

Nutritional Properties of Composite Flour Based on Whole Wheat Flour and Sensory Evaluation of its Biscuits

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Abstract – Current study is based on the fortification of composite flours containing lentil, millet, whole wheat, wheat flour (22.5, 11.5, 24, 42%) respectively were evaluated for its sensory and nutritional properties and the results were compared to mixture flour which contains whole wheat and wheat flour (65.5, 34.5%) respectively, the quality of the biscuits has been successfully improved. Fortification with great protein legume flours could may provide a good possibility to improve the dietary quality of necessary protein consumed by many people. The composite flour includes a higher contain of protein, ash, Zn, Cu, K, Mg, Ca, and the amino acids. The sensory evaluation for the composite flour biscuit showed the highest hardness compared to the mixture flour and wheat flour.

Keywords – Millet, Lentil, Whole Wheat, Sensory Properties, Biscuits.

I. INTRODUCTION

Cookies are popular bakery items with its unique taste and texture; thus, they are consumed as a snack by all generations widely. However, cookies are usually made with wheat flour, and most formulations possess high calorie consumption and low fiber content. With increasing curiosity by customers in living a wholesome life, many experts have studied health-promoting cookies that use bean (Cady, Carter, Kayne, Zabik, & Uebersax, 1987), buckwheat (Hadradev, Torbica, & Hadradev, 2013) or barley (Frost, Adhikari, & Lewis, 2011) flour.

Fortification with great proteins legume flours could give a good opportunity to enhance the nutritional quality of proteins consumed by many people (Hussein, Amal, Amany, Aber, & Gamal, 2011). Also, fortification of wheat flour with non-wheat proteins boosts protein quality by enhancing its amino acid profiles, Latest scientific reviews indicate that fenugreek will certainly have therapeutic properties which may be helpful in treating such illnesses as hypercholesterolemia and diabetes (Madar, 1984; Singhal, Gupta, & Joshi, 1982).

Lentil (*Lens culinaris*) is among the essential legume commonly consumed worldwide and particularly in the developing countries. Lentil consists of about, 56 g carbohydrates, 25 g proteins, 2.6 g ash, 1.0 g fats, and 31 g fibers per 100 g of the seeds. Legume proteins are believed to be among the best and the cheapest way to obtain

vegetable proteins, like the essential amino acid lysine (Adsule, Kadam, & Leung, 1989), proteins are lacking in a few of the essentials amino acids; lowering the product quality and dietary properties of foods and their products (Dhingra & Jood, 2002). The combination of legume and cereal proteins offers a balance of essential proteins (Eggum & Beames, 1983). Starch of Legume is a suitable for incorporation in food handling business items as they contribute to large thermal stability (Chung, Liu, Pauls, Fan, & Yada, 2008; Hoover & Sosulski, 1991). Lentil is well known because of its low glycemic response because of the existence of β -glucan which induces short-term satiety and may assist in bodyweight maintenance (Kim, Behall, Vinyard, & Conway, 2006). The insoluble and soluble dietary fibers of legumes show many health advantages such as for example lowering cholesterol, LDL, sugars level and blood pressure, as the control of gastric emptying property steadily eliminates constipation and various other intestinal disorders promoting laxation (Tosh & Yada, 2010). The lentils physicochemical properties such as hydration capacity, bulk density, swelling index and water absorption possess supported its work as a unwanted fat replacer (Jood, Bishnoi, & Sharma, 1998; Lazou & Krokida, 2010).

Millet generally have good efficiency on marginal lands, brief growing routine, and excellent adaptability to a wide selection of an array of climate including temperature and dry circumstances. This makes millets favorable crops for meals security in semi-arid regions of Africa and Asia where fact the other major crops have a tendency to fail (Baltensperger & Cai, 2004; J. Taylor, 2004). The full total world creation of millet seeds was approximated in 2012 as 704,239 tonnes with India being the very best producer (273,000 tonnes) accompanied by Niger (106,427 tonnes) and Nigeria (60,800 tonnes) The (Faostat, 2016) potential wellness benefits and the nutrient composition of millets have already been previously summarized (Saleh, Zhang, Chen, & Shen, 2013). Briefly, millets could be abundant with vitamins B, minerals (iron and calcium), phosphorus (in phytic acid type), dietary fiber, polyphenols and lipids, based on the precise type (Shahidi & Chandrasekara, 2013). Because millets absence gluten, they could be an aid for individuals with celiac disease (J. R. Taylor & Emmambux, 2008). Millets also have hypoglycemic properties although underlying reasons remain to become better studied (Annor,

