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The Physicochemical and Sensory Characteristic of Cookies Baked from Wheat Flour and Mango Pulp

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Abstract
Food produced from fruits and cereals processing plants possesses an important natural and valuable material in producing less expensive functional food due to the presence of several bioactive substances. Therefore, the aim of the present study is to investigate the nutritional composition, physicochemical properties, and sensory quality of the control, wheat flour cookies substituted with 20, 30 and 50% mango pulp. The proximate analysis results demonstrated that the control from 100% from wheat flour (C1), 80% wheat flour with 20% mango pulp (C2), 70% wheat flour with 30% mango pulp (C3) and 50% wheat flour with 50% mango pulp (C4); the moisture contents were 5.49%, 6.81%, 8.37%, 12.41% respectively. The total ash contents for C1, C2, C3 and C4 were 1.89%, 2.19%, 2.65% and 3.12% respectively. The functional properties values of our products such as water absorption idex values of C1=2.5, C2=2, C3=3.2 and C4=3.5 and water solubility index C1, C2, C3 and C4 were 34.75%, 31.7%, 30.48% and 29.27% respectively. Sensory qualities this product were evaluated in terms of color, flavor, taste, crispness and acceptability. Generally, the cookies produced from C2 (20%) and C3 (30%) mango pulp were gave better colour, test and acceptability but there was no significant difference with other C1 AND C4 quality attributes such as flovour then from this results the cookies which had more acceptable were could be produced.
Keywords: Mango pulp, Cookies, Physicochemical properties, functional properties, sensory analysis properties.

Introduction

Cookies represent the largest category of snack items among baked foods all over the world. It contains less moisture content. Different verities of cookies are used as one of the fast and nutritious snacks. Cookies are popular as convenient food (Upadhyay at el., 2010). It conserve as vehicle for important nutrients if made readily available to the consumer. It consists of three major components: flour, sugar, and fat, which compose cookie dough and influence the quality of the final product. The main ingredient of cookie dough is wheat flour (Biniyam, 2010).

Wheat is a major cereal crop in many parts of the world. It belongs to the *Triticum* family, of which there are many thousands of species, with *T. aestivum* subspecies Vulgare and the hard wheat *TriticumDurum*being the most important commercially. Wheat is grown as both a winter and aspring cereal and, owing to the number of species and varieties and their adaptability; it is grown in many countries around the world(Slavin, 2003).

Wheat is generally not classed by variety. Instead classes are used, based on the time of year the wheat is grown and the milling and baking quality of the flour produced. Within each class there is a group of different varieties of wheat with similar characteristics. Most of the wheat produced is used for human consumption and because of its unique properties, a large range of ingredients and foods are produced, including wheat germ, spelt (a coarse type of wheat), couscous, cracked wheat or bulgur and wheat starch(Slavin, 2003).

Mangoes belong to the genus *Angifera*, consisting of numerous species of tropical fruiting trees in the flowering plant family Anacardiaceous. The mango is indigenous to the Indian subcontinent and Southeast Asia (mango -botany-taxonomy, 2008). Cultivated in many tropical regions and distributed widely in the world. It is one of the most extensively exploited fruits for food, juice, flavor, fragrance and color and a common ingredient in new functional foods often called super fruits. Its leaves are ritually used as floral decorations at weddings and religious ceremonies. Mango contains amino acid, carbohydrates, fatty acids, minerals, organic acids, proteins, vitamin A &C, and dietary fibres. It is one of the most recommended fruit which have medicinal importance to fight beriberi, heal bronchial diseases and cure brain fatigue, mental depression, wrestle heartburn and insomnia.(Md. Farid Hossain2015);Rimm *et al.,* 1996).

Materials and methods

Physicochemical Properties

Determination of Moisture Content

Moisture was determined according to AOAC (2000) using the official method 925.09. A clean dried and covered flat aluminum dishes were weighed and about 10gm of the sample were transferred to the dish. The dish then placed in the oven at 105^{o}c for twenty four hours and cooled in desiccators and re-weighed.

