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A STUDY ON THE EFFECT OF INGREDIENTS ON QUALITY AND ACCEPTABILITY OF PIZZA

A.K.M. Sarwar Inam *, Dijen Chandra Roy, Dr. Md. Shams-Ud-Din and Rashed Mahmud

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Abstract

The study was concerned with the preparation of pizza from locally available raw materials and to evaluate the effect of ingredients on quality and acceptability of prepared pizza. Wheat flour, corn flour and potato mash were used as principal ingredients to prepare three types of pizza. Dry gluten, baking powder, yeast, sugar, salt and soybean oil were also used. Wheat flour pizza was prepared from wheat flour. For potato pizza, potato mash was used with wheat flour to make pizza bread. Corn flour pizza was prepared from corn flour and wheat flour with gluten which was previously separated from wheat flour. At first, the necessary ingredients were mixed properly and doughs were made by using water. The doughs were rested for 2 hours, manipulated for 10 minutes, again rested for 1 hour then 1st proofing was done at 27°C for 10-15 min and final proofing at 37°C for 1 hour. The doughs were rolled and toppings were added and then doughs were placed in baking oven at 210°C for 20min. After baking, the dressings were added. The prepared pizzas were tested by panel of 10 testers. The color, flavor, texture and overall acceptability of all samples were not similar. Pizzas made from wheat flour and from corn flour were more acceptable than the other in terms of color, flavor, texture and overall acceptability.

Introduction

Pizza is a very popular and common fast food item having high calorie. Pizza dough can be made from wheat flour, corn flour plus wheat flour with gluten and potato mash, as the dough indicates the better shape and quality of pizza. It is the name of an oven-baked, flat, usually round bread covered with tomato sauce and often cheese, with other toppings left optional. Pizza is the single most popular food in the world. The Americans spend 33 billion dollars worth of pizza annually (Levine,1995). Pizza is one of the deep-fat-fried products commonly consumed among all. There has being an increase in the volume of sales of cookies in our locality.

* Corresponding Author, e-mail: sea_bau@hotmail.com
Department of Food Technology & Rural Industries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

The pizza formulations consist of the same basic components but include an exceptionally diverse choice of ingredients, such as anchovies, egg, pineapple, banana, coconut, sauerkraut, eggplant, kimchi, lamb, couscous, chicken, fish, and shellfish, chicken tikka masala, and non-traditional spices such as curry and Thai sweet chili. When making pizza dough, the amount of flour needed to complete the dough will vary, depending on the humidity and temperature (Ridgaway, 2005).

Martin (2003) experimented about pizza. He tried "setups" with partially beaked crust, pre baked pizza crust and frozen baked dough. He tried to add additional ingredients in pizza. But he found the biggest problem that was the crust was not quite right. So he made verification with the quantity of wheat flour.

Rips (1989) performed an experiment where subjects were asked to consider an object that was half way between the size of an U.S. quarter and the smallest pizza they had seen. They then judged whether it was more likely to be a pizza than a quarter, whether this object was more similar to a pizza than to a quarter. About 40% of the subjects reported that the object was more similarly to a pizza, but 60% reported that it was more typical of a pizza and as many as 70% that it really was a pizza. From this and other similar experiments Rips concluded that categorization cannot be based on similarity judgments.

Daramola and Asunni, (2006) demonstrated the various sensory characteristics of pizza at fry-point as shown in Table 1.

Table 1. Sensory characteristics of pizza at fry-point

Quality Attribute	Parameters
Tenderness	Hard
Moistness	Slightly moist
Appearance	Smooth
Taste	Good
Flavor	Pleasant
Color	Golden yellow

Source: Daramola and Asunni, (2006)

In Bangladesh, pizza is still a food of high price and only made from wheat flour is available. But it can be made from corn flour too and thus the price can be reduced as the price of corn flour is not so high as compared to wheat flour. It is known that the gluten is absent in corn flour, so gluten powder can be used with it. In pizza making, potato mash can also be used along with wheat flour. By using potato mash, a certain proportion of wheat flour can be used in the formulation of pizza. Pizza is more amenable to variation in the formulation to meet a wide spectrum of consumer demands with respect to taste and nutritional requirement.

Materials and Methods

The study was conducted in the laboratory of the Department of Food Technology and Rural Industry under the Faculty of Agricultural Engineering and Technology, Bangladesh Agricultural University, Mymensingh.

Product development

Preparation of potato mash

The selected potato tubers were thoroughly washed in clean water to remove adhering soil and other unwanted materials. The cleaned tubers were then boiled in water for 10 minutes. Then the peels were removed manually. Potato mash was made by grinding the peeled potato using mortar and pestle.

