International Journal of Food Science and Nutrition
ISSN: 2455-4898; Impact Factor: RJIF 5.14
Received: 01-11-2018; Accepted: 03-12-2018
www.foodsciencejournal.com
Volume 4; Issue 1; January 2019; Page No. 12-17

Development and quality evaluation of pasta with incorporation of Colocasia leaves powder and beetroot powder

B Mounika[1], Srinivas Maloo[2], V Bhasker[3]
[1, 2, 4] Department of Food Technology, University College of Technology, Osmania University, Osmania University Hyderabad, Telangana, India
[2] Associate Professor, Department of Food Technology, University College of Technology, Osmania University, Hyderabad, Telangana, India
[3] Assistant Professor, Department of Food Technology, University College of Technology, Osmania University, Hyderabad, Telangana, India

Abstract
The study was conducted with the aim of increasing protein content of the pasta and utilizing more nutritious colocasia leaves powder, Beetroot powder. Formulations were prepared by keeping semolina and beetroot powder constant at added whole wheat flour and colocasia powder in the ratios (10%,20%,30%) respectively. These were extruded by using single screw extruder. These were assessed for their sensory properties, nutritional composition and shelf life studies. The levels of colocasia powder increased in the formulations of pasta that increased mineral content, crude fiber. The sensory evaluation results showed that pasta prepared with 50% wheat flour and 50% semolina (S1) perceived as the most accepted product followed by. Increase the% of colocasia powder, the acceptability decreased. Cooking loss is decreased, and cooking time is increased with increasing the added colocasia powder.

Keywords: colocasia powder, beetroot powder, pasta, wheat flour, semolina

1. Introduction

In the present world, the biggest challenge for the food industry is to develop the health promoting food. The future of the food products ultimately regards how it affects the consumer health and the raw materials that will deliver such health benefits. Today's lifestyle of individual is becoming more hectic, and people have very less time in preparing meals, this eventually affecting the rise in interest towards snacking patterns.

Pasta is a staple food in many cultures made from unleavened dough which is stretched, extruded, or rolled flat and cut into one of a variety of shapes. While long strips may be the most common, many varieties forms of pasta include long shapes, short shapes, tubes, flat shapes and sheets, miniature soup shapes, filled or stuffed and specialty or decorative shapes. Instant pasta are currently consumed and enjoyed worldwide due to convenience, ease of cooking, widely acceptable taste, flavor as well as affordable prices

Pasta is at the core of the Mediterranean Diet recognized by nutritionists as one of the world's best eating patterns and successful at weight management since noodles is often combined with fresh vegetables, tomato sauce, and olive oil and small portions of fish, legumes and other lean proteins.

Weight problems are almost never the fault of one food; its total diet and lifestyle that matter. Noodles are traditionally served with other wholesome foods, including vegetables and olive oil, mushroom, chicken. Researchers in France analyzed data on how the Mediterranean diet relates to the risk of Alzheimer's and other forms of dementia.

When pasta is eaten with other healthy ingredients, like olive oil, spinach, or chicken, the Glycemic Index of the complete pasta meal is even lower. Those looking for an even bigger nutrient punch can choose whole grain pasta, which provide more fiber and protein, along with many essential vitamins and minerals.

1.1 Colocasia leaves powder

Colocasia esculenta. Commonly known as Taro, is a staple vegetable crop that has been used as food for over 9,000 years, making it one of the world's oldest food crop. It is used as a source of protein, starch and vitamins. It is toxic when raw but edible when cooked. It can also be used for medicinal purposes.

It can be found in Southeast Asia but how has spread through the world, becoming a very important crop in Asia, Pacific, Africa, and the Caribbean. As a crop it remains mostly under the control of local communities, rarely being traded on global scale.

1.1.1 Nutritional Aspects

Colocasia leaves are rich in complex carbohydrates and are a primary source of starch. The nutritional value of colocasia root is similar to potatoes. Colocasia leaves have very little fat. For 100gms of colocasia has 7g of dietary fiber which is about 27% of daily recommended amount.

100g of colocasia powder has 11% of vitamin C daily value of 19% and vitamin E and 22% of vitamin B6 (all critically important for the immune system).It also has 10% of the daily value of magnesium and phosphorus,13% of copper,18%of potassium and 30% of manganese.

