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## Sensory characteristics of kheer prepared from coconut milk residues, quinoa seed and kodo millet

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**Abstract**

In the modern era, people are more concerned about their health and lifestyle, and there is a demand for the production of low calorie, high protein, and high-fiber food products. People are more concerned with their health and there is a need for the development of low-calorie, high-protein, and high-fiber food products. The aim of this study, to developed value-added *Kheer* using Coconut Milk Residues, particular millets (Quinoa Seed and Kodo Millet), and natural sweeteners, as well as to assess the organoleptic attributes of the developed product. The value added *Kheer* was prepared by different ratio of coconut milk residues, Kodo millets and quinoa seeds with rice was incorporated in 450 ml milk which ratio was; T<sub>1</sub> 80:5:5:10:50, T<sub>2</sub> 60:10:10:20:50, T<sub>3</sub> 40:15:15:30:50, T<sub>4</sub> 20:20:20:40:50 i.e. rice + quinoa seed + Kodo millet + coconut milk residues + dates paste and honey (30 gram and 20 gram) as natural sweeteners respectively, Where T<sub>0</sub> 100:50 i.e. rice and sugar. The prepared product were analysed for different Organoleptic attributes using the 'Nine Point Hedonic Scales' where T<sub>0</sub> had highest score (8.8) followed by T<sub>1</sub> (7.4), T<sub>2</sub> (6.76), T<sub>3</sub> (6.41), and T<sub>4</sub> (5.64) respectively in overall aspects so that T<sub>1</sub> is best among all the treatments. There was significant difference between control and the all sensory attributes of the treatments ( $p < 0.05$ ).

**Keywords:** Coconut milk residues, quinoa seed, kodo millet, kheer, value added product

**1. Introduction**

*Kheer* is one of the basic traditional foods and is accepted by everyone in the society. Traditionally, this is prepared by simmering rice in milk with sugar or jaggery until the rice starch becomes gelatinous (Chavhan *et al.*, 2019) [5]. People's changing eating habits and lifestyles are also driving demand for nutrient-dense foods that require less preparation and are affordable. *Kheer* has a luxurious treat situation. Hindu folklore refers to *Kheer* as the heavenly nectar, "Amrit," and elevates it to the rank of being "the life-giving food" and standing out among other foods as the mystery of immortality. The Hindu word *Kheer* is gotten from the Sanskrit 'ksheer' for milk and 'kshirika' for any dish arranged with milk. *Kheer* is known by various names, in various parts of the country, for example, '*kheer*' in North Western area, 'payasam' in Southern locale, 'payas' in Eastern district, 'phirni' in Northern area, 'kheech' in Mewar locale and 'payesh' in Bengal (Aneja *et al.*, 2002) [1].

The most significant and adaptable crop, coconut, offers all the necessities for human life. For many generations, populations all over the world have been fed and sustained by the nutritious meat, juice, milk, and oil that the coconut offers. Fibre, vitamins, and minerals are abundant in coconut. It is regarded as a "functional food" because it offers numerous health advantages in addition to its nutritional value. Coconut residues obtained after the extraction of coconut milk. Coconut milk residues is extremely high in fiber with almost double the amount found in wheat bran. Coconut milk residues can improve digestion, help regulate blood sugar, protect against diabetes, help prevent heart disease and cancer, and aid in weight loss.

Quinoa (*Chenopodium quinoa* Willd.), which is classified as a pseudo-cereal or pseudo-grain, is very nutrient-dense because of its exceptional protein content and extensive variety of minerals and vitamins. Its high protein content has earned it recognition as a complete food. Because of its excellent amino acid balance and 15% protein content, it offers amazing nutritional qualities. Protein from the quinoa grain is abundant in amino acids like lysine and methionine, which are lacking in cereal proteins. The flour is used to make biscuits, bread, processed foods, beer, soup, breakfast cereal, and other products from the grain. It has also been discovered to contain insignificant substances such as phytosterols and flavonoids that may have beneficial effects on nutraceuticals. Quinoa starch has some useful (technical) qualities that enable a variety of uses, including solubility, good water-holding capacity,

gelation, emulsification, and foaming. In addition, it has been regarded as an oil crop due to its unique omega-6 balance and high vitamin-E content.

