

Original Research Article

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## Development and Evaluation of Value Enriched *Sattu* Mix for under nutrition

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### ABSTRACT

*Sattu* is flour consisting of a mixture of ground pulses and cereals from India. The process of preparing *sattu* is ancient and is popular over a wide area of India, particularly Bihar. It is also known as "desi horlicks" in the state of Bihar. *Sattu* is known as the 'poor man's protein.' It's essentially a flour-like substance that's abundant in nutrients and known as the "energy powerhouse." *Sattu* is a wonder flour that can be consumed uncooked. The cooling properties of *sattu* make it a perfect summer choice. It has low glycemic index and high fiber content. In current study traditional *sattu* powder is enriched with incorporation of nutritionally rich millets. Value enriched *sattu* mix was standardized and analyzed for their sensory, nutritional evaluation and storage study. Four variations of *sattu* mix was developed i.e. T1 controlled trail and experimental T2, T3, and T4 trail. Sensory evaluation of developed value enriched *sattu* mix tails and controlled trail was made in terms of their colour, taste, flavor, texture and overall acceptability using five point ranking scale. Results showed that among all the trails prepared, T4 was most accepted in terms of all the sensory parameters by semi trained panel members. The nutritional analysis of accepted trail of value enriched *sattu* mix depicted that it has high amount of crude fibre, calcium, total minerals and crude protein content. Developed value enriched *sattu* mix was stored in an air tight container at room temperature for 3 months. It was concluded that prepared value enriched *sattu* mix is very beneficial for undernourished patients and also helpful for weight reduction.

#### Keywords

Development, Enriched, *Sattu*, Undernutrition, Millets

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### Introduction

'*Sattu*' is a roasted flour mixture of cereal and pulse combination and used as 'ready -to-eat' snack food in most parts of India. It is a convenient and inexpensive

food product, containing digestive and dietary constituents or principles of vital importance. Owing to its high nutritional value, long shelf life and excellent taste, *sattu* is popular supplement food especially in rural India (Deshpande *et al.*, 2013). The dry powder of *Sattu*

is prepared in various ways as a principal or secondary ingredient of dishes. *Sattu* is a wonder flour that can be consumed uncooked. Making a sharbat is one of the simplest ways to use *sattu*. It is also employed in the preparation of 'litti.' Apart from that, it can be used to make parathas, upma, or even porridge. It can also be taken by mixing it with milk like protein powder.

The process of preparing *Sattu* is ancient and is popular over a wide area of India, particularly Bihar. It is also known as "desi horlicks" in the state of Bihar. *Sattu* is known as the 'poor man's protein.' It's essentially a flour-like substance that's abundant in nutrients and known as the "energy powerhouse (Bishnupriya Mahanty *et al.*, 2021). *Sattu* is liked by people of all ages and has therapeutic uses too. It can be used as a weaning food, geriatric food, food for tube feeding and malnutrition (Rohini Devi *et al.*, 1990).

High in soluble fibre and all other vital elements, this food gives you rapid energy to work in direct sunlight and helps you avoid feeling tired. *Sattu*, which is high in iron, manganese, and magnesium and low in sodium, gives rapid energy as well as acting as a cooling agent to keep the internal organs at ease. *Sattu* is good for the intestines since it contains a lot of insoluble fibre. It is one of the highest sources of vegetarian proteins that is easily digestible and also of calcium and magnesium. It also provides iron and hence very healthy option for anemia. It regulates gas, constipation, and acidity, making it an ideal summer cooler that not only keeps the body cool in the heat, but also protects against sunstroke. *Sattu* hydrates the body during the summer months, resulting in a healthy glow and radiant skin.

In current study traditional *sattu* powder is enriched with incorporation of nutritionally enriched millets and foods for enhancing its health benefits. Owing to its high nutritional value, long shelf life and excellent taste, *sattu* is popular supplement food especially in rural India. The nutritional value of *sattu* can be enhanced by fortification and supplementation with a wide variety of protein, vitamin and mineral sources.

The main objectives of this study include, to development value added *sattu* mix and enhance nutritional and health benefits of traditional *sattu* mix. Also to evaluate sensory and nutritional content of *sattu* mix.

