Original Paper

Nutritional characteristics and composition of the biscuits available in the Spanish market and biscuits marketed to children

M.ª Socorro Hoyos Vázquez[a], Sergio García Castillo[b], Juan Rodríguez Delgado[c], Manuel Praena Crespo[d]

[a]Pediatra. CS Zona VII-Feria. Albacete. España • [b]Neumólogo. Complejo Hospitalario Universitario de Albacete. España • [c]Pediatra. Consultorio Local de Alpedrete. Madrid. España • [d]Pediatra. CS La Candelaria. Sevilla. España. Instituto Catalán de la Salud (ICS). Barcelona. España.

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M.ª Socorro Hoyos Vázquez:
mshoyos@sescam.jccm.es

Abstract

Introduction: The consumption of biscuits is high in the Spanish paediatric population. Biscuits are ultra-processed products with a high energy content and energy density and generally contain added sugars and unhealthy fats.

Methods: We conducted a cross-sectional descriptive study on the characteristics and nutritional composition of biscuits available in Spanish supermarkets, and compared biscuits marketed to children to all other biscuits.

Results: We analysed a sample of 350 biscuits. The mean energy content was 471.86 ± 35.83 kcal/100 g. Saturated fats were used in 53.1%, palm oil in 47.1% and added sugars in 90% (median content, 25 g/100 g; IQR: 20-33). The median dietary fibre content was 3.2 g/100 g (IQR: 2.4-5.2). The packaging of 86 advertised that the product contained fibre, specifying the total fibre content in 95.34% of cases, with a median value of 5.45 g/100 g (IQR: 4-7.9). Of the total products, 53 (15.1%) were marketed to children, and their mean energy content was 466.47 ± 19.31 kcal/100 g. The main fat was olive oil or high oleic sunflower oil (HOSO) in 67.9%, and palm oil was present in 20 (37.7%). There were added sugars in 98.1% (mean sugar content, 25.88 ± 6.82 g/100 g). The median dietary fibre content was 2.9 g/100 g (IQR 2.27-3.42). The packaging of 75.5% featured some form of advertising. The comparative analysis showed that a greater percentage of biscuits specifically marketed to children had added sugars (98.1% *vs* 88.6%, $p = 0.033$) and that these biscuits had a lower fibre content (median, 2.9 g/100 g *vs.* 3.5 g/100 g, $p = 0.005$), that a greater percentage contained olive oil or HOSO (67.9% *vs* 36.7%, $p < 0.001$), and a greater percentage featured promotional advertising in their packaging (75.5% *vs* 45.5%, $p < 0.001$).

Conclusions: Biscuits marketed to the paediatric population had added sugars and a high energy content; more than 37% had saturated fats and a high proportion featured advertising in the packaging. On the other hand, we found that monounsaturated fats were used in more than 50% of these products. The findings of this study could serve as reference to guide the development of public health interventions or product reformulation by manufacturers.

Key words:
• Biscuits
• Marketing
• Childhood obesity
• Ultra-processed foods

Características nutricionales y composición de las galletas disponibles en el mercado español y de las galletas dirigidas a la población infantil

Resumen

Introducción: en España existe un elevado consumo de galletas en la población infantil. Son productos ultraprocesados de alto contenido energético y densidad calórica, en general con azúcar añadido y grasas poco saludables.

Material y métodos: estudio descriptivo transversal sobre características y composición nutricional de galletas disponibles en supermercados españoles y comparativo entre las dirigidas al público infantil y el resto.

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Resultados: se analizaron 350 galletas: valor energético medio 471,86 ± 35,83 kcal/100 g. El 53,1% contenían grasas saturadas, aceite de palma el 47,1% y azúcar añadido el 90%. Mediana de azúcares 25 g/100 g (rango intercuartílico [RI]: 20-33). Mediana de fibra alimentaria 3,2 g/100 g (RI: 2,4-5,2); 86 galletas mostraban publicidad sobre fibra y 95,34% indicaban la cantidad, mediana de 5,45 g/100 g (RI: 4-7,9). Se analizaron 53 galletas (15,1%) dirigidas al público infantil. Valor energético medio 466,47 ± 19,31 kcal/100 g. El aceite de oliva/girasol alto oleico (GAO) fue la grasa principal en el 67,9%. Aceite de palma presente en el 37,7% y azúcar añadido en 98,1% (media 25,88 ± 6,82 g/100 g). Mediana de fibra alimentaria 2,9 g/100 g (RI: 2,27-3,42). El 75,5% mostraron publicidad de reclamo. Las galletas dirigidas al público infantil contenían azúcar añadido en mayor porcentaje (98,1 frente a 88,6%; $p = 0,033$), menos fibra (mediana 2,9 g/100 g frente a 3,5 g/100 g; $p = 0,005$), aceite de oliva/GAO en mayor porcentaje (67,9 frente a 36,7%; $p < 0,001$) y más publicidad de reclamo (75,5 frente a 45,5%; $p < 0,001$).