Kodo millet, is planted in Madhya Pradesh, Maharashtra, Uttar Pradesh, and the Deccan region. According to estimates, kodo millet is cultivated on an area of around 9,07,800 hectare and produces about 3,10,710 tons per year. The two states with the largest shares in kodo millet production and promotion are Madhya Pradesh and Tamil Nadu. The Madhya Pradesh government is also actively encouraging the development and sale of this crop. More than 400 species, often an annual crop, belong to the Paspalum genus. Dietary fibre, antioxidants, and minerals like iron are abundant in kodo millet. Kodo millet has a lower phosphorus level than any other millet and a significantly higher antioxidant potential than any other millet or significant cereal. Processing techniques like parboiling and debranning change the fibre and mineral content, but they also lessen anti-nutritional elements like phytate. Kodo has been used exclusively in the preparation of certain traditional Indian dishes, or it has been combined with other cereal and legume flours to improve their functionality, flavour, and nutritional

content.

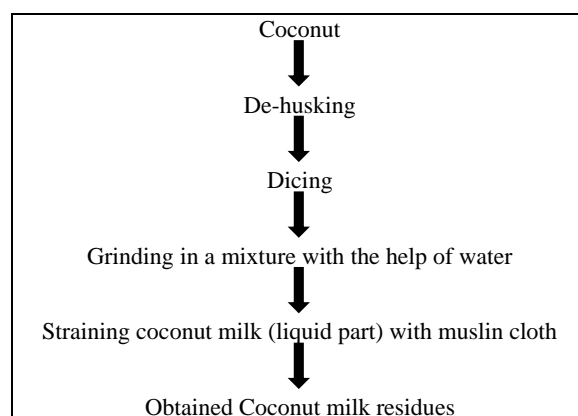
Scientific evidences suggest that increased intake of added sugar is one of the major causes for dental caries, glucose intolerance, diabetes mellitus, cardiovascular diseases, obesity, hypertension and behavioural complications such as hyperactivity in children. In many parts of the world, consumption of added sugar is much higher than the dietary recommendation from health organizations. Dates and honey have natural sweetness. It is beneficial for health and a better alternative to sugar. Thus the side effects of sugar can be avoided and improved eating habits.

The main objectives of this study were to developed value-added *Kheer* using Coconut Milk Residues, particular millets (Quinoa seed and Kodo millet), and natural sweeteners, as well as to assess the organoleptic qualities of the products.

## 2. Methodology

Millets (Quinoa Seed and Kodo Millet) purchased from local market of Naini, Prayagraj, Uttar Pradesh. Coconut had purchased from local market (Mahewa) of Prayagraj.

### 2.1 Preparation of Coconut milk residue



(Source: Olubumni Ibidapo, 2015)

Fig 1: Flow Diagram for Processing of Coconut Milk Residues.

Table 1: Details of variations of developed value added *Kheer*.

Control/treatment	Rice	Quinoa seed	Kodo millet	Coconut milk residues	Milk	Sweeteners-Table sugar/Honey and dates paste	Replication
T <sub>0</sub>	100 g	-	-	-	450 ml	50g	3
T <sub>1</sub>	80 g	5 g	5	10 g	45 ml	50g	
T <sub>2</sub>	60 g	10 g	10 g	20 g	45 ml	50g	
T <sub>3</sub>	40 g	15 g	15 g	30 g	450 ml	50g	
T <sub>4</sub>	20 g	20 g	20 g	40 g	450 ml	50g	

### 2.2 Preparation and Sensory evaluation of *Kheer*

Products namely- *Kheer* prepared by using coconut milk residues, quinoa seed and kodo millet. The products was prepared by using standard recipe. Coconut milk residue, Quinoa seed, Kodo Millet will be used in different proportion for preparation of value added food product *Kheer*. Only rice was used in control and sugar was used as a sweetener whereas Kodo millet, Quinoa Seed and Coconut milk residues were used along with rice according to the proportion of different treatments written in the above table no.1. Honey and dates were used as a sweeteners. The sensory evaluation of food products were carried out by a panel of 5 judges selected randomly from the department of Food Nutrition and Public Health, Ethelind College of Home Science, Sam

Higginbottom University of Agriculture, Technology And Sciences, Prayagraj, using Nine Point Hedonic Scale (Srilakshmi, 2010) [12]. Score card used for the sensory evaluation of the products. The panel lists were asked to judges the different sensory aspects (colour and appearance, body and texture, taste and flavour, and overall acceptability) by giving them a score. The whole experiment was replicated three times with four time treatments.

### 2.3 Statistical analysis of the value-added *Kheer*

The data was statistically analyzed by using Analysis of variance (Two- way anova) techniques, Critical difference (C.D) test.

