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A Survey Evaluating the Sugar and Nutrient Labeling of Biscuits and Cakes Available for Sale in the City of Soran, Kurdistan Region of Iraq

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ABSTRACT

Background: Biscuits and cakes are widely consumed packaged foods that can contribute significantly to dietary sugar and energy intake. This study aimed to evaluate the sugar content, energy value, and overall nutritional composition of biscuits, cookies, and cakes available in local markets in Soran city, Kurdistan Region of Iraq.

Methods: A cross-sectional survey was conducted between October and December 2025. A total of 112 packaged products were randomly collected from 7 local medium and supermarkets, representing commonly visited commercial areas, and included items from 27 countries. Nutritional information, including energy, total sugars, carbohydrates, fat, protein, and selected minerals, was obtained from product labels and standardized per 100 g for comparison.

Results: The results showed variation in product distribution by country of origin. For biscuits, products from Turkey represented the highest proportion (35%), followed by Iran and Spain (16% each). In cookies, Turkey and Spain each accounted for 24%, while Iran and Germany contributed 14% each. For cakes, nearly half of the products originated from Turkey (48%), followed by Germany (13%) and several countries contributing smaller proportions (4–9%). These findings indicate a strong dominance of imported products, particularly from Turkey. In addition, cakes generally showed higher sugar and energy values compared to biscuits and cookies.

Conclusion: Overall, many products were energy-dense and high in sugar, highlighting the importance of clear nutritional labelling and increased consumer awareness to support healthier food choices.

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Keywords: Nutritional Value, Non-Communicable Disease, Soran City, Sugar Content

Abbreviations

NCDs: Non-Communicable Diseases

USD: United State Dollar

ID: Iraqi Dinar

Introduction

Bakery products such as cakes, cookies, and biscuits are among the most widely consumed processed foods worldwide. The main ingredient in cakes, biscuits, and crackers is carbohydrates, which are mostly obtained from flour and added sugars [1]. Most commercially available products are made from refined or bleached wheat flour, which diminishes their nutritional value by removing vital nutrients like fiber, vitamins, and minerals [2]. Bleached flour is treated with chemical agents, such as benzoyl peroxide or potassium bromate, to speed its aging process [3]. Consumers of biscuits and cakes frequently lack awareness of their differences, and nutritional information may not always be clearly understood or compared [4]. In Malaysia, the consumption

of packaged good especially biscuit is increasing, 16.3% of adult Malaysians ate five biscuits a day on average, making them one of the top ten foods consumed every day [5]. Trend Economy [6] reports that exports of bread, pastry, cakes, biscuits and other bakers' wares, whether or not containing cocoa; communion wafers, empty cachets of a kind suitable for pharmaceutical use, sealing wafers, rice paper and similar products" exceeded \$53 billion globally in 2023 (based on external trade statistics of 128 countries). People utilize cakes, cookies, and nibbles all over the world because they are convenient, have a long shelf life, and provide instant energy. Because they are portable and don't require cooking, they are perfect for busy, modern urban lifestyles. Sugar consumption high energy content has been linked to increase in Non-Communicable Diseases (NCDs). The NCDs, such as metabolic syndrome, chronic inflammation, diabetes, cancer, cardiovascular illnesses, and persistent respiratory difficulties, are not disseminated by microorganism. Poor diet, tobacco use, alcohol abuse and physical inactivity are the four main risk factors for NCDs [7] Approximately two thirds of all fatalities and 81% of years lived with a disability are caused by NCDs, which are the leading cause of death and disability worldwide [8]. The

NCDs account for 41 million deaths per year, or 74% of all deaths worldwide. Cardiovascular illnesses (19 million), cancer (10 million), chronic respiratory ailments (4 million), and diabetes more than (2 million), including kidney disease associated with diabetes are the top causes of NCD fatalities [9]. Obesity and overweight are major risk factors for NCDs, accounting for 8.52% of deaths globally, especially in Europe where a high body mass index (BMI) of 25 or higher is common [10]. Over 4 billion individuals could be overweight or obese by 2035, with nearly 2 billion, or 1 in 4, being classed as such. Malnutrition is largely caused by obesity, which is prevalent in middle income nations. Prevalence in the Eastern Mediterranean is between 25% to 81.9% [11]. The obesity rate in Iraqi Kurdistan has tripled since 1975 [12]. Dental caries, also referred to as tooth decay or dental cavities, is the most frequent NCD and a significant public health concern, with 2.5 billion cases globally [13]. The high incidence rates and the substantial cumulative treatment costs of NCD impose a significant financial burden on health systems and hinder global economic development, with an estimated global cost of \$30 trillion projected between 2011 and 2030 [14]. With 96% of Iraqis suffering from NCD purchasing their medications from private pharmacies, the median monthly out-of-pocket expense amounts to roughly \$81 USD [15]. The biscuits market size has grown strongly in recent years. In 2023, Iraq became a significant global importer, bringing in about \$357 million worth of waffles, wafers, and sweet biscuits, mostly from Turkey [16]. The population of the Soran district has recently increased due to migration and urbanization. Local markets provide a mix of locally produced goods and a diverse range of imports from various countries. Despite this availability, there is limited scientific data evaluating the nutritional composition of these products in Iraq. This lack of region-specific data represents an important research gap and limits the ability of consumers, health professionals, and policymakers to properly assess dietary risks associated with these foods [4]. Therefore, understanding the relationships between product types, country of origin, sugar content, and energy density is essential for improving nutritional awareness. The outcome of this work can be exploited: biscuits, cakes, and cookies are ultra-processed foods known for their high energy density, substantial added sugar, and high saturated fat content, while lacking essential vitamins, minerals, or fiber. Therefore, the objectives of this study were to classified biscuits, cookies, and cakes available for sale at local market in Soran city, Kurdistan Region of Iraq. To assess variations in nutritional value content among different product categories. To compare products of biscuits, cookies, and cakes available at local marker originating from different countries and to provide baseline data that may support future nutritional monitoring and public health strategies.

Materials And Methods

Geographic Location of Soran

Soran district is located in the Kurdistan Region of Iraq, approximately 100 km from Erbil, at an elevation of about 700 meters above sea level (36.93° N, 44.69° E). Its location near the borders of Turkey and Iran supports active trade and the distribution of food products in the local market [17]. The selected markets for data collection are distributed across the Soran district, including both large and medium markets (Figure S1).