Marcone, Bertoft, & Seetharaman, 2013). All these nutritional elements and bioactive properties make millets potential applicants for diverse practical foods that could prevent and delay the occurrence of non-communicable illnesses (Dixit, Azar, Gardner, & Palaniappan, 2011). In addition to the novel promising from the novel promising applications Aside traditionally, millets have been completely have been completely used to produce various beverage and foods including porridge, beer, non-fermented and fermented flatbreads, composite flour substances, popping foods, distilled spirit, nonalcoholic drinks (Baltensperger & Cai, 2004). The quality and production of the millet products are, to an excellent extent, from the properties, structures, and interactions of the main component starch. The purpose of this study measure the nutritional and sensory properties by the replacement of different flours.

II. MATERIALS AND METHODS

A. Materials and Chemicals

Whole wheat flour, millet and lentil and various other food-grade ingredients were purchased from local markets. All chemicals, solvents and reagents had been of analytical quality.

B. Samples Preparation

The preparation of the samples was according to the former work in a paper not yet published as follows: The composite flour (COMF) contained whole wheat flour 42%, millet flour 11.5%, lentil flour 22.5% and wheat flour 24%. The combination flours (MIXF) two types of flour were combined, whole wheat flour 65.5% and wheat flour 34.5%. Finally, the primary control that was the wheat flour (WF).

C. Preparation of Biscuits

The biscuits prepared using the technique described by Krishnan et al., (2011), with some modifications sugar (90 g) and butter (75 g) were creamed in a (Kitchen Aid mixer (St. Joseph, Michigan USA) with a flat beater, for 2 min and to the cream, water containing sodium bicarbonate (2.7 g), ammonium bicarbonate (3 g), water (50-60 g) and sodium chloride (3 g) were added and mixed further for 5 more min to obtain a homogeneous cream. To the cream, each of the different flours (300 g) were added and mixed continuously to create homogeneous dough and sheeted utilizing a rolling pin to a thickness of 2 mm using material platform and framework. Biscuits were formed with a 5 mm diameter cutter and baked on aluminium trays for 10 min at 205 °C, cooled for 30 min and kept in airtight tins for 24 h and evaluated for the product quality features (Manohar & Rao, 1999).

D. Moisture Determination

Water contain was determined gravimetrically to continuous weight in an oven in 105 °C for 24 h based on the AOAC method (In, 2000).

E. Determination of Crud Protein

Total content of protein was identified using an automated nitrogen analyzer. The nitrogen-to-protein factor of conversion was $N \times 5.7$ based on the AOAC method (Chemists, 1990). The outcomes had been expressed as g protein/100 g sample.

F. Determination of Crud Fat

Total content of fat was analyzed by Soxhlet extraction (Soxtec System HT6, Tecator AB, Hoganas, Sweden), based on the AOAC method (In, 2000), using a petroleum ether. The outcomes were expressed as g lipid/100 g sample.

G. Determination of Ash

Content of the crude ash was estimated by incineration in a muffle furnace in 550 °C, based on the AOAC method (In, 2000).

H. Determination of carbohydrates and energy

Carbohydrates were calculated by $100 - (\text{protein content, fat content, ash content and moisture})$ and the total energy was calculated by multiplying the protein and carbohydrates $\times 4$ and the fat content $\times 9$.

I. Determination of Minerals

The minerals were analyzed from solutions obtained by the incineration of 1 ± 0.02 g dried samples in a muffle 550 ± 1 °C to get the ash. The residue was dissolved in 20mL of 50% of nitric acid alternative and produced up to final level of 50mL with distilled water using a volumetric flask. From then on the minerals (Zn, Fe, Cu, Mn, Na, K, Mg, and Ca) had been analyzed individually according to AOAC method (In, 2000), using an Atomic Absorption Spectrophotometer of Spectra AA 220, USA Varian.

