Effect of Hydrocolloid on Indian Traditional Food Puri Bended With Pearl Millet and Soyabean Flour

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Abstract: *Puri* is an Indian food prepared for different festivals. *Puri* is deep fat fried food and hence it is blended with pearl millet and soya bean flour in different concentration. The nutritional value was changed dramatically. *"Puri"* prepared from 20% pearl millet and 10% soya bean flour was accepted by the 10 judges panel in sensory analysis. In study it was found that, as the concentration of pearl millet flour increased, the concentration of ash and protein is decreased while the concentration of moisture, carbohydrate, fat and fiber content was increased. But during the addition of soya bean flour, it was found the concentration of moisture, ash, crude fat, fiber and protein content were increased while the carbohydrate content is decreased. The final product was treated with 0.25 %, 0.50 %, 0.75% and 1% (w/w) concentration of guar gum. The 1% guar gum concentration showed highest oil uptake ratio.

Keyword: - Hydrocolloid, puri, oil uptake ratio.

I. INTRODUCTION

Deep fat frying process is most common cooking process in India. Hence Indian foods are rich in fat or edible oil. The puri bhaji is an important Indian deep fried product made from wheat flour and generally on different festivals. The heat is transferred from oil to the product, water is evaporated and oil is absorbed. Crust formation and browning also take place giving the product an attractive golden appearance and crispy mouth feel (Annapure et al., 1998). Another approach is to use edible ingredients in the batter to improve coating performance and blending of cereals and legumes (Annapure et al. 1999). The hydrocolloids are widely used in many food formulations to improve quality attributes and shelf-life (Saha and Bhattacharya 2010). The amount of oil uptake is directly proportional to the amount of moisture lost (Gamble and Rice 1987). The oil uptake and its distribution in the fried product is mainly near the surface i.e. crust (Varela 1988). Toma et al., (1986) reported that fried potatoes absorb 15% oil during frying. To make such product more acceptable to the health cautious consumers, the oil uptake should be reduced either by use of fat replacers such as low calorie fats and fat substitutes.

Pearl millet (*Pennisetum glaucum*) is the most widely grown millet. Its production is concentrated in the developing countries. India is the single largest producer of pearl millet in the world (Basavaraj et al., 2010). Pearl millet forms a staple food for large population living below poverty line. The fat, proteins and minerals of millet is comparable to other cereals but rough texture, lack of gluten and typical flavour of grain limit their uses in various food preparation. Iron deficiency anemia is widely prevalent amongst women and children in India. Dietary fiber is one of the important nutraceutical components with wide range of health benefits. Pearl millet is one of the richest sources of iron and dietary fiber (Singh & Sehgal, 2008).

The amount of oil uptake is directly proportional to the amount of moisture lost (Gamble and Rice 1987). The oil uptake and its distribution in the fried product is mainly near the surface i.e. crust (Varela 1988). Toma et al., (1986) reported that fried potatoes absorb 15% oil during frying. To make such product more acceptable to the

health cautious consumers, the oil uptake should be reduced either by use of fat replacers such as low calorie fats and fat substitutes.

Hydrophilic colloids are those materials which give viscous solutions or form dispersions in water. In general, this criterion of water solubility to yield increased viscosity covers the large majority of gums used in the food industry (Glicksman, 1965). Hydrocolloidal materials have colloidal properties and are usually high molecular weight polymers. Chemically, most of them are polysaccharides and few are proteins such as gelatin and casein. In recent years, many synthetic hydrocolloid polymers have been developed. In actual practice the scientific term "*hydrocolloid*" has been used interchangeably with the shorter more common term "*gum*". Nowadays, guar gum is standing as one of the cheapest Hydrocolloids in food processing with no harmful health hazard like that of caused by synthetic chemicals used as colloids in food industry. The importance of hydrocolloids in food applications is due to their unique, functional properties, more important of which are water binding capacity, reduction in evaporation rate, alteration in freezing rate, modification in ice crystal formation, regulation of rheological properties and participation in chemical transformations. The United State Food and Drug Administration regulate gums, classifying these compounds as either food additives or generally recognized as safe (GRAS) substances. Though, these are generally required at usage levels of less than 2% to achieve desired properties in food systems.

