ENRICHMENT OF NOODLES WITH BEETROOT PULP AND ARROWROOT POWDER

Project report submitted in partial fulfillment of requirements

for the award of

Bachelor of Science

In

FOOD TECHNOLOGY

Of

Hindustan Institute of Technology and Science, Padur

By

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Under the guidance of

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HINDUSTAN
INSTITUTE OF TECHNOLOGY & SCIENCE
(DEEMED TO BE UNIVERSITY)

MAY 2020

DEPARTMENT OF FOOD TECHNOLOGY

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CERTIFICATE

This is to certify that the project report entitled

ENRICHMENT OF NOODLES WITH BEETROOT PULP AND ARROWROOT POWDER

Submitted by

ARSHITHA RAMESH (0018349002)

In partial fulfillment of the requirements for the award of the Degree of Bachelor of Science in Food Technology at Hindustan Institute of Technology and Science is a bonafide account of the work carried out by the students of this department during the academic year **2020-2021** under our supervision.

DR. SANKAR GANESH	**Dr. Selva Muthukumaran**
Asst. Professor	**Head of the Department**
(Project Guide)	

DECLARATION

I, **ARSHITHA RAMESH**, hereby declare that the research work entitled “Enrichment of Noodles with Beetroot Pulp and Arrowroot Powder” is an outcome of my own efforts under the guidance of **DR. SANKER GANESH** and has not been previously submitted to any other university

This project is solely submitted to the department of Food Technology, Hindustan Institute of Technology and Science, Padur for the partial fulfillment of Bachelor of Science degree in Food Technology, 2018 - 2021

ACKNOWLEDGEMENT

At first, I would like to express my gratitude to my creator the almighty for enabling me the strength and opportunity to complete the report in time successfully.

I am grateful to my parents without whom I cannot be here. Without the support of my parents, I could not be able to achieve my objectives and goals.

I would like to express my sincere gratitude to my guide, Dr. Shanker Ganesh for the continuous support and valuable inputs to my project, for his patience, enthusiasm, and immense knowledge. His guidance has helped me, to understand and execute the project.

Thank you to Dr. A. Surendra Babu, H.O.D Department of Food Technology Dr. Selvamuthu Kumaran, for their encouragement, insightful comments, and hard questions.

A research project in the final year does indeed broaden mindsets of future possibilities.

Thanks to my peers Arun Roy, Fadil A.K, Muhammed Althaf and Aarya Premanandhan, thank you for your complete efforts in the project work and helping me execute the various tests and sensory evaluation.

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ABSTRACT

The study was on the base of enrichment of noodles with beetroot pulp and arrowroot powder with the percentage of three sample S1, S2. Beetroot pulp has prepared from the fresh beetroot. Standard temperature and time have considered during the preparation of noodles. After the preparation of noodles, sensory evaluation, proximate analysis of noodles took place in the project and has shown the analytical report of S1, S2. Moisture (14.40%), protein (8.75%), fat (10.8%), carbohydrate (79.3%) in S1, Moisture (), protein (), fat (), carbohydrate () in S2. The sensory evaluation of noodles was carried out by 20 panelists on a nine-point hedonic scale for different sensory parameters such as appearance, flavor, taste, texture and overall acceptability. In quality parameter test S1 showed a positive result and it was approved to be the best in all sensory attributes by the panelists.

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CHAPTER- 1

INTRODUCTION

Noodles are under the category of cereal foods where most commonly, it's made from wheat. The basic raw materials of noodles production are flour, salt and water. The nutritional value of noodles basically come from flour, because flour is the main raw material in producing noodles where noodles may contain protein, carbohydrates and trace amount of fat and mineral. Therefore, noodles also can be consumed as a complete meal to serve some nutritional requirement (Ojure and Quadri, Zhang and Ma, 2012; 2016). However, Ojure and Quadri (2012) stated that there is little study and evidence on the nutrient content of noodles and the process, wheat flour refinement which is carried out during production of noodles can cause the lost in some of the nutrients like B vitamins, certain minerals and dietary fiber. It can be considered that the most economical energy foods are cereal foods, because they most probably served the main energy contributor to human body. Therefore, noodles also widely recognized as staple food in many Asian countries (Zhang and Ma, 2016). As known, China has the most significant consumption rate of noodles because as suggested by the study of Zhang and Ma (2016), China had sold a total of 8.6 billion Yuan to 20.26 billion Yuan of noodles, showing amazing sales, consumption and production rate. In other segment, China was the largest consumer of noodles as of 2016 (Zhang and Ma, 2016). Significantly, noodles is earning popularity and acceptability worldwide especially in Western countries, such as Australia due to their convenience, different cooking methods and fast cooking characteristics, simplicity as simple and little time needed for preparation, organoleptic taste, cost and satiety.

Types of Noodle Dishes

Baked noodles: Boiled and drained noodles are combined with other ingredients and baked. Common examples include many casseroles.