Ash: A clean and dry porcelain dish containing 10g sample was placed in a muffle furnace (thermolyne, 1000

furnaces) set at 500^0C for 8hrs and then cooled in a desiccators and weighed, and the ash content was determined using the equation below(Legesse.M.B. 20120).

Water-Holding Capacity (WHC) and Oil-Holding Capacity (OHC),

For the determinations of water-holding capacity (WHC) and oil-holding capacity (OHC), 25 mL of distilled water or commercial oil were added to 0.5 g of MP vigorously shaken for 1 min and then centrifuged for 15 min at 10,000rev, the residue was weighed and the WHC and OHC were calculated as g water or oil per g of dry sample, respectively (Larrauri *et al.,* 1996).

Water solubility index (WSI): Water solubility index (WSI) was a measure of starch degradation; it means that as the WSI increase starch degradation consequently increase soluble molecules in the extrudates.. WSI is the influential factor for estimation of solubilisation of small molecules for complimentary food which is related to digestibility of the food.

Water absorption index (WAI): WAI was an indicator of the ability of food or flour to absorb water, depends on the availability of hydrophilic groups which bind water molecules and on the gel-forming capacity of macromolecules (Hoseney, 1986)

Gluten Content Determination

It was conducted according to St. Paul, MN.(2000) method. A 10-gram sample of flour or ground wheat was weighed and placed into the glutomatic washing chamber on top of the polyester screen. The sample was mixed and washed with a 2% salt solution for 5 minutes. Then wet gluten content was determined by washing the flour or ground wheat sample with a salt solution to remove the starch and other solubles from the sample. The residue remained after washing was the wet gluten. The percentage of gluten remaining on the sieve was defined as the Gluten Index, which was an indication of gluten strength.

Sensory Evaluation

It's the field that measures product perceived by the human senses. The twelve panelists were selected from food technology and process Engineering Department to assess the sensory acceptability of cookies that made from mango pulp blended with wheat flour in different ratio. The evaluation included sensory attributes such as color, flavor, taste, texture and overall acceptability of the product. For colour, flavour, taste, Crispness and overall acceptance of the product 7-point hedonic scale rating from 1(dislike extremely) , 2 (dislike moderately) , 3 (dislike slightly) , 4 (neither like nor dislike) , 5 (like slightly), 6 (like moderately) and , 7 (like extremely) were used.

Functional and Physicochemical properties

In this chapter the outcome of proximate analysis of functional properties, the physicochemical properties and the sensory evaluation of the Mango cookies of the samples were discussed. Table 4.1. shows the results of moisture contents, dry matter, total ash content, water solubility and water absorption,

TABLE 4.1.Some functional and physicochemical properties of cookies

Sample Code	Moisture content(%)	Dry matter(%)	Ash(%)	WSI(%)	WAI(ml/g)
C1(Control)	5.49	94.51	1.89	34.75	2.5
C2	6.81	93.19	2.19	31.7	3
C3	8.37	91.63	2.65	30.48	3.2
C4	12.41	87.59	3.12	29.27	3.5

Moisture content: The moisture determinations of the sample ranged from 5.49 and 12.41%. The moisture content result showed that increasing the amount of mango had a significant effect on moisture increment. This result agree with the work of (Nasir et al., 2010*)* according to those research finding the Moisture contents of normal cookies arise from 1-6% . Then the reason why moisture content our products were increased from due to some parameter during processing i.e. uncontrolled time temperature relationships, lack of hygienic condition, storage and packaging materials which we were used. In summary it seems that the moisture content for C2 and C3 is in the moisture range generally accepted for dry products in order to obtain a desirable shelf life of the product according to (Ajila *et al.,* 2008;2010)

