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# Effect of Wheat ARF Treatment on the Baking Quality of Whole Wheat Flours of the Selected Varieties of Wheat

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**ABSTRACT**

The present study was conducted to see the effect of Wheat Amylase Rich Food (ARF) on the baking quality of whole wheat flours of selected three varieties i.e. vw-120, J-24 and Bhalia of wheat. The specific objectives were to study the physico-chemical properties of selected whole wheat flours, standardization of whole wheat flour bread (control) and to incorporate ARF at 1%, 2% and 3% levels in whole wheat flours to see its effect on dough and bread and carrying out acceptability trials of the final product using sensory evaluation. The physico-chemical assessment of breads prepared with different additions of ARF revealed a significant increase in loaf volume as compared to their controls. Maximum increase was recorded with 3% ARF addition in J-24. Product developed with 1% addition of ARF was rated as most acceptable and 3% as least acceptable in terms of various sensory attributes. Among all,Bhalia variety treated with 1% ARF scored maximum (93%) comparable to standard (94%). Thus wheat ARF could play an important role as an additive to improve the overall bread making properties of whole wheat flours pre-dominantly the loaf volume at 1% level.

## INTRODUCTION

In India, about 80% of wheat consumption is in the form of chapatti and its culinary variations such as Tandoori, Roti, Nan, Paratha and Puri. However its preparation is time consuming and involves lot of attention prior to serving. Moreover it has poor shelf life (Syed *et al.*, 1991) and its preparation is also inconvenient for joint families and institutional feeding.

One of the widely used form in which it is widely consumed all over the world is bread. Bread occupies a unique position both in production and utilization as compared to other bakery products in baking industry. Process of bread making is less tedious, less time consuming and does not demand any last minute attention prior to serving. Bread made from refined wheat flour i.e. Commercial refined wheat flour is consumed all over the world but since it is poor in fibre content, it causes health problem if consumed frequently. Another important form in which it is consumed is bread made from whole wheat flour i.e. Brown Bread. Since whole wheat flour contains bran rich in fibre and whole grain constituents are present in whole wheat flour, brown bread is beneficial to consume from health point of view (Bennion *et al*., 1939). But with whole wheat flour it is not possible to attain good volume and appearance, this being an important property of a loaf that attracts consumer. This is because of glutathione which is present in whole wheat flour; brown bread does not give good volume as compared to white bread made from refined wheat flour (Griswold,1962). Therefore treatment to improve nutritive quality of whole wheat flour bread becomes important.

Malting or germination of barley or wheat grain has been considered to improve the nutritive quality of brown bread (Kent Jones and Amos, 1967). Malting consists of the steeping and germination of barley or wheat grain employing 48-60 hours and then germinating it for 2-4 days, resulting in the production of diastases that readily break down starch. The process is arrested by mild roasting of the dried germinated grains and the product is called malt. It is rich in alpha-amylase activity and therefore use of cereal malt flour as one of the additives in bread recipes was suggested to improve baking quality of these flours (Bains *et al*., 1975). Most of the studies done in India are to improve baking quality of refined wheat flour or its blend with whole wheat flour. Recently the consumer's awareness regarding high quality and healthy foods called functional foods are increasing.

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Therefore the trend is to produce special breads made from whole grain flour and other functional ingredients known as health breads (Dewettinck*et al*,2008).

Taking into consideration the prevailing practice, consumer trend, nutritional superiority of whole wheat flour over refined wheat flour, its large consumption, easy availability in the local market, it was considered worthwhile to study the effect of Wheat Amylase Rich Food (ARF) treatment on the baking quality of the whole wheat flours of some of the selected varieties of wheat.

## METHODS AND MATERIALS

### Site of Sample Selection

Agricultural University, Anand, Gujarat

### Site of Study

Baroda

### Sample Size

Out of the most commonly consumed wheat varieties in Baroda, three varieties of wheat grains namely Bhalia, J-24 and vw-120were selected.

### Sample Preparation

The selected samples of wheat grain were milled in Baby Prince Mill available in Food and Nutrition Laboratory in batches of two kilograms each at a fixed degree of fineness to pass through 40 mesh sieve (0.08mm sieve opening).