Basic noodles: These are cooked in water or broth, then drained. Other foods can be added or the noodles are added to other foods (see fried noodles) or the noodles can be served plain with a dipping sauce or oil to be added at the table. In general, noodles are soft and absorb flavors.

Chilled noodles: Noodles that are served cold, sometimes in a salad. Examples include Thai glass noodle salad and cold udon.

Fried noodles: Dishes made of noodles stir fried with various meats, seafood, vegetables, and dairy products. Typical examples include chow mein, lo mein, mie goreng, hokkien mee, some varieties of pancit, yakisoba, Curry Noodles, and pad thai.

Noodle soup: Noodles served in broth. Examples are beef noodle soup, chicken noodle soup, ramen, laksa, saimin, and batchoy.

CHAPTER- 2

REVIEW OF LITERATURE

2.1 Beetroot

2.1.1 Types of beetroot

2.2 Arrowroot

2.3 Enrichment of Noodles

2.1 Beetroot

Beetroot (*Beta vulgaris L.*) has several varieties from yellow to red, with the range of bulb colours and beetroot is botanically classified as an herbaceous biennial from Chenopodiacae family. Bright red-coloured beetroots are mostly acceptable for human consumption, as consideration for both cooked and raw as salad and juice. Tend to use of natural food colour is growing up, because the consumers are becoming more conscious to assess the synthetic dyes. But in food processing, with a comparison anthocyanins and carotenoids, betalains are less commonly used, although between pH 3 and 7these water-soluble pigments are stable. Nowadays, peoples prefer to consume fruit- and vegetable-based products with high levels of bioactive phytonutrients. Red beetroot (Beta vulgaris L.) is preferred as a rich source of betacyanin, having the group of reddish to violet betalain pigments which are majorly composed of betanins and isobetanins. In red beetrootbetalains and phenolic compounds that exist have been reported to increase the resistance of low-density lipoproteins (LDL) to oxidation and to prevent cancer and cardiovascular diseases by reducing the oxidative effect of free radicals on lipids. Beetroot (Beta Vulgaris L.) powder making, at first, they were washed fresh Beetroot with tap water, chopped it into small pieces. They were dried the beetroot in an air-circulated oven(60°C) to complete dryness for about 11-12 hours. Then grinded the dried beetroots win a grinder. The ground beetroot powder was passed through 65 mesh size of ASTM standard and packed in air tight coloured glass bottles for further use (Shikha Srivastava and Kanchan Singh, 2016). Another study on Beetroot, washed and chopped beetroots were separately dried in an air-circulated oven at 40°C to complete dryness. The dried material was separately transferred into powder form as much as possible and added as 5% for preparation of biscuit fortified with beetroot powder (AOAC, 1997). By using a blender for 1 min at average speed 270 g of fresh red

beet roots were chopped mixed with 300 ml ethanol. At the 4ºC.the mixture was macerated forv24h. After that, passing through 0.45 µm pore size cellulose acetate membrane filter resulting extract was filtered. The resulting extract was added as 2.5% in preparation of biscuit fortified with beet extract (Amnah, M. A. Alsuhaibani.Life Sci J 10(3): 1579-1584, 2013).

2.1.1 Types of beetroot

Cylindra Beetroot: Cylindra beets, botanically classified as Beta vulgaris, are edible, underground roots that belong to the Amaranthacae family. Also known as Formanova beets, Cylindra beets are an heirloom variety that was named for their cylindrical shape and are often referred to as 'Butter Slicer' beets for their smooth, fine-grained texture. Cylindra roots are highly desirable for processing due to their uniform shape and size, typically used for pickling and canning, and are favoured by consumers for their sweet flavour and versatility in savoury applications.

Touchstone gold Beetroot: Touchstone Gold offers a root with a vibrant orange-red exterior and rich gold interior color. Combined with its striking green leaf/gold petiole contrast and sweet, mild flavor, this beet is sure to catch your eye on the dinner plate. Very sweet, with a milder taste compared to red beets. 85 - 90 days to harvest. (approx. 200 seeds/pkt)

Green top bunching beetroots: Beets seem to have originated in the Mediterranean region, where people grew them for thousands of years. Later, beets grew in Germany and Holland and were used as cattle fodder, they were later imported to England for this purpose, but the poor began to raise them for an affordable food source. American colonists later brought them to the New World, where they became a commonly enjoyed food both for their roots and their greens.

Golden beetroots: Golden beets are simply a beet variety lacking that vibrant red pigment. They are bred to be golden in color, which is a wonderful thing for this beet lover who doesn't like the mess. Golden beets and white beets are said to be sweeter and milder than their red counterparts.