II. MATERIAL AND METHOD

A. Materials

a. Procurement of raw material

Good quality raw materials such as refined wheat flour, soyabean flour, soyabean oil, guar gum and pearl millet were procured from local market of Aurangabad which was used for making puri. Various chemicals and instruments used were obtained from Department of Agricultural Engineering Maharashtra Institute of Technology, Aurangabad.

B. Methods

a. Batter preparation

Dry solid content of control sample was composed of wheat flour and salt. Wheat flour is mixed well. 35% water was added to the dry solid content and kneaded to make soft pliable dough. Dough was kept for about 1 min.

b. Deep frying and frying conditions

Dough was divided and rolled to ½ cm thickness .Further these desired shape was deep fried in 300ml of oil for 3 min at 175 ± 5^0C. To ensure even frying temperature was monitored by the thermometer. This Temperature was decided to be suitable according to the preliminary experiments. The fried samples were removed after frying, drained and allowed to cool to room temperature. After each frying, the oil was changed.

c. Treatment combinations

Puri fortified with Pearl millet flour was prepared with following treatments.

Table 1 Different combination of wheat flour and pearl millet flour

Sr. No.	**Treatments**	**Quantity***
1	T_0	100%WF
2	T_1	90% WF + 10% PMF
3	T_2	80% WF + 20% PMF
4	T_3	70% WF + 30% PMF
5	T_4	60% WF + 40% PMF

*WF= Wheat flour, PMF= Pearl millet flour

After deciding the pearl millet concentration, do the same process to calculate the soya bean flour concentration suitable for product.Puri fortified with soyabean flour was prepared with following treatments.

Table 2 Different combination of wheat flour and soyabean flour

Sr. No.	Treatments	Quantity	Quantity of soyabean flour
1	T_0	100% (WF)	-
2	S_1	90% (WF+ PMF)	10%
3	S_2	80% (WF+ PMF)	20%
4	S_3	70%(WF+ PMF)	30%
5	S_4	60%(WF+ PMF)	40%

*WF= Wheat flour, PMF= Pearl millet flour, SF = soyabean flour

Table 3 Different levels of hydrocolloid used in puri production (g/100g flour)

Treatments	Guar gum(%)
G_1	0.25
G_2	0.50
G_3	0.75
G_4	1.0

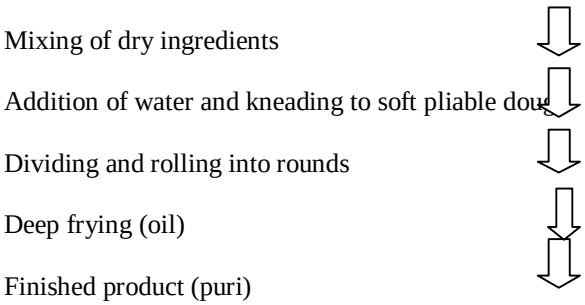

Fig. 1 Flow chart for preparation of *puri*

III. EXPERIMENTS AND RESULTS

The experiments were conducted for "Effect of hydrocolloid on Indian traditional food puri blended with pearl millet flour and soyabean flour". The present investigation was under taken to evaluate the quality as well as acceptability of utilization of hydrocolloid for the preparation puri.

The results obtained during the present investigation are presented and discussed under suitable heading. The results were discussed in the view of relevant scientific literature available in the country and elsewhere.

a. Chemical Analysis of puri blended with pearl millet flour

Chemical composition of puri blended with pearl millet flour were determined and tabulated in Table 4.

