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"STUDY ON BIOCHEMICAL AND NUTRITIVE VALUE OF POPPED FOXTAIL MILLET"

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ABSTRACT

Millets are rich source of nutrients and it was taken as food by the economically weaker section in the world. Popping is a simple processing technique to prepare ready to eat products. Fox tail millet (setaria Italica) is one type of minor millet are popped by mechanical process and used for the production of different snack foods. Foxtail millet have sulphur- containing aminoacids like tryptophan-0.99, threonine-3.10, isoleucine-7.60, leucine-16.06, lysine-2.10, methionine-2.80, phenyl alanine-6.70, valine-6.90, arginine-3.60 and histidine-2.10. In this study, the popping of millet with different pretreatment with sugar, sodium chloride, citric acid and control with water. Then the dried grains were popped in mechanical popper and the popped grain is used for different analysis such as physical and chemical analysis. The Physical characters like moisture, acidity, porosity, rapid viscosity, popped , unpopped, volume, length, breadth and Chemical characters like fat, carbohydrate, crude fiber, amylose, protein, starch, free fatty acid were analyzed from the popped foxtail millet. Then isolate the bacterial colonies were undergone for microbial load analysis such as TNTC, TLTC . The presence of carbohydrate, starch and amylase were analyzed from the prepared Starch cake food and health drink.

KEYWORDS: Foxtail millets,Processing technique, Popping ,Physical ,**Chemical.**

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1. INTRODUCTION

Millets are a group of highly variable grasses which are called as “little giant”. Millets are mainly classified into two they are major millets and minor millet.Major millets are maize, great millet and pearl millet. Minor millets includes six main grain crops like little millet (Samai or *Panicum sumatrense*), proso millet (Panivaragu or *Panicum milliaceum*),foxtail millet (Varagu or *Paspalum serobiculatu*),finger millet (Ragi in Tamil vernacular or *Eleusine coracana*).[5,6]. The most important millets are foxtail millet (*Setaria italic*), pearl millet (*Pennisetum glaucum*), finger millet (*Eleusine coracana*) and proso millet (*Panicum miliaceum*). Kernel colors vary from white, yellow, green, purple, black and grey. Kernel shape classified into three they are; souna (obovate, hexagonal, lanceolate), sanio (globular) and elliptical. In foxtail millet internal structure is similar to all millets. The pericarp is thin, aleurone layer is single celled, contain corneous and floury endosperm. Functional properties and potential uses as food of millets are described by [12,19]. In southern Karnataka 100% of the rural population and 94% of the urban population consume finger millet as a traditional food called “mudde” or “thick porridge”. [24]The foxtail millet can be cooked as rice after polishing and useful for the preparation of various snack foods.The combination of rice and foxtail millet for various product preparation helps to increase the nutritive value of the products. Millets have the following anti-nutritional components like polyphenols and tannin, phytic acid and phytate, goitrogen and oxalic acid. Millets change color reversibly from grey to yellow-green at alkaline pH, and partially reversibly from grey to creamy white under acidic conditions due to the presence of phenolic compounds (glucosylvitexin, glucosylorientin, vitexin)[29]. The millets are popped in traditional methods using hot sand media used as food for the preparation of snack foods. The popping of millets under this method leads to lesser yield and contamination with silica particles to the popped millets[18,15]. The popping of millet using suitable machinery without sand and standardization of optimum conditions will help to get higher yield of popped millet without silica particle contamination. The snack foods prepared from popped millets will be more acceptable by the consumer due to crispiness and the flavour.

2. METHODOLOGY

2.1 Effect of pretreatment with common salt, sugar, citric acid (10 min soaking) on popping of foxtail millet

The salt, sugar, citric acid solutions (each 100ml) were prepared with the required concentration for soaking of foxtailmillet grain(each 100g) separately.The millet grains were soaked for 10 minutes and then water was drained. The excess water in the grain was removed using filter paper. The moisture content of the grain was observed by oven dry method. This grain were popped in the electrically operated popping machine at 300^0c temperature for a few seconds. The water was used as untreated check for treating the grain for the comparision. The expansion volume, length and breadth of the popped grain were measured. The analysis of moisture,protein,carbohydrate,oil,free fatty acid were analysed using the standard methods.

