offered in the two universities showed that the percentage of products classified as LNQ was higher at the UPV/EHU compared to at OsloMet ($p < 0.001$). Specifically, the subcategories in which these differences were observed were: salty snacks, sweet snacks, dairy products other than yogurt, and dairy drinks ($p < 0.05$). The only subcategory in which the results were the other way around, that is, the percentage of products classified as LNQ was higher in OsloMet than in the UPV/EHU, was sweets and chewing gums with sweeteners ($p < 0.05$). However, this result was not confirmed when the less rigorous criterion was applied, that is, in separate analyses for LNQ products with inconsistent classification (Table S4). In contrast, the percentage of sweets and chewing gums with sweeteners classified as LNQ "with inconsistent classification" was higher in the UPV/EHU than in OsloMet.

In any case, the results related to the offer of salty snacks and sweet snacks classified as LNQ at the UPV/EHU compared to those of OsloMet were confirmed in separate analyses for LNQ products "with inconsistent classification." Moreover, employing this less rigorous criterion, the following differences in subcategories were observed, in favor of the UPV/EHU: sandwiches, sweets and chewing gums with added sugars, carbonated drinks with added sugars, and juices.

On the other hand, a comparison of the results obtained with the three NPMs for food supply at OsloMet showed substantial agreement between the results obtained with the UK NPM and the AECOSAN criteria and a moderate agreement between the UK NPM and the MFU criteria (Table 3). The agreement between the AECOSAN and the MFU criteria was fair. However, in the case of the food supply at the UPV/EHU, the agreement between the results obtained with the UK NPM and the AECOSAN criteria was moderate, and between the UK NPM and the MFU criteria, and between the AECOSAN and the MFU criteria were fair.

3.3 | Processing level of commercially produced foods

According to the NOVA system, most of the products offered were categorized as "ultra-processed," which was the case for 87.6% of the solid foods and 82.9% of drinks of OsloMet, and 85.5% of the solid foods and 75.5% of drinks of the UPV/EHU (Table 4). No differences were found between the two universities analyzed regarding the share of ultra-processed foods, neither for total of products, for solid foods, nor for drinks. In any case, the product subcategory that presented a higher percentage of products of LNQ was dairy products other than yogurt at OsloMet compared to the UPV/EHU ($p < 0.001$), and juices at the UPV/EHU in comparison with OsloMet ($p < 0.05$).

3.4 | Comparison between the nutritional profile and processing level of commercially produced foods

Regarding the comparison between the NPMs and processing level classification, at both universities, there was from none to fair agreement between the NOVA classification and the three NPMs combined. For each of the NPMs separately, at OsloMet, there was a none-to-slight agreement between the NOVA system and the AECOSAN criteria, whereas, at the UPV/EHU, there was a fair agreement between these two criteria. At both universities, there was fair agreement when comparing the processing level classification with the UK NPM and moderate agreement with the MFU criteria (Table 5). In general, drinks presented a lower agreement compared to solid foods when comparing the NOVA system with the three NPMs combined and separately, except for the comparison with the AECOSAN criteria at OsloMet, and the UK NMP at UPV/EHU. In both cases, solid food presented a lower agreement.

4 | DISCUSSION

The present study aimed to assess differences in the nutritional profile and processing level of commercially produced foods offered at food outlets at the UPV/EHU and OsloMet, as well as discrepancies between the

TABLE 3 Percentages of commercially produced food products sold on campus of OsloMet—Oslo Metropolitan University and the University of the Basque Country UPV/EHU, classified into the same or opposite category and agreement between the three NPMs used (the AECOSAN, the UK NPM, and the MFU criteria).

	AECOSAN[a]				Kappa coefficient[b]	
	OM, *n* (%)		UPV/EHU, *n* (%)		OM	UPV/EHU
	LNQ	HNQ	LNQ	HNQ		
UK NPM[c]						
Solid foods (OM, $n = 169$; UPV/EHU, $n = 822$)					0.647	0.558
LNQ	85 (50.3)	10 (5.9)	533 (64.8)	12 (1.5)		

(Continues)

nutritional quality and processing level of these food products sold in both universities. In summary, the percentage of products of LNQ was higher at the UPV/EHU than at OsloMet; however, no differences were found in the percentage of ultra-processed products. The percentage of LNQ food products sold at both universities was highly variable according to the criteria used for the applied NPMs.