### 3. Result and Discussion

**Table 2:** Average sensory scores of Control and Treated sample of *Kheer*.

Control and Treatments	Colour and Appearance	Body and Texture	Taste and Flavour	Overall Acceptability
T <sub>0</sub>	8.3	8.5	8.7	8.8
T <sub>1</sub>	7.1	7.3	7.46	7.4
T <sub>2</sub>	7.16	6.16	6.96	6.76
T <sub>3</sub>	6.5	6.12	6.63	6.41
T <sub>4</sub>	6.3	5.16	5.46	5.64
F <sub>Cal</sub> (5%) F <sub>Tab</sub> (5%)	11.28	4.88	33.79	39.41
CD ( $p \leq 0.05$ )	3.83	3.83	3.83	3.83
S.A.	0.58	0.41	0.55	0.56
	S	S	S	S

S= significant, S.A. = Statistical Analysis.

The table no. 2 and Fig. no. 2. shows that Control (T<sub>0</sub>) had white colour which scored 8.3 was most liked by the panel members due to rice, milk and sugar followed by T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, and T<sub>4</sub> had brown colour that was increased gradually due to increased ratio of quinoa seed and decreased ratio of rice. Quinoa incorporated products were dark brown in colour due to its natural colour of the grains. This is supported by study Veena *et al.*, (2003) [14] they reported as the incorporation of millet increases the colour of the product and decreases texture.

Control (T<sub>0</sub>) had 100 % rice that had thick consistency so that most liked by the panel members, followed by semi thick consistency of treatment (T<sub>1</sub>) was much liked by the panel members due to 80% of rice, T<sub>2</sub> had 20% rice, so that less liked by the panel members. T<sub>3</sub> and T<sub>4</sub> had thin consistency little by little due to gradually increased proportion of coconut milk residues, quinoa seed and Kodo millet and gradually decreased proportion of rice.

Control (T<sub>0</sub>) had 100 % rice and had many layer of subtle flavor, creamy taste so it was most liked by the panel members. T<sub>1</sub> had milky and nutty flavor with creamy taste and sweetness of honey and dates which scored 7.46 was much liked by the panel members regarding taste and flavour in *Kheer* followed by T<sub>2</sub> and T<sub>3</sub> and T<sub>4</sub> had less creamy taste due to increased ratio of coconut milk residue, quinoa seed and kodo millet and decreased proportion of rice in *Kheer*.

So that control (T<sub>0</sub>) had most acceptable in overall aspects which scored 8.8 was much liked by the panel members regarding overall acceptability in *Kheer* followed by T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub>.

The Anova shows that calculated value of 'F' is greater than the tabulated value on 8 degree of freedom at 5% probability level ( $P < 0.05$ ). It indicates that there was significant difference between control and the all sensory attributes of the

treatments. T<sub>1</sub> was found best than the other treatments.

Relatively a study founded stated by Praveen *et al.*, (2021) [8-9] found that Quinoa was blended in rice *kheer* in the proportion of T<sub>0</sub> (00:100), T<sub>1</sub> (20:80), T<sub>2</sub> (40:60), T<sub>3</sub> (60:40), T<sub>4</sub> (80:20) and T<sub>5</sub> (100:00) was prepared. The sensory score of color for T<sub>0</sub> obtained highest (8.3) and lowest for T<sub>5</sub> sample, on the basis of consistency T<sub>0</sub> obtained highest score (8.8) while T<sub>5</sub> obtained lowest score (8.3). T<sub>4</sub> obtained highest score (7.4) while T<sub>0</sub> obtained lowest score (6.5) for flavor. Organoleptically accepted T<sub>4</sub> sample received highest score i.e. 8.1 in case of all sensory attributes when compare to other samples.

Barela & Shelke, (2017) [3] did investigation on "studies on acceptability, chemical composition and cost structure of *kheer* prepared from cow milk blended with coconut milk" Cow milk was blended with coconut milk as T<sub>1</sub> (100:00), T<sub>2</sub> (90:10), T<sub>3</sub> (80:20), T<sub>4</sub> (70:30) and T<sub>5</sub> (60:40) all five treatments were replicated for five times. It was observed that overall acceptability of *kheer* prepared from cow milk blended with coconut milk in proportion 80:20 found superior while for 90:10, 70:30 and 60:40 had fair quality.

