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BREAD WITH FLOUR OBTAINED FROM RAW TARO FLOUR AS PARTIAL SUBSTITUTE FOR WHEAT FLOUR : FUNCTIONAL, PHYSICAL , CHEMICAL CHARACTERISTICS AND ACCEPTANCE

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Abstract-

This study investigation shows that taro is good for health, it is a source of energy also it could be utilized day by day. The effects of using taro flour as partial substitution of wheat flour in bread making with substitution levels of 5, 10, 15 and 20% on the produced bread. The preference for taro flour bread decreased refined wheat flour quantity with increasing amount taro in the bread. It give better result along observed that increase amount of taro in bread with substitution levels it effect on functional properties, physical properties, chemical properties & organoleptic evaluation of the blended dough and produced bread. S3 (Taro wheat flour10%) produced similar to the control (wheat flour) in physical and chemical properties, organoleptic properties. The physical properties showed that increasing taro flour with decreasing width, volume, thickness, density and weight also increased. The increase in the taro flour content resulted in the significant increase crude fiber, ash, carbohydrate and also decrease protein and fat content .The effect of various levels of taro flour on sensory attributes of crust colour, taste odour, appearance roundness crumb colour and over all acceptability of bread was found to be non-significant except for roundness which was found to improve with increased level of taro flour inclusion. It can be concluded that the use of upto 10% of taro flour as a substitute for refined flour in bread, although provided changes in physical, chemical characteristics, resulted in products with improve nutritional properties without loss on the acceptance or shelf –life.

Keywords:

Bread, Colocasia esculenta flour, edible, functional properties, physical properties and chemical composition, organoleptic characteristics

Introduction –

Bread is a carbohydrate-rich source of starch and dietary calories, and hence is an important part of a balanced diet. The major or mandatory ingredients in bread making are flour, water, salt, and yeast. However, due to the high cost, geographical scarcity, and high demand of wheat flour, efforts are being directed toward the provision of alternative source of flour. Because of this, cocoyam, cassava, taro, and other root and tubers crops have been found to be

additional ingredients of major raw materials for bread making. Taro (Colocasia esculenta (L.) Schott) is a major tuber crop cultivated in the tropical and subtropical regions of the world. Taro is one of the staple roots and tuber crop grown for various purposes. Taro tubers provide a number of desirable nutritional and health benefits such as anticancer activity, phenolic acid, and phytochemicals. The leaves of taro are consumed as sauces, purees, stews and soups.

Taro roots contain a wealth of organic compounds, minerals, and vitamins that are essential for human health and can benefit our overall health in a number of different ways. It contains significant amount of dietary fiber and carbohydrates, as well as high levels of vitamin A, C, E B6, and foliates, as well as magnesium, iron, zinc, phosphorus potassium, manganese, and copper as trace elements. Taro also provides some protein, but the amount is almost negligible as compared with wheat flour in food production areas [1]. Taro is mainly consumed by athletes for long lasting energy. This is because it contains a low glycaemic index which is good for athletes to reduce fatigue, One cup of taro can give 187 calories energy which may loss body weight Taro fiber gives the feeling of being full for a longer time even after a small meal , increase digestion for clear stomach. Taro roots can give 19% of the daily required Vitamin E that is required to prevent the risk of a heart attacks at is low glycaemic properties and acts as anti aging due to the trace element rich sources[3]. A few varieties of Bangladesh having good amount of vitamin A with poly phenol compounds which are great toxicants to protect even from cancer [2]

A one-cup of taro serving has a third of your daily recommended intake of manganese, which contributes to good metabolism, bone health, and blood clotting. Its high levels of vitamins can also promote healthy vision, skin, circulation, and immune system function [4]. Taro can also be used for entrapment of flavoring compounds [5].

