

# Quality characteristics of blended wheat flour with *Bajra*, chickpea soybean and maize flours

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An experiment was conducted on the quality characteristics of blended wheat flour of wheat variety RR-21 with four cereals/pulses viz., soybean, *Bajra*, maize and chickpea. Flour of each was prepared using the proportion by weight as 02, 05, 10 and 20% for evaluation of dough and chapati characteristics. The blending flours improved the water holding capacity of dough and recorded maximum in 20 per cent blending level. It was observed that blending of soybean and chickpea flour fairly improved the nutritional quality of flour upto 20% blending while maize and *Bajra* blending showed by and large no improvement in the quality of flour. All the blended wheat flour did not affect adversely and showed desirable dough quality at all four blended levels. Similarly the quality of chapatis and their taste were also desirable and fairly acceptable in all types of blended flour at all the levels.

**Key Words :** Blended wheat flour, Dough, Quality, Characteristics of chapati

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## INTRODUCTION

Wheat is the second most important crop in India next only to rice. About 80-85 per cent wheat consumption in India is in the form of chapati prepared from high extraction of wheat flour or *Atta*. It is an important and cheap source of carbohydrate, protein, vitamin and minerals and can provide an inexpensive and nutritionally adequate diet to the people of large part of the world. The improvement in the nutritional quality of wheat can be achieved by proper blending with the flour of other cereals, millets and legumes before consumption (Clausi, 1971).

Pearl millet or *Bajra* is an important food with an

average protein content of 11.60%. Because of containing higher concentration of basic and sulphur containing amino acids, it can compensate the deficiency of the amino acids if blended with wheat flour.

Chickpea or Bengal gram has about 17% protein, 5% fat and 10 mg iron, very high potassium, phosphorus and calcium and rich in vitamin B with a reasonable fibre and vitamin A and C content. The fortification of chickpea lysine, thus, can improve the lysine content if blended with wheat flour (Shehata and Fryer, 1970).

Maize or corn occupies a prominent place in the world food map because of its great adaptability to a wide range of agro-climatic regions. In India, over 85% of maize produced is directly used as human food. It is a stable food because of principal source of carbohydrate. The protein content in whole grain of maize varieties ranges from 8.5 to 13.6%, lysine from 2.5 to 3.6% and tryptophan from 0.37 to 0.67% protein. The nutritional quality of maize protein is poor because of imbalanced amino acid composition due to deficiency of two main

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essential amino acids, lysine and tryptophan and excess of leucine.

Soybean ranks high among the leguminous crops of the world in its content of protein and its nutritional quality (Wolf, 1970). The nutritional quality of soybean protein is the best available from plant source. Apart from legume, soybean is an oilseed crop and has the highest content of lysine (6.4%), which is a limiting factor in cereals. So, there is possibility of enriching cereal diets with soy proteins and fortification prospects (Bressani, 1981).

Thus, visualizing the significance of *Bajra*, chickpea, maize and soybean for the improvement of protein quality and quantity of wheat flour, the study was carried out on blending of wheat flour with flour of these millets and legumes to find out the best level of blending in respect of acceptability.

## METHODOLOGY

Wheat grain of variety RR-21 and the grains of *Bajra*, chickpea, maize and soybean were cleaned and graded and flours were prepared on commercially available four meal. The flours were sieved separately through sieve used for kitchen purpose and stored in air tight container until use.

### Preparation of blends:

Homogenous blends of wheat flour with flours of *Bajra*, chickpea, maize and soybean were prepared using the following proportion by weight (Table A).

### Dough characteristics test :

#### Water absorption :

One hundred gram of flour sample was weighed and measured quantity of water was added to make a dough of normal consistency. The amount of water absorbed by the flour to give dough of normal consistency was recorded as water absorption percentage.

#### Colour, appearance and dough handling properties:

Colour, appearance and dough handling properties

were determined by visual observations of the dough and rating was done to the following gradations as given by Austin and Ram (1971).

- Colour of dough : Dull whitish, Whitish, Creamish, Yellowish, Light reddish and Reddish.
- Appearance of dough : Homogeneous and Heterogeneous.
- Dough handling properties : Sticky, Slightly sticky, Non-sticky.