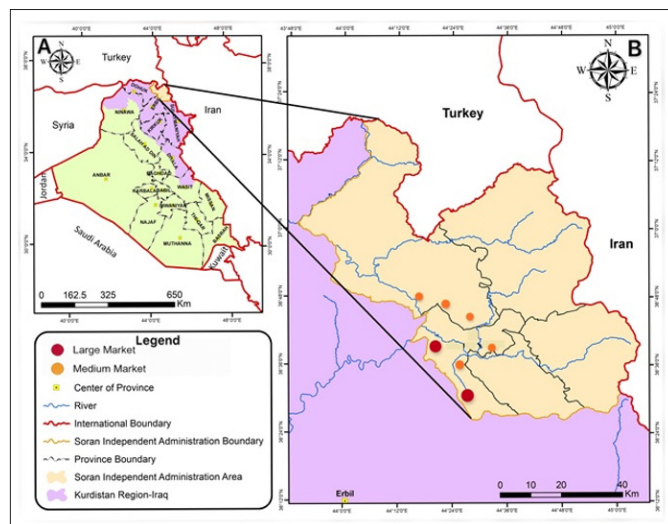


Figure S1: Map of (A) Iraq and the Kurdistan region; (B) Shows the Sites Under Study

Population

The population of Soran district is estimated at around 350,000 and has increased in recent years due to urban growth and migration. This population size supports the evaluation of food consumption patterns and the availability of packaged food products in local markets [17]. Soran city features a diverse commercial landscape with various supermarkets and bazaars offering local and imported baked goods. Samples were taken from both large and medium markets, including Team Mart, Hafta Bazar, Town Center Market, Harzan Bazar, and Said Majid Market. This approach captured a range of products, brands, and price points available to consumers in the area.

Materials and Sample Collection

The study analyzed packaged cakes, biscuits, and crackers from selected supermarkets in Soran city, with samples collected randomly from September to December 2025. Nutritional information was recorded from product labels using sheets and electronic spreadsheets for accuracy and consistency. The selection also included various packaging colors to reflect market patterns, linking colors to product types such as chocolate, digestive, and health-oriented items

Data Collection

Nutritional data were gathered from product labels, documenting country of origin, product name, package weight, serving size, total sugars, and energy content for biscuits, cookies, and cakes. Additional components such as total fat, protein, carbohydrates, calcium, and other minerals were noted when available. Energy content reflects the contribution from macronutrients, and all values were recorded as presented on the packaging to ensure accuracy and consistency (Figure S2).

Nutrition Facts	
8 servings per container	
Serving size 2/3 cup (55g)	
Amount per serving	
Calories	230
% Daily Value*	
Total Fat 8g	10%
Saturated Fat 1g	5%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 160mg	7%
Total Carbohydrate 37g	13%
Dietary Fiber 4g	14%
Total Sugars 12g	
Includes 10g Added Sugars	20%
Protein 3g	
Vitamin D 2mcg	10%
Calcium 260mg	20%
Iron 8mg	45%
Potassium 240mg	6%

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Figure S2: Example of Nutritional Facts and Packaging Related to Data Collection

Statistical Analysis

Data were classified by product type, with all values standardized per 100 g for accurate comparison. The samples data were analyzed by one-way analysis of variance (ANOVA) for each product type and the means were compared by (Tukey) test as described by the graph Pad Prism Program with significant differences defined at ($P < 0.05$) level. Results of nutritional facts were expressed as mean (Mean) $\pm$ standard error of the mean (SEM).

Result

Biscuits, Digestive Biscuits, Coated and Sandwich Biscuits

Nutrition information was collected for 68 samples of biscuits across 11 countries found within the local market in Soran city. The nutritional composition of biscuits showed clear variation between countries. In Table 1. The mean carbohydrate content was highest in biscuits from Turkey (74.7 ± 25.3 g/100 g) and Arabic countries (63.9 ± 32.4 g/100 g), whereas lower values were

found in Germany (17.3 ± 5.75 g/100 g) and the UK/USA (16.8 ± 1.43 g/100 g), respectively. However, this was not statistically significant ($p > 0.05$). The mean of total sugar content was highest in biscuits from Turkey (35.4 ± 12.9 g/100 g) and Arabic countries (34.9 ± 12.5 g/100 g), when compared with biscuits from Spain (0.95 ± 0.75 g/100 g). This difference was statistically significant ($p < 0.05$). The mean energy content varied across countries, with the highest energy observed in biscuits from Arabic countries (765 ± 69.5 calories/100 g) and Turkey (570 ± 198 calories/100 g), while the lowest energy values were reported in Germany (103 ± 37.5 calories/100 g) and UK/USA (122 ± 1.21 calories/100 g). There was no significant difference ($p > 0.05$) in the energy content across different countries. Table 1 indicates that only the sugar and calcium contents of the biscuits had nutritional values that were statistically significant ($p < 0.05$). In Table 1, digestive biscuits showed differences in nutritional values across various countries found in the local markets in Soran city. The mean of total sugar content was the highest in digestive biscuit products from Turkey (13.6 ± 3.86 g/100 g) and Romania (10 ± 0.0 g/100 g), respectively, while the lowest sugar content was found in Spain (3.27 ± 2.94 g/100 g). However, the difference was not statistically significant ($p > 0.05$). Dietary fiber content was highest in Turkey (3.11 ± 0.9 g/100g) and lowest in Iran (0.68 ± 0.68 g/100g), this difference was not statistically significant ($p > 0.05$). Digestive biscuits, generally showed higher dietary fiber content than plain biscuits, coated and sandwich biscuits, wafers, cookies, and cakes. Overall, digestive biscuits represent a highest source of dietary fiber among the analyzed products. The mean of energy values in digestive biscuits ranged from 300 ± 93.1 calories/100 g in Turkey to 108 ± 0.0 calories/100 g in the UK, with no significant difference among countries ($p > 0.05$). Digestive biscuits had lower sugar and energy values compared to other types of biscuits. The digestive biscuits showed no cholesterol or minerals. Coated and sandwich biscuits had higher sugar and fat contents compared with other biscuit types. The highest total sugar and energy content was observed in products from Turkey (52.9 ± 29.9 g/100 g and 715 ± 40 calories/100 g) when compared with Ukraine (9.84 g/100 g and 141 calories/100 g), respectively. These differences were not statistically significant ($p > 0.05$) (Table 1).