Substitution of taro flour to wheat flour in bread making is an important avenue toward utilization of this crop. Dough properties are important factors influencing the quality of bread made from it. Knowledge of the effect of varying levels of incorporation of taro flour on wheat dough characteristics can thus be used for optimizing replacement of wheat with taro flour without significant modifications of the properties of the dough. The objective of this study was to evaluate the effect of taro flour with blending ratios on the functional, physical chemical attributes and sensory quality of wheat–taro bread. Such information would open up real opportunities for greater use of taro in bread processing.

Materials and Methods

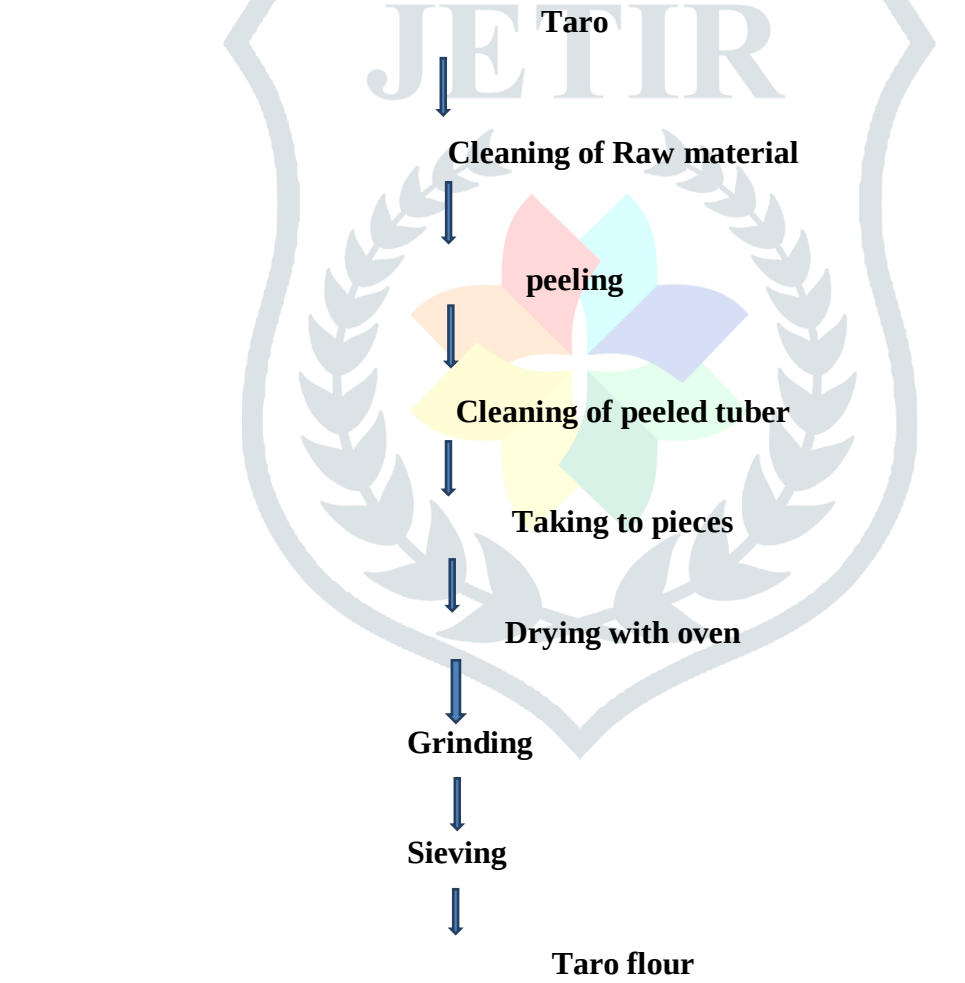
This study was carried out in Department of Food Technology, Institute of Engineering & Technology, Bundelkhand University, Jhansi.

