Sensory evaluation of fortified biscuits with different types of chickpea flour

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Abstract

The current study was aimed to preparation of an acceptable food product such as biscuits using different types of chickpea flour. The chemical composition of the variety of chickpea (local, import, tasaly) was determined. The obtained results indicated that the contents of moisture were: 9.4%, 11.3%, 7.1%g, respectively and the content of protein was greatest on local chickpea than that in the import & tasaly, that recorded ,11.8g, 9.6g, 8.4g, respectively while the crude fat was, 5.9g, 9,9g,5.5g, respectively. The content of amino acid ranged from 1.6, 1.8, 2.1, g/100 g and the carbohydrate ,58.3, 55.8, 63.7, g/100g respectively. The fiber content ranged from 4.2, 4, 4.3 g/100 g. In terms of Sensory evaluation of the results showed that fortification of biscuits with chickpea flour increased the coherence and the lightness of biscuit. Results indicated that as the fortified chickpea flour ratios increased, most of liking and sensory attributes increased. There were no significant differences between fortified and control biscuit samples in sensory evaluation except for flavor and color in general. Also, results indicated that Chickpea flour up to 30% level could be incorporated the formulation of biscuits without affecting their overall quality.

Generally, it could be recommended that it is possible to produce acceptable food products such as biscuits using chickpea flour because it contains many nutrients that contribute to the treatment of some disease, especially malnutrition diseases.

Key Words: Sensory evaluation – Fortified biscuits – Chickpea flour- Normal flour- chemical composition of chickpea.

Introduction

Chickpea is an important food legume and is a major source of nutrient in many diets. Chickpea is gaining importance as a functional food due to its several health benefits such as cholesterol control, prevention of type-2 diabetes, anti-cancerous activity, and weight loss. It is a rich source of dietary fiber and has a low glycemic index. Biscuit is a widely consumed starchy processed food, composing of wheat flour, sucrose and fat. **Sulieman et al., (2019).**

Studies have shown that chickpea is beneficial for heart burns, skin diseases, blood disorders, biliousness, liver, spleen and bronchitis **Sastry et al., (1990).**

Biscuits and cookies have amazingly become one of the most desirable desserts for both youth and old people due to their low manufacturing cost, more convenience, and long shelf life **Akubor; (2003); Hooda and Jood; (2005)**. Biscuits and cookies represent the largest category of snack items among baked foods all over the world **Pratima and Yadava (2000)**. Biscuit is a well-known product; it is categorized as a miscellaneous food category product. It consists of 3 major components: flour, sugar, and fat, which compose biscuit dough and influence the quality of the final product **O'Brien et al., (2003**). The main ingredient of biscuit dough is soft wheat flour **Tsen (1976).** Cereal grains, including soft wheat flour, are low in protein (7 to14%) and are deficient in some amino acids such as lysine and certain other amino acids**. Claughton and Pearce; (1989).** Legumes on the other hand, are higher in proteins (18 to 24%) than cereal grains and could be used to support certain amino acids such as lysine, tryptophan, or methionine (Potter 1986). Fortified biscuits with other components such as legumes flour were proposed to overcome several drawbacks encountered in the untreated wheat flour biscuits such as the quality and availability of wheat flour as well as the growing interest in finding high-nutritional biscuits due to the possibility of using these fortified products in feeding programs, daycare centers, schools, and in catastrophic situations such as starvation or earthquakes.

S.M. Claughton;(2006)

Materials and methods

The summers are especially cool in your region, it may take up to 5-6 months for the beans to get mature enough to harvest, but that isn't any reason to shy away from growing nutritious, delicious chickpeas. Ideal temperatures for growing chickpeas are in the range of 50-85 F Normal wheat flour**.**

Wheat flour is the principal component of nearly all biscuits. The properties of the flour obtained on milling vary with the variety and with the agronomic and climatic conditions under which the wheat is grown and harvested. The terms "hard" and "soft", as used to describe wheat, relate to the milling characteristics of the wheat.

grains. When a grain of soft wheat is milled the resulting flour contains, not only fragments of endosperm, but also free starch granules and fragments of free protein. The endosperm of hard wheat on the other hand breaks into larger fragments, resulting in the production of a coarser flour containing many damaged Hard wheats tend to have higher protein

contents than soft wheats. Flour from hard wheats is primarily used for bread making and flour milled from soft cultivars for making biscuits and cakes. In general, biscuits made from soft wheat flour have a better appearance, softer bite and greater tenderfeet. than those made from hard wheat flour soft wheat cultivars produced biscuits with larger width than hard flours did. Biscuits baked from soft wheat flours. **Baljeet, S.Y etal.,(2010**)