Figure 4.1.sample of cookies prepared for determination of moisture contents

Dry matter: The amount dried samples that remains after all the moisture contents are removes from the sample the dried products that left was called as dry matter. i.e the samples that have high moisture contents have lower dry matter. This indicates the products which had low moisture contents had higher shelf life, where as the cookies containing higher moisture it sensitive to the formation of mold. (Ajila *et al.,* 2008;2010)

Ash: Ash is one of the important constituents of our product. As shown in the above table(Table 4.1) as the amounts of mango pulp increased (10%, 30%, and 50%) the total mineral increased (2.19%, 2.65%,3.12%). This result agree with the work of (Legesse.M.B and s. Admassu (2012) they were analysis on mango peel and mango kernel cookies.

Water Solubility: Water solubility is the indicator of the amount of soluble food products which occurs in cookies. From the above table 4.1 the sample codes C1,C2,C3 AND C4 were had the value water solubility 34.75%. 31.7%, 30.48% and 29.27% respectively. (Mbfung, 2006)

Water Absorption

The ability to absorb water is a very important property of used in food preparation. The ability of food materials to absorb water is sometimes attributed to the protein content (Mbfung, 2006). WAC is an important functional property required in food formulations especially those involving dough handling (Udensi1, *et al.,* 2008). From the above table as the amounts of the persents of mango pulp increases the ability to absorption is slightly increased 2 to 3.5.

Gluten content: The we determined gluten content that was the gluten of wet basis was 31.86% and that of the wet the dry basis was 10.93 % , the moisture basis 20.93%.according to the work of disagree with this results because of our sellection of wet flour from the suppre market *(St. Paul, MN.2000*).

Table4.2.ANOVA for Sensory evaluation

Treatments	Colour	Flavour	Taste	Crispness	Overall acceptability
C1	5.67 ± 0.98^{a}	6.00 ± 1.04^{a}	6.08 ± 0.99^{a}	6.33 ± 0.65^{a}	5.83 ± 1.03^{a}
C2	6.25 ± 0.97^{a}	6.25 ± 0.62^{a}	6.50 ± 0.67^{a}	6.08 ± 0.79^{ab}	6.17 ± 0.83^{a}
C3	6.33 ± 0.98^{a}	5.83 ± 1.03^{a}	6.25 ± 0.87^{a}	5.42 ± 1.51^{bc}	6.42 ± 0.51^{a}
C4	5.83 ± 1.4^{a}	6.17 ± 0.72^{a}	6.33 ± 0.78^{a}	5.25 ± 1.29^{c}	6.00 ± 1.13^{a}
CV	2.035	2.035	2.035	2.035	2.035
LSD	0.88	0.61	0.68	0.76	0.64

Mean with same superscript within a column are not significantly different at $p<0.05$.

C' Stands for Cookies

Where, C_1=Control sample (with only wheat flour) 100%

C_2= Containing 80% wheat flour and 10% mango pulp

C_3= Containing 70% wheat flour and 30% mango pulp

C_4= Containing 50% wheat flour and 50% mango pulp

a, b,...Are superscripts given to show the significant difference between means, a > b > c

DISCUSSIONS

Colour/appearance acceptability

Color or appearance is an important quality indicator of a food system that could affect consumer acceptance. The color of mango pulp incoporated with wheat flour to form cookies were shown not significantly different ($p<0.05$). According to our sensory evalutors the colour of cookies which containing different blending ratio of have not significantly different from that of the control one. The mean value of C2=6.25, C3=6.33, C4=5.83 were greater than C1=5.67.As the the ratio of mango pulp increases the color acceptance of the cookies also increases and its more attractive. This could be because of mango pulp naturally had an attractive color. Especially the sample code represented by C2 and C3 had more accepted by the panalists ,. So it possible to produces cookies by blending mango pulp 20% and 30%. The Color and color uniformity are vital components of visual quality of foods and play a major role in consumer choice. This result agree according to (Haridas Rao (1993).

