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Compliance of Nutrient Claims with Nutrition Labelling Standards in Packaged Bakery Products

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aim: Nutrition claim means any representation which states, suggests or implies that a food has particular nutritional properties including but not limited to the energy value and to the content of protein, fat and carbohydrates, as well as the content of vitamins and minerals. Consumers may perceive foods carrying nutrition-related claims more positively because of the presence of a claim. However, sometimes the products may not be complaint with their nutrient claims.
Place and Duration of Study: The study was carried out in Ludhiana, between 2021-2022.
Methodology: In the present study, the packaged bakery products with nutrient claim (7 products) were selected from Ludhiana market and their complacency was evaluated in three phases- 1) Nutrient profiling through nutrition label on packaging 2) Nutrient content claims 3) Nutrient comparative claims.

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Results: The findings of the study revealed that the selected products such as Cornflake Biscuit, Max Protein cookies, Brownie, Sugar free cookies, Light biscuit, Whole wheat Biscuit and Brown bread were found with nutrient claims such as “rich in fiber”, “trans-fat free”, “cholesterol free”, “rich in protein”, “10g protein”, “4g fibre”, “contains calcium”, “no trans-fat”, “21g protein”, “rich in iron”, and “contains 6 vitamins”. In cornflake biscuits, data regarding nutrient comparative claims showed that the product without nutrition claim contained protein content (2.5g/100g) at par with the product with nutrition claim (2.3g/100g) while, dietary fiber content was significantly ($p<0.05$) lower in the former (0.98g/100g) as compared to later product (3.98g/100g). The laboratory analysis of max protein cookies showed that protein was present in cookies with a nutrition claim, indicating compliance of this product. However, the value (5.21g/100g) did not meet claim criteria value (10g/100g). Further, the product was compliant in term of claims related to fibre and calcium but the analyzed values such as 2.98g and 280mg per 100 g were found significantly lower ($p<0.05$) than the claim criterion. Most of the nutrient content claims related to protein and fibre did not meet information on the nutrition label, otherwise the selected products were compliant in terms of nutrition claims.

Conclusion: In terms of nutrient content claims, the values of the nutrients obtained through laboratory analysis did not meet the claimed values on nutrition label. Therefore, further studies should focus on evaluating the prevalence and compliance of claims on foods with health or nutrition claim as consumers may perceive them as healthy.

Keywords: Nutrient claim; nutrient content claim; nutrient comparative claim; packaged baked foods; nutrition label.

1. INTRODUCTION

In modern times, baked food products have become an indispensable ingredient of human nutrition. The expediency, easy availability, and nutritional profile associated with these products have comprise the major reasons behind their sustainability in the current market. In India, most bakery products are consumed as evening snacks (Doménech-Asensi et al, 2016). Sweet products such as biscuits, crackers, rusks sweet buns and cream rolls are preferred with milk and tea (Omeroglu and Ozdal, 2020). The trend of buying cakes to celebrate birthdays, anniversaries, and other occasions is gradually replacing traditional Indian sweets. Therefore, the Indian bakery industry is expected to expand at a CAGR of 9.3 percent during coming years. Similarly, the cake market of India has been expected to rise with a CAGR of 12.5 percent in near future (NPCS, 2014). Due to urbanization and rising working inhabitants, outdoor food consumption choices and preference for ready-to eat but healthy products have increased. Thus, changing food choices and busy schedules of end users are shaping the bakery industry in India as well (Bijlwan et al, 2019). Nowadays, aware and health-conscious consumers prefer to look for ‘guilt-free’ baked products or goods prepared using healthier ingredients such as whole wheat, multigrain and high-quality oils etc. Besides large market players, even traditional and local bakeries are also progressing with a variety of baked products to cater to the emerging demand for healthier foods. Moreover, the rise of non-communicable diseases in the country has also led to an increase in demand for sugar free and healthy bakery products (Colla et al,, 2018).

