



Develop the Value Added Products and Evaluate the Storage Quality of Kodo Millet Grains Products

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ABSTRACT

Kodo millet is rich in dietary fiber and minerals like iron, antioxidant. The phosphorus content in kodo millet is lower than any other millet and its antioxidant potential is much higher than any other millet and major cereals. Processing like parboiling and debranning affects the mineral content and fibre, however it reduced anti-nutritional factors like phytate. Several traditional Indian food items have been prepared solely from kodo or blended with other cereal and legume flours to enhance the nutritional value, palatability and functionality. Development and value addition to kodo millet incorporated products like kodo millet dosa, pongal, cutlet, methi rice, sev, thattai, payasam, pakoda and halva. It can be concluded that sensory evaluation done on all the recipes revealed that Kodo millet significantly improved their organoleptic and storage quality. Organoleptic evaluation of sev during storage gradually decreases from 5th day and it was not acceptable on 15th day similarly the organoleptic evaluation of thattai during storage decreases from 5th day and it was moderately not acceptable on 15th day. All products revealed that kodo millet significantly improved their organoleptic and storage quality and also contributed to their high acceptance.

Key words: Kodo millet, Rice grass, Phytate, Fibre

INTRODUCTION

In India different kinds of traditional foods made from small millet grains from staple diet for many rural and urban households. The kodo millet is known as cow grass, rice grass, ditch millet, Native Paspalum, or Indian cow grass⁴.

The local names of kodo millet varies from region to region and it is known as Kodo in Bengali, Kodra in Gujarati, Punjabi and

Marathi, kodon in Hindi, Harka in Kannada, koduain in odia, Varagu in tamil and Arikelu in Telagu.

Kodo millet is one of the hardiest crop grown in Madhya Pradesh, Maharashtra, Uttar Pradesh, Deccan region and the cultivation as estimation says kodo millet is grown in area of about 9,07,800ha with annual production about 3,10,710 tonnes.

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Madhya Pradesh and Tamil Nadu have maximum share in the production and promotion of kodo millet. Government of Madhya Pradesh also playing active role in promoting the cultivation and marketing of this crop. The Paspalum genus has more than 400 species, usually an annual crop.

Kodo millet is monocot and the seeds are very small and ellipsoidal, being approximately 1.5mm in width and 2mm in length; they vary in color from being light brown to a dark grey. Kodo millet has a shallow root system which may be ideal for intercropping. The grain is enclosed in hard, corneous, persistent husks (Deshpande et al). Kodo millet cooks very fast. It is fantastic substitute for rice and can be used to make a variety of dishes. It can be consumed at every meal-breakfast, lunch and dinner. Here are some delicious recipes that can be made with Kodo millet.

Breakfast : Upma with vegetables, dosa, idli, adai.

Lunch/Dinner: Kodo millet coriander rice/methi rice, Kodo millet pulao, mixed millet chapathi.

Dessert : Kodo millet payasam, Sheera.

Snacks : Kodo millet chakli, murukkus, biscuits.

MATERIAL AND METHODS

Value addition to Kodo

Minor millets can be used for traditional as well as novel foods. However, there is a need to look into the possibilities of alternative uses. Value addition to food has assumed critical importance in the last decade due to the socio economic and industrial factors.

3.4.1 Selection of the recipe

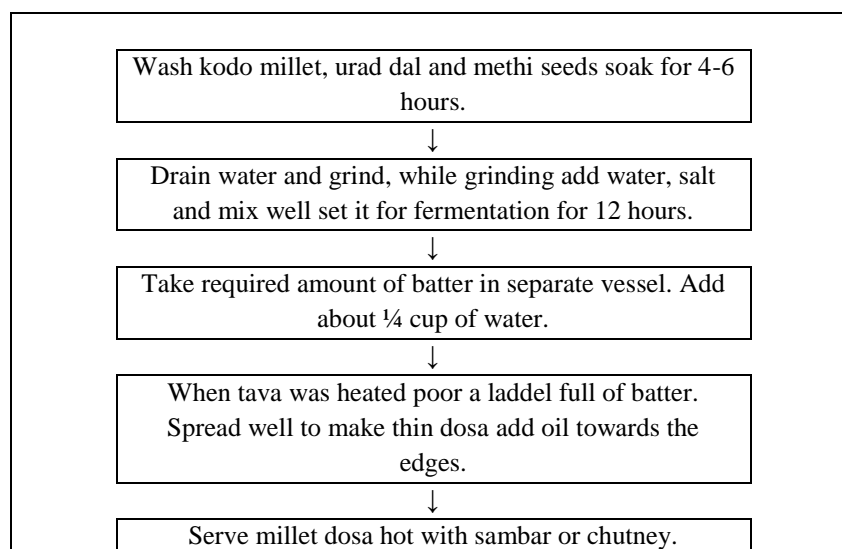
Here, the Kodo millet dosa, pongal, cutlet, methi rice, sev, thattai, payasam, pakoda and halwa are made, this type of products may provide balanced nutrients. Hence, an attempt was made to explore the Value addition of kodo millet in terms of this products.