Conclusiones: las galletas dirigidas al público infantil contienen azúcar añadido, elevado contenido calórico, grasas saturadas en más del 37% y publicidad de reclamo en elevado porcentaje. Por otro lado, se observa el uso de grasas monoinsaturadas en más del 50%. La información de este estudio podría facilitar intervenciones de salud pública e incentivar a los fabricantes para reformular sus productos.

Palabras clave:
- Alimentos ultraprocesados
- Galletas
- Obesidad infantil
- Publicidad

INTRODUCTION

Biscuits are the main staple of breakfast and the afternoon snack of children in a large proportion of Spanish households, not only at present, but also in the past. It is estimated that biscuits started being made 10 000 years ago, when our nomadic ancestors discovered that cooking a paste made of cereals produced a food similar to bread in texture, easy to carry and with a high energy content. Practically all ancient peoples cooked biscuits, which are one of the first cooked foods that ever existed. They were introduced in Europe in the VIII century with the early Arab conquests,[1], and their mass production started from the Industrial revolution (XVIII and XIX centuries) to meet the demands of the navy and other shipping fleets, which needed long-lasting food products.

In the last few decades, social and cultural changes have brought on significant shifts in dietary habits in Spain, a phenomenon known as nutrition transition. Industrial and processed products, some of which specifically target the paediatric population (including biscuits), with a higher energy density and rich in animal fat and sugars, largely replacing fresh foods and the Mediterranean diet.[2]

On the other hand, childhood obesity has become an important public health problem, exhibiting an alarming increase in recent years all over Europe,[3] and Spain is one of the European countries with the highest rates of obesity.[4] This substantial increase cannot be attributed to genetic causes, but rather to environmental factors, including the consumption of hypercaloric foods and the lack of physical activity, which combine to create the so-called obesogenic environment, in which children find themselves from an early age.[2]

Although there are no data on the percentage of the population that regularly consumes biscuits with point of sale and product promotions, we known that this type of marketing of unhealthy foods and beverages is widely recognised in Europe as a significant contributor to childhood obesity, and the development of non-communicable diseases (NCDs) related to the diet.[5]

In this study, we described and analysed the nutritional characteristics of a large number of biscuits sold in Spanish supermarkets and biscuits specifically marketed to children, and compared biscuits marketed to children with all other biscuits.

MATERIAL AND METHODS

We conducted a cross-sectional descriptive and correlational study in a sample of biscuits sold in large supermarket chains in Spain between November 2018 and January 2019.

We collected data by an online search of the products sold in 4 large supermarket chains in Spain: Carrefour, Mercadona, Día and El Corte Inglés. We selected products in the order that they appeared

and consulted the ingredients list provided in the packaging. We obtained a sample of biscuits of 61 different brands. We excluded products for which nutritional information was not available and savoury biscuits. We considered that a biscuit was marketed specifically to the paediatric population if the design of the packaging or the promotional marketing suggested this target population.

We collected data on the following variables: manufacturer and brand name, energy content (kcal/100 g) and energy density (kcal/g), nutritional composition (total fat, saturated fat, carbohydrate (CH), sugars, fibre, protein and salt) per 100 g of product, and other characteristics such as whether the biscuit was a private label or organic product, had a filling or a coating, its main fat, whether it contained palm oil, artificial sweeteners, was labelled as being "sugar-free", "gluten-free" or "lactose-free", whether the packaging made claims regarding the fibre content, the percentage of whole-grain flour, any promotional advertising and the price per kg of product.

