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Effect of Partial Substitution of Date by Sesame Seed Cake on The Nutritional Value of School Meal (Biscuit-Date)

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ABSTRACT

School meal has an important nutritional value, especially at the primary stage. It is cover a high percentage of the daily intake. This study aimed to study the affecting partial substitution of date paste by sesame seed cake in the school meal (biscuit-date) on sensory evaluation, physical and chemical characteristics and evaluating from the daily intake of school children. Siwi date paste, and sesame seed cake were analyzed before being used in the production of the school meal. Sesame seed cake was added as a partial substitute of the date paste at different ratio 10,20,30,40 and 50%. Result showed that the ratio of date paste sesame seed cake (80:20) was the highest sensory parameters. Results indicated that the substitution date paste of biscuit with sesame seed cake up 20% is higher in nutritional value than date paste in bascuit only especially of protein, fat, ash, total phenols and antioxidant activity. The substitution date paste of bascuit with sesame seed cake up 20% were given the recommended dietary allowances higher than bascuit with date paste.

Keywords: date, paste, siwi. school, meal, sesame cake

Introduction

Nutritional and health status have a powerful influence on children's health, disease reduction and behavior as well as learning and performance in school **(Monir et al., 2013)**. Malnutrition for Egyptians represents 5.1% of the population in 2021 **(FAO,2021)**. School feeding contributes to reducing hunger for millions of children around the globe and supports to their education, nutrition, health and future productivity as adults **(WFP, 2009)**. Egypt's school feeding program (SFP) had been established in 1951 until now. The school meal in Egypt varies in several forms fortified with vitamins and minerals, such as biscuits, biscuits with dates, school pie, biscuit wafer and sometimes a drink with fruit taste or milk 200 milliliters. Bakery products are distinguished by their many shapes and ease of use for eating directly, moreover ,the wide popularity of these products for all age groups **(Peter- Ikechukwu et al., 2017)**.Biscuit is the most popular bakery product worldwide, because of its acceptability in all age groups especially children, longer shelf life, better taste and is considered as a suitable product for protein fortification and other nutritional improvement **(Nyadroh et al.,2021)**. Dates are one of the main ancient fruits in the Arab and Islamic world. Egypt produces 1.710.600 tons of date fruits **(Ministry of agriculture and land reclamation, 2017).** Date fruits (Siwi variety) at tamr stage contain moisture 17.85 %, total sugars 85.12 %, fiber 3.25, ash 2.31% and total acidity 0.32 % on dry weight basis **(Assous and Sorour, 2014).** Also, protein and fat content at the same variety were2.83 and 1.25% on dry weight bases, respectively **(Assous et al.,2009)**. The percentage of date paste in school meals (biscuit– pie) ranged from 25 to 30% per 100g of the product. Sesame (*Sesamum indicum*, L.) is considered as one of economically important crop over the entire world. Sesame seeds are considered rich sources of multiple micronutrients such as copper, magnesium, calcium, phosphorus, iron and zinc **(El-Enzi et al.,2018a)**. Sesame seeds are rich in protein, it contains 25% protein and are rich in vitamins A, B complex and E **(Onsaard et al.,2010).** The value of moisture, ash, crud protein, fat and fiber content of white sesame were 5.24, 4.81, 18.95, 47.09 and 5.61%, respectively **(Ali, et al., 2020).** The sesame seeds were primarily used for oil and an important for some food formulations such as Halawah (sweetened Tehinehin in human nutrition **(Gandhi, 2009 and Kanu, et al., 2007)**. Also, after oil extraction, a cake is obtained which is rich in proteins and used in bakeries and pastry shops for human and animal consumption, preparation of antioxidants, cosmetics, and medicines **(Gharby, et al., 2017)**. There are many researchers who have studied the nutritional value of biscuits with dates or sesame cake, but there are few studies on the effect of supplementing biscuits with dates and sesame cake together. Therefore, this research aims to study the addition of sesame cake to the school meal (biscuits with dates) on the sensory, physical and chemical characteristics and evaluating from the daily intake of school children.

Materials and Methods

Materials

Sesame seeds (*Sesamum indicum*), Giza 32 cultivar were obtained from the Field Crops Research Institute, Agricultural Research Center. Date fruits (*Phoenix dactylifera* L.), Siwi cultivar as semi dry at tamr stage were obtained from The Central Laboratory for Date Palm Research & Development, Agricultural Research Center. Wheat flour (72%), sugar, skim milk powder, sucrose, shortening, eggs, sodium bicarbonate and vanilla were purchased from the local market. The packaging materials (Propylene Metalized) were obtained from Egypt Company for Packaging Materials, Egy Wrap 6 October City, Giza, Egypt.

