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Production and evaluation of nutritional raisin snack bars

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Abstract
Food bars are products obtained from raisin, oatmeal, and sesame seeds at different levels and also it was contained a high nutritional value for human health. Due to raisin has a high nutritional value and distinctive phytochemical composition. Sesame seeds had a high level of minerals and essential fatty acids. Oatmeal is higher in protein, calcium, and essential fatty acids.
The results showed that raisin bars with 30% sesame and 20% oat (F4) had the highest acceptability. The chemical composition of the raisin bars changed significantly with different sesame seed substitution. In general, the addition of sesame seeds resulted in an increase in protein, fat, ash, and energy, as well as decrease in hardness. In addition, the mineral and vitamin content of the produced bars increased significantly with the increase of sesame seed level. The data presented in this study showed that raisin bars can contribute significantly to fulfill a significant part of the energy, protein, and a few important mineral requirements of adults.
Therefore, it could be concluded that the bars product which had contained 50% raisins, 30% sesame seeds, and 20% oat mail give the best bar and a high nutrition value for adults.

Keywords: food bars, raisin, oatmeal, sesame seeds, hardness

Introduction
In recent years, food consumption habits and preferences have modified to a high extent. Customers' requests for healthy, simple, and appropriate foods increased. Cereal-fruit bars are selected as an alternate supply of appetizers had contained great in a macromolecule, biological effect compounds and could be a main provider of energy to each day. Fruit bars are considered an exceptional instant food that may provide the desired dietary fiber and different bioactive compounds, needed to fulfill the daily necessities of humans (Sun-Waterhouse *et al.*, 2010) [36].
Raisins (*Vitis vinifera L.*) are one of the dried fruits in the world may be due to their great nutritional value (Fang *et al.*, 2010) [12]. Raisins had contained rich amounts of necessary minerals for human health and it is a source of sugar almost was fructose. Raisins supply total dietary fiber and its fractions and their needed daily fiber intake and at level that help cardiovascular health, cancer, and constipation (Ghrairi *et al*., 2013) [15]. Raisins contained high amounts of natural antioxidants activity and their capacity for scavenging free radicals from the blood. Moreover, the natural antioxidant as a phenolic compound from raisins which antibacterial effect (Sério *et al*., 2014 and Mnari *et al*., 2016) [31, 24].
Fulgoni *et al*. (2018) [13] examined the needs intake of raisins from minerals content and dietary fiber amounts in kids and adolescents 2–18 years of age. The results indicated that raisin consumers had significantly higher daily intakes of dietary fiber and minerals content, as well as lower intakes of sugar and total lipids; therefore, the whole fruit intake was useful for health. Thus, intake of raisins was preferable between children consuming raisins, and bakery products contained raisins. Raisins help to lower the overweight and obesity may be Caused to their elevated dietary fiber content and has contained the necessary minerals content for body functions (Olmo-Cunillera *et al*., 2020) [26].
Oats (*Avena sativa* L.) used in healthy food and it is eaten as a whole-grain. Oat had contained high amounts of chemical composition, minerals content, and essential polyunsaturated fatty acids than other grains. As well, it is containing great dietary fiber, such as soluble fiber and β-glucan, which reduce serum lipid profile (Webster, 2011 and Whitehead *et al*., 2014) [39, 40].
Sesame seeds (*Sesame indicum*) had contained high amounts of important proteins which may be utilized to manufacture flour with improved protein content for using to bread production. additionally, sesame seeds (*Sesame indicum*) have been reported to be a decent source of calcium, magnesium, iron, phosphorus, zinc, copper, manganese, selenium, molybdenum, vitamin B complex and dietary fiber (Quasem *et al*., 2009 and Pathak *et al.*, 2014) [29, 27]. This study aims were to produce raisin bars and their formula, contained at different levels of sesame seeds and oatmeal to produce bars with a high nutrition value

Materials and Methods
Materials
Raisin, sesame seeds, oatmeal were obtained from the Giza local market. Chemicals were analytical grade, were obtained from El Gomhoria for chemical Company Egypt.

Methods
Proximate analysis of raw materials
All raw materials (raisin, sesame seeds and oatmeal) were analyzed for moisture, protein, Ash; fat and crude fiber according to the methods of AOAC (2005) [1]. Total carbohydrate was calculated by difference.

