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SHORT COMMUNICATION

Effect of hydrocolloids incorporation in casing of *samosa* on reduction of oil uptake

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Abstract An experiment was conducted in Randomized Block Design (RBD) with the four types of hydrocolloids viz. HPMC, CMC, guar gum and xanthan gum. These hydrocolloids were added to wheat flour on dry basis at each 0.5, 1.0, and 1.5% levels in *samosa*. The prepared *samosa* was evaluated for various physico-chemical and sensory characteristics. The study revealed that xanthan gum at 1.5% level significantly reduced the oil content in *samosa* (8.56%) as compared to all other hydrocolloids and their concentration levels. Xanthan gum followed by CMC at 1.5% level (9.38%) was also statistically significant as compared to other hydrocolloids. Further it was observed that there was significant decrease in oil uptake with increase in level of all hydrocolloids. The s*amosa* prepared with xanthan gum (1.5%) was also found superior with respect to sensory qualities compared to control.

Keywords Hydrocolloids · *Samosa* · Moisture retention · Oil uptake · Sensory characteristics · RBD

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Introduction

Frying is a process of cooking and drying through contact with hot oil and it involves simultaneous heat and mass transfer. Deep fat frying of various kinds of foods coated with batter is a popular cooking procedure in many countries (Kimber and Holding 1987), wherein 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 mouthfeel (Annapure et al. 1998). 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 fat mimetics, low calorie fats and fat substitutes. 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 use of hydrocolloids in the food industry has become very common in the last few decades. Various ingredients such as pectin, sodium alginate (Holikar et al. 2005 and Khalil 1999), powdered cellulose (Annapure et al. 1999 and Mallikarjunan et al. 1997) and corn zein (Feeney et al. 1993) were attempted. The *samosa* is a deep fat fried product prepared from refined wheat flour, potatoes, spices and condiments and used as a snack food during breakfast. The objective of present study was to know the effect of incorporation of HPMC (hydroxypropyl methyl cellulose), CMC (carboxyl methyl cellulose), guar gum and xanthan gum in the casing of *samosa* on moisture retention, oil uptake and sensory quality.

Preparation of samosa The potatoes (*Solanum tuberosum* L.) were cooked, peeled, mashed and seasoned in the oil with mustard, cumin, onion, green chillies and curry leaves. The salt, turmeric powder, spice mix and raw mango powder were cooked and mixed well. The refined wheat flour, water and vegetable oil in the ratio of 10:4:1 were mixed thoroughly and dough for the casing of *samosa* was prepared. The hydrocolloids such as HPMC, CMC, guar gum and xanthan gum (Jay Chemicals, Mumbai) were incorporated in wheat flour on dry basis each at 0.5, 1.0 and 1.5% level. Other ingredients were kept constant in all the preparations. The dough of 20 g was pocketed to 1.0±0.1 mm thickness, cut into semicircles and folded into funnel shape. A known quantity of filling material was filled inside and the ends were sealed manually to give a trihedral pyramid shape as reported by Indira et al. (1999). The s*amosa* was fried in fresh refined vegetable oil (1:3 W/V) at 150°C±5°C for 8 min, allowed to cool and used for analysis of moisture retention, oil uptake and sensory quality. The frying of *samosa* was carried out in the fresh refined oil at every time.

Physico-chemical and sensorial analysis of samosa The moisture content of *samosa* was determined with rapid moisture analyzer (Simadzu make MOC-120) while oil uptake was determined by using Soxhlet apparatus (AOAC 2002). The s*amosa*s were evaluated for sensory quality attributes like color, aroma, taste, mouthfeel and overall acceptability by a trained panel of 10 judges on 9 point Hedonic scale (1- extremely dislike, 9- extremely like) suggested by Amerine et al. (1965).

Statistical analyses For comparing different hydrocolloids and their levels, an experiment was conducted in RBD with four hydrocolloids added at different levels in *samosa* i.e. 0.5, 1.0, and 1.5% along with control. The experiment was conducted in three replications. In all, there were 13 treatments including control. The data generated during experimentation were analyzed statistically. The analysis of variance (ANOVA) for each characteristic was carried out and presented in Table 1. The treatment means, their standard errors (SE) and critical differences (CD) at 5% level of significance were worked out for comparison of treatments (Das and Giri 1988).

Oil uptake and moisture loss The effect of levels of various hydrocolloids on% oil content of *samosa*s was studied and the data obtained are presented in Table 2. The results of deep-fat frying of *samosa* showed moisture loss and oil uptake by the casing only. The hydrocolloids were found statistically significant at 1% level of probability. The oil content of *samosa* significantly decreased with increase in the level of hydrocolloids, irrespective of the type of hydrocolloids. On addition of hydrocolloids, the oil content of *samosa*s decreased significantly, being least (8.56%) with xanthan gum at 1.5% level, followed by CMC (9.38%), guar gum (10.32%) and HPMC (12.71%) in that order. Among of the hydrocolloids studied, xanthan gum with 1.5% concentration level was found statistically effective in reducing oil content in *samosa* as compared to other hydrocolloids and their levels. The reduction in oil uptake was maximum (53.32%) with xanthan gum followed

