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Syed Zubair
Department of Food Trade and Business Management
College of Food Technology, VNMKV, Parbhani. (M.S), India

Satwadhar PN
Department of Food Trade and Business Management
College of Food Technology, VNMKV, Parbhani. (M.S), India

Mohammad Nisar
Department of Food Trade and Business Management
College of Food Technology, VNMKV, Parbhani. (M.S), India

More DR
Department of Food Trade and Business Management
College of Food Technology, VNMKV, Parbhani. (M.S), India

Correspondence
Syed Zubair
Department of Food Trade and Business Management
College of Food Technology, VNMKV, Parbhani. (M.S), India

Studies on effect of partially defatted soybean flour on color, weight loss and textural properties of *chapati*

Syed Zubair, Satwadhar PN, Mohammad Nisar and More DR

Abstract
The present work have been undertaken to study the effect of partially defatted soybean flour on color, moisture loss and textural properties of *chapati*. It was found that with increase in proportion of partially defatted soybean flour to *chapati* L* value (Lightness) gets reduced from 71.75 to 54.06, a* (Redness) of *chapati* get increased from 2.06 to 7.85 and b* (Yellowness) of *chapati* get decreased from 24.46 to 13.94. The weight loss properties were studied by packing in different packaging material. For unwrapped *chapati*, sample T_0 lossed weight from 38.2 to 35.9 g. for sample T_1, T_2 and T_3 loss of weight were 40.6 to 38.8 g, 4.4 to 40.2 g and 42.9 to 41.6 g respectively. For *chapati* in LDPE pouch, sample T_0 was lossed weight from 37.9 to 36.2 g. The loss of weight for treatments T_1, T_2 and T_3 were 40.3 to 38.8 g, 41.2 to 39.8 g and 42.6 to 41.3 g respectively. For *chapati* packed in LDPE with aluminum foil, T_0 was lossed weight from 38.1 to 36.6 g. The loss of weight for treatments T_1, T_2 and T_3 were 40.6 to 39.2g, 41.4 to 40.2g and 42.7 to 41.5 g respectively. Effect of partially defatted soybean flour on *chapati* showed, hardness for sample T0, T1, T2 and T3 were 2.572, 2.719, 2.862 and 3.823 kg respectively. The extensibility of sample T0, T1, T2 and T3 were 0.538, 0.394, 0.322 and 0.276 mm respectively. It was conlcuded that with increasing partially defatted soybean flour to *chapati* color value get slightly changed. It was found that *chapati* in LDPE with aluminum foil packaging; loss of weight was less as compare to unwrapped *chapati* and packaging in LDPE package because of better protection of *chapati* against light, water and air. It was also concluded that with increasing partially defatted soybean flour to *chapati* hardness increases and extensibility of *chapati* decreases.

Keyword: Partially defatted soybean flour, *Chapati*, Color, Hardness, weight loss

Introduction
Soybean (*Glycine Max*) is nature's richest source of proteins. The protein content of most beans averages 20-25 percent, but soybean contains about 40 percent protein. The proteins present in soy meet the amino acid needs of body, both for adults and children. Generally legumes proteins are deficient in essential sulfurated amino acid methionine. However soy protein contains enough of this important amino acid to meet adult needs. Protein in just 250 g of soybean is equivalent to protein in 3 liters of milk or 1 kg of meat or twenty four eggs.

Soybeans (*Glycine max*) (L) have been thus far considered as a source for crude oil for edible and industrial purposes, and the protein-rich (more than 50 percent) meal is seen as a protein source for animal feed. In recent years, however, there has been increasing interest in utilization of soy meal as a protein source for human foods. Soybean is crushed into oil and partially defatted meal and meal is usually used as an animal feed and smaller percent is further processed into food ingredient including soy flour, concentrate, isolate and textured protein (Jideani, 2011) [2].

In recent year there has been a considerable shift in the consumer's perception of food due to changing lifestyle, modernization and increase women employment, increased per capita income and newer marketing strategies employed by major food manufacturers. Most consumers demand convenience food, ready to eat snacks or food which add bulk and satisfy appetites without taking up preparation time (Peter *et al.*, 2012) [6]. 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.

Chapati (unleavened flat bread) traditional food, which is prepared from whole wheat flour are served as the staple food in the Indian sub-continent. *Chapaties* are one of the most favorite bread items in northern South Asia. *Chapati* is a form of roti or rotta (bread).