1.2 Beetroot powder

Beet" redirects here. For the plant species and its numerous varieties, see Beta vulgaris. For other uses, see Beet

(disambiguation). The beetroot is the top root portion of beet plant usually known in North America as the beet, and also table beet, garden beet, red beet, or golden beet. It is one of several of the cultivated varieties of Beta vulgaris grown for their edible taproots and their leaves (called beetgreens). These varieties have been classified as *B. vulgaris* subsp. *vulgaris* Conditiva Group.
Other than as a food, beets have use as a food colouring and as a medicinal plant. Many beet products are made from other Beta vulgaris varieties, particularly sugar beet.
From the middle Ages, beetroot was used as a treatment for a variety of conditions, especially illnesses relating to digestion and the blood. Bartolomeo Platina recommended taking beetroot with garlic to nullify the effects of "garlic-breath".
During the middle of the 19th century, wine often was coloured with beetroot juice.

1.2.1 Nutritional Aspects
Beetroot is 88% water, 10% carbohydrates, 2% protein, and less than 1% fat (see table). In a 100 gram amount providing 43 calories, raw beetroot is a rich source (27% of the Daily Value, DV) of folate and a moderate source (16% DV) of manganese, with other nutrients having insignificant content (table).
Beetroots are also richest source of glutamine, an amino acid, essential to the health and maintenance of intestinal tract. Beetroot contain valuable nutrients that may help your blood pressure fiber cancer.

1.3 Extrusion
Extrusion is a process which combines several unit operations including mixing, cooking, kneading, shearing, shaping and forming.

1. Extrusion technologies have an important role in the food industry as efficient manufacturing processes. Their main role was developed for conveying and shaping fluid forms of processed raw materials, such as dough's and pastes.
2. Extrusion cooking technologies are used for cereal and protein processing in the food and, closely related, pet foods and feeds sectors. The processing units have evolved from simple conveying devices to become very sophisticated in the last decade.
3. Today, their processing functions may include conveying, mixing, shearing, separation, heating or cooling, shaping, co-extrusion, venting volatiles and moisture, flavor generation, encapsulation and sterilization.
4. They can be used for processing at relatively low temperatures, as with pasta and half product pellet dough's, or at very high ones with flatbreads and extruded snacks. The pressures used in extruders to control shaping, to keep water in a superheated liquid state and to increase shearing forces in certain screw types, may vary from around 15 to over 200 atmospheres.

Food extruders can perform one or several functions at the same time while processing food or feed: Including mixing/degassing ingredients, homogenization, grinding, shearing, starch cooking (gelatinization), protein denaturation and texturization, texture alteration, enzyme in-activation, pasteurization and sterilization of food spoilage and pathogenic microorganisms, thermal cooking, shaping products, expansion, puffing, agglomerating ingredients, dehydration, unitizing etcetera.