### Chapati characteristics test:

Chapaties were prepared and evaluated for quality characteristics like puffing, colour, appearance, aroma, texture, texture after keeping for four hours and taste according to the method described by Austin and Ram (1971).

### Puffing, colour, appearance, aroma and texture of chapatias:

These quality characteristics of chapatias were determined by the procedure described by Austin and Ram (1971).

The dough of known weight was flattened into a thin uniform sheet of 3mm in thickness and 15cm in diameter to make chapatias. These were then placed on a hot iron plate. After 1 minute and 30 seconds, the chapatias were turned over so that the other side also got cooked. The chapatias were removed from hot iron plate and kept directly on the open flame of hot plate for few seconds which resulted into the puffing of chapatias. The different chapati characters were then recorded according to the following gradations:

- Puffing : Fully expanded and Partially expanded.
- Colour : Dull whitish, Whitish, Creamish, Yellowish, Light reddish and Reddish.
- Appearance : Torn and Untorn.
- Texture : Soft, Smooth, Silk, Coarse, Pliable, Slightly stiffy, Stiff and Brittle.
- Texture after storage : Soft, Slightly stiff, Stiff, Pliable and Brittle.

Wheat flour (%)	Maize flour (%)	Bajra flour (%)	Soy flour (%)	Chickpea flour (%)
98	02	02	02	02
95	05	05	05	05
90	10	10	10	10
80	20	20	20	20

– Taste (Palatability) : Sweetish (SW), Less sweetish (LS) and Non-sweetish (NS).

### Organoleptic test for palatability:

The grading method was used for the assessment of chapati palatability. The judges were first selected after a preliminary test. Chapaties made with one variety were distributed simultaneously to ten tasters in order to test the palatability by a grading method. The grades were “A+” for sweetishness, “A” for moderately sweetish taste and “A” for tastelessness. Those who gave “A+” and “A” were selected as tasters for palatability tests since they possessed more or less identical sense of taste (Austin and Jhamb, 1964). Code numbers were given at random to the samples under test, for the purpose of statistical analysis of the data, the grades “A+” and “A” were converted into scores by fixing the values 2, 1 and 0, respectively.

## OBSERVATIONS AND ASSESSMENT

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

### Dough characteristics of soybean blended flour:

Dough characteristics of soybean, blended flour are presented in Table 1. The blending of soybean flour increased the water absorption for making dough. Eighty per cent water absorption was the highest in 20% soybean flour among all the blendings. While the lowest was in wheat flour alone (58%). The soybean flour alone showed

153 per cent water absorption.

The colour of dough gradually changed dull white to very light creamish, light creamish and yellowish with the increasing levels of soybean blending. Similarly, change in dough appearance was also recorded from homogeneous to slight heterogeneous with increase in mixibility of soybean flour. The dough of soybean flour alone showed heterogeneous appearance. The dough handling property was affected by different blending levels as they showed slightly sticky. The dough of alone soybean flour was non-sticky (Rihotta *et al.*, 2005). Olaoye *et al.* (2006) also made similar observations.

### Dough characteristic of maize blended flour:

Dough characteristic of maize blended flour are also presented in Table 1. The blending of maize flour with wheat flour increased the water absorption for making dough. Twenty per cent maize blended wheat flour gave 68 per cent water absorption whereas wheat flour alone was having lowest value (58 %). Maize flour alone recorded 85 per cent water absorption.

The present findings are also supported with the observations made by Raghvendra Rao *et al.* (1979), who found increased water absorption capacity on the blending of maize flour and Giwa and Victor (2010) also reported similar findings.

The mixibility of maize flour to the wheat flour did not change the colour of dough upto 10 per cent level while it changed to creamish yellow at 20 per cent level of blending. Maize flour alone showed yellowish colour of dough. Similarly, homogeneous appearance of dough