3.4.1. Preparation of Kodo millet dosa

Ingredients

Kodo millet - 100g, Urad dal - 25gm, 1 teaspoon methi seeds and Salt

Method of preparation



1.4.1.2 Preparation of kodo millet pongal

Ingredients

Kodo millet - 50gm, Split green gram lentils - 25gm

Fresh grated coconut - 1/4 cup, Chopped ginger - 1 tea spoon

Black pepper - 1/2 tsp

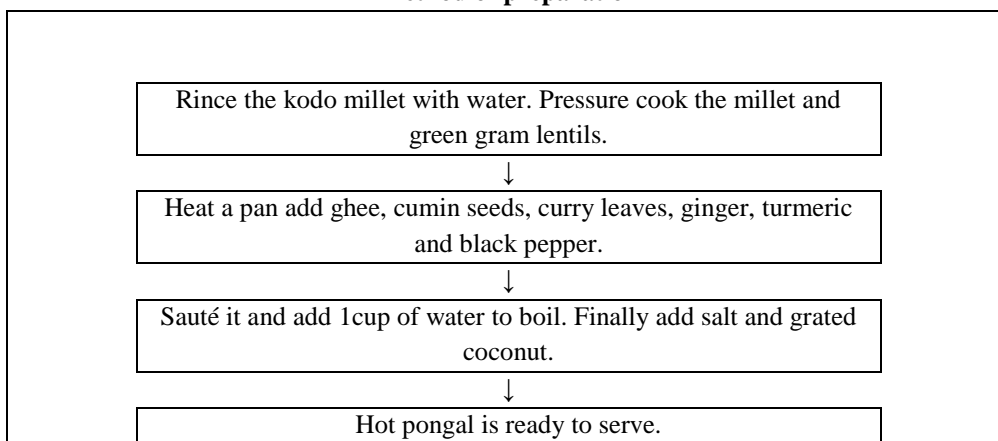
Green chilies - 3 to 4

Turmeric powder - A pinch

Ghee - 2 tsp

Cumin seeds - 3/4 tsp

Curry leaves - Few

Method of preparation

Preparation of kodo millet cutlet

Ingredients

Kodo millet - 50gm
 Potatoes - 2
 Carrot - ½ cup grated

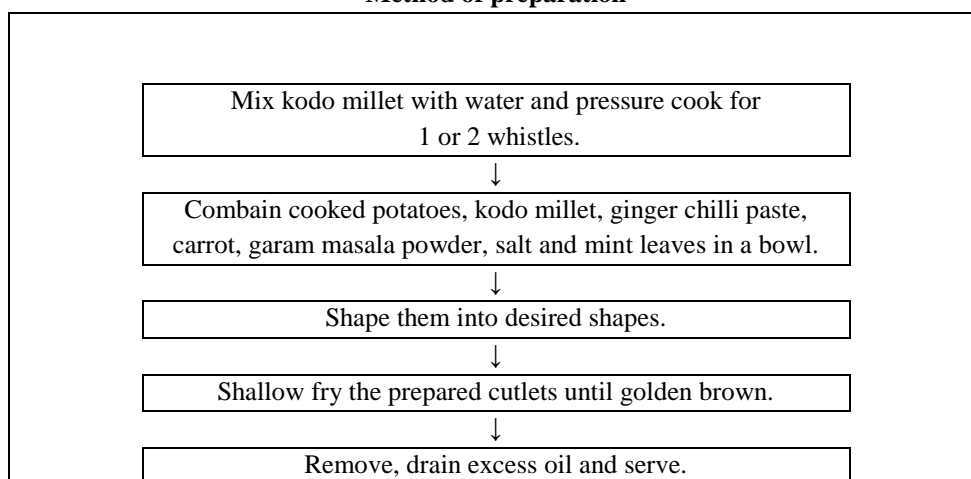
Ginger green chilli paste -2 tsp

Garam masala powder -1 tsp

Mint leaves

Oil required

Salt as per taste

Method of preparation**3.4.1.2 Preparation of kodo millet methi rice****Ingredients**