Processing methods

Preparation of date paste

The Siwi dates were cleaned and the seeds were removed with a date Destoner machine, then homogenized with Paste machine, then the

paste was packed in propylene metalized bags and stored at 25ºC for analysis and processing.

Preparation of sesame cake

Sesame seeds were cleaned, removed stones and other extraneous materials. The sesame seeds were extracted oil with the mechanical extraction unit (Fred`s Carver Inc., Model 2759, USA). The sesame cake after oil extraction was dried at 50ºC for 10 hrs., then finely powdered using mechanical blender, sieved through mesh screen (0.5 mm) and packed in propylene metalized bags and stored at 25ºC for analysis and processing.

Production of biscuit

The biscuit was produced based on the formula described in Table (1). Sesame cake was added to the formula at ratios 10, 20, 30,40and 50% from total quantity date paste as substitution of date paste . Biscuits were prepared according to the method described in **AACC (2002)**. The ingredients included wheat flour ,sugar, skim milk powder, ammonium bicarbonate and vanillin were mixed in a dough mixer at slow speed till homogeneity. During blending, shortening and whole eggs were added to a dough mixer. Then water was added at the same slow speed for 3 min. followed high speed for 15 min. The dough was sheeted to a uniform thickness of 4 mm, then the homogenized date pastes as control and the different ratio between date paste and sesame cake was added to sheet. After the addition it was covered with the dough at the same thickness of 4 mm, transferred to the trays after forming with a hand cutter. The biscuits were backed at 170 ±10 ºC for 12min. followed by cooling at room temperature before packing in propylene metalized bags.

Table (1): Ingredients of biscuit with date paste and sesame cake

Ingredients	Formulas/100 gm wheat flour					
	Date paste: Sesame cake					
	Control	90:10	80:20	70:30	60:40	50:50
Wheat flour (72%)	100	100	100	100	100	100
Sugar	25	25	25	25	25	25
Shortening	35	35	35	35	35	35
Date paste	65	58.5	52	45.5	39	32.5
Sesame cake	---	6.5	13	19.5	26	32.5
Skim milk powder	4	4	4	4	4	4
Whole Eggs	2	2	2	2	2	2
Vanillin	0.1	0.1	0.1	0.1	0.1	0.1
Ammonium bicarbonate	1	1	1	1	1	1
Water	20	20	20	20	20	20

Analytical methods

Texture profile analysis

Biscuits texture measurements were carried out with universal testing machine (Cometech, Btype, Taiwan) provided with the software, 35mm diameter compression disc was used. Two cycles were applied at a constant crosshead of 1mm/s to 50% of sample depth and then returned .From the results force curve ,the values of texture profile (N) were calculated from TPA graphic according to **Bourne (2002).**

Analytical analysis

Moisture, reducing, non-reducing and total sugars, protein, fat, crude fiber, ash contents were determined by the method of **AOAC (2016).** Total carbohydrates were estimated according to: Carbohydrate = 100% - % (moisture + protein + fat + crude fiber + ash). Sodium, calcium, potassium, magnesium, manganese, iron, zinc and selenium contents were determined according to the method of **AOAC (2016).** Fractionation, identification and determination of sugar content were carried out using HPLC technique according to the method of **Weiß and Alt (2017)**. The amino acids profile was determined by using amino

acid analyzer (Biochrom 30) according to the method of **AOAC (2016)**. Fatty acids profile of samples was determined according to the method analyzed by GC-FID using an Agilent 6890 N series gas chromatograph (Agilent, USA) as described in **AOAC (2016)**. Total phenolic content was determined using the Folin-Ciocalteu reagent **(Singleton and Rossi, 1965).** The findings were expressed as gallic acid. Total flavonoids content was determined according to **Ordonez et al. (2006)**. The total flavonoids were expressed as Quercetin (QE)Antioxidant activities of the samples were analyzed by investigating their ability to scavenge the 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radicals using the method of **Baraca et al. (2001)**.

Sensory evaluation

Color, taste, flavor, texture and overall acceptability of the biscuit products were evaluated according to **Ranganna (1977).**

Statistical analysis

The results of sensory evaluation biscuit with date paste and different ratio with date paste: sesame cake was statistically analyzed using the **SPSS (1990)** statistical package.