Table 4 Nutritional value of puri blended with different pearl millet flour

Sr. No.	Parameters	T_0	T_1	T_2	T_3	T_4
1.	Moisture (%)	28.40±0.3	28.60±0.2	28.90±0.4	29.90±0.2	32.22±0.4
2.	Ash (%)	1.20±0.2	1.06± 0.2	1.0±0.3	0.91±0.3	0.83±0.5
3.	Total Carbohydrate (%)	44.36±0.3	47.90±0.3	49.27±0.5	49.39±0.4	49.63±0.3
4.	Crude fat (%)	18.80±0.4	18.20±0.4	16.90±0.3	16.59±0.2	16.25±0.2
5.	Crude protein (%)	6.55±0.2	4.22±0.2	3.90±0.3	3.37±0.4	2.99±0.5
6.	Crude fiber (%)	0.69±0.5	0.82±0.3	0.93±0.4	1.01±0.3	1.08±0.2

*Each value is average of three determinations.

b. sensory analysis of puri blended with pearl millet flour

The following table shows that sensory score of puri. Overall acceptability of prepared puri was defined by sensory evaluation which was performed by ten number of semi- trained panelist. The accepted the level of pearl millet flour incorporated puri was 20%. Data about the sensory evaluation for appearance, colour, flavor, texture and overall acceptability of cookies are summarized in Table 5

Table 5 Sensory characteristics of puri prepared from different blends of pearl millet flour

Group	Treatments	Blended ratio	Color	texture	flavor	Taste	Overall acceptability
Control	T_0	100:00	7.0	7.0	7.0	8.2	**8.3**
Wheat : Pearl millet flour	T_1	100:10	7.4	7.0	7.3	7.0	**7.2**
	T_2	100:20	7.7.	8.4	7.4	7.1	**7.6**
	T_3	100:30	7.3	7.4	7.1	7.0	**6.8**
	T_4	100:40	6.5	6.5	7.0	7.0	**7.0**

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The score of color first increased and then reduced significantly for incorporation level 10%. All pearl millet in incorporated puris had less sensory score for taste than the control puri. Sensory score for flavor for pearl millet incorporated puri was observed in range from 7.0 to 8.4. The significant difference in colour was found at the level of 10 and above. The texture of pearl millet incorporated puri was slightly harder than control which resulted more

score for texture as compare to control for incorporation level 10 % and above. Development of roughness was observed on the surface of incorporated puri for incorporation level of 40 % and was the cause of poor appearance. Overall acceptability of decreased as pearl millet incorporation level increased. The sensory score of control and all the pearl millet incorporated puri for overall acceptability is expressed in figure 5. On the basis of sensory evaluation (overall acceptability) the maximum level of pearl millet to be incorporated was found to be 20 %. Thus, T_2 blend consisting of 80:20 (wheat flour: pearl millet flour) could be used to develop the product and for further study of effect of utilization of different levels of hydrocolloid.

c. Chemical Analysis of puri blended with soyabean flour

Table 6 Nutritional value of puri blended with different soyabean flour levels.

Sr. No.	**Parameters**	**T_0**	**T_2S_1**	**T_2S_2**	**T_2S_3**	**T_2S_4**
1	Moisture (%)	28.40±0.2	29.188±0.3	30.61±0.3	32.11±0.2	33.79±0.2
2	Ash (%)	1.20±0.3	2.25±0.4	2.30±0.3	2.33±0.3	2.37±0.3
3	Total Carbohydrate (%)	44.36±0.4	44.87±0.2	40.83±0.3	33.23±0.3	29.01±0.4
4	Crude fat (%)	18.80±0.3	17.40±0.3	18.30±0.4	19.50±0.4	20.17±0.2
5	Crude protein (%)	6.55±0.2	4.37±0.4	5.26±0.2	6.15±0.3	7.0±0.3
6	Crude fiber (%)	0.69±0.3	1.93±0.3	2.70±0.3	3.14±0.4	4.0±0.4

*Each value is average of three determinations.