The descriptive analysis involved the calculation of absolute and relative frequencies for qualitative variables and measures of central tendency and dispersion for quantitative variables. We used the mean and standard deviation if the data distribution was normal and the median and interquartile range (IQR) otherwise. In the comparative analysis, we used contingency tables and the χ^2 test or Fisher exact test, as applicable, for qualitative data, and the Student t test for normally distributed quantitative data and the Mann-Whitney U test for quantitative data that did not follow a normal distribution. We considered differences corresponding to a *p*-value of less than 0.05 statistically significant.

RESULTS

Total biscuit sample

We included 350 biscuit products in the analysis, of which 94 (26.9%) were private label biscuits. Of the total sample, 53 (15.1%) were specifically marketed to the paediatric population. We analysed different types of biscuits: 125 with coatings or fillings (35.7%), 22 "organic" (6.3%), 37 "sugar-free" (10.6%), 20 "gluten-free" (5.7%) and 27 "lactose-free" (7.7%). When it came to the claims and advertising in the packaging, 86 (24.6%) had claims regarding fibre and 175 (50%) had promotional advertisement. We analysed the price per kg of product and found a median price of 6.69 € (IQR, 4.13-10.5).

When it came to the nutritional composition of the products, we obtained the following results: the mean energy content was 471.86 ± 35.83 kcal/100 g of product and the median energy density was 4.72 kcal/g (IQR: 4.47-5).

We analysed the main fat used in the manufacture of the biscuits, finding that olive oil or high-oleic sunflower oil (HOSO) was the main fat in 145 (41.4%) and saturated fats (lard, butter, coconut oil, palm oil, rapeseed oil) in 186 (53.1%). When it came to the total fat content, we found a median of 19 g /100 g (IQR: 15.67-24), with a median saturated fat content of 6 g/100 g (IQR: 2.1-12). We assessed whether the biscuits contained palm oil, and found it as an ingredient in 165 (47.1%).

We analysed the CH content and found a median of 67 g/100 g (IQR: 62-71) and a median sugar content of 25 g/100 g (IQR: 20-33). There were added sugars in 315 of the products (90%) and artificial sweeteners in 40 (11.4%). The median protein content was 6.3 g/100 g (IQR: 5.5-7) and the median salt content 0.7 g/100 g (IQR: 0.5-0.9). We analysed the dietary fibre content, finding a median of 3.2 g/100 g (IQR: 2.4-5.2). Of the 86 products whose packaging featured claims about the fibre content, 82 (95.34%) featured the amount of fibre in the packaging, the median of which was 5.45 g/100 g (IQR: 4-7.9). In the remaining products whose packaging did not feature claims about fibre, the nutritional information included information on the fibre content in 187 (70.83%), with a median content of 2.7 g/100 g (IQR: 2.2-3.5). We found a statistically significant difference in the fibre content between both groups of biscuits, with $p < 0.001$. The packaging of 64 products (18.3%) highlighted

the presence of whole grain flour. The packaging of 51 (79.7%) specified the percentage of whole grain flour, with a median percentage of 32.73 ± 18.34%. Thirteen products (20.3%) did not provide information on this percentage (**Table 1**).

Biscuits specifically marketed to the paediatric population

Of these 53 biscuit brands, 9 (17%) were private label products, 17 (32.1%) had a filling or a coating, 2 (3.8%) were "sugar-free", 4 (7.5%) "gluten-free" and 6 (11.3%) "lactose-free".

When it came to the advertising found in the packaging, 5 (9.4%) referred to the fibre content of the product and 40 (75.5%) featured promotional advertising. We analysed the price per kg of product, and the mean was 7.24 ± 3.64 €.

The results of the analysis of the nutritional composition were the following: the mean energy content was 466.47 ± 19.31 kcal/100 g and the median energy density was 4.65 kcal/g (IQR: 4.56-4.76). Olive oil or HOSO was the main fat in 36 products (67.9%) and saturated fats in 17 (32.1%). The mean total fat content was 17.49 ± 3.18 g/100 g and the mean saturated fat content was 4.86 ± 3.86 g/100 g. Palm oil was used in 20 products (37.7%). The mean CH content was 69.95 ± 3.72 g/100 g and the mean sugar content 25.88 ± 6.82 g/100 g. We found added sugar in 52 products (98.1%) and sweeteners in 1 (1.9%). The mean protein content was 5.94 ± 0.93 g/100 g and the mean salt content 0.69 ± 0.21 g/100 g. The median dietary fibre content was 2.9 g/100 g (IQR: 2.27-3.42). In 3 products (5.7%) the packaging emphasised the presence of whole