Theoretical Calculation of Energy

The energy values were calculated theoretically using the following conversion factors 4.0, 4.0, and 9.0 kcal/g for protein, carbohydrates and fat, respectively, as follows: Total calories (kcal/100g) = 4 (protein%+ carbohydrate%) + 9 (fat %) according to the method described by **Paul and Southgate (1979)**.

Results and Discussion

Texture profile of biscuits

The texture analysis results of biscuits were shown in Table (2). The results showed that adding of sesame cake to formula of date paste and sesame cake reduced firmness and gumminess from 32.160 and 2.868 N at control (without addition sesame cake) to 23.359 and 2.174 N of biscuit with (date paste and sesame cake 50:50). The decrease in firmness is due to the lack of

homogeneity of the sesame cake with the date paste. The firmness of the biscuits was reduced with the increasing addition of sesame cake; the biscuits will be easily broken. Chewiness, springiness and resilience were increased with increasing the ratio of sesame cake. The confirms that biscuits with sesame cake are not accepted at higher rates than more 20% of the amount of dates added. This result is in agreement with **Jia et al., (2020)** and **Soleimanifard et al., (2018)**.

Table (2): Texture analysis of Biscuit with date paste and sesame cake.

Products	Resilience	Springiness	Chewiness	Gumminess	Firmness
Biscuit with date paste(control)	0.106	0.127	0.364	2.868	32.160
Biscuit with date paste and sesame cake(90:10)	0.109	0.131	0.375	2.958	31.109
Biscuit with date paste and sesame cake(80:20)	0.102	0.123	0.372	2.871	29.140
Biscuit with date paste and sesame cake(70:30)	1.679	0.308	0.672	2.181	23.440
Biscuit with date paste and sesame cake(60:40)	1.732	0.318	0.693	2.250	24.177
Biscuit with date paste and sesame cake(50:50)	1.673	0.307	0.670	2.174	23.359

Organoleptic Properties of biscuit Produced from Different ratio of date paste: sesame cake.

The results in Table (3) showed that the addition of sesame cake improves the taste of biscuits by up to 20%, while the increase in sesame cake above this percentage has no significant differences. It is due to the balance between the fats in the sesame cake and the sugar in the date paste up to 20% compared to other treatments which non incorporation of sugar and fat **(Peter-Ikechukwu et al.,2020).** The mean score of color was not significant with control and addition 10,20 and 30%sesame cake. Increasing the ratio of sesame cake to biscuit formula was significant compared to other treatments. Also, the same table, the texture and flavor were super till 30% addition of sesame cake while increasing sesame cake

over 30% was inferior. The overall acceptability was insignificant till 20% addition of sesame cake. These results are in agreement with **Hafez (2018)**. The use of date palm fruit pulp and toasted watermelon seed as sugar and fat substitutes respectively in the cookies production improved the physical and organoleptic properties of the cookies **(Peter-Ikechukwu et al., 2020)**. sesame flour supplementation up to 40% improve the nutritional properties of biscuit whereas sensory evaluation was found highest at 20% substitution **(El-Enzi et al.,2018 b).** From these results in Table (2 and 3) the biscuit a ratio (80:20) of date paste: sesame cake was selected for analysis and evaluation compared biscuit with date paste (control).

Table (3): Mean score values of sensory evaluation of biscuit with date paste and sesame cake.

Parameters	Taste	Color	Texture	Flavor	Overall acceptability
Biscuit with date paste(control)	8.6^{ab}±1.17	9.3^{ab}±04.8	8.8^{a}±1.07	9.4^{a}±0.84	9.5^{a}±0.71
Biscuit with date paste and sesame cake(90:10)	8.8^{a}±0.92	9.6^{a}±0.52	8.8^{a}±1.03	9.3^{a}±0.95	9.5^{a}±0.88
Biscuit with date paste and sesame cake(80:20)	9.0^{a}±1.15	9.5^{a}±0.74	8.7^{ab}±0.47	9.4^{a}±1.20	9.5^{a}± 0.97
Biscuit with date paste and sesame cake(70:30)	8.3^{ab}±0.95	9.1^{ab}±0.74	8.0^{ab}±1.03	9.1^{ab}±1.17	8.9^{ab}±0.88
Biscuit with date paste and sesame cake(60:40)	7.6^{b}±1.35	8.7^{b}±1.06	7.7^{b}±1.05	8.6^{b}±0.92	8.4^{b}±1.18
Biscuit with date paste and sesame cake(50:50)	7.5^{b}±0.75	7.9^{b}±0.99	7.5^{b}±1.72	8.5^{b}±0.82	8.2^{b}±0.75
L.S.D.	1.009	0.715	1.023	9.924	0.840

Means with the same letter are not significantly different at 0.05 level of significance.