Table 7 Sensory characteristics of puri prepared from different blends soyabean flour

Group	**Treatments**	**Color**	**Texture**	**flavor**	**Taste**	**Overall acceptability**
Control	T_0	7.0	7.0	7.0	8.2	**8.3**
Wheat : Pearl millet flour	T_2S_1	7.4	7.5	7.0	7.4	**7.5**
	T_2S_2	8.0.	7.1	6.8	6.8	**7.4**
	T_2S_3	7.0	7.0	7.2	7.2	**7.2**
	T_2S_4	6.2	6.1	6.7	6.4	**6.8**

The score of color first increased and then reduced significantly for incorporation level 10%. All soyabean in incorporated puris had less sensory score for taste than the control puri. Sensory score for flavor for soyabean incorporated puri was observed in range from 6.8 to 7.2. The significant difference in colour was found at the level of 10% and above. The texture of soyabean incorporated puri was slightly harder than control which resulted more score for texture as compare to control for incorporation level 10 % and above. Development of roughness was observed on the surface of incorporated puri for incorporation level of 40 % and was the cause of poor appearance. Overall acceptability of puri decreased as soyabean incorporation level increased. The sensory score of control and all the soyabean incorporated puri for overall acceptability is expressed in figure 7. On the basis of sensory evaluation (overall acceptability) the maximum level of soyabean to be incorporated was found to be 10 %. Thus, S_1 blend consisting of 90:10 (wheat flour: soyabean flour) could be used to develop the product and for further study of effect of utilization of different levels of hydrocolloid.

d. Effect of addition of different levels of hydrocolloid on oil recovery and quality of puri

The effect of levels of various concentration of hydrocolloid on percent oil content of puri was studied and the data obtained were presented in Table 4.8. The results of deep-fat frying of puri showed moisture loss and oil uptake by the puri. The oil content of puri significantly decreased with increase in the level of hydrocolloid. On addition of hydrocolloid, the oil content of puri decreased significantly, being least (9.04%) with guar gum at 0.25% guar gum level, followed by 0.50%guar gum level (13.40%), 0.75% guar gum(23.29%) and1% guar gum level (34.74%) in that order.

This could have been due to formation of film of hydrocolloids on the product which might have decreased the tendency of the product to absorb the oil and lose moisture (Annapure *et al.*, 1999). The film forming characteristics of these hydrocolloids might have prevented the absorption of oil and at the same time helped to retain the natural moisture of foods. This could be the reason of using these hydrocolloids in deep frying of fried products (Varela *et al*., 2011; Mallikarjunan *et al*., 1997; Ang 1993).

The effect of levels of various hydrocolloids on percent moisture content of puri was studied and the data obtained are also presented in Table 4.10. The moisture content significantly increased with increase in level of hydrocolloid. The puri prepared with addition of guar gum at 1.0% level showed significance with respect to highest moisture content (34.74%) over all other hydrocolloid level.

Table 8 Effect of addition of different levels of hydrocolloid on oil uptake of puri

Treatments	**Moisture Content of Dough (%)**	**Moisture Content of puri (%)**	**Oil Content (%)**	**% Reduction in oil Uptake**	**Uptake ratio U_R**
T_2S_1	56.80	28.40	18.80	-	0.66
$T_2S_1G_1$	46.30	23.15	17.40	9.04	0.75
$T_2S_1G_2$	54.84	27.42	16.28	13.40	0.59
$T_2S_1G_3$	55.0	27.50	14.42	23.29	0.52
$T_2S_1G_4$	59.92	29.96	12.60	34.74	0.42

IV.CONCLUSION

It is concluded from the present investigation that the use of pearl millet and soyabean flour improved the qualities of puri. Guar gum at 1% has been found to be the most effective additive for the highest moisture retention, and lowest oil uptake within the product. Thus, puri with low fat content with better acceptance can be prepared in order to meet the demand of low fatty foods of health cautious consumers.

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