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Influence of quinoa supplementation in wheat flour on organoleptic properties of chapatti

Haroon Munir, Muhammad Tahir Nadeem, Muhammad Umair Arshad, Farhan Saeed*, Faqir Muhammad Anjum, Tabussam Tufail

Institute of Home & Food Sciences, Government College University Faisalabad, Pakistan

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Abstract

Demand for health-oriented products such as sugar-free, low calorie and high fibre products is increasing and this can be achieved using replacements with various pseudo-cereals. Nutritional supplementation may be used to treat muscle loss with aging (sarcopenia). This study was designed to evaluate the effects of enriching wheat flour with quinoa (*Chenopodium quinoa Willd.*), which was considered a pseudo cereal. It had been recognized as a complete food due to its protein quality, protein content (15%) and great amino acid balance. The experiment was included two wheat (*Triticum aestivum* L.) cultivars, Faisalabad-2008 and Zincol-2016. These experimental wheat flours were supplemented by using quinoa flour with the ratios, following 80:20, 75:25, 70:30 of each variety respectively. Moreover 100 per cent wheat flours of both the cultivars were taken as a control. The final product was tested for its qualitative and sensory attributes It was noted that the level of supplementation for quinoa seed flour (QSF) with normal wheat flour (NWF) and zincol-2016 wheat flour (ZWF) had a pronounced effect on quality of protein. Though the nutritional profile of treatment with supplementation level of 30:70 (QSF/ZWF) was relatively good than all the other blends used in this experiment but it gave poor over all acceptability. The best one level of supplementation was found 25:75 (QSF/ZWF) on the basis of both organoleptic evaluation and chemical characterization.

* **Corresponding Author:** Dr. Farhan Saeed ✉ f.saeed@gcuf.edu.pk

Introduction

Nutritious crops with minimum input requirement are the need of the time for the development of a healthy nation. Chapatti is a staple eating regimen for the individuals of Indo-Pak subcontinent. Tactile qualities are significant towards the loving or loathing of chapattis. The customers lean toward chapattis with light dark colored and smooth shading having delicate enough surface to fold it for making the ideal scoop. Modern world is seeking the technologies to get improved nutrition. Massive increase in populace generates fabulous demand for the food. The demand for food is also has increasing trend due to high purchasing power of the people (Aggarwal, 2008). Though, in the developing countries, people are lack of mineral and protein rich diets. In these countries the staple diets include rice and wheat as major crops. Global food insecurity depends upon the stress on various food crops due to which most of the crops are being constricted to cultivate. Ultimately a devastating effect on the crops appeared with unexpected stresses, diseases and pest disasters (Prescott-Allen and Prescott-Allen, 1990; Mayes *et al.*, 2012).

Quinoa is integral pseudo cereal of South America. Quinoa (Chenopodium quinoa Willd) plant may be branched or unbranched depending upon its variety (Repo-Carrasco-Valencia *et al.*, 2010b). Moreover, Quinoa protein exhibits strange nutritional value with good amino acid score and contain lysine in tremendous levels as compared to cereals such as wheat and rice (Watanabe *et al.*, 2003). So, the quinoa seed is used for the supplementation of wheat flour to design the nutritional and innovative products of bakery and extruded products (Morita *et al.*, 2001; Tufail *et al.*, 2018;). In addition, Quinoa plants are more resistant to drought, salinity and frosty conditions to grow and can even withstand the low fertile soils (Jacobsen *et al.*, 2003).

Quinoa is a native pseudo cereal of Latin America that now has great consumer acceptance in Europe and throughout the world. Because of its suitable balance of carbohydrates, proteins, lipids and minerals and its bioactive compound content, it has been proposed that it should be included as a strategy to improve the nutritional quality of bakery products made with refined flours. Not only would the incorporation of quinoa flour in formulations increase the protein content but it could also improve the biological value of the proteins in these formulations, since quinoa proteins contribute essential amino acids that are limiting in wheat flours (such as lysine and threonine), and they are more digestible Moreover, its high fibre and mineral contents could help to attain the daily requirements of these substances and of calcium, iron and zinc in the diet The aim of this study was to make a detailed analysis of the chemical composition of the raw materials and the products developed, including the nutritional profile of products in which wheat flour was supplemented with quinoa flour (Ruales and Nair, 1994; Wright *et al.*, 2002a; Vega-Galvez *et al.*, 2010).

In this paper, we provide a comparison of studies from the dietary intervention using Zincol-2016 as the potential Zn source in vegan diet and by supplementing with different ratios of Quinoa flour due to its remarkable nutritional properties; not only from its protein content (15%) but also from its great amino acid balance. The organoleptic data was evaluated with for the determination of overall acceptability.

Materials and methods

Procurement of raw materials

The study was based on three types of food grains. These grains were selected keeping in view of the salient features of these grains. The basic grain used in these blends was the wheat flour which was replaced with varying degree of quinoa seed flour in two clusters. The Normal wheat was purchased from the open market and the second grain was Zincol-2016 a bio fortified wheat variety was purchased from the seed corporation Pakistan. Quinoa seed was procured from the crop physiology department-UAF. Research work was done with the collaboration of AARI Faisalabad and IHFS – Government College University Faisalabad. Wheat Research Institute,

Faisalabad.