Arrowroot

Arrowroot (*Maranta arundinacea***)** is a starch-rich, creeping underground rhizome belonging to the Marantaceae family plants. It is widely cultivated in the Philippines, Caribbean islands, and South America for its fine, easily digestible edible starchy tubers.Some of the common

names are West-Indian arrowroot, uraro (in the Philippines), arruruz, araru, cara maco, sagu, yuquill, etc. Arrowroot powder is one of the finest carbohydrate sources. The powder endowed with qualities such as easy digestibility, and the ability to mix well with a broad range of food ingredients; rating it as one of the most sought-after starch substances employed in infant formulas and confectionaries. Arrowroot is very low in calories; 100 fresh roots carry just 65 calories; less than that of potato, yam, cassava, etc. Its chief polymeric carbohydrates are amylopectin (80%) and amylose (20%). Its powder is fine, odourless, granular starch that is found utility in the food industry as thickener and stabilizing agent. It has relatively more protein than that of other tropical food source like yam, potato, cassava, plantains, etc. As in other roots and tubers, arrowroot too is free from gluten. Gluten-free starch is used in special food preparations for celiac disease patients. According to US National Library of Medicine National Institutes of Health, being a low-glycaemic index food, arrowroot consumption in fact help in better regulation of blood glucose levels in diabetes patients. Fresh roots indeed are a good source of folates. 100 g arrowroot provides 338 µg or 84% of daily required levels of folates. Folate, along with vitamin B-12, is one of the essential components that take part in the DNA synthesis and cell division. Diet rich in folate when given during preconception periods and pregnancy may help prevent neural-tube defects and other congenital malformations in the offspring. Arrowroot contains healthy levels of the B-complex group of vitamins such as niacin, thiamine, pyridoxine, pantothenic acid, and riboflavin. Many of these vitamins take part as substrates for enzymes in carbohydrate, protein, and fat metabolism in the body. Further, it contains moderate levels of some essential minerals like copper, iron, manganese, phosphorous, magnesium, and zinc. Besides, it is an excellent source of potassium (454 mg per 100g or 10% of RDA). Potassium is an important component of cell and body fluids that help regulate heart rate and blood pressure.To prepare arrowroot powder, select fine quality tender roots. Wash them thoroughly in cold water. Scrape or peel the outer layer. At the processing units, the tubers are pounded in a mortar until it becomes a single mass. A clear milk-like liquid is extracted which is then filtered using a cheesecloth. The milk obtained thus is then dried under sunlight to get a fine, white arrowroot powder.

In general, arrowroot flour is added as a thickener, colloidal stabilizer, a binding and leavening agent in liquid-based recipes. It has several advantages over other starchy flours. It mixes well in low-temperature cooking and gives stable viscosity to the recipes. It has a neutral taste, prevents dextrinization (breaking carbohydrates to dextrin), and can be added to

acidic-based recipes. However, it will not get along well with dairy-based recipes as it turns them slimy. One tablespoonful of flour is enough to thicken one cup of liquid.

2.3 Enrichment of noodles

The knowledge about noodles production should be known with proper standards. And therefore, for the purposes of fortification or enrichment noodles could be a suitable food. In addition, to fulfill the consumer expectations enriched product should be economically affordable, nutritive and satisfactory. But they are indigent and less concerned about their protein quantity and amino acid balance. By enrichment of noodles and protein rich foods consuming could be a step to solve the deficiency problem. Especially in Asia recently, enriched noodles with nutritive compounds have become available in food market. When AKF addition level was increased Noodles had shown the lower sensory scores. In terms of mouthfeel (firmness) property t white salted noodles are soft (not very soft) (Kim, 1996). Whereas the difference was not significant ($p>0.05$) 5% AKF added noodle got the highest score for appearance. The study results, up to a level of 15%, flour weight basis, suggest that AKF incorporation seems suitable in terms of physicochemical and sensory properties. An alternative utilization of AK makes an important notice for producer and processors as flour substitute in noodle preparation. To evaluate undersize or broken kernels it is most probably possible to obtain flour. (E.Ebru and H .Mehmet , November,2008). From a lot of Noodles research here is an article about Xanthan gum used in Noodles. Significant difference has shown in color, starchy mouth feels, stickiness, firmness, from plain flour and with Xanthan gum (PNO) used flour($P<0.5$). It was found to be very smooth within the range of 1.5-4.2in terms of smoothness. It was adjudged to be very firm among the noodle samples from plantain flour andthe range of firmness values was (2.2-4.1). It was found not to be as sticky as other noodle samples produced from plantain flour and the range of values for stickiness was (1.4-4.3) also. It was found to have the least starch mouth feel, range of values for starchy mouth feel was (1.6-4.2). Noodles produced from plantain flours examined and the result shown that there was no significant difference ($p>0.05$) in all the sensory attributes (like appearance, flavour, taste, texture and colour). Between the plantain noodle samples and the commercial branded noodles, it has shown significant difference ($p<0.5$). (Ojure M.A and Quadri J.A, December 2012)

2.4 Objective

After undergoing the survey of literature, the following objectives were planned with a novel approach

1. To find out unique information about Noodles enrich with beetroot powder.
2. To find out the nutritional value of noodles and beetroot.
3. Determine the proximate analysis of noodles enrich with beetroot powder.
4. Differentiate Noodles with Beetroot powder and without Beetroot powder.