Table 1. Summary of qualitative and quantitative variables in the total sample of biscuits and the group of biscuits marketed to the paediatric population

	Total (*n* = 350)	Children (*n* = 53)
Qualitative variables (Yes [%])		
Private label	94 (26.9%)	9 (17%)
Filling/coating	125 (35.7%)	17 (32.1%)
Organic	22 (6.3%)	0 (0%)
Main fat olive oil/HOSO	145 (44.4%)	36 (67.9%)
Main fat saturated fat	186 (53.1%)	17 (32.1%)
Containing palm oil	165 (47.1%)	20 (37.7%)
Added sugars	315 (90%)	52 (98.1%)
Sweeteners	40 (11.4%)	1 (1.9%)
Sugar-free	37 (10.6%)	2 (3.8%)
Gluten-free	20 (5.7%)	4 (7.5%)
Lactose-free	27 (7.7%)	6 (11.3%)
Advertised fibre content	86 (24.6%)	5 (9.4%)
Promotional advertising	175 (50%)	40 (75.5%)
Whole grain flour	64 (18.3%)	3 (5.7%)
Quantitative variables		
Energy content (kcal/100 g)	471.86 ± 35.83	466.47 ± 19.31
Energy density (kcal/1 g)	4.72 (IQR: 4.47-5)	4.65 (IQR: 4.56-4.76)
Total fat (g/100 g)	19 (IQR: 15.67-24)	17.49 ± 3.18
Saturated fat (g/100 g)	6 (IQR: 2.1-12)	3.4 (IQR: 1.85-7)
Carbohydrates (g/100 g)	67 (IQR: 62-71)	70 (IQR: 68-73)
Simple carbohydrates/sugars (g/100 g)	25 (IQR: 20-33)	25 (IQR: 22.8-31)
Dietary fibre (g/100 g)	3.2 (IQR: 2.4-5.2)	2.9 (IQR: 2.27-3.42)
Protein (g/100 g)	6.3 (IQR: 5.5-7)	6 (IQR: 5.5-6.65)
Sal (g/100 g)	0.7 (IQR: 0.5-0.9)	0.68 (IQR: 0.51-0.79)
Whole grain flour (%)	26.08 ± 21.05	No information
Price per kilogram (€)	6.69 (IQR: 4.13-10.5)	6.76 (IQR: 5.04-6.76)

grain flour, but the actual percentage of this flour was not featured in any of them (Table 1).

Comparison of biscuits marketed to children and all other products in the sample

The percentage of biscuits in which the main fat was olive oil or HOSO was 67.9% in the group marketed to children compared to 36.7% in the rest of the sample, a difference that was statistically significant (p <0.001). We found statistically significant differences in the percentage of biscuits in which the main fat was saturated, which was greater in the group not marketed specifically to children (56.9% versus 32.1%, p = 0.001). As for advertising in the packaging regarding the fibre content and the use of whole grain flour, both were more frequent in biscuits marketed to children. We found promotional advertising more frequently in the products marketed to children (75.5% versus 45.5%, p <0.001). We found statistically significant differences in the proportion of biscuits that had added sugars, that had sweeteners and labelled "organic" (Table 2). We also found statistically significant differences in the total fat, dietary fibre and protein contents, with p = 0.005, and in the saturated fat and CH contents, with p <0.001 (Table 3).

DISCUSSION

In Spain, biscuits are mainly consumed during breakfast and as an afternoon snack in every age group. According to the Estudio Nutricional de la Población Española (Nutrition Study of the Spanish Population, ENPE) conducted in 2014 and 2015, 44.6% of children aged 3 to 8 years and nearly 40% of those aged 9 to 18 years eat biscuits at breakfast [6].

Biscuits are ultra-processed foods: they are very profitable due to their low cost and prolonged shelf-life, they are easy to eat and transport and they are very palatable, reasons that may explain their substantial consumption in the population.[7,8] But there is yet another disadvantage to them: they displace consumption of healthier foods. There are several classifications of foods based on their degree of processing, and the most widely used is the NOVA classification,[9,10] which includes biscuits in category 4: ultra-processed foods. As most foods in this category, biscuits have a high calorie content and energt density. Our study corroborated this fact, as can be seen in Table 1. The mean energy content per 100 g of product (471.86 kcal/100 g) and the mean energy density (4,72 kcal/g) were high, as was the amount of added sugars (25 g/100 g).