Table 1: The Nutritional Value of Biscuits and Digestive Biscuits Across Different Countries is Available within the Local Market of Soran City

Biscuit (g/100g)	Turkey	Iran	Spain	Germany	Italy	UK and USA	Arabic country	p-value
Number	7	3	3	2	2	2	2	
Serving size	63.6 $\pm$ 13.5	49.6 $\pm$ 27.1	2.13 $\pm$ 0.61	22.5 $\pm$ 7.5	12.4 $\pm$ 0.13	25.8 $\pm$ 0.22	75 $\pm$ 25	0.08
Carbohydrate	74.7 $\pm$ 25.3	52.7 $\pm$ 26.1	21.9 $\pm$ 8.06	17.3 $\pm$ 5.75	32.5 $\pm$ 9.5	16.8 $\pm$ 1.43	63.9 $\pm$ 32.4	0.58
Dietary fiber	1.91 $\pm$ 0.16	0 $\pm$ 0	1.49 $\pm$ 0.60	0.6 $\pm$ 0.1	0.63 $\pm$ 0.08	0.90 $\pm$ 0.43	13.4 $\pm$ 4	0.06
Total sugar	35.4 $\pm$ 12.9	13.3 $\pm$ 6.45	0.95 $\pm$ 0.75	4.95 $\pm$ 1.95	8.28 $\pm$ 4.85	9 $\pm$ 1	34.9 $\pm$ 12.5	0.03
Total fat	9.9 $\pm$ 9.67	11.9 $\pm$ 5.55	4.54 $\pm$ 0.93	2.68 $\pm$ 0.92	4.26 $\pm$ 1.29	5.29 $\pm$ 0.37	28.6 $\pm$ 4.21	0.3
Saturated fat	16.5 $\pm$ 7.1	6.1 $\pm$ 3.55	0.44 $\pm$ 0.09	1.65 $\pm$ 0.65	1.01 $\pm$ 0.45	2.42 $\pm$ 0.24	14.9 $\pm$ 1.15	0.41
Protein	6.99 $\pm$ 2.21	6.36 $\pm$ 3.09	2.22 $\pm$ 0.76	1.95 $\pm$ 0.45	3.80 $\pm$ 1.20	1.42 $\pm$ 0.24	10.8 $\pm$ 6.45	0.4
Sodium	0.25 $\pm$ 0.11	0.43 $\pm$ 0.19	0.08 $\pm$ 0.03	0.08 $\pm$ 0.01	0.07 $\pm$ 0.03	0.08 $\pm$ 0.03	0.39 $\pm$ 0.11	0.39
Calcium	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0.135 $\pm$ 0.05	0 $\pm$ 0	0 $\pm$ 0	0.001
Energy (Calories)	570 $\pm$ 198	340 $\pm$ 164	133 $\pm$ 39.3	103 $\pm$ 37.5	185 $\pm$ 53.1	122 $\pm$ 1.21	765 $\pm$ 69.5	0.2
Cholesterol	0	0	0	0	0	0	0	-
Vitamin D	0	0	0	0	0	0	0	-
Iron	0	0	0	0	0	0	0	-
Potassium	0	0	0	0	0	0	0	-

Digestive biscuit (g/100g)	Turkey	Iran	Spain	UK	Roman	p-value
Number	3	2	3	1	1	
Serving size	30.5±1.98	15.1±1.44	51.7±27.4	24±0.0	33±0.0	0.7
Carbohydrate	42.1±12.5	27.8±2.21	31.9±6.49	16.8	21±0.0	0.62
Dietary fiber	3.11±0.9	0.68±0.68	2.86±0.03	0.8±0.0	1±0.0	0.21
Total sugar	13.6±3.86	7.74±0.4	3.27±2.94	4.40±0.0	10±.0	0.3
Total fat	12.9±4.9	7.65±0.08	9.2±1.4	3.2±0.0	8±0.0	0.56
Saturated fat	7.34±2.83	3.61±0.03	1.46±0.5	1.6±0.0	4±0.0	0.33
Protein	4.83±1.43	4.02±0.07	3.46±0.5	1.6±0.0	2±0.0	0.48
Sodium	1.26±1.07	0.15±0.10	0.16±0.06	0.09±0.0	0.13±0.0	0.75
Calcium	0	0	0	0	0	-
Energy (Calories)	300±93.1	195±9.19	220±37.1	108±0.0	165±0.0	0.6
Cholesterol	0.003±0.3	0±0	0±0	0±0	0±0	0.77
Vitamin D	0	0	0	0	0	-
Iron	0	0	0	0	0	-
Potassium	0	0	0	0	0	-

Coated and sandwich biscuit (g/100g)	Turkey	Germany	Ukraine	UK	Roman	p-value
Number	3	1	1	1	1	
Serving size	76.6±23.1	7.69±0.0	100±0.0	8.33±0.0	8.31±0.0	0.43
Carbohydrate	91.7±53.3	25±0.0	19.5±0.0	33.3±0.0	38.6±0.0	0.20
Dietary fiber	2.74±1.64	1.04±0.0	0.150±0.0	0.220±0.0	0.00±0.0	0.32
Total sugar	52.9±29.9	13.5±0.0	9.84±0.0	27.2±0.0	21.6±0.0	0.91
Total fat	31.2±16.2	9.23±0.0	6.34±0.0	19.4±0.0	14.8±0.0	0.9
Saturated fat	13.7±5.9	4.62±0.0	3.13±0.0	11.1±0.0	6.93±0.0	0.85
Protein	8.31±4.6	2.19±0.0	1.53±0.0	2.00±0.0	4.76±0.0	0.89
Sodium	0.16±0.05	0.09±0.0	0.11±0.0	0.09±0.0	0.13±0.0	0.13
Calcium	0±0	0±0	0±0	0±0	0±0	-
Energy (Calories)	715±40	194±0.0	141±0.0	314±0.0	310±0.0	0.9
Cholesterol	0±0	0±0	0±0	0±0	0±0	-
Vitamin D	0±0	0±0	0±0	0±0	0±0	-
Iron	0±0	0±0	0±0	0±0	0±0	-
Potassium	0	0	0	0	0	-

Values are expressed as mean ± SEM. Means within a same row ($p < 0.05$) was significantly different.

SEM= standard error of mean.

Arabic country =Arabia sundial and Jordan.

Coated Wafers, Multigrain Biscuits, and Wafers

The nutritional values of coated wafers, multigrain biscuits, and wafers varied amongst nations (Table 2). There was a statistically significant difference ($p < 0.05$) in the mean dietary fiber content of multigrain biscuits in Spain (2.33 ± 0.47 g/100 g) and Iran (0.08 ± 0.05 g/100 g) (Table 2). The mean of total sugar and energy content in multigrain biscuits was the highest in Iran (5.12 ± 1.65 g/100 g) and (189 ± 52.6 calories/100 g), in comparison with Italy (0.11 ± 0.0 g/100 g) and (167 calories/100 g), respectively. Additionally, the average energy content of multigrain biscuits in Spain was equal to that of Italy. Nevertheless, there is statistically no significant difference ($p > 0.05$) (Table 2). When compared to wafers from Germany and Iran, Turkish wafers from the Soran city local market had the greatest mean carbohydrate (140 ± 22.4 g/100 g), total sugar (89.1 ± 14.6 g/100 g), fat (63.4 ± 9.78 g/100 g), and energy (1176 ± 183 calories/100 g). Despite this, Table 2 shows that these differences were not statistically significant ($p > 0.05$). For coated wafers, the mean of energy and fat content was the highest in products from the UK (536 ± 0.0 calories/100 g and 30.7 g/100 g), when compared with Spain (212 ± 85.2 calories/100 g and 10.4 ± 3.87 g/100 g), with no significant difference ($p > 0.05$) (Table 2).

