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RESEARCH ARTICLE

PROXIMATE COMPOSITION, CHEMICAL AND MICROBIOLOGICAL EVALUATION OF PEANUT BUTTER IN SUPERMARKETS IN KHARTOUM STATE

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ABSTRACT

The aim of this work was contribute to the food safety of Sudanese consumers by studying the physicochemical properties and microbiological evaluation of peanut butter samples .The samples were collected from different area in Khartoum state. The results revealed that some samples were nutritive which had protein values ranged between (27.47-24.31%), oil content values ranged between (50.38-46.28%), energy values ranged between (610.69-600.03kcl/100g) and appear to have positive effects on human health and so could meet the dietary needs of the population. But concerning the quality, three samples were not meet the quality requirements because they showed high peroxide value (20.36, 19.05 and18.51m.eq./kg) which may affect the organoleptic properties of the product. Also the presence of salmonella in five samples may be responsible for many health hazards in human population.

INTRODUCTION

The genus Arachis, a member of the family Leguminoseae, is widely distributed in the tropics and moderate regions. Peanut (Arachis hypogaea L.) is an important source of edible oil for millions of people living in the semi tropic region. Peanuts make an important contribution to the diet in many countries. Peanut seeds are a good source of protein, lipid and fatty acids for human nutrition (Tai and Young 1975; Gaydou *et al*.1983; Grosso and Guzman 1995; Grosso *et al*.,1999). Peanut are rich in oil, naturally containing from 47 to 50 %. The oil is pale yellow and has the characteristic odor and flavor of peanuts (O'Brien, 1998). Oil quality and its stability are therefore very important for the consumers (Jambunathan *et al*.1993). The composition of peanut and its oil of several cultivars of Arachis hypogaea and peanut species have been studied (Mozingo *et al*.1982, Mercer *et al*.1990, Hashim *et al*.1993, Grosso *et al*. 1999, Celik 1995, Grimm 1996, Chiou *et al*.1997). Peanut paste is a very important product in the world, it can be used as condiment or for the preparation of soup (Katz, 2005). Its butter is also a good source of protein, fat, carbohydrate, fiber and minerals and has longer shelf life, smoothness and a very pleasant flavor (Chow, 2007). According to Fraser *et al*., (1992), frequent peanut paste consumption can reduce the incidence of coronary heart diseases by 25 to 50 %. Consumption of peanut snacks daily is important to the health of the individual since it contains other nutrient essential to the human systems development (Hu *et al.,* 1998). Peanut paste can therefore serve as a good product for the control of type 2 diabetes when consumed frequently or incorporated daily into meals (Jiang *et al*., 2002). Although peanut is the most important leguminous crop cultivated in Sudan peanut butter is a semi-perishable product that is subject to a number of microbial, chemical and physical deteriorative changes, which affect the final quality of the finished product. The shelf life is greatly dependent on the quality of peanuts used and the conditions of the peanuts used for making the peanut butter. Deterioration of peanut butter arises from putrefaction of protein fraction caused by bacterial metabolism; darkening, which results from an interaction between sugar and protein in the product and; oxidative rancidity that develops in the unsaturated portion of oil when it is exposed to air (Woodroof, 1983).The observed fungi contamination of the studied peanut butters exposing the consumers to a potential risk of acquiring food borne disease. Indeed, food borne illnesses of microbial origin are a major international health problem associated to food safety in developing countries (WHO, 2002). The objective of this work was to contribute to the food safety of Sudanese consumers by investigating the proximate composition, chemical and microbiological characterization of peanut butter samples which were purchased from some of existing supermarkets in Khartoum state.

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MATERIALS AND METHODS

Materials: Eight samples of peanut butter were collected from different supermarkets in Khartoum state.

Methods

Proximate analysis: The proximate analysis of peanut butter were performed according to those described by (pearson, 1981) which are : crude protein, oil content, ash content, moisture content, crude fiber ,carbohydrate and The calorific value (energy) was calculated as follow: (protein x 4) + (carbohydrate x 4) + (lipid x 9).

Chemical analysis: The chemical analysis techniques were performed according to those described by the Association of Official Analytical Chemist (AOAC, 2000) which was (peroxide value and free fatty acids).

Microbiological analysis

Peanut samples were collected from different supermarkets in Khartoum was conducted to microbiological testes to determined yeast, mould, salmonella and E.coli using Harrigan, 1998 method.

RESULTS AND DISCUSSION

Proximate composition: The proximate composition of peanut butter samples tested is shown in Table 1. All the parameters showed significant difference ($p<0.05$). The protein content of the studied peanut butters (24.31- 27.47%) falls within the range reported by Zamble *et al*.,(2013). Therefore, these butters could be considered as a valuable source of protein in improving the nutrition status of humans (FAO/ WHO, 2007).

Table 1. Proximate composition of peanut butter in supermarkets in Khartoum State