**Table 1: Dough characteristics of soybean blended and maize blended flour**

Sample	Dough characteristics			
	Water absorption (%)	Colour of dough	Appearance of dough	Dough handling properties
Wheat flour alone	58	Dull white	Homogeneous	Slightly sticky
Wheat + 2% Soybean	61	Dull white	Homogeneous	Slightly sticky
Wheat + 5% Soybean	64	Dull white	Very slight heterogeneous	Slightly sticky
Wheat + 10% Soybean	69	Very light creamish	Slight heterogeneous	Slightly sticky
Wheat + 20% Soybean	80	Light creamish	Slight heterogeneous	Slightly sticky
Soybean flour alone	153	Yellowish	Heterogeneous	Non-sticky***
Wheat flour alone	58	Dull white	Homogeneous	Slightly sticky
Wheat + 2% Maize	61	Dull white	Homogeneous	Slightly sticky
Wheat + 5% Maize	64	Dull white	Homogeneous	Slightly sticky
Wheat + 10% Maize	66	Dull white	Homogeneous	Slightly sticky
Wheat + 20% Maize	68	Creamish yellow	Slightly heterogeneous	Slightly sticky
Maize flour alone	85	Yellowish	Slightly heterogeneous	Non-sticky***

\*\*\* Dough binding properties quite absent

was recorded upto 10 per cent blending level while it changed to slightly heterogeneous at 20 per cent level of blending. Maize flour along was slightly heterogeneous. The maize blending did not show significant change in dough handling property as slightly sticky nature was recorded at all the levels while maize flour was non-sticky in nature (Table 1).

#### Dough characteristics of Bajra blended flour:

Dough characteristics of *Bajra* blended wheat flour are shown in Table 2. A slight increase in water absorption was recorded with increased level of *Bajra* blending. Highest absorption (64%) was estimated in 20% blended flour, while lowest was in wheat flour alone.

The colour of dough was affected with *Bajra* blending and it changed to greyish colour from dull white. The dough appeared homogeneous upto 10 per cent blending level and there after slightly heterogeneous dough appearance was recorded. The dough made from *Bajra* flour alone was heterogeneous.

Upto 5 per cent blending level, the dough was slightly sticky while 10, 20 per cent and along *Bajra* dough were non-sticky. Blending of *Bajra* increased the water absorption capacity which varied from 58% to 64%. The present findings are well supported by the observations made by Murty and Austin (1963), who also observed increased water absorption with blending of *Bajra* flour.

#### Dough characteristics of chickpea blended flour:

Dough characteristics of chickpea blended wheat flour are also shown in Table 2. The blending of chickpea

to wheat flour decreased the water absorption. The highest water was absorbed by the wheat flour alone while 20 per cent chickpea blended flour needed lowest water for making dough. Chickpea alone flour showed 40 per cent water absorption. The reduction in water absorption capacity has been also reported by Yousseff *et al.* (1976) and Murty and Austin (1963) which is in accordance to the present findings.

The colour of dough was significantly affected by chickpea blending. It changed from dull white to brownish yellow with increasing level of chickpea flour. The blending of chickpea flour showed heterogeneous appearance of dough at all the levels. The dough appeared slightly sticky upto 10 per cent blending while the dough made from 20% blend flour and chickpea alone was sticky in nature.

#### Chapati characteristic of wheat-soybean blends :

Observations on chapati characteristic of soybean blended wheat flour have been presented in Table 3. The blending of soybean flour to wheat flour did not affect the chapati characteristic *viz.*, nature of puffing, colour, appearance, aroma, texture and texture after keeping 4 hours. The chapati made from 20 per cent soybean blends gave full and rapid puffing, creamy colour, untorn appearance, pleasing aroma, soft and pliable texture. The texture of chapati after keeping 4 hours was also soft and pliable. On the other hand, chapati made from soybean alone did not expand (puffing) while light reddish colour, torn appearance, non-pleasing aroma, course and brittle texture and semi-hard and brittle texture when kept

**Table 2 : Dough characteristics of Bajra and chickpea blended flour**

Sample	Dough characteristics			
	Water absorption (%)	Colour of dough	Appearance of dough	Dough handling properties
Wheat flour alone	58	Dull white	Homogeneous	Slightly sticky
Wheat + 2% <i>Bajra</i>	60	Dull white	Homogeneous	Slightly sticky
Wheat + 5% <i>Bajra</i>	61	Dull white	Homogeneous	Slightly sticky
Wheat + 10% <i>Bajra</i>	62	Greyish dull white	Homogeneous	Non-sticky
Wheat + 20% <i>Bajra</i>	64	Greyish dull white	Slightly heterogeneous	Non-sticky
Soybean flour alone	61	Greyish	Heterogeneous	Non-sticky**
Wheat flour alone	58	Dull white	Homogeneous	Slightly sticky
Wheat + 2% chickpea	58	Dull white	Heterogeneous	Slightly sticky
Wheat + 5% chickpea	56	Creamish	Heterogeneous	Slightly sticky
Wheat + 10% chickpea	54	Creamish yellow	Heterogeneous	Slightly sticky
Wheat + 20% chickpea	50	Yellowish	Heterogeneous	Sticky
Flour alone	40	Brownish yellow	Heterogeneous	Sticky*