Table 2: The Nutritional Value of Multigrain Biscuit, Wafer and Coated Wafer Across Different Countries is Available within the Local Market of Soran City

Multi grain biscuit (g/100g)	Iran	Spain	Italy	p-value
Number	4	4	2	
Serving size	13.2±3.96	35.1±21.8	11.9±0.0	0.52
Carbohydrate	24±7.65	26.24±7.02	25.24±0.0	0.9
Dietary fiber	0.08±0.05	2.33±0.47	0.81±0.0	0.005
Total sugar	5.12±1.65	1.02±0.16	0.11±0.0	0.04
Total fat	8.02±2.12	6.08±1.42	7.41±0.0	0.72
Saturated fat	2.94±1.36	0.613±0.23	0.590±0.0	0.20
Protein	4.94±1.59	2.97±0.82	2.41±0.0	0.4
Sodium	0.04±0.01	0.14±0.03	0.08±0.0	0.1
Calcium	0±0	0±0	0±0	-
Energy (Calories)	189±52.6	167±43.1	167±0.0	0.07
Cholesterol	0±0	0±0	0±0	-
Vitamin D	0±0	0.11±0.11	0±0	0.52
Iron	0±0	0±0	0±0	-
Potassium	0±0	0±0	0±0	-

Wafer (g/100g)	Turkey	Iran	Germany	Russian	p-value
Number	7	1	1	1	
Serving size	78.6±14.9	100±0.0	29.±0.0	100±0.0	0.57
Carbohydrate	140±22.4	58±0.0	18±0.0	41.3±0.0	0.2
Dietary fiber	4.73±1.13	0.0±0.0	1±0.0	1.3±0.0	0.37
Total sugar	89.1±14.6	21±0.0	10±0.0	36±0.0	0.19
Total fat	63.4±9.78	27±0.0	8±0.0	29.3±0.0	0.21
Saturated fat	42.2±7.12	11.7±0.0	6±0.0	3.33±0.0	0.15
Protein	15.2±3	5.87±0.0	2±0.0	5.33±0.0	0.24
Sodium	0.59±0.16	0.12±0.0	0.05±0.0	0.17±0.0	0.52
Calcium	0±0	0±0	0±0	0±0	
Energy (Calories)	1176±183	497±0.0	150±0.0	530±0.0	0.21
Cholesterol	0±0	0±0	0±0	00±0	-
Vitamin D	0±0	0±0	0±0	0±0	-
Iron	0±0	0±0	0±0	00±0	-
Potassium	0.09±0.06	0±0	0.06±0	0±0	0.93

Coated wafer (g/100g)	Turkey	Spain	UK	p-value
Number	3	1	1	
Serving size	72.5±27.5	48.1±26.7	100±0.0	0.61
Carbohydrate	30.4±16.1	30.5±12	57.2±0.0	0.63
Dietary fiber	1.64±0.52	0.81±0.54	3.23±0.0	0.18
Total sugar	22.4±13.8	16.2±15.8	47.1±0.0	0.60
Total fat	12.7±7.43	10.4 ±3.87	30.7±0.0	0.32
Saturated fat	9.16±6.75	5.57±2.06	17.1±0.0	0.5
Protein	2.86±1.30	1.89±0.77	5.76±0.0	0.30
Sodium	0.09±0.05	0.03±0.02	0.06±0.0	0.62
Calcium	0.06±0.04	0.0±0.0	0.0±0.0	0.40
Energy (Calories)	226±147	212±85.2	536±0.0	0.44
Cholesterol	0±0	0±0	0±0	-

Vitamin D	0±0	0±0	0±0	-
Iron	0±0	0±0	0±0	-
Potassium	0.14±0.08	0.0±0	0.0±0.0	0.29

All data are mean± SEM, means within a same row ($p < 0.05$) was significantly different. SEM= standard error of mean.

Crackers, Cookies, Coated and Sandwich Cookies

Countries differed in the nutritional content of crackers, cookies and sandwich coated (Table 3). Iranian crackers had the highest carbohydrate, total fat and energy content (83 ± 0.0 g/100 g , 26 ± 0.0 g/100g and 596 ± 0.0 calories/100g, respectively), while Malaysian crackers had the lowest (11.2 ± 2.45 g/100g , 3.63 ± 0.0 g/100g and 80.6 ± 15.4 calories/100g). The energy content of crackers did not significantly differ ($p > 0.05$), but the mean total fat content was statistically significant ($p < 0.05$) across different countries (Table 3). Cookies showed significant variation in nutritional composition between countries. The mean of total sugar and carbohydrate content was highest in Greece cookies (41.3 ± 0.0 g/100 g and 73.8 ± 0.0 g/100 g, respectively) but lowest in Iranian cookies (6.11 ± 3.18 g/ 100 g and 14.8 ± 5.63 g/ 100g), the total sugar was a statistically significant ($p < 0.05$) difference but the mean of carbohydrate was not statistically ($p > 0.05$) significant. However, there was no significant difference ($p > 0.05$) between the mean energy content of Greek cookies (606 ± 0.0 calories/100 g) and Iranian cookies (103 ± 39.3 calories/100 g) (Table 3). For coated and sandwich cookies, the total sugar content and energy content were highest in products from Arabic countries (37.8 ± 0.0 g / 100 g and 574 ± 0.0 calories / 100 g) and lowest in Italy (11.1 ± 0.0 g / 100 g and 160 calories / 100 g), with no statistically significant difference ($p > 0.05$) (Table 3).