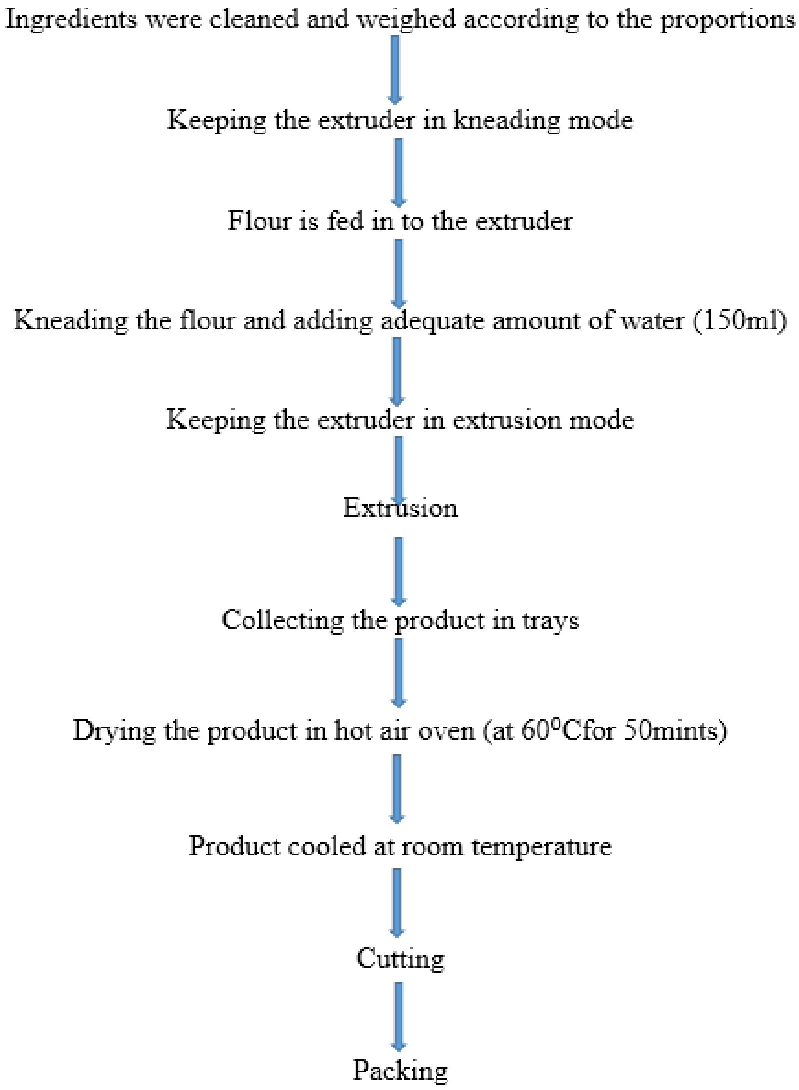
1.3.1 Classification of extruders
Extruders are classified into two types according to operation: Hot and cold extruders
Based on type of construction extruders are classified into: Single screw and twin screw extruders.

1. Single screw extruder
2. Twin screw extruder

1.3.2 Single-screw extruder
A typical single-screw extruder consists of a live bin, feeding screw, preconditioning cylinder, extruder barrel, die and knife. The live bin provides a buffer of raw material so the extruder can operate without interruption. Typically, the height of raw material in the bin is maintained within defined limits by high and low sensors which activate a conveyor supplying the bin. The bin is designed to prevent bridging of its contents and blocking the feed screw leading to the pre conditioner. Speed of the feed screw to the conditioner or extruder must be variable to ensure a continuous uniform supply of raw material, which, in turn, leads to consistent and uniform operation of the extruder
Because single-screw extruders have relatively poor mixing ability, they are usually supplied with premixed material which often has been preconditioned\ with added steam and water. Generally, preconditioning prior to extrusion enhances extrusion processes which benefit from higher moisture content and longer equilibration time. Preconditioning of the raw material typically improves the life of wearing components in the extruder by several folds. Although the weight of ingredients in the extrusion system is increased, preconditions are relatively inexpensive to build for the volume they hold and time added to the process for preconditioning. Product quality can be improved greatly by preconditioning the raw ingredients.
The main aim of the study is to develop nutritional rich pasta and asses the nutritive and sensory analysis of developed pasta.

2. Materials and Methods
2.1 Materials Required
Ingredients (wheat flour, semolina, colocasia leaves powder and beetroot powder) weighing balance, Extruder, Tray dryer.

Pasta Formulation and Preparation



Formulations

Indigents	S1	S2	S3	S4
Semolina	50	50	50	50
Wheat flour	50	25	15	5
Colocasia powder	0	10	20	30
Beetroot powder	0	15	15	15

2.2 Methods

2.2.1 Determination of moisture content

Apparatus
a) Petri plate dishes.
b) Hot air oven.
c) Weighing balance.
d) Desiccator containing efficient desiccant such as phosphorus pentoxide or calcium chloride.

Procedure

Weigh accurately about 5 grams of sample in a previously dried and tare moisture dish. Place the dish in the hot air oven maintained at 105oC temperature and dry at least for 2 hours. Cool in a desiccator and weigh. Repeat the process of heating, cooling, and weighing until the difference between the two consecutive readings doesn't exceed 2mg. Record the lowest weight.

$$\text{Moisture (\%)} = \frac{w2 - w1 - (w3 - w2)}{(w2 - w1)}$$

Where,
W1 = Initial weight of petri dish (g)
W2 = Weight of the petri dish with sample before drying (g)
W3 = Weight of the petri dish with sample after drying (g).