Use of partially defatted soybean flour in chapati results in number of physical and chemical changes in chapati. In present investigation effect of partially defatted soybean flour on color, weight loss and textural properties of chapati were studied.

Material and Method

Materials

Raw materials

Good quality soybean (*Glycine max)* seed were procured from AICRP on soybean, VNMKV, Parbhani and local market of parbhani, Maharashtra. Wheat flour procured from local market of parbhani.

Chemicals

Chemicals used in this investigation were of analytical grade. They were obtained from Department of Food Trade and Business Management, Department of Food Chemistry and Nutrition, Department of Food and Industrial Microbiology, College of Food Technology, VNMKV Parbhani.

Packaging material

Packaging material i.e. Aluminium foils and LDPE pouches was purchased from local market.

Methods

Packaging of *chapati* fortified with partially defatted soybean flour

Chapatis were packed in self-sealing low-density polyethylene pouches and Aluminium foil stored for 7 days at 26 ± 2^0c (Shaikh *et al.*, 2007) [7].

Colour

Chapati color compared with munsell soil color chart and the matching Hue, Value, and chroma notation (Mateu *et al.*, 2015) [5].

Textural analysis of *chapati* fortified with partially defatted soybean flour

Stable Micro System *TAXT2 plus* Texture Analyzer was used for texture profile analysis (TPA) *chapati*. The test was configured so that the hardness calculated at the time of the test by determining the load and displacement at predetermined points on the TPA curve. Hardness (h) was the maximum lad expressed in kg applied to the sample during the first compression.

Hardness (kg) = F1

Extensibility (mm) = Separation distance (cycle-1)

Result and Discussion

Color characteristics of *chapati* fortified with partially defatted soybean flour

All color data are expressed as Hunter L*, a*, and b* values corresponding to lightness, redness, and yellowness, respectively. Hunter-lab color values of *chapati* fortified with partially defatted soybean flour are given in Table 1.

Table 1: Effect of partially defatted soybean flour on color characteristics of *chapatti*

Treatments	Color characteristics		
	L* (Lightness)	a* (Redness)	b* (Yellowness)
T_0	71.75	2.06	24.46
T_1	68.62	3.41	22.78
T_2	61.36	5.93	18.66
T_3	54.06	7.85	13.94
S.E±	0.372	0.334	0.249
C.D at 5%	0.791	0.711	0.530

*Each value an average of three determinations

The data obtained from Table 1 reveals the effect of different level of partially defatted soybean flour on color characteristics of *chapati*. It was observed that with increase in level of partially defatted soybean flour to *chapati* L* value (lightness) gets reduced from 71.75 to 54.06. up to 20 percent of partially defatted soybean flour slight changes in color were found. With increasing level of partially defatted soybean flour to *chapati* a* (redness) of *chapati* get increased from 2.06 to 7.85 where as b* (yellowness) of *chapati* get decreased from 24.46 to 13.94. Similar results were obtained with Cheng and Bhat (2015) [1] and Khan *et al*. (2013) [4].

Effect of different level of partially defatted soybean flour on weight loss of *chapati*

Loss in weight is important quality characteristics of *chapati* during storage. Partially defatted soybean flour has properties of retaining moisture. Effect of partially defatted soybean flour and different packaging material on weight loss properties of *chapati* is presented in table 2.

Table 2: Effect of different level of partially defatted soybean flour on weight loss properties of *chapatti*

Time (hr)	Weight (g)											
	Unwrapped				LDPE				LDPE+ Aluminum foil			
	T_0	T_1	T_2	T_3	T_0	T_1	T_2	T_3	T_0	T_1	T_2	T_3
0	38.2	40.6	41.6	42.9	37.9	40.3	41.2	42.6	38.1	40.6	41.4	42.7
6	37.4	40.1	41.2	42.4	37.3	39.7	40.5	41.9	37.5	40.1	41.1	42.2
12	36.9	39.7	40.9	42	36.9	39.4	40.2	41.6	37.3	39.7	40.7	41.8
18	36.5	39.2	40.5	41.7	36.7	39.1	40.0	41.5	36.9	39.4	40.6	41.7
24	35.9	38.8	40.2	41.6	36.2	38.8	39.8	41.3	36.6	39.2	40.2	41.5
Loss/ day	2.3	1.8	1.4	1.3	1.7	1.5	1.4	1.3	1.5	1.4	1.2	1.2
S.E±	0.30	0.44	o.41	0.62	0.40	0.41	0.44	0.45	0.44	0.37	0.41	0.41
C.D at 5%	0.64	0.95	0.89	1.33	0.86	0.88	0.95	0.97	0.93	0.80	0.87	0.88