Table 3. The Nutritional Value of Cracker and Cookies with their Coated and Sandwich across Different Countries is Available within the Local Market of Soran City

Cracker (g/100g)	Turkey	Iran	Germany	Malaysia	p-value
Number	1	1	1	2	
Serving size	29.8±0.0	25±0.0	20±0.0	16.5±0.0	0.4
Carbohydrate	19.1± 0.0	83±0.0	47.3±0.0	11.2±2.45	0.07
Dietary fiber	0.48± 0.0	0.0± 0.0	2± 0.0	0.4± 0.4	0.42
Total sugar	7.26±0.0	7.25±0.0	1.6±0.0	3.78±0.0	0.20
Total fat	7.38±0.0	26±0.0	3.93±0.0	3.63±0.0	0.03
Saturated fat	3.33±0.0	6.63±0.0	0.53±0.0	1.82±0.18	0.07
Protein	2.02±0.0	7.5±0.0	8±0.0	1.07±0.53	0.13
Sodium	0.08±0.02	0.65±0.0	1.01±0.0	0.15±0.0	0.04
Calcium	0±0	0±0	0.03±0.01	0±0	0.59
Energy (Calories)	150±0.0	596±0.0	261±0.0	80.6±15.4	0.06
Cholesterol	0±0	0±0	0±0	0±0	-
Vitamin D	0±0	0±0	0±0	0±0	-
Iron	0±0	0±0	0±0	0±0	-
Potassium	0±0	0±0	0±0	0±0	-

Cookies (g/100g)	Turkey	Iran	Germany	Spain	France	Greek	p-value
Number	5	3	3	2	2	1	
Serving size	31.5±6.63	21.7±8.21	16.4±2.17	100±0.0	29±4	25±0.0	0.001
Carbohydrate	31.8±11.6	14.8±5.63	37.9±4.79	52.7±0.38	69.3±0.66	73.8±0.0	0.07
Dietary fiber	0.34±0.11	0.37±0.3	1.33±0.10	3.81±0.04	2.32±0.4	5.88±0.0	0.001
Total sugar	16.3±6.05	6.11±3.18	20.9±2.62	1.77±0.23	26.4±1.61	41.3±0.0	0.03
Total fat	12.6±4.97	4.57±1.88	16.3±1.49	12.3±0.0	22.9±7.15	30±0.0	0.12
Saturated fat	7.84±3.92	3.06±1.74	8.31±0.66	0.92±0.0	15±5.04	17.5±0.0	0.18
Protein	2.71±1.10	1.25±0.5	3.82±0.4	5.38±0.0	5.06±0.06	7.5±0.0	0.04
Sodium	0.142±0.08	14.8±5.63	0.24±0.01	0.28±0.03	0.5±0.03	73.8±0.0	0.001
Calcium	0±0	0.003±0	0±0	00±0	0±0	0±0	0.56
Energy (Calories)	320±102	103±39.3	316±27	329±0.7	468±66.2	606±0.0	0.12
Cholesterol	0±0	0.003±0.03	0±0	0±0	0±0	0±0	0.53
Vitamin D	0±0	0±0	0±0	0±0	0±0	0±0	-

Iron	0±0	0±0	0±0	00±0	0±0	0±0	-
Potassium	0±0	0±0	0±0	0±0	0±0	0±0	-
Coated and sandwich cookies (g/100g)	Spain	Italy	Arabic country	p-value			
Number	3	1	1				
Serving size	16.5± 4.42	11.1 ± 0.0	33.3± 0.0	0.29			
Carbohydrate	46± 7.86	24.4± 0.0	68.4± 0.0	0.27			
Dietary fiber	2.05± 1.07	0.7±0.0	2.89±0.0	0.73			
Total sugar	15±8.68	11.1±0.0	37.8±0.0	0.42			
Total fat	14.3±2.84	5.93±0.0	29.6±0.0	0.14			
Saturated fat	4±0.6	2.59±0.0	12.2±0.0	0.04			
Protein	3.79± 0.78	1.89±0.0	6.22±0.0	0.28			
Sodium	0.20±0.02	0.03±0.0	0.3±0.0	0.1			
Calcium	0±0	0±0	0±0				
Energy (Calories)	322±57.2	160±0.0	574±0.0	0.18			
Cholesterol	0±0	0±0	0±0	-			
Vitamin D	0±0	0±0	0±0	-			
Iron	0±0	0±0	0±0	-			
Potassium	0±0	0±0	0±0	-			

All data are mean± SEM, Means within a same row ($p < 0.05$) was significantly different. SEM= standard error of mean.

Cakes, Grain and Snack Cake

The nutritional composition of cakes varied among countries (Table 4). Plain cakes from Arabic countries had the highest carbohydrate (185 ± 13.4 g/ 100g) and total sugar (70 ± 40.9 g/ 100g), while Italian cakes had the lowest (33 ± 0.0 g/ 100g) and (14.7 ± 0.0 g/ 100g), respectively, with no significant difference ($p > 0.05$). Turkish cakes had the highest mean potassium content (0.016 ± 0.01 g/100 g), while Arabic and Italian cakes had zero (0.0 ± 0.0). Table 4 indicates that this difference was not statistically significant ($p > 0.05$). Coated and spongy cakes showed the highest energy content in French products (567 ± 0.0 calories /100g) and lowest in German products (302 ± 9.51 calories / 100g), with no significant difference ($p > 0.05$). Iron and potassium were found in grain and snack cakes, with Turkish products having the highest levels (0.005 ± 0.05 g/100 g and 0.77 ± 0.25 g/100 g, respectively). In Iran, Germany, Spain, and Poland, however, both iron and potassium were equal to zero (0.0 ± 0.0). Table 4 shows that these differences were not statistically significant ($p > 0.05$).

Table 4: The Nutritional Value of Cake, Coatedgrain and Cracker across Different Countries is Available within the Local Market of Soran City

Cake (g/100g)	Turkey	Arabic country	Italy	p-value
Number	5	2	1	
Serving size	86.7±13.3	100±0.0	100±0.0	0.7
Carbohydrate	90.1±37.4	185±13.4	33±0.0	0.5
Dietary fiber	1.20±0.89	0.50±0.5	0.87±0.0	0.89
Total sugar	43.1±15	79±40.9	14.7±0.0	0.42
Total fat	43.8±23.1	32.8±12.8	18.7±0.0	0.87
Saturated fat	21.3±9.2	15±0.47	2.33±0.0	0.46
Protein	8.14±4.19	17.7±14.1	3.53±0.0	0.58
Sodium	0.38±0.12	0.25±0.21	0.23±0.0	0.79
Calcium	0.004±0	0.28±0.28	0.0±0.0	0.25
Energy (Calories)	793±374	1107±718	304±0.0	0.76
Cholesterol	0.01±0	0±0	0±0	0.79
Vitamin D	0±0	0±0	0±0	-
Iron	0.20±0.2	0±0	0±0	0.79
Potassium	0.016±0.01	0±0	0±0	0.78