Chickpea flour(CF)

Eggs and baking powder were obtained from the local market. Wheat flour, Chickpea Flour, Sugar, Fat, Nutrilac milk protein, Salt, Water, & Glucose Other Protein, Fat, Carbohydrates Solids, (total) Water Energy (in kJ per 100g) Energy (in Kcal per 100g) Protein (percentage of the total energy) Carbohydrate (percentage of total energy).

Chickpea flour is simply a fine flour made from ground up dried chickpeas or garbanzo beans. It's also known as garbanzo flour, gram flour and basin and is used frequently in Middle Eastern & Indian cooking and baking. It's denser than regular flour, naturally gluten free and packed with protein. This is the brand we use and love.

Chickpea flour (CF) was mixed with normal wheat flour with different percent 10% & 20% & 30% respectively. The mixture was stirred and mixed at room temperature degree, until well \blended. After that the rest of the elements are added (egg, milk, water, salt, sugar, oil, and baking powder).

- **Coconut oil:** to give the cookies the perfect amount of moisture and flavor. You can also use melted butter or melted vegan butter if you prefer but I love the flavor of coconut oil in these!
- **Brown sugar:** the best sweetener for these chickpea flour cookies. You can also use coconut sugar but I truly find brown sugar to be the best. Don't forget to pack the brown sugar!
- **Eggs:** you'll need one egg + one extra egg yolk to give the cookies the right consistency. If you'd like you can easily make these vegans by using 1 tablespoon flaxseed meal + 1/4 cup water. (More vegan instructions in the note section of the recipe!)
- **Baking staples:** we're also using good old vanilla extract, baking soda & salt.Chickpea flour: the one and only! Chickpea flour keeps these cookies both gluten free & grain free and gives them such a great texture.
- **Chocolate chips:** feel free to use chocolate chips or chop up your favorite dark chocolate bar. You can also use dairy free chocolate chips to keep the cookies dairy free/vegan.

Methods:

Biscuit-making procedure

Biscuit-making procedure that vegetable oil (30 g) was added to the dough mixer and stirred for a few minutes, and then the egg liquid (15 g) was added in small amounts and several times. After mixing thoroughly until without obvious separation, the well-m, sugar (2 g), salt (1 g), and compound baking powder (1 g) were added, and mixed again until there were no obvious particles. Then the well-mixed power (the total amount normal wheat flour and Chickpea Flour with percent (10% & 20% &and 30%)respectively, was sieved into the dough. then the biscuit mold was used to make the biscuit pieces. Then they were baked at 180 ◦C (bottom/surface fire temperature) for 15 min, and were allowed to cool for 30 min on a rack. Produced biscuits were stored in airtight containers until evaluation. Wheat flour was obtained from the Modern Pasta factories. chickpea was purchased from a local market. Chickpea and broad bean were purchased from the local market and were milled locally to obtain flour was obtained from the local agent Al-Mara' I). The other components included sugar, sodium bicarbonate, and shortening fat; these were food grade and purchased from the local market. **Delamare et al., (2020)**,

Proximate chemical analysis

Proximate analysis (protein, fat, ash, and moisture) on flour treatments and biscuit samples after processing were carried out according to procedures outlined by **A.O.A.C, (1984).**

Consumer testing

The consumer sample population was selected from a database of consumers in University of south valley who were 20 to 60 y of age and of various socioeconomic backgrounds. Consumers responded to questionnaire including various layers as well as the consumption frequency of biscuits. Only those who consumed biscuits at least once per week were selected to participate in the assessment. With a target of 60.