J. Determination of Amino Acids

Dried samples had been digested with HCL (6 M) in 110°C for 24 h under nitrogen atmosphere. Reversed phase high performance liquid chromatography (RP-HPLC) evaluation was carried out in an Agilent 1100 (Agilent Technologies, Palo Alto, CA, USA) assembly program after precolumn derivatization with o-phthalaldehyde (OPA) (Jarrett, 1986). Each sample (1 μ L) was injected onto a Zorbax (80A C18) column (i.d., 4.61 x 180 mm, Agilent Technologies) at 40°C with detection at 338nm. The mobile phase a was 7.35 mM/L sodium acetate/ triethylamine/ tetrahydrofuran (500: 0.12: 2.5, v/v/v), adjusted to pH 7.2 with acetic acid, while mobile phase B (pH 7.2) was 7.35 mM/L sodium acetate/m ethanol/acetonitrile (1: 2: 2, v/v/v). The expression of amino acid composition was as g of amino acid per 100 g of protein.

K. Sensory Evaluation

For the sensory analysis of biscuits 10 experienced panelists had been asked to describe and evaluate the biscuits, the panelists assigned a score (1-5) for each quality attribute such as presence of appearance (1: fine, 5: grained), flavor (1: weak, 5: pronounced), hardness at the first bite (1: soft, 5: rough), sweet degree (1: weak sweet taste, 5: pronounced sweet taste), effort of chewing (1: little effort of chew, 5: long effort of chew), and aftertaste after swallowing (1: unnoticed aftertaste, 5: pronounced aftertaste).

L. Statistical Analysis

Data were expressed as mean \pm standard deviation (SD). Evaluation of variance (ANOVA) Variations were regarded as a significant at $p < 0.05$. Relationship between the variance parameters analyzed had been evaluated by processing Pearson linear correlation coefficients at the $p < 0.05$ confidence level.

III. RESULTS AND DISCUSSION

A. Moisture Determination

Table 1 describes the characterization of the different samples COMF, MIXF and WF. Moisture of the samples ranged start from 12.5 to 15.8 %, the MIXF had the highest moisture content (15.8%), the COMF had the lowest moisture content (12.5%) where the WF was 14.5% in term of the moisture content.

B. Determination of Crud Protein

For protein content results showed that the COMF had the highest level of protein which was (16.45%), and the lowest content of protein was (10.9%) in WF, while the protein content in MIXF was (14.42%).

C. Determination of Crud Fat

The full total lipids in COMF were (1.32%), the best lipids content material was in the MIXF that was (1.62%), as the lowest quantity of lipids was in WF (1.15%).

D. Determination of Ash

The ash content in the COMF was the higher than MIXF and the lowest content was in WF (1.46%), (1.15%) and (0.49%) respectively.

E. Determination of Carbohydrates

The highest content of carbohydrates and energy were found in WF samples (74.81%) and (353.39), the MIXF samples had the lowest energy content (338.2 kca) While the COMF got the lowest carbohydrate content (66.27%).

Table 1. Approximate composition COMF, MIXF and WF

	COMF	MIXF	WF
Protein %	16.45±0.25 ^c	14.24±0.09 ^b	10.95±0.96 ^a
Fat %	1.62±0.01 ^c	1.32±0.02 ^b	1.15±0.02 ^a
Ash %	1.46±0.005 ^c	1.15±0.01 ^b	0.45±0.02 ^a
Moisture %	15.65±0.08 ^c	14.5±0.13 ^b	12.6±0.32 ^a
Carbohydrates %	66.27±0.24 ^a	67.34±0.16 ^b	74.81±0.84 ^c
Energy (kcal)	345.46	338.2	353.39

F. Determination of Minerals

The full total of the mineral contents were found to be higher in COMF than MIXF and WF. As demonstrated in fig (1) the Zn was (1.01 mg/L) in COMF and (1.08 mg/L) in the MIXF while in the WF was (0.50 mg/L), the Fe was in WF greater than the MIXF and the COMF (4.98 mg/L),