Flavor acceptability

Flavor rating was significantly ($P<0.05$) not different from 100% wheat flour cookies (control). The incorporation of mango pulp in to wheat cookies resulted in well flavor scores. The results showed increase in scores as the wheat flour was substituted with mango pulp. Cookies with 100% wheat flour C1 records the lowest mean value than that of C2 and C3. This was due to mango flavored cookies is more liked by panelists. Flavor is a rather subjective property which is difficult to quantify. Again, flavors are altered during processing and, following severe processing, the main flavors may be derived from additives. This result agree with the work of(Butt, S.M. et.al., (2010)).

Taste acceptability

Taste is the primary factor which determines the acceptability of any product, which has the highest impact as far as market success of product, is concerned. Taste rating of the above ANOVA results shows it not significantly different for cookies that contain 20%mango with 80% wheat, 30%mango with 70%wheat and 50%mango pulp with 50%wheat flour rating compared to the control ($P<0.05$).The mean sensory scores obtained for the taste for the mango pulp supplemented cookies were significantly not different from that of wheat cookies (control) at ($p<0.05$). This sensory evaluation result agree with the work of (Harte B.J., Dolan D.K. (2010)

Crispness acceptability

The texture of the crust was related to the external appearance of the bread top which implies smoothness or roughness of the crust. The texture of crust was decreased from to 6.33±0.65 to 5.25±1.29 with the increase in substitution of mango pulp from 0 to 50% to the Cookies. The reseon for dicreased in crispness could be the increasements of high fiber contents in the mango pulp. This result agree with the work of (Leelavathi, K. and Haridas Rao, P. 1993).

Cookies contain 20%mango pulp and Cookies containing 30% mango pulp–was had similar texture. The texture of productC2 and C3 were not significantly different ($p<0.05$). The scores for crispness of the composite cookies samples, decrease with increase in mango pulp substitution, when compared to the wheat flour cookies (control sample 1). The cookies with 20% mango pulp substitution (sample C2), had best texture scores next to the cookies containing 30% mango pulp (sample C3).But significantly not different. whereas the crispness of C1 was significantily different from C4. This may due to the state of cookies components, such as fibers, protein (gluten) weather damaged or undamaged and the amounts of absorbed water during dough mixing, all contribute to the final texture of the cookies (Gomez et al., 2003; Bakke and Vickers, 2007; Serrem et al., 2011).

Overall acceptability

Overall acceptability includes many implications, which is the important parameter in organoleptic estimation. The overall acceptance expresses how the consumers or panelists accept the product generally. The sensory evaluation also revealed that cookies with mango pulp substitution were acceptable since it cannot be significantly not different from the controls, even though normal cookies was still un acceptable and no preferred by panelist. The preference of the panelists for the sensory attributes of the mango pulp added cookies may due to mango components and attractively. The baking properties of composite flour are often impaired as well as the organoleptic attributes of the products, because of the dilution of the gluten content.This sensory evaluation result agree according to (Dewettinck et al., 2008; Jideani and Onwubali, 2009).

Conclusion

The study attempted to investigate the effect of mango on functional, sensory evaluation and physicochemical properties of cookies The conclusion is that the different ratio of wheat flour to the mango pulp was produced significantly different sensory scores.. The scores for organoleptic attributes like flavor, taste, appearance,

crispness and overall acceptability were generally acceptable. The organoleptic analysis also indicates that generally, wheat flour and mango pulp supplemented cookies is preferred to cookies.

Therefore, the mean wheat flour cookies had lower overall acceptability scores than the mango pulp mixed/composite cookies. The preference of the wheat flour and mango pulp mixed cookies may be due to the product is new and give sweat taste to consumers than normal whole wheat flour cookies.

In addition to this functional and physicochemical properties of cookies is a very essential types of products which contains many nutritional compositions.

Generally from this observations, it was seen that the cookies C2 and C3 gave a better results, a good color , tastes, flovour and acceptabilities , when compared with other samples.

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