Minerals content as iron, zinc, copper, manganese, calcium, potassium, magnesium and sodium were determined in all raw material according to the method outlined in the AOAC (2005) [1] using the Perkin Elmer (Model 300, USA) Atomic Absorption Spectrophotometer. Total phosphorus was determined by the colorimetric method of Trough and Mayer, (1929) [38].

Vitamin A and B complex was determined in all raw material using HPLC (Agilant technologies, Germany, 1200 series equipped with a variable wave length detector) according to the method described by Plozza *et al.* (2012) [28] and Batifoulier *et al*. (2005) [3].

Fatty acids were measured in all raw material according to AOAC (2005) [1] by an Agilent 6890 series gas chromatograph equipped with a DB23 (60 m X 0.32 mm X 0.25 µm capillary column (Agilent Technologies Inc., CA, USA). All measurements are done in triplicate.

Production of raisin bars

Sucrose was mixed with glucose syrup and water (Table 1) and the final concentration for the syrup was 68% total soluble solids (using a Laboratory Refractometer, Bellingham and Stanley Ltd, England), the temperature was 105±2°C, then cinnamon was added. The oat bars were prepared according to the method described by Silva de Paula *et al.* (2013) [32] with some modification as shown in Table (1).

Table 1: Formulas for different raisin bars/g

Blends	Raisin	Oatmeal	Sesame Seeds (white)	Glucose Syrup	Sucrose	Water
Control	50	50	-	14	20	12
F1	50	35	15	14	20	12
F2	50	30	20	14	20	12
F3	50	25	25	14	20	12
F4	50	20	30	14	20	12

Sensory evaluation of different bar products

The sensory study was conducted to access the consumer preference for raisin bars from raisin, sesame, and oatmeal. The attributes of the bar set were order, color, taste, texture, appearance, and overall acceptability. The samples were coded with 3 digits random coding and a 9-point hedonic scale was used for the sensory ratings according to Yee and Wah, (2017) [42].

Physical properties of different bar products

Moisture analysis was conducted according to the methods of AOAC (2005) [1]. The measurements were performed in triplicate. The water activity (aw) of the bars product was measured using Rotronic Hygrolab3 CH-8303, Switzerland as mentioned by Cadden (1988) [5].

The hardness of bar product was measured by Universal Testing Machine (Cometech, B type, Taiwan) provided with software as described by Bourne, (2003) [4]. Three replicates of each bars formula were cut using a flat ended probe (2.50 mm thickness) with a cross-head speed of 1 mm/s at a 20% level of compression. The hardness was recorded by Newton (N).

Chemical composition of the different bar products

Chemical constituents, minerals content, vitamins, and fatty acids content were determined in different bar products according to previously methods.

Total calories of the bars were estimated in bar products by multiplying the crude protein, fat and carbohydrates by calculation as kcal/g, respectively according to the method of James, (1995) [18].

Statistical analysis

Statistical analyses were carried out by SPSS 16 program (SPSS, 2000). Data were statistically analyzed for means values and standard deviations according to Steel and Torrie, (1980) [33]. The data were subjected to one-way analysis of variance (ANOVA) at $P<0.05$ followed by Duncan's new multiple range tests to assess differences between samples mean.

Results and Discussion

Chemical analysis of raw materials

The results from the chemical compositions of raw materials as raisin, oatmeal, and sesame seeds are reported in Table (2). The results indicated that sesame seeds were the highest in protein, fat, and ash (34.41, 47.37, and 3.76%), and also, it had the highest contents of Ca, P, Mg, Zn, Cu, and Na were 131, 774.0, 346.0, 10.23, 1,46 and 39.0mg/100g, respectively compared with the other raw materials. Moreover, the sesame seeds had contained 66.00 IU and 0,146 mg/100g from vitamins A and B respectively. These results confirmed by Hirata *et al.* (1996) [17] who found that the sesame seeds had contained: 45-63% total lipids, 19-31% crude proteins, about 14% total carbohydrates, and 3% ash content. Sesame seeds had rich amounted from minerals content like copper and calcium. In addition, it is a good source of phosphorous, iron, magnesium, manganese, zinc, and vitamins (Hasan *et al.*, 2000) [16].

Meanwhile oatmeal contained 15.30, 6.30, 2.10, and 76.3% in protein, fat, ash, and total carbohydrates, whereas, the crude fiber was the highest (10.60%) than other raw materials. Furthermore, the oatmeal had a rich amount of iron and vitamin A was 4.20mg/100g and 101.0 IU, respectively than other raw materials. Oatmeal (*Avena sativa* L.) is known as healthy food in the world which it containing significant amounts of minerals content like iron and calcium, dietary fiber, total lipids, and vitamins (Sterna *et al.*, 2016) [34].

