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DEVELOPMENT OF TECHNIQUE AND FORMULATION FOR ROTI PRODUCTION ON AUTOMATIC PLANTS

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ABSTRACT

Roti was prepared from flour of 90% extraction which contained 12.6% protein and 1.2% ash. Farinographic curve revealed that water absorption of flour was 65.5% and dough development time was 9.5 minutes (min.) Addition of 1% or 2% common salt increased the water absorption to 69% and dough development time to 10 min. and 12 5 min., respectively. The dough containing 0.175% yeast and 0.25% baking soda was subjected to fermentation for 45 min. at 30°C and relative humidity (RH) 75%. After flattening, dough was subjected to second proofing at 35°C and RH 90% for 10 min. and then baked. The quality of roti was judged after production at intervals of 4,12,20,24 and 32 hours for appearance, breakability, sponginess, foldingability, softness, and taste and flavour. Roti was more elastic and soft when fresh and remained soft and showed less breakability after 24 hours of storage in polyethylene bags.

INTRODUCTION

Roti or chapati (flat bread) is the principal part of daily diet of the people in Pakistan. This product is prepared from coarsely ground wheat flour which is locally called "atta". Chapaties are generally baked at home by female members of the family. Tanoori roti is the commercial bread which is baked mostly in country restaurants. The method for the preparation of roti is not satisfactory and hygienic. In order to overcome this problem, the Government of Pakistan had installed automatic Roti Plants in 1974 in seven big cities. In these plants, rotis ore being prepared from yeast fermented dough and baked in ovens heated by means of natural gas. Unfortunately, the product being marketed by these plants does not possess desirable characteristics. The storage life of this roti is 8 to 12 hours, and the product lacks flavour, elasticity

and freshness.

It was reported that keeping quality of bread was enhanced by the addition of 2 g calcium propionate per kg of flour and could be kept for 6 days at 18 to 20°C (Stasewsks and Janika, 1976). The chapaties could be preserved for more than 6 months by incorporating citric acid, sugar, common salt and sorbic acid and subsequently packaging them in moisture proof packs (Arya *et al.*, 1977). The addition of salt upto 3% affected the rheology of wheat flour dough at 30°C (Nasif *et al.*, 1980). It was also observed that small amount of yeast present in the starter was considered responsible for leavening action of the dough (Azar *et al* , 1977). Chen (1979) recommended baking soda as a leavening agent in dough. Keeping in view the importance of chapati in our diets, the present study was planned to develop formulations and techniques to improve the quality of rotis prepared by the Roti Plants to make this industry viable and profitable.

MATERIALS AND METHODS

The materials such as flour, yeast, sugar, salt, ghee, mould inhibitor and sodium bicarbonate were collected from Roti Corporation of Pakistan Limited (RCP), Faisalabad. The samples of flour were analysed for moisture, crude protein and ash contents according to the methods of A.A.C.C. (1976). Physical characteristics of flour were determined by subjecting the samples to farinograph according to A.A.C.C. (1976).

Baking test: The rotis were prepared by different formulae and procedures in Roti Plant, Faisalabad. The details of which are given in the following table:

Ingredients	Formula in practice at RCP (%)	Modified formula (%)
Atta	100.000	100.000
Yeast	0.200	0.175
Sugar	0.250	0.150
Salt	2.000	1.000
Ghee	1.000	1.000
Baking soda	Nil	0.250
Mould inhibitor	0.050	0.100
Water	According to hydration capacity of atta	

2) PROCEDURES FOR PREPARATION OF ROTIS:

PROCEDURE No. 1

Mixing and fermentation: All the ingredients were mixed in a single step by automatic mixer at two speeds i.e., slow speed (98 rpm) for 7 min. and fast speed (392 rpm) for 4 min. and allowed to ferment for one hour at 30°C.

Cutting, moulding & proofing: After fermentation, the cutting of dough into dough balls of 110 g weight was done by automatic moulder and cutter and then proofed for 15 min. in a proofing chamber at 35°C and 85% RH.

Sheeting: After proofing, the dough balls were flattened into rotis of 8½ inches diameter by sheeters.

Baking: The rotis were baked on moving iron belt, heated by gas burners from upper and lower sides in a tunnel type oven. The temperatures of the oven were 204.4°C, 315.5°C and 426.6°C at the start, middle, and end respectively. The baking time was 80 seconds.

Cooling and packing: The rotis were cooled to 32.2°C and 5 rotis were packed in a single pouch of polyethylene and stored at 29.4°C

PROCEDURE No. 2

It was primarily the same as reported above except the following modified steps:

Mixing: It was carried out into two steps.

a) All the ingredients were mixed for 5 min. at slow speed andfor 2 min. at fast speed and allowed to rest for 15 min. at 30C.

b) The dough was mixed again for 4 min. at fast speed and allowed to ferment for 45 min. at 30°C and 75% RH.

Second proofing: The flattend and rounded rotis were proofed for 10 min. at 32.2°C and 90% RH and then baked as mentioned in procedure 1.

Organoleptic evaluation: The rotis were evaluated organoleptically by a panel of nine judges after 4,12,20,24 and 32 hours of storage for appearance, breakability, sponginess, foldingability, softness, taste and flavour (Larmond, 1977).

Statistical analysis : The data were subjected to statistical analysis by using

randomized block design and comparison of means was done by using least significant difference test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

The flour used in this study had an extraction rate of 90% which was analysed for moisture, protein and ash contents. The results revealed that mean moisture, protein and ash were 14.0, 12.6 and 1.2% respectively. The quality of flour is considered to be one of the most important factors affecting the finished quality of bread (Kasper, 1981).