### Phase-I Determination OfPhysico-Chemical Properties Of Wheat Flours

#### *Moisture content of these flours*

It was determined as described by Wheat Commission (1960). First, the crucibles were cleaned with chromic acid washed and dried in an oven at 70-80$^{o}$C for one hour. After cooling indesiccators, crucibles were weighed. Then the crucibles were weighed with 5 grams of sample and placed in an oven maintained at 100$^{o}$C for five hours with the lid removed. Then the crucibles were cooled with the lid replaced indesiccators to room temperature. The crucibles were then weighed and the process was repeated till two consecutive weights were obtained.

#### *Determination of the gluten content of wheat flours*

It was done using Kent-Jones and Amos (1967) method. Protein content of the flour is a factor determining its baking quality which is reflected in the amount of gluten that can be formed when the flour is mixed with water 20g of the flour was made into a normal dough with the requisite amount of water (10-12ml usually) with a spatula. Dough was allowed to stand in a bowl of water for one hour at room temperature. It was then kneaded with hands under a gentle stream of tap water about 250ml per minute. During washing, a stretched piece of silk was kept under dough which allowed the starch to pass through but retained small piece of gluten which break off in washing. Such pieces were collected and added to the gluten in the final stage of washing. Dough was washed for 10 minutes and allowed to dry in petridish on an aluminium foil in an oven at 100$^{o}$C for 24 hours. Dry gluten was calculated.

#### *Determination of Diastatic activity of flour*:

Blish and Sandstedt Method was followed as given by Kent-Jones and Amos (1967). A group of enzymes known as diastases are able to convert some the starch essentially the damaged starch into sugars and so enable suitable gas to be generated for the aeration at the critical period of fermentation. Thus they build up a reserve supply of sugars for the yeast to ferment 5 grams of flour+ 46ml of buffer solution incubated at 30$^{o}$C for one hour was followed by addition of 2ml sodium tungstate solution as described in the method. The result is expressed in milligrams of maltose present in 10 grams of flour.

#### *Determination of damaged starch content of the flours*

It was carried out using Farrand E A (1964) method: Susceptibility of a given starch to diastasis is not solely an inherent characteristic of the starch but partly due to the extent to which it has been mechanically damaged during milling process. Damaged starch is measured in arbitrary units as a percentage of total starch by incubating flour with alpha amylase extract for one hour at 30$^{o}$C and titrating with sodium thiosulphate to neutralize the blue colour developed by addition of starch solution.

### Phase-Ii Standardization of The Standard Bread (Refined Wheat Flour) And Control Bread (Whole Wheat Flour)

Bread made from refined wheat flour was considered as standard bread. It was made using Straight dough method of Bennion (1939). After the standardization of standard bread, the next step was to prepare and standardize control bread-whole wheat flour bread using Straight dough method of Bennion (1939). In this method, wholewheat flour (350g), fresh yeast (14g), sugar (14g), salt (7g), hydrogenated fat (7g), scalded milk (70g) are the ingredients used for making brown bread. After activating yeast in lukewarm water (100ml) for about 15 minutes, all the ingredients were added to it. Dough was kneaded. It was then kept for proofing or ripening for one hour. Thereafter it was punched and knocked back with the fist. It was again allowed to rise for one hour under similar conditions. It was rolled to form a rectangle or cylinder and kept in baking pan for proofing for half an hour before baking. The moulded dough was kept in preheated oven at 180$^{o}$C. The bread was baked for half an hour at 180$^{o}$C. The bread was allowed to cool on wire racks. It was then wrapped in polythene sheet and stored at room temperature.

### Preparation of Amylase Rich Food (ARF):

Germinated wheat flours, rich in alpha amylases-ARF prepared by using simple household technology have been developed in the Department of Foods and Nutrition, M.S.U., Baroda-Gopaldas et al (1988) Steps are as under:

Steeping- The cleaned wheat grains were soaked in triple volume of water for 12 hours.

Germination- The steeped grains after draining excess water were spread on wet muslin cloth and were germinated for 48 hours. During this period little water was sprinkled to keep the cloth surface wet.