Table 2. Comparison of qualitative variables in biscuits marketed to children versus all other biscuits

Qualitative variable (Yes [%])	Not to children	To children	*p*
Private label	85 (28.6%)	9 (17%)	0.078
Filling/coating	108 (36.4%)	17 (32.1%)	0.548
Organic	22 (7.4%)	0 (0%)	0.033
Main fat olive oil/HOSO	109 (36.7%)	36 (67.9%)	<0.001
Main fat saturated fat	169 (56.9%)	17 (32.1%)	0.001
Containing palm oil	145 (48.8%)	20 (37.7%)	0.136
Added sugars	263 (88.6%)	52 (98.1%)	0.033
Sweeteners	39 (13.1%)	1 (1.9%)	0.018
Sugar-free	35 (11.8%)	2 (3.8%)	0.081
Gluten-free	16 (5.4%)	4 (7.5%)	0.521
Lactose-free	21 (7.1%)	6 (11.3%)	0.27
Advertised fibre content	81 (27.3%)	5 (9.4%)	0.005
Promotional advertising	135 (45.5%)	40 (75.5%)	<0.001
Whole grain flour	61 (20.5%)	3 (5.7%)	0.01

Table 3. Comparison of quantitative variables in biscuits marketed to children versus all other biscuits

Quantitative variable	Not to children	To children	*p*
Energy content (kcal/100 g)	472.82 ± 37.97	466.47 ± 19.31	0.235
Energy density (kcal/1 g)	4.74 (IQR: 4.46-5.05)	4.65 (IQR: 4.56-4.76)	0.158
Total fat (g/100 g)	19.91 ± 6.13	17.49 ± 3.18	0.005
Saturated fat (g/100 g)	7 (IQR: 2.5-13)	3.4 (IQR: 1.85-7)	<0.001
Carbohydrates (g/100 g)	66 (IQR: 61.25-70)	70 (IQR: 68-73)	<0.001
Simple carbohydrates/sugars (g/100 g)	25 (IQR: 20-34)	25 (IQR: 22.8-31)	0.663
Dietary fibre (g/100 g)	3.5 (IQR: 2.46-5.5)	2.9 (IQR: 2.27-3.42)	0.005
Protein (g/100 g)	6.5 (IQR: 5.5-7.3)	6 (IQR: 5.5-6.65)	0.005
Sal (g/100 g)	0.7 (IQR: 0.5-0.91)	0.68 (IQR: 0.51-0.79)	0.789
Whole grain flour (%)	32.73 ± 18.34	No information	?
Price per kilogram (€)	6.64 (IQR: 3.99-11.06)	6.76 (IQR: 5.04-6.76)	0.751

In our literature search, we found the Technical-Health Regulations for the Elaboration, Manufacture, Distribution and Sale of Biscuits (Boletín Oficial del Estado A-1982-13243), but this document made no reference or specified what the nutritional composition of biscuits should be.

Our search also did not identify any domestic or international study similar to ours, and most published studies focused on the reformulation of flours or the analysis of 2 or 3 variables. Therefore, our study is the broadest study conducted on the biscuits available in the market and could provide reference data for potential public health interventions or motivate manufacturers to reformulate their products. However, while the sample was large, it was not exhaustive, and the data in the analysis were those provided by the manufacturer. A laboratory analysis of the biscuits would provide more comprehensive data.

A growing number of studies is providing evidence of the association of consumption of ultra-processed foods with the development of obesity and other NCDs,[12,13] as well as an increased mortality in the adult population,[14] and while more prospective studies are required to confirm and identify the underlying causes of this relationship, it seems reasonable to avoid consumption of these products.

The use of unhealthy diets in the manufacturing process improves the palatability of the product. Dietary fats are one of the main sources of energy, and their quality has a profound impact on health. From the perspective of nutrition, triglycerides, in the form of fatty acids, are the main component of ingested fats. The most common saturated fatty acids (SFAs) found in the diet are lauric acid, palmitic acid and stearic acid. Several studies have found an association between SFAs and abnormalities in the lipid profile (elevated total cholesterol, LDL cholesterol, HDL cholesterol and total cholesterol/HDL cholesterol ratio), which is considered a risk factor for coronary and cardiovascular disease.[15,16] Our study found that the main fat in more than half of the biscuits was in the form of SFAs, although this proportion was smaller in the group of products marketed to the paediatric population.