2.2.2 Determination of ash value

Apparatus

Muffle Furnace
Crucibles
Desiccators: containing an efficient desiccant for example freshly dried silica gel

Procedure

The ash value is mainly due to potassium and phosphorous and the composition of it. About five grams of the sample were weighed accurately into a porcelain crucible. This was transferred into
A muffle furnace set at 600°C and left for about 4 hours. About this time it had turned into white
Ash. The crucible and its content were cooled to about 100°C

in the air, then to room temperature
In desiccators and weighed. The percentage ash was calculated from the formula below.
% Ash content = (weight of Ash/Original weight of sample) x100

2.2.3 Determination of crude fiber
Reagents

- Sulfuric acid (H_2SO4) 1.25% - 0.255 ± 0.005 N. 12, 5g, 98% concentrated to 1000 ml With distilled water. Control the concentration by titration.
- Potassium hydroxide (KOH) 1.25% - 0.223 ± 0.005 N, free from carbonate. 12.5 g to 1000 ml with distilled water. Control the concentration by titration.
- N-octanol as antifoam.
- Anhydrous acetone

Procedure

Determine separately the sample moisture by heating in an oven at 105°C to constant weight.
Cool in a desiccator. Weight accurately about 1 g of grinded sample (1 mm about) approximately with 1 mg. ==> W1. Add 1.25% sulfuric acid up to the 150 ml notch, after preheating by the hot plate in order to reduce the time required for boiling. Add 3-5 drops of n-octanol as antifoam agent. Boil 30 minutes exactly from the onset of boiling. Connect to vacuum for draining sulfuric acid. Wash three times with 30 ml (crucible filled up to the top) of hot deionized water, connecting each time to compressed air for stirring the content of crucible.

2.2.4 Determination of protein
Kjeldahl method:

A food is digested with a strong acid so that it releases nitrogen which can be determined by a
Suitable titration technique. The amount of protein present is then calculated from the nitrogen concentration of the food. The Kjeldahl method does not measure the protein content directly a conversion factor (F) is needed to convert the measured nitrogen concentration to a protein concentration. A conversion factor of 6.25 (equivalent to 0.16 g nitrogen per gram of protein) is used for many applications, however, this is only an average value, and each protein has a different conversion factor depending on its amino-acid composition.

Procedure

Take 0.55g of sample in a digestion tube of instrument & add 25ml concentrated H_2SO_4 and 1-2
Catalyst stabilizers. Adjust temperature to 370°C and keep for digestion for 4-6 hours till the solution becomes blue in color. Remove the tube from 0.1N H_2SO_4 solution in a titration flask, placing of the distillation unit, attach a tube containing digested sample to distillation until the press start button to effect a metered addition of NaOH & to initiate steam distillation stops add 5 drops to yellow color. This is the end point. Now using 25ml of 0.1N HCl with 0.1N NaOH in the burette.
Once the nitrogen content has been determined it is converted to a protein content using the appropriate conversion factor:
% Protein = 6.23 X% N.

$$\text{Protein} = \frac{\text{blank sample X Normality X 1.4007X 6.25}}{\text{Weight of Sample}}$$

2.2.5 Determination of fat
Reagents: Hexane

Procedure

Fat was estimated by soxhlet method. Take an empty thimble (container) weight. Weigh 5 grams of sample into a dry thimble. Difference in weight gives sample weight. Weight the empty soxtherm flask with boiling stone. Keep the thimble in soxtherm extractor. Pour the solvent (150 ml of hexane) into the soxtherm flask. Fix the soxtherm flask in soxtherm extraction apparatus with a reflux condenser. Keep the total arrangement of process for at least 4 hours. After 4 hours, take out the solvent from hexane and thimble from extraction apparatus. Keep the soxhlet flask in the hot air oven for 10 minutes to evaporate the solvent and cool it in a desiccator. Then weigh the flask with extracted fat.