Farinograph interpretation: The data obtained by Farinograph are shown in Table 1. It was revealed that water absorption of flour increased from 65.50 to 69.0% with 1 or 2% addition of common salt. The findings are in accordance with the results obtained by Guy *et al.* (1967). The arrival time of sample treated with 2% salt was found to be 9.5 min. which was higher than the

Table 1. *Effect of salt on farinographic characteristics of atta*

Salt added (%)	Water absorption (%)	Dough development time (min.)	Arrival time (min.)	Departure time (min.)	Tolerance index (B.U.)
0 Control	65.50	9.50	5.50	13.00	75
1	69.00	10.00	7.50	13.00	85
2	69.00	2.50	9.50	16.50	75

B.U. = Brabender Units.

sample treated with 1% salt. An increasing trand in dough develpment time and departure time was observed with the increase in salt quantity. The tolerance index of sample containing 1% salt was found to be maximum (85 B.U.).

Organoleptic evaluation: The rotis prepared by Roti corporation of Pakistan have a relatively short storage life of 12 hours after which the product begins to harden and suffers from lack of foldingability, breaks easily and is thus considered by the consumers as stale. In this study the rotis were prepared at the Roti Plant, Faisalabad, early in the morning and were packed in polyethylene bags soon after production, cooling them down to room temperature. The quality of roti was judged after production at 4,12,20,24 and 32 hour intervals.

Table 2. *Effect of storage on organoleptic characteristics of roti*

Storage period	Appearance Treatments				Breakability Treatments				Sponginess Treatments				Foldingability Treatments				Softness Treatments				Teste & flavour Treatments			
(hours)	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
4	8.0	7.5	7.6	8.5	4.9	7.4	8.4	8.5	4.2	6.9	7.3	9.2	5.8	7.0	6.8	9.0	9.0	9.5	9.1	10.4	5.1	8.3	8.2	8.8
12	5.4	7.6	7.6	8.7	4.5	7.2	7.4	8.8	3.7	6.7	7.1	9.0	5.0	6.8	6.7	9.2	5.0	8.2	8.4	9.5	5.0	8.2	8.0	8.6
20	5.5	7.4	7.6	8.5	4.5	6.7	7.2	7.6	3.1	6.6	7.0	8.9	4.6	6.8	6.8	9.0	4.4	6.8	6.6	9.6	5.0	8.2	7.8	8.6
24	5.4	7.5	7.5	8.5	4.0	6.6	7.0	7.1	3.5	6.6	7.0	8.4	3.1	6.3	6.6	8.6	2.7	6.5	6.0	9.0	4.5	8.0	7.6	7.9
32	5.3	7.3	7.3	8.5	4.0	6.3	6.2	7.5	2.9	6.2	6.0	8.4	2.7	5.0	6.1	8.0	2.1	6.5	5.9	7.0	4.5	7.9	7.6	8.0
LSD	1.2				0.5				1.1				0.97				1.8				0.88			

1. For organoleptic evaluation, maximum score for best quality was 10 points.

T1 : Rori prrpared by formula No. 1 and procedure No. 1.

T2 : Roti prepared by formula No. 1. and prodedure No. 2.

T3 : Roti prepared by formula No. 2 and procedure No. 1.

T4 : Roti prepared by formula No. 2 and procedure No. 2.

a) *Appearance*: It is evident from the data that the appearance of roti deteriorated with the passage of storage time in all the treatments. The appearance was maintained to a great extent in case of T4 when the roti was preparedaccording to the modified formula and procedure. The appearance was good in case of T1. The behaviour of T2 and T3 was somewhat similar. The product of modified formula and procedure differed significantly as compared to other treatments ($P<0.01$).

b) *Breakability*: T1 got minimum mean score whereas T4 got maximum mean score. The score decreased with an increase of storage time. There was more increase in breakability in T1 while it was the least in case of T4. The trend of increased breakability in case of T2 and T3 was similar. The results of the analysis of variance showed that T4 differed significantly as compared to others ($P<0.01$).

c) *Sponginess*: The mean score for sponginess of roti ranged between 4.2 to 9.2, 3.7, to 9.0, 3.5 to 8.9, 3.1 to 8.4 and 2.9 to 8.4 during storage of 4,12, 20,24 and 32 hours, respectively, depending on the treatments employed. T1 got minimum score whereas T4 got maximum score. There was a decrease in sponginess as the storage time increased. This decrease in sponginess was minimum in case of T4. When the data were analysed statistically, T4 differed significantly as compared to others ($P<0.01$).

d) *Foldingability*: The foldingability decreased as the storage time increased in case of all treatments. T1 got minimum score whereas T4 got the maximum score. The foldingability was poor in case of T1, the best in case of T4, while T2 and T3 were intermediate in this respect. T4 differed significantly as compared to all other treatments.

e) *Softness*: The softness of roti was judged best at 4 hours storage in case of all treatments. However, the softness decreased rapidly in case of T2 and T3. The product of T4 maintained the original softness upto 24 hours. T1 resulted in minimum score while T4 got the maximum.

f) *Taste and flavour*: It was observed from the data that the taste and flavour were adversely affected in case of T1 at 4 hours storage. The decrease in taste and flavour was not observed further in this treatment during storage. The products of T2, T3 and T4 got maximum score and there was a small decrease in

score for taste and flavour during storage with these treatments, however, T4 got maximum score. The differences of T2, T3 and T4 were non-significant.

It is clear from the data that the appearance, breakability, sponginess, foldingability and taste and flavour of rotis prepared by new formulation and procedure (T4) were superior to control (T1). It was thus concluded that the roti prepared with the addition of sodium bicarbonate, common salt, mould inhibitors and by adopting double dough maximum method, second proofing after sheeting and then baking, gave a superior product with long shelf life. These findings were almost similar to those of Stasewska and Janika (1976) and Chen (1979).

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