Drying- The germinated grains were spread on filter paper and dried in an oven at 50$^{o}$C till brittle.

Milling- Sprouts were removed from the grains by hand abrasion followed by sieving the grains. Such grains were ground to a fine powder.ARF thus prepared was packed in polythene bag, heat sealed and stored in refrigerator.

**Standardization of the experimental breads:**

As per the given recipe of control bread, experimental breads were prepared by adding ARF at 1%, 2%, 3% levels. During the preparation of control and experimental breads, dough characteristics were recorded.

**Phase-Iii To Estimate Physico-Chemical Properties Of The Baked Product**:

***Measurement of weight:***

It was taken 12 hours next day. Weights were taken on a two pan balance using fraction of weight varying from one gram to five hundred grams.

***Measurement of the loaf volume***

It was carried out using Rape Seed Displacement Method of Griswold (1962). Volume of the empty container was found out by pouring rape seed into it and measuring volume of those seeds using graduated cylinder. Then the bread was placed into that container after removing seeds from it and again pouring the seeds to it until the container overflowed. The level of the seeds was done by passing a ruler across the top of the container. Then the volume of the seeds was measured. The difference in both the volumes gave the volume of the bread.

***pH of the bread***

It was done using Kent-Jones and Amos (1967) method.20 grams of the bread crumb was weighed and put into the beaker containing 100ml of distilled water. It was mixed thoroughly and after 45 minutes, supernatant was taken and pH was directly read from the digital pH metre.

***Moisture content in bread***

Various slices of 0.5cm thickness were weighed initially and then weighed again after drying in an oven in petrifies at 100$^{o}$C for 24 hours and cooling them at room temperature.

***Acceptability Trials of the baked products***

Sensory evaluation of the final products was undertaken to assess quality of product's volume, colour, crust, size of the cells , uniformity of grains , crumb , moistness of crumb, flavour etc. using a score card and score sheet followed by Hunter M B (1950). Ten trained panel members were selected on the basis of thresh- hold test and were asked to evaluate experimental product in comparison to control bread. Standard bread was always prepared and given along. Sensory evaluation of bread was carried out by a panel of trained judges for external characteristics i.e. volume, colour of crust, symmetry of form and other internal characteristics i.e. grain, colour of crumb, aroma, taste, texture, using a scoreboard card with numerical numbers. A score sheet followed by Hunter M B (1950) with descriptive adjectives was used.

**Statistical Analysis**

The data were statistically analysed using ANOVA. The least significant difference (LSDo.o5) was used to test the effect of treatments. Analysis of variance, 2 ways classification and F test was statically calculated to see significant difference in the products prepared by addition of A.R.F.

**RESULTS AND DISCUSSION**

The physico-chemical properties of the selected flours have been discussed in Table 1.The moisture content of the flours ranged from 8-10% which also goes with the result of Austin, 1971 who studied different varieties of wheat. Highest moisture and gluten content was reported for variety J-24 i.e. 10.2% and 20.6% respectively. Diastatic activity and damaged starch content proportionately co-relate with each other and were found to be highest among the whole wheat flours, Bhalia2.3% and 33.46% respectively. These results are supported by the findings of Shurpalekar *et al.*,1976. As reported by Farrand, 1964 the damaged starch content of most bread flours were found between 15 to 30%. The moisture content of ARF was 9.8%. This value is similar to the value reported by Gopaldas *et al*., 1988 for wheat ARF. The diastatic activity of ARF was found to be 5.9%. The result is supported by the findings of Leelavathi *et al.*,1990 in which diastatic activity of ARF was found to be 3.4% to 9.67% in the germinated wheat flour (48 hours germination).

Dough making is an important step in bread making. In Phase-II, the dough characteristics like hydration capacity and amount of water required for dough development were recorded. The hydration capacity of the selected flours ranged from 67.14 to 74.28% (Table 2).