Hence, rising concerns for health have driven the bakery market to come up with innovative products such as fortified bakery products. It may be possible to encourage the general public include necessary fatty acids and other essential nutrients in their diet by fortifying biscuits with omega fatty acids (Amrutha Kala, 2014). To have a positive impact on consumer health, the active ingredients should be viable enough in the finished products. Thereby, production of functional bakery goods of high quality and with sufficient health-promoting qualities raises interesting research questions and the possibility of further studies (Zhang et al, 2018). Also, several Indian manufacturers have established an innovative approach towards consumer safety by adopting accurate labelling practices, thereby informing the Indian consumer regarding nutrition, ingredients, allergens, and claims. So, the nutrition-related claims may help parents, desk job doers and other consumers make healthier choices, ironically, research pertaining to health and nutrition-related claims has documented an insignificant impact of these claims on consumer’s decision-making about purchasing packaged snack foods (Aschemann-

Witzel et al, 2019). However, some health-conscious food lovers may consider foods with nutrition-related claims more nutritious due to the claims printed on the label. However, sometimes the products may not be complaint with their nutrient claims (Soni and Kaur, 2023). A study conducted in 2016 in Sydney, Australia found that 34 percent of the products with nutrient claims did not meet their nutrient profiling criteria (Wellard-Cole et al, 2020). Therefore, it is imperative to evaluate the actual nutrient content of foods bearing nutrition-related claims to determine their compliance.

2. MATERIALS AND METHODS

A survey was conducted on consumers' behaviour in context with purchase and consumption of the bakery products in the Ludhiana city. On the basis of the survey, the most commonly consumed packaged and unpackaged bakery products were selected and were bought from the local market of Ludhiana city. Seven packaged baked foods with nutrition claims and analogous foods without any claims were sampled. All sampled foods were purchased and the packaging was retained**.** For nutrient profiling through the nutrition label on packaging, the nutrients listed on the food label of packaged baked foods carrying nutrition-related claims were recorded. For nutrient content claims, the selected samples were analyzed for the nutrients present in packaged baked foods as per the guidelines provided by Food Safety Standard Authority of India (FSSAI) (FSSAI, 2018) for nutrition claims and specifically claimed nutrients on the food labels were analyzed using standard methods (FSSAI, 2018). For nutrient comparative claims, the same packaged baked food but without a nutrition claim was analyzed for the nutrients as recommended by the FSSAI and nutrient profiles of packaged baked foods with and without nutrition claim were compared.

2.1 Nutrient Analysis of the Selected Samples

The selected samples were dried. About 100–200 g of the food samples were ground in a mortar and pestle. Further, the homogenized samples were stored in airtight polyethylene pouches at 4°C till further analysis.

Proximate composition: The nutrients such as protein (AOAC, 2000), fat (AOAC, 2000), fibre (AOAC, 2005) and total ash (AOAC, 2000) were analyzed using standard methods. Based on the analysis, values for moisture, crude fat, crude protein, crude fibre and were determined and subtracted from 100 to obtain the proportion of available carbohydrates.

Total Carbohydrates=
100-(Moisture+Crude protein+Crude fat+crude fibre+Ash)

Protein, carbohydrate, and fat contents were then multiplied by four, four and nine, respectively, to calculate the energy in Kcal.

Estimation of cholesterol content: Cholesterol content was determined according to the method described by Dimberu and Belete (2011).

Estimation of Total sugars: Total Sugars were extracted using method described by AOAC 1965 (1965) and estimated by the Phenol-sulphuric acid Method (AOAC, 1965). For analysis, 0.2 ml of the test extract was added to each of the test tubes, and the volume was adjusted to 1 ml. Both the blank and the glucose standards (10–60 µg) were measured simultaneously. Each test tube was first filled with 1 ml of 5 percent phenol, then 5 ml of 95.5percent sulphuric acid was quickly added. To ensure proper mixing, the acid stream was directed against the liquid surface rather than the side of the test tube. The solutions were then combined and brought to room temperature. At 490 nm, the absorbance of the generated pink colour was measured. The standard glucose curve was then used to determine the total sugar in the test extracts.

Estimation of minerals: Elements namely iron, calcium, zinc, selenium and sodium were estimated using inductively coupled plasma-optical emission spectrometry (ICP-AAS), after wet digestion (AOAC 2000). For wet digestion, a 0.5 g sample was weighed and added in 250 ml conical flask. To this 25 ml of the triacid mixture was added. The contents were heated at low temperature on a hot plate to the following day until there was only around one ml of clear, colourless liquid left after being stored overnight on a stand for slow digestion. The remaining contents were then transferred into a 50 ml volumetric flask, repeatedly washed with deionized water, and the volume was adjusted to the required level. The digests were stored in dried, decontaminated, and labelled sealed polyethylene bottles for ICP-AAS mineral detection after being filtered with Whatman No.