The predominant use of palm oil in the food industry has made it the vegetable oil with the highest production in the world. In recent years, it has been scrutinised by institutions related to health and health policy, such as the World Health Organization (WHO). Its direct effects on health remain controversial, although there is scientific evidence on the association between SFAs and cardiovascular disease, and palm oil has a SFA percentage that is much higher compared to other vegetable oils.[16] According to the WHO, massive cultivation of this plant has a significant indirect impact on health: increases in premature death and respiratory, ophthalmological and cutaneous diseases.[17] This poor reputation, which is justified, has led the food industry to modify its products, removing palm oil

from biscuits, and although there are no previous data on the subject, our study found that more than 40% of the biscuits in the sample had healthier fats. Nevertheless, more than half of the products still contained palm oil, even if it was not the main fat. We also found that olive oil and above all HOSO were used as the main fat in a high percentage of biscuits marketed to the paediatric population. High oleic sunflower oil has 10 g of SFAs per 100 g compared to the 49 g of SFAs per 100 g of palm oil. In addition, the manufacturer often used this fact to make claims to promote the product.

A characteristic shared by nearly all the biscuits was the presence of added sugars (90% of the total sample and 98.1% of the biscuits marketed to children). Although the available evidence is of variable quality, an excess of added sugars in the diet is associated with obesity, metabolic syndrome, caries and type 2 diabetes. The most solid evidence of this association has been obtained in studies measuring the impact on health of sugary drinks. However, while there is a degree of controversy regarding the association of a high sugar intake and NCDs, an increasing number of international organizations are assuming that the association exists and recommend restricting the intake of added sugars. [18,19] In 2015, the WHO established a target for reducing added sugars to less than 10% of the total energy intake, noting that an even greater reduction would be preferable (<5%).[19] Multiple studies have demonstrated that children consume more added sugars than adults. In Spain, children aged 6 months to 17 years consume a median of 95.1 g of sugars a day, amounting to 21.5% of the total daily energy intake.[20]

There is evidence associating poor nutrition with disease and increased mortality. Based on this evidence, strategic plans have been implemented to reformulate ingredients selected through the establishment of agreements between expert groups and different sectors involved in the food industry. In Spain, the NAOS strategy was developed by the Agencia Española de Consumo, Seguridad Alimentaria y Nutrición (Spanish Agency of Consumption, Food Safety and Nutrition, AECOSAN), which is part of the High Level group that in 2008 undertook the adoption of the European Union Framework for Salt Reduction and in 2011 the European Union Framework for National Initiatives on Selected Ingredients, which sought the reformulation of products in terms of ingredients such as fats, saturated fats, trans fats, added sugars and the total energy content.

There are studies suggesting that product reformulation to reduce sugar content would help decrease consumption of these products and thus improve population health. In the case of biscuits, a study conducted in the United Kingdom concluded that the composition of biscuits can be reformulated, decreasing or even eliminating added sugars, thus reducing the total energy content.[21] However, there are few studies like this, and many have low-grade evidence, the interventions are vastly heterogeneous and there are multiple possible confounders.[22]

In our study, we found a greater use of olive oil and HOSO as the main fat in biscuits marketed to the paediatric population. We also found a lower mean energy content and density in "sugar-free" biscuits in the comparative analysis. In addition, "sugar-free" biscuits had higher percentages of olive oil or HOSO compared to the rest of the sample, and lower palm oil contents. Although there are no previous studies for comparison, these findings could result from industry strategies to reformulate products marketed to children to promote them as being healthier. However, while some of these modifications constitute a relative nutritional improvement compared to products high in sugars or unhealthy fats, biscuits are an ultra-processed food with a high energy content and should not be part of the usual diet of the paediatric population in Spain, where the prevalence of childhood overweight and obesity is alarming.

When it came to the biscuits in the sample specifically marketed to the paediatric population, we found a higher percentage that contained added sugars (98.1% versus 88.6%) and a significantly smaller fibre content compared to the rest of the

sample. These data may be useful in urging the food industry to modify the biscuits marketed to children, similar to past changes made in regard to the use of fats, with the end of improving the nutritional composition of these products.