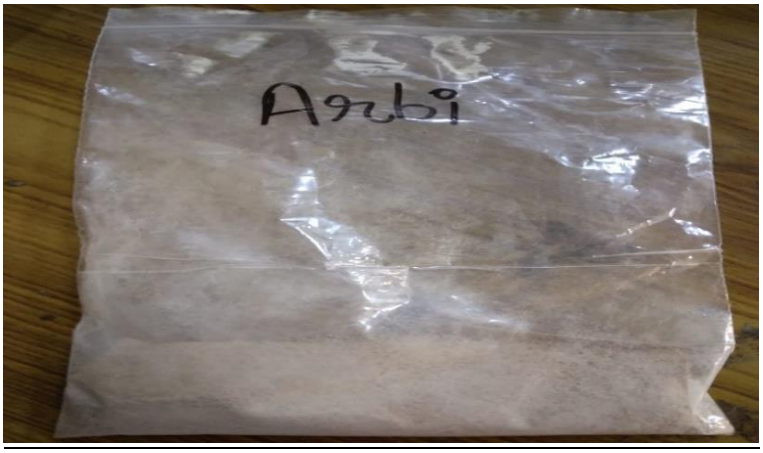
Method

Taro flour /powder

Uniformly mature taro was collected from the local market. Flour of taro (Colocasiaesculenta) was obtained using the conventional dehydration techniques as described by Nip [8]. Taro was cleaned and rinsed with a large amount of tap water, peeled and manually sliced into approximately 2 to 3 cm thick round or cube pieces, which were dried at 45degree Celsius for 24hr in an air dehydrator to ensure a constant weight. On layer of slice was placed on a tray in the dehydrator chamber and a constant flow of hot air was applied. Dried slices were fine milled into flours (with granules size pass through 60- mesh screen).

FLOWCHART OF TARO FLOUR





Taro Flour

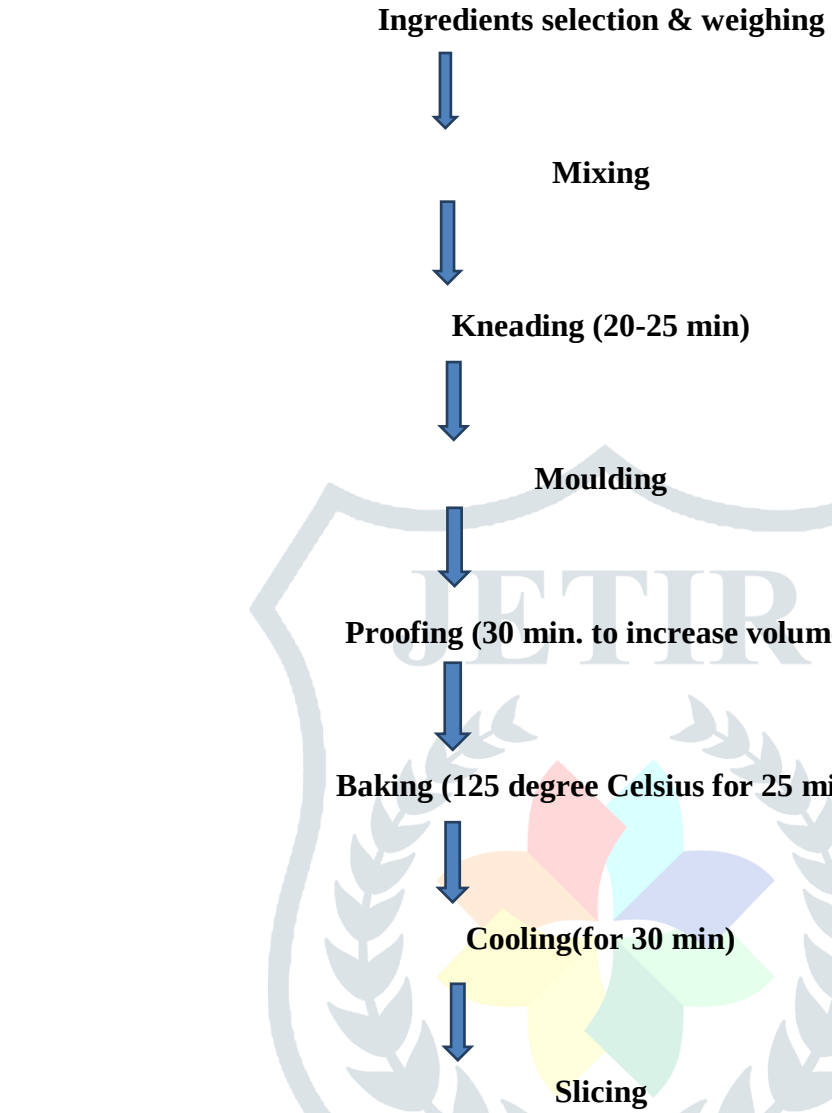
3.3 PREPARATION OF TARO BREAD :