Grain and snack cake (g/100g)	Turkey	Iran	Germany	Spain	Poland	p-value
Number	2	1	1	2	2	
Serving size	150±150	10±0.0	22.2±0.0	52.6±47.4	5.16±0.4	0.8
Carbohydrate	123±67.7	7±0.0	53.9±0.0	62.2±1.62	76.6±8.97	0.5
Dietary fiber	2.78±2.78	0.0±0.0	0.86±0.0	2.36±0.27	6.42±2.53	0.52
Total sugar	88.6±38.6	3±0.0	40.6±0.0	0.5±0.12	1.05±0.28	0.21
Total fat	38.4±16.2	1.96±0.0	6.64±0.0	1.85±0.30	4.21±0.01	0.22
Saturated fat	20.6±6.69	0.0±0.0	3.13±0.0	0.30±0.07	0.67±0.10	0.11
Protein	11.9±6.31	0.75±0.0	3.44±0.0	5.58±0.95	8.88±0.12	0.5
Sodium	0.55±0.19	0.10±0.0	0.07±0.0	0.29±0.28	0.32±0.11	0.66
Calcium	0.125±0.07	0.0±0.0	0.0±0.0	0.0±0.0	0±0.0	0.37
Energy (Calories)	873±436	30±0.0	29.3±0.0	292±1.54	393±31.3	0.45
Cholesterol	0±0	0±0	0±0	00±0	0±0	-
Vitamin D	0±0	0±0	0±0	0±0	0±0	-
Iron	0.005±0.05	0±0	0±0	0±0	0±0	0.71
Potassium	0.77±0.25	0±0	0±0	0±0	0±0	0.30

All data are mean± SEM, Means within a same row ($p < 0.05$) was significantly different. SEM= standard error of mean. Arabic country =Arabia sundial and Jourdan

Total Weight, Price of Biscuits and Cakes

Table 5 showed the mean total weight and price with the minimum and maximum value of biscuits found in the local market in Soran city, with variation among countries. These differences reflect variation in packaging size and market price among biscuit items. Spanish countries had the highest mean total weight for biscuits (427 ± 166 g), which was statistically significant when compared to Arabian countries (40.5 ± 17.5 g). Italian biscuits were the most expensive (5125 ± 16.25 ID), which was statistically significant ($p < 0.05$) when compared to Turkish (536 ± 127 ID). Conversely, for digestive biscuits, coated and sandwich biscuits, coated wafers, and crackers, no statistically significant differences ($p > 0.05$) were observed in either total weight or price, as shown in Table 3.5. Italy had the highest mean total weight and price for multi-grain biscuits (270 ± 0.0 g and 2625 ± 125 ID, respectively), while Iran had the lowest (221 ± 43.1 g and 1000 ± 0.0 ID, respectively). The price differed significantly ($p < 0.05$), but the overall weight did not ($p > 0.05$). The total weight of cookies, however, was lowest in Greek (80 ± 0.0 g) and highest in Iranian (210 ± 78.1 g). Price cookies had the lowest values in Turkish (1000 ± 362 ID) and the highest values in Spanish (4575 ± 13 ID). Table 3.5 shows that these differences were statistically significant ($p < 0.05$). Germany had the highest total weight for wafers (100 ± 0.0 g), whereas Iran showed the lowest (30 ± 0.0 g), with this difference being statistically significant ($p < 0.05$). Similarly, the price was highest in German wafers (4000 ± 0.0 ID) and lowest in both Turkish and Iranian (250 ± 0.0 ID). The total weight for coated and sandwich biscuits was highest in Italy (270 ± 0.0 g) and lowest in those from Arabian countries (90 ± 0.0 g). In terms of price, Spanish products were the most expensive (3250 ± 289 ID), whereas products from Arabian countries had the lowest price (2000 ± 0.0). However, these differences were not statistically significant ($p > 0.05$) (Table 5).

Table 5: Total Weight and Price of Biscuits and Cakes across Treatment Groups (Countries) in the Different Markets are Found in the City of Soran

Biscuit	Total weight(g)	Price ID
Turkey	72.7±15 (30-125)	536±127 (250-1000)
Iran	86.7±16.7 (70-120)	1167±441 (500-2000)
Spain	427±166 (200-750)	3833±1014 (2000-5500)
Germany	150±50 (100-200)	3500±100 (2500-4500)
Italy	250±70 (180-320)	5125±16.25 (3500-6750)
UK and USA	205±95 (110-300)	2125±1624 (500-3750)
Arabic country	40.5±17.5 (23-58)	357±125 (250-500)
P-value	0.02	0.002
Digestive biscuit	Total weight (g)	Price (ID)
Turkey	205±82.3 (114-369)	917±417 (500-1750)
Iran	225±5 (220-230)	750±250 (500-1000)
Spain	217±35 (150-270)	2833±507 (2000-3750)
UK	250±0.0 (250-250)	2750±0.0 (2750)
Roman	100±0.0 (100-100)	1750±0.0 (1750)
P-value	0.37	0.08
Coated and sandwich biscuit	Total weight (g)	Price ID
Turkey	52.3±16.3 (30-84)	1083±712 (250-2500)

Germany	260±0.0 (260)	3500±0.0 (3500)
Ukraine	320±0.0 (320)	2500±0.0 (2500)
UK	180±0.0 (180)	5000±0.0 (5000)
Italy	166±0.0 (166)	4750±0.0 (4750)
p-value	0.04	0.26
Multi grain biscuit	Total weight(g)	Price ID
Iran	221±43.1 (166-350)	1000±0.0 (1000)
Spain	223±45.7 (150-340)	2125±427 (1000-3000)
Italy	270±0.0 (270)	2625±125 (2500-2750)
p-value	0.07	0.02
Turkey	37±1.65 (28-40)	250±0.0 (250)
Iran	30±0.0 (30-30)	250±0.0 (250)
Germany	100±0.0 (100-100)	4000±0.0 (4000)
Russian	75±0.0 (75-75)	500±0.0 (500)
p-value	0.001	-
Coated wafer	Total weight (g)	Price (ID)
Turkey	119±46.2 (40-200)	833±583 (250-2000)
Spain	200±36.1 (150-270)	3750±1010 (2500-5750)
UK	99±0.0 (99)	2500±0.0 (2500)
p-value	0.37	0.15
Cookies	Total weight (g)	Price (ID)
Turkey	100±35.4 (47-240)	1000±362 (250-2000)
Iran	210±78.1 (80-350)	1333±84 (250-3000)
Germany	158±14.2 (135-184)	3167±33 (2500-3500)
Spain	130±0.0 (130)	4575±13 (3000-5750)
France	111±10.5 (100-121)	2750±25 (2500-3000)
Greek	80±0.0 (80)	2000±0.0 (2000)
p-value	0.5	0.03
Coated and sandwich cookies	Total weight (g)	Price ID
Spain	155±32.8 (115-220)	3250±289 (2750-3750)
Italy	270±0.0 (270)	3000±0.0 (3000)
Arabic country	90±0.0 (90)	2000±0.0 (2000)
p-value	0.27	0.29