Our results revealed that the UPV/EHU had a higher offer of LNQ products (almost 54.5% of the total products) than OsloMet (almost 40%). These findings confirm our hypothesis that the percentage of LNQ foods is higher at the Spanish university than at the Norwegian university. This difference could be due, at least in part, to the government´s measures to promote health and prevent disease through a healthier diet in both countries (Spain and Norway). In a recent work by Pineda et al. (2022), the Norwegian nutrition policies have been compared with the best international practices, and it has been concluded that they are quite better than those of other countries, among them Spain.

In particular, the UPV/EHU had a higher offer of salty snacks, sweet snacks, dairy products other than yogurt, and dairy drinks of LNQ compared to OsloMet. Some of these products were characterized by high caloric density, fat (especially SFA), sugar, and salt content. Moreover, these outcomes agree with the opinion of the university community about the FE on campus, more students and staff from OsloMet consider that they are usually able to choose healthy foods compared to those from the UPV/EHU (Martinez-Perez et al., 2022a, 2022b). In this sense, it should be noted that after this study, the UPV/EHU implemented some measures to improve the nutritional quality of the food products, through the bid specifications of contracts related to food services. However, difficulties in compliance monitoring have been noted because specific plans for monitoring implementation were not provided. Therefore, opportunities to create healthier FEs at this university remain challenging within ongoing the current global economic and environmental crises.

These discrepancies in LNQ food supply at both universities could also be due to the differences in campus sizes and the number and type of outlets. However, other authors observed few differences in the food supply among campuses with different numbers of student enrolment (an indicator of campus size) (Byrd-Bredbenner et al., 2012), as well as in the ratio of on-campus venues per student. Horacek et al. (2013) studied the dining environment in 15 post-secondary institutions from different regions of the USA and found a ratio of one on-campus food outlet in every 913 students in large institutions (≥30,000 students) and 1 in every 816 students in medium institutions (15,001–29,999 students). In contrast, in the present study, the UPV/EHU had a food outlet for every 546 students, and at OsloMet, 1 for every 1773 students.

The type of food sale in which the greatest differences were found in terms of number between both universities were vending machines. In particular, at the UPV/EHU, 203 vending machines were analyzed versus 2 vending machines at OsloMet. Concerning the ratio of vending machines per person at the UPV/EHU, it was 1 for every 245 people (including students and workers), whereas at OsloMet, it was 1 for every 10,850 people.

In this sense, it should be noted that in another study in which food outlets at the UPV/EHU were audited from the quality point of view, it was observed that the vending machines got the lowest score compared to other food services (Martinez Perez, 2022). This fact could partially explain the differences in terms of the higher percentage of products with LNQ at the UPV/EHU, in comparison with OsloMet. Another important factor that could explain the differences between the two universities is that there was only one company selling food at OsloMet. Thus, it is easier to have a common policy, for example, for having healthier FEs. In any case, the differences in LNQ food supply at both universities could also be due to the dietary patterns of northern and southern Europe, which, in turn, are shaped by cultural, environmental (e.g., food ingredient availability), technological, and economic factors.

Regarding the processing level of commercially produced foods offered at food outlets, in general, no

TABLE 3 (Continued)