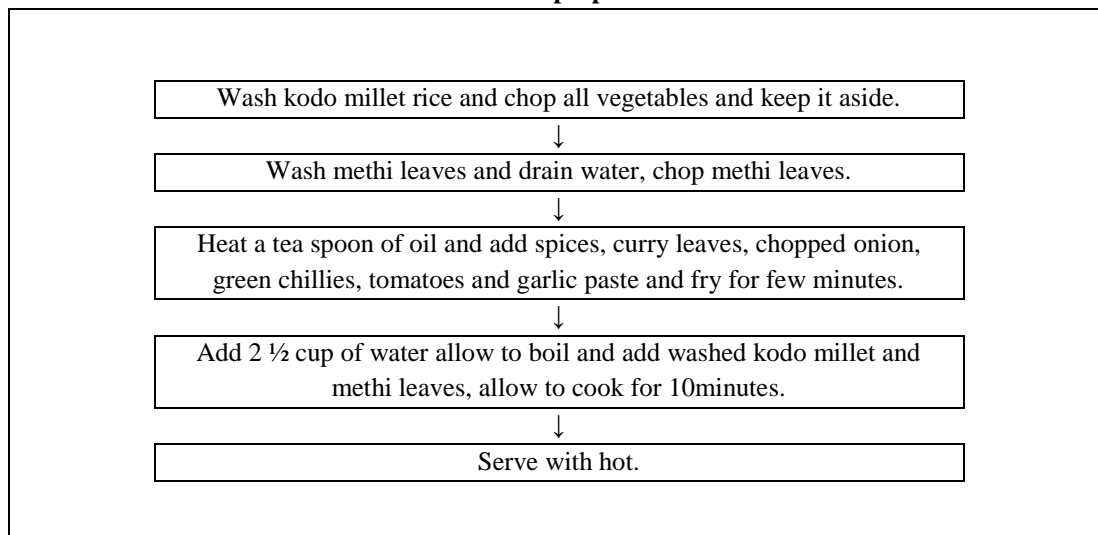
Kodo millet - 50gm
 Chopped methi leaves - 2cups
 Chopped onion - ½ cup
 Chopped tomato - ½ cup