Calculation

$$\% \text{ Fat content} = 100 \times (W3–W2) / (W1–W)$$

Where,
W - Weight in grams of empty thimble
W1 - Weight in grams of thimble with sample
W2 - Weight in grams of empty soxtherm flask
W3 - Weight in grams of soxtherm flask with extracted fat

2.2.6 Determination of carbohydrates
Total CHO (g/100g dry weight) = 100- (g moisture + g protein + g crude fiber + g ash + g fat)

2.2.7 Determination of calcium
Take 2ml of mineral solution into a 15ml centrifugal tube. Add 2ml of distilled water and 1ml of
4% ammonium oxalate solution and mix thoroughly and leave overnight. Again the contents are mixed and centrifuged for 5min at 1500rpm. The supernatant liquid is poured off and the centrifuge tube is drained by inverting the tube for 5min on a rack (care should be taken not to disturb the precipitate). The mouth of centrifuge tube is wiped with a piece of filter paper. The precipitate is stirred and the sides of the tubes are washed with 3ml dilute ammonia. It is centrifuged again and drained as before. The precipitate is washed once more with dilute ammonia to ensure complete removal of ammonium oxalate. The precipitate is dissolved in 2ml of 1N H_2SO_4.

Blank: Take 2ml of 1N H2SO4 heat and titrate against KMnO4 solution till pink color is obtained.

Formulae: 1ml of 0.01N KMnO4 is equivalent to 0.2004 mf of Ca. Calcium content was calculated as follows:

$$\text{Calcium} = \frac{\text{Titre value x N of KMnO 4 x 20 x Total vol .of ash sol}}{\text{ml of ash solution wt of sample taken for estimation}} \text{x100}$$

2.2.8 Sensory Evaluation
All dried noodle samples were prepared for sensory evaluation. The samples were boiled using
Water for the optimum cooking time. Cooked noodles with masala mix were evaluated for appearance, flavor, taste, texture and overall acceptability of the samples by 10 untrained panelists using nine-point hedonic scales, where 9 = extremely like and 1 = extremely dislike.

The optimal ratio of tamarind kernel flour in the noodles was investigated using sensory qualities in comparison to the control pasta.

Feeling/Attribute	Rating
Like Extremely	9
Like Very Much	8
Like Moderately	7
Like Slightly	6
Neither Like Nor Dislike	5
Dislike Slightly	4
Dislike Moderately	3
Dislike very Much	2
Dislike extremely	1

3. Results and discussions
3.1 Nutritional composition of different extruded samples with added Colocasia powder and beetroot powder**.**

Table 1

Nutrients	C	S1	S2	S3
Moisture (g/100g)	9.306	9.161	8.086	7.962
Ash	0.755	1.075	1.185	1.187
Fat (g/100g)	1.25	2.085	2.377	2.95
Protein (g/100g)	11.25	11.809	13.721	14.965
Crude Fiber (g/100g)	1.05	3.789	4.318	5.881
Carbohydrates (g/100g)	72.1	75.538	79.450	82.987
Calcium(mg/100g)	32	177.345	342.365	496.38

3.1.1 Moisture content
Moisture content is an important factor that determines the product shelf life. The moisture content of the product is in the range of 7.962-9.306g/100g.

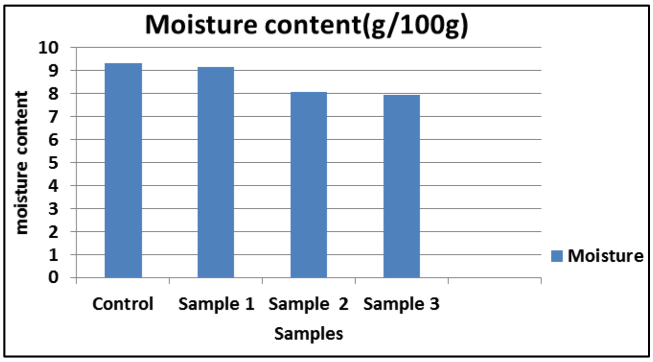


Fig 1

3.1.2 Mineral content
The ash value refers to the inorganic residue that remains after burning of the organic matter in a food sample this residue arises from the mineral matter in the sample and it exist in the organically bound form or in the inorganic form. The ash obtained helps in determination of individual minerals the ash value of extruded samples in the range of 0.755-1.187g/100g.

