Available online at www.elixirpublishers.com (Elixir International Journal)

Food Science

Elixir Food Science 74 (2014) 27116-27119

ISSN: 2229-712X

Evaluation of physiochemical properties, proximate composition and microbial load of some cookies products of Jammu & Kashmir

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ARTICLE INFO

Article history:

Received: 14 July 2014;

Received in revised form:

21 August 2014;

Accepted: 20 September 2014;

Keywords

Cookies, Proximate composition, Physicochemical properties, Microbial load.

ABSTRACT

Cookies are one of the best known quick snack products. Cookies play important role in human diet since these contain naturally high amounts of valuable nutrients like soluble fibers, carbohydrates, proteins, unsaturated fatty acids, vitamins, minerals, etc. In the present study, the cookies samples were analyzed for their physicochemical properties, proximate composition and microbial load and were compared with each other. The results revealed that there was significant difference in the proximate composition between the samples with respect to each other at $p>0.05$. No significant difference was observed in most of the determined physicochemical properties of the samples. Moreover, the microbial load of the samples was found to be in acceptable range. Hence the study ascertains that the sensory qualities may be similar as there was very slight change in the physicochemical characteristic and which are acceptable for everyone.

Introduction

Cookies are nutritive snacks produced from unpalatable dough that is transformed into appetizing product through the application of heat in an oven. They are ready-to-eat, convenient and inexpensive food product, containing digestive and dietary principles of vital importance (Kulkarni, 1997). The principal ingredients of cookie are flour, fat, sugar and water; while other ingredients include milk, salt, flouring agent and aerating agent (Wade, 1988). Cookies are a rich source of fat and carbohydrate, hence are energy giving food and they are also a good source of protein and minerals (Kure *et al.*, 1998). Cookies are one of the best known quick snack products. Cookies are often referred to as small sweet cakes. They are characterized by a formula high in sugar and shortening and low in water. The terms cookies and biscuits are almost synonymously used in India for the products prepared commercially using refined flour, hydrogenated fats and sugar along with emulsifiers and other additives. However, in the Western world 'biscuit' is small round bread leavened with baking powder or soda and the 'cookie' is small, flat baked bread, containing milk, flour, eggs, sugar and leavening agents. This food is made from unleavened dough. It is produced from a mixture of flour and water which may contain fat, sugar and other ingredients mixed together into dough which is rested for a period and passed between rollers to make a sheet (Okaka and Portter, 1997). Cookies and biscuits belong to the group of food products, which are very popular in daily diet of almost all profiles of consumers (Raljic *et al.*, 2007), having not only the nutritive purpose but influencing also on emotional status of consumers with the effects even on the positive mood enhancement (Turner *et al.*, 2010). Cookies are convenient snack product dried to a very low moisture content taken among young people and adult to provide energy. Cookies are the most popular bakery products consumed by a wide range of populations. This is mainly due to its ready-to-eat nature, good nutritional quality and availability in different tastes, longer shelf life and relatively low cost (Ajila *et al.*, 2008). Therefore, the alteration of composition of cookies directed to enhancement their nutritive and/or functional properties or to enabling of their consumption to the groups of consumers with special needs and demands has been the subject of interest of many researchers. The basic composition of cookies enables variety of different possibilities for achievement of dietary properties of the products in respect to type, share and function of three main components for cookies dough production: flour (Rukshan *et al.*, 2001) fat and sugar (Pareyt *et al.*, 2008). There are different possibilities for development and production of dietary cookies, from sugar replacement (Duffy *et al.*, 1998), over alteration of fat shares, composition and properties (Goldstein *et al.*, 2011) to enrichment of cookies with different functional components (Arshad *et al.*, 2007). The bakery industry has been steadily growing in the country, being the largest among the processed food industries. The two major bakery industries namely bread and cookies account for almost 82 per cent of the total bakery products. The annual production of bakery products is estimated to be more than 3.0 million tonnes. India is recognized to be the second largest producer of cookies next only to the United States of America with annual production of which was 7.40 lakh metric tonnes in 1997-98 which has escalated to 17.14 lakh metric tonnes in 2005-2009 (Agrawal, 1990). Among the bakery products cookies command wide popularity in rural as well as urban areas among people of all age groups (Agrawal, 1990). The production of cookies in the country, both in the organized and unorganized sectors, is estimated to be around 11 million tones.