Ginger garlic paste

Green chillies - 2to3

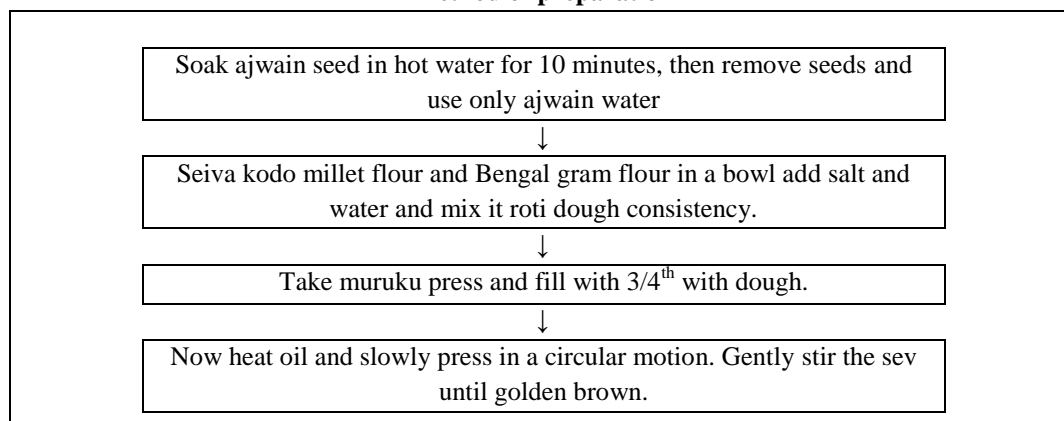
Curry leaves

Clove - 2psc

Method of preparation**3.4.1.3 Preparation of kodo millet sev****Ingredients**

Kodo millet flour - 1cup
 Bengal gram flour - 1/2 cup

Ajwain - 1tbsp
 Salt and oil

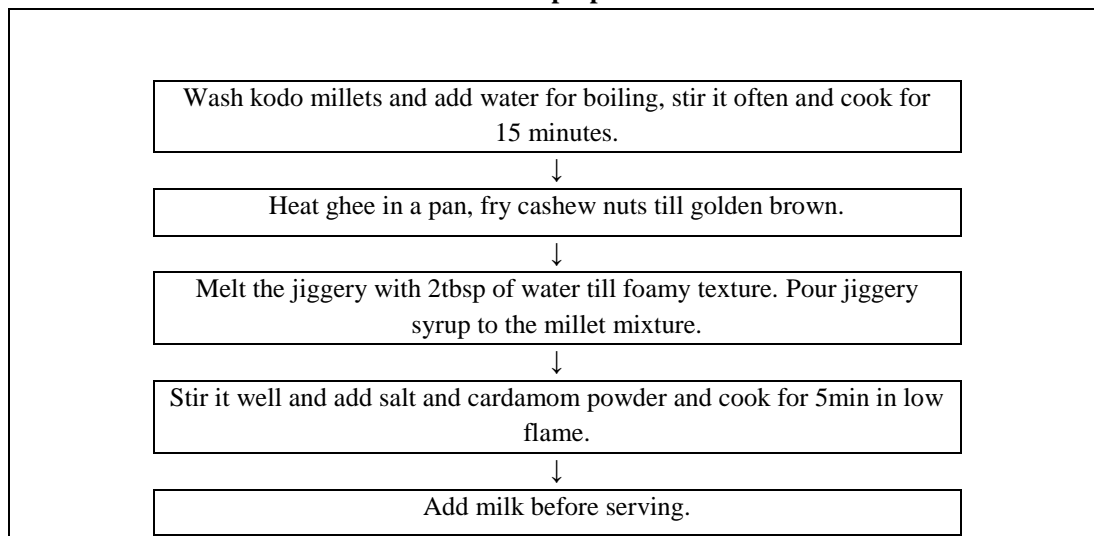
Method of preparation**3.4.1.4 Preparation of kodo millet thattai****Ingredients**

Kodo millet - 100gm
 Roasted gram - 20gm

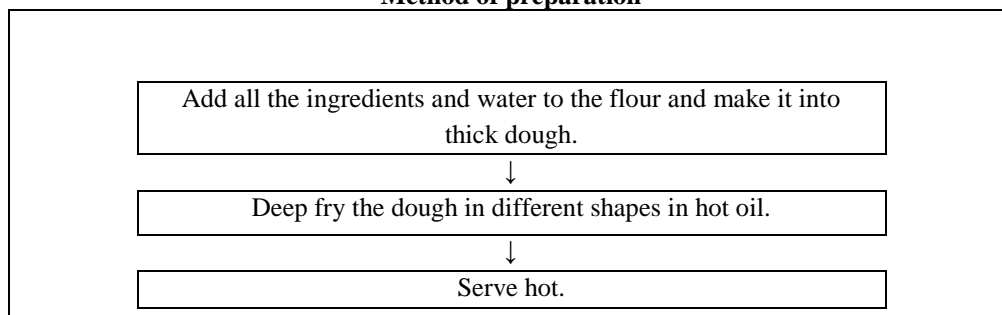
Bengal gram dal -20gm
 Red chili powder -1tsp
 Oil and Salt

Method of preparation**3.4.1.5 Preparation of kodo millet payasam****Ingredients**