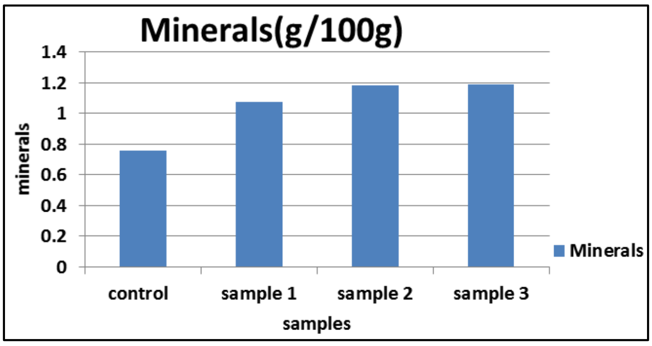


Fig 2

3.1.3 Fat content
One strategy frequently used for weight reduction is to eat foods low in caloric density, biologically due to high percentage of carbons in fats; they stored nutrients with the highest energy or calorific value of food constituents. The fat content of the extruded sample is in the range of 1.25-2.95g/100g.the fat content has been slightly increased with the added colocasia powder.

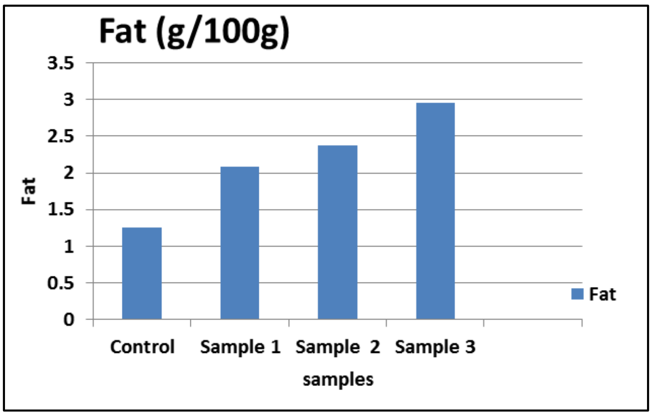


Fig 3

3.1.4 Protein content
Protein plays an important part in the body building.it consist of amino acids which are beneficial for the daily body functioning. In this study of extruded samples, the protein content is in the range of 11.25-14.965g/100g respectively.in these extruded products, it is observed that there is an increase in protein content gradually with the increase in proportion of colocasia powder.

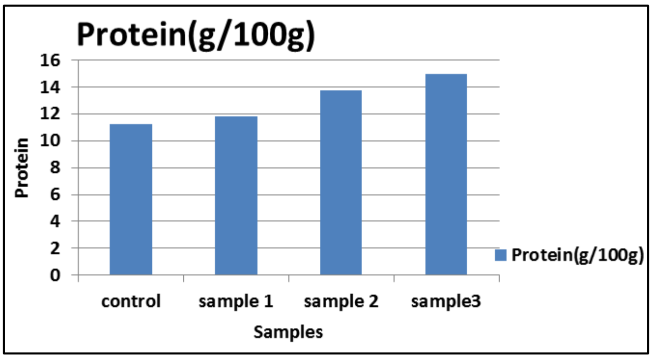


Fig 4

3.1.5 Crude fiber
It gives bulk to the diet, consisting largely of cellulose followed by hemicellulose, pentosans and nitrogenous substances. Fiber helps to maintain the health of gastrointestinal track, but in excess it may carry away some trace elements without absorption. The crude fiber content of the extruded sample is in the range of 1.05-5.881g/100g.

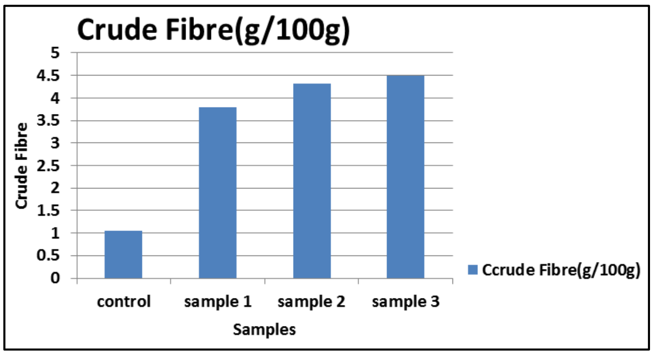


Fig 5

3.1.6 Carbohydrate content
Carbohydrates provide major source of energy in the human diet.in the extruded product the carbohydrate content in the range of 72.1-82.987g/100g.

