

Development and Evaluation of Composite Flour for *Missi roti* /chapatti

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Abstract

The present research work on development and evaluation of composite flour for *missi roti* / chapatti were carried out to develop the nutritious flours from various food commodities (wheat flour, chickpea, and soybean and methi leaves powder) to make good quality of chapatties. Four types of blends were acceptable. They were made from wheat flour, chickpea, full fat soy flour and methi powder in different ratio viz; 'A' wheat flour: chickpea flour (80:20). 'B' wheat flour: fullfat soy flour (90:10) 'C' wheat flour: chickpea flour: soy flour (80:10:10) and 'D' wheat flour: chickpea flour: soy flour: methi leaves powder (75: 10: 10: 05). The proximate composition of blends used for preparation of various products contained higher amount of protein and other nutrients. They contained proteins (11.8 to 15.37%), fat (1.53 to 3.45%), fibre (1.24 to 2.05%), ash (2.08 to 2.70%) and carbohydrates (65.99 to 74.2%). These results showed that soy flour / chickpea flour alone or in combination, both increased the amount of protein significantly. Calcium, phosphorus and iron were found to increase on supplementation of chickpea, soy flour and methi powder. Iron was high in methi supplemented blend. All these blended flours were found to have good sensory quality characteristics of products as control. All these blended flours could be well stored in polyethylene bags or tin boxes for the period of 3 months without any deterioration of quality. The supplementation of 5% methi powder increased the nutritional quality of flour particularly in minerals (calcium and iron) and fibres.

Keywords: Wheat flour; Cowpea; Chapatti; Nutritional quality; Mineral value

Introduction

Wheat (*Triticum aestivum*) is the major food produce among all the cereal crops. It is a staple food of large segment of world population. Wheat is extensively used for production of flat breads [1] such as the steam-leavened chapatti, a major source of nutrients [2] and staple diet common to Pakistan, India, and some parts of Africa [3]. About 85% of wheat consumption in India is in the form of chapattis.

Legumes have been known as "a poor man's meat". They supply protein, complex carbohydrates, fibre and essential vitamins and minerals to the diet, which are low in fat and sodium and contain no cholesterol. Legumes have been identified as low glycaemic index food [4]. A low glycaemic index food are very important in the dietary treatment of diabetes mellitus, increases satiety, facilitate the control of food intake and has other health benefits for healthy subject in terms of post-prandial glucose and lipid metabolism [5]. Regular consumption of pulses may have important protective effects on risk for cardiovascular disease [6]. Due to social reasons, the Indian peoples heavily depend on pulses a source of proteins, vitamins and minerals in the daily diet. Chick pea, pigeon pea, *mung* bean, *urad* bean, lentil and field pea are the importance pulses of significant dietary importance. In addition to nutritional importance, they are also being recognized as having therapeutic and medicinal properties. Chickpea occupies first position among pulses representing 35% of total cultivated area of pulses and contributing 45% of total production in India. In Madhya Pradesh chickpea is grown in an area of 2.56 million hector with an annual production of 2.37 million tons.

Addition of legume and beans to cereal based products could be a good option for increasing the intake of legumes and beans. In addition, legume proteins are rich in lysine and deficient in sulphur containing amino acids, whereas cereal proteins are deficient in lysine, but have adequate amounts of sulphur amino acids [7]. Therefore, the combination of grain with legume proteins would provide better overall essential amino acid balance, helping to overcome the world protein calorie malnutrition problem [8]. Use of composite flour

based on wheat and other cereals including minor millets in bakery products is becoming popular because of the economic and nutritional advantages [9]. The composite flours containing wheat and legumes are being utilized in many parts of the world. The basic composite flour technology refers to the process of mixing wheat flour with cereals and legumes to produce high quality food products in an economical way. Several studies about the influence of the addition of legume flours on the functional properties of bread dough and final bread quality have been reported in the last 30 years. Among the legumes tested, it is worth mentioning the addition of chickpea flour [10], germinated chickpea flour to wheat flour for obtaining bread. Even though the good results obtained with bread, those studies have not been extended to other cereal baked products. Hence the present work was planed with the objective to develop *missi roti* /chapatti from composite flour made from wheat, chickpea, soy flour and dried leafy vegetables. Nutritional characteristics, sensory quality and shelf life of the flour and products were studied.

