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CONTENTS

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Editorial Note

In the last two decades India has experienced number of changes in the business and industrial environment. The New Reforms of 1991 has been able to provide a dynamic business environment that was lacking in the first five decades after independents. Accordingly new and hitherto unobserved business opportunities have emerged for budding entrepreneurs. The traditional and conventional business lines have taken a back seat. Sum of these emerging areas of business are outsourcing, consultancy, hospitality, tourism and others.

The Food Technology, Management and Food Services Sector also are under this important emerging area. Late Prof. Dr. A. D. Shinde, The Founder Director of CSIBER Trust, realized the importance of this field way back in early eighties. To realize his dream he started the College of Non-Conventional and Vocational Courses for Women (CNCVCW) at Kolhapur. He introduced innovative courses especially for women. These courses are skill oriented and help the women to find suitable placement in Food, Fashion and Interior Designing fields. At the same time they are equipped and trained to start their own business and become a source of employment for others in the society.

As a part of the academic responsibility and make the stakeholders aware about the recent trends in the three sectors, the college regularly conducts seminars, workshops and conferences. This year the college conducted a National level conference on the Recent Trends in Food Technology and Management on 28th and 29th March 2014. The conference received overwhelming response. There were almost 35 participants from different parts of the country presenting their research papers on different sub themes of the conference. In the poster presentation category there were almost 15 participants displaying their ideas and innovations in the area of Food and Management.

The topics covered in the papers submitted for the conference dealt with innovations in Food Processing industry, Bio technological aspects, Legal environment for food industry and the management trends in the sector. The national conference was able to attract good research papers on different themes from participants hailing from various states of our country. In the present issue we publish selected research papers of the conference. These papers will serve as an academic input for all those scholars interested in this specialized and emerging area.

Dr. T. V. G. Sarma
Editor

Effect of Legume Flours Addition on Chemical Characteristics of Sorghum Bhakri (Unleavened Flat Bread)

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Abstract: Bhakries prepared with sorghum flour and substitution with chick pea and soybean flours separately were evaluated for chemical characteristics and protein content. It was observed that the chemical composition of bhakries prepared from sorghum and enriched flours did not differ significantly for moisture, and ash contents while differed significantly for total carbohydrate, crude protein and crude fat content. The composition of bhakries were also found to be non-significantly different for crop years with sorghum flours and legume flour combinations whereas legume flour combinations differed significantly with one another with respect to enriched bhakries composition. The mean values of moisture, crude protein, crude fat, ash and total carbohydrate ranged from 30.35 to 36.73%, 6.66 to 11.39%, 0.63 to 2.23%, 0.3 to 1.29% respectively for bhakries prepared from sorghum and chick pea enriched flour and the mean values of moisture, crude protein, crude fat, ash and total carbohydrate ranged from 30.35 to 36.73%, 6.98 to 16.25%, 0.78 to 4.51% and 0.37 to 1.44% respectively for bhakries prepared from sorghum and soybean enriched flour.

Key Words: Sorghum; Chick pea; Soybean; bhakri; Chemical characteristics

1.0 INTRODUCTION:

Grain sorghum [Sorghum bicolor (L.) Moench] is an important food crop particularly in arid and semi-arid tropics. It is a dual-purpose crop providing staple food for human consumption (35%) and rest of as a fodder for livestock, alcohol production, as well as preparation of industrial products (Awika and Rooney 2004). Many millions of people in Africa and Asia depend on sorghum as the stuff of life. Unfortunately, lysine is the first limiting amino acid in sorghm flour. Tryptophan, threonine and methionine are also low in sorghum when compared to the FAO standards (FAO/WHO, 1973). The deficiencies of essential amino acids lead to poor utilization of proteins and thus contribute to the prevalence of malnutrition. The cereal are deficient in lysine further aggravate the situation due to its losses during baking. The lysine is destroyed more than 10% during baking (Saab et al., 1981). Protein deficiency also results in predisposition to parasitic and infectious diseases and general ill-health. The specific maladies such as Kwashiorkor and Marasmus are more prevalent due to protein deficiency. In adults, apart from direct ill-health, protein deficiency results in reduced capacity for physical work. Altogether, sorghum is one of several really indispensable crops required for the survival of man. In India, sorghum is mainly consumed in the form of unleavened pancake (bhakri/roti). However, several indigenous processed foods such as bhatwadi, papadi, and roti are prepared and consumed in the semi-arid tropics (Salunkhe et al. 1984). The scientists have made various attempts to improve protein content and quality of sorghum flour through different means. They