K. G. Solanki *et al.*, (2018) [11] the sensory of finger millet *kheer* that ratio was T<sub>0</sub> (97.5 parts of buffalo milk by weight + 2.5 Parts of Rice), T<sub>1</sub> (98 parts of buffalo milk by weight + 2 Parts of finger millet powder), T<sub>2</sub> (96 parts of buffalo milk by weight + 4 Parts of finger millet powder), T<sub>3</sub> (94 parts of buffalo milk by weight + 6 Parts of finger millet powder). The treatment T<sub>0</sub> had scored comparatively highest mean overall score than the T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> treatments. The lowest overall acceptability score i.e. 6.46 was found in treatment T<sub>3</sub> which was due to increased level of finger millet powder which decreased flavour, colour and appearance and body and texture.

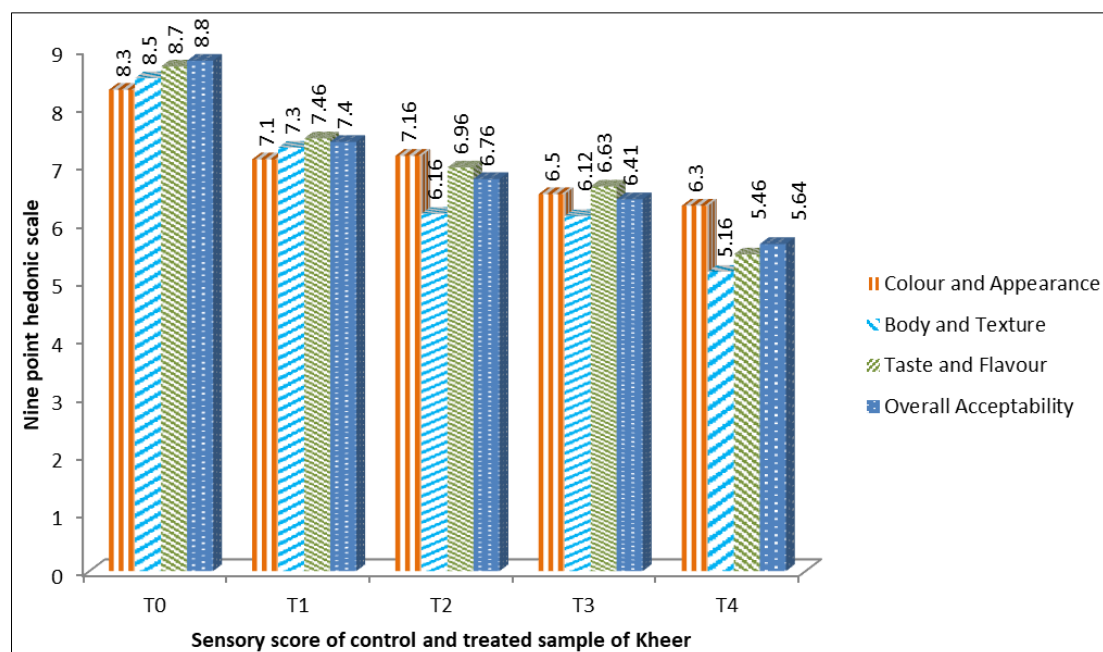


Fig 2. Average sensory scores of Control and Treated sample of *Kheer*.

### Conclusion

This research concluded that the researcher developed a value-added *kheer* in which high-nutritive millets such as Kodo millet and Quinoa seed, along with Coconut milk residues, were used. Coconut milk residues are generally fed to animals or thrown away, but they are edible and enhance the nutritional value of food products. Honey and dates have been used as a sweeteners. They are a great sugar replacement and prevent harmful consequences of sugar. All ingredients successfully incorporated in different proportions of four treatments for preparation of value added *Kheer*. The prepared product were analysed for different Organoleptic attributes using the 'Nine Point Hedonic Scales' where T<sub>0</sub> had highest score (8.8) followed by T<sub>1</sub> (7.4), T<sub>2</sub> (6.76), T<sub>3</sub> (6.41), and T<sub>4</sub> (5.64) respectively in overall aspects so that T<sub>1</sub> is best among all the treatments which ratio was T<sub>1</sub> 80:5:5:10:50 i.e. rice + quinoa seed + Kodo millet + coconut milk residues + dates paste and honey respectively.

### Recommendation

Intake of this value added *Kheer* are suitable as a nutritional pack for all age group and extremely beneficial for childrens, adolescent girl, pregnant and lactating women. It is rich in fiber and HDL so that helpful for the patient of coronary artery disease. It is alternative dessert for a diabetic person and helpful in lowering of blood glucose level.

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