Materials and Methods

Wheat, chickpea, soya bean were procured from local market of Aurangabd. All the chemicals and glassware's used in the present investigation were of standard companies (Merck and Borosil).

Preparation of wheat flour

Wheat grains were thoroughly cleaned to remove dirt, dust, insect

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Received October 25, 2011; Accepted November 22, 2011; Published December 02, 2011

Citation: Kadam ML, Salve RV, Mehrajfatema ZM, More SG (2012) Development and Evaluation of Composite Flour for *Missi roti* /chapatti. J Food Process Technol 3:134. doi:10.4172/2157-7110.1000134

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excreta/ feathers and admixture of other food grains. The clean graded materials were ground in the electric grinder to make fine flour and sieved by 80-100 mesh sieves. The flour samples obtained were kept in airtight container before use.

Preparation of chickpea flour

Chickpea grains were cleaned to remove the foreign materials and then pearled in a hand-operated chakki for removal of husk. The pearled grains were ground in electric grinder to make fine powder and sieved by 80-100 mesh sieve. The obtained flours were stored in airtight container before use.

Preparation of full fat soy flour

Soybean grains were thoroughly cleaned to remove the dust and other foreign materials. The clean grains were soaked in water for 4-6 hours and then autoclaved for 5 minutes in a pressure cooker. They were removed and dried directly in the sun for 3-4 days till the material was completely dried having 6-8% moisture content. Soybean was then ground to make fine flour and sieved through 80 – 100 mesh sieves. The flour samples obtained were kept in airtight container before use.

Preparation of leafy vegetable powder

The fresh leaves of methi were washed in tap water to remove the foreign materials and directly dried in the sun for 4-5 days till the material was completely dried having 6-8% moisture content. They were ground in the electric grinder to make fine powder. The flour samples obtained were kept in air container before use.

Preparation of various kinds of blends for making chapatti

Four types of blends were prepared to make chapattis. A blends contained wheat flour and chickpea flour in different ratio viz., blend "A" consisting of 95:05, 90:10, 85:15, 80:20, 75:25 and 70:30 and denoted as T₁ to T₆; "B" blends consisting wheat flour and full fat soy flour in different ratio of 95:05, 90:10, 85:15 and 80:20 and denoted as T₇ to T₁₀; "C" blends consisting wheat flour, chickpea flour and soya flour in the ratio of 90:05:05 and 80:10:10 and denoted T₁₁ and T₁₂; "D" blends consisting wheat flour, chickpea flour, soy flour and leaves powder (methi) in the ratio of 75:10:10:05 and 70:10:10:10 denoted T₁₃ and T₁₄. Wheat flour is used as control flour. These different blends were used in the preparation of various products.

Preparation of chapatti /paratha / poories

The different kinds of blends along with 100% wheat flour control were used to make the products after mixing with suitable water and small amount of salt (1.5%). All the ingredients were taken in a plastic bowl mixed and hand kneaded to make dough by the addition of water (60±6 ml for 100g). The dough was then rolled up manually in a circle having 5cm radius and thickness of about 0.16cm and taken on an open pan maintained at 180-200 °C for without oil chapatti and with oil paratha, whereas poories were prepared by frying the rolled dough circles in oil at 200-220°C for 2-2.5 min. After baking and frying they were subjected to sensory as well as nutritional evaluation by the standard procedures.

Biochemical analysis of flour

The biochemical analyses of the flours i.e. moisture content, fat content, protein content, ash content, crude fiber, total carbohydrate, fatty acids, minerals, calcium, phosphorus and iron were determined by A.O.A.C [11].

Sensory evaluation of products

The sensory evaluations of products were made by panel of 10 judges as described by Amerine et al. [12] on 9-point hedonic scale.