Sensory evaluation

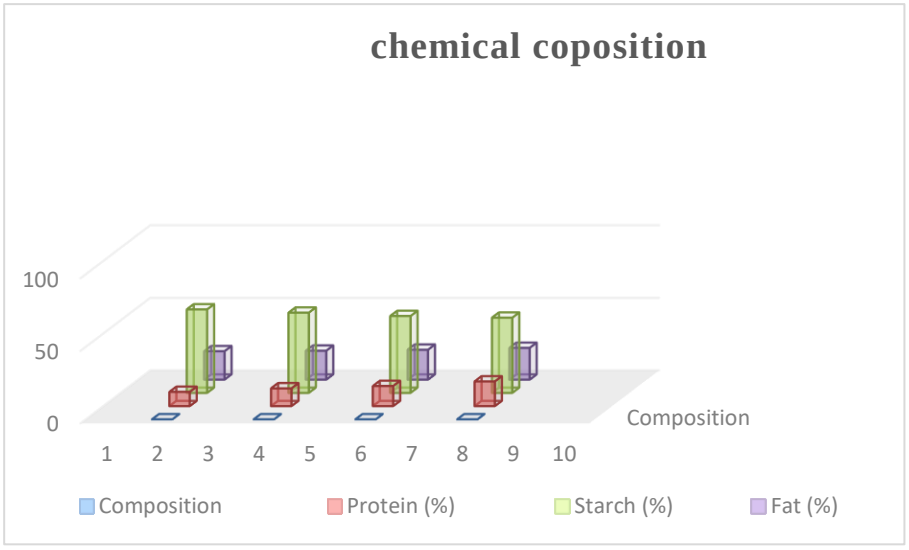
The sensory evaluation was made by 50 untrained consumers under laboratory conditions using a 5-point hedonic scale (1 – low quality, 5 – high quality). On the evaluation form, the panelists were instructed to evaluate their linking of 4 parameters (appearance, texture, sweetness, taste), as well as their overall rating of the short-dough biscuits. Water (room temperature) was used as a neutralizer between different samples.

Results and discussion

Chemical composition of different present of chickpea:

Composition	Protein (%)	Starch (%)	Fat (%)
Control (0% CF)	9.79 ± 0.68^{c}	57.54 ± 0.009^{a}	19.60 ± 0.83^{b}
10% CF	12.25 ± 0.90^{b}	55.29 ± 0.011^{a}	19.95 ± 0.25^{b}
20% CF	13.84 ± 4.45^{ab}	52.97 ± 0.013^{b}	20.62 ± 0.35^{a}
30% CF	17.02 ± 2.78^{a}	51.84 ± 0.027^{b}	21.90 ± 0.01^{a}

The data are presented as mean ± standard deviation. Values with different superscripts in the same column are significantly different ($P < 0.05$) Compared with wheat flour, CF contains more protein and fat. With the replacement amount of CF increasing, the protein content in the biscuits increased especially and it was easy to form a strong and continuous matrix, which could entrap the starch **Cordelino et al., (2019); Garcia-Valle, Bello-P´erez, Agama-Acevedo, & Alvarez-Ramirez, (2021).** Biscuit composition and microstructure With the replacement amount of CF increasing, the content of protein, fat and starch in the biscuits had changed significantly (Table 2). In general, CF (chickpea flour) increased the protein and fat content of the sample and reduced its starch content. It was caused by the fact that the CF contains high level of protein and fat, but low starch content compared with wheat flour.



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Effect the different percent of chickpea on T.G, cholesterol, VLDL, LDL and HDL

Parameters / Groups	T.G	Cholesterol	VLDL	LDL	HDL
Control negative (-)	**86.40 ± 6.11^{d}**	**83.40 ± 0.89^{c}**	**19.00 ± 1.22^{b}**	**18.00 ± 4.06^{ab}**	**50.60 ± 3.21^{a}**
Control positive (+)	**112.80 ± 9.89^{a}**	**96.40 ± 4.10^{a}**	**24.20 ± 1.92^{a}**	**33.20 ± 1.30^{a}**	**$32.90^{e} \pm 2.30$**