42 filter paper. To create the blank, 25 ml of the triacid mixture was digested in the same manner as the samples, and the volume was then increased to 50 ml using deionized water. A Standard solution of each element was used to create the standard graph. The prepared solutions included 100 ppm of each mineral. These were diluted with distilled water to varying concentrations, 1 ml of concentrated sulfuric acid was added, and the volume was increased to 50 ml. The automated recorder in the ICP-OES measured the absorbance to produce a standard curve. Additionally, an automatic record of the samples' concentration was made.

Mineral content= (Sample conc (ppm)-Blank conc (ppm))/ (Weight of sample (g or ml)) *total dilution

2.2 Estimation of B-complex Vitamins

Sample preparation was done in two steps. First step involved weighing and dividing each sample into three equal portions of 6 g, placing each portion in glass test tube of 10 ml volume containing 5 ml of methanol, and centrifuging the mixture for 25 min at 5 103 rpm after 25 min of sonication in an ultrasonic bath. To evaporate the methanol, the supernatant solution from the three glass test tubes was mixed rapidly for 2 hours in a 25 ml beaker at 35 °C in the dark. To dissolve the residue 0.1 ml of sodium hydroxide (0.1723 M) was added. In second step, 2 ml of HPLC water was added to the solid precipitate in each of the three glass test tubes. Shake for 10 minutes in a vibrating bath. Add phosphoric acid (0.05 M) of 0.1 ml to each tube. Shake for 20 minutes in an ultrasonic bath. Centrifuge for 25 minutes at 5 103 rpm. The supernatant solutions were transferred to the residue that had been dissolved in the 25 ml beaker. To 5 ml volumetric flasks, 2.5 ml of the final sample and 0.25 ml of the methyl paraben solution (1 g/l) were added, then diluted to the appropriate mark and filtered through a 0.22 µm Millipore filter.

Further, the column was operated at 40^{o}C. Starting with 100% solvent A, the flow rate was 1.6 ml/min, and the injection volume was 20 µl. For five minutes, a gradient elution was carried out until the mobile composition reached 50% A and 50% B. Vitamin B1 was detected at 246 nm, vitamin B2 at 267 nm, vitamin B3 at 260 nm, vitamin B6 at 290 nm, vitamin B9 at 361 nm, and vitamin B12 at 361 nm. For the first three minutes, the FLD Detector was configured at λ_{ex} = 296 nm, and λem = 390 nm for vitamin B6, and from minutes three to six, at λ_{ex} = 450 nm and λ_{em} = 530 nm for vitamin B2 (Antakli et al, 2015)

2.3 Estimation of Trans Fatty Acids

Trans fatty acids were determined according to the method described by O'Fallon et al., (2007).

2.4 GC Condition

Gas chromatography (Agilent Technologies, Palo Alto, California, USA) fitted with a flame ionization detector (FID) was used to determine the composition of trans fatty acids (TFA). To separate and measure each fatty acids methyl ester (FAME) component, a capillary column HP88 (100.0 m x 0.25 mm x 0.2 µm of film thickness) coated with cyanopropyl-polysiloxane (Agilent J & W Scientific GC Column, USA) was used. Helium was used as the carrier gas at a constant flow rate of 1 ml/min, hydrogen gas was kept at 40 ml/min, and air used for flame ionisation detection (FID) was kept at 450 ml/min (David et al, 2005). The temperature was gradually raised from 120 to 175 °C and finally to 230° C for five minutes. Injector and flame ionization detector temperatures were set at 250°C and 280°C, respectively.

2.5 Statistical Analysis

All samples were analyzed in triplicate and the results were expressed as mean ± standard deviation. A statistical t-test was used to compare the means between products with claims and without claims. The statistical significance was expressed at $p < 0.05$ and $p \leq 0.01$ with the help of Statistical Package for the Social Sciences (SPSS, [PASW version 18.0] Inc., USA).