Storage studies

The shelf-life studies of flour were carried out in polyethylene and tin containers for a period of 3 months at ambient temperature. 100gm of each sample were packed and kept at room temperature for 90 days. All samples were drawn periodically after 0, 30, 60, 90, days and further analysis was carried out.

Results and Discussion

Proximate composition of composite flours

From Table 1 it can be seen that moisture content varied from 8.41 to 8.89 % with the lowest T₁₃ (8.41%) and highest is T₄ (8.89%). The protein content in the various blended flours ranged from 11.80 to 15.98. The highest protein value was recorded in T₁₃ and lowest in T₀ (11.80%). Fat content varied from 1.51 to 3.95% with the lowest in T₀ (1.51%) and highest in T₁₃ (3.95%). The highest amount of crude fibre was in T₁₃ (2.05) and lowest in T₀ (1.22%). Ash content varied from 2.03 to 2.70%. The lowest value was observed in T₀ (2.03%) and highest in T₁₃ (2.70). The maximum amount of carbohydrates were recorded in T₀ (74.22%) and lowest in T₁₃ (65.99%). These findings were in line as observed by many investigators [13,14].

From Table 2 it can be observed that calcium content ranged from 50 to 156.85 mg/100g in the blended flours. The highest value recorded in T₁₃ and lowest in T₀ (50mg/100g). The phosphorus content varied from 320 to 378 mg/100g in blended flours. The highest phosphorus content was recorded in T₁₃ (378mg/100g) and lowered in T₀ (320mg/100g). The iron content varied from 5.3 to 12.11 mg/100g. The highest amount was recorded in T₁₃ (12.11mg/100g) and lowest in T₀ (5.3mg/100g). The increase in the nutritive value of flour by supplementation of other vegetables has been reported by many investigators [15,16].

Shelf life of the composite flours

The shelf-life of the composite flours was evaluated by moisture content and fatty acid acidity. The various kinds of composite flours were stored in polyethylene bags and tin boxes for the period of 3 months at room temperature. The obtained results were tabulated in different Tables 3 to 6.

Changes in moisture content during storage

From Table no 3 & 4 it was found that the moisture content of different kinds of blends varied from 8.41 to 10.20 in the polyethylene bags for the period of 3 months. The average mean values were 8.66% 0 days, 9.07% on 30 days, 9.71% on 60 days and on 10.02% 90 days of different blends. This indicated that moisture content also did not change significantly during different storage periods. Similarly, storage of different kinds of composite flours was made in tin boxes for the period of 3 months at room temperature. The results showed that moisture content varied from 8.4 to 10.28%. The average values of moisture in different kinds of flours 8.66% on 0 days, 9.18% on 30 days, 9.81% on 60 days and 10.10% on 90 days. The results indicate that moisture content did not varied significantly during different storage periods. The moisture contents of flours in both the containers were more or less the same. Butt et al studied the effect of moisture and

Constituents (%)	Blends					C.D. at 5%
	T ₀	T ₄	T ₈	T ₁₂	T ₁₃	
Moisture	8.8±0.02	8.89±0.01	8.12±0.00	8.76±0.02	8.41±0.04	NS
Protein	11.8±0.02	12.86±0.05	14.85±0.01	15.37±0.01	15.98±0.05	0.247
Fat	1.5±0.03	2.26±0.00	3.28±0.02	3.28±0.03	3.95±0.02	1.671
Fibre	1.2±0.02	1.74±0.02	1.45±0.04	1.72±0.02	2.05±0.01	0.038
Ash	2.0±0.03	2.16±0.03	2.23±0.02	2.31±0.04	2.70±0.01	0.861
Carbohydrates	74.2±0.04	71.66±0.02	67.87±0.05	67.6±0.02	65.99±0.02	0.239

*Values are average of 3 replications

Table 1: Proximate composition of different kinds of blends.