All control flours recorded higher water absorption than the experimental flours treated with ARF. Highest water absorption was noticed for Bhalia flour (74.28%) followed by vw-120 (72.85%) and J-24 (71.84%) wheat flours. Decrease in hydration capacity was recorded with increase in ARF levels in all the selected varieties. Bailey and Singh, 1940 had reported high water absorption value of Indian wheat flours to high damaged starch. Similar observations have been reported by Shurpalekar, 1976; D' Appolonia and Ciacco, 1982; Singh *et al.,* 1987. Hence it can be inferred that addition of germinated flour at 1-3% might have resulted in marginal reduction in water absorption capacity. In comparison to all WWF, hydration capacity of CRWF was lowest i.e.62.85%. It is due the higher water capacity of bran present in WWF as expressed by Rao and Rao, 1991. During fermentation for two hours, dough handling properties were recorded for sensory characteristics. It was interesting to note that addition of ARF at 3% level made the dough sticky in all the three varieties of wheat flours and dough handling properties were impaired.

Dough was found to be sticky and runny. Addition of ARF changed a part of gluten is changed from an insoluble condition to a soluble condition by its proteolytic activity. This change brought a difference in the feel of the dough. Too much softening of gluten caused the dough to become sticky and runny. Bennion, 1939 enlisted some of the causes of sticky and runny dough and pointed out that excessive malt makes the dough sticky and runny. As the supplementation of ARF increased from 1% to 3%, colour of the dough changed from cream to pale yellow, smoothness and softening increased and stickiness was felt at 3%. Cracks were seen at the upper surface of the dough due to too much ripening of the gluten and hence stretching of the gluten strands.

Table 3 discusses the observations in the weight. Dough weights gradually decreased during subsequent stages of fermentation. Highest reduction in weights took place in all the doughs treated with 3% ARF as compared to other experimental and control doughs. During fermentation, enzymes of the yeast act on starch and sugar to form $CO_2$ gas. The evolution of this gas causes the dough to rise and conditions the dough, making it lighter and more extensible. Supplementation of ARF at different levels might have resulted into production of large amount of maltose, produced by degradation of damaged starch, a substrate for amylase action according to Kent-Jones and Amos, 1967.

The pH of the doughsbeing preparedwere recorded (Table 4). Marginal decrease in pH of the dough with increased ARF treatment was noticed. This is also reflected in the increased weight loss of doughs treated with 3% ARF which might be due to increased alcoholic fermentation of yeast leading to decrease in pH. The physico-chemical properties of the experimental products are discussed under following sub-headings: loaf volume, moisture content of baked products and pH.

## Loaf Volume

The recorded data of the control and experimental bread with reference to volume, mass etc. is summarized in Table5. A rise in volume of loaf was recorded in all the breads prepared from whole wheat flours treated with ARF at all the levels. Highest volume increase was recorded for J-24 wheat flour bread prepared by adding ARF at 3% levels. Kaur and Bains, 1976 observed an increase in loaf volume from 525ml to 610ml by addition of wheat malt to the level of 11.1SKB/100g flour equivalents of the supplements. Addition of 3% ARF led to excessive amylase activity which caused hydrolysis of soluble starch. Also, increased proteolytic activity of ARF led to excessive softening of the gluten which caused changes in the colloidal properties of protein deterioration of gluten quality leading to escape of gas during baking, therefore loss of shape and weight occurred due to decrease in viscosity. Statistical analysis of the loaf volume data is given in Table6. Analysis indicates insignificant difference in the volume of the breads prepared by the additions of ARF at 1%, 2% and 3% levels and as well as in breads prepared without ARF treatments (controls). Analysis of variance, 2-way classification also indicated insignificant difference in the volume of the breads prepared from different varieties of wheat flour.

**Table. 1:** Physico-chemical properties of the flours.

| Sr. No. | Varieties of wheat flour | Moisture (%) | Dry Gluten content (%)* | Diastatic Activity (%) * | Damaged Starch (%) * |
|---|---|---|---|---|---|
| 1. | CRWF | 8.69 | 16.42 | 2.5 | 13.47 |
| 2. | VW-120 | 9.31 | 19.2 | 2.0 | 28.44 |
| 3. | J-24 | 10.2 | 20.60 | 1.7 | 25.01 |
| 4. | BHALIA | 9.47 | 19.33 | 2.3 | 33.46 |
| 5. | ARF | 9.8 | 13.85 | 5.9 | 98.4 |