Preparation of flours

Both normal wheat and Zincol-2016 wheat seeds were processed into whole wheat flours, using pin mill locally named as China Chakki separately. The method of the process ensures effective removal of most of the anti-nutritional factors. Quinoa flour production was done after removal of saponins. Saponins were removed by using cold water treatment.

Preparation of chapatti

The chapattis were prepared from whole wheat composite flours after 0, 30 and 60 days of storage intervals according to the method explained by (Haridas *et al.*, 1986). The dough for unleavened flat bread was made by mixing 200 g of whole wheat flour with predetermined quantity of water for 3 minutes and allowed to rest for 30 minutes. A dough piece weighing 80 g was rolled on a sheet of 2 mm thickness with a wooden roller pin on a specially designed wooden platform and cut into circle of 17 cm diameter. The unleavened flat breads were baked on thermostatically controlled hot plate at a temperature of 210 °C for 1.5 minutes.

Sensory evaluation of the products (Chapatti)

To assess the quality and acceptability, the chapattis were presented to a trained panel of six judges and the evaluation for sensory parameters such as color, taste, aroma, chewing ability, foldability and overall acceptability characteristics were carried out using 09 point hedonic scale (Appendix-I) according to methods described by Land and Shepherd (1988).

Statistical analysis

The data obtained for each parameter was subjected to analyse under complete randomized design (CRD) and standard deviation to determine the level of significance using Minitab 16, as described by Steel *et al.,* 1997).

Results and discussion

A prepared board of judges evaluated the chapattis for their colour, taste, aroma, chewability, fold ability and by and large worthiness to dole out scores by following 9 point hedonic score framework.

Table 1. Treatment plan for composite flour.

Treatments	Wheat flour (%)	Quinoa Flour (%)
NWF	100	0
ZWF	100	0
NWF/QSF	90	10
NWF/QSF	80	20
NWF/QSF	70	30
NWF/QSF	60	40
ZWF/QSF	90	10
ZWF/QSF	80	20
ZWF/QSF	70	30
ZWF/QSF	60	40

NWF: Normal wheat flour, ZWF: Zincol wheat flour, QSF: Quinoa seed flour.

Colour

The results revealed that chapattis prepared from (QSF) supplementation in whole wheat flour were markedly different scores according to colour. The highest colour score (7.77) was noted for chapattis prepared from 100% whole wheat flour, and the lowest scores (5.79) was for the chapattis prepared from 30% (QSF) supplemented whole wheat flour. Likewise, decreasing tendency in the scores assigned to colour of chapattis was detected when level of (QSF) supplementation in ZWF was increased. The scores extended from 5.54 (chapattis supplemented

with 30% (QSF) to 7.77(NWF). It has been determined that the results that chapattis containing 15 and 20% QSF supplemented in NWF got scores for colour i.e 7.35 and 6.78, respectively. The chapattis prepared from whole wheat flour containing 25and 30% QSF depicted also had similar scores for their colour.

Taste

The results given in the Table 2 revealed that scores allotted to taste of chapattis prepared form different levels of supplementation of QSF with NWF flour decreased significantly from 7.34 (whole wheat flour) to 5.86 (chapattis supplemented with 30% QSF). The results further showed that chapattis containing 20 and 25% QSF supplementation had no significant effect on the taste.

Aroma

It was observed further that the effect of the supplementation levels has non-significant results. Maximum score was attained by the product as given in the Table 2 depicted that the maximum value 8.28 and 7.89 % were observed for the whole wheat flours of of both types i.e. normal wheat flour and Zincol-2016.The chapattis having Supplemented with QSF with Zincol-2016 had a decreasing trend in the scores and dropped from a maximum score of 8.28 to 6.45.

The chapattis prepared from whole wheat composite flours comprising 15 and 20% QSF were found mutually non-significant. The chapattis prepared from 30% QSF supplemented in NWF had the lowest scores (6.34).

The Table 2 indicates that the values observed for the QSF supplemented with normal wheat flour dropped from maximum 8.28 (100 % wheat flour) to 6.45 for chapattis prepared from 30 % QSF supplemented ZWF. The scores assigned to aroma of chapattis prepared from 20and 25% QSF supplemented NWF did not differ and are mutually non-significant.

Table 2. Effect of Quinoa seed flour supplementation on the organoleptic properties of Chapatti.