local chickpea 10%	**93.20 ± 8.10^{c}**	**86.22 ± 7.2^{b}**	**22.00 ± 2.10^{a}**	**21.90 ± 2.81 ^{b}**	**44.90 ± 1.52 ^{b}**
local chickpea 20%	**89.40 ± 5.28^{d}**	**82.20 ± 2.49^{c}**	**20.00 ± 0.71 ^{b}**	**20.20 ± 8.63 ^{b}**	**47.80 ± 4.51^{a}**
local chickpea 30%	**87.97±6.85^{d}**	**78.85±1.74^{d}**	**19.87±0.86^{b}**	**19.20 ± 9.83 ^{b}**	**50.89±3.56^{a}**
Import chickpea 10%	**103.20 ± 1.30 ^{b}**	**88.80 ± 1.30^{b}**	**22.90 ± 0.57 ^{a}**	**24.20 ± 9.03 ^{b}**	**42.04 ± 2.92^{b}**
Import chickpea 20%	**99.41 ± 9.50 ^{c}**	**83.80 ± 0.84^{c}**	**22.04 ± 2.38 ^{a}**	**22.70 ±5.63^{b}**	**39.60 ± 2.97^{c}**
Import chickpea30%	**91.66±4.32^{c}**	**80.09±0.98^{c}**	**21.05±1.034^{a}**	**21.89±7.46^{b}**	**36.86±3.87^{c}**
Tasaly chickpea 10%	**101.04±5.63^{b}**	**82.88±0.64^{c}**	**20.74 ± 2.38 ^{a}**	**25.00±0.01^{a}**	**38.65±0.43^{c}**
Tasaly chickpea 20%	**98.03±3.09^{c}**	**80.67±0.73^{c}**	**20.85±3.42^{a}**	**24.08±0/76^{a}**	**35.89±1.38^{c}**
Tasaly chickpea 30%	**91.01±1.04^{c}**	**79.01±0.05^{d}**	**19.87±2.89^{b}**	**22.09±0.98^{a}**	**33.98±3.79^{c}**

SD=Standard division. ***P<0.001. Values are mean ± SD. One-way ANOVA followed by Tukey's *post-hoc* test. Mean with different superscripts are significantly different (P<0.05)

Mean HDL cholesterol was significantly (P< 0.05) higher in groups treated with chickpea than control positive group. The mean TG, cholesterol, LDL, VLDL and LDL content was significantly (P< 0.05) higher in control positive group compared to all other groups; whereas, diabetic treated groups with 3 types of chickpea had significantly (P< 0.05) lower TG, cholesterol, LDL, VLDL and LDL levels (Table 1). It may be due to both types of fiber had high amount of fiber. In general, increased consumption of soluble fiber from foods results in reduced serum total cholesterol and LDL-cholesterol (LDL-C) and has an inverse correlation with CHD mortality **James et al., (2003).**

The TG, cholesterol, LDL, VLDL levels were significantly (P < 0.05) lower in groups fed on local chickpea groups compared to diabetic rats fed on imported chickpea groups. On contrast the level of HDL were significantly (P < 0.05) higher in groups fed on local chickpea groups compared to diabetic rats fed on imported chickpea groups at the same amount.

Chickpea has a high total dietary fiber content and a higher amount of fat. But other study confirmed that, two PUFA, LA and OA, constitute almost about 50–60% of chickpea fat. Intake of PUFA such as LA (the dominant fatty acid in chickpea) has been shown to have a beneficial effect on serum lipids, insulin sensitivity and hemostatic

factors, thereby it could be helpful in lowering the risk of CHD **(Harris 2000)**

Chickpea Flour contains more protein and fat. With the replacement amount of Chickpea Flour increasing, the protein content in the biscuits increased especially and it was easy to form a strong and continuous**. Cordelino et al., (2019); Garcia-Valle, Bello-P´erez, Agama-Acevedo, & Alvarez-Ramirez, (2021).**

Biscuit composition

With the replacement amount of Chickpea Flour increasing, the content of protein, fat and starch in the biscuits had changed significantly. In general, chickpea flour increased the protein and fat content of the sample and reduced its starch content. It was caused by the fact that the Chickpea Flour contains high level of protein and fat, but low starch content compared with wheat flour. The Chemical analysis and physical properties

The chemical composition of flour,

Chickpea flour contains higher protein amount than wheat flour, while chickpea has the highest fat. The protein content of biscuits was increased by fortifying biscuits with different rates of CF increase is expected due to the complementation of wheat flour with other replacements that contain higher amounts of proteins Moisture content of cookies was increased significantly by increasing protein content, resulted from replacing wheat flour with chickpea This increase could be due to the presence of polar amino acids and the positive influence of increasing levels of protein on water-holding capacity, taking into consideration the high moisture content associated with using CF different replacement levels, due to higher hydration rate that is associated with higher protein content. Fat content of biscuits was increased. Fat content was increased CF. These differences in chemical analysis are expected due to the complementation of wheat flour with different percent that contain different amounts of protein.