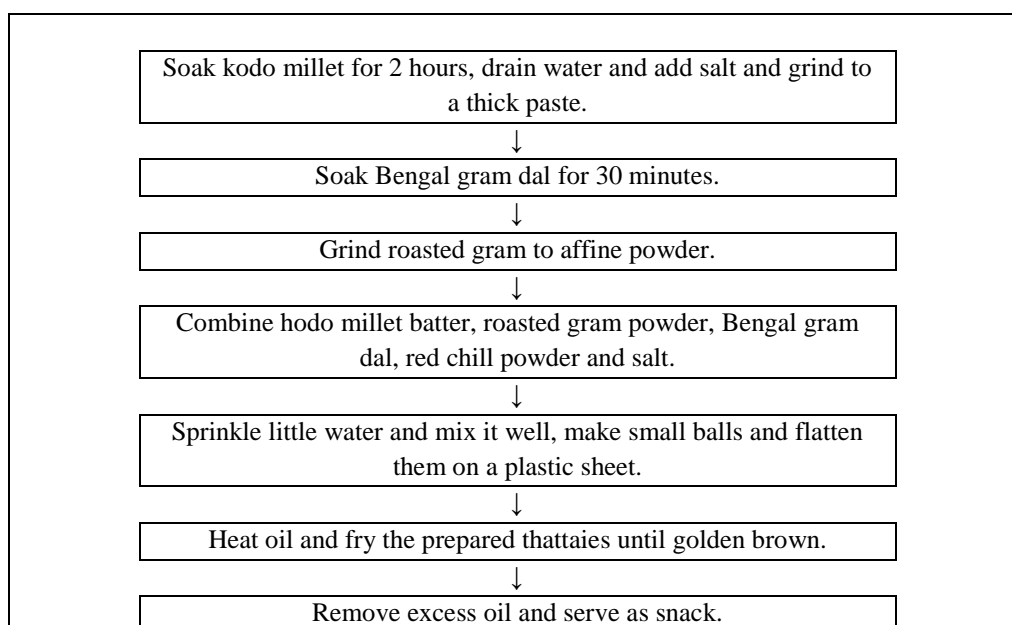
Kodo millet -50gm
 Jaggery -1cup
 Ghee -2tsp
 Cashew nuts - 10
 Cardamom powder - 1tsp
 Milk -50ml and Salt

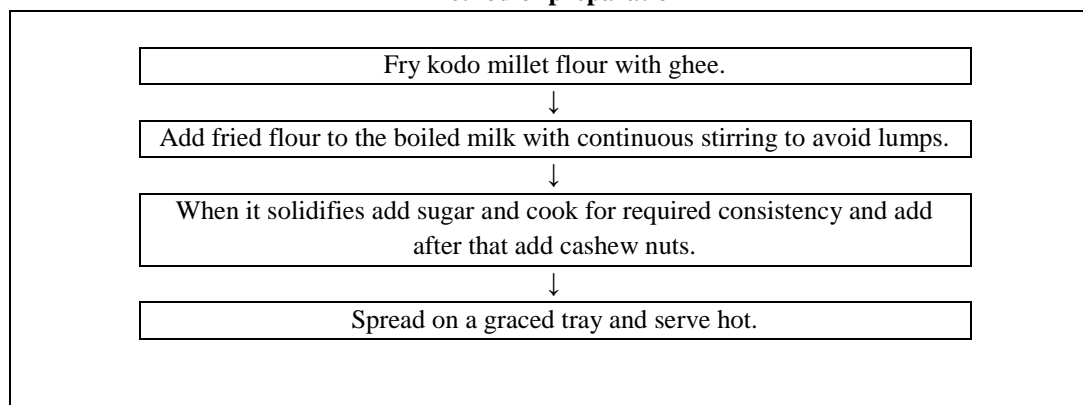
Method of preparation**3.4.1.6 Preparation of kodo millet pakoda :Ingredients:**

Kodo millet - 75gm
 Bengalgram flour – 25gmn, Chopped onion - 50g, Ajwain - 5g , Salt and Oil

Method of preparation**3.4.1.9 Preparation of kodo millet halwa****Ingredients**

Kodo millet flour - 50gm, Powdered sugar - 25g Ghee - 2tbsp
 Cashew nuts - 10gm and Milk - 50ml



Method of preparation**3.4.2 Sensory evaluation of kodo millet based products**

Sensory evaluation of the prepared products was carried out using 9 point hedonic scale. Which is like extremely, 8 – like very much, 7 – like moderately, 6 – likes slightly, 5 – neither like nor dislike, 4 – dislike slightly, 3 – dislike moderately.

3.5 Storage quality of grains and kodo millet based products

Storage quality is an important parameter influencing utilization potential of any food commodity. Assessment of shelf life helps to provide suitable storage environment. Hence, an attempt was made to study the effect of storage on quality of grains and flour of kodo millet and kodo millet based products.

3.5.1 Grains

Grains were stored to study the shelf life quality. The grains were packed in

polyethylene bag. Similarly, the roasted grains were also stored for shelf life evaluation.

3.5.2 Flour

The unprocessed kodo millet flour was packed in polyethylene bags at ambient temperature. the roasted flour was also stored for shelf life evaluation.

3.5.3 Evaluation of stored products

The stored samples were analyzed by visual observation for insect infestation. And the sensory evaluation is also done for both products.