Constituents (%)	Blends					C.D. at 5%
	T ₀	T ₄	T ₈	T ₁₂	T ₁₃	
Calcium	50.00±0.01	52.00±0.01	67.00±0.03	70.00±0.04	56.85±0.03	0.228
Phosphorus	320.00±0.03	322.50±0.03	357.00±0.01	358.00±0.01	378.00±0.05	NS
Iron	5.30±0.04	6.06±0.04	5.92±0.04	6.30±0.01	12.11±0.04	0.032

*Values are average of 3 replications

Table 2: Mineral composition of different kinds of blends.

Treatments	Periods of storage (Days)				C.D. at 5%
	0	30	60	90	
T ₀	8.80±0.01	9.31±0.01	9.92±0.01	10.20±0.01	NS
T ₄	8.89±0.01	9.20±0.01	9.97±0.01	10.18±0.01	NS
T ₈	8.72±0.01	9.12±0.01	9.88±0.01	10.15±0.01	NS
T ₁₂	8.76±0.01	9.18±0.01	9.94±0.01	10.16±0.01	NS
T ₁₃	8.41±0.01	8.84±0.01	9.32±0.01	9.76±0.01	NS

*Values are average of 3 replications

Table 3: Changes in moisture content of blended flours in polyethylene bags during different storage periods.

Treatments	Periods of storage (Days)				C.D. at 5%
	0	30	60	90	
T ₀	8.80±0.02	9.40±0.02	9.98±0.05	10.31±0.02	NS
T ₄	8.89±0.03	9.38±0.04	10.12±0.06	10.28±0.03	NS
T ₈	8.72±0.05	9.23±0.04	9.97±0.04	10.23±0.04	NS
T ₁₂	8.76±0.01	9.24±0.04	10.02±0.03	10.25±0.05	NS
T ₁₃	8.41±0.04	8.97±0.05	9.44±0.02	9.79±0.04	NS

*Values are average of 3 replications

Table 4: Changes in moisture content of blended flours in Tin boxes during different storage periods.

Treatments	Period of storage (Days)				C.D. at 5%
	0	30	60	90	
T ₀	0.112±0.02	0.115±0.01	0.118±0.03	0.120±0.02	NS
T ₄	0.161±0.04	0.165±0.04	0.161±0.04	0.162±0.04	NS
T ₈	0.181±0.01	0.182±0.04	0.190±0.01	0.231±0.02	NS
T ₁₂	0.152±0.03	0.164±0.02	0.181±0.03	0.219±0.03	NS
T ₁₃	0.169±0.04	0.161±0.01	0.171±0.03	0.232±0.01	NS

*Values are average of 3 replications

Table 5: Changes in fatty acid acidity (mg of KOH/100 g of flour) of different kinds of blended flour in polyethylene bags during different storage periods.

Treatments	Period of storage (Days)				C.D. at 5%
	0	30	60	90	
T ₀	0.110±0.02	0.121±0.03	0.120±0.01	0.130±0.02	NS
T ₄	0.160±0.01	0.181±0.04	0.180±0.02	0.181±0.03	NS
T ₈	0.183±0.03	0.209±0.02	0.221±0.03	0.270±0.04	NS
T ₁₂	0.161±0.04	0.164±0.04	0.183±0.04	0.232±0.03	NS
T ₁₃	0.167±0.02	0.181±0.01	0.213±0.02	0.242±0.02	NS

*Values are average of 3 replications

Table 6: Changes in fatty acid acidity (mg of KOH/100 g of flour) of different kinds of blended flours in tin boxes during different storage periods.

packaging on the shelf life of wheat flour and observed that multiwall polyethylene bags were found to be effective against moisture changes.

Changes in fatty acid acidity during storage

From Table 5 & 6 it was found that the storage of different kinds of blended flours in polyethylene bags and tin boxes for the period of 90 days at ambient temperature revealed that fatty acid acidity was minimum (0.110-0.112) in control containing wheat flour alone. However, the soy flour and chickpea blended flours contained higher values for fatty acid acidity (0.161-0.270). During storage of flours in both polyethylene bags and tin boxes showed that there were gradual increase in the fatty acid acidity in all the blends except control.

