



STUDY ON EXTRACTION AND ORGANOLEPTIC EVALUATION OF OKRA AND HYBISCUS MUCILAGE INCORPORATED PRODUCTS

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ABSTRACT

Mature okra stem and hibiscus leaves were cut into pieces and pounding and soaking in water (1:10, v/v) at 6 hours. After 6hrs, the extract was filtered through double layer muslin cloth and get residue. Flocculate the mucilage with ethanol in 50:50 v/v, washed with acetone (100%) and air dried and was made into powder. The moisture, protein, fat, energy, fiber and carbohydrate of okra & and hibiscus mucilage were estimated. The energy content of okra and hibiscus mucilage was 74.5 and 88.17 respectively. By using okra and hibiscus mucilage powder recipes such as idli, upma and roti were prepared and evaluated for consumer acceptability and nutritive value. All the prepared products had higher acceptability in term colour, texture, flavor and taste.

Key words: Hibiscus, Okra, Mucilage powder.

INTRODUCTION

Okra (ladies finger) is valued for its edible delicious and nutritious green fruits as throughout the world. Ethiopia, India, Africa, North America, South America and Caribbean are its origin (www.Holisticonline.com). The plant contains in its fruit leaves and stem, a mucilaginous material that has several food and medicinal uses. In India cooking it is sautéed or added to gravy-based preparations and soups. The green stems of mature plants after the picking of fruit are generally used for preparation of crude mucilage extract. Mucilage powder is used as clarificant in jaggery manufacture (Nisha, 1998). The okra mucilage is a glycoprotein comprising of about 10% protein and 80% polymeric carbohydrates. It has large water binding properties due to hydroxyl group of sugar. The okra mucilage helps to stabilize blood sugar by curbing the rate of which from the intestinal tract (Kalu *et.al*, 2006). *Abelmoschus esculentus* is cultivated throughout the tropical and warm temperate regions of the world for its fibrous fruits or pods containing round, white seeds. The fruits are harvested when immature and eaten as a vegetable (kiran, 2002). Okra is eaten as a food. A traditional food plant in Africa, this vegetable has potential to improve nutrition, boost food security, foster rural development and support sustainable land care.

Mucilage's are not pathological products. They are formed in normal plant growth within the plant by mucilage-secreting hairs, sacs, and canals; however, they are not found on the surface as exudates as a result of bacterial or fungal action after mechanical injury, as are gums. Mucilage's occur in nearly all classes of plants in

various parts of the plant, usually in relatively small percentages, and are not infrequently associated with other substances, such as tannins (Whistler, R. L.; Conrad). The most common sources are the root, bark, and seed, but they are also found in the flower, leaf, and cell wall. Any biological functions within the plant are unknown, but they may be considered to aid in water storage, decrease diffusion in aquatic plants, aid in seed dispersal and germination, and act as a membrane thickener and food reserve (Wee Yeow Chin, 1992 and Brewer1992).

Hibiscus Rosasinensis is belonging to the malvaceae family is native to tropical Asia. All parts of *Rosainensis* plants, the roots, leaf, stem and flower are studied greatly in detail by several investigators (www.herbs.com). The hibiscus flowers are used for several medicinal uses in different countries (www.wiki.org/hibiscus). Hibiscus leaves are astringent, demulcent, enrollent, regrigerant, constipating, hypoglycemic, aphorodisiae, emenagogue and used for treating aloparia, burning sensation in the body, diabetes and mental disorders (Khemani *et al*, 2007 and kendall *et al* 2006). Hibiscus plants are among the showiest of flowering shrubs, often reaching 30feet in nature. Glossy foliage varies somewhat in size and texture depending on variety. All parts of the plant, the roots, leaf, stem and flower are studied in great detail by several investigators. Estimated Indian demand for hibiscus dry flowers is around 300 tonnes per annum. Expert market for herbal shampoo would be a thrust area

A 2008 USDA study shows consuming hibiscus tea lowers blood pressure in a group of pre-hypertensive and mildly hypertensive adults. Three cups of

tea daily resulted in an average drop of 7.2 point in their systolic blood pressure, compared to a 1.3 point drop in the volunteers who drank the placebo beverage. Study participants with higher blood pressure readings (129 or above), had a greater response to hibiscus tea, their systolic blood pressure went down by 13.2 points. This data supports the idea that drinking hibiscus tea in an amount readily incorporated into the diet may play a role in controlling blood pressure, although more research is required (Marshall, R. D. 1972& Pearson, D, 1970).