## **Materials and Methods**

### **Selection and procurement of ingredients**

All the necessary ingredients required for the development of *value enriched sattu mix* viz. wheat, roasted bengal gram dal, ragi, oats, almonds, milk powder, dry ginger powder, nutmeg, cardamom, cinnamon, and cocoa powder were procured from the local market of Baramati. The above food stuffs used for preparation of *sattu mix* were cleaned to remove the stones, dust, woods and any other foreign materials from the grains. The cleaned ingredients were stored for further use.

### **Standardization of basic sattu**

The basic *sattu* was standardized using raw materials used for preparation of *sattu i.e.* wheat, roasted bengal gram dal and required spices and condiments. Three variations were tried by changing the proportion of roasted bengal gram dhal and wheat which are used commonly for preparation of *sattu*. The sensory quality parameters of prepared *basic sattu* were evaluated by 15 semi trained panel members for its acceptability. The highly accepted standardized *sattu* was selected and served as basic.

### **Development and formulation of value enriched sattu mix**

For development of value enriched *sattu mix* different proportion of nutritionally enriched and flavoured foods staffs such as ragi, oats, almonds, milk powder and cocoa powder were used with changing proportion of basic *sattu*. The four variations of *sattu mix* were prepared including basic variation to increase micronutrient and macronutrient content of *sattu*.

### **Sensory evaluation of value enriched sattu mix**

The sensory evaluation of prepared value enriched *sattu mix* variations were conducted to find out the maximum level of incorporation of nutrient dense food stuffs in standardized basic *sattu powder* (Amerine *et al.*, 1965). The prepared value enriched *sattu mix* variations were evaluated by 15 selected semi-trained panel members for its acceptability. The judges were score the prepared value enriched *sattu mix* by using five point ranking scale in which point 5 represent excellent, 4 represent

very good, 3 represent good, 2 represent fair and 1 represent poor (Amerine *et al.*, 1965). The highly accepted value enriched *sattu* mix variation and standardized basic *sattu* were analyzed for nutritional evaluation and storage study.

### **Nutritional evaluation**

The standardized basic *sattu* and most accepted variation of value enriched *sattu* mix under the study were analyzed for assessing their nutrient content.

### **Shelf life storage stability of value enriched *sattu* mix**

The developed value enriched *sattu* mix was stored in air tight container at room temperature for evaluation of shelf life. The stored product was assessed for acceptability.

## **Results and Discussion**

### **Sensory evaluation of value enriched *sattu* mix**

A brief picture of mean scores of various sensory parameters of basic *sattu* and value enriched *sattu* mix is presented in Fig. 3. Acceptability of a product is determined by sensory evaluation. Sensory evaluation was done by using 5 point ranking scale. The evaluation was done by the semi trained panel of Food, Science and Nutrition department of SPMACS College, Shardanagar, Baramati. An acceptability test was conducted for the value enriched *sattu* by evaluating by semi trained panel consisting of 20 panelists.

The basic and value enriched *sattu* mix samples were standardized in terms of ingredients used, procedure and measurements. Four variations of *sattu* mix were prepared with selected levels of incorporation of value enriched foods. *Sattu* prepared without incorporation of value enriched food stuffs was served as basic *Sattu*. For developed variation T1 (Basic), T2, T3 and T4 were the codes given for identification of products.

For choosing the best variation amongst four variations of value enriched *sattu* mix were evaluated for sensorial attributes against basic *sattu*. The sensory scores for different variations of value enriched *sattu* mix shows that variation T4 scored highest than other variation. Variation T4 was excellent in all the sensory parameters,

colour (4.4), texture (4.0), taste (4.1), flavour (3.7) and overall acceptability (4.5). These results suggest that finger millet can be successfully incorporated up to 15 percent and oats 10 percent in basic *Sattu* powder for value enriched *sattu* mix.