The values were higher in tin boxes (0.161-0.270) as compared to polyethylene bags (0.152-0.132). This indicates that polyethylene bags could be considered the safest for storage of different kinds of flours. Mahadevaiah et al. [17] studied the effect of flexible films packaging on Pulses and Cereal Flours and found a significant effect on cereal flours packed in polyethylene bags.

Sensory quality characteristics of products

From figure 1,2 and 3 it can be observed that different kinds of blends were developed to make chapatties and subjected to sensory evaluation. The results revealed that the sensory scores of various attributes viz; colour & appearance, flavor, taste, texture and overall

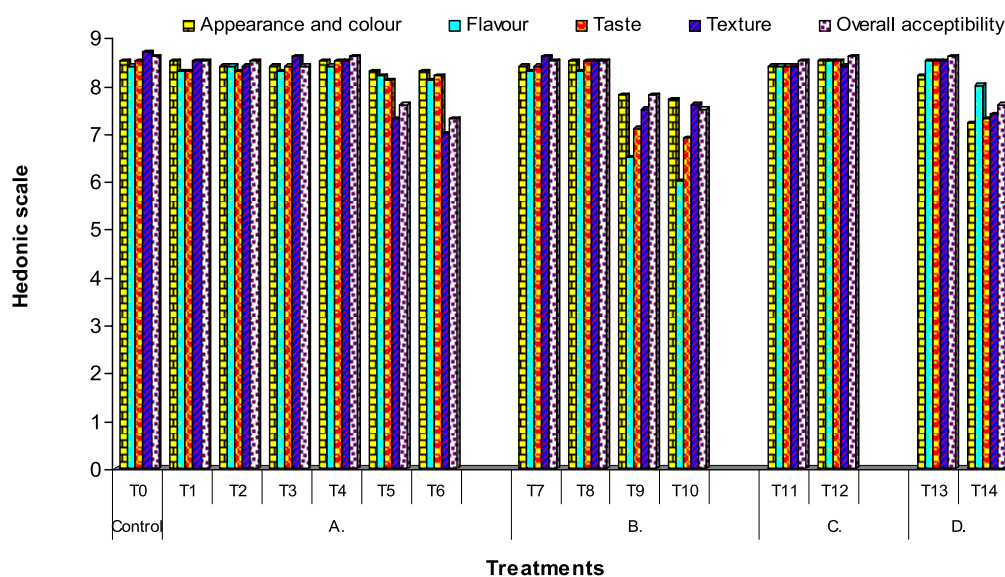


Figure 1: Sensory evaluation of chapatti made from different blends.