	AECOSAN[a]				Kappa coefficient[b]	
	OM, *n* (%)		UPV/EHU, *n* (%)		OM	UPV/EHU
	LNQ	HNQ	LNQ	HNQ		
HNQ	19 (11.2)	55 (32.5)	133 (16.2)	144 (17.5)		
Total	104 (61.5)	65 (38.5)	666 (81.0)	156 (19.0)		
Cold drinks (OM, $n = 82$; UPV/EHU, $n = 229$)					0.695	0.521
LNQ	21 (25.6)	3 (3.7)	86 (37.5)	21 (9.2)		
HNQ	8 (9.8)	50 (61.0)	34 (14.8)	88 (38.4)		
Total	29 (35.6)	53 (64.6)	120 (52.4)	109 (47.6)		
Total (OM, $n = 251$; UPV/EHU, $n = 1051$)					0.682	0.568
LNQ	106 (42.2)	13 (5.2)	619 (44.0)	33 (2.3)		
HNQ	27 (10.6)	105 (41.8)	167 (11.9)	232 (16.5)		
Total	133 (53.0)	118 (47.0)	786 (55.9)	265 (18.8)		
MFU[d]						
Solid foods (OM, $n = 169$; UPV/EHU, $n = 822$)					0.323	0.481
LNQ	96 (56.8)	41 (24.3)	642 (78.1)	87 (10.6)		
HNQ	8 (4.7)	24 (14.2)	24 (2.9)	69 (8.4)		
Total	104 (61.5)	65 (38.5)	666 (81.0)	156 (19.0)		
Cold drinks (OM, $n = 82$; UPV/EHU, $n = 229$)					−0.013	−0.025
LNQ	16 (19.5)	30 (36.6)	52 (22.7)	102 (44.5)		
HNQ	13 (15.8)	23 (28.0)	68 (29.7)	59 (25.8)		
Total	29 (35.6)	53 (64.6)	120 (52.4)	109 (47.6)		
Total (OM, $n = 251$; UPV/EHU, $n = 1051$)					0.246	0.388
LNQ	112 (44.6)	71 (28.3)	694 (66.0)	137 (13.0)		
HNQ	21 (8.4)	47 (18.7)	92 (8.7)	128 (12.2)		
Total	133 (53.0)	118 (47.0)	786 (74.8)	265 (25.2)		
	UK NPM[c]					
MFU[d]						
Solid foods (OM, $n = 169$; UPV/EHU, $n = 822$)					0.610	0.343
LNQ	95 (56.2)	42 (24.8)	536 (65.2)	193 (23.5)		
HNQ	–	32 (18.9)	9 (1.1)	84 (10.2)		
Total	95 (56.2)	74 (43.8)	545 (66.3)	277 (33.7)		
Cold drinks (OM, $n = 82$; UPV/EHU, $n = 229$)					0.257	0.270
LNQ	19 (23.2)	27 (32.9)	63 (27.5)	39 (17.0)		
HNQ	5 (6.1)	31 (37.8)	44 (19.2)	83 (36.2)		
Total	24 (29.3)	58 (70.7)	107 (46.7)	122 (53.3)		
Total (OM, $n = 251$; UPV/EHU, $n = 1051$)					0.424	0.369
LNQ	114 (45.4)	69 (27.5)	599 (53.2)	232 (22.1)		
HNQ	5 (2.0)	63 (25.1)	53 (5.0)	167 (15.9)		
Total	119 (47.4)	132 (52.6)	652 (62.0)	399 (38.0)		

Abbreviations: AECOSAN, Spanish Agency for Consumer Affairs, Food Safety and Nutrition; EHU, University of the Basque Country UPV/EHU; HNQ, high nutritional quality; LNQ, low nutritional quality; MFU, Norwegian Food and Drink Industry Professional Practices Committee; NPM, nutrient profiling model; OM, OsloMet—Oslo Metropolitan University.

[a]Spanish Agency for Consumer Affairs, Food Safety and Nutrition—AECOSAN (2010).

[b]The kappa results were interpreted as follows: values ≤0 no agreement, 0.1–0.20 none to slight, 0.21–0.40 fair, 0.41–0.60 moderate, 0.61–0.80 substantial, and 0.81–1.00 almost perfect.

[c]Department of Health of the United Kingdom (2011).

[d]Matbransjens Fagligle Utvalg (MFU) (2013).

TABLE 4 Differences in processing level of commercially produced food products sold in food outlets on campus between OsloMet—Oslo Metropolitan University and the University of the Basque Country UPV/EHU.

Type of product	NOVA system[a] Ultra-processed, %		
	OM	EHU	p[b]
Solid foods			
Fruit and fruit derivatives	37.5	12.5	0.102
Dairy products			
Yogurts	88.2	87.0	1.000
Other dairy products (custard, cream caramel, cheese, pudding, etc.)	83.3	32.4	**<0.001**
Nuts	50.0	60.0	0.682
Salty snacks	84.2	90.8	0.408
Sandwiches	100.0	100.0	–
Sweet snacks	93.9	99.2	**0.005**
Sweets and chewing gums			
With added sugars	100.0	100.0	–
With sweeteners	100.0	100.0	–
Total of solid foods	87.6	85.5	0.486
Drinks			
Bottled water	–	–	–
Carbonated drinks			
With added sugars	100.0	100.0	–
With added sugars and sweeteners	100.0	100.0	–
With sweeteners	100.0	90.9	0.407
Without added sugars or sweeteners	–	–	–
Dairy drinks	100.0	100.0	–
Juices	30.0	74.6	**0.008**
Milk	–	–	–
Non-carbonated drinks			
With added sugars	100.0	100.0	–
With sweeteners	100.0	100.0	–
Vegetable drinks	100.0	71.4	1.000
Total of drinks	82.9	75.5	0.170
Total of products	86.1	83.3	0.295

Abbreviations: EHU, University of the Basque Country UPV/EHU; OM, OsloMet—Oslo Metropolitan University.