### **Nutrient analysis of value enriched *sattu* mix**

Table 2 denotes the proximate nutrient content of basic and value enriched *sattu* mix. The moisture content of basic *sattu* was 6.04 percent whereas for value enriched *sattu* it was 4.23 percent. The crude protein content of basic and value enriched *sattu* was 14.68 and 15.67 percent respectively. The fat content of value enriched *sattu* was decreased by 0.3 g. The fiber and total mineral content of experimental variation sample of *sattu* was increased by 1.39 g (from 1.84 to 3.23 g/100g) and 0.91 g (from 2.41 to 3.32 g/100g) respectively.

The carbohydrate content of basic sample of *sattu* was more (76.95 %) than value enriched *sattu* sample (75.96 %). The calcium content of value enriched *sattu* was increased by 5.46 mg (from 50.85 to 56.31 mg/100g). The Phosphorous content of value enriched *sattu* was decreased from 260.51 mg/100g to 250.24 mg/100g. Addition of value enriched foods in basic *sattu* of increases crude protein, decreases crude fat and carbohydrate content, increases total mineral and crude fibre content. With reduced fat and carbohydrate content and increased crude protein, crude fibre, calcium and total minerals content, value enriched *sattu* could be used instead of traditional *sattu* by the people who have dietary restriction of carbohydrates and fat and helps to reduce weight, cholesterol and blood sugar level. Increased in micronutrient content of value enriched *sattu* mix can be beneficial for undernutrition.

### **Shelf life storage of value enriched *sattu* mix**

The mean sensory scores of *sattu* during storage are given in Table 3. Among all the 4 variation of *sattu* most accepted variation of value added *sattu* T4 was selected for storage study. It was stored in an air tight container at room temperature for 3 months. The sensory scores for colour decreased from 4.5 to 4.2, texture from 4.8 to 4.4, taste and flavour from 4.8 to 4.2 and overall acceptability from 4.8 to 4.2 after 90 days of storage. *Sattu* was well accepted by the judges after 60 days. Hence, it can be concluded that prepared value added *sattu* (T4 variation) can be stored for about 60 days without changing its sensory attributes.

**Table.1** Ingredient composition of value enriched sattu mix (g)

Ingredients (g)	Variation I	Variation II	Variation III	Variation IV
Wheat	65	30	25	25
Roasted bengal gram dhal	35	25	25	20
Ragi	-	10	10	15
Oats	-	10	10	10
Almonds	-	5	5	5
Milk powder	-	5	5	5
Dry ginger powder	4	4	4	4
nutmeg	2	2	2	2
Cinnamon	2	2	2	2
Cardamom	2	2	2	2
Cocoa powder	-	5	10	10

**Table.2** Nutrient content of basic and value enriched *sattu* mix (per 100g)

Sr. No.	Nutrients	Basic <i>Sattu</i> (T1)	Value added <i>Sattu</i> (T4)
1	Moisture (%)	6.04	4.23
2	Crude Protein (%)	14.68	<b>15.67</b>
3	Crude fat (%)	4.12	<b>3.82</b>
4	Total minerals (%)	2.41	<b>3.32</b>
5	Crude fibre (%)	1.84	<b>3.23</b>
6	Calcium (mg/100g)	50.85	<b>56.31</b>
7	Phosphorous (mg/100g)	260.51	250.24
8	Carbohydrate (%)	76.95	<b>75.96</b>
9	Energy (Kcal)	403.60	400.90

**Table.3** Mean sensory scores of value enriched *sattu* of variation T4 during storage

Storage period (Days)	Mean Sensory Score				
	Colour	Texture	Taste	Flavour	Overall acceptability
0	4.5	4.8	4.8	4.8	4.8
15	4.5	4.7	4.8	4.7	4.7
30	4.5	4.7	4.7	4.6	4.7
45	4.4	4.6	4.7	4.5	4.6
60	4.4	4.6	4.6	4.3	4.6
75	4.2	4.4	4.3	4.2	4.3
90	4.2	4.4	4.2	4.2	4.2