Cracker	Total weight (g)	Price ID
Turkey	84±0.0 (84)	500±0.0 (500)
Iran	80±0.0 (80)	250±0.0 (250)
Germany	150±0.0 (150)	750±0.0 (750)
Malaysia	155±29 (125-184)	1876±87 (1000-2750)
p-value	0.57	0.74
Turkey	46.2±13.7 (24-99)	3000±50 (250-500)
Arabic country	37.5±17.5 (20-55)	375±125 (250-500)
Italy	150±0.0 (150)	1250±0.0 (1250)
p-value	0.05	0.003
Coated and spongy Cake	Total weight (g)	Price (ID)
Turkey	119±41.5 (40-200)	750±421 (250-2000)
France	75±0.0 (75)	1250±0.0 (1250)
Germany	139±0.0 (128-150)	3375±125 (3250-3500)
p-value	0.78	0.03
Grain and snack Cake	Total weight (g)	Price (ID)
Turkey	23.5±12.5 (11-36)	375±125 (250-500)
Iran	200±0.0 (200-0)	1250±0.0 (1250-1250)
Germany	128±0.0 (128)	2500±0.0 (2500)
Spain	130±0.0 (130)	3500±50 (3000-4000)
Poland	97.5±7.5 (97-105)	4000±0.0 (4000)
p-value	0.006	0.01

Similarly, the total weight and price of cakes products varied among countries (Table 3.6). Italian cakes had the highest mean total weight (150 ± 0.0 g), while Arabian cakes had the lowest mean total weight (37.5 ± 17.5 g). Table 5 shows that there were significant differences ($p < 0.05$) in both total weight and price. German cakes had the highest total weight (139 ± 0.0 g) in coated and spongy cakes, while French cakes had the lowest total weight (75 ± 0.0 g), with no significant difference ($p > 0.05$). German cakes were the most costly (3375 ± 125 ID) compared to Turkish cakes (750 ± 421 ID). This difference was statistically significant ($p < 0.05$).

Biscuits, Cookies and Cakes Percentage by Country Across Different Local Markets

Biscuits, cookies, and cakes percentage were provided to local markets in Soran City based on imports from all over the world as illustrated in the Fig. 1. A total of 112 samples were analyzed, representing products from 27 different countries (Table 6). The distribution of biscuits samples showed that Turkey dominated with 35% of the total analyzed products, followed by Spain and

Iran, each contributing 16%. Germany, Italy, and the UK and US collectively represented 7% each, while the remaining countries (Arabic country, Roman, Ukraine, Russian, and Malaysia) accounted for smaller proportions ranging from 2% to 3%. A total of 68 biscuits samples were collected from 11 different countries (Table 6). For cookies, Turkey had the largest share at 24%, which was equal to Spain's. Germany and Iran followed with 14% each, while France represented 9%. Five percent of the cookie samples came from Greece and Italy, and the remaining five percent came from an Arabic nation. The cookie category included 21 samples obtained from 8 countries, as shown in Fig.1. In the category of cakes, Turkey had the largest sample (48%). The 9% of the cake samples were from Arab countries, and 13% were from Germany. France, Iran, and Spain accounted for 4% of the samples. In the cake category, there were 23 samples from eight different countries (Figure 1).

Table 6: Total Number of Biscuits, Cookies, and Cakes with their Percentage (%) across the Different (Countries) Found within the Local Market of Soran City

Types	No. of samples (percentage)	No. of countries (percentage)
Biscuits	68 (60.71%)	11 (40.74%)
Cookies	21 (18.75%)	8 (29.63%)
Cakes	23 (20.54%)	8 (29.63%)
Total (%)	112 (100%)	27 (100%)

No=Number.

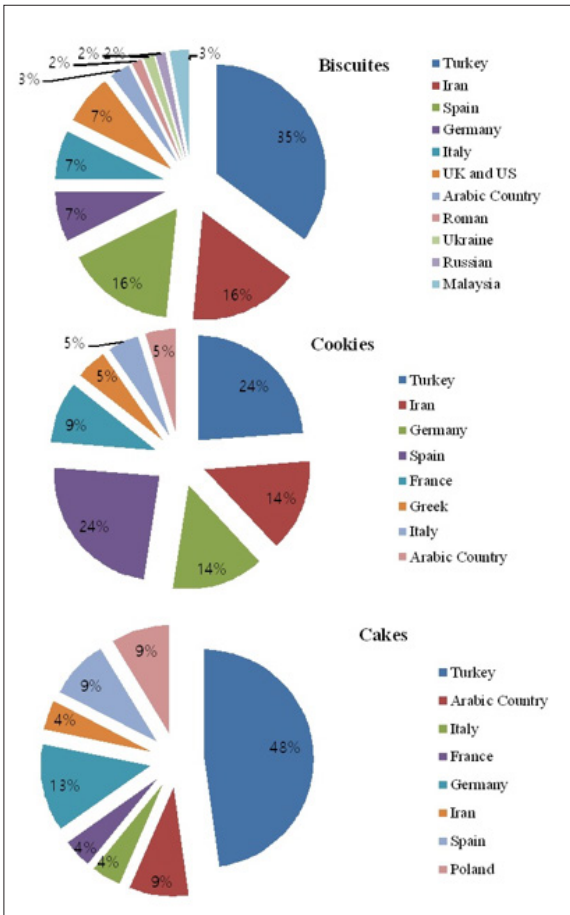


Figure 1: Biscuits, Cookies and Cakes Percentage by Country across Different Local Markets.

Discussion

Cakes, biscuits, and crackers are all baked, flour-based products, but they differ significantly in texture and ingredients, creating distinct categories of baked goods. In Soran city, local market cakes, cookies, and biscuits exhibited significant alterations in nutritional composition, affecting the distribution of energy value, macronutrients (carbohydrates, sugars, fats, and protein), and micronutrients (e.g., minerals), which collectively influence the nutritional quality of these food products. Added Sugars refers specifically to those added for taste or functionality. It is recommended that free sugars constitute less than 10% of daily energy intake, with a reduction to below 5% providing additional health benefits. High sugar consumption, particularly of added and free sugars, correlates with poor dietary quality and excessive energy intake, contributing to NCDs [18]. Cakes have the highest sugar and energy levels, cookies have moderate to high sugar and fat content, while digestive and multigrain biscuits exhibit more favorable nutritional profiles [19]. These differences reflect variations in formulation, processing methods, and intended consumption patterns among the three product groups [20].

Carbohydrate and Total Sugar Content across Product Groups

The study found that cakes have the highest carbohydrate content, followed by cookies, while biscuits contain lower levels, particularly multigrain and digestive types. Cakes use refined wheat flour, which is high in sugars but low in fiber. Carbohydrates provide essential glucose, but too many refined carbs can spike blood sugar and insulin levels [21]. Differences observed between countries may be related to product formulation characteristics and consumer preferences. The study found that multigrain and digestive biscuits have the lowest sugar content, cookies have moderate sugar, and cakes have the highest. High sugar consumption leads to increased energy intake and diminished feelings of fullness, contributing to obesity. It is also associated with metabolic disorders and dental issues [22]. Furthermore, it causes insulin resistance by raising blood glucose levels [23]. This highlights the need to monitor sugar levels in commonly consumed bakery products.