[a]Monteiro et al. (2018a).

[b]χ^2 test or the Fisher exact test was used to assess differences between universities.

differences were found between both universities. Thus, the hypothesis that the commercially produced food supply at the Spanish university has a higher percentage of ultra-processed foods than the supply at the Norwegian university was not confirmed. Nevertheless, the supply of ultra-processed dairy products other than yogurt was more frequent at OsloMet than at the UPV/EHU, and the supply of ultra-processed sweet snacks and juices was more frequent at the UPV/EHU than at OsloMet. To our knowledge, there are no previous similar studies analyzing the ultra-processed food supply in these FEs. However, Monteiro et al. (2018b) showed a greater total household availability of ultra-processed foods in Norway than in Spain. In any case, nowadays, ultra-processed products have become more available, heavily promoted, and relatively more affordable compared to minimally or unprocessed foods, in most FEs (Food and Agriculture Organization of the United Nations—FAO, 2016).

Concerning the differences in the classifications based on several NPMs, the hypothesis that the percentage of LNQ food products sold at both universities is highly variable according to the criteria used for the evaluation

TABLE 5 Percentages of commercially produced food products sold on campus of OsloMet—Oslo Metropolitan University and the University of the Basque Country UPV/EHU, classified into the same or opposite category and agreement between the three nutrient profiling models used and processing level classification (NOVA system).

	NOVA system[a]				Kappa coefficient[b]	
	OM, *n* (%)		EHU, *n* (%)			
	Ultra-processed	Non-ultra-processed	Ultra-processed	Non-ultra-processed	OM	EHU
AECOSAN[c]						
Solid foods (OM, $n = 169$; EHU, $n = 822$)					0.170	0.404
LNQ	97 (57.4)	7 (4.1)	616 (74.9)	50 (6.1)		
HNQ	51 (30.2)	14 (8.3)	87 (10.6)	69 (8.4)		
Total	148 (87.6)	21 (12.4)	703 (85.5)	119 (14.5)		
Drinks (OM, $n = 82$; EHU, $n = 229$)					0.202	0.185
LNQ	29 (35.4)	–	101 (44.1)	19 (8.3)		
HNQ	39 (47.6)	14 (17.1)	72 (31.4)	37 (16.1)		
Total	68 (82.9)	14 (17.1)	173 (75.5)	56 (24.4)		
Total (OM, $n = 251$; EHU, $n = 1051$)					0.192	0.352
LNQ	126 (50.2)	7 (2.8)	717 (68.2)	69 (6.6)		
HNQ	90 (35.9)	28 (11.1)	159 (15.1)	106 (10.1)		
Total	216 (86.1)	35 (13.9)	876 (83.3)	175 (16.6)		
UK NPM[d]						
Solid foods (OM, $n = 169$; EHU, $n = 822$)					0.256	0.291
LNQ	93 (55.0)	2 (1.2)	512 (62.3)	33 (4.0)		
HNQ	55 (32.5)	19 (11.2)	191 (23.2)	86 (10.5)		
Total	148 (87.6)	21 (12.4)	703 (85.5)	119 (14.5)		
Drinks (OM, $n = 82$; UPV/EHU, $n = 229$)					0.157	0.324
LNQ	24 (29.3)	–	100 (43.7)	7 (3.1)		
HNQ	44 (53.7)	14 (17.1)	73 (31.9)	49 (21.4)		
Total	68 (82.9)	14 (17.1)	173 (75.5)	56 (24.4)		
Total (OM, $n = 251$; EHU, $n = 1051$)					0.224	0.311
LNQ	117 (46.6)	2 (0.8)	612 (58.2)	40 (3.8)		
HNQ	99 (39.4)	33 (13.1)	264 (25.1)	135 (12.8)		
Total	216 (86.1)	35 (13.9)	879 (83.6)	175 (16.6)		
MFU[e]						
Solid foods (OM, $n = 169$; EHU, $n = 822$)					0.534	0.633
LNQ	132 (78.1)	5 (3.0)	682 (83.0)	47 (5.7)		
HNQ	16 (9.5)	16 (9.5)	21 (2.5)	72 (8.8)		
Total	148 (87.6)	21 (12.4)	703 (85.5)	119 (14.5)		
Drinks (OM, $n = 82$; EHU, $n = 229$)					0.417	0.363
LNQ	46 (56.1)	–	99 (43.2)	3 (1.3)		
HNQ	22 (26.8)	14 (17.1)	74 (32.3)	53 (23.1)		
Total	68 (82.9)	14 (17.1)	173 (75.5)	56 (24.4)		
Total (OM, $n = 251$; EHU, $n = 1051$)					0.488	0.549
LNQ	178 (59.0)	5 (2.0)	781 (74.3)	50 (4.8)		
HNQ	38 (15.1)	30 (11.9)	95 (9.0)	125 (11.9)		
Total	216 (86.1)	35 (13.9)	876 (83.3)	175 (16.6)		
AECOSAN + UK NPM + MFU[f]						
Solid foods (OM, $n = 169$; EHU, $n = 822$)					0.204	0.302
LNQ	83 (49.1)	2 (1.2)	498 (60.6)	26 (3.2)		
HNQ	65 (38.5)	19 (11.2)	205 (24.9)	93 (11.3)		