2.2 Determination of acidity

Popped sample was soaked in distilled water for 10 min and 10 ml of solution was pipetted out and mixed with 2drops of phenolphthalein and Titrated against 0.01N NaoH and appearance of pale pink colour is the end point.

2.3 Fat estimation-soxhlet method

Accurately weighed 5-10g of test portion of grounded material (fine grinding) was taken in a thimble. Without previous drying; the sample was extracted in soxtherm fat extractor, with hexane for 6 hours. Then the bakers were dried in an air oven for 3 hours at 105^oC.

2.4 Estimation of free fatty acid

Take 1-10g of oil or melted fat was dissolved in 50ml of the neutral solvent in a 250ml conical

flask and it was mixed with few drops of phenolphthalein and it was titrated against 0.1N potassium hydroxide. The solvent was shaked constantly until a pink colour which persists for fifteen seconds is obtained.

2.5 Determination of total carbohydrate by anthrone method

About 100mg of the sample was weighed and it was hydrolysed with 5ml of 2.5N HCL. The solution was neutralized with solid sodium carbonate until the effervescence ceases and it was make up to the volume of 100ml and centrifuge. The supernatant was collected and 0.5and 1ml aliquots taken for analysis. The standard were prepared by taking 0, 0.2, 0.4, 0.6, 0.8 and 1ml of the working standard.'0' serves as blank. Make up the volume to 1 ml in all the tubes. Then it was added with 4ml of anthrone reagent and it was heated for eight minutes. The sample was cooled rapidly and the green to dark green colour readed at 630 nm. From the values the graph was plotted and from the values of graph the amount of carbohydrate was estimated.

2.6 Estimation of starch by Anthrone reagent method

Take 0.1-0.5 g of the sample was homogenized in hot 80% ethanol to remove sugars and centrifuged to retain the residue. The residue was washed repeatedly with hot 80% ethanol. The residue was dried. The residue was added with 5.0 ml of water and 6.5 ml of 52% perchloric acid. Extracted at 0^0c for 20 min.The sample was centrifuged and the supernatant was saved. 0.1 or 0.2 ml of the supernatant was Pipetted out and make up the volume to 1 ml. The standards Prepared by taking 0.2, 0.4, 0.6, 0.8 and 1 ml of the working standard and make up volume to 1 ml in each tube. 4 ml of anthrone reagent was added to each tube and heated for eight minutes in a boiling water bath. The sample was Cooled rapidly and the intensity of green to dark green colour was readed at 630nm.

2.7 Estimation of crude fibre

About 2 g of ground material was extracted with ether or petroleum, ether to remove fat (Initial boiling temperature 35-38°C and final temperature 52°C). After the extraction with ether 2 g of dried material was boiled with 200 ml of sulphuric acid for 30 min with bumping chips. The sample was filtered through muslin.The solution was boiled with 200 ml of sodium hydroxide solution for 30 min. Then the sample was filtered through muslin cloth again and wash with 25 ml of boiling 1.25% H2SO4, three 50 ml portions of water and 25 ml alcohol. The residue was removed and transfered to ashing dish (preweighed dish W1). The residue was dried for 2 h at 130±2°C and cooled the dish in desiccators and weigh (W2). The sample was Ignited for 30 min at 600±15°C the sample was Cooled in a desiccater and reweigh (W3).

2.8 Determination of amylose

Take 100 mg of the powdered sample was weighed, and added with 1 ml of distilled ethanol. Then it was added with 10 ml of 1N NaOH and leaved to over night. The sample was make up to the volume to 100 ml. 2.5ml of the extract was taken and mixed with about 20ml distilled water and then three drops of phenolphthalein. 0.1 N HCL was added drop by drop until the pink colour just disappears. Then 1 ml of iodine reagent was added and make up the volume to 50 ml and the colour readed at 590 nm. 0.2, 0.4, 0.6, 0.8 and 1 ml of the standard amylose solution was taken and develop the colour as in the case of sample. Then the amount of amylose present in the sample was calculated using the standard graph. 1 ml of iodine reagent was diluted to 50 ml with distilled water for a blank.