Table 1 ANOVA for various physico-chemical characteristics of *samosa*

Source	DF	SS	MS	F	P
Oil content					
Treatment	12	261.146	21.7621	757.84	0.000
Block	2	0.523	0.2615	9.11	0.001
Error	24	0.689	0.0287		
Total	38	262.358			
Moisture content					
Treatment	12	313.22	26.1027	61.17	0.000
Block	2	1.917	0.9583	2.25	0.128
Error	24	10.241	0.4267		
Total	38	325.390			
Color					
Treatment	12	60.9231	5.07692	6.60	0.000
Block	2	7.5385	3.76923	4.90	0.016
Error	24	18.4615	0.76923		
Total	38	86.9231			
Aroma					
Treatment	12	98.7692	3.23077	3.41	0.005
Block	2	3.2308	1.61538	1.70	0.203
Error	24	22.7692	0.94872		
Total	38	64.7692			
Taste					
Treatment	12	50.7692	4.23077	4.07	0.002
Block	2	1.0769	0.53846	0.52	0.602
Error	24	24.9231	1.03846		
Total	38	76.7692			
Mouth feel					
Treatment	12	54.00	4.500	4.33	0.001
Block	2	1.0769	0.56846	0.52	0.602
Error	24	24.9231	1.03846		
Total	38	80.00			
Overall Acceptability					
Treatment	12	62.7692	5.23077	5.44	0.000
Block	2	2.9231	1.46154	1.52	0.239
Error	24	23.0769	0.96154		
Total	38	88.7692			

Table 2 Effect of levels of hydrocolloids on quality of *samosa*

Hydrocolloids	Levels of addition (%)	Oil Content (%)	Moisture Content (%)	Color	Aroma	Taste	Mouth feel	Overall Acceptability
Control		18.34	18.50	9	8	9	8	9
Xanthan gum	0.5	12.40	22.76	6	7	6	6	6
	1.0	10.17	24.92	7	8	7	7	7
	1.5	8.56	28.96	8	8	8	9	8
CMC	0.5	13.32	21.70	6	7	6	6	6
	1.0	11.20	24.10	6	7	6	7	7
	1.5	9.38	27.58	9	9	8	9	9
Guar gum	0.5	14.70	20.30	7	7	8	8	8
	1.0	12.60	23.42	7	7	8	7	7
	1.5	10.32	25.87	5	5	6	5	5
HPMC	0.5	15.54	19.42	6	7	6	6	6
	1.0	13.50	22.30	7	6	7	7	7
	1.5	12.71	24.63	5	6	5	6	5
Mean±SD		12.5±2.63	23.3±2.93	6.8±1.51	7.1±1.31	6.9±1.42	7.0±1.45	6.9±1.52
SE (±)		0.0978	0.3771	0.5064	0.5623	0.5884	0.5884	0.5661
CD at 5% level of significance		0.2849	1.0986	1.4752	1.6383	1.7140	1.7140	1.6493

n=3 for chemical parameters and *n*=10 panelists for sensory parameters

by CMC (48.85%), guar gum (43.72%) and HPMC (30.69%) at 1.5% level of each hydrocolloids over the control. 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). Khalil (1999) also reported 40% reduction in oil uptake in French fries with 5% pectin. 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 (Williams and Mittal 1999; Mallikarjunan et al. 1997; Ang 1993; Koelsch and Labuza 1992).

The effect of levels of various hydrocolloids on% moisture content of s*amosa*s was studied and the data obtained are also presented in Table 2. The moisture content significantly increased with increase in level of hydrocolloids. The s*amosa* prepared with addition of xanthan gum at 1.5% level showed the statistical significance with respect to highest moisture content (28.96%) over all other hydrocolloids. This treatment was followed by CMC (27.58%), guar gum (25.87%) and HPMC (24.63%) at 1.5% level of addition. It was further observed that with increase in level of hydrocolloid, there was significant increase in the per cent moisture content. The incorporation of hydrocolloids in to the food products has the ability to affect the moisture migration. The hydrocolloids act as barriers to the migration of moisture from the coated product. The moisture barrier property could reduce weight loss of the coated product (Annapure et al. 1999; Kimber and Holding 1987).

Sensory quality of samosa The sensory quality is an important aspect in considering the overall acceptability of food product. Deep fat frying is widely used in industrial preparation of foods, because consumers prefer the taste, appearance and texture of fried food products (Saguy and Pinthus 1994). The s*amosa*s prepared by addition of various hydrocolloids in varied levels were subjected to sensory evaluation for various quality parameters like color, aroma, taste, mouth feel and overall acceptability by semi trained panel of ten judges using nine point hedonic scales. The sensory scores obtained with respect to various quality attributes were statistically analyzed and presented in Table 2. The results on sensory quality of *samosa* with different hydrocolloids showed that coating with CMC at 1.5% level was found superior in quality with respect to overall acceptability as compared to all other hydrocolloids. This treatment was followed by xanthan gum at the same level. The *samosa* with guar gum and HPMC scored poorly with respect to sensory quality. Xanthan gum at 1.5% level resulted better in sensory quality. Both xanthan gum and CMC show equal sensory quality, in fact CMC has scored higher except for some difference in oil absorption. This could have occurred due to minor errors. It is reported that hydrocolloids are used to improve the texture and moisture retention in cake batters and dough, to increase the volume and shelf life of cereal foods by limiting starch retrogradation, improve their eating quality and appearance (Kotoki and Deka 2010; Kohajdova and Karovicova 2009)

Conclusion

Among all the hydrocolloids studied at different levels for preparation of *samosa,* it can be concluded that *samosa* prepared with addition of xanthan gum at 1.5% was statistically significant over all other hydrocolloids in oil uptake with optimum sensory quality characteristics. Thus, *samosa* with low fat and low calorie 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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