Preparation of dry gluten

About 500 g of wheat flour was taken and 250 ml of water was added to it. A uniform mixture was made to form a firm dough, taking care to incorporate all loose pieces. The mixing was completed by hand kneading until the flour was uniformly mixed. Then the dough was allowed to stand immersed in water for 30 minutes. The dough was manipulated under a gentle stream of water. The washing process was carried until no further starch separates. The wet gluten was dried in oven at 80^{O}C for 4-5 hours. It was then packaged and stored in a cool and dry place. The dry gluten had 9.34% moisture and 78.39% protein.

Formulations of different types of pizzas

Three different types of pizza were prepared following three different formulations as shown in Table 2.

Table 2. Ingredients for processing of pizza from wheat flour, corn flour and potato mash

Ingredients	Formulation-I	Formulation-II	Formulation-III
Wheat flour	550g	250g	300g
Corn flour		250g	
Potato			300g
Dry gluten		25g	
Baking powder	5g	5g	10g
Sugar	80g	80g	80g
Salt	2.9g	2.9g	2.9g
Soybean oil	5-8mL	5-8mL	5-8mL
Water	350mL	300mL	300mL
Yeast	10g	10g	10g
Topping materials			
Chicken kima	100g	100g	100g
Cheese	25g	25g	25g
Dressing materials			
Tomato ketchup	10g	10g	10g
Cucumber	20g	20g	20g

Formulation-I: Pizza from wheat from

Formulation-II: Pizza from corn flour plus wheat flour with gluten
Formulation-III: Pizza from potato mash with wheat flour

Processing of pizza from wheat flour

The methods of Kent (1984) were followed in the making of pizza bread. At first, the yeast was dehydrated in warm (40^{O}C) water (8ml water/ g of yeast) to ferment for 10 minutes. Sugar and salt were dissolved in remaining calculated quantity of water. All the ingredients (Table 2, Formulation-I) were mixed mechanically in a mixer for about 10-15 minutes to make dough. The prepared dough was set aside for 2 hours. While fermentation proceeded, the dough was covered with moistened cloth to prevent moisture loss. After 2 hours, the dough was manipulated to push out the gas that had been evolved in order to even out the temperature and gave more thorough mixing. After manipulation, the dough was again rested for about 1 hour. Then the dough was divided into loaf size portion (200g) and these were roughly flattened. The dough pieces were rested at about 27^{O}C for 10-15 minutes (1st proof) and molded into final shape (0.25 inch thick) during which the dough was worked to tighten it so that the gas was better distributed and retained, and placed in pre-greased baking pans. The dough was rested again in the baking pan for the final proof for 1 hour at 37^{O}C. Then cheese and chicken kima were placed on the dough as topping materials and the doughs were then baked in the oven at a temperature of 210^{O}C for 20 minutes. Tomato ketchup and sliced cucumber were placed on the pizza as dressing materials.

Processing of pizza from corn flour

After figuring the mix according to the formulation-II given in Table 2, the gluten powder was added to the mix. In this formulation, wheat flour and corn flour were added in equal proportion. Then for processing of pizza from corn flour, the same procedure was followed.

Processing of pizza from potato mash

Potato tubers were boiled in hot water for 10 minutes. Then they were peeled and mashed to prepare potato mash. Formulation-III given in Table 2 was followed to prepare pizza from potato mash.

Analytical methods

The raw potatoes, corn flour and wheat flour were analyzed for their moisture, ash, fat, protein and total carbohydrate contents. All the determinations were done in triplicate and the results were expressed as average value. Moisture content was determined adopting AOAC (1984) method.

Subjective (sensory) evaluation of pizzas

For statistical analysis of sensory data, three different types of pizza were evaluated for color, flavor, texture and overall acceptability by a panel of 10 testers. All the testers were the students of Bachelor of Science and Master of Science of the Department of Food Technology and Rural Industries and were briefed before evaluation. Three pieces of each pizza were presented to 10 panelists and randomly coded sample. The test panelists were asked to rate the different formulated pizzas presented to them on a 9 point hedonic scale with the ratings of: 9 = Like extremely; 8 = Like very much; 7 = Like moderately; 6 = Like slightly; 5 = Neither like nor dislike; 4 = Dislike slightly; 3 = Dislike moderately; 2 = Dislike very much; and 1 = Dislike extremely. The results were evaluated by Analysis of Variance (ANOVA) and Duncun's Multiple Range Test (DMRT) procedures of the Statistical Analysis System (SAS, 1985).