Sample	Crude protein (%)	Oil content (%)	Moisture content (%)	Crude fibre (%)	Ash content (%)	Carbohydrates (%)	Energy (kcal/100g)
1	25.70^{bcd} ±0.54	48.84^{b} ±0.13	2.89^{cd} ±0.08	4.43^{cd} ±0.15	5.53^{a} ±0.16	17.05^{bc} ±0.74	610.52^{ab} ±0.35
2	26.31^{b} ±0.05	49.35^{b} ±0.16	4.21^{abcd} ±1.58	4.20^{d} ±0.06	5.41^{a} ±0.30	14.73^{de} ±1.17	608.25^{ab} ±5.96
3	26.04^{bc} ±0.05	46.28^{e} ±0.09	2.71^{d} ±0.35	4.16^{d} ±0.10	4.68^{bc} ±0.09	20.31^{a} ±0.12	601.84^{c} ±1.51
4	25.68^{bcd} ±0.34	50.38^{a} ±0.05	5.07^{a} ±0.21	4.88^{ab} ±0.09	5.27^{ab} ±0.25	13.62^{e} ±0.06	610.56^{ab} ±2.06
5	27.47^{a} ±0.64	47.43^{d} ±0.15	3.43^{bcd} ±0.26	5.06^{a} ±0.05	5.85^{a} ±0.14	15.83^{cd} ±0.61	600.03^{c} ±1.22
6	24.31^{e} ±0.01	49.32^{b} ±0.15	3.66^{abcd} ±0.33	4.51^{bcd} ±0.37	4.49^{c} ±0.25	18.25^{b} ±0.10	614.06^{a} ±0.97
7	24.96^{de} ±0.06	48.12^{c} ±0.28	4.33^{abc} ±0.45	5.08^{a} ±0.02	4.53^{c} ±0.62	18.07^{b} ±0.38	605.14^{bc} ±0.0
8	25.22^{cd} ±0.26	49.41^{b} ±0.56	4.85^{ab} ±0.07	4.76^{abc} ±0.23	4.24^{c} ±0.01	16.29^{c} ±0.74	610.69^{ab} ±3.10
$Lsd_{0.05}$	0.7717^{*}	05695^{*}	1.429^{*}	0.3994^{*}	0.6603^{*}	1.418^{*}	6.031^{*}
SE±	0.2366	0.1746	0.4382	0.1225	0.2025	0.4347	1.849

Values are mean±SD. Mean(s) having different superscript(s) in a column are significantly different ($P\leq0.05$) according to DMRT.

Table 2. Chemical properties of peanut butter in supermarkets in Khartoum State

Sample	Peroxide value (mEq/kg)	Free fatty acids (as% oleic acid
1	6.22^{c} ±0.26	0.245^{c} ±0.01
2	20.36^{a} ±0.23	1.050^{a} ±0.01
3	3.68^{f} ±0.33	0.165^{e} ±0.02
4	19.05^{b} ±0.04	0.900^{b} ±0.01
5	5.39^{d} ±0.06	0.345^{d} ±0.01
6	4.82^{de} ±0.21	0.235^{e} ±0.01
7	4.58^{e} ±0.49	0.185^{e} ±0.01
8	18.51^{b} ±0.23	0.830^{b} ±0.08
$Lsd_{0.05}$	0.6145^{**}	0.07292^{*}
SE±	0.1884	0.02236

Values are mean±SD.
Mean(s) having different superscript(s) in a column are significantly different ($P\leq0.05$) according to DMRT.

In addition, the fat content of the studied sample is within the range (41- 48%) reported by Makeri *et al*., (2011) for peanut paste prepared with two Nigerian cultivars of *Arachis hypogeal l.* The fats play a nutritionally role in providing essential fatty acids for humans. The lowest value of moisture content was 2.71± 0.35% while the highest value was 5.07±0.01%. These values are lower thanthat (7.48%) of raw peanut seeds (Ayoola and Adeyeye, 2010) and this fact could be explained by the decrease of moisture content during the roasting which is an important step of peanut butter processing (Campos-

Mondragon *et al*., 2009). The crude fiber of the sample ranged from 4.16±0.1% to 5.08±0.02%, indicate an ability of peanut butter to maintain a normal intestinal tract and so protection against colon diseases. The ash content of the samples ranged from 4.24±0.01% to 5.85±0.14%, this value was higher than that (3.4%) of raw peanut seeds indicated by Ere- Ejiofor *et al*., (2012).

Table 3. Microbiological characterization of peanut butter in supermarkets in Khartoum State

Sample	Fungi and yeasts	*Salmonella*	*E. coli*
1	-ve	+ve	-ve
2	-ve	+ve	-ve
3	-ve	+ve	-ve
4	-ve	+ve	-ve
5	-ve	-ve	-ve
6	-ve	+ve	-ve
7	-ve	-ve	-ve
8	-ve	-ve	-ve

The highest values of energy (600.03- 614.06Kcal/ 100g) of peanut butter samples analyzed in this study may be attributed to the highest values of their protein and fat contents. Table (2) shows the chemical properties of peanut butter sold in supermarkets in Khartoum State. Oil from samples was extracted using the cold extraction method. Samples 2, 4 and 8 showed high oxidation levels compared to other samples. Lipid oxidation is a main factor that lowers the quality of oil .Peroxide value is the widely used parameter for expressing the extent of lipid oxidation. The peroxide value of roasted peanuts increases with storage time and temperature (Abayomi *et al*., 2002). The free fatty acids of the samples are ranged from 0.165±0.02 to 1.050±0.01. The lipolytic enzymes of yeasts and moulds are also known to hydrolyze lipids in to free fatty acids and thus promote the hydrolytic rancidity (Sacks *et al*., 2006). Sample 2 exhibited higher peroxide value (20.36±0.23) and free fatty acids (1.050±0.01), where sample 3 has lower peroxide value (3.68±0.33) and freey fatty acids (0.165±0.02). Table (3) shows the microbiological characterization of peanut butter and E.coli, but five samples wear contaminated by salmonella bacteria. This contamination might be due to processing, food handling procedures personal hygiene.

Conclusion

The results revealed that some samples were nutritive and appear to have positive effects on human health and so could meet the dietary needs of the population. But concerning the quality, three samples were not meeting the quality requirements because they had high peroxide value which may affect the organoleptic properties of the product. Also the presence of salmonella in five samples may be responsible for many health hazards in human population. Variations observed between the results of this work could be probably due to effects of cultivars, locations, the differences in climatic conditions, soil moisture and environmental temperature during maturation of peanut seeds or due to peanut butter processing.

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