***Note: All values are calculated on % dry matter basis**

**Table. 2:** Effect of ARF on dough properties.

| Variety of wheat flour | Levels of ARF (%) | Hydration Capacity (%) | Dough Handling Property | | | Colour | | Nature of Dough |
|---|---|---|---|---|---|---|---|---|
| | | | Initial stage | Knock-back stage | Moulding stage | Flour | Dough | |
| Commercial refined wheat flour | - | 62.85 | N | N | N | W | W | S |
| VW-120 | - | 72.85 | N | N | N | C | C | P |
| | 1 | 68.57 | N | N | N | C | C | P |
| | 2 | 67.14 | N | N | S | C | C | P |
| | 3 | 66.10 | S* | S* | S* | DW | LY | S* |
| J-24 | - | 71.42 | N | N | N | C | C | P |
| | 1 | 68.57 | N | N | N | C | C | P |
| | 2 | 67.14 | N | N | N | DW | C | P |
| | 3 | 66.0 | S* | S* | S* | C | LY | S* |
| BHALIA | - | 74.20 | N | N | N | C | C | P |
| | 1 | 72.85 | N | N | N | C | C | P |
| | 2 | 71.42 | N | N | LP | C | C | P |
| | 3 | 68.57 | S* | S* | S* | C | LY | S* |

***Note:** W - White, S - Strong- liquid needed to form dough of desired consistency, DW - Dull White, C -Creamish, P – Pliable, N – Normal, Y – Yellow, E-Elastic, LR - Light Red, LP - Less Pliable, S*- Sticky

**Table. 3:** Effect of ARF on dough'sweigh during fermentation period.

| Sr. No. | Variety of wheat flour | ARF levels (%) | Loss in wt. of dough at 1 hr. of fermentation (%) | Loss in wt. of dough at 2 hr. of fermentation (%) |
|---|---|---|---|---|
| 1. | CRWF | 0 | 0.51 | 1.22 |
| 2. | VW-120 | 0 | 0.38 | 1.19 |
| | | 1 | 1.17 | 1.60 |
| | | 2 | 1.20 | 1.17 |
| | | 3 | 1.55 | 2.06 |
| 3. | J-24 | 0 | 0.59 | 1.30 |
| | | 1 | 1.09 | 1.34 |
| | | 2 | 1.53 | 1.69 |
| | | 3 | 1.54 | 2.03 |
| 4. | BHALIA | 0 | 0.56 | 1.36 |
| | | 1 | 0.73 | 1.54 |
| | | 2 | 0.89 | 1.87 |
| | | 3 | 1.62 | 2.04 |

**Table. 4:** pH of the doughs before baking and of the final products after baking.

| Sr. No. | Variety of Wheat flour | Levels of ARF (%) | pH before baking | pH after baking |
|---|---|---|---|---|
| 1. | CRWF | - | 5.33 | 5.75 |
| 2 | VW-120 | 0 | 5.46 | 6.15 |
| | | 1 | 5.34 | 6.01 |
| | | 2 | 5.33 | 5.94 |
| | | 3 | 5.05 | 5.89 |
| 3. | J-24 | 0 | 5.72 | 5.99 |
| | | 1 | 5.70 | 5.89 |
| | | 2 | 5.51 | 5.85 |
| | | 3 | 5.40 | 5.83 |
| 4. | BHALIA | 0 | 5.63 | 6.10 |
| | | 1 | 5.62 | 6.01 |
| | | 2 | 5.54 | 5.94 |
| | | 3 | 5.41 | 5.85 |