MATERIALS AND METHODS

Okra (Ladies finger) and Hibiscus Rosasinensis were selected for extraction and standardization of recipes. The nutrient composition of mucilage powder and the recipes were analyzed. Recipes were standardized by using mucilage incorporated with cereal and millet.

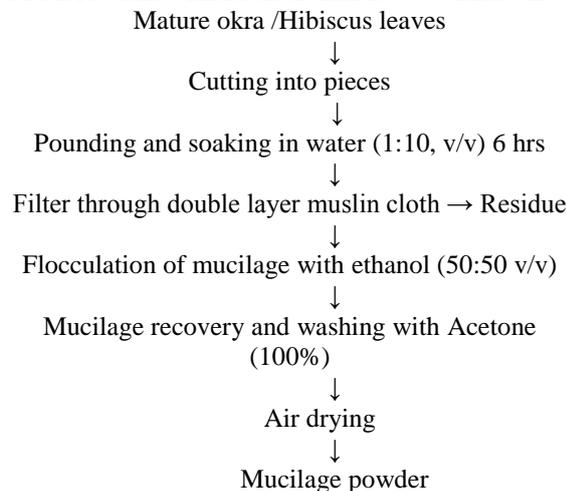
EXTRACTION OF MUCILAGE

Mature okra stem/Hibiscus leaves were cut into pieces and pounding and soaking in water (1:10, v/v) at 6 hours.

EXTRACTION OF MUCILAGE

Then it filters through double layer muslin cloth and get residue. Flocculation of mucilage with ethanol in 50:50 v/v. It was washing with acetone (100%) and air drying was used for powder of mucilage.

PROCESS AND PREPARATION OF MUCILAGE FROM MATURE OKRA AND HYBISCUS LEAVES



EFFECT OF EXTRACTION CONDITIONS ON THE RECOVERY

In the extraction of mucilage, the effect of extraction was analyzed by doing the extraction procedure in different conditions and the mucilage yield was calculated. The best dilution with maximum mucilage yield was selected for further analysis using different

soaking periods such as 3,6,12,24 and 48 hours, and the mucilage yield in percentage was analyzed.

EXTRACTION CONDITIONS

Sample: Solvent (W/V)

1:5
1:10
1:20
1:50

Soaking period, hours

2:0
4:0
8:0
12:0
16:0

NUTRIENT COMPOSITION OF MUCILAGE POWDER

The nutrient content of the mucilage powder and recipes were analyzed. The chemical constituents namely, carbohydrate, protein, fat, fiber and energy were determined.

RECIPE FOR IDLI

For the preparation of idli the ingredients like 60g rice /60g finger millet, 30g black gram, 10g fenugreek seeds and 5g okra mucilage powder/hibiscus mucilage powder made into batter which was allowed to ferment 24hr. After fermentation, the batter was dispensed into pan and steam cooked.

RECIPE FOR ROTI

For the preparation of roti, the flour of rice or finger millet (70g), wheat flour (30g) and okra or Hibiscus mucilage powder (5g) were made into dough. The dough balls were rolled into thin flat rounds was backed over the heated iron pan till both sides were cooked.

RECIPE FOR UPMA

The coarsely ground flour(95 g rice flour or finger millet ,5g of bengal gram dhal and 5g of mucilage powder) was roasted slightly in a pan and then boiled with sufficient water (two times the weight) till cooked.

ORGANOLEPTIC EVALUATION

The recipes was evaluated using a panel of 20 trained judges to assess colour, appearance, flavor, texture, taste and overall acceptability using 9 point hedonic score card (Bhat and Sharma, 1989). The data were statistically analyzed using randomized block design. For the analysis, the products developments were grouped into 3 dish namely idli, upma and roti and supplementary foods. The average of the score under each group of product was taken for analysis. This was done to arrive at definite conclusion about the type of product liked by the consumers.