The results in the same table showed that the lowest chemical constituents in the raisins and it was the highest in total carbohydrates and minerals like potassium also, vitamin B were 94.43%, 751.0mg/100g and 0.248mg/100g, respectively. Raisins besides being a concentrated source of carbohydrate, minerals like potassium and vitamins, also provide high soluble and insoluble fiber along with fructans, boron, phenolics, and antioxidants (Gary and Arianna, 2010 and Ghrairi *et al.*, 2013) [14, 15].

Table 2: Chemical analysis of raw materials on dry weight

Chemical analysis	Raisin	Oatmeal	Sesame Seeds
Moisture	15.42	8.80	9.52
Protein	3.22	15.30	34.41
Fat	0.46	6.30	47.37
Ash	1.89	2.10	3.76

Fiber	4.00	10.60	9.05
Total Carbohydrates	94.43	76.3	14.46
Mineral Content (mg/100gm)			
Ca	49.6	52.00	131.00
P	97.000	474.000	774.00
Mg	33.00	148.00	346.00
Fe	2.06	4.20	3.09
Zn	0.27	3.07	10.23
Cu	0.31	0.34	1.46
Na	12.00	4.00	39.00
K	751.00	350.00	406.00
Vitamins			
Vit A IU	8.000	101.000	66.000
Vit B mg/100g	0.248	0.120	0.146

Values are means of three replicates, on dry weight basis.

Fatty acids content in raw materials

From the results in Table (3), it could be found that the highest unsaturated fatty acids in sesame were 39.055mg/100g. Sesame oil had contained rich amounts in polyunsaturated fatty acids used in margarine production and cooking oils. As well as it was contained natural antioxidants, has been cholesterol-lowering effect in humans (Ogawa et al., 1995 and Hirata et al. 1996) [25, 17].

Followed by oatmeal had 7.28 mg/100 unsaturated fatty acids. Oatmeal had contained rich amounts from polyphenolic compounds, and essential fatty acids, and the water-soluble β-glucans have been against chronic heart diseases (Zieliński *et al.,* 2012 and Kawka and Achremowicz 2014) [43, 20].

Unsaturated fatty acids are responsible for lowering the cholesterol level, as well as preventing various diseases like cancer, chronic heart diseases, and blood sugar (Khiari *et al.,* 2018) [21]. Among unsaturated fatty acids in raisin is linoleic acid (C18:2) was the most dominant compound this results confirmed with Aydin (2011) [2].

Table 3: P Fatty acids content in raw materials (mg/100g)

Fatty acids	Raisin	Oatmeal	Sesame Seeds
Myristic C14:0	0.004	0.010	0.120
Palmitic C16:0	0.129	0.940	4.292
StearicC18:0	0.018	0.060	2.019
Saturated fatty acids	0.151	1.010	6.431
Palmtoleic C16:1	0.000	0.010	0.144
Oleic C18:1	0.018	1.970	17.897
Linoleic C18:2	0.104	2.200	20.654
Linlenic C18:3	0.031	0.100	0.363
Unsaturated fatty acids	0.153	7.28	39.055

Values are means of three replicates, on dry weight basis.

Sensory evaluation raisin bars

Table (4) showed that the results of sensory quality evaluation for the different bar products made from raisin, oatmeal, and sesame. The results observed that the bars with 30% sesame (F4) scored the highest in color, taste, appearance, and overall acceptance. Color is one of the paramount significant qualities a numerical of breakfast fried snacks accurately concerning consumer understanding. It is estimated by consumers and frequently is the foundation for their chosen fried snacks (Mendoza *et al.,* 2007) [23].

As well as for bars with oatmeal only scores were lower than the other parameters. Therefore, from the results, it could be found that raisin bars product which had contained 30% sesame and 20% oatmeal (F4) had the highest acceptability for the panelists. The sensory evaluation for all raisin bar products presented acceptable scores (>5) which were high acceptance rate acquired by the raisins bars reflects a great purchase for this product (de Conto *et al.,* 2015) [8]. Using raisin, oatmeal, and sesame to prepare bar products led to becoming better sensory properties to product for consumers. Therefore these bar products can be available to consumers as healthy food (Silva *et al.,* 2013) [32].