Bread was baked using straight-dough methods as described in the AACC (2000). The bread was prepared by mixing with 0, 5, 10, 15, 20% raw taro flour. The standard formula used for bread was 100 gram refined wheat flour / flour blends with 10 gm yeast, 2 gm salt, 10 gm sugar, 8 gm fat, luke warm water. Bread was prepared using flour, sugar, salt, water, yeast, fats, and with emulsifier were mixed together to form a dough. Then the produced dough was left at room temperature for 30 min. to complete fermentation and then the dough was divided into dough balls, which were baked at 125 Degree Celsius for 25 min in oven.

Table -1 Formulation scheme for wheat- taro composite flour dough

Ingredients	S1	S2	S3	S4	S5
Taro flour , g	0	5	10	15	20
Wheat flour g	100	95	90	85	80
Yeast as baking agent g	5	5	5	5	5
Table salt g	4	4	4	4	4
Sugar g	4	4	4	4	4
Treated water ml	65	65	65	65	65
Fat	8	8	8	8	8
Bread improver	1.0	1.0	1.0	1.0	1.0

3.4 Flowchart for Taro Bread preparation:



The Baked loaves of each treatment divided into two parts one for the sensory evaluation and the other was stored in plastic bags at -18 degree Celsius until analyzed.

Functional Properties –

Water absorption capacity (WAC) was determined essentially by the method of phillips et al .(9) water stability index (WSI) was measured according to the method of Anderson et al.(10) and oil absorption capacity (OAC) was estimated by the method of centrifuging a known quality of flour saturated with palm oil(sodeconton, garoua, cametoon) following the producer of sosulski(11) . The Retrogradation index (RI) was evaluated by gravimetric measurements of the synergic water separated from the paste sample, with some modifications(12).

Physical Properties-

To determine the loaf volume and density of samples method 10-05.01 described in AACC (2000) was used which is based on rapeseed displacement. Thickness and width was determined using rular and weight was determined by using digital weighing balance.

Proximate Analysis -

Prepared taro flour and whole wheat flour bread were analysed for moisture , protein , ash ,crude fiber and total sugar content by the method described in AOAC (2010). Carbohydrate content was determined by subtraction methods.

Organoleptic Evaluation- A semi-trained panel did the sensory evaluation . A1-9 point hedonic rating test was used to assess the degree of acceptability of crust colour, taste, odour, appearance roundness crumb colour and OAA of taro bread containing 5%, 10%, 15% and 20% taro flour . The score was arranged in a frequency table and statistically evaluation for variance analysis.

Statistical analysis – Data obtained were subjected to analysis of variance (ANOVA) to identify differences among treatment means.

Result & Discussion – The present study was based to evolve effect of flour on quality of taro bread.