**Table. 5:** Weight and Volume of the final products.

| Sr. No. | Variety of wheat flour | Levels of ARF (%) | Loaf Weight (g.) | Loaf Volume (ml.) | Density (g/ml) | Specific Volume (ml. / g) |
|---|---|---|---|---|---|---|
| 1. | CRWF | - | 510 | 1806 | 0.282 | 3.541 |
| 2. | VW-120 | 0 | 530 | 1404 | 0.376 | 2.656 |
| | | 1 | 518.5 | 1484 | 0.349 | 2.862 |
| | | 2 | 515.5 | 1492 | 0.345 | 2.894 |
| | | 3 | 513.9 | 1500 | 0.342 | 2.918 |
| 3. | J-24 | 0 | 527 | 1274 | 0.413 | 2.417 |
| | | 1 | 524.5 | 1424 | 0.368 | 2.714 |
| | | 2 | 521.5 | 1544 | 0.337 | 2.960 |
| | | 3 | 510.5 | 1548 | 0.329 | 3.032 |
| 4. | BHALIA | 0 | 547 | 1358 | 0.40 | 2.48 |
| | | 1 | 540 | 1480 | 0.364 | 2.74 |
| | | 2 | 530 | 1485 | 0.356 | 2.80 |
| | | 3 | 520 | 1534 | 0.338 | 2.95 |

**Table. 6:** Difference in the volume ofthe experimental as well as control breads.

| Sr. No. | Sources of Variation | Sum of Squares | Degrees of freedom | Mean Square | F Value calculated | F Value Tab |
|---|---|---|---|---|---|---|
| 1. | Between control and(diff. ARF levels) | 121.69 | 3 | 40.56 | 11.14 | 4.76* |
| 2. | Between three varieties of wheat flours) | 5.82 | 2 | 2.91 | 0.79NS | 5.14 |
| 3. | Residual | 21.8 | 6 | 3.64 | | |
| | Total | 149.31 | | | | |

*Note: Results indicate significant difference at P=0.05 *, NS - Not significant

## Moisture content of baked breads

Breads which have certain amount of moisture in the finished loaf are palatable and will remain fresh and moist for longer time. Experimental breads prepared by addition of ARF at 1%, 2% and 3% levels showed increase in moisture content in order of increased supplementation of ARF. An inverse relationship was noticed between retention of moisture in the crumb of the loaf and loss of moisture during baking process (Fig. 1A). Moisture content of all the breads varied from 33.3-44% which is in the range as reported by Bennion, 1939 i.e. 35-42%. Kent-Jones and Amos, 1967 opined that flours with excess alpha-amylase activity during baking leave insufficient unconverted starch to bind all the water at the time of gelatinisation. This leads to damp and sticky crumb which was also felt by panellists in 3%treated breads.

## pH of the baked products

Acidity plays an important part in bread making.pHof the finished product is influenced by yeast action as well as the diastatic action. A very narrow range of pH level variations existed in different varieties of wheat, both prior to baking and after baking. The range prior to baking was 5.35 to 5.72 and that of the after baking was 5.85 to 6.15. As the ARF supplementation increased, the pH decreased marginally in all the wheat varieties.