3. RESULTS AND DISCUSSION

The results revealed that cornflake biscuits were found with four claims “rich in fibre”, “trans-fat free”, “cholesterol free” and “rich protein” (Table 1).

The laboratory analysis showed that the values of protein and fibre were 2.30 and 3.98 g per 100 g, respectively, which did not meet the claimed values on the nutrition label (Table 2). Further, the product was also not compliant in terms of claims related to trans- fatty acids (TFA) as the analyzed value 0.45 g per 100 g was higher than the criterion given by the Food Safety and Standards Authority of India (FSSAI). According

Table 1. Composition of Bakery products

Bakery product	Number of claims	Type of claims
Cornflake biscuit	4	Rich in fibre 0% trans fat cholesterol free rich in protein
High fibre biscuit	1	High fibre
Light biscuit	3	Rich in iron Trans-fat free contains 6 vitamins
Whole wheat biscuit	2	Trans fat free Calcium rich
Protein cookies	3	10g protein 4g fibre calcium
Sugar free cookies	1	Sugar free
Brownie	2	No trans fat 21g protein

to FSSAI, all the food containing edible oils and fats as an ingredient should not contain industrial TFA more than 2 percent by mass of total oils/fats present in the product. In terms of nutrient comparative claims, the product without a nutrition claim contained protein content (2.5g/100g) on par with the product with the nutrition claim (2.3g/100g) while, dietary fibre content was significantly ($p<0.05$) lower in the former (0.98g/100g) as compared to the later (3.98g/100g) (Table 2). Lappi et al., (2020) also found that supermarkets own brands had comparatively lower content of fibre, higher content of protein and lower sugar and total fat content than in regular brands.

The data revealed that protein cookies were found with three nutrition claims i.e., “10g protein”, “4g fibre” and “contains calcium” (Table 1). The laboratory analysis showed that protein was present in cookies with a nutrition claim, which showed the compliance of this product. But, the value (5.21g/100g) did not meet the claimed criteria value (10g/100g). Further, the product was compliant in terms of claims related to fibre and calcium, the analyzed values such as 2.98g and 280mg per 100 g were found significantly lower ($p<0.05$) than the claim criterion. In terms of nutrient comparative claims, the product without a nutrition claim contained protein content (2.23g/100g), which was significantly lower than the product with the nutrition claim (5.21g/100g). Further, the product without a nutrition claim contained fibre (1.89g/100g) and calcium (0.01 mg/100g) content lower than the product with the nutrition claim (Table 3). TFAs in both types of products were present in higher amounts than standard criterion.

Further, the third product i.e., brownie was found with two claims “no trans-fat” and “21g protein” (Table 1). The laboratory analysis showed that the values of *trans*-fat and protein were 0.62 and 8.12 g per 100 g, respectively, which did not meet the claimed values on the nutrition label. In terms of nutrient comparative claims, the product without a nutrition claim contained trans-fat content (0.48g/100g) on par with the product with the nutrition claim (0.62g/100g), while, protein content was significantly ($p<0.05$) lower in the former (1.89g/100g) as compared to later (8.12g/100g) (Table 3).

The data regarding fourth product revealed that high fibre biscuit was found with one nutrition claim i.e., “high-fibre” (Table 1). Laboratory analysis showed that fibre was present in the biscuit with the nutrition claim, which demonstrated compliance of this product. But, the value (5.52g/100g) was found significantly ($p<0.05$) lower than the claimed value (6g/100g). In terms of nutrient comparative claims, the product without a nutrition claim contained fibre content (0.62g/100g), which was significantly lower than the product with the nutrition claim (5.52g/100g) (Table 2).

Further, the data revealed that sugar-free cookies was found with one nutrition claim i.e., “sugar free” (Table 1). Laboratory analysis showed that sugar content was present in the cookies with the nutrition claim, indicating non-compliance of this product. But, the value (0.11g/100g) was close to the claimed criteria value (0g/100g) (Table 3). Almughthim and Jradi (2020) concluded that 29 percent of foods made nutritional or health claims. About 19.2 percent of foods with health claims and 28.9 percent of all items with nutritional claims complied with standard regulations.