2.5 Limitation of study

Everything has some limitations. Therefore, this study also has some limitations.

The main limitation was due to Covid- 19. Because of this reason the research was to conducted properly. And cannot acquire more panelists for sensory evaluation. To make a perfect and clear research high technology and machineries were required.

CHAPTER- 3

RESEARCH METHODOLOGY

3.1 Sample collection:

The research conducted on Noodles enrich with beetroot and arrowroot, to estimate the proximate composition (Such as Moisture content, Protein, Fat). The experimental sample was collected from local market, this sample was collected as fresh as possible

3.2 Preparation of Beetroot Pulp

Fresh beetroot was collected and then washed with tap water and then beetroots were sliced into small pieces. The pieces of Beetroots were blanched in hot water at 75 to 85° C for 1 to 2 min. After blanching the beetroot slices were for cooling and the cooled beetroot slices were ground in a grinder and the puree was extracted.

3.3 Sample preparation:

Preparation of Noodles enriched with Beetroot pulp and arrowroot powder

Preparation of sample was followed with standards. Sample percentage was added on the base of flour weight as main ingredient. All the materials were weighed accurately and mixed together to form a dough. The dough should not be too much sticky and hard, it should be elastic. Rest the dough for 30 min for the gluten network to be generated.

Enrichment of beetroot pulp and arrowroot in noodles causes increasing the cooking time of noodles. But the bright red color of beetroot in noodles is little bit affected. From the analysis the results express that the nutritive value is increased as protein, antioxidant etc.



Fig 3.1



Fig 3.2



Fig 3.3



Fig 3.4

3.4 Proximate Analysis of Samples

3.41 Protein, fat, carbohydrate:

Main proximate nutrients of Noodles enrich with beetroot pulp and arrowroot powder are protein, fat and carbohydrate. These nutrients provide energy. They work for growth and metabolism. Protein is essential for building and repairing tissues. These nutrients also regulate the body processes.

3.41.1 Protein

For daily calories intake we need to take 15-20% from protein containing food. Noodle can be a great source of protein.

3.41.2 Fat

Fat is another essential nutrient, which we need to take every-day through fat, containing food. We should consume 30 % or less than 30% calories daily. Fat has different types such as saturated fat, polyunsaturated fat and monounsaturated fat. Saturated fat increases the blood cholesterol level, which is bad for our health. However, polyunsaturated fat decreases the blood cholesterol level. Monounsaturated fat also decreases the LDL cholesterol. LDL (Low-density lipoprotein) is known as bad cholesterol. It increases the risk of heart attacks.

3.41.3 Carbohydrate

Carbohydrate provides fuel and energy to our body. It is necessary to carry our daily activities. Our body requires Carbohydrate to perform its function continuously. Purple-fleshed sweet potato has great amount of carbohydrate. Therefore, we should take it regularly.

3.42 Determination of moisture:

Determination of moisture content of flour, beetroot powder and Noodles samples were conducted by AOAC method (AOAC, 1979).For this intention materials were taken as sample and weighed taken. The samples were allowed to dry into the oven dryer at 130°C for 24 hours in order to remove the moisture from the samples. Drying, cooling, and weight were recognized. Moisture content was calculated by using following formula:

3.43 Calculation of moisture (%)

$\%of\ moisture$=Weight of loss sample / weight of the sample taken ×100

3.44 Determination of proteins:

Proteins are complex nitrogenous substances formed by the sub unit of amino acid through peptide bond. Protein occupies a central position in the architecture and function of the living matter. The crude protein of Noodles enrich with beetroot powder was determined by micro kjeldhal method (Pearson, 1999). In the Kjeldahl procedure, proteins and other organic food components in a sample are digested with Sulphur acid in the presence of catalyst. The total organic nitrogen is converted to ammonium sulfate. The digest will be neutralized with alkali and distilled into a excess hydrochloric acid or Sulphur acid solution (back titration method). The unreacted acids are titrated with standardized alkali. The result of the analysis represents the crude protein content of the food since nitrogen also comes from non-protein components (the Kjeldahl method also measures nitrogen in any ammonia and ammonium sulphate).

3.44.1 Preparation of sample solution:

Solid foods are ground to pass a mash screen. Samples for analysis should be homogeneous. No other special preparations are required.

3.44.2 Preparation of digestion Solution:

- Take 0.4 gm sample, H2SO4 10 ml and digestion mixture (2gm CU2SO4+98gm K2SO4) 2gm.
- Put it on the digestion flask.
- Use two digestion flasks for this procedure so that average value can be taken.
- At first heat slowly, then increase the heat and heat about 3-4 hrs.
- The end point will be no white smoke of H2SO4 and the solution will be crystal clear.
- Cool it for some time.

3.44.3 Distillation:

- Pour the solution in a volumetric flask and make it 100ml level using distilled water.
- Take 10 ml from that volumetric flask to the distillation flask.
- Take 150 ml distilled water and 10 ml of 40% NaOH to the distillation flask.