have carried out studies on the preparation of the composite flours comprising sorghum supplemented with protein rich materials of different products with legume and oilseed flours (Chavan, Kadam, & Salunkhe, 1989). Legume flours significantly improve the quality of sorghum flour because of its high contents of protein and essential amino acids especially lysine. This situation demands to explore the possibility of improving the sorghum based foods such as bhakries, breads, noodles and crackers with protein sources (Anyango, De Kock, & Taylor, 2011; Pelembe, Erasmus, & Taylor, 2002) This approach seems to be more feasible and exhibits advantages of substantial enhancement in the protein content and at the same time it helps correcting the amino acid balance deficiencies and consumer acceptability (Akinyele & Fasaye, 1988). Proteins from legumes may help in solving protein deficiency problems to combat the malnutrition prevalence in different regions of Maharashtra. The use of legume flours for preparation of indigenous products such as bhakri has not been carried out extensively. Thus there was a need to explore the possibility of using legume protein enriched sorghum flour for the production of nutritious bhakri without sacrificing its functional and sensory characteristics. Therefore, the present study was undertaken to find out the suitable proportion of legume flours into sorghum flour for the production of protein enriched bhakries and also to find out acceptability of bhakries prepared from legume enriched sorghum flours.

2.0 MATERIALS AND METHODS

2.1 Procurement of Raw Material

Sorghum variety Phule Vasudha was purchased from the Sorghum Research Station, Mahatma Phule Krushi Vidhyapeeth, Rahuri (MS). Chick pea variety Vijay and soybean variety JS 335 were collected from the Pulses Improvement Project, Mahatma Phule Krushi Vidhyapeeth, Rahuri (MS).

2.2 Cleaning of raw material

Sorghum, chick pea and soybean were cleaned manually to remove dust particles, damaged seeds and other impurities.

2.3 Preparation of flours

All grains were tempered at 10% moisture by following the procedure of AOAC 1990 and milled in stone chakki to obtain flour followed by sieving through 20 mesh sieve and packed in separate air tight containers and stored at room temperature until utilized.

2.4 Partial replacement of legume flour

Legume flours (soybean and chick pea) are replaced 10, 20 and 30 % with respect to sorghum flour separately

2.5 Preparation of bhakies

Put the flour in a wide plate or mixing bowl. Add water bit by bit till the flour can be gathered up into a ball of dough Form into a thick circle working with finger tips with the patty between the palms of (floured) hands. Turn out onto floured surface and continue to form a circle pressing it out with the finger tips. Heat a tava or griddle (temperature around 300-

325° C) and put the bhakri on it. After 2 to 3 minutes the bhakri starts becoming opaque. Sprinkle some water on the surface by hand. After two minutes turn the roti around and cook on the other side for 20 to 30 sec. time. Turn over twice more till the roti develops brown spots all over and becomes a lighter colour in between.

2.6 Proximate analysis

All flours and bhakries were analyzed for moisture, crude protein, crude fat, crude protein, total ash and total carbohydrates content according to their methods described in AOAC 1990.

2.7 Statistical Analysis

The data was statistically analyzed by performing analysis of variance technique and interpreted according to Duncan's Multiple Range Test at 5% level of probability.