The results showed that light biscuits were found with three claims “rich in iron”, “trans- fat free” and “contains 6 vitamins” (Table 1). Laboratory analysis showed that the values of iron and trans-fat were 2.67mg and 0.5g per 100 g, respectively, which did not meet the claimed values on the nutrition label. However, the product was compliant in terms of the claim “contain 6 vitamins” i.e., vitamin B1, B2, B3, B6, B9 and B12 as the analyzed values such as 0.26, 0.25, 4.28, 0.5 mg, 44.98 and 0.49 µg per 100 g, respectively, were significantly at par with

the claimed values. In terms of nutrient comparative claims, the product without a nutrition claim contained iron (0.89 mg) and *trans*-fat content (0.62g/100g) both significantly lower than in the product with the nutrition claim (Table 2). But, TFAs in both types of products were present in higher amounts than the standard criterion given by FSSAI. Similarly, Reshma, et al., (2012) concluded that there were unlabelled products which did not comply with the government regulations for labelling TFA content.

Table 2. Complacency of nutrients with respect to nutrition labelling in packaged bakery products carrying nutrition-related claims (Biscuits)

Products	Nutrients	Packaged Bakery product with nutrient-related claim		Nutrient profiling of bakery product without claims through laboratory analyses	t-value (p-value)
		Nutrient profiling through nutrition labelling on packaging	Nutrient profiling through laboratory analyses		
Cornflake Biscuit	Energy (Kcal)	492.6	479.84±1.21	456.54±0.82	7.81*
	Carbohydrates (g)	66.8	71.91± 0.15	81.71±0.09	22.93**
	Dietary fibre (g)	4.6	3.98 ±0.08	0.98±0.03	60.09***
	Protein (g)	7.5	2.30 ±0.28	2.5±0.10	NS
	Fat (g)	21.7	20.33 ±0.07	13.3±0.23	7.30*
	Saturated fat (g)	10.8	11.03±0.01	7.2±0.31	17.64***
	Trans fat (g)	0	0.45 ±0.00	0.45±1.25	NS
	Cholesterol (mg)	-	0.01±1.44	0.20±0.01	42.57***
High fibre Biscuit	Energy (Kcal)	485	476.02±0.93	496.58±0.18	7.43*
	Total fat (g)	21	20.57± 0.01	21.02±0.19	3.68*
	Saturated fat (g)	10.2	10.8±0.05	12.35±0.06	11.48***
	MUFA (g)	8	7.88±0.07	5.65±0.03	54.44***
	PUFA (g)	2.4	2.31±0.01	1.47±1.84	177.59***
	Trans fat (g)	0	0.70± 0.01	0.75±0.03	18.14**
	Carbohydrates (g)	68.4	68.79±0.90	74.87±0.52	4.61*
	Total sugar (g)	14.4	15.28 ±0.15	21.05±0.12	10.07**
	Protein (g)	8.6	3.94 ±0.25	1.98±0.07	22.18***
	Dietary fibre (g)	6	5.52± 0.10	0.62±0.02	39.36**
	Sodium (mg)	463	458.03 ±0.09	154±1.36	83.11***
	Cholesterol (mg)	0	0.5±0.01	1.2±0.21	41.02***
Light Biscuit	Energy (Kcal)	445	447.45±0.17	462.87±0.10	29.68**
	Total fat (g)	11	10.78± 0.05	14.56±0.08	17.34**
	Saturated fat (g)	5.6	5.56±0.02	6.20±0.03	3.61*
	Trans fat (g)	0.07	0.5±0.12	0.62±0.03	8.45**
	Cholesterol (mg)	0.1	0.1± 0.00	0.56±0.06	190.87***
	Protein (g)	9.1	2.45±0.37	2.89±0.09	6.60**
	Carbohydrates (g)	77.4	85.15±0.45	80.07±0.36	6.57*
	Total sugars (g)	21.3	22.15 ±0.02	27.23±1.20	7.25*
	Sodium (mg)	292.4	291± 0.12	320.19±0.92	25.03***
	Iron (mg)	2.9	2.67 ±0.11	0.89±1.23	58.84***
	Vit B1(mg)	0.3	0.26± 0.01	-	NA
	Vit B2 (mg)	0.3	0.25 ±0.04	-	NA
	B3(mg)	4.3	4.28 ±0.06	-	NA
	B6 (mg)	0.5	0.51± 0.03	-	NA
	B9 (µg)	45	44.98 ±0.07	-	NA
	B12 (µg)	0.5	0.49 ±0.03	-	NA
Whole wheat Biscuit	Energy (Kcal)	438	438.18±0.15^{b}	451.77±0.29^{a}	55.51***
	Total fat (g)	12.5	11.67 ±0.04^{b}	12.34±0.43^{a}	NS
	Saturated fat (g)	6.3	6.42±0.02^{a}	5.62±0.00^{b}	6.75*
	MUFA (g)	5	4.85±0.00^{a}	4.23±1.26^{b}	89.83***
	PUFA (g)	1.2	1.15±0.03^{b}	1.45±0.08^{a}	112.14***
	Trans fat (g)	0	0.01±0.07^{b}	0.20±0.01^{a}	202.62***
	Carbohydrates (g)	75	80.41± 0.03^{b}	82.60±1.34^{a}	6.43**
	Protein (g)	7.8	2.89 ±0.37^{a}	2.58±0.03^{b}	14.67***
	Dietary fibre (g)	5	4.07 ± 0.08^{a}	2.01±1.27^{b}	159.99***