\* Dough binding properties was moderate.

\*\* Dough binding properties was very less.

for 4 hours were observed. Upto 10 per cent blending of soybean flour, the chapati was less sweetish while 20 per cent blend and soybean flour alone were not sweetish. The similar effects were also observed by Verma *et al.* (1987); Sahni *et al.* (1976); Cheryan *et al.* (1979) and Ahmad *et al.* (1987).

The finding showed that mixability of soybean flour fairly improved the water absorption capacity in blended flour. It varied from 58-80%. The similar effect was also observed by Pollack and Geddes (1960); Sahni *et al.*

(1976); Finney *et al.* (1950); Turro and Sipos (1968); Tsen *et al.* (1971) and Yousseff *et al.* (1976).

### Chapati characteristics of wheat-maize blends:

Perceptions of chapati characteristics of maize blended wheat flour are also presented in Table 3. It revealed that upto 10 per cent blending of maize flour, the quality of chapati did not affect full and rapid puffing. Creamy colour, untron appearance, pleasing aroma, soft and pliable texture were recorded upto 10 per cent blending

**Table 3 : Chapati qualities of wheat-soybean and wheat-maize blends**

Sample	Nature of puffing	Colour of chapati	Appearance	Aroma	Texture	Texture after storage	Taste/palatability
<b>Chapati qualities of wheat-soybean blends</b>							
Wheat flour alone	Full and rapid	Creamy	Untorn	Pleasing	Soft and pliable	Soft and pliable	Less sweetish
Wheat + 2% Soybean	Full and rapid	Creamy	Untorn	Pleasing	Soft and pliable	Soft and pliable	Less sweetish
Wheat + 5% Soybean	Full and rapid	Creamy	Untorn	Pleasing	Soft and pliable	Soft and pliable	Less sweetish
Wheat + 10% Soybean	Full and rapid	Creamy	Untorn	Pleasing	Soft and pliable	Soft and pliable	Less sweetish
Wheat + 20% Soybean	Full and rapid	Creamy	Untorn	Pleasing	Soft and pliable	Soft and pliable	Non-sweetish
Soybean flour alone	Nil	Light reddish	Torn	Non-pleasing	Coarse and brittle	Semihard and brittle	Non-sweetish
<b>Chapati qualities of wheat-maize blends</b>							
Wheat flour alone	Full and rapid	Creamy	Untorn	Pleasing	Soft and pliable	Soft and pliable	Less sweetish
Wheat + 2% maize	Full and rapid	Creamy	Untorn	Pleasing	Soft and pliable	Soft and pliable	Less sweetish
Wheat + 5% maize	Full and rapid	Creamy	Untorn	Pleasing	Soft and pliable	Soft and pliable	Less sweetish
Wheat + 10% maize	Full and rapid	Creamy	Untorn	Pleasing	Soft and pliable	Soft and pliable	Less sweetish
Wheat + 20% maize	Full and rapid	Slightly yellowish	Untorn	Pleasing	Soft and pliable	Soft and pliable	Less sweetish
Maize flour alone	Partial and gradual	Light reddish	Slightly torn	Pleasing	Coarse and brittle	Coarse and brittle	Non-sweetish