2.9 Nitrogen analysis by micro-kjeldahl method

About 100mg of the sample was weighed (containing1_3mg nitrogen) and transfered to a 30ml digestion flask. 1.9±0.1 potassium sulphate and 80±10mg mercuric oxide and 2ml conc.H2SO4 was added. If the sample size is larger than 20 mg dry weight, 0.1 ml H2So4 should be added for each 10 mg dry material. Boiling chips was added till the solution becomes colourless After cooling dilute it with distilled ammonia_free water and transfer to the distillation apparatus. The kjeldal flask should be rinsed with water. 100 ml conical flask containing 5ml of boric acid solution with a few drops of mixed indicator with the tip of

the condenser dipping below the surface of the solution and added with 10ml of sodium hydroxide -sodium thio sulphate solution to the test solution in the apparatus. Distill and collect the ammonia on boric acid (At least15-20ml of distillate should be collected). Titrate the solution against the standard acid until the first appearance of violet colour.

2.10 Starch cake food

The fox tail millet grains were soaked for over night in a fermentation flask. The grain was grounded and it was settled for 6to 8 hours. The liquid portion was drained and the remaining was discarded. The pink coloured liquid portion was used as nigerion food.

2.11 Gram staining

Make a thin smear of the culture and heat fixes it. Cover the smear with crystal violet for 30 seconds and wash gently, then add iodine solution and leave for 30 seconds. Wash off the iodine solution with 95% ethyl alcohol. Then wash the ethyl alcohol with distilled water. Finally add saffranin and allow it for 30 seconds. Wash off and analyze under microscope.

2.12 Hanging drop technique

Clean and flame a hanging drop slide. Place it on the table with the depression uppermost. Clean a cover slip. Apply petroleum jelly on each of the four corners of the cover slip.transfer one loopful of culture in the centre of the cover slip. Place the depression slide on the coverslip, with the cavity facing down so that the depression covers the suspension. Press the slide gently to form a seal between the coverslip and the slide.

3.RESULTS AND DISCUSSION

The fox tail millet grains were pretreated with different components like sugar, salt, citric acid and the control grains were pretreated with water. These different types of pretreated grains were popped in electrically operated popping machine at the hot air temperature of 360ºC at 600rpm, without any sand particles. The popping of foxtailmillet using hot air will not contain any sand particles as in the case of popping in hot sand media(230ºC) similarly, [17,14] reported that the hot air popping(Mechanical popper) improved the quality of popped grain when compare to popping in sand media in which the popped grain contain fine sand particles. The popped millet did not contain any silica particles in electrically popped foxtail millet grain [15,26] also revealed that the popping is a high temperature short time treatment to grains in air heated to about 300ºc.

3.1 Effect of popping with sodium chloride, sugar, citric acid (10min soaking) of foxtail millet

The foxtail millet was pretreated with sodium chloride, sugar, citric acid (10 min soaking) and popped in electrically popping machine. The popping percentage is higher in different varieties of foxtail millet grains viz; 65.74, 61.56 and 61.27 percent in 1,2,3,4 and 5 percent concentration respectively when compare to control (water). According to the moisture content present in between the grain and husk varies the popping percentage[21,23,28]. In this work 100g of foxtailmillet was soaked in different concentration of salt, sugar, citric acid with different percentage of 1%, 2%, 3%, 4% and 5% with 20ml of water. Then the samples were dried in room temperature for 1to2 days. The citric acid and sugar soaked samples takes higher time duration for drying[1,7]. The control (water) and sodium chloride treated millet grains shows higher popping percentage when compare to sugar and citric acid soaked samples.

3.2 Physicochemical nature of popped foxtailmillet with sodium chloride, sugar, citric acid (10min soaking)

The physical parameters like acidity, popped, volume of the popped foxtailmillet were shown in the figure 1, 2 and 3. But the results showed no more variations between the pretreated and control (water) samples[11,20]. The chemical parameters like fat, carbohydrate, crude fiber, amylose, protein, starch, free fatty acid were analysed and the results were shown in Figures 4,5,6, 7,8,9 and 10. The chemical parameter values are not much more different when compare to pretreated and control samples [16,27,8,4].