Products	Nutrients	Packaged Bakery product with nutrient-related claim		Nutrient profiling of bakery product without claims through laboratory analyses	t-value (p-value)
		Nutrient profiling through nutrition labelling on packaging	Nutrient profiling through laboratory analyses		
	Cholesterol (mg)	0	0.1 ± 0.00[b]	0.34±0.01[a]	99.46***
	Sugars (g)	21	21.05 ± 0.01[b]	27.89±0.63[a]	15.04***
	Calcium (g)	0.55	0.52 ± 0.01[a]	0.21±0.56[b]	82.55***
	Zinc (mg)	3.4	3.47 ± 0.07[a]	1.87±0.04[b]	45.18***
	Selenium(mg)	0.1	0.07 ± 0.00	-	NA
	Vit B1(mg)	0.27	0.19± 0.02	-	NA
	Vit B6 (mg)	0.58	0.50 ± 0.06	-	NA

*Values are mean ± SD (N=3); *** Significantly at 0.1% level of significance (p≤ 0.001), **Significantly at 1% level of significance (p ≤ 0.01), *Significantly at 5% level of significance (p ≤ 0.05), NS- Non-Significant.*

Table 3. Complacency of nutrients with respect to nutrition labelling in packaged bakery products carrying nutrition-related claims (Cookies and Brownie)