(4.69 mg/L) and (2.41 mg/L) respectively, the COMF was higher than the MIXF and WF in term of Cu (0.23 mg/L), (0.18 mg/L) and (0.13 mg/L) respectively, the MIXF had the highest amount of Mu (1.21 mg/L) whereas the WF had the lowest degree of Mu (0.20 mg/L), in Na the WF was higher than both COMF and MIXF (7.76 mg/L), (1.66 mg/L) and (2.33 mg/L) respectively, the COMF had the highest content of K (128.70 mg/L) and the MIXF had (90.70 mg/L) while the WF had the lowest content in term of K, no significant variations found between COMF and MIXF in term of Mg (28.80 mg/L) and (28.50 mg/L), while the WF had the lowest content of Mg (5.19 mg/L), the MIXF had the highest content of Ca (37.60 mg/L) when the COMF was (35.60 mg/L) and the lowest quantity was in WF (28.20 mg/L).

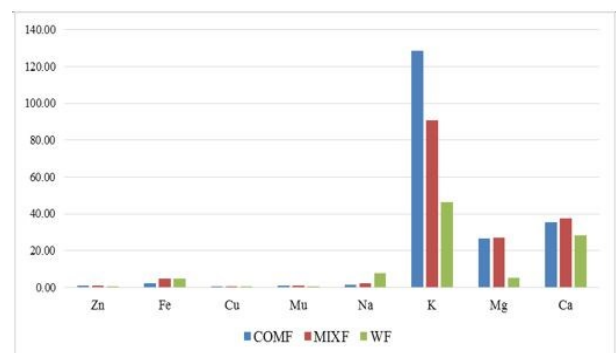
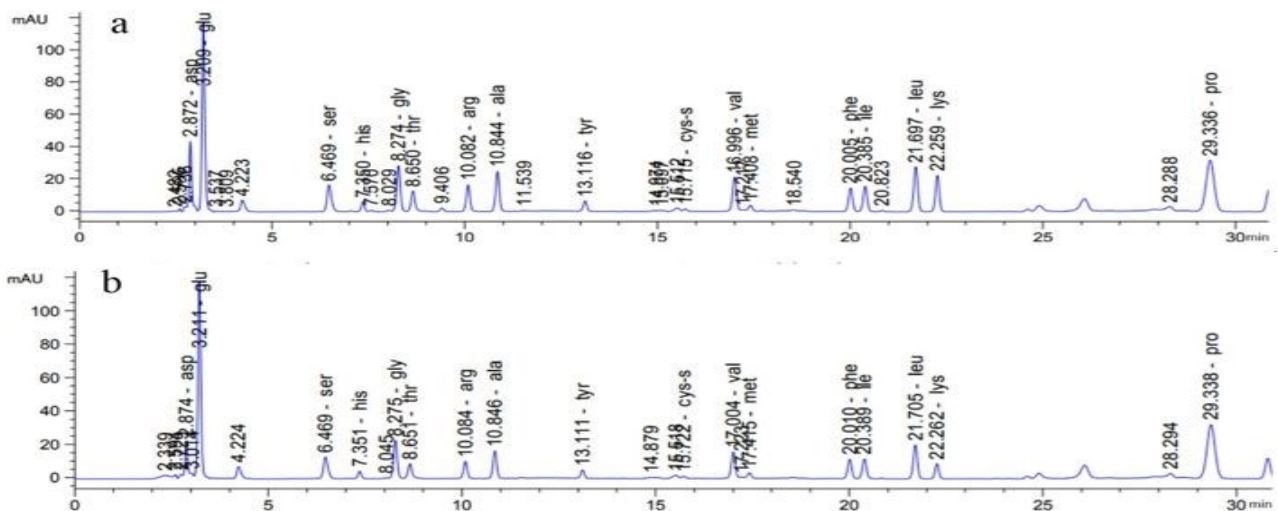


Fig. 1. Contains of minerals in COMF (a), MIXF (b) and WF (c)

G. Determination of Amino Acids

Outcomes for the amino acid composition of the COMF, MIXF and WF are presented in Fig. (2). 17 amino acids were determined including seven essential types (phenylalanine, isoleucine, lysine, leucine, methionine, valine and threonine) and ten nonessential amino acids (arginine, alanine, histidine, aspartic tyrosine acid, glutamic acid, glycine, serine, proline, and cysteine) amino acids. The amino acids amount in COMF were greater than in both MIXF and WF except for glutamic acid and proline that have been nearly the same content in COMF and MIXF. Whereas the WF acquired the lowest level in all amino acids.