Chemical composition of siwi date paste, sesame cake and biscuit products.

Results in Table (4) showed that the chemical properties of raw materials supplemented biscuit and biscuit with date paste (control) and biscuit with date paste and sesame cake 20%. From results in table, the highest content of siwi date paste where sugars content was 72.78% of total sugars, 69.18% of reducing sugars and non-reducing sugars3.60%, respectively on dry weigh bases while, the total sugars of sesame cake were very low. The protein and fat content of sesame cake were very high which in 34.5 and 29.17 %, respectively, while the protein and fat content were very low compared the sesame cake. Also, the ash and fiber contents of sesame cake were higher than that siwi date paste. The antioxidant activity of sesame cake were higher than siwi date paste, it may be due to high content of total phenols and fat content. These results are in agreement with **Costa do Nascimento et al., 2011, Yasothai 2014, Parn et al., 2015, Khalid et al., 2017, and Mekky et al., 2019.** From the results in Table (4) showed that the chemical composition of biscuits supplemented with date paste and sesame cake at a ratio 80:20 was higher than that biscuit supplemented date paste only. It is due to the high chemical component of sesame cake **(El-Enzi et al.,2018 a and b)**. The high nutritional value of biscuits fortified with sesame helps to eat high quantities of nutrients for the school meal compared to biscuits supplemented with date paste only.

Table (4): Chemical composition of siwi date paste, sesame cake and biscuit products% on dry weight bases).

Chemical properties (%)	Siwi date paste	Sesame cake	Biscuits with date paste (control)	Biscuits with date paste and sesame cake (80:20)
Moisture	19.17	6.72	4.60	3.24
Reducing sugar	69.18	0.07	15.02	10.41
Non-reducing sugar	3.60	1.25	12.14	13.55
Total sugar	72.78	1.32	27.16	23.96
Protein	1.80	34.5	10.80	12.50
Fat	0.45	29.17	18.32	19.66
Fiber	1.43	5.04	1.84	2.10
Ash	1.96	7.25	1.32	1.56
Total phenols (mg)	0.45	1.69	1.16	1.81
Total flavonoids (mg)	0.048	0.050	0.035	0.071
Antioxidant activity	14.18	37.18	29.46	49.21
Total carbohydrates (by differences)	75.19	4.94	61.78	62.28

Minerals content of siwi date paste, sesame cake and biscuit products

The date in Table (5) indicated that sodium, potassium, calcium, magnesium, iron, zinc, manganese and selenium of sesame cake were higher than that siwi date paste. It due to high content of ash content of sesame cake **(Abbas et al., 2022 and Assirey, 2015).** The addition of sesame cake to date paste at a ratio 80:20 was combined increasing the minerals content of supported biscuit. Calcium, zinc, iron, and selenium were increased significantly of biscuit with date paste and sesame cake compared to biscuit with date paste only. While sodium content of biscuit with date paste (control) was almost the same content of biscuit with date paste and sesame cake while, potassium content of the biscuit with date paste was higher than biscuit with date paste and sesame cake. It is due to high content of date paste.

Table (5): Minerals content of of siwi date paste, sesame cake and biscuit products (mg/100g on dry weight bases).

Elements	Siwi date paste	Sesame cake	Biscuits with date paste (control)	Biscuits with date paste and sesame cake (80:20)
Sodium	3.61	43.14	51.76	53.99
Potassium	577	810	269.19	239
Calcium	55.12	1100	44.55	103.62
Magnesium	39.05	51.20	23.51	24.05
Iron	3.14	10.24	2.28	2.67
Zinc	0.13	10.27	0.98	1.55
Manganese	0.34	2.89	0.36	0.52
Selenium	0.095	0.21	0.054	0.069

Fractionation sugars content of of siwi date paste, sesame cake and biscuit products.