Table No-2 Proximate Composition of taro flour and wheat flour-

Parameter	**Wheat flour**	**Taro flour**
Moisture %	14.15±0.45	8.42 ±0.34
Ash %	1.84±0.23	4.28±0.45
Fibre %	1.7±0.13	1.85±0.21
Fat %	0.90±0.24	0.61±0.12
Protein %	11.52±0.34	4.82±0.67
Carbohydrate %	68.78±0.89	79.70±0.78

The chemical composition of taro and wheat flour is presented in Table no-2 . On a comparative basis, taro flour contains appreciable amounts of minerals, as can be inferred from their ash content 4.28% compared to that of wheat flour 1.84%. On the other hands, the level of available carbohydrate in wheat flour 68.78 % falls with the range of that of taro studied 79.70%. Comparable values were also observed on the crude fibre level of wheat 1.7% and taro 1.85% flour. Although wheat flour is generally low in fat content 0.90%, this value is much higher than in taro.(20)

Table no- 3 Functional Properties of wheat and taro flour

Properties	**Wheat flour**	**Taro flour**
Water absorption capacity %	67	145
Water solubility index WSI	7.9	9.5
Oil absorption capacity %	78.12	81
Retrogradation index RI	15.4	6.9

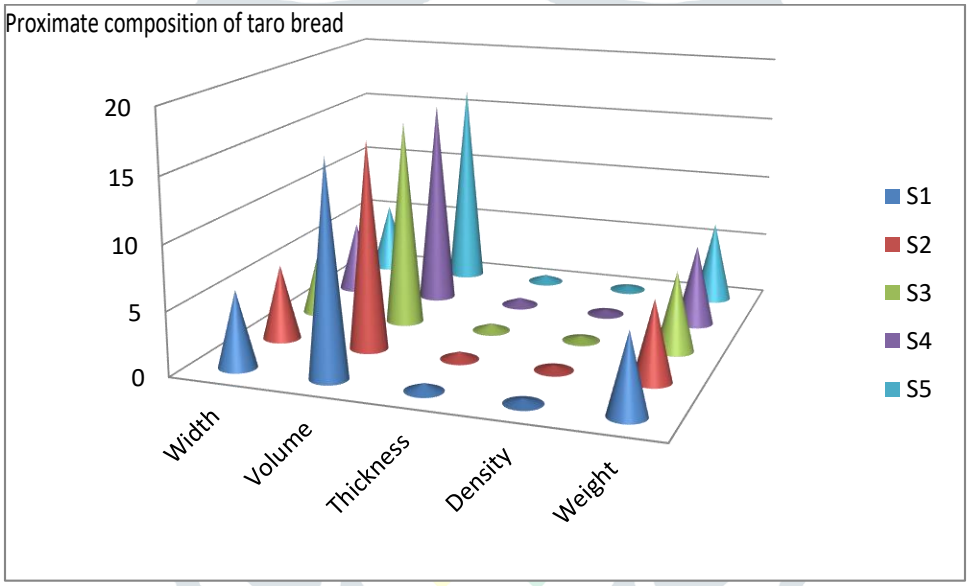
The functional properties of wheat and taro flour are given in (Table 3) . In general, flour obtained from the taro corm used exhibited higher water absorption capacity (WAC) , as well as higher oil absorption capacity (OAC) than wheat flour , while the Retrogradation index was much higher for wheat than for taro flour. The high synergic value observed for wheat flour compared to taro flour may be attributed to differences in amylose content , given the fact that starch with high amyl pectin content has been reported to retrogrades slowly(13, 14) .

It could possibly be because taro starch has been demonstrated to have smaller starch granules than other starches. As a matter of fact, studies have revealed that flours with big starch granules display greater synergic (%) values, while flours with small starch granules exhibit lower synergic values. (11, 13)

Table no- 4 Physical properties of taro flour bread

Sample	Width	Volume	Thickness	Density	Weight
S1	6.0	16.56	0.59	0.40	6.26
S2	5.9	16.30	0.58	0.40	6.30
S3	5.7	16.32	0.57	0.39	6.33
S4	5.6	16.36	0.57	0.38	6.39
S5	5.5	16.44	0.55	0.37	6.43

S1 – control bread, S2 -Bread with 5% taro flour, S3 -bread with 10% taro flour, S4- Bread with 15% flour, S5- bread with 20% taro flour.