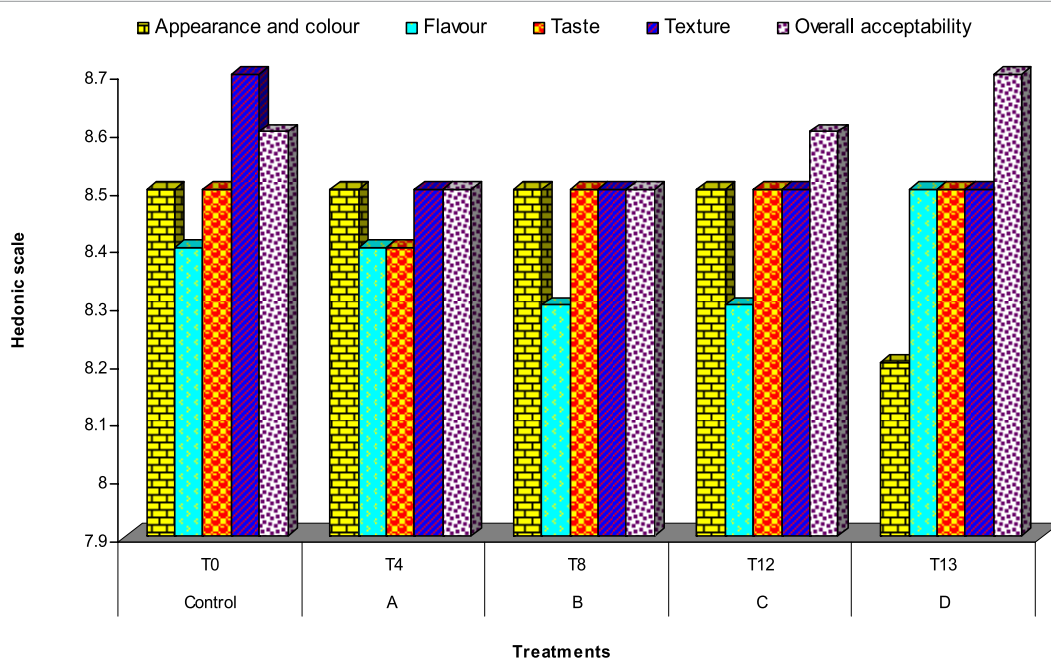


Figure 2: Sensory evaluation of paratha made from different blends.

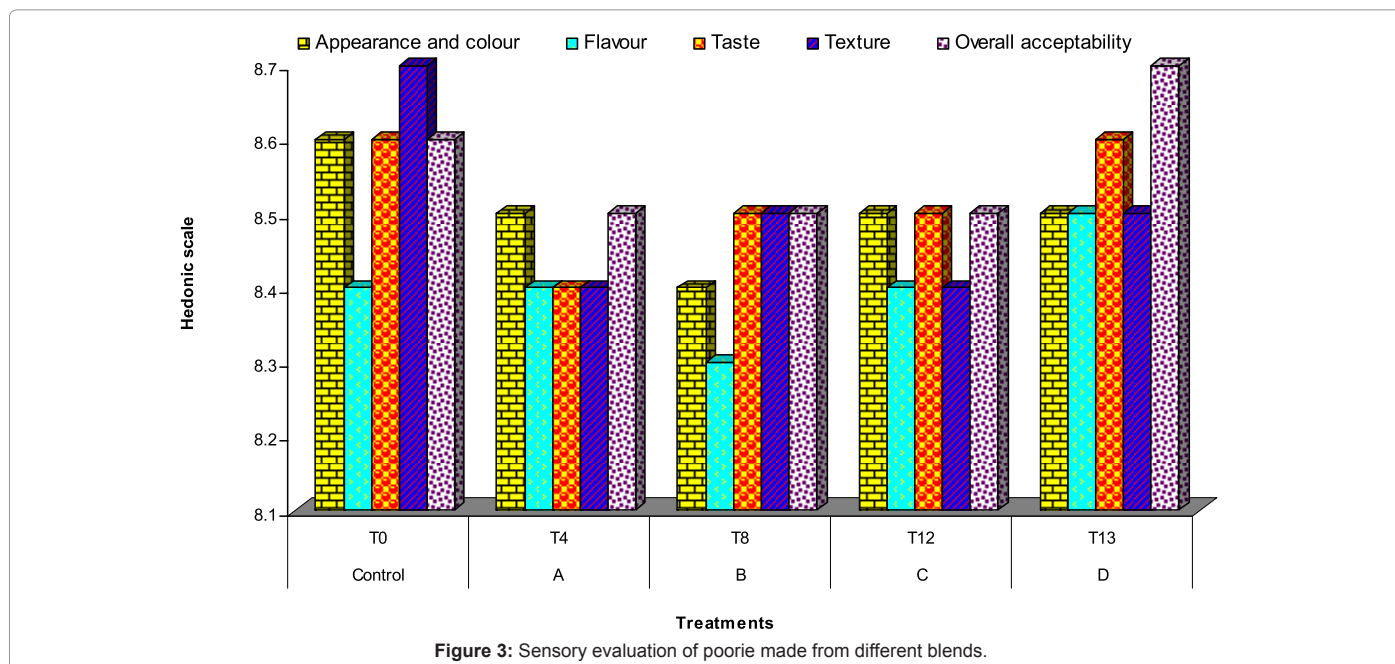


Figure 3: Sensory evaluation of poorie made from different blends.