3.0 RESULTS AND DISCUSSION:

3.1 Proximate analysis

3.1.1 Moisture content

The statistical analysis revealed that moisture content of bhakri was not affected significantly by the crop years as well as sorghum flour. The interaction of crop years, sorghum with chick pea and sorghum with soybean flour combinations was also found to be non-significantly different with one another. It is obvious from the results that the moisture content of bhakries among legume flour combinations differed significantly. The average moisture content of bhakries prepared from chick pea and soybean flour enriched sorghum flour is shown in Table I. The data showed that the moisture content in bhakries was found to be significantly the highest in sorghum flours enriched with 30% of chick pea and soybean respectively. The sorghum flours enriched with 10 and 30% chick pea and soybean flour were found to be statistically at par with respect to moisture content. The lowest moisture was obtained in the bhakries prepared from sorghum flour enriched with 10 % chick pea and 10 soybean flour followed by bhakries prepared from whole sorghum flour. The bhakries from sorghum flour enriched with 10 and 30 % chick pea flour and 10 and 30 % soybean flour yielded identical moisture content. The bhakries prepared from sorghum flour enriched with 20 and 30% legume flours significantly contained higher moisture content than the bhakries prepared from un-enriched sorghum flour. The studies conducted by Bhat and Vivian (1980) had indicated that the moisture contents in chapattis were 32.6 to 36.0% when supplemented with soy, peanut and cottonseed flours while moisture contents in whole wheat chapati was 35.5%. The moisture content found in the present study is well correlated to the findings of these workers. However, significant variation among the enriched sorghum flour may be due to higher water holding capacity of the legume flours. However, the baking conditions also have pronounced effect on the moisture content of bhakries. Since the conditions were kept identical throughout the experimentation. Therefore, the variation may be due to addition of legume flours in sorghum flour.

3.1.2 Crude Protein:

The crude protein content of bhakries also did not differ significantly due to interaction of crop years with wheat flours and oilseed flour combinations. The results indicated that the bhakries prepared from different combination of legume flours possessed significant differences in protein content. The mean value for crude protein content is presented in Table II. The protein content was found to be the highest in bhakries prepared from sorghum flour enriched with 30% soybean flour. The bhakries prepared from sorghum flour enriched with 20% chick pea and 10% soybean flour did not differ significantly for this chemical constituent. The lowest crude protein content was recorded in bhakri prepared from un-enriched sorghum flour followed by the bhakries prepared from sorghum flour enriched with 10% chick pea flour and 10% soybean flour. The data on crude protein content showed that there was a significant increase in the crude protein content of bhakries when prepared from legumes enriched sorghum flour. Jan et al. (2000) has reported an increase in the crude protein content of chapatties enriched with oilseed flours. Rawat et al. (1994) also reported an increase in protein level of soy flour fortified chapatties. Ghandi et al. (2000) observed increase in protein contents from 11.9 to 19.8% at 20% blending level of defatted soy enriched chapatties. The protein content of chapatties prepared from wheat flour enriched with soy, peanut and cottonseed flour was higher in chapatties prepared from whole-wheat flour (Bhat & Vivian, 1980).

3.1.3.Crude fat

Crude fat content was not affected significantly by the crop years, sorghum flour and the interaction of crop year with sorghum flour and legume flour combinations. It also showed that the legume flour combinations differed significantly with one another with respect to crude fat content of bhakries. The crude fat content of bhakries prepared from legume enriched sorghum flour is shown in Table III. The results regarding bhakries prepared from enriched sorghum flour showed same trend for fat content, which was observed in case of the respective enriched flours. It was observed that the crude fat content was found to be the highest in bhakries prepared from 30% soybean enriched sorghum flour. The bhakries prepared form sorghum flour enriched with 20% chick pea and 10% soybean gave statistically identical values for fat. Significantly minimum crude fat content was found in the bhakries prepared from un-enriched sorghum flour followed by the bhakries enriched with 10 and 20% chick pea flour. The increase in crude fat content of bhakries prepared from legume flours enriched sorghum flour in the present study are in line with the findings reported by Jan et al. (2000) and Bhat and Vivian (1980) who found that chapatties prepared from oilseed blended flours contained higher crude fat content. Since the results reported previously indicated that flour enriched are higher in crude fat content than the un-enriched cereal flours. Total ash