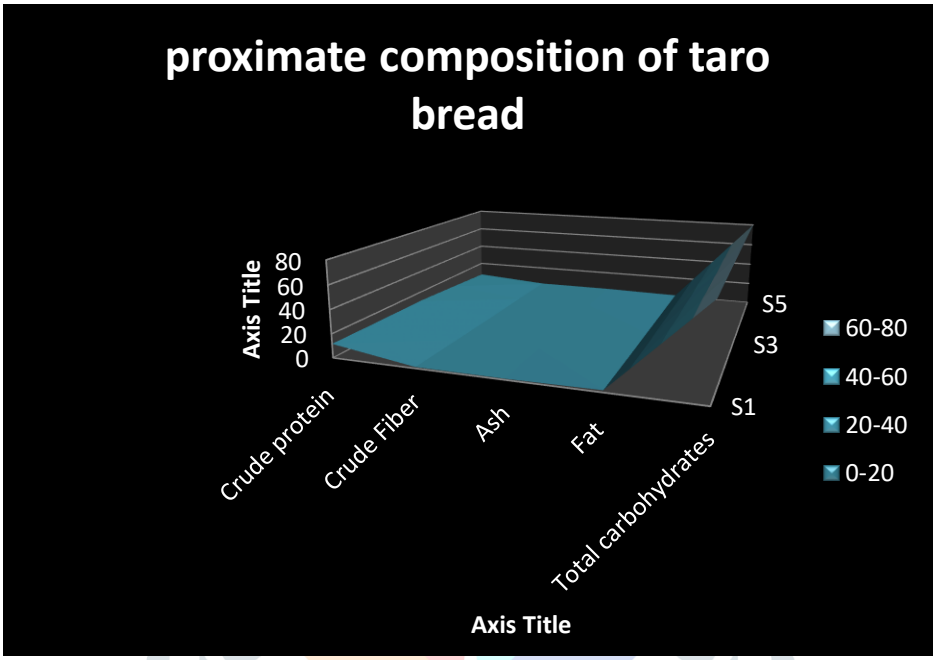
In this Table 4, the width of bread sample are decrease 6.0 to 5.5 cm, the highest width observed in control S1and lowest width observed in 20% S5. Loaf volume indicate that in control S1- 16.56 cm (cube) and S5 16.44 cm(cube) the difference observed is 0.12. In thickness of the sample was decrease by increasing taro flour in bread 0.59 cm to 0.55 cm. Density in sample indicate that decrease with increasing taro composition in bread 0.40 gram per cm(cube) in control and 0.37gram cm(cube) in S5 difference come in bread testing is 0.3. Weight of the sample increase by increasing taro flour in wheat flour in bread. In control sample (S1) 6.26 gram and S5 6.43 gram.

Table no-5 Proximate composition of taro bread

Sample	Crude protein	Crude Fiber	Ash	Fat	Total carbohydrates
S1	11.80	1.16	0.96	1.70	75
S2	11.45	1.30	1.50	1.35	76.5
S3	11.47	1.55	1.70	1.29	77.6
S4	9.37	2.05	2.11	1.24	79
S5	7.09	2.20	2.19	1.15	80

S1 – control bread, S2 -Bread with 5% taro flour, S3 -bread with 10% taro flour, S4- Bread with 15% flour, S5- bread with 20% taro flour.

*Analysis performed for three replication, values are as presented as mean ± SD, and values in a row followed by the same letter are significantly different ($p \leq 0.05$).



Chemical Composition: Table 5 shows that the increase of substitution ratio of wheat flour with taro flour resulted in decreasing of crude protein and fat of the bread samples, while the other components increased with increasing the level of taro flour in the blend since, crude fibre increased from 1.16 to 2.20, ash increased from 0.96 to 2.19 and total carbohydrates increased from 75 to 80 % for the control and S5 sample respectively.