3.6 Statistical Analysis

The result of the study need to be analyzed statistical to determine its significance. Hence, suitable methods were used for data obtained in the present study. Mean and standard deviation were used to interpret data.

Table 3. Sensory evaluation of Kodo millet dosa

Sensory attribute	Mean ± Standard deviation
Appearance	8.90 ± 0.30
Color	8.90 ± 0.30
Taste	8.90 ± 0.30
Consistency	8.54 ± 0.52
Flavour	8.90 ± 0.30
Texture	8.72 ± 0.46
Overall acceptability	8.81 ± 0.40

Table no. 3 shows that kodo millet dosa was highly acceptable with appearance, color, taste and flavour (8.90), least acceptable with

consistency (8.54) and overall acceptability was 8.81.

Table 4. Sensory evaluation of Kodo millet pongal

Sensory attribute	Mean \pm Standard deviation
Appearance	8.5 \pm 0.7
Color	8.4 \pm 0.8
Taste	8.2 \pm 0.9
Consistency	8.1 \pm 0.7
Flavour	8.3 \pm 0.9
Texture	8.2 \pm 0.9
Overall acceptability	8.1 \pm 0.7

Table no. 4 shows that kodo millet pongal was highly acceptable with appearance (8.5), Table 8 shows that kodo millet sev was highly

acceptable with consistency (8.1) and overall acceptability was 8.1.

Table 5. Sensory evaluation of Kodo millet cutlet

Sensory attribute	Mean \pm Standard deviation
Appearance	8.7 \pm 0.48
Color	8.6 \pm 0.51
Taste	8.6 \pm 0.51
Consistency	8.4 \pm 0.51
Flavour	8.8 \pm 0.42
Texture	8.7 \pm 0.48
Overall acceptability	8.6 \pm 0.51

Table no.5 shows that kodo millet cutlet was highly acceptable with flavour (8.8), least

acceptable with consistency and overall acceptability was 8.6.

Table 6. Sensory evaluation of Kodo millet methi rice

Sensory attribute	Mean \pm Standard deviation
Appearance	8.3 \pm 0.389
Color	8.3 \pm 0.389
Taste	8.6 \pm 0.65
Consistency	8.1 \pm 0.52
Flavour	8.4 \pm 0.51
Texture	8.5 \pm 0.52
Overall acceptability	8.5 \pm 0.52

Table no.6 shows that kodo millet methi rice was highly acceptable with taste (8.6) least

acceptable with consistency (8.1) and overall acceptability was 8.5.

Table 7. Sensory evaluation of Kodo millet sev

Sensory attribute	Mean \pm Standard deviation
Appearance	8.9 \pm 0.316
Color	8.8 \pm 0.421
Taste	8.6 \pm 0.69
Consistency	8.9 \pm 0.31
Flavour	8.8 \pm 0.42
Texture	8.9 \pm 0.31
Overall acceptability	8.9 \pm 0.31

Table no.7 shows that kodo millet sev was highly acceptable with appearance, texture and

consistency (8.9), least acceptable with taste and overall acceptability was 8.9.

Table 8. Sensory evaluation of Kodo millet thattai

Sensory attribute	Mean \pm Standard deviation
Appearance	8.8 \pm 0.42
Color	9 \pm 0
Taste	8.8 \pm 0.4
Consistency	8.4 \pm 0.6
Flavour	8.9 \pm 0.31
Texture	8.8 \pm 0.42
Overall acceptability	8.9 \pm 0.31

Table no.8 shows that kodo millet thattai was highly acceptable with color (9), least

acceptable with consistency and overall acceptability was 8.9.

Table 9. Sensory evaluation of Kodo millet payasam

Sensory attribute	Mean \pm Standard deviation
Appearance	8.8 \pm 0.38
Color	8.8 \pm 0.38
Taste	8.8 \pm 0.38
Consistency	8.8 \pm 0.38
Flavour	8.7 \pm 0.45
Texture	8.8 \pm 0.38
Overall acceptability	8.8 \pm 0.38

Table no. 9 shows that kodo millet payasam was highly acceptable with appearance, color, taste, consistency and texture (8.8), least

acceptable with flavour (8.7) and overall acceptability was 8.83.