The rapid viscosity analyses were made and the results are shown in Table 2.. The salt treated samples shows higher variations when compare to sugar and control. The salt treated popped ground samples need high temperature (160ºC) and high rpm(1600) for its binding property but the sugar and control sample need low temperature(80ºC) and low rpm (600) for its binding property. From the rapid viscosity analysis and the binding property of the popped grain was analysed [10,30] and The binding property of the popped millet flour is very low. This analysis shows that the binding property of the flour occurs at which time and temperature. According to the time, temperature and rpm (rotation per minute) the flour reaches the colloidal state and shows its binding value.

3.3 Effect of expansion volume on popped foxtailmillet with sodium chloride, sugar, citric acid (10min soaking)

The pretreated grains with sodium chloride, sugar, citric acid and the control grains treated with water. These grains were popped in mechanical popper and the expansion volumes were determined. The results showed that the expansion volume of water treated control grains and different components treated grains shows no much difference. The popped grain expansion volume research studies were also made by [3,13,22]**.** The popped grain contains crunchy in nature. The sugar treated popped grains contains slightly sweet in taste, salt treated popped grains contains salty taste and the citric acid treated popped grains contains bitter in taste. [14] The popped foxtailmillet grains are commercially produced in large and small scale basis and the popped grains are marketed according to expansion volume basis. From the popped fox tail millet different snack foods are prepared and used for marketing.From the popped millet microbial load were analysed by using pour plate technique. In the agar plate white coloured isolated bacterial colonies were observed. The microbial loads were determined by using colony counter equipment. In the salt treated samples shows TNTC, TLTC values. The microbial load values were determined and shown in Table 1.

3.4 Product development

A fermented Starch cake food is prepared and nutrient analysis like carbohydrate, starch, amyloses were made and its results were shown in Figure 11. This food contains rich energy source when compare to other foods. Health drink and dried cake also prepared [2,17,25] and its results were shown in the Figure 12. From these foods nutrient analysis like carbohydrate, starch, amyloses were made. Health drink contains fruit mixtures like apple, grapes etc. by using popped millet. The sensory evolution shows very good results.