RESULT AND DISCUSSION

PERCENTAGE OF RECOVERY OF MUCILAGE FROM OKRA AND HIBISCUS IN VARIOUS EXTRACTION CONDITIONS

The yield of mucilage powder from okra and hibiscus obtained by filtration of extract was 4% for the 1:10 dilution. Maximum yield of mucilage was obtained only soaking for 6hrs before filtration.

NUTRIENT COMPOSITION OF MUCILAGE POWDER

The energy content of okra mucilage powder and Hibiscus mucilage powder was 74.5kcal and 88.17kcal respectively (Table 1). The protein content of okra mucilage powder is 3.97g/100g and hibiscus mucilage powder is 3.9g. The fat content is 0.2g in okra mucilage powder and 0.87gm hibiscus mucilage powder and fiber content of okra mucilage powder is 2.07g and hibiscus mucilage powder is 2.87g.

Table -1 Nutritive value of extracted mucilage Powder

Nutrients	Okra mucilage powder	Hibiscus mucilage powder
Energy (kcal)	74.5	88.17
Protein (g)	3.97	3.9

fat(g)	0.2	0.87
Carbohydrate (g)	14.2	17.4
Fibre(g)	2.07	2.87

ORGANOLEPTIC EVALUATION OF PRODUCTS

As evident from table 2, Rice based hibiscus mucilage Idli recipe given high scores of 7.8 and in contrast rice based okra mucilage Idli recipe was given a lower score of 7.06 for appearance attribute. For the attribute of colour, Ragi based okra mucilage Idli recipe given higher score of 6.26 and in contrast Ragi based hibiscus mucilage Idli recipe was given a lower score of 5.20. For the attribute of flavour, Rice based okra mucilage Idli recipe and Ragi based okra mucilage were given maximum scores 7.40 and Ragi based okra mucilage Idli recipe was given a minimum score of 7.20. Rice based okra mucilage idli recipe was given higher scores of 5.6 and Ragi based hibiscus mucilage was given a lower score of 4.86 for texture attribute. For the attributes of taste, Rice based hibiscus mucilage idli recipe was given higher score of 6.80 and ragi based hibiscus mucilage idli recipe was given lower score of 6.6. In the overall acceptability, rice based okra mucilage Idli recipe was found to be highly accepting with a score of 6.80.

Table 2 Organeloptic evaluation of idli

S.no	Recipe	Appearance	Colour	Flavour	Texture	Taste	Overall acceptability
1.	Rice based okra mucilage Idli	7.066±0.7 ^a	6.13±1.18 ^b	7.40±0.50 ^a	5.6±1.34 ^a	6.80±0.77 ^a	6.80±1.37 ^b
2.	Ragi based okra mucilage Idli	7.60±0.50 ^b	6.26±1.09 ^b	7.20±0.41 ^a	5.46±1.1 ^a	6.73±0.96 ^a	5.86±1.40 ^a
3.	Rice based hibiscus mucilage Idli	7.86±0.35 ^b	5.86±0.91 ^{ab}	7.26±0.45 ^a	5.26±0.9 ^a	6.86±1.06 ^a	6.06±0.59 ^{ab}
4.	Ragi based hibiscus mucilage idli	7.53±0.51 ^b	5.20±0.41 ^a	7.40±0.50 ^a	4.86±0.8 ^a	6.66±0.97 ^a	5.8±1.14 ^a
5.	F.ratio	5.814	3.724	0.670	1.447	0.123	2.281
6.	P value	0.002 ^{**}	0.016 [*]	0.574 ^{NS}	0.239 ^{NS}	0.946 ^{NS}	0.089 ^{NS}