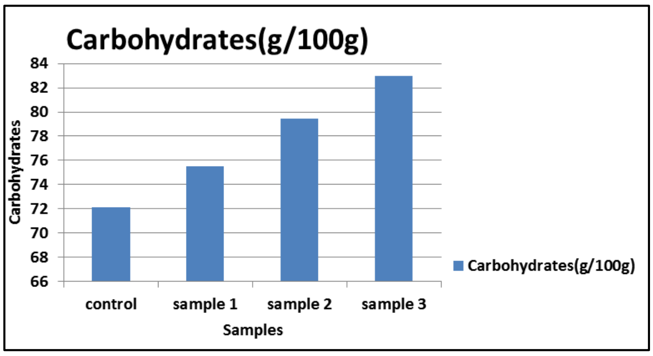


Fig 6

3.1.7 Calcium content
Calcium is abundant mineral in our body. In bones calcium occurs as calcium phosphates within a soft fibrous, organic matrix. Calcium deficiency in children leads to rickets, while in adults it may result in osteomalacia. The calcium content in the extruded sample is in the range of 32-496.38g/100g.

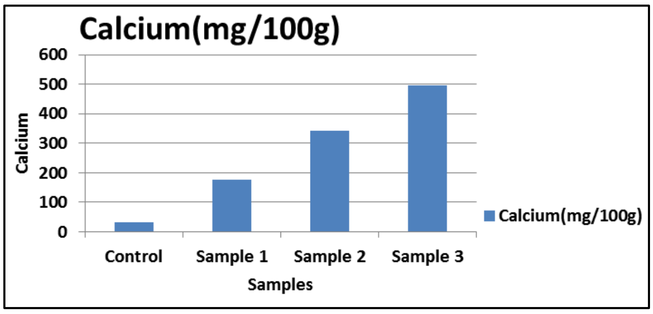


Fig 7

4. Sensory evaluation of different samples

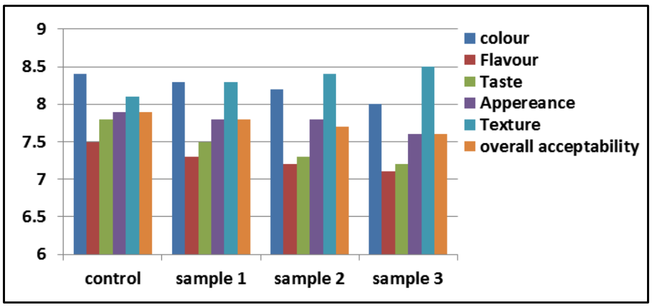


Fig 8

5. Conclusion
This study showed that the developed pasta the nutritive values of protein and calcium are increasing due to increasing proportions of colocasia leaves powder and beetroot powder. Sensory analysis of developed pasta texture is improved by addition of colocasia leaves powder and beetroot powder but there is low acceptability of colour. In this study beetroot powder showed no influence towards colour. Overall acceptability is better for sample 1 (S1).

6. References
1. GRIN. Colocasia Schott". Taxonomy for Plants. National Germplasm Resources Laboratory, Beltsville, Maryland: USDA, ARS, National Genetic Resources Program. Retrieved, 2007-2010.
2. Query Results for Genus Colocasia". IPNI. Retrieved, 2010.
3. Name-Colocasia Schott subordinate taxa. Tropicos. Saint Louis, Missouri: Missouri Botanical Garden. Retrieved, 2010.
4. Wagner WL, Herbst DR, Sohmer SH. Manual of the Flowering Plants of Hawai‘i. Revised edition. University of Hawai‘i Press/Bishop Museum Press. 1999; 2:1357.
5. Dioscorides in English translation is available from the links at the Wikipedia Dioscorides page. In the translation of Dioscorides by Tess Anne Osbaldeston (year 2000) see pages 248 and 331-332 for colocasia and colocassion. Beet. def. 1 and 2. Also beet-root. Oxford English Dictionary Second Edition on CD-ROM (v. 4.0) © Oxford University Press, 2009.
6. Sorting Beta names. Multilingual Multiscript Plant Name Database. The University of Melbourne. Archived from the original on 2013-04-15. Retrieved 2013-04-15.
7. Gledhill, David (2008). "The Names of Plants". Cambridge University Press. ISBN 9780521866453 (hardback), ISBN 9780521685535 (paperback). pp 70
8. Beet. Online Etymology Dictionary, Douglas Harper. 2017. Retrieved 25 April 2017.