India although is the largest producer of cookies, paradoxically the per capita consumption of cookies is as low as 8 kg per annum as against 15 kg per annum in developed countries (Shukla *et al.*, 2000). It is interesting to note that

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although cookies do not belong to the Indian traditional cuisine, they are ubiquitously present in all types of markets of India, which indicates the popularity of these products. Cookies are available in different unit packages in various flavours, shapes, sizes and with excellent organoleptic characteristics. Excellent shelf life at ambient conditions, simplicity and ease of handling during use and transport and availability at affordable prices for the diverse consumers make the cookies popular even in traditional food cultures of India. Owing to their popularity and ubiquitous presence in Indian markets, the cookies are important components of one's diet that provide nutrients. The cookies if modified suitably are probably the best vehicles to carry the nutrients to meet the nutritional demand of common consumers. There is a growing awareness among the consumers regarding the constituents that affect health both positively and negatively. The number of such health conscious consumers is fast increasing and so is the health food industry. Cookies with new health claims are flooding the market to meet the diverse demands of consumers.

In the present study the physicochemical properties, sensory and textural properties and microbial load of cookies available in Srinagar (Jammu and Kashmir) has been evaluated and compared by using modern techniques.

Materials and Methods

The materials and methods used in this present study are as follows.

Materials

Cookie samples were procured from the Hattrick, Jan Bakers and Jee Enn Son`s bakery industry of Srinagar district (Jammu and Kashmir) and were carried to the laboratory for the analysis of various parameters.

Methods

Chemical Analysis

The chemical analysis of the various cookies samples were analyzed for the proximate compositions with the parameters like carbohydrate (Anthrone method), protein (Lowry's method), fat (Soxhlet method), crude fiber and physicochemical properties with the parameters like moisture, ash and calorific value by using standard procedures given by A.A.C.C. (2000).

Cookies Quality

The various cookies quality parameters like thickness and diameter were evaluated manually while as the spread ratio and spread factor were calculated by the following formulas:

$$\text{Spread ratio} = \frac{\text{Cookie weight (g)}}{\text{Cookie thickness (mm)}}$$

Spread Factor = Diameter/Thickness × CF ×10

CF is correction factor at constant atmospheric pressure

Moreover, the sensory properties were also evaluated manually and the texture of the cookies was calculated by the texture analyzer (TA HD Plus, Texture analyzer).

Microbial evaluation

The cookie samples (1gm) were powdered and dissolved in 10ml of sterile saline solution and homogenate for one minute. Serial dilutions using 1 ml of homogenates were made in 9 ml sterile saline, dispensed in test tubes and 0.1ml of the dilution (10^{-1}, 10^{-2} and10^{-3}) was spread on sterile Petri plates containing nutrient agar media for the analysis of microbial load. The plates were incubated at 37^{o}C for 24 hours. The plates were observed for number of colonies produced on each plate of different dilutions and colonies were counted by colony counter (Digital Colony Counter). Counts of visible colonies were made and expressed as CFU/g as given below:

$$\text{CFU/g} = \frac{\text{No. of colonies (Mean)} \times \text{Dilution factor}}{\text{Volume of sample used (0.1ml)}}$$

CFU/g is colony forming units per gram.

Statistical analysis

All the experiments were conducted in triplicate for each sample. The data generated was analyzed using Minitab for calculation of least significance difference (LSD). Significance was accepted at $p \leq 0.05$ level.

Results and Discussion

The data in Table-1 and Fig.1 outlines the proximate analysis of cookie samples. On evaluation of results it was found that cookie sample from Jee Enn Son's have high moisture content (4.50%) followed by Jan Bakers (2.90%) and lowest moisture was reported in Hattrick (1.38%) cookie sample. The moisture content in all three cookie samples differ significantly at 5 % level of significance. The difference in moisture content is attributed to different packaging material used by bakers. The total fat content of cookies is majorly a function of externally added fat during cookies preparation. The highest value of 33.60 % was recorded in Hattrick sample, followed by Jan Bakers 31.40 % and lowest value of 29.60 % was recorded in cookie of Jee Enn son's. The protein content of the cookies procured from local market was attributed due to the wheat proteins and also may be other protein ingredients (eggs, dry fruits) used in cookie preparation. The lowest values of 8.47 and 8.97 % protein content were recorded in Jee Enn Son's and Jan Bakers cookies, respectively. Highest value of 12.46% was recorded in cookie procured from Hattrick. However the highest ash content (0.73%) was recorded in the samples of Jee Enn Son's and lowest value (0.49%) was observed in cookie samples of Jan Bakers whereas (0.66%) was observed in cookie samples of Hattrick. Statistically at 5% level of significance carbohydrate content between cookie samples of Jan Bakers and Jee Enn Son's are not significantly different, where as cookies of Hattrick are significantly different. It was observed that the increase in level of protein, fat, fiber, ash and moisture contents results in decrease in level of total carbohydrate content.