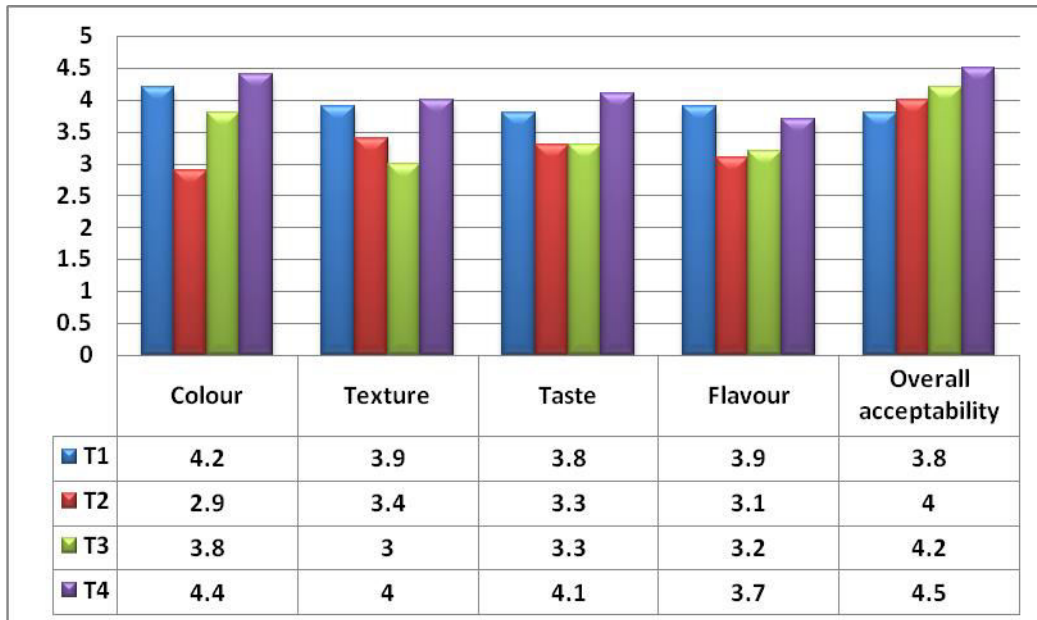
**Figure.1** Ingredients used for develop value enriched *sattu* mix



**Figure.2** Standardized selected value enriched *sattu* mix and basic *sattu* variation



**Figure.3** Sensory evaluation scores of value enriched *sattu* mix



Similarly, Nida fatma *et al.*, (2017) indicated that soya *sattu* could be safely stored in metallic containers up to 60 days during summer and rainy seasons. Shakeb *et al.*, (2022) noticed that the formulated *sattu* mix samples were found to be shelf stable for 60 days at RT, with an increased in moisture content of 4-6 percent. Reeta Mishra *et al.*, (2018) reported similar results of prepares *sattu* could be stored safely for 60 days in humid and warm conditions of storage in metal container.

Traditional popular and nutritious snack of rural India called *sattu was successfully value* enriched using nutritional dense food stuffs. Incorporation of ragi, oats and other nutritional dense and flavoured foods increases its nutritional and sensory quality.

Variation T4 of developed *sattu* mix was excellent in all the sensory parameters. The results of sensory evaluation suggest that ragi can be successfully incorporated up to 15 percent and oats 10 percent in basic *sattu* powder for value enriched *sattu* mix.

Incorporation of nutritional dense food stuff in tradition *sattu* powder helps to increase crude protein, crude fibre, calcium and total minerals content and reduces fat and carbohydrate content of developed value enriched *sattu* mix. It can be used for people who have dietary restriction of carbohydrates and fat so that it helps to reduce weight, cholesterol and blood sugar level. Prepared value enriched *sattu* (T4 variation) can be stored for about 60 days without changing its sensory attributes.

It was concluded that traditional *sattu* powder is enriched with incorporation of nutritionally dense millets and foods for enhancing its sensory as well as nutritional quality. Hence developed value enriched *sattu* mix is beneficial for undernourished persons as it rich in micro and macronutrient content.

### Author Contribution

Deshpande Sai Vilas: Investigation, formal analysis, writing—original draft. Kotwal Chaitali Sandeep: Validation, methodology, writing—reviewing. Deshpande Varad Vilas:—Formal analysis, writing—review and editing.

### Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

### Declarations

**Ethical Approval** Not applicable.

**Consent to Participate** Not applicable.

**Consent to Publish** Not applicable.

**Conflict of Interest** The authors declare no competing interests.

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