Figure 1
Analysis the Acidity in Popped Foxtail millet

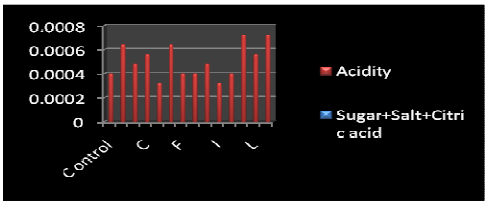

Figure 2
Analysis the amount of Popping in Foxtail millet

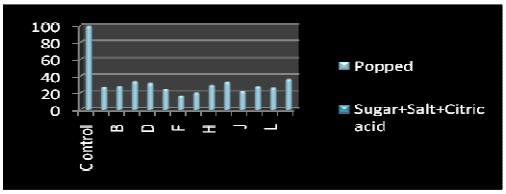

Figure 3
Analysis the Popped Volume in Foxtail millet

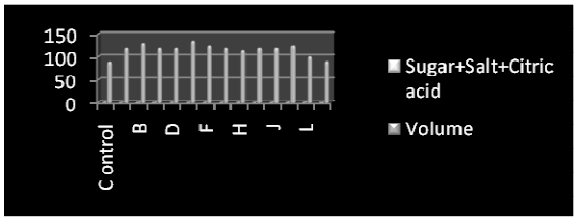

Figure 4
Analysis the Fat content in Popped Foxtail millet

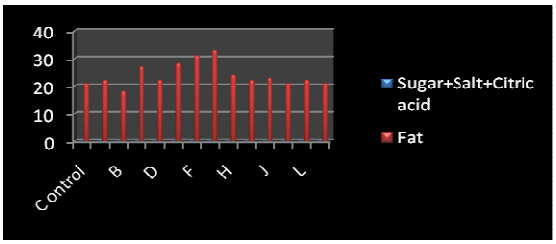

Figure 5
Analysis the presence of Carbohydrate in Popped Foxtail millet

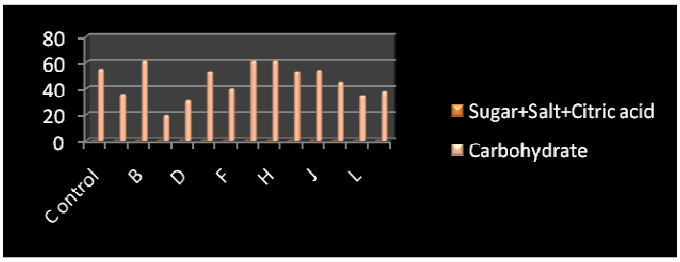

Figure 6
Analysis the amount of Crude Fibre in Popped Foxtail millet

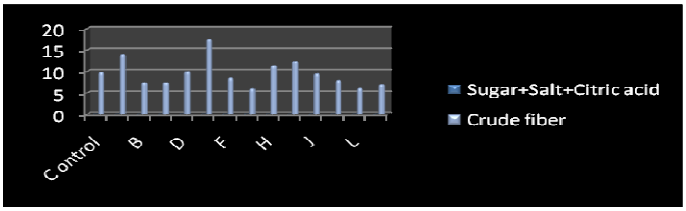

Figure 7
Analysis the Amylose content in Popped Foxtail millet

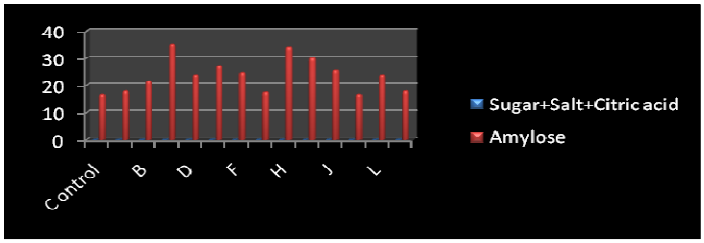

Figure 8
Analysis the amount of Protein in Popped Foxtail millet

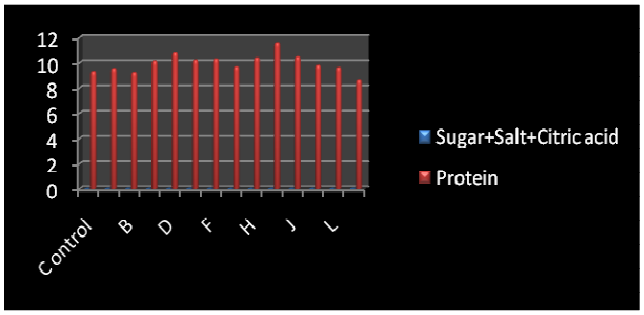

Figure 9
Analysis the Starch in Popped Foxtail millet

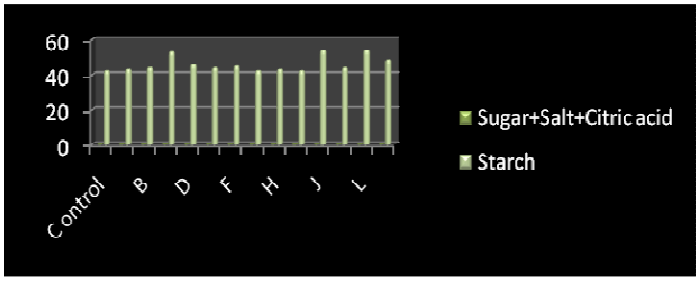

Figure 10
Analysis the Free fatty acid in Popped Foxtail millet

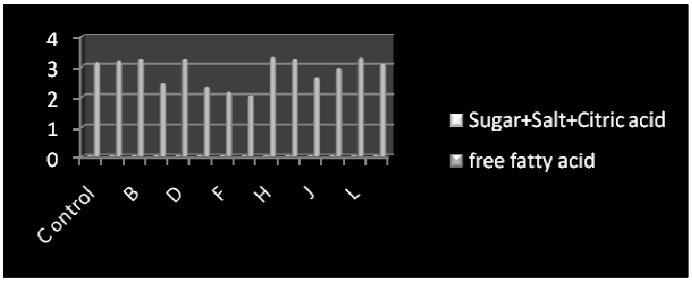

Figure 11
Starch Cake Food

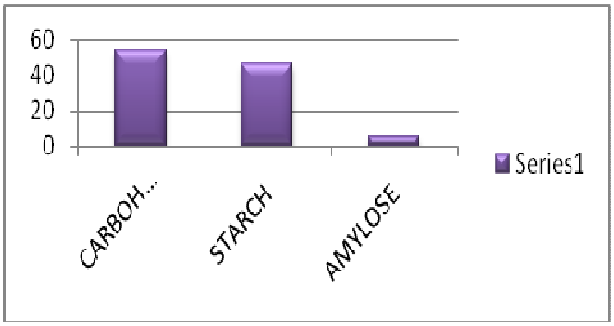

Figure 12
Health Drink

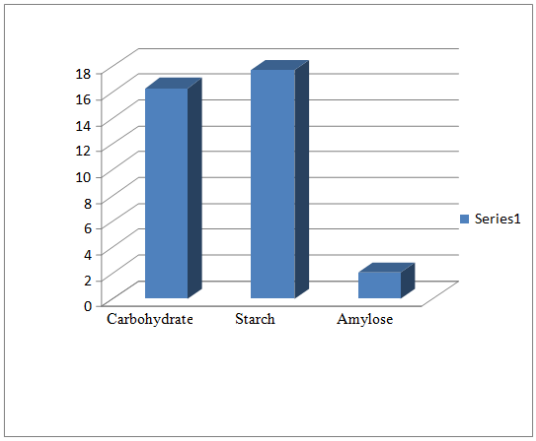

Table 1
MICROBIAL LOAD

Sugar+Salt+Citric acid 1%+1%+1%	21	14
1%+2%+1%	31	8
1%+3%+1%	10	8
1%+4%+1%	TNTC	19
1%+5%+1%	5	TLTC
2%+1%+1%	10	5
3%+1%+1%	34	6
4%+1%+1%	22	8
5%+1%+1%	85	6
1%+1%+2%	25	13
1%+1%+3%	TNTC	8
1%+1%+4%	98	28
1%+1%+5%	87	35

NOTE TNTC—Too Numerous to Count
TLTC—Too Low to count

Table 2
RAPID VISCOSITY ANALYSIS

S.NO	CONCENT-RATION	MOISTURE	WEIGHT OF FLOUR	WEIGHT OF WATER	TOTAL WEIGHT	PEAK VISCOSITY	TROUGH	BD (BREAK DOWN)	FINAL VISCOSITY	SB (SET BACK)	PASTING TIME