Results in Table (6) indicated that glucose and fructose of siwi date paste were 34.02 and 33.92%. The predominant sugar content was reduced sugar of siwi date paste, which is beneficial to health when eating dates or their products. **Assirey (2015)** reported that the reducing sugars were the most content of ten date fruits. Sugar contents (sucrose, glucose and fructose) were low of sesame cake. It is due to the sesame is an oil crop mainly. Also, the same Table showed that the sucrose content of biscuit with date paste (control) and date paste and sesame cake was 11.99 and 13.33%, respectively. It is due to the addition of sucrose to the biscuit formula during baking. Reducing sugars of biscuit with date paste were higher than that biscuit with date paste and sesame cake.

Table (6): Fractionation sugars content of siwi date paste, sesame cake and biscuit products)% on dry weight bases).

Sugar type	Siwi date paste	Sesame cake	Biscuits with date paste (control)	Biscuits with date paste and sesame cake (80:20)
Sucrose (%)	3.73	1.18	11.99	13.33
Glucose (%)	34.02	0.028	7.89	4.90
Fructose (%)	33.92	0.079	8.17	4.88

Fatty acids analysis of siwi date paste, sesame cake and biscuit products.

Results in Table (7) showed that the relative distribution (%) of fatty acids for date paste, sesame cake and biscuit products. The linoleic acid and oleic acid were the major of siwi date paste and sesame cake followed by palmitic acid and stearic acid. It observed that unsaturated fatty acids were the highest of siwi date paste and sesame cake. Sesame is more contains 80% unsaturated fatty acids and a small amount of saturated fatty acids **(Wei, et al., 2022). Azoz (2011a)** showed that the unsaturated fatty acids/saturated fatty acids ratio was higher in formula school meal, it was rich in healthy . From the same table palmitic acid relative distribution of biscuit with date paste and biscuit with date paste and sesame cake was 42.43 and 36.73%. It due to addition shortening to formula of biscuit. The relative distribution of oleic acid biscuit with date paste and biscuit with date paste and sesame cake were 33.44 and 36.57 % followed by linoleic acid 9.18 and 13.28%, respectively. It is noted that there are 14 fatty acids of saturated and unsaturated fatty acids in biscuits, regardless of the addition of date paste or sesame cake. From the date in table (7) it concluded that the prepared formula supplemented with date paste and sesame cake is considered the best, most suitable and healthier formula for Egyptian school children aged between 6 and 12 years.

Amino acids content of siwi date paste, sesame cake and biscuit products.

The amino acids content of raw materials and biscuit with date paste and sesame cake in Table (8). The essential amino acids of sesame cake were high from 1.0 g/100g of each methionine, threonine, valine, isoleucine, leucine and phenylalanine while, histidine and lysine were 0.85 and 0.91g/100, respectively. Also, non-essential amino acids of date paste and sesame cake were found and higher in sesame cake than date paste. Glutamic, arginine and aspartic amino acids were 6.65,4.37 and 2.91% of the sesame cake, respectively while, in the date paste were 0.22 ,0.04 and 0.18% , respectively. Generally, the amino acids of date paste were less than sesame cake. The supplemented biscuit with sesame cake was increased the amino acids than other control. **Azoz (2011b)** showed that the Egyptian school meal had a good source of protein (9.7%) which could be safe for school children compared to

the healthy diet of adult (0.75/kg body weight daily intake). The biscuit with date paste and sesame cake were higher than Egyptian school meal

Table (7): Fatty acids analysis of siwi date paste, sesame cake and biscuit products.

		Relative Distribution (%)			
Fatty acids	**Name**	Siwi date paste	Sesame cake	Biscuits with date paste (control)	Biscuits with date paste and sesame cake (80:20)
C12:0	Lauric acid	1.55	0.54	2.94	2.08
C14:0	Myristic acid	0.24	0.15	2.85	2.51
C15:0	Pentadecanoic acid	--	--	0.19	0.17
C16:0	Palmitic acid	9.17	9.33	42.43	36.73
C16:1ω7	Palmitoleic acid	0.18	0.17	0.35	0.38
C17:0	Heptadecanoic acid	--	--	0.18	0.24
C18:0	Stearic acid	5.52	5.65	6.07	5.56
C18:1ω9	Oleic acid	39.96	40.37	33.44	36.57
C18:1ω7	Vaccenic acid	0.92	0.92	1.17	1.22
C18:1ω5	6-octadecosaenoic acid	--	--	0.18	0.17
C18:2ω6	Linoleic acid	41.47	41.74	9.18	13.28
C18:2ω4	Linolenic acid	0.30	0.31	0.18	0.17
C18:3ω3	Arachidic acid	0.55	0.58	0.25	0.29
C18:4 ω	Gondoic acid	0.14	0.15	0.18	0.16
C20:0	----	zero	0.09	0.32	0.34
Non identified		--	--	0.10	0.13

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Table (8): Amino acids of siwi date paste, sesame cake and biscuit products (g/100gm on dry weight bases).