Products	Nutrients	Packaged Bakery product with nutrient-related claim		Nutrient profiling of bakery product without claims through laboratory analyses	t-value (p-value)
		Nutrient profiling through nutrition labelling on packaging	Nutrient profiling through laboratory analyses		
Protein cookies	Energy (Kcal)	259	424.94±0.21	514.35±1.21	11.97**
	Total fat (g)	14.5	28.15± 0.03	29.67±0.59	NS
	Saturated fat (g)	9.2	9.32±0.04	12.32±0.09	15.41**
	Total sugars (g)	11	10.53± 0.01	18.96±0.06	20.98**
	Cholesterol (mg)	1	1.2± 0.04	0.45±0.89	63.09***
	Trans fat (g)	0.1	0.39 ±0.01	0.58±0.01	14.10***
	Carbohydrates (g)	23.9	37.69 ±0.09	59.6±1.45	25.90**
	Protein (g)	10	5.21± 0.93	2.23±0.09	7.79*
	Dietary fibre (g)	4	2.98± 0.07	1.89±1.18	16.97***
	Sodium (mg)	124	174.61± 0.03	180.28±0.03	4.43*
	Calcium (mg)	300	280± 0.04	0.01±0.52	76.85***
Sugar free cookies	Energy (Kcal)	488	476.02±0.07	486.29±1.44	NS
	Total fat (g)	25.8	26.98 ±0.03	21.25±0.57	NS
	Saturated fat (g)	14.7	15.3±0.01	13.9±0.00	0.50**
	MUFA (g)	8.3	8.1±0.00	4.8±1.24	34.80***
	PUFA (g)	1.2	1.3±0.07	1.4±0.06	4.07*
	Trans fat (g)	0	0.15±0.00	0.65±0.01	43.74***
	Carbohydrates (g)	56	68.79± 0.90	71.53±1.35	NS
	Protein (g)	6.2	2.14± 0.06	2.23±0.06	NS
	Dietary fibre (g)	6.2	5.52± 0.10	1.57±0.56	71.57***
	Sugar (g)	0	0.11± 0.01	21.89±1.75	90.63***
	Cholesterol (mg)	0	0.02± 0.03	0.45±0.01	14.68**
Brownie	Energy (Kcal)	245.83	352.14±1.28	366.47±1.89	NS
	Total fat (g)	8.45	17.62 ±0.02	20.31±0.73	4.65*
	Saturated fat (g)	3.91	4.02±0.01	7.62±0.16	21.24*
	MUFA (g)	3.73	3.67±0.03	1.59±0.01	104.25***
	PUFA (g)	0.81	0.78±0.00	0.45±1.36	26.47***
	Trans fat (g)	0	0.62±0.03	0.48±0.00	16.00**
	Carbohydrates (g)	21.45	33.42± 0.04	44.03±0.56	16.30***
	Protein (g)	21	8.49± 0.87	1.89±0.02	38.21**
	Dietary fibre (g)	3.9	3.05± 0.04	2.76±0.04	12.91**
	Sugar (g)	7.5	8.12±0.07	13.8±0.34	28.33**

*Values are mean ± SD (N=3); *** Significantly at 0.1% level of significance (p≤ 0.001), **Significantly at 1% level of significance (p ≤ 0.01), *Significantly at 5% level of significance (p ≤ 0.05), NS- Non-Significant.*

Further, it was observed that whole wheat biscuit were found with two claims “trans-fat free” and “contains calcium” (Table 1). Laboratory analysis showed that the values of trans- fat and calcium were 0.01 and 0.52g per 100 g, respectively, which were at par to with the claimed values on the nutrition label. In terms of nutrient comparative claims, the product without a nutrition claim contained trans-fat content (0.20g/100g), which was higher than the product with the nutrition claim (0.01g/100g) while, calcium content was significantly ($p<0.05$) lower in the former (0.21g/100g) as compared to the latter product (0.52g/100g) (Table 2).

Further, one out of five breads were found with one nutrition claim i.e., “fibre rich”. Laboratory analysis showed that fibre was present in bread with the nutrition claim, which showed the complacency of this product. However, the value (5.73g/100g) did not meet the claimed criteria value (7.8g/100g). Bedran et al., (2022) also concluded that the claims made about the nutritional value of salt, fibre, and sugar on pita bread did not meet expectations. Therefore, the product was not compliant to the nutrient claims. Similarly, another study showed that products with health or nutritional claims had significantly lower levels of salt (371.36 mg/100 g), sugar (9.67 g/100 g), fat (9.2 g/100 g), and saturated fat (3.2 g/100 g) (Doménech-Asensi et al, 2016). The UK nutritional profiling model found that 46.9 percent of products with claims were less healthful than those without claims. Similarly Shaheen et al., (2023) reported that about half of the goods contained protein (58%), fat (54%), and carbohydrate (42%) amounts that were under the European Union (EU) tolerance limit, as per the EU tolerance guideline. However, only around one-third of the samples had saturated fat (33%) and salt (38%), as well as sugar (21%), that satisfied the tolerance limit given by EU.

4. CONCLUSION

In the present study, seven packaged bakery products with nutrient claims were compared with their analogous bakery products without claims. Further, nutrient profiling through laboratory analysis of analogous packaged bakery product without any claim was compared with the laboratory analysis of product with claims. Most of the nutrient content claims related to protein and fibre did not meet the information provided on nutrition labelling, these products were compliant with respect to nutrition claims. Therefore, further studies should focus on evaluating the prevalence and compliance of claims on foods with health or nutrition claims as consumers may perceive them as healthy. Future studies might compare how consumers react to the existence of particular claims, how useful they are for making decisions, and how they use the nutrition information panel and claims while purchasing.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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