Table 4: Sensory evaluation of raisin bars

Formula	Odor (9)	Color (9)	Taste (9)	Texture (9)	Appearance (9)
Control	7.95 ± 0.07 ^{e}	7.91 ± 0.05 ^{c}	7.50 ± 0.06 ^{c}	8.19 ± 0.07 ^{c}	8.89 ± 0.08 ^{b}
F1	8.27 ± 0.03 ^{d}	8.47 ± 0.05 ^{b}	7.60 ± 0.05 ^{b}	8.17 ± 0.04 ^{c}	8.96 ± 0.09 ^{a}
F2	8.52 ± 0.08 ^{c}	8.52 ± 0.02 ^{b}	7.67 ± 0.03 ^{b}	8.25 ± 0.08 ^{b}	8.90 ± 0.05 ^{ab}
F3	8.80 ± 0.06 ^{b}	8.90 ± 0.04 ^{a}	8.75 ± 0.08 ^{a}	8.55 ± 0.02 ^{a}	8.92 ± 0.02 ^{a}
F4	8.92 ± 0.02 ^{a}	8.91 ± 0.01 ^{a}	8.79 ± 0.01 ^{a}	8.58 ± 0.03 ^{a}	8.94 +± 0.02 ^{a}

Values are meaning of ten replicates ±SD, number in the same column followed by the same letter is not significantly different at 0.05 levels.

Physical properties of raisin bars

The results in Table (5) reported that the moisture content in the different bar products was ranged between 18.50% and 19.59% due to the addition of sesame seeds reduced the moisture content of the raisin bars may be due to the ability of added sesame to absorb the syrup, thus the moisture was decreasing. The results from the same table reported that there were no variations in water activity (0.518–0.520) between all different raisin bars products with and without sesame. The values for water activity were all well below 0.7, indicating, as the water activity to bars containing pineapple peel between from 0.66 to 0.72 (Damasceno *et al.*, 2016) [7]. The results of the hardness of all different raisin bars products are shown in the same table. The hardness decreased significantly with the addition of sesame. This result may be due to the addition of sesame, which has the ability of sesame to absorb the syrup, allowing the ingredients to collect, and the raisin- sesame bars becoming Easier to cut.

The results observed that the raisin bar (F1) was the greatest hardness and the raisin bar (F4) has the lowest hardness may be due to the F4 rich in fat content than F1. The values of hardness influence the acceptance of raisin bars (Estévez *et al.*, 1995) [11]. Thus, the addition of oatmeal made the raisin bar harder may be due to the oatmeal had contained rich amounts from crude fiber and dietary fiber. In the case of the replacement with sesame in the preparation of the raisin bar, it is observed a decrease in the hardness may be the reason the sesame contained a good source from unsaturated fatty acids.

Table 5: Physical properties of raisin bars

Formulas	Moisture	Water Activity	Hardness (g)
Control	19.59±0.10^{a}	0.520±0.01^{a}	1572.53±0.09^{a}
F1	19.01±0.07^{b}	0.518±0.04^{a}	1565.25±0.13^{b}
F2	18.75±0.02^{c}	0.519±0.02^{a}	1558.01±0.12^{c}
F3	18.62±0.09^{c}	0.520±0.06^{a}	1548.95±0.10^{d}
F4	18.50±0.05^{c}	0.519±0.01^{a}	1537.31±0.11^{e}

Values are meaning of ten replicates ±SD, number in the same column followed by the same letter is not significantly different at 0.05 levels.

Chemical composition of raisin bars

The results presented in Table (6) show that the chemical composition of the raisin bars changed significantly with different sesame seed substitution. In general, the addition of sesame seeds resulted in an increase in protein, fat, ash, and energy. The crude protein content of different cereal bar samples ranged from 9.25 to 15% which was increased with increasing the level of sesame seeds. Bars with 30% sesame seeds (F4) showed the highest protein content. Similarly, the fat content of bars increased significantly with increasing levels of sesame seeds up to 15.70%. Ash content follows the same trend. As a result, energy increased from 408.94 to 468.54 Kcal. The difference in the content of protein, fat, and ash of produced bar samples, which increase with the increasing level of sesame seeds, might be due to the highest protein, fat, and ash content of sesame seeds (34.41, 47.37, and 3.76% respectively)in comparison to oats (15, 6.3 and 2.10%). Results of bars are in agreement with those reported by Subedi and Upadhyaya, (2019) [35] who prepared cereal bars incorporated with flaxseed.