acceptability (Figure 1) in between 8.3 to 8.7 in the products (T_1 to T_4). However, on increasing the level of chickpea flour at the level of 25 and 30%, there were a decrease in the textural quality and overall acceptability of the product (T_5 & T_6). This indicates that higher amount of chickpea flour beyond 20% affected the textural quality characteristics. On the basis of their observations T_4 blend consisting of 80:20 (wheat flour: chickpea flour) could be considered the best for preparation of good quality of chapattis. Gomez et al. [18] studied the quality of cake prepared by using blend of wheat flour and cowpea and observed that the replacement of wheat flour by chickpea flour induced an increase in the initial firmness but cohesiveness and resilience diminished, increasing the tendency to hardening.

The supplementation of soy flour in wheat flour at the level of 5% to 20% for chapattis preparation revealed that the scores of various sensory attributes ranged in between 6.0 to 8.6 (Figure 1). The values were highest is T_7 and T_8 ranging in between 8.3 to 8.6 (Figure 1). However, values in T_9 and T_{10} ranged in between 6.0 to 7.8. This indicated that higher amount of soy flour decreased the sensory quality characteristics of the product. On the basis of their observation the supplementation of soy flour at the level of 10% could be considered the best from sensory point of view. The supplementation of both chickpea and soy flour at the level of 5 and 10% did not change the sensory quality of the chapattis which were the same as control. The scored of various sensory attributes ranged in between 8.4 to 8.6 (Figure 1) Thus, supplementation chickpea and soy flour both at the level of 10% each could also be considered good from sensory points of view. The supplementation of methi leaves powder at 5 and 10% showed that the values of various attributes ranged from 7.3 to 8.6 with lower values in T_{14} . However, higher values were recorded in T_{13} . This indicates that 5% methi powders could be considered best from sensory points of view. The sensory quality characters of poorie and paratha made from various kinds of blends containing 20% chickpea (T_4), 10% soy flour (T_8), 10% each chickpea and soy flour (T_{12}) and 10% chickpea flour, 10% soy flour and 5% dried methi leaves powder (T_{13}) concealed that the scores for various sensory attributes viz., colour and appearance, flavour, taste, texture and overall acceptability were good ranging in

between 8.2 to 8.7 (Figure 2 and 3). This indicates that the good quality poorie and paratha could also be prepared from these blends. These findings support the previous results as observed by many investigators in chapati and other products [19-21]

This decrease in scores of the chapattis with increasing the level of soy flour incorporation may be attributed due to the typical taste and showed that chapattis prepared from blended wheat flour with more than 20% defatted soy flour had undesirable taste [22].

Conclusion

In the present investigations, different kinds of flours were made from wheat flour, chickpea flour, and soy flour and methi leaves powder and subjected to sensory evaluation in the form of chapatti, poorie and paratha. The results showed that wheat flour with 20% chickpea flour could be considered the best because all the sensory quality characteristics of the products were the same as control. At higher concentration of chickpea flour, there were slight decreases in the sensory quality. The supplementation of soy flour in wheat flour for chapatti preparation revealed that 10% processed soy flour were good without changing in the sensory characteristics of the chapatti. However, at higher concentration the values of sensory scores were found to decrease. The supplementation of soy flour in combination of chickpea in equal quantities i.e. 10% each did not change the sensory quality characteristics of chapattis as observed in the present study. These blends used in the preparation of poorie and paratha showed that sensory scores of these products were also the same as the chapattis suggesting that these blends could be well used in the preparation of poories and paratha. The storage of different kinds of flours in tin boxes and polyethylene bags revealed that there were no changes in the moisture content and fatty acid acidity of the flours during storage periods. Fatty acid acidity ranged in between 0.115 to 0.270 and moisture content 8.84 to 10.31%. This indicates that containers did not influence much on the quality of blended flours. Thus, it was concluded that composite flour having high nutritional quality can be prepared from wheat flour with 10% chickpea and 10% soy flour and / or with 10% soy flour for making good quality of chapties. The

supplementation of 5% methi powder can also be made to enhance the nutritional quality of flour particularly in minerals and fibres.

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