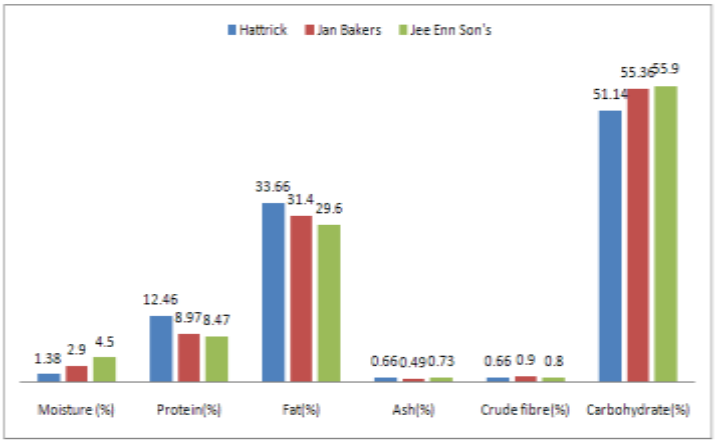

Fig. 1: Graphical representation of proximate composition of cookie samples

As evident from the Table 2 and Fig.2, highest calorific value of 557.44 kcal/g was observed in cookie samples of Hattrick, followed by Jan Bakers (539.84kcal/g) and lowest in Jee Enn Son's (523.88 kcal/g) cookie samples. The greater calorific value observed in the cookies of Hattrick may be due to the high amount of fat content than the other two cookies sample.

Table 1: Proximate composition * of cookies

Sample	Moisture %	Ash %	Protein %	Fat %	Crude fiber %	Carbohydrate %
Hattrick	$1.38^{a}\pm0.20$	$0.66^{ab}\pm0.31$	$12.46^{b}\pm2.47$	$33.66^{c}\pm4.80$	$0.66^{a}\pm0.52$	$51.14^{a}\pm4.30$
Jan Bakers	$2.90^{b}\pm0.63$	$0.49^{a}\pm0.18$	$8.97^{a}\pm0.99$	$31.40^{b}\pm3.25$	$0.90^{c}\pm0.40$	$55.36^{b}\pm5.34$
Jee Enn Son's	$4.50^{c}\pm1.27$	$0.73^{b}\pm0.30$	$8.47^{a}\pm0.85$	$29.60^{a}\pm2.86$	$0.80^{b}\pm0.40$	$55.90^{b}\pm5.67$

Mean values in the same column bearing the same superscript do not differ significantly ($p \leq 0.05$).
*Mean of triplicate determinations ± standard deviation.

Table 2: Calorific value* of cookies

Sample	Fat (9 kcal/g)	Protein (4kcal/g)	Carbohydrate (4kcal/g)	calorific value (kcal/g)
Hattrick	$302.40^{c}\pm9.22$	$49.84^{c}\pm5.04$	$205.20^{a}\pm3.78$	$557.44^{c}\pm8.94$
Jan Bakers	$282.60^{b}\pm9.08$	$35.88^{b}\pm3.98$	$221.36^{b}\pm4.36$	$539.84^{b}\pm8.74$
Jee Enn Son's	$266.40^{a}\pm8.56$	$33.88^{a}\pm3.48$	$223.60^{b}\pm4.40$	$523.88^{a}\pm8.23$

Mean values in the same column bearing the same superscript do not differ significantly ($p \leq 0.05$).
*Mean of triplicate determinations ± standard deviation

Table 3: Physical properties* of cookies

Sample	Thickness (mm)	Diameter (mm)	Weight (grms)	Spread ratio	Spread factor
Hattrick	$13.70^{b}\pm0.25$	$52.60^{a}\pm2.64$	$16.18^{a}\pm0.02$	$1.17^{a}\pm0.02$	$39.30^{b}\pm4.47$
Jan Bakers	$13.70^{b}\pm0.25$	$50.50^{a}\pm1.38$	$15.06^{a}\pm0.03$	$1.08^{a}\pm0.02$	$36.60^{a}\pm1.62$
Jee Enn Son's	$10.90^{a}\pm0.26$	$56.80^{b}\pm0.80$	$19.20^{b}\pm0.02$	$1.75^{a}\pm0.04$	$52.00^{c}\pm1.32$

Mean values in the same column bearing the same superscript do not differ significantly ($p \leq 0.05$).
Mean of triplicate determinations ± standard deviation