Control	12	9.7	3.333	25.167	28.5	151	140	11	197	46	6.73
1	12	9.9	3.341	25.167	28.5	176	172	4	294	118	6.67
2	12	8.9	3.304	25.196	28.5	186	180	6	288	102	6.53
3	12	10.1	3.348	25.152	28.5	269	261	8	421	152	6.93
4	12	9.4	3.322	25.178	28.5	110	104	6	162	52	7
5	12	9.8	3.337	25.163	28.5	309	309	0	503	194	6.93
6	12	9.5	3.326	25.174	28.5	348	342	6	496	148	6.87
7	12	9.5	3.326	25.174	28.5	94	83	11	135	41	6.8
8	12	9.9	3.341	25.159	28.5	96	91	5	154	58	6.67
9	12	9.0	3.308	25.192	28.5	67	63	4	113	46	6.4
10	12	9.8	3.337	25.163	28.5	175	171	4	287	112	7
11	12	9.7	3.333	25.167	28.5	280	276	4	442	162	7
12	12	10.5	3.363	25.137	28.5	192	188	4	298	106	6.8
13	12	9.6	3.330	25.170	28.5	98	93	5	177	79	7

4. CONCLUSION

This project work mainly revealed to determine the physicochemical nature of the popped fox tail millet. The popping of millet with different pretreatment with sugar, sodium chloride, citric acid and control with water. Then the dried grains were popped in mechanical popper and the popped grain is used for different analysis. The first and second part of this work showed that the physical and chemical parameter values did not show much difference when compared to control than treated grains. The third part of the work showed that the presence of microbial load. The fourth part of this work from fermented product Kamu (A Nigerion starch cake food) and Health drink showed that the presence of carbohydrate, starch, amylose and also characters like appearance, taste, texture are in good condition.

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