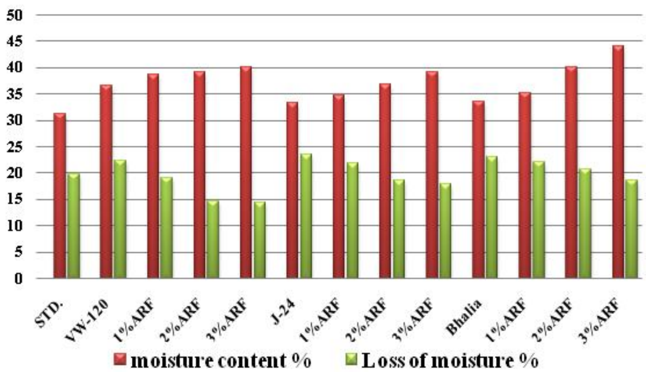



**Fig. 1:** Chart showing moisture content and loss of moisture in breads during baking.

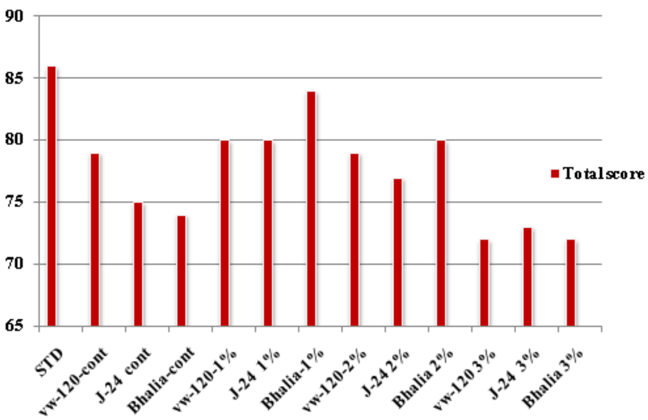
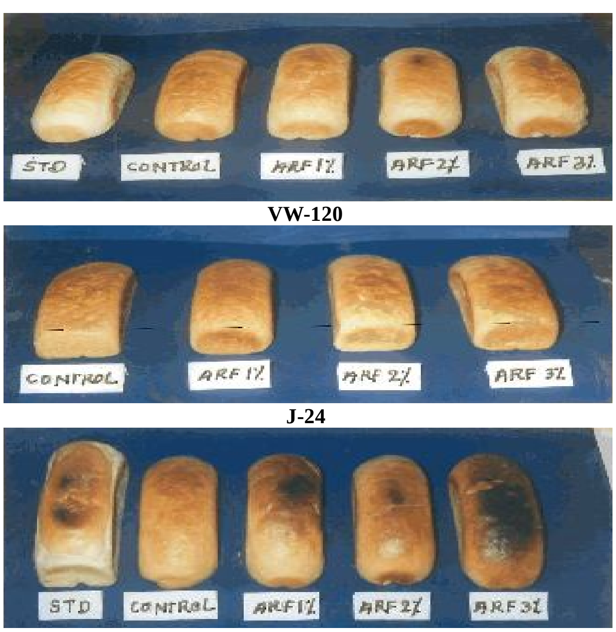



**Fig 2:** Total scores obtained by the experimental breads.




**BHALIA PHOTOGRAPHSSHOWING VOLUME AND CRUST**
**P:2**

**Fig. 3:** Photograph showing Volume and Texture of all the varieties of experimental breads.

**Acceptability Trials**

Sensory evaluations are based on human judgement which is individual and not always consistent. Still these are important because it is they who are going to eat it. Sensory evaluation of the experimental products was carried out on a panel of judges using a score sheet and is summarised in Figure 2. As revealed by the data, the bread made from Bhalia wheat flour with 1% ARF supplementation was rated near to the standard CRWF and showed excellent crumb characteristics. Breads prepared with 3% ARF supplementation had moist andsticky crumb, so got low score and were unacceptable. This is also felt by Kent-Jones and Amos,1967 in breads possessing excessive amylase activity. Total score obtained by Bhalia (1% ARF treatment) was 76 which were highest among the experimental products whereas fall in score was noticed on additional levels of ARF. As the level of ARF increased, the colour of the crust changed from pale to dark brown. There were cracks seen on the crust in the bread with 3% ARF specially Bhalia bread. Too much dialytic activity in 3% ARF addition gave rise to darker crust. Porous open texture was missing in case of 3% ARF addition breads. Results of statistical analysis on the total scores obtained by each product indicated significant difference in the products prepared by the additions of ARF but insignificant difference in the breads prepared from the three varieties of wheat flour.

## CONCLUSION

ARF affected the dough preparation and baking quality, thereby affecting bread quality. The beneficial effect of ARF was seen with the supplementation of ARF at 1% level in all the three varieties of wheat in terms of loaf volume, porosity, loaf structure, moistness, etc. Higher doses of ARF i.e. 2% and 3% created structural weakness in the final product. Excessive amylase affected starch and protein of the flour and impaired the final loaf volume and collapse of shape and made the crumb moist, sticky and soggy. Overall,Bhalia bread with 1% ARF treatment was rated as most acceptable and all the experimental products with 3% as least acceptable by the panel members.

## DECLARATION

This paper was presented as a poster under the theme of New Technologies in food processing and preservation, at the International Conference on Food and Nutrition Technology for Public Health Care ICFNP-2012May 4th-5th2012. Effect of Wheat ARF treatment on the baking quality of whole wheat flours of the selected varieties of wheat by Vanisha S Nambiar, Vinita Nigam, ShashikantaTuteja and Bijoy Kumar Chakravorty and received 2nd prize.

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