Table no-6 Organoleptic characteristics of bread containing taro flour at various levels in bread

Property	Crust Color	Taste	Flavor	Appearance	Roundness	crumb	OAA
S1	9.5	9.0	10	18.8	14	9.7	92
S2	9.4	9.0	9.7	18.8	13.5	9.7	91
S3	9.4	8.5	9.0	18.6	13	9.6	90
S4	8.5	7.5	8.0	17.0	12	7.0	80
S5	8.0	7.0	6.7	13.5	11	5.5	75

*Means in the same row with the same superscripts are not significantly different (P= 0.05)

** Sum of the seven organoleptic properties

***Average of seven organoleptic properties

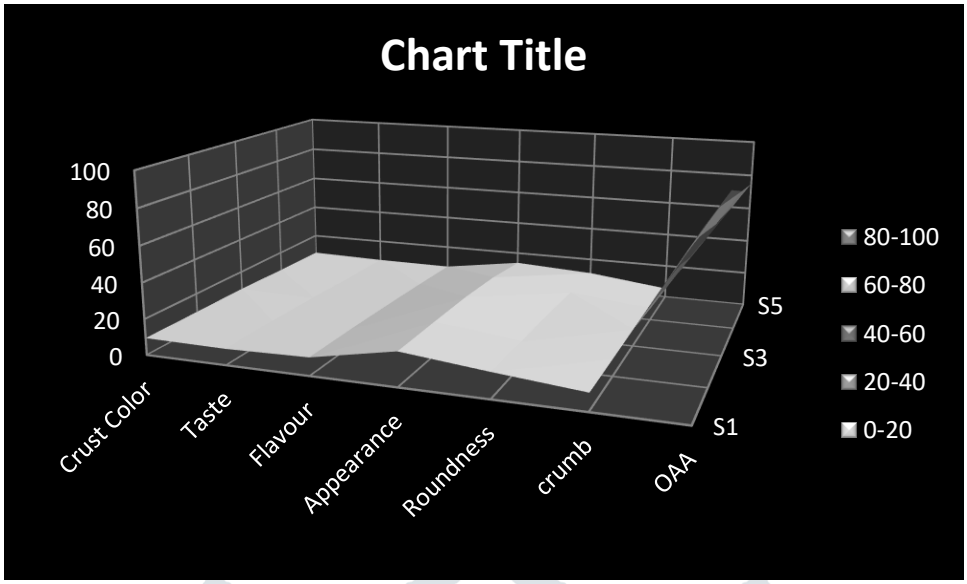
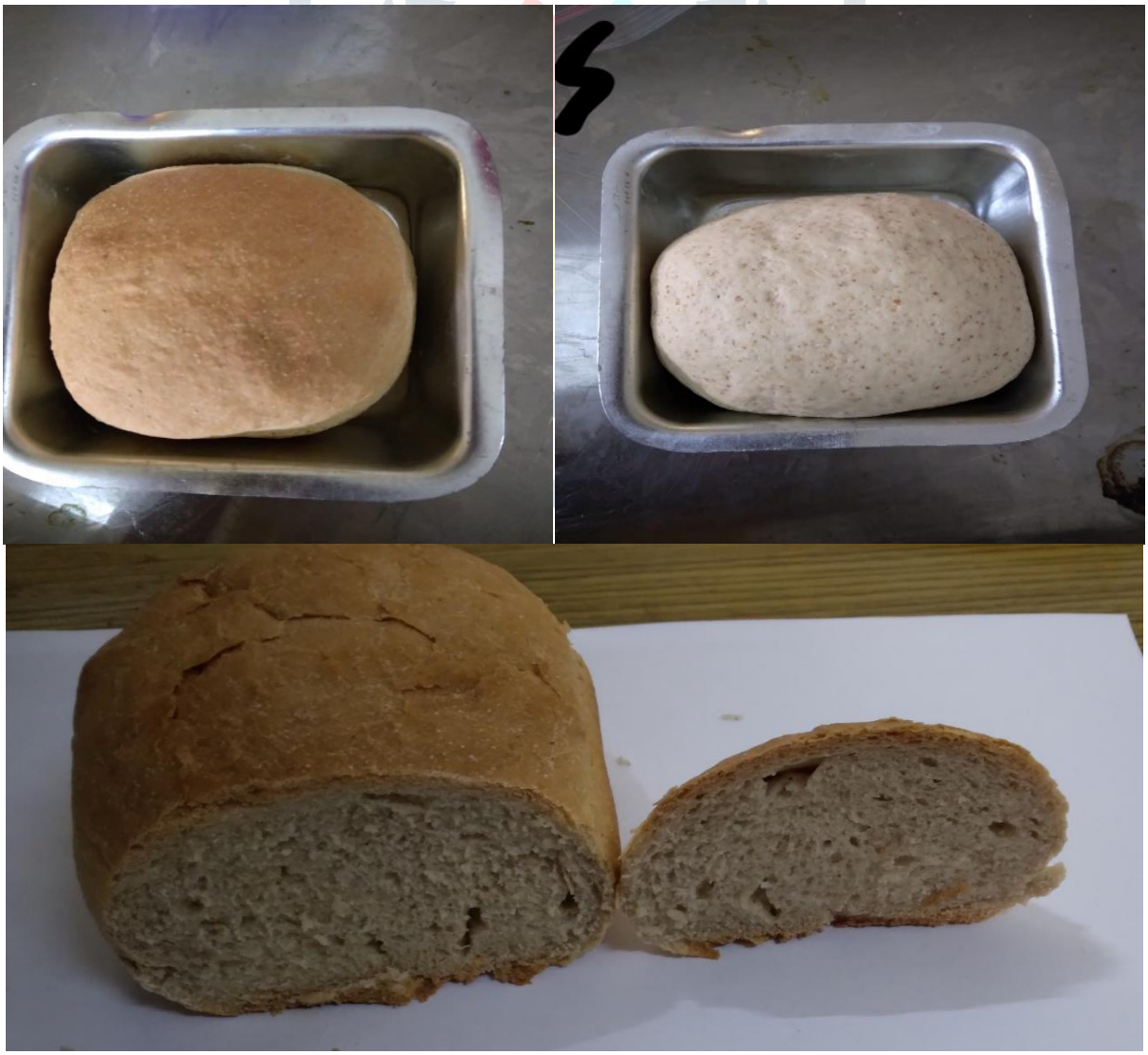