**-Significant at 0.01% level, *-Significant at 0.05% level, NS-No significant difference

Table 3: Organeloptic evaluation of roti

S.no	Variation of recipe	Appearance	Colour	Flavour	Texture	Taste	Overall acceptability
1	Rice based okra mucilage Roti	6.6± 0.72 ^b	6.53±1.06 ^a	5.66±1.39 ^a	5.46±0.516 ^a	5.80±0.77 ^a	6.86±0.83 ^b
2	Ragi based okra mucilage Roti	7.33±0.72 ^c	6.46±1.40 ^a	6.0±1.00 ^{ab}	6.93±0.798 ^b	6.46±1.18 ^a	7.13±0.83 ^a
3	Rice based hibiscus mucilage Roti	5.53±1.06 ^a	5.80±1.26 ^a	6.86±0.83 ^c	7.53±0.51 ^c	6.26±0.96 ^a	6.33±1.23 ^a
4	Ragi based hibiscus mucilage Roti	7.20±0.67 ^{bc}	6.46±0.91 ^a	6.53±0.63 ^{bc}	6.86±1.06 ^b	5.86±0.63 ^a	6.53±1.12 ^a
5	F.ratio	15.31	1.295	4.250	20.02	1.835	1.802
6	P value	0.000 ^{**}	0.285 ^{NS}	0.009 ^{NS}	0.000 ^{**}	0.151 ^{NS}	0.157 ^{NS}

** -Significant at 0.01% level, * -Significant at 0.05% level, NS-No significant difference

Results of Duncan test revealed that there is a significant difference between rice based okra mucilage Idli recipe with Ragi based okra mucilage Idli recipe and rice based hibiscus mucilage idli recipe as well as Ragi based hibiscus mucilage Idli recipe for the attributes of appearance. For colour attribute, there is a significant difference between ragi based hibiscus mucilage Idli recipe with rice based okra mucilage idli recipe and Ragi based okra mucilage Idli recipe. There is no significant difference for flavour, texture, taste and overall acceptability.

Table 3 shows that ragi based okra mucilage roti recipe were given high scores of 7.33 followed by the least score of 5.53 was obtain from ragi based hibiscus mucilage roti recipe. For the attributes of colour rice based okra mucilage roti recipe were given high scores of 6.53 and lower score was given by rice based hibiscus mucilage roti recipe. For the attribute of flavour, rice based hibiscus mucilage roti recipe was given high scores of 6.86 and in

contrast rice based okra mucilage roti recipe was given lower score. For the attributes of texture rice based hibiscus mucilage recipe were given higher scores of 7.53 and lower score of 6.86 for Ragi based hibiscus mucilage roti recipe. For the taste attribute, Ragi based okra mucilage roti recipe was given high score of 6.46 and lower score of 5.80 for rice based okra mucilage roti recipe.

Results of Duncan's test revealed that there is significant difference between rice based hibiscus mucilage roti recipe with rice based okra mucilage roti recipe and ragi based okra mucilage roti recipe for appearance. There was also significant difference between rice based okra mucilage roti recipe with ragi based okra mucilage roti recipe & rice based hibiscus mucilage roti recipe. There is no significant difference between recipes for colour, flavour, taste and overall acceptability.

Table 4 Organoleptic evaluation of Upma

S.no	Recipe	Appearance	Colour	Flavour	Texture	Taste	Overall acceptability
1.	Rice based okra mucilage Upma	5.86 ± 0.91 ^a	5.40±0.63 ^a	6.60±1.24 ^b	5.60±0.73 ^a	5.07±0.75 ^a	6.53±0.74 ^a
2.	Rice based okra mucilage Upma	5.93±0.88 ^a	5.33±0.97 ^a	6.46±1.18 ^b	5.80±0.77 ^a	5.93±.98 ^b	6.60±0.63 ^a
3.	Rice based hibiscus mucilage Upma	6.26±1.16 ^a	5.46±0.74 ^a	6.53±1.12 ^b	5.73±0.70 ^a	5.46±1.2 ^{ab}	6.66±0.48 ^a
4.	Ragi based hibiscus mucilage Upma	5.9±0.79 ^a	6.06±1.27 ^a	5.40±0.82 ^a	6.53±0.82 ^b	5.46±0.92 ^a	6.66±0.61 ^a
5.	F.ratio	0.542	1.932	3.964	4.030	1.684	0.156Ns
6.	P value	0.656 ^{NS}	0.135 ^{NS}	0.012 [*]	0.011 [*]	0.181 ^{NS}	0.926 ^{NS}