Physical characteristics

The physical characteristics of biscuit prepared from differentreplacements by wheat flour, chickpea, spread factor values of fortified biscuits and control samples compared with the control of spread factor of biscuits. Spread factor results showed that as the concentration of incorporated treatments of CF, chickpea, the spread ratio decreased ($P < 0.05$) and this could be due to the increase in number of hydrophilic sites available that compete for the limited free water in biscuit dough **McWatters (1978)**. These results agreed with other research workers who reported that incorporation of oat bran, soy flour, and black gram flour decreased the spread factor. **Sharma and Chauhan (2002).**

results showed no significant differences (P <0.05) of fortification of chickpea (30%), and the control of sensory quality attributes of liking and JAR except for overall flavor and color. Fortified chickpea (30%) increased the lightness scores and this might be related to chickpea's sapiens. increased the darkness this could be related to the high protein contents. CF (30%) increased the texture scores and this could be also due to high amount of protein that might have increased the cross-linkage between structures.

Conclusion

This study showed that probe and clarify the influence of different incorporation levels of Chickpea Flour on the digestibility of biscuits. Accordingly, the basic components, effect of temperature, microstructure, were carried out to elucidate the effects on the key properties of biscuits. Additionally, quality evaluation was conducted to ensure that the biscuits had acceptable mouthfeel.

The results of this study aimed to fortification of biscuits with chickpea flour, could be used to produce high-protein biscuits with consumer acceptance. Fortification with CF increased the hardness and the darkness, while chickpea flour increased the lightness. Descriptive results indicated that as the fortified chickpea flour ratios increased most of liking. Consumer results demonstrated no significant differences of fortification of chickpea or CF and the control of sensory quality except for overall flavor and color. Chickpea flour up to 30% level could be incorporated in the formulation of biscuits without affecting their overall quality

Recommendations

This work recommended with application of Chickpea Flour in the development of food with slow digestion characteristics.

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Rheological and quality characteristics of composite gluten-free dough and biscuits

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التقييم الحسي للبسكويت المدعم بأنواع مختلفة من دقيق الحمص

الملخص العربى:

تهدف الدراسة الحالية إلى إعداد بسكويت مقبول مدعم بنسب مختلفة من دقيق الحمص كاضافات الى دقيق القمح، تم تحديد التركيب الكيميائي لأنواع الحمص (محلي ، مستورد ، تسالي). أشارت النتائج المتحصل عليها إلى أن محتوى الرطوبة كان: ٩.٤٪ ، ١١.٣٪ ، ٧.١٪ جم على التوالي ، وكان محتوى البروتين أعلى في الحمص المحلي مقارنة مع الواردات والتسالي التي سجلت ١١.٨ جم ، ٩.٦ جم ، ٨.٤ جم. على التوالي ، بينما كانت الدهون الخام ٥.٩ جرام ، ٩.٩ جرام ، ٥.٥ جرام على التوالي. تراوح محتوى الأحماض الأمينية من ١.٦ ، ١.٨ ، ٢.١ ، جم / ١٠٠ جم والكربوهيدرات ٥٨.٣ ، ٥٥.٨ ، ٦٣.٧ ، جم / ١٠٠ جم على التوالي. بينما تراوح محتوى الألياف من ٤.٢ ، ٤ ، ٤.٣ جم / ١٠٠ جم. من حيث التقييم الحسي للنتائج اظهر ان تدعيم البسكويت بدقيق الحمص يزيد من تماسك وخفة وزن البسكويت. كما أشارت النتائج إلى أنه كلما زادت نسب دقيق الحمص المدعم ، ازدادت قياسات الصفات الحسية والتقييم العام الكلي، ولا توجد فروق ذات دلالة إحصائية بين عينات البسكويت المدعم بدقيق الحمص في التقييم الحسي باستثناء النكهة واللون بشكل عام. كما أشارت النتائج إلى أن مستوى دقيق الحمص بنسبة ٣٠٪ كمضاف الى دقيق القمح أعطى أفضل النتائج الحسية دون التأثير على جودته الشاملة بشكل عام ، وتوصي الدراسة بإنتاج منتجات غذائية مقبوله مثل البسكويت باستخدام دقيق الحمص لاحتوائه على الكثير من المغذيات التي تساهم في علاج بعض الأمراض وخاصة أمراض سوء التغذية.

الكلمات الدالة: التقييم الحسي– البسكويت المدعم– دقيق الحمص