(Continues)

TABLE 5 (Continued)

	NOVA system[a]				Kappa coefficient[b]	
	OM, *n* (%)		EHU, *n* (%)			
	Ultra-processed	Non-ultra-processed	Ultra-processed	Non-ultra-processed	OM	EHU
Total	148 (84.6)	21 (12.4)	703 (85.5)	119 (14.5)		
Drinks (OM, $n = 82$; EHU, $n = 229$)					0.095	0.148
LNQ	16 (19.5)	–	48 (21.0)	1 (0.4)		
HNQ	52 (63.4)	14 (17.1)	125 (54.6)	55 (24.0)		
Total	68 (82.9)	14 (17.1)	173 (75.5)	56 (24.4)		
Total (OM, $n = 251$; EHU, $n = 1051$)					0.169	0.277
LNQ	99 (39.4)	2 (0.8)	546 (51.9)	27 (2.6)		
HNQ	117 (46.6)	33 (13.1)	330 (31.4)	148 (14.1)		
Total	216 (86.0)	35 (13.9)	876 (83.3)	175 (16.6)		

Abbreviations: AECOSAN, Spanish Agency for Consumer Affairs, Food Safety and Nutrition; EHU, University of the Basque Country UPV/EHU; HNQ, high nutritional quality; LNQ, low nutritional quality; MFU, Norwegian Food and Drink Industry Professional Practices Committee; NPM, nutrient profiling model; OM, OsloMet—Oslo Metropolitan University.

[a]Monteiro et al. (2018a).

[b]The kappa results were interpreted as follows: values ≤0 no agreement, 0.1–0.20 none to slight, 0.21–0.40 fair, 0.41–0.60 moderate, 0.61–0.80 substantial, and 0.81–1.00 almost perfect.

[c]Spanish Agency for Consumer Affairs, Food Safety and Nutrition—AECOSAN (2010).

[d]Department of Health of the United Kingdom (2011).

[e]Matbransjens Fagligle Utvalg (MFU) (2013).

[f]To classify the commercially produced food products, the combination of the three NPMs was used, that is, if a food or drink had been classified as LNQ according to the Spanish Agency for Consumer Affairs, Food Safety and Nutrition—AECOSAN (2010), the UK NPM (Department of Health of the United Kingdom, 2011), and the Matbransjens Fagligle Utvalg (MFU) criteria (2013), it was considered LNQ.

of their nutritional profile was confirmed. The highest level of agreement was obtained between the UK and the AECOSAN NMP (moderate–substantial), and the lowest between the AECOSAN and the MFU NMP (fair). These differences may be related to discrepancies in the constructs and scoring criteria of the NMPs used. The UK NMP criteria, for example, penalize critical nutrients, but the scores are offset by positive points associated with other foods/nutrients. However, this is not the case for the AECOSAN or the MFU NMP.