- Take 50 ml of distilled water and 10 ml 0.1N HCL and 2 drops of methyl red (1%) in the trapping conical flask
- Use three distillation flasks for this procedure where one of them will be blank i.e. no sample only take 150 ml distilled water with 10 ml 40% NaOH.
- Use three trapping solution in three trapping conical flasks remaining the same thing.
- Set up the condenser and start it.
- Run for 30 min.

3.44.4 Titration:

- Fill the burette with 0.1N NaOH.
- Do the titration with 3 trapping solution.

The end point will be color changes from pink to light yellow.

3.44.5 Calculation:

(B-S) × 1.4 × 10 × 6.25 × 0.1 / sample weight

= **Result**

3.45 Determination of Fat content (%):

Fat is extracted, semi continuously, with an organic solvent. Solvent is heated and volatilized, then is condensed above the sample. Solvent drips onto the sample and soaks it to extract the fat. At 15-20 min intervals, the solvent is siphoned to the heating flask, to start the process again. Fat content is measured by weight loss of sample or weight of fat removed.

3.45.1 Calculation of Fat (%):

% of fat=weight of residue /weight of sample taken ×100

3.45.1 Estimation of Fat content:

- Sample weight taken.
- Weighted of the blank flasks and thimble.
- Filter the sample solution soaked in solution for 6 hrs.
- Cool in desiccator.

- Weigh of the flasks and thimble containing sample.
- Record the weighted fat that getting.

3.46 Determination of carbohydrate%

Weight of food in grams/100 x carb per 100g = amount of carb

3.47 Antioxidant activity assay:

In foods, antioxidants have been defined as substances that in small quantities are able to prevent or greatly retard the oxidation easily oxidisable materials such as fats. In the biological system, the definition for antioxidant has been extended to any substance that, we present in low concentrations compared to those of oxidisable substrate, significantly delays or prevent oxidation of that substrate Natural antioxidant, such as those derived from herbs, vegetables other plants have many advantages over chemical antioxidants (and processing procedures) currently used. They are readily accepted by consumers as considered to be safe not a chemical. Thus, no safety taste use required for legislation if a component of food is generally recognized as safe (GRAS). Natural antioxidants may function

a) as reducing agent

b) as free radical scavengers c)

as complexes of per oxidant metals

d) as quenchers of formation of singlet oxygen.

They can be use in food industry and there is evidence that they exert their antioxidant effects within human body. In response to the growing consumer demand, investigation on antioxidant from natural sources gained interest.

CHAPTER- 4

RESULT AND DISCUSSION

4.1 Table of proximate analysis:

Parameters	S1	S2
Moisture (%)	14.40%	12.2%
Protein (g)	12g	10g
Fat (%)	10.8%	12%
Carbohydrate (%)	19%	12%

Table 4.1

Proximate Analysis report of S1, S2

S1 – Noodles enriched with beetroot pulp and arrowroot powder

S2 – Standard sample i.e., normal spaghetti

Proximate analysis report

Table 4.1 shows that the values of carbohydrate (19%), protein (12g), moisture (14.40%) in S1 is higher than S2. And the value of fat percent (12%) in higher in S2 than in S1.

4.2 Sensory evaluation

SCORE	**S1**					**S2**				
	Appearance	Flav Our	Taste	Texture	Overall Acceptance	Appearance	Flavour	Taste	Texture	Overall Acceptance
Like Extremely	8	7	5	7	4	7	8	6	5	7
Like very much	7	8	9	9	10	5	5	7	6	7
Like moderately	5	5	6	4	6	8	7	7	9	6
Like slightly										
Neither like nor dislike										
Dislike slightly										
Dislike moderately										
Dislike very much										
Dislike extremely										