In recent years, the advertisement of unhealthy foods and beverages has been identified as a significant risk factor for development of childhood obesity and other NCDs related to nutrition due to its impact on dietary habits. For this reason, and in light of the rigorous evidence from multiple studies published in the past decade, the WHO, through its Global Strategy on Diet, Physical Activity and Health, urges governments to promote interventions to regulate and modify the advertising of foods and beverages with a high energy content and little nutritional value targeting the paediatric population or that may reach the paediatric population. However, these measures may not be enough or perhaps they are not effective, as we are facing a global childhood obesity epidemic. Television is the most frequently used medium to advertise these products, but online advertising on the web, mobile phones, social networks etc is rapidly growing and can be easily accessed by children of increasingly young ages.[5] There is evidence that exposure of children to advertisements of unhealthy foods and beverages increases their consumption and promotes a preference for these products during and for a short period following exposure to the advertisement, especially in children aged less than 8 years, although there is evidence than younger children could be even more vulnerable to exposure to these advertisements.[23,24]

A study conducted in Andalusia on the contents of advertisements of food products aimed at the paediatric population compared to the general population concluded that there were significant differences, with advertisements targeting children using emotional and irrational persuasive strategies such as fantasy, cartoons or announcements of gifts with the purchase of the product emphasising the incentive to purchase rather than the food product itself.[25] This was corroborated by our study, as we found promotional advertising in the packaging of 75% of the biscuits aimed at the paediatric population, a percentage that vastly exceeded the percentage found for all other products.

Governments should regulate the marketing of these products more strictly, banning advertising specifically aimed at the paediatric population and the use of toys in promotional campaigns, limiting the presence of advertising in audiovisual media accessible to children, etc. Promoting the consumption of natural, unprocessed foods should be the main objective of all agents involved in child nutrition.

In conclusion, our study gathered an extensive dataset on the characteristics and nutritional composition of the biscuits sold in Spanish supermarkets. The majority of biscuits marketed specifically to children had a high energy content and high amounts of added sugars. In two thirds of the sample, the main fat as a monounsaturated fat. Promotional advertising was featured in a high percentage of the products. These data could provide a reference for potential public health interventions or could motivate manufacturers to reformulate their products.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare in relation to the preparation and publication of this article.

ABBREVIATIONS

AECOSAN: Agencia Española de Seguridad Alimentaria y Nutrición • **AGS:** saturated fatty acid • **ENT:** non-communicable disease • **GAO:** high oleic sunflower oil • **HC:** carbohydrates • **NAOS** (strategy): nutrition, physical activity and prevention of obesity • **OMS:** World Health Organization • **IQR:** interquartile range.