Table 6 indicates sensory evaluation scores of the control and wheat taro flour balady bread loaves . the control bread and bread made of blends containing 5 and 10% taro flour were exhibited good organoleptic properties scores without any significant difference among them, while the bread made of S4 blend become in the second degree with significant difference ($p<0.05$) than the previous mentioned bread samples and the bread made of S5 blend which exhibited the worth organoleptic properties. Finally the increase of the substitution ratio resulted in decrease of the organoleptic quality of the produced bread sample.



Conclusion – The present study focused on the use of taro flour to improve the functional chemical and nutritional qualities of bread without significantly affecting consumer acceptability. Depending on the quantity and type of starch used, replacing 10% of the wheat flour with taro flour produced dough with a variety of physical and chemical properties.

The composite bread would serve as functional food because of the high trace element content. The composite bread with taro flour substitutions will be nutritionally superior (have higher mineral and crude fibre content) to whole bread . Amount of taro was cheap so it could utilize day to day energy requirements by replacing cereals and grains. The amount of taro flour increase starch content in wheat taro bread that why it color gradually became darker after baking. It has a clean effect on the texture of dough. Physical properties which decreased the amount of taro flour in making bread it increasing weight and decreasing width, volume, thickness and density. Chemical or quality parameter showed that taro wheat flour bread sample, increasing taro flour in bread decrease crude protein, ether extract with increase other parameter. Also mineral content in wheat taro flour bread is higher than wheat flour bread.

The taro bread was successfully developed by evaluation of sensory and physiochemical analysis. So the sample with 10% (S3) of raw taro flour shows the health benefits of the appétit of body and because of its nutritional value, incorporation was highly acceptable in comparison to the other.

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