**-Significant at 0.01% level, *-Significant at 0.05% level, NS-No significant difference

Table 5 Nutritive value of Hibiscus incorporated rice based recipes

S.No.	Nutrients	Hibiscus incorporated rice based recipes			Hibiscus incorporated ragi based recipes		
		Idli	Roti	Upma	Idli	Roti	Upma
1.	Energy (Kcal)	255.87	356.07	272.6	284.97	317.7	325.2
2.	Protein(g)	5.95	10.16	5.6	5.8	9.8	6.2
3.	Fat(g)	1.01	8.53	8.91	1.5	8.6	8.9
4.	Carbohydrate(g)	58.39	62.4	63.21	62.8	61.0	61.6
5.	fibre (g)	5.8	8.5	5.96	8.03	9.3	8.2

The table 4 shows that, rice based hibiscus mucilage upma recipe was found to obtain the maximum score of 6.26 and minimum score of 5.86 for rice based okra mucilage upma recipe for appearance. For the attribute of colour, Ragi based hibiscus mucilage upma recipe was found to obtain the maximum score of 6.06 and minimum score of 5.33 for Ragi based okra mucilage upma recipe. For flavour attribute, Rice based okra mucilage upma recipe was found to obtain the maximum score of 6.60 and minimum score of 5.40 for Ragi based hibiscus mucilage upma recipe. For the attribute of texture,

Ragi based hibiscus mucilage upma recipe was found to obtain the maximum score of 6.53 and minimum score of 5.60 for rice based okra mucilage upma recipe. In the taste attribute, ragi based okra mucilage recipe was found to obtain the maximum score of 5.93 and minimum score of 5.0 for rice based okra mucilage upma recipe for taste attribute. In the overall acceptability Rice and Ragi based hibiscus mucilage upma recipe were found to be highly accepted with a score of 6.66. Results of Duncan's test revealed that there was a significant difference between Ragi based hibiscus mucilage upma recipe with rice based

hibiscus mucilage upma and rice and ragi based okra mucilage upma for flavour attribute. There was also significant difference between Ragi based hibiscus mucilage upma recipe with rice and ragi based okra mucilage upma recipe and rice based hibiscus mucilage upma recipe for texture attribute. There was no significant difference between the recipes for attribute of appearance, colour, taste and overall acceptability. The energy is high for okra incorporated ragi based recipes. Protein and fat content were high for okra incorporated ragi based recipes than rice based recipes. Carbohydrate and fiber content was also high in ragi based okra incorporated recipes than rice based recipes except fiber content (59.21 and 8.9g respectively) of roti.

NUTRIENT COMPOSITION OF HIBISCUS INCORPORATED RICE/RAGI RECIPES

The nutrient composition of hibiscus incorporated rice or ragi recipes were shown in table 5. The energy content of hibiscus incorporated rice based roti (356.07 kcal), upma (272.6) were higher than ragi based product. But energy content of ragi based idli (284.97) was higher than rice based (255.87) recipes. Protein content was higher in ragi based recipes except upma than rice based recipes. Carbohydrate was higher in rice based roti and upma than ragi based recipes. Fiber content was high in ragi based recipes. Compare with okra, hibiscus recipes contains more nutrient composition.

CONCLUSION

The yield of mucilage powder from okra and hibiscus obtained by filtration of extract was 4% for the 1:10 dilution. Maximum yield of mucilage was obtained only soaking for 6hrs before filtration. The energy content of okra mucilage powder and Hibiscus mucilage powder was 74.5kcal and 88.17kcal respectively. The protein content of okra mucilage powder is 3.97g/100g and hibiscus mucilage powder is 3.9g. The fat content is 0.2g in okra mucilage powder and 0.87gm hibiscus mucilage powder and fiber content of okra mucilage powder is 2.07g and hibiscus mucilage powder is 2.87g. Rice based hibiscus mucilage Idli recipe given high scores of 7.8 and in contrast rice based okra mucilage Idli recipe was given a lower score of 7.06 for appearance attribute. Ragi based okra mucilage roti recipe were given high scores of 7.33 followed by the least score of 5.53 was obtain from ragi based hibiscus mucilage roti recipe. Rice based hibiscus mucilage upma recipe was found to obtain the maximum score of 6.26 and minimum score of 5.86 for rice based okra mucilage upma recipe for appearance.

ACKNOWLEDGEMENT

The first author acknowledges the financial support provided by the **Tamil Nadu State council for Science and Technology, Chennai** through the student

Research Fellowship scheme to carry out this research work.

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