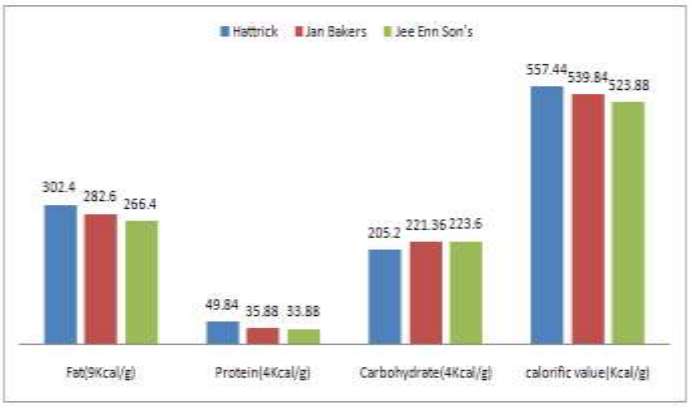

Fig. 2: Graphical representation of calorific value of cookie samples

Physical Analysis of cookies

From the Table 3 and Fig. 3 it was found that the diameter of the cookies followed the following order i.e Jee Enn Son's > Hattrick > Jan Bakers. The decrease in the diameter is due to the the difference in fibre content (Sievert *et al.*, 1990). Similar trend has been followed in case of other physical properties like thickness, weight, spread ratio and spread factor.

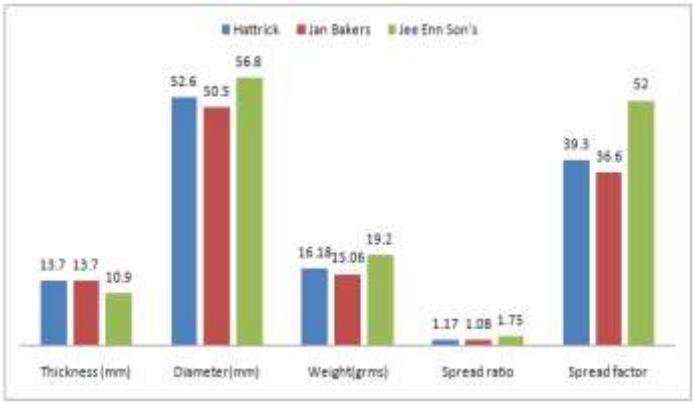

Fig 3: Graphical representation of physical properties of cookie samples

Texture analysis of the samples is illustrated by the Table 5, which depicts the mean highest peak force (4.45kg) for Jan Bakers cookies, followed by Hattrick cookies (3.4kg) and mean lowest peak force for Jee Enn Son's cookies (0.85kg). The difference in peak force among different cookies might be due to different moisture content, thickness, and different components involved in product formulation.

Table 5: Mean texture analysis* of cookies

Sample	Mean Force (kg)
Hattrick	$3.40^{b}\pm0.22$
Jan Bakers	$4.45^{c}\pm0.64$
Jee Enn Son's	$0.85^{a}\pm0.27$

Mean values in the same column bearing the same superscript do not differ significantly ($p \leq 0.05$).
Mean of triplicate determinations ± standard deviation.

Microbiological evaluation

The data in Table 6 reflects the mean total plate count of the microbial load in cookies samples on nutrient agar media. Total plate counts on nutrient agar reflect the hygienic conditions in which the cookie samples were prepared. The count can be used to predict the shelf life or keeping quality of the product. The spoilage of many foods may be imminent when the total plate count reaches 10 -100 million per gram of product (Emmanuel *et al.*, 2012). The total microbial load on nutrient agar for Hattrick cookie sample was 3.33×10^{2} followed by Jan Bakers ($3.86\times10^{2)}$ and 4.84×10^{2} for Jee Enn Son's cookies. The microbial load of given cookies samples were compared with the microbiological standards of fortified blended goods, total plate counts less than 100,000 cfu/g. It was observed that the value is still within acceptable limit.

Table 6: Microbiological evaluation of cookies

Sample ⇨	Hattrick	Jan Bakers	Jee Enn Son's
Cfu/g ⇨	3.33×10^{2}	3.86×10^{2}	4.84×10^{2}

Conclusion

Cookies are one of the best known quick snack products. Cookies play important role in human diet since these contain naturally high amounts of valuable nutrients like soluble fibres,

carbohydrates, proteins, unsaturated fatty acids, vitamins, minerals, etc. The studies reflected that Hattrick cookies have highest acceptability and recorded low microbial load than Jan Bakers and Jee Enn Son's cookies. The proximate composition changed significantly in all the three samples, the moisture content differ significantly. The texture analysis also revealed different mean cutting force (peak force) in cookie samples. Microbial load on the cookie samples was under acceptable range. From the entire work carried out for the Analysis of Different Cookies, it can be concluded that the best cookie among the three is Hattrick in terms of proximate analysis, sensory, texture and microbial load**.**

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