Results and Discussion

Composition of wheat flour, corn flour and potato tubers

The wheat flour, corn flour and potato tubers were analyzed for their moisture, protein, fat, ash and total carbohydrate contents. The results are presented in Table 3. The wheat flour has more protein content (11.9%) than that of corn flour (11.23%) and potato tubers (2.2%). For that reason, wheat flour more suitable for pizza bread. The results also indicate that the total carbohydrate content of wheat flour (72.23%) is higher than that of corn flour (66.76%) and potato tubers (19.8%). Potato tubers (77.62%) contained more moisture than that of corn flour (13.93%) and wheat flour (12.58%).

Wheat flour contained moisture, 12.58%; protein, 11.9%; fat, 1.40%; ash, 1.89%; and total carbohydrate, 72.23%. The composition of wheat flour under study was more or less similar to those reported by Gopalan *et al* (1981). He reported that wheat flour contained moisture, 12.2%; protein, 11.8%; fat, 1.5%; total carbohydrate, 71.2%; mineral, 1.6%; fiber, 1.2%; Calcium, 41mg; Phosphorus, 355mg; Iron, 4.1mg; Carotene, 64mg; Thiamine, 0.5mg; Riboflavin, 0.09mg; Niacin, 4.3mg; and energy, 346 Kcal. .

Corn flour contained moisture, 13.93%; protein, 11.23%; fat, 3.4%; ash, 1.62%; and total carbohydrate, 66.76%. The composition of corn flour under study was more or less similar to those reported by Gopalan *et al* (1981). He reported that corn flour had moisture, 14.9%; protein, 11.2%; fat, 3.6%; total carbohydrate,

66.2%; mineral, 1.5%; fiber, 2.7%; Calcium, 10mg; Phosphorus, 348mg; Iron, 2mg; Carotene, 90mg; Thiamine, 0.4mg; Riboflavin, 0.1mg; Niacin, 1.8mg; and energy, 342 Kcal.

Potato tubers contained moisture, 77.62%; protein, 2.2%; fat, 0.13%; ash, 0.25%; and total carbohydrate, 19.8%. The composition of potato tubers under study was more or less similar to those reported by Schwimmer and Burr (1967). They reported that potato tubers contain moisture, 77.5%; total solid, 22.5%; protein, 2.0%; fat, 0.1%; carbohydrate, 19.2%; crude fiber, 0.65; and ash, 1.0%.

A slight variation in the composition of wheat flour and corn flour might be due to varietals differences, variations in stage of maturity, time elapsed between harvesting and analysis, atmospheric condition during storage, growing region, growing conditions of the crops and the analytical methods.

A slight variation in the composition potato tubers might be due to growing region, harvesting period, stage of maturity, atmospheric condition during storage, varietals differences and analytical methods.

Table 3. Composition of wheat flour, corn flour and potato tubers

Components	Wheat flour	Corn flour	Potato tubers
Moisture (%)	12.58	13.93	77.62
Protein (%)	11.9	11.23	2.2
Fat (%)	1.4	3.4	0.13
Ash (%)	1.89	1.62	0.25
Carbohydrate (%)	72.23	66.76	19.8

Effect of ingredients on the color of pizza bread

Pizza breads from the above three formulations shown in Table 1 were baked at 210^{O}C for 20 minutes, the color developed were observed visually. The results are shown in Table 4.

Table 4. Effect of ingredients on the color of pizza bread

Sample No.	Color
1	Light Brown
2	Brown
3	Yellowish Brown

Sample 1: Baking of wheat flour pizza bread at 210^{O}C for 20 minutes;

Sample 2: Baking of corn flour and wheat flour pizza bread at 210^{O}C for 20 minutes; and

Sample 3: Baking of potato mash and wheat flour pizza bread at 210^{O}C for 20 minutes.

The results showed that pizza bread made from wheat flour produced more acceptable color (light brown) than those made from corn flour plus wheat flour or potato mash.

Effect of ingredients and temperature on the color of pizza bread

Pizza breads made from different formulations shown in Table 1 was baked at 200^{0}C, 210^{0}C and 220^{0}C for 20 minutes to obtain acceptable color of the final products. The colors developed at the end of the baking time, were evaluated visually and the results are presented in Table 5. The results showed that wheat flour pizza bread showed light brown color at 200^{0}C and 210^{0}C and brown color at 220^{0}C. Corn flour pizza bread showed light color at 200^{0}C, brown color at 210^{0}C and deep brown color at 220^{0}C. Pizza bread prepared from potato mash showed light yellow color at 200^{0}C, yellowish brown at 210^{0}C and brown color at 220^{0}C.