Table 10. Sensory evaluation of Kodo millet pakoda

Sensory attribute	Mean \pm Standard deviation
Appearance	9 \pm 0
Color	8.9 \pm 0.31
Taste	8.8 \pm 0.42
Consistency	8.9 \pm 0.31
Flavour	8.9 \pm 0.31
Texture	9 \pm 0
Overall acceptability	8.8 \pm 0.42

Table no.10 shows that kodo millet pakoda was highly acceptable with appearance and

texture (9), least acceptable with taste and overall acceptability was 8.8.

Table 11. Sensory evaluation of Kodo millet halwa

Sensory attribute	Mean \pm Standard deviation
Appearance	8.5 \pm 0.52
Color	8.8 \pm 0.42
Taste	8.4 \pm 0.51
Consistency	8.4 \pm 0.51
Flavour	8.6 \pm 0.51
Texture	8.2 \pm 0.42
Overall acceptability	8.6 \pm 0.51

Table no.11 shows that kodo millet halwa was highly acceptable with color (8.8), least

acceptable with texture (8.2) and overall acceptability was 8.6.

Table 12. Descriptive characteristics of kodo millet sev

Attributes	Kodo millet : Bengal gram flour		
	100 : 00	50 : 50	100 : 50
Appearance	Reddish-brown, long intact strands attractive	Brownish in color, long intact strands attractive	Brownish in color, long intact strands attractive
Texture	Hard and firm texture	Slightly hard and firm texture	Slightly hard and firm texture
Taste	Bitter taste	Good taste	Good taste
Firmness	Firm, short and breakable	Firm, long and breakable	Firm, short and breakable
Overall acceptability	Not acceptable	Acceptable	Acceptable

In the product development, there is a need to state the descriptive characteristics of the product. The addition of Bengal gram flour to kodo millet, that improves the sensory quality of the sev. The acceptability of sev varied with the levels of incorporation. The appearance of kodo millet sev was reddish brown long intact strands attractive, firm texture and hard, bitter in taste, firm, short breakable and it is not

highly acceptable. In 50 : 50 ratio of kodo millet and bengal gram flour, appearance was brownish in color long intact strands attractive, slightly hard and firm texture, good in taste, firm long and breakable and it is acceptable. In 50% incorporation, appearance was brownish in color long intact strands attractive, slightly hard and firm texture, good in taste, firm short and breakable and it is acceptable.

Table 13. Descriptive characteristics of kodo millet thattai

Attributes	Kodo millet : Roasted gram : Bengal gram dal		
	100 : 00 : 00	50 : 25 : 25	100 : 25 : 25
Appearance	Reddish-brown, oval and attractive	Brownish, oval and attractive	Brownish, oval and attractive
Texture	Hard and firm texture	Slightly hard and firm texture	Slightly hard and firm texture
Taste	Bitter taste	Good taste	Good taste
Firmness	Hard and breakable	Round and smooth	Round and smooth
Overall acceptability	Not acceptable	Acceptable	Acceptable

In the product development, there is a need to state the descriptive characteristics of the product. The addition of roasted and bengal gram flour to kodo millet, that improves the sensory quality of the thattai. The acceptability of thattai varied with the levels of incorporation. The appearance of kodo millet thattai was reddish brown oval and attractive, firm texture and hard, bitter in taste, breakable and it is not highly acceptable. In 50 : 25 : 25

ratio of kodo millet, roasted gram and bengal gram flour, appearance was brownish in color oval and attractive, firm texture, good in taste, round, smooth and it is acceptable. In 100 : 25 : 25 ratio of kodo millet, roasted gram and Bengal gram appearance was brownish in color oval and attractive, slightly hard and firm texture, good in taste, round, smooth and it is acceptable.

Table 14. Storage quality of Kodo millet Sev

Sensory attributes	Duration of storage		
	5 th day	10 th day	11 th day
appearance	8.90 ± 0.30	8.7 ± 0.46	8.3 ± 0.38
Color	8.90 ± 0.30	8.6 ± 0.51	8.3 ± 0.38
Taste	8.90 ± 0.30	8.6 ± 0.51	8.6 ± 0.51
Consistency	8.54 ± 0.52	8.4 ± 0.51	8.1 ± 0.52
Flavor	8.90 ± 0.30	8.8 ± 0.42	8.4 ± 0.51
Texture	8.72 ± 0.46	8.7 ± 0.48	8.5 ± 0.52
Overall acceptability	8.81 ± 0.40	8.6 ± 0.51	8.5 ± 0.52

Table no. 14 shows that sensory score of stored kodo millet sev, in which sensory attributes viz appearance, color, taste,

consistency, flavour texture and overall acceptability was acceptable with storage.