Supplementation of Quinoa%	Colour		Taste		Aroma		Chew ability		Overall acceptability	
	NWF/QSF	*ZWF/QSF*	*NWF/QSF*	*ZWF/QSF*	*NWF/QSF*	*ZWF/QSF*	*NWF/QSF*	*ZWF/QSF*	*NWF/QSF*	*ZWF/QSF*
Control	7.84±0.14	7.84±0.14	7.28±0.26	7.28±0.26	8.18±0.15	8.18±0.15	7.96±0.06	7.96±0.06	7.92±0.38	7.92±0.38
10	7.42±0.08	7.58±0.11	6.33±0.15	6.52±0.07	7.36±0.13	7.52±0.07	7.81±0.09	7.76±0.06	7.20±0.20	6.70±0.27
20	6.79±0.10	6.61±0.06	6.78±0.08	6.70±0.10	7.25±0.05	7.44±0.15	7.05±0.09	6.89±0.10	6.16±0.07	6.08±0.08
30	6.65±0.13	6.38±0.06	6.09±0.03	6.12±0.03	6.89±0.10	6.70±0.06	6.05±0.06	6.21±0.04	6.15±0.05	6.10±0.03
40	6.18±0.04	5.77±0.06	5.79±0.07	5.56±0.06	6.35±0.05	6.40±0.06	5.97±0.06	6.04±0.02	5.58±0.03	5.69±0.04

NWF: Normal Wheat Flour, ZWF: Zincol-2016 Wheat flour, QSF: Quinoa Seed Flour.

The statistical data regarding the scores assigned to chew ability of chapattis made from different QSF supplemented with NWF and ZWF composite flours have been presented in Table 2. The maximum score was recorded for the whole wheat flours of both types NWF and ZWF. With the increase in the supplementation levels with QSF the score ultimately reduced to a minimum of 6.00 and 6.05. The scores given to chew ability of chapattis fluctuated fundamentally by the supplementation levels of QSF to NWF and ZWF composite flour (Table 2). The chew ability scores (7.89) was allocated to be altogether most surprising to chapattis arranged from QSF enhanced normal wheat flour (control). The outcomes further showed that chapattis arranged from 20 and 25 % QSF enhanced entire wheat flour had comparative scores. The chapattis arranged from 25 and 30% QSF supplemented normal wheat flour got factually at standard scores for chew ability.

Overall acceptability scores

The statistical results for overall acceptability of chapattis prepared from different levels of QSF with NWF and ZWF supplemented in Table 2 indicated that overall acceptability scores of chapattis were affected significantly by the supplementation levels of

QSF. The scores given to overall acceptability of chapattis declined significantly as the level of supplementation of QSF with NWF and ZWF wheat flours increased. The highest scores (8.00) for overall acceptability was given to chapattis prepared from 100% NWF (control) and 100% ZWF. The overall acceptability scores of chapattis prepared from QSF supplemented NWF significantly decreased from 8.00 (control) to 5.55 (chapattis supplemented with 30% QSF). The chapattis supplemented below 30 % level of PDF, i.e.15,20, and 25%, were found acceptable by the judges with respect to their overall acceptability scores. The results indicated that chapattis prepared from QSF supplemented NWF had a lower overall acceptability scores as compared to QSF supplemented with ZWF chapattis. The judges assigned less overall scores for chapattis prepared from 25 and 30% QSF supplemented NWF and ZWF. The chapattis prepared from up to 25% level of QSF supplementation got 6.12 and 6.07 score which was considered acceptable by judges.

The most important parameters of chapatti quality are colour, texture and flavour and were evaluated as greater pliability, soft texture, and light creamish brown colour with small brown spots, fully puffed, slight chewiness and baked whitish aroma (Shaikh *et al.*, 2007 and Haridas *et al.*, 1986). The sensory parameters of chapattis supplemented with QSF and NWF and ZWF flours in the present study were affected significantly due to supplementation levels of flaxseed flour into whole wheat flour. The results of the present study are supported by the earlier findings of Maheshwari and Devi (2005) who reported that addition of flaxseed in chapattis caused unacceptable changes in flavour, taste, and texture ultimately decreased overall acceptability scores of chapattis. The results are also supported by Siddique (1989) who reported that chapattis supplemented above 10% soy flour decreased the acceptability scores of chapattis. The colour scores of chapattis decreased as the level of flaxseed supplementation increased. The darker brown colour of flaxseed flours may be one of the main reasons to impart dark colour of flaxseed supplemented chapattis. The judges disliked the darker colour chapattis and assigned lower scores. The chew ability and foldability scores of chapattis also decreased due to higher levels of flaxseed supplementation in WWF that might be due to coarser texture of flaxseed flour and reduction in the gluten contents of chapattis. The taste, aroma and overall acceptability scores of chapattis were also declined by the addition of higher levels of QSF with NWF and ZWF. The present study suggested that though supplementation of QSF with NWF and ZWF significantly affected the scores assigned to different sensory parameters yet the scores remained within the acceptable limits. However, higher concentration of QSF in Zincol and normal wheat flour affected significantly. It may be concluded from the present study that acceptable chapattis Zincol can be prepared from 25% QSF supplemented with both kind of wheat flour impact of greater zinc in Zincol had no significant effect on the overall acceptability of chapattis The supplementation of QSF into ZWF can produce chapattis not only acceptable from the sensory standpoint but also will provide more nutrition and health benefits. This provides an opportunity to explore supplementation of QSF in whole wheat flour for the production of functional chapattis which is a staple food in Pakistan.

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