Energy Content and Energy Density of Products

Energy content followed a similar pattern to sugar and fat levels. Here, energy refers to the amount of calories provided by the food, which the body uses to perform daily physiological functions, including movement, growth, and metabolism [4]. Cakes showed the highest energy values, followed by cookies, while biscuits exhibited lower energy density. Energy-dense foods provide a high number of calories in small portions, which may contribute to excessive energy intake if consumed frequently. From a physiological perspective, chronic positive energy balance may lead to weight gain and increased risk of chronic diseases [4, 24].

Fat and Saturated Fat Content

The study revealed that coated sandwich cakes and cookies contain higher levels of fat and saturated fat than plain and digestive biscuits. While fat is essential for hormone synthesis and the absorption of fat-soluble vitamins, excessive saturated fat is associated with cardiovascular disease. It is recommended that adults maintain total fat intake between 20–35% of daily calories and limit saturated fat to fewer than 10% of daily energy intake [25]. Variations among countries may reflect the use of different sources of fat, such as butter, palm oil, or vegetable oils [26]. For cost-effectiveness and shelf life, some countries opt for palm oil or hydrogenated fats [27].

Dietary Fiber Content across Product Categories

Dietary fiber, the indigestible parts of plant foods beneficial for digestion, varies significantly among product groups. Digestive and multigrain biscuits contain the highest fiber levels, while cookies and cakes have the lowest due to the use of refined wheat flour, which removes fiber-rich bran and germ during processing [21]. Dietary fiber is crucial for gastrointestinal health, blood glucose regulation, and cholesterol metabolism. Adults should intake 25–30 g daily [28], although children's needs vary, the "Age + 5" formula is a commonly used pediatric rule of thumb. A five-year-old, for example, needs roughly ten grams of fiber daily, gradually climbing to the recommended daily consumption [28].

Minerals Content and Biological Importance

Iron, calcium, and potassium levels in cakes, cookies, and biscuits are usually low because refined flour removes important nutrients. Iron is needed for oxygen transport, calcium for bones and teeth, and potassium for fluid balance and muscle function. Not getting enough of these can cause anemia, bone issues, and electrolyte imbalance. Daily intake recommendations are 18 mg of iron, 1000 mg of calcium, and 3500 mg of potassium, with lower needs for children based on age [29]. The low mineral content in bakery products shows they do not help much with daily dietary needs. This is mainly due to refining, which removes bran and germ [29].

Country-to-Country Variation in Nutritional Values

Significant differences in nutritional composition exist among products from different countries. Products from Turkey, Arabic countries, Greece, and France often have higher sugar and energy levels, while those from Italy, Ukraine, Romania, Germany, and Iran usually have lower values in many biscuit and cake categories. These differences may be linked to food standards, ingredient availability, formulation traditions, and economic factors, like the cost of white refined sugar versus alternatives [20]. Many products are high in sugar and energy but low in fiber and minerals, raising health concerns. Eating too many sweets can harm dietary quality and raise disease risk. Promoting moderation and informed food choices is important [23, 26–30]. Country-to-country variation and market dominance patterns highlight the importance of continuous monitoring of bakery products available to consumers [20].

Distribution of Bakery Products by Country

The study found that Turkish bakery products made up about 45–50% of all samples collected. This is due to close geographic location, trade ties, and low transportation costs [4]. Bakery products from Ukraine, Malaysia, Romania, and Poland were sampled less due to low imports and high costs [30]. Consumer familiarity and preferences affect market availability, leading to more purchases from nearby or well-known exporting countries.

Relationship Between Package Weight, Price, and Nutritional Quality of Bakery Products

According to the results of this study, both the total weight and price of biscuit, cookie, and cake packages varied across countries and product categories. Larger package sizes were more commonly observed in products originating from Spain, Italy, Germany, Poland, and Ukraine, whereas relatively smaller package sizes were frequently noted among products from Turkey and the Arabic countries in several categories. Other countries, including Iran, France, Greece, Malaysia, Russia, the UK, and the USA, showed intermediate variation depending on product type. However, higher package weight did not consistently correspond to higher price. Cakes and biscuits imported from neighboring countries were sometimes cheaper than those from more distant

countries, indicating that price is influenced by production costs, transportation, customs, exchange rates, branding, and packaging [4]. While some high-sugar or coated products were more expensive, this was not always the case, as some lower-priced items also contained elevated sugar levels. From a public health perspective, larger packages may promote greater consumption of sugar, fat, and energy. Evaluating both package weight and price alongside nutritional content is therefore important for guiding healthier consumer choices [24].

Packaging Colour and Nutritional Perception of Bakery Products
Packaging colour analysis revealed that chocolate products are often in red or brown tones, linking red to sweetness and brown to chocolate richness [24]. Digestive biscuits often used blue with other colours, suggesting moderation and relatively lower sugar content [31]. Multigrain products were mainly packaged in white combined with a secondary colour reflecting flavour (e.g., fruits or nuts). White is associated with naturalness and health, while additional colours indicate specific ingredients [32, 33]. The "health halo" effect occurs when packaging colors make products seem healthier. However, nutritional analysis reveals that color does not accurately show sugar or energy content, stressing the need to read labels [31, 32].

Conclusion

In summary, cakes were the most energy-dense products, cookies showed moderate nutritional values, and biscuits particularly multigrain and digestive types demonstrated comparatively better nutritional quality. Variations were noted between countries, with products from Turkey and some from Iran exhibiting higher sugar and energy levels. The study recommends that public health authorities promote awareness programs to educate consumers about the risks of excessive sugar and energy intake, emphasizing balanced dietary habits. It suggests using alternative sweeteners to reduce sugar content and encourages the selection of lower-sugar products and careful reading of nutritional labels. Key dietary practices include focusing on balanced meals with healthy fats, proteins, and fibers, drinking plenty of water, and avoiding overeating. Additional research is needed on low-carb cake and biscuit products available in the market.

Author contributions

Concept and design: Abdulwahid-Kurdi S.J. Analysis and interpretation: Abdulwahid-Kurdi, S. J; Abdullah, N.S.; Muhammed, R.R. Data Collection: S. J; Abdullah, N.S.; Muhammed, R.R. Statistical analysis: Abdulwahid-Kurdy, S. J. Final approved of the article: All of the authors. Responsibility: Abdulwahid-Kurdy, S. J.

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