Table 15. Storage quality of Kodo millet thattai

Sensory attributes	Duration of storage		
	5 th day	10 th day	15 th day
appearance	8.5 ± 0.52	8.3 ± 0.38	8.2 ± 0.91
Color	8.4 ± 0.51	8.3 ± 0.38	8.4 ± 0.51
Taste	8.6 ± 0.65	8.4 ± 0.51	8.2 ± 0.91
Consistency	8.1 ± 0.52	8.1 ± 0.52	8.1 ± 0.52
Flavor	8.4 ± 0.51	8.3 ± 0.38	8.3 ± 0.38
Texture	8.5 ± 0.52	8.2 ± 0.91	8.2 ± 0.91
Overall acceptability	8.5 ± 0.52	8.2 ± 0.91	8.1 ± 0.52

Table no. 15 shows that sensory score of stored kodo millet thattai, in which sensory attributes viz appearance, color, taste, consistency, flavour texture and overall acceptability was acceptable with storage.

Kodo millet is a grain of excellent nutritional quality ideal for inclusion in the daily diet for health benefits. Kodo millet blends with common food ingredients without affecting sensory qualities in common recipes at specified levels of incorporation. Kodo millet incorporated products like kodo millet dosa, pongal, cutlet, methi rice, sev, thattai,

payasam, pakoda and halva were acceptable with organoleptic evaluation of sev during storage gradually decreases from 5th day and it was not acceptable on 15th day similarly the organoleptic evaluation of thattai during storage decreases from 5th day and it was moderately not acceptable on 15th day. Kodo millet is a small seeded grain exhibiting minute variation in gram color, thousand grain weight, volume and density. Kodo millet is light yellow in color small seed prior to dehulling (Table1). After dehulling, the seed size is further reduced, with thousand grain

weight, volume and density of 2.8g, 1.2ml and 1.84 respectively. The dehulled grain color is light yellow to very creamish white is acceptable by common consumer.

CONCLUSION

Kodo millet is one the ancient grains of the world, In India different kinds of traditional foods made from small millet grains from staple diet for many rural and urban households. Kodo millet is rich in carbohydrate and crude fiber. Mulletts are nutritionally superior than other cereals. Development and value addition to kodo millet incorporated products like kodo millet dosa, pongal, cutlet, methi rice, sev, thattai, payasam, pakoda and halva. It can be concluded that sensory evaluation done on all the recipes revealed that Kodo millet significantly improved their organoleptic and storage quality. Organoleptic evaluation of sev during storage gradually decreases from 5th day and it was not acceptable on 15th day similarly the organoleptic evaluation of thattai during storage decreases from 5th day and it was moderately not acceptable on 15th day. All products revealed that kodo millet significantly improved their organoleptic and storage quality and also contributed to their high acceptance. The fact that there are inexpensive, locally available and nutritious make them potentially effective in solving

diabetes, cardiovascular disease, constipation and obesity.

REFERENCES

1. Mohan Vidhya. A. and Roobhadevi, M., Formulation and shelf life Evaluation of Kodo Millet Incorporated Ready to Cook Mixes, *Indian Journal of Research in Food Science and Nutrition*, **1(1)**: 27–31 (2014).
2. Poongodi, Vijayakumar, T. and Jemina Beryl Mohankumar, Quality evaluation of dosa from millet flour blend incorporated composite flour, *Elixir Food Science* **34**: 2624–2629 (2011).
3. Satish Kumar, D., Sudha Devi, G., Joseph. Raju, P. and Dayakar Rao, B., Development and Standardisation for Preparation of Doughnut Using Millets (Jowar, pearl, ragi, little, kodo, barnyard, prosa and foxtail), *Int. J. Curr. Microbiol. App. Sci*, **7(1)**: 990–999 (2018).
4. Sudha Devi, G., Palanimuthu, V. P. and Kumar, A., Studies on development and storage of kodo millet based pasta, *Internal J. Proc. And Post Harvest Technol*, **5(1)**: 33–40 (2014).
5. Yadav, N., Chaudhary, K., Singh, A. And Gupta, A., Evaluation of hypoglycemic properties of kodo millet based food products in healthy subjects, *Iosr Journal of Pharmacy*, **3(2)**: 14–20 (2013).