On the other hand, fiber content decreased from 5.5 to 5.03%, with increasing sesame seeds. Also, carbohydrate follow the same trend, the value decreased from 85.38 to 66.81%.

The vitamin content of raisin bars, prepared with and without sesame seeds, are summarized in the same table. Data showed no significant increase in vitamin B with the addition of sesame seeds and oatmeal where no change occurred in raisin bar products. This could be attributed to the equal content of vitamin B in sesame seeds and oatmeal (Table 2) Hussien *et al.* (2020). As for vitamin A, a significant decrease occurred; this may be due to the decreased addition of oatmeal to the different blends during the process of the bars

Table 6: Chemical composition of raisin bars

Chemical composition	Control	F1 bar	F2 bar	F3 bar	F4 bar
Protein	9.25 ± 0.11^{e}	12.12 ± 0.08^{d}	13.07 ± 0.10^{c}	14.03 ± 0.09^{b}	15.00 ± 0.01^{a}
Fat	3.38 ± 0.03^{e}	9.54 ± 0.07^{d}	11.59 ± 0.09^{c}	13.65 ± 0.06^{b}	15.70 ± 0.03^{a}
Fiber	5.50 ± 0.05^{a}	5.27 ± 0.09^{b}	5.19 ±0.11^{c}	5.11 ± 0.03^{d}	5.03 ± 0.07^{e}
Ash	1.99 ± 0.01^{e}	2.24 ± 0.10^{d}	2.33 ±0.07^{c}	2.41 ± 0.03^{b}	2.49 ± 0.05^{a}
*Carbohydrate	85.38 ± 0.10^{a}	76.10 ± 0.05^{b}	73.01 ±0.10^{c}	69.91± 0.10^{d}	66.81 ± 0.11^{e}
Energy	408.94 ± 0.16^{e}	438.75 ± 0.15^{d}	448.63 ± 0.12^{c}	462.03 ± 0.17^{b}	468.54 ± 0.14^{a}
Vitamin A (IU)	41.290 ± 0.21	37.310 ± 0.27	35.980 ±0.20	34.66 ± 0.28	33.33 ± 0.23
Vitamin B mg/100g	0.140 ± 0.02	0.140 ± 0.01	0.140 ± 0.03	0.140 ± 0.01	0.14 ± 0.07

Values are meaning of ten replicates ±SD, number in the same column followed by the same letter is not significantly different at 0.05 levels. * Total carbohydrates were calculated by difference.

Mineral composition of raisin bar

Table (7) shows the mineral assay of raisin bar prepared from oatmeal and sesame. The results found that the potassium was the highest and it ranged between 418.32 and 431.05 mg/100g followed by phosphorus magnesium and calcium was ranged 216.92 to 285.11, 68.80 to 113.80, and 38.83 to 56.79 mg/100g, respectively. Magnesium is found in all foods; therefore, a varied diet should supply the RDA for magnesium (Jodral-Segado *et al.*, 2003) [19]. Sodium, iron, zinc, and copper were lower amounts in a bar than other minerals may be due to the ingredient bar was poor in these minerals (Table 2). Campos-Vega *et al.* (2010) [6] found that a correlation between the minerals content such as copper and zinc ratio and the happening of chronic heart disease. In addition, decreases zinc in humans is a public health problem (Ramirez-Cardenas *et al.*, 2010) [30].

Table 7: Mineral composition (mg/100 g) of raisin bar samples

Minerals	Control	F1 bar	F2 bar	F3 bar	F4 bar
Ca	38.83 ± 0.11 e	47.81 ± 0.08 d	50.80 ± 0.17 c	53.80 ± 0.09b	56.79 ± 0.11 a
P	216.92 ± 0.23 e	251.02 ± 0.29 d	262.38 ± 0.25 c	273.74 ± 0.39b	285.11 ± 0.31 a
Mg	68.80 ± 0.13 e	91.30 ± 0.18 d	98.80 ± 0.16 c	106.30 ± 0.25b	113.80 ± 0.22 a
Fe	2.41 ± 0.01 e	2.82 ± 0.03 d	2.95 ± 0.10 c	3.09 ± 0.12b	3.22 ± 0.07 a
Zn	1.29 ± 0.03 e	2.11 ± 0.06 d	2.38 ± 0.11 c	2.65 ± 0.09b	2.92 ± 0.05 a
Cu	0.26 ± 0.01 e	0.38 ± 0.02 d	0.42 ± 0.05 c	0.47 ± 0.07b	0.51 ± 0.01 a
Na	13.58 ± 0.07 e	17.55 ± 0.15 d	18.88 ± 0.13 c	20.20 ± 0.19b	21.53 ± 0.10 a
K	418.32 ± 0.25 e	424.68 ± 0.28 d	426.80 ± 0.23 c	428.92 ± 0.29b	431.05 ± 0.25 a

Values are meaning of ten replicates ±SD, number in the same column followed by the same letter is not significantly different at 0.05 levels.