*Each value an average of three determinations

Unwrapped Chapati

The data obtained from Table 2 showed that by the time passing loss of weight occurred in *chapati*. For sample T_0 weight loss from 38.2 to 35.9 g. for sample T_1, T_2 and T_3 loss of weight were 40.6 to 38.8 g, 4.4 to 40.2 g and 42.9 to 41.6 g respectively. But it was found that more loss in weight found in control sample (T_0) 2.3 g, and loss in weight tends to decreased with increasing the levels of partially defatted soybean flour in *chapati*.

Ldpe Packaging

The data from Table 2 reveals that loss in weight of *chapati* for control sample was 37.9 to 36.2 g with loss of 1.7 g of weight after 24 hours. The loss of weight for treatments T_1, T_2 and T_3 were 40.3 to 38.8 g, 41.2 to 39.8 g and 42.6 to 41.3 g respectively. It was found that with increase in partially defatted soybean flour content to wheat flour there were decrease in weight loss. It was also found that in LDPE packaging loss of weight was less as compare to unwrapped *chapati* because of having good barrier to air, oxygen, light as

well as low water transmission rate.

Aluminum foil with ldpe

The data from Table 2 showed that loss in weight of *chapati* for control sample was 38.1 to 36.6 g with loss of 1.5 g of weight after 24 hours. The loss of weight for treatments T_1, T_2 and T_3 were 40.6 to 39.2g, 41.4 to 40.2g and 42.7 to 41.5 g respectively. It was found that with increase in levels of partially defatted soybean flour to *chapati* there were decrease in weight loss. It was also found that *chapati* in LDPE with aluminum foil packaging loss of weight was less as compare to unwrapped *chapati* and packaging in LDPE package because of better protection of *chapati* against light, water and air.

Similar results were obtained with Venketaswara *et al*. (1986) [9]. He packed the chapattis in wax paper and polyethylene pouches and compared with unwrapped *chapati*.

Textural properties of *chapati* fortified with partially defatted soybean flour

The textural profile analysis of *chapati* fortified with partially defatted soybean flour samples are presented in Table 3.

The texture of any product plays a very important role in determining the acceptability. Texture Profile Analysis (TPA) of *chapati* fortified with partially defatted soybean flour using a texture analyzer. The values are summarized in table 3.

Table 3. Effect of different level of partially defatted soybean flour on textural characteristics of *chapatti*

Treatment	Hardness (kg)	Extensibility (mm)
T0	2.572	0.538
T1	2.719	0.394
T2	2.862	0.322
T3	3.823	0.276
S.E ±	0.068	0.019
C.D at 5%	0.146	0.041

*****Each value an average of three determinations

Data obtained from table 3 showed that effect of different level of partially defatted soybean flour on textural characteristics of *chapati*. It was found that hardness for sample T0, T1, T2 and T3 were 2.572, 2.719, 2.862 and 3.823 kg respectively. It was found that with increasing levels of partially defatted soybean flour to *chapati* hardness of *chapati* get increased. The extensibility of sample T0, T1, T2 and T3 were 0.538, 0.394, 0.322 and 0.276 mm respectively. It was found that with increasing partially defatted soybean flour there were decrease in extensibility of *chapati*. Similar results were observed with (Tyagi *et al*., 2007) [8]. Kadan *et al*. (2001) [3] prepared rice bread baked in a home bread machine and compared with local commercial whole-wheat bread. The results showed that rice breads had less specific volume, harder texture, and were more prone to retrogradation during storage than whole wheat bread.

Conclusion

Thus in light of scientific data of the present investigation, it was concluded that with increasing partially defatted soybean flour to *chapati* color value get slightly changed. It was found that *chapati* in LDPE with aluminum foil packaging; loss of weight was less as compare to unwrapped *chapati* and packaging in LDPE package because of better protection of *chapati* against light, water and air. It was also concluded that with increasing partially defatted soybean flour to *chapati* hardness increases and extensibility of *chapati* decreases.

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