Amino acids (%)	Siwi date paste	Sesame cake	Biscuits with date paste (control)	Biscuits with date paste and sesame cake (80:20)
Essential amino acids				
Methionine	0.02	1.13	0.17	0.23
Threonine	0.06	1.24	0.46	0.57
Valine	0.10	1.62	0.52	0.61
Histidine	0.03	0.85	0.26	0.30
Isoleucine	0.06	1.25	0.59	0.64
Leucine	0.11	2.21	0.36	0.55
Phenylalanine	0.07	1.60	0.49	0.55
Lysine	0.05	0.91	0.75	0.89
Non-essential amino acids				
Cystine	0.05	0.90	0.14	0.27
Aspartic	0.18	2.91	0.70	0.86
Tyrosine	0.03	1.28	0.32	0.41
Serine	0.07	1.43	0.51	0.66
Glutamic	0.22	6.65	2.27	2.89
Arginine	0.04	4.37	0.43	0.67
Proline	0.11	1.54	1.03	1.14
Glycine	0.11	1.70	0.34	0.46
Alanine	0.10	1.56	0.33	0.39

Nutritional value of biscuit with date paste (control) and biscuit with date paste and sesame cake compared with the recommended dietary allowances (RDAs) for 100gm products/day.

Results in Table (9) showed that nutritional value of school meal (biscuit with date paste only) for 100gm /day and biscuit supplemented with sesame cake and date paste. It was clear that the energy (Kcal) of biscuit supplemented with sesame cake and date paste was higher than biscuit with date paste (control) which is represented 22.26 and 23.80 of RDAs, respectively. Protein is one of the nutritional foods in building the body for children. Therefore, food raw materials must be added to the school meal to increase its percentage in the meal. The addition of sesame cake to biscuit formulas increased protein content to12.5%. The % RDAs of biscuit meal (control) and biscuit with sesame cake were 38.57 and 44.64 %, respectively. The data of Table (9) illustrated that fat content of biscuits (school meals) and biscuits supplemented with sesame cake were 8.24 and 8.85 of % RDAs, respectively. A range of population fat intake goal according to FAO/ WHO/UNU (2001) recommendations was 15–30% of total energy. School meals should be designed to improve the health and development of poor and disadvantaged children in Egypt (Hussien et al.,2015). % RDAs of Calcium was high two times of biscuit with date paste and sesame cake from biscuit with date paste only. Also, in the same Table (9) indicated that % RDAs of magnesium, iron and zinc of biscuit with date paste and sesame cake were higher than that other formula without sesame cake especially iron content.

Table (9): Nutritional value of biscuit with date paste (control) and biscuit with date paste and sesame cake compared with the recommended dietary allowances (RDAs) for 100gm products/day.

Nutrients /Micronutrients	Recommended dietary Allowances RDAs	Biscuit with siwi date paste (control)	%RDAs	Biscuit with siwi date paste and sesame cake (80:20)	%RDAs
Energy (Kcal)	2000	455.20	22.26	476.06	23.80
Protein (gm)	28	10.80	38.57	12.50	44.64
Fat (gm)	≤ 30%from RDA	18.32	8.24	19.66	8.85
Calcium (mg)	800	44.55	5.57	103.62	12.95
Magnesium(mg)	100	23.51	23.51	24.05	24.05
Iron(mg)	10	2.28	22.80	2.67	26.70
Zinc(mg)	10	0.98	9.80	1.55	15.50

Therefore, it is recommended to supplemented school biscuits with sesame cake and date paste at a ratio of 80:20. It contains high nutritional value, is acceptable for sensory evaluation, and cover a higher percentage of recommended dietary allowances of school children compared to date biscuits only.

Conculation

From results in this study, it concludes that school meal (biscuit-date) with partial substitution of date by sesame seed cake at ratio (80:20) improve the nutritional properties, sensory evaluation and cover a higher percentage of recommended dietary allowances of school children compared to date biscuits only.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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