Table 5. Effect of ingredients and temperature on the color of pizza bread

Baking temperature	Color of pizza bread from		
	Wheat flour	Corn flour	Potato mash
200^{0}C	Light brown	Light color	Light yellow
210^{0}C	Light brown	Brown	Yellowish brown
220^{0}C	Brown	Deep brown	Brown

Effect of ingredients on the sensory quality of pizza

The color, flavor, texture and overall acceptability of pizzas made from different formulations were evaluated by 10 panel judges. Sample No. 1 was made from wheat flour at 210°C for 20 minutes. Sample No. 2 was prepared from corn flour and wheat flour at 210°C for 20 minutes and sample No. 3 was made from potato mash with wheat flour at 210°C for 20 minutes. The means score for color, flavor, texture and overall acceptability of different samples are presented in Table 6.

Table 6. Means of sensory evaluation of pizza

	Sensory attribute			
Sample No.	Color	Flavor	Texture	Overall acceptability
1	7.70^a	8.70^a	8.60^a	8.0^a
2	7.10^{ab}	7.50^b	7.80^b	7.4^{ab}
3	6.70^b	6.60^c	6.50^c	6.90^b
LSD ($p<0.05$)	0.6204	0.4316	0.4160	0.8066

The means with the same subscripts within a column are not significantly different at $p<0.05$

Sample 1: Baking of wheat flour pizza bread at 210^{O}C for 20 minutes;

Sample 2: Baking of corn flour and wheat flour pizza bread at 210^{O}C for 20 minutes; and

Sample 3: Baking of potato mash and wheat flour pizza bread at 210^{O}C for 20 minutes

A two way analysis of variance (ANOVA) on sensory qualities of pizza revealed that the score of color, texture, flavor and overall acceptability were significantly different at $p<0.05$.

In case of color preference among the samples, a two way analysis of variance (ANOVA) showed that there was significant difference in color ($p<0.05$), since, the calculated F (5.1045) was greater than the tabulated value of F (3.55). The results show that sample 1 and sample 2 have higher color score than those of sample 3.

In case of flavor preference among the samples, a two way analysis of variance (ANOVA) showed that there was significant difference in flavor ($p<0.05$), since, the calculated F (52.5789) was greater than the tabulated value of F (3.55). The results show that sample 1 has higher flavor score than those of sample 2 and sample 3.

In case of texture preference among the samples, a two way analysis of variance (ANOVA) showed that there was significant difference in texture ($p<0.05$), since, the calculated F (57.2264) was greater than the tabulated value of F (3.55). The results show that sample 1 has higher texture score than those of sample 2 and sample 3.

In case of overall acceptability preference among the samples, a two way analysis of variance (ANOVA) showed that there was significant difference in overall acceptability ($p<0.05$), since, the calculated F (4.1156) was greater than the tabulated value of F (3.55). The results showed that sample 1 has higher overall acceptability score than those of sample 2 and sample 3.

Sample 1 had greater proportion of wheat flour than those in sample 2 and sample 3. Wheat flour contains gluten which is mainly responsible for the baking quality of pizza. As gluten content in sample 1 was more than those in sample 2 and sample 3, sample 1 showed the higher overall acceptability score.

Summary and Conclusion

The purpose of the study was to prepare pizza from locally available raw materials such as wheat flour, corn flour and potato mash and to develop a standard methodology for production of pizza. To make pizza using wheat flour, corn flour plus wheat flour with dry gluten and wheat flour with potato mash, the procedures were the same. The samples of pizzas produced from different raw materials were subjected to sensory evaluation. A statistical analysis on scores given by the panelists on the sensory properties of various samples showed the

color, flavor, texture and overall acceptability have significant differences. The sensory evaluation revealed that the color of pizza of sample 1 (pizza made from wheat flour) was more acceptable than sample 2 (pizza made from corn flour) and sample 3 (pizza made from wheat flour and potato mash). The statistical analysis revealed that the flavor of pizza of sample 1, 2 and 3 were not equally acceptable because there was significant difference among the samples. In case of texture of different types of pizza, sample 1 was more acceptable than sample 2 and 3. In case of overall acceptability of different pizzas, pizza made from wheat flour was more acceptable than the other two.

This study has demonstrated that pizza made from wheat flour and corn flour was more acceptable than pizza made from wheat flour plus potato mash. Higher incomes and more active life style in recent years in Bangladesh have resulted in consumer in seeking low cost, but high quality convenience foods in the market. The pizza made from corn flour may help to fulfill the needs of consumers for this very popular fast food item in the country.

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