Table 4.2 Table of Sensory Evaluation

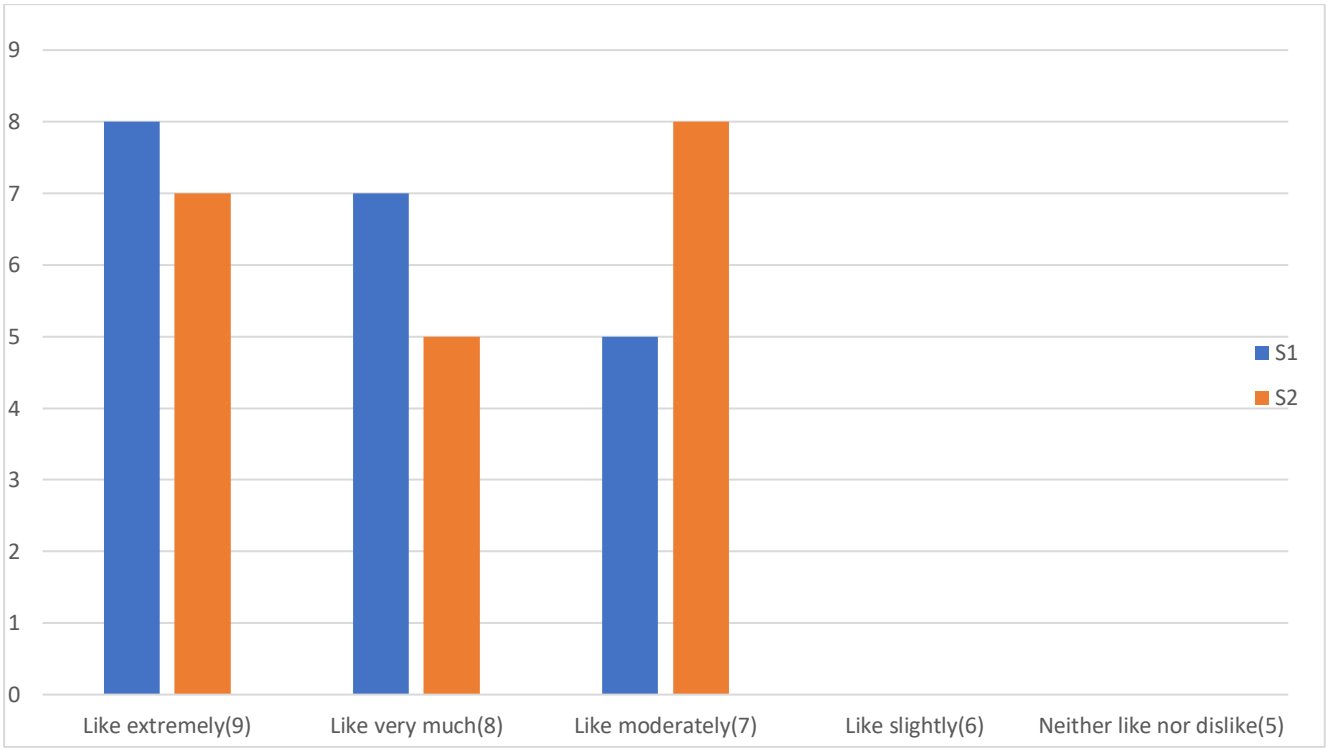


Fig 4.1 Column chart of sensory evaluation – Appearance preference

Fig 4.1 shows the appearance attributes of S1 and S2 bar charts in 9-point Hedonic scales. The bars showed that that sample- S1 got the highest score as liked very much.

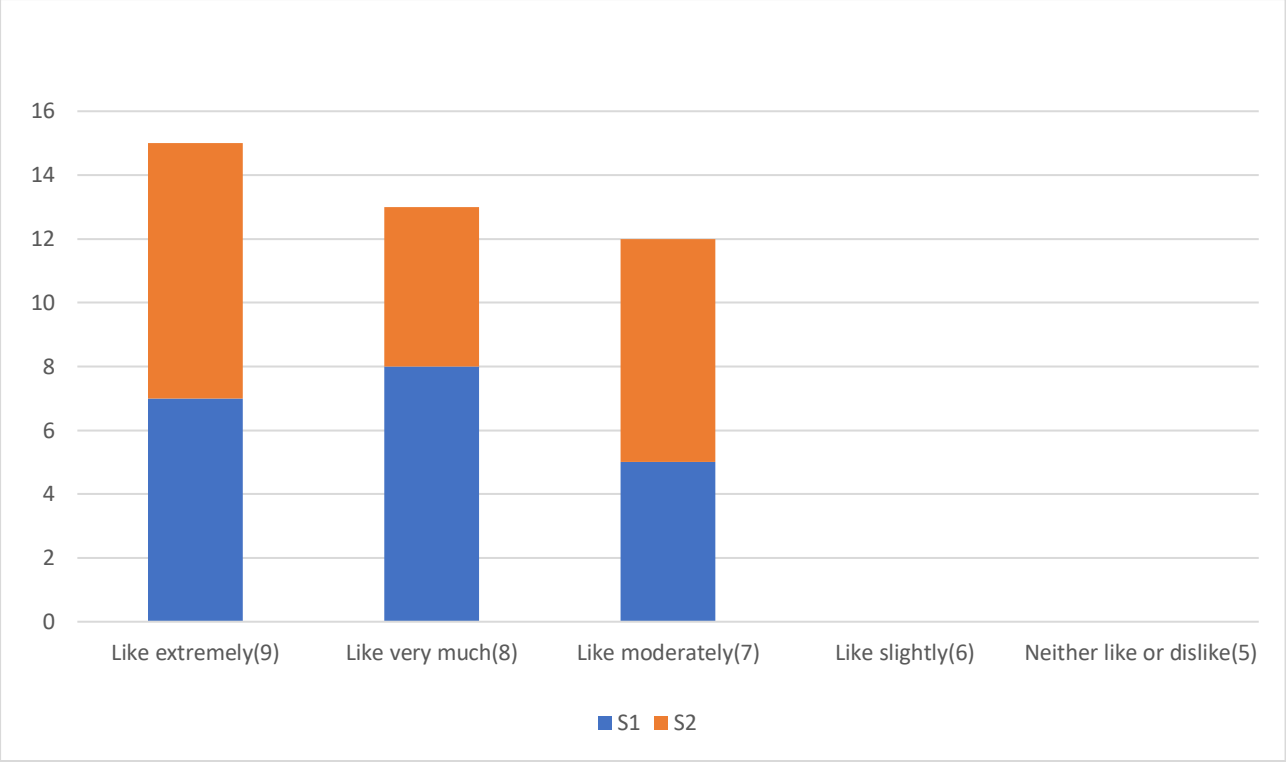


Fig 4.2 Column chart of sensory evaluation- Flavor preference.