On the other hand, the hypothesis that LNQ food products are mostly ultra-processed was not confirmed. At both universities, there was from none to fair agreement between the NOVA classification and the three NPMs combined. This result agrees with that of Lee et al. (2023), and it is probably because although ultra-processed foods are usually characterized by a high content of sugar, salt, and/or fats, these contents do not always exceed the limits of the NPMs. In any case, ultra-processed foods had, in general, a worse nutrient profile than less-processed foods (Luiten et al., 2016).

To better contextualize the findings of this research, some limitations need to be acknowledged. First, only commercially produced food products offered in food outlets have been analyzed in both universities. The authors recorded data on the supply of homemade products offered at the UPV/EHU; however, the offer of these products at OsloMet could not be studied due to the campuses' closure due to the COVID-19 pandemic. We plan to assess the complete offer in the future to make broader conclusions, and to incorporate other elements of the conceptual model proposed by de Castro and Canella (2022), as well as other healthiness indicators (Ferreira et al., 2021), for a better understanding of these organizational FE.

Second, data on food were registered at one point in time; thus, changes in the food supply were not taken into account. However, these changes are usually few in number during the valid period of the supply contract. Third, the sales or consumption of products was not assessed; to overcome this limitation, we plan to analyze these data shortly. Despite these limitations, there are several strengths associated with this study. First, to our knowledge, no studies have analyzed the differences in the nutritional profile of foods and drinks sold in different European universities, nor in other FEs of the participating countries (Norway and Spain). Second, we used a fairly new tool for vending machine assessment studies, digital photography. This method is highly accurate, reliable, and time-effective and allows data acquisition for uninterrupted evaluation of the FE (Horacek et al., 2019; Matthews et al., 2014).

5 | CONCLUSION

In conclusion, the northern and southern European universities studied are different in terms of the proportion of commercially produced foods of LNQ offered. In particular, a higher proportion of this type of product was found at the UPV/EHU than at OsloMet. However, overall, no differences were found in the percentage of ultra-processed products offered at both universities, probably due to a low level of concordance between the nutritional profile and the level of processing. Our exploratory hypothesis is that this phenomenon is a consequence of the Nordic government policies that have great potential to create healthy FEs.

Given these results, there is a need to develop specific intervention programs and policies, especially those adapted to the sociocultural context of the Basque Country, to promote campus FE fully supportive of healthy eating. It should be noted that an unhealthy FE may negate food policies, especially among students who can leave campus, and could also lower the effectiveness of health education in the classroom by setting a highly visible example that counters educational messages (Sturm, 2008).

AUTHOR CONTRIBUTIONS

Naiara Martinez-Perez: Conceptualization; methodology; formal analysis; investigation; data curation; writing—original draft; writing—review and editing; visualization; funding acquisition. **Liv Elin Torheim**: Conceptualization; methodology; resources; writing—review and editing; funding acquisition. **Marta Arroyo-Izaga**: Conceptualization; methodology; resources; data curation; writing—original draft; writing—review and editing; visualization; supervision; project administration; funding acquisition.

ACKNOWLEDGMENTS

This research was supported by the Vice Rectorate of Scientific and Social Development and Transfer of the University of the Basque Country UPV/EHU, funded by the contract program formalized with the Basque Government (code of the Campus Bizia Lab project: 21ARRO and 22ARRO) and by the Department of Nursing and Health Promotion of the OsloMet. The authors also acknowledge the support provided by the Erasmus Doctoral Program (2019–2020) for the fellowship grant. Open Access funding is provided by the University of the Basque Country UPV/EHU BIOMICs Research Group is supported by the Basque Government (No. IT1633-22). The authors thank the participating universities and companies for their collaboration in the research.

CONFLICT OF INTEREST STATEMENT

All other authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data are available from the corresponding author on a reasonable request, together with a research plan proposal.

ORCID

Marta Arroyo-Izaga https://orcid.org/0000-0001-5592-4241

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Martinez-Perez, N., Torheim, L. E., & Arroyo-Izaga, M. (2024). Availability and properties of commercially produced food products offered in European public universities: A North–South comparison. *Journal of Food Science*, *89*, 2494–2511. https://doi.org/10.1111/1750-3841.17022