Fatty acids content of raisin bar samples

The fatty acid content of control raisin bar, prepared from sesame and oatmeal to produce bars (F1-F4) is summarized in Table (8). The results showed that all fatty acids increased with the addition of sesame seeds may be due to the sesame had contained rich amounts of total lipid this results confirmed with Thakur *et al.* (2017) [37] who found that the sesame is an excellent source of oil (57-63%). Thus, the unsaturated fatty acid content in the bar product was gradually increased with the increasing of sesame seeds content in bars.

Fats are essential for correct nutrition; they may adversely influence the human body not only through the excessive intake in the diet but also through their incorrect profile (Wolańska and Kłosiewicz-Latoszek, 2012) [41].

For example, the excessive consumption of saturated fatty acids, especially long-chain fatty acids, contributes to increased plasma cholesterol levels and promotes atherosclerosis (Fernandez and West, 2005) [10]. In turn, unsaturated fatty acids have a generally positive effect on the plasma lipid profile and cardiovascular system, through their anti-atherosclerotic, anti-inflammatory and anti-aggregation actions (Kolanowski, 2007) [22].

Expected nutritional contributions of raisin bars to adult diet

All nutritionists confirm the necessity to make sure an adequate intake of micronutrients. The recommended dietary allowances (%RDA) from resin bars for adults (19-31 years) are presented in Table (9).

Table 8: Fatty acid content (g/100 g) of raisin bar samples

Fatty Acids (gm/100 gm)	Control Bar	F1 bar	F2 bar	F3 bar	F4 bar
Myristic C14:0	0.010	0.020	0.020	0.030	0.030
Palmitic C16:0	0.410	0.790	0.910	1.040	1.170
Stearic C18:0	0.030	0.250	0.330	0.400	0.470
Saturated fatty acids	0.450	1.060	1.260	1.470	1.670
Palmtoleic C16:1	0.000	0.020	0.020	0.030	0.030
Oleic C18:1	0.750	2.560	3.170	3.770	4.370
Linoleic C18:2	0.880	2.970	3.670	4.370	5.070
Linlenic C18:3	0.050	0.080	0.090	0.100	0.110
Unsaturated fatty acids	2.130	5.630	6.950	8.270	9.580

Table 9: Expected nutritional contributions of raisin bars in the human diet

	Male (19-30)				Female (19-30)			
Blends	Protein (56g/d)	Fe (6mg/d)	Zn (11 mg/d)	C a (1000mg/d)	Protein (46g/d)	Fe (8 mg/d)	Zn (8 mg/d)	Ca (1000mg/d)
Control	16.52	40.17	11.72	3.88	20.11	30.13	16.13	3.88
F1	21.64	47.00	19.18	4.78	26.35	35.25	26.38	4.78
F2	23.34	49.17	21.64	5.08	28.41	36.88	29.75	5.08
F3	25.05	51.50	24.09	5.38	30.50	38.63	33.13	5.38
F4	26.78	53.67	26.55	5.68	32.61	40.25	36.50	5.68

The expected nutritional contribution of raisin bars to the adult's diet was calculated by taking into consideration the protein and micronutrients contents of various raisin bar samples. The calculations for the protein and energy contributions of raisin bars as a percentage of the Dietary Reference Intakes (2005) [9] within the diets of assorted age groups are presented in Table (9). A higher protein and mineral levels recorded can be attributed to the addition of sesame seeds. The data presented in this table show that raisin bars can contribute significantly to fulfill a significant a part of the energy, protein and a few important mineral requirements of adults.

Conclusion

The study verified that raisin, sesame seeds, and oatmeal can be used to prepare fruit bars of high nutritional value which has contained high nutritional constituents, minerals content, unsaturated fatty acids, and a natural antioxidant for both males and females.

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