Fig 4.2 shows the flavor preference attributes of S1, S2, bar charts in 9-point hedonic scales. The bars showed that sample-S1 got the highest score as liked very much

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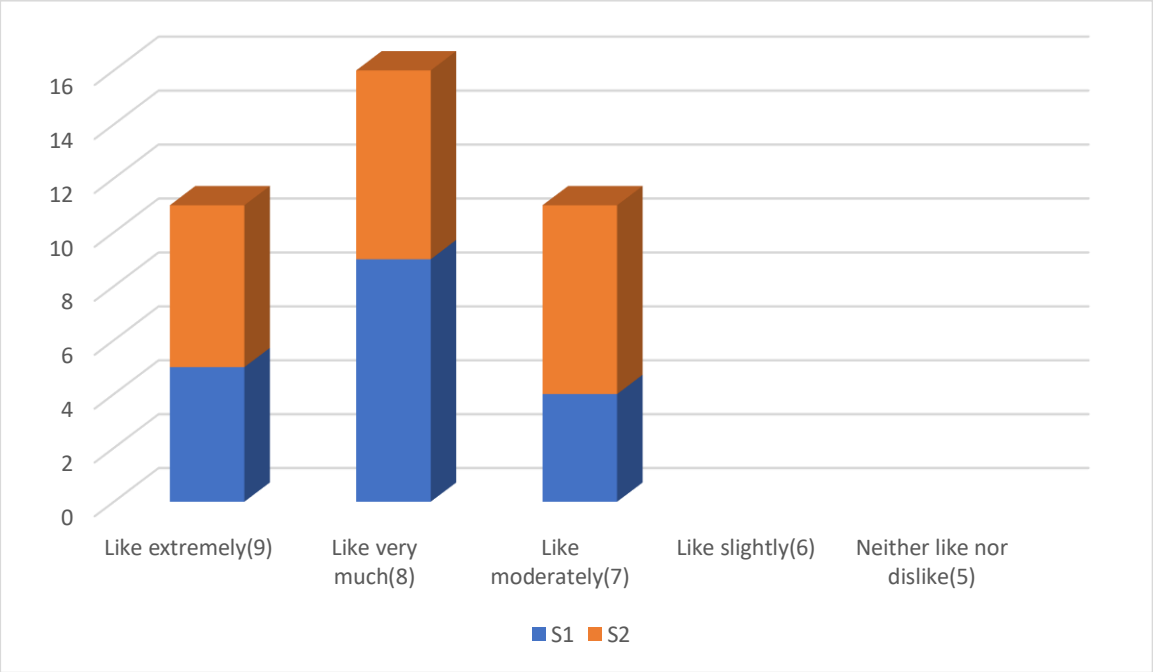


Fig 4.3 Column chart of sensory evaluation- Taste preference.

Fig 4.3 shows the Taste preference attributes of S1, S2, bar charts in 9-point hedonic scales. The bars showed that sample-S1 got the highest score as liked very much**.**