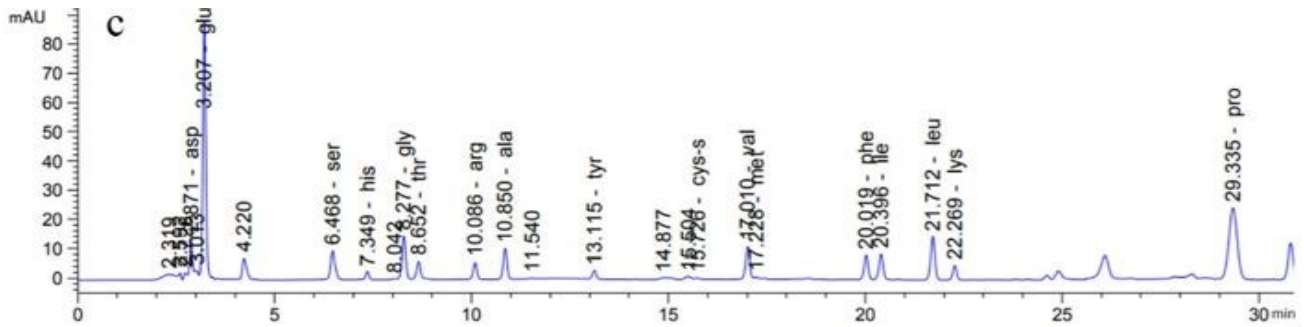


Fig. 2. Contains of Amino acids in COMF (a), MIXF (b) and WF (c)

H. Sensory Evaluation

The biscuits are described by The panelists in term of flavor, appearance, hardness at the first bite, sweet level, aftertaste after swallowing and effort of chewing, the looks was referred to in the WF biscuit as an excellent appearance (1.5) compare to the MIXF biscuit had a grained appearance (4.1) where the COMF biscuit described with (3) in term of appearance. Flavor was pronounced in MIXF biscuit compare to the WF biscuit which had a weak flavor (1.3) while the COMF biscuit was (3). The COMF biscuits had the highest hardness at the first bite (4) while the MIXF biscuit had a soft texture in the first bite where the WF biscuit has also had a tough texture (3.3). The sweet degree was (3.1), (3) and (3.2) in COMF, MIXF and WF biscuits respectively. The COMF and MIXF biscuits showed same result in term of effort of chewing (3) compare to the WF biscuits showed that it need little effort of chew (2.5). The MIXF biscuits had a pronounced aftertaste which was (3.9) compare to the COMF and WF biscuits which had (2.8) and (2.5) respectively. Also the COMF biscuits demonstrated higher acceptance compare to the MIXF biscuits (data in paper yet not published).

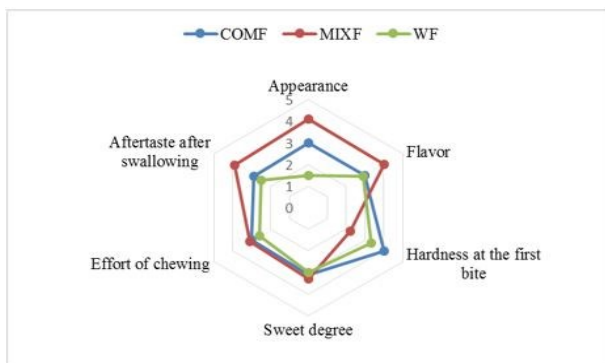


Fig. 3. Sensory evaluation COMF, MIXF and WF biscuits

IV. CONCLUSION

It's been successfully demonstrated that the lentil flour and millet flour could be possibly be safely employed as a way to obtain of mineral, amino acids and protein. Protein content up to 16.14% was attained by the addition the MF, WWF and LF. A decrease in fat content in the biscuits could be highlighted with an increase the replacement level of LF, the sensory evaluation of the biscuits demonstrated also the good outcomes for the COMF biscuit compare to MIXF biscuit.

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