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REFERENCES

1. Historia. In: Instituto de la Galleta [online] [accessed on 21/03/2020]. Available at http://institutodelagalleta.com/historia.php?cl=2
2. Estrategia NAOS. Estrategia para la nutrición, actividad física y prevención de la obesidad. 2005. In: Agencia Española de Seguridad Alimentaria y nutrición [online] [accessed on 21/03/2020] Available at www.aecosan.msssi.gob.es/AECOSAN/docs/documentos/nutricion/estrategianaos.pdf
3. Pérez-Farinós N, López-Sobaler AM, Dal Re MÁ, Villar C, Labrado E, Robledo T, *et al*. The ALADINO study: a national study of prevalence of overweight and obesity in Spanish children in 2011. Biomed Res Int. 2013:163687.
4. Serra-Majem L, Aranceta Bartrina J, Pérez-Rodrigo C, Ribas-Barba L, Delgado-Rubio A. Prevalence and deteminants of obesity in Spanish children and young people. Br J Nutr. 2006;96:S67-72.
5. Marketing of foods high in fat, salt and sugar to children: update 2012-2013. In: World Health Organization [online] [accessed on 21/03/2020]. Available at www.euro.who.int/__data/as- sets/pdf_file/0019/191125/e96859.pdf
6. Pérez-Rodrigo C, Ramos Carrera N, Lázaro-Masedo S. Desayuno, rendimiento y equilibrio alimentario: ¿cómo desayunan los españoles? Rev Esp Nutr Comunitaria. 2017;23:S5-13.
7. Monteiro CA, Cannon G, Levy RB, Moubarac J-C, Louzada ML, Rauber F, *et al*. Ultra-processed foods: what they are and how to identify them. Public Health Nutr. 2019;22:936-41.
8. Gibney MJ, Forde CG, Mullally D, Gibney ER. Ultra-processed foods in human health: a critical appraisal. Am J Clin Nutr. 2017;106:717-24.
9. Monteiro CA, Cannon G, Levy RB, Moubarac JC, Jaime P, Martins AP, *et al*. NOVA. The star shines bright. Food classification. Public Health World Nutr. 2016;7:28-38.
10. Monteiro CA, Cannon G, Moubarac JC, Levy RB, Louzada MLC, Jaime PC. The UN Decade of Nutrition, the NOVA food classification and the trouble with ultra-processing. Public Health Nutr. 2018;21:5-17.
11. USDA Food Composition Databases [online] [accessed on 21/03/2020]. Available at https://ndb.nal.usda.gov/ndb/
12. Milmaniene MA. Obesity: from calories to ultraprocessed foods. Vertex. 2018;29:111-9.
13. Hall K. Ultra-processed diets cause excess calorie intake and weight gain: A one-month inpatient randomized controlled trial of ad libitum food intake. Cell Metab. 2019;30:67-77.
14. Schnabel L, Kesse-Guyot E, Allès B, Touvier M, Srour B, Hercberg S, *et al*. Association between ultraprocessed food consumption and risk of mortality among middle-aged adults in France. JAMA Intern Med. 2019;179:490.
15. Carbajal A. Grasas y lípidos. In: Manual de Nutrición y Dietética [online] [accessed on 21/03/2020]. Available at https://eprints.ucm.es/22755/1/Manual-nutricion-dietetica-CARBAJAL.pdf
16. Sacks FM, Lichtenstein AH, Wu JHY, Appel LJ, Creager MA, Kris-Etherton PM, *et al*. Dietary fats and cardiovascular disease: a presidential advisory from the American Heart Association. Circulation. 2017;136:1-23.
17. Kadandale S, Marten R, Smith R. The palm oil industry and noncommunicable diseases. Bull World Health Organ. 2019;97:118-28.
18. SACN Carbohidrates and Health Report. The Scientific Advisory Committee on Nutrition (SACN) recommendations on carbohydrates, including sugars and fibre. In: Public Health England [online] [accessed on 21/03/2020]. Available at www.gov.uk/government/uploads/system/uploads/attachment_data/file/445503/SACN_Carbohydrates_and_Health.pdf
19. Directriz sobre el consumo de azúcares en adultos y niños. 2015. In: World Health Organization [online] [accessed on 21/03/2020]. Available at www.who.int/nutrition/publications/guidelines/sugar_intake_information_note_es.pdf?ua=1
20. Estudio ENALIA 2012-2014: Encuesta Nacional de consumo de Alimentos en población Infantil y Adolescente. 2017. In: Agencia Española de Consumo, Seguridad Alimentaria y Nutrición [online] [accessed on 21/03/2020] Available at www.aecosan.msssi.gob.es/AECOSAN/docs/documentos/seguridad_alimentaria/gestion_riesgos/Informe_ENALIA2014_FINAL.pdf
21. Hashem KM, He FJ, Alderton SA, MacGregor GA. Cross-sectional survey of the amount of sugar and energy in cakes and biscuits on sale in the UK for the evaluation of the sugar-reduction programme. BMJ. 2018;8:e019075.

22. Hashem KM, He FJ, MacGregor GA. Effects of product reformulation on sugar intake and health - a systematic review and meta-analysis. Nutr Rev. 2019;77: 181-96.

23. Sadeghirad B, Duhaney T, Motaghipisheh S, Campbell NRC, Johnston BC. Influence of unhealthy food and beverage marketing on children's dietary intake and preference: a systematic review and meta-analysis of randomized trials. Obes Rev. 2016;17:945-59.

24. Boyland EJ, Halford JCG. Television advertising and branding. Effects on eating behaviour and food preferences in children. Appetite. 2013;62:236-41.

25. Ponce-Blandón JA, Pabón-Carrasco M, Lomas-Campos MM. Análisis de contenido de la publicidad de productos alimenticios dirigidos a la población infantil. Gac Sanit. 2017;31:180-6.