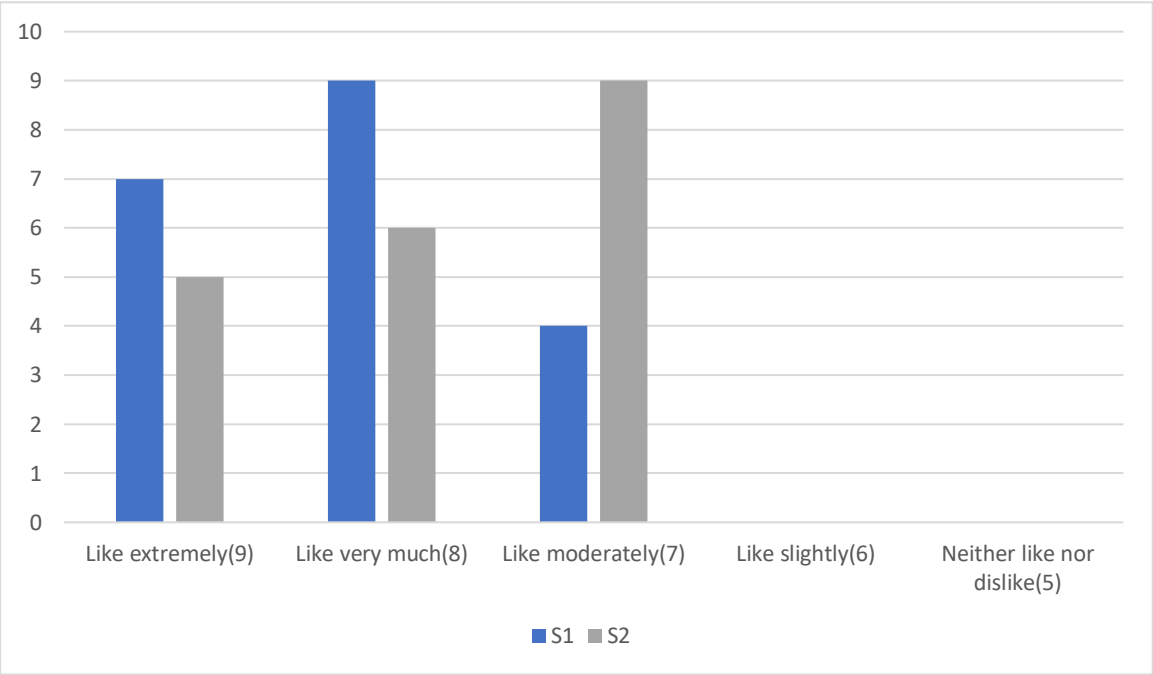


Fig 4.4 Column chart of sensory evaluation- Texture preference.

Fig 4.4 shows the Texture preference attributes of S1, S2 bar charts in 9-point hedonic scales. The bars showed that sample-S1 got the highest score as liked very much.

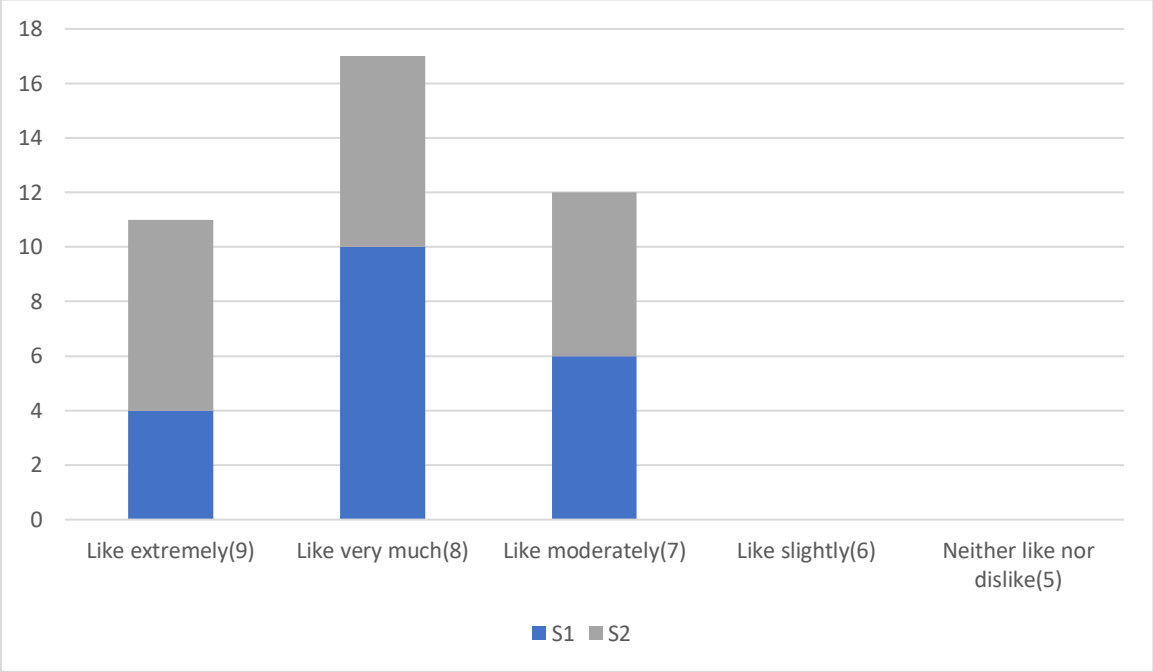


Fig 4.5 Column chart of sensory evaluation- Overall acceptance preference.

Fig 4.5 shows the Overall acceptance preference attributes of S1, S2 bar charts in 9-point hedonic scales. The bars showed that sample-S1 got the highest score as liked very much.

CHAPTER- 5

CONCLUSION

The study was revealed that sample S1 was higher in protein and fat content It was quite clearly depicted that S1 was the most acceptable in terms of overall acceptability and had gained maximum score in sensory characteristics as liked very much by the panellists. The study revealed that usage of beetroot pulp and arrowroot in noodles can provide attractive colour and to improve nutritional aspects. The purpose of this investigation was to extensive study of proximate composition such as moisture, protein, fat, carbohydrates of samples, further studies were required to determine total phenolic contents and total antioxidant properties of all samples.

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