Ash content of bhakri differed significantly due to the crop years and sorghum flour. The

interaction of crop years with sorghum flour and legume flour combinations was found to be non-significant for this constituent. The results further showed that legume flours combinations differed significantly with one another with respect to ash content of bhakri. The mean ash content of bhakries prepared from different legume enriched sorghum flour is shown in Table IV. The data revealed that the ash content was found to be significantly higher in bhakries prepared from sorghum flour enriched with 30% soybean. The bhakries prepared from sorghum flour enriched with 10% chick pea and 10% soybean flour were found to be statistically at par with respect to ash content. The ash content of bhakries prepared from sorghum flour enriched with 10 and 20% chick pea and 10% soybean also did not differ significantly for this chemical constituent. The lowest ash content was found in the bhakries prepared from un-enriched sorghum flour followed by enriched with 10% chick pea and 10% soybean flour. The variation in ash content between bhakries prepared from sorghum flour enriched with 10% chick pea and 10% soybean flour were found to be non-significant. The increase in total ash content of bhakries prepared from legume flours enriched sorghum flour in the present study are in range with the findings reported by Jan et al. (2000) and Bhat and Vivian (1980) who found that chapatties prepared from oilseed blended flours contained higher in total ash content. Since the results reported previously indicated that flour enriched are higher in total ash content than the un-enriched cereal flours.

4.0 CONCLUSION:

The results of the present study indicated that there was a significant increase in moisture, crude protein and ash contents in bhakries prepared from sorghum flour enriched with chick pea and soybean flours. It is evident from this study that enrichment of sorghum flour with legume flours not only increased the protein content and ash content of the enriched flours but also increased the level of these constituents in the bhakries as well. This further showed that sorghum flour enrichment with legume flours may help to improve the nutritional status of masses whose staple diet is bhakri.

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Table I. Moisture (%) of bhakries prepared from different legume enriched flours

Years	Sorghum flour	Chick pea flour	Soybean flour	Control	Sorghum + Chick pea			Sorghum +Soybean		
					10	20	30	10	20	30
2011 - 12*	10.10	10.03	10.22	33.23	30.32	33.83	36.70	30.37	35.76	36.75
2012 - 13*	10.06	10.07	10.16	33.29	30.38	33.77	36.76	30.33	35.84	36.71
Mean	10.08	10.05	10.19	33.26	30.35	33.80	36.73	30.35	35.80	36.73

* Each value of triplicate.

Table II. Crude protein (%) of bhakries prepared from different legume enriched flours

Years	Sorghum flour	Chick pea flour	Soybean flour	Control	Sorghum + Chick pea			Sorghum +Soybean		
					10	20	30	10	20	30
2011 - 12*	7.80	25.07	39.53	6.29	7.97	9.67	11.34	9.60	12.98	16.22
2012 - 13*	7.88	25.15	39.43	6.37	8.05	9.73	11.44	9.66	12.90	16.28
Mean	7.84	25.11	39.48	6.33	8.01	9.70	11.39	9.63	12.94	16.25

* Each value of triplicate

Table III. Crude fat (%) of bhakries prepared from different legume enriched flours

Years	Sorghum flour	Chick pea flour	Soybean flour	Control	Sorghum + Chick pea			Sorghum +Soybean		
					10	20	30	10	20	30
2011 - 12*	0.50	0.65	0.77	0.69	1.07	1.69	2.20	1.81	3.23	4.49
2012 - 13*	0.56	0.61	0.79	0.63	1.11	1.63	2.26	1.89	3.13	4.53
Mean	0.53	0.63	0.78	0.66	1.09	1.66	2.23	1.85	3.18	4.51

* Each value of triplicate

Table VI. Ash (%) of bhakries prepared from different legume enriched flours

Years	Sorghum flour	Chick pea flour	Soybean flour	Control	Sorghum + Chick pea			Sorghum +Soybean		
					10	20	30	10	20	30
2011 - 12*	0.32	0.39	0.41	0.34	0.60	0.93	1.27	0.65	1.09	1.40
2012 - 13*	0.28	0.33	0.33	0.38	0.66	0.99	1.31	0.71	1.03	1.48
Mean	0.30	0.36	0.37	0.36	0.63	0.96	1.29	0.68	1.06	1.44

* Each value of triplicate

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