**Table 4 : Chapati qualities of wheat-Bajra and wheat-chickpea blends**

Sample	Nature of puffing	Colour of chapati	Appearance	Aroma	Texture	Texture after storage	Taste/palatability
<b>Chapati qualities of wheat-Bajra blends</b>							
Wheat flour alone	Full and rapid	Creamy	Untorn	Pleasing	Soft and pliable	Soft and pliable	Less sweetish
Wheat + 2% Bajra	Full and rapid	Creamy	Untorn	Pleasing	Soft and pliable	Soft and pliable	Less sweetish
Wheat + 5% Bajra	Full and rapid	Creamy	Untorn	Pleasing	Soft and pliable	Soft and pliable	Less sweetish
Wheat + 10% Bajra	Full and rapid	Creamish grey	Untorn	Pleasing	Soft and pliable	Soft and pliable	Less sweetish
Wheat + 20% Bajra	Gradual and partial	Light grey	Untorn	Pleasing	Soft and pliable	Soft and pliable	Non-sweetish
Bajra flour alone	Nil	Grey with greenish tinge	Torn	Non-pleasing	Coarse and slightly stiff and brittle	Coarse, stiff and brittle	Non-sweetish
<b>Chapati qualities of wheat-chickpea blends</b>							
Wheat flour alone	Full and rapid	Creamy	Untorn	Pleasing	Soft and pliable	Soft and pliable	Less sweetish
Wheat + 2% chickpea	Full and rapid	Creamy	Untorn	Pleasing	Soft and pliable	Soft and pliable	Less sweetish
Wheat + 5% chickpea	Full and rapid	Creamy	Untorn	Pleasing	Soft and pliable	Soft and pliable	Less sweetish
Wheat + 10% chickpea	Full and rapid	Creamy	Untorn	Pleasing	Soft and pliable	Soft and pliable	Less sweetish
Wheat + 20% chickpea	Full and rapid	Yellowish	Untorn	Pleasing	Soft and pliable	Soft and pliable	Less sweetish
Chickpea Flour alone	Partial and gradual	Brown yellowish	Slightly torn	Pleasing	Slightly stiff and brittle	Stiff and brittle	Less sweetish

while at 20 per cent blending level, the colour of chapati was slightly yellowish and texture was soft and pliable when kept for 4 hours. The chapati made from maize flour alone had partial and gradual puffing, light redish colour, slightly torn appearance, pleasing aroma and coarse and brittle texture. The mixibility of maize flour did not affect the sweetness of chapaties at any level. The chapati prepared from maize flour alone was recorded not sweetish. Khalil and Chughtai (1984) and Rai *et al.* (2012) have also evaluated the nutritional quality of wheat supplemented with maize flour.

#### Chapati characteristic of wheat-Bajra blends:

Observations on chapati characteristics of *Bajra* blended wheat flour have been shown in Table 4. The quality of chapati was almost unaffected with the blending of *Bajra* flour upto 10 per cent level in which full and rapid puffing, creamish colour, untorn appearance, pleasing aroma and soft and pliable texture were observed. The chapati prepared from 20 per cent *Bajra* blended wheat flour gave partial and gradual puffing, light grey colour, untorn appearance, pleasing aroma, soft and pliable texture and soft and less pliable texture after keeping for 4 hours. Chapati made from *Bajra* flour showed no puffing, grey with a greenish tinge colour, torn appearance, non-pleasing aroma, coarse, stiff and brittle texture. In palatability observation, the chapaties were less sweetish upto 10 per cent blending of *Bajra* while 20 per cent *Bajra* blended flour and *Bajra* alone flour gave chapati not sweetish. These findings are in accordance with Murty and Austin (1963).

#### Chapati characteristic of wheat-chickpea blends:

Perception on chapati characteristics of chickpea blended wheat flour presented in Table 4 showed that blending of chickpea flour to wheat flour not affected the chapati quality upto 10 per cent level giving full and rapid puffing, creamy colour, untorn appearance, pleasing aroma and soft and pliable texture while chapati of 20% chickpea blended flour had yellowish colour and soft and pliable texture when kept for 4 hours. Chapati prepared from chickpea alone flour showed partial and gradual puffing, brownish yellow colour, slightly torn appearance, pleasing aroma, slightly stiff and brittle texture, and stiff and brittle texture after keeping for 4 hours. The blending of *Bajra* flour did not affect the palatability of chapaties at any level. Chickpea alone flour made chapati was also

recorded less sweetish (Murty and Austin, 1963).

The organoleptic evaluation reflected that chapati prepared from chickpea blended flour has satisfactory and acceptable taste/palatability of all blending levels (Figuerola *et al.*, 1987).

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