

# Technology assessment on alternative natural sweetener used for cookies through on farm trial (2019-2020)

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■ **ABSTRACT** : A study was conducted during 2019-2020 in ICAR-KVK, Vamban, Pudukkottai district, Tamil Nadu Agricultural University, Coimbatore. The people are facing various health problems for high consumption of white sugar viz., obesity, diabetes, dementia, cardiovascular disease, macular degeneration, alzheimer's disease, increased blood glucose level, kidney ailments, gout, heart problems, hyperactivity, cancer and cavities. Children who eat sweets containing sugar also suffer from health issues. Hence, we have developed cookies with natural sugars and sensory evaluated for the period of 30 days stored in poly ethylene pack at room temperature. The cookies were nutritious and convenient snack for all age groups. The present study was undertaken to develop different cookies with addition of palm sugar, jaggery, white sugar and to evaluate the sensory acceptability, shelf life and benefit cost ratio of cookies through on farm trial for entrepreneurship development programme.

■ **KEY WORDS**: OFT, Alternate sugar, Cookies, Sensory evaluation, BC ratio

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The History of 18<sup>th</sup> century shows sugar became luxury and due to the profit it made, it was called as white gold. The first refinery sugar was recognized in 1537 in Germany. In 17<sup>th</sup> Century, the impact of refined sugar was started. Up to 18<sup>th</sup> century, it was well known and reached high demand in sugar.

White sugar is one of the well-known sweeteners which had become a favorite for centuries. It is in the form of crystallized sucrose, which is extracted from sugar beets or sugarcane. The baked goods have sugar which helps to maintain moisture and makes them supple as well as soft. White sugar is also known as refined sugar. It has no calories and also lack in minerals and

nutrients. Jaggery is a natural sweetener that is gaining popularity as a healthier alternative to refined white sugar. It is prepared from the sap or the juice of plants that contains a considerable amount of sucrose or sugar. This includes plants like sugarcane and certain palms like date palm and Palmyrah. Traditional jaggery is unrefined and non-distilled, so no chemicals are used in making it and all the nutrients like magnesium, iron, calcium and phosphorus are retained. Palm sugar is free from chemicals and additives, whereas white sugar is highly refined. White sugar is free of all nutrients whereas palm sugar is rich in nutrients. Palm sugar has a low glycemic index as opposed to white sugar. Palm

sugar is an apt sweetener for kids, adults and even pregnant women than white sugar as it is devoid of any nutrients.

Sugar is an essential and mostly commonly used ingredient in the Indian cuisines, mostly all the people in India consume sugar at least once in their daily meals. There are different varieties of sugar available in our country. Now days the consumption of coffee, tea, jams, chocolates, processed food and candies is higher. It leads to various health problems. Over consumption of white sugar might lead to serious health ailments. It is associated with obesity, diabetes, dementia, cardiovascular disease, macular degeneration, Alzheimer's disease, increased blood glucose level, kidney ailments, gout, heart problems, hyperactivity, cancer and cavities. The present study is promotion and creating awareness of alternative sugars to public through value addition technology as on farm trial.

#### **Problem definition / description:**

Sulphur is a contaminant which enters sugar during refining. The maximum permissible limit for sulphur according to Bureau of Indian Standards is 70 ppm. According to International standards, it is 10 ppm. The sugar industries claim to be the amount of sulphur in white sugar is 20-70 ppm. If the amount of sulphur exceeds the permissible limits, it is highly toxic and accounts for the defamation of white sugar. Hence now a days people are avoiding consumption of white sugar. Instead of white sugar, they go for jaggery and palm sugar. In view of this, trial was made to replace white sugar with jaggery and palm sugar to prepare cookies.

Palm sap is nutritious and indigenous sweet product. When palm sap is heated, it turns to be a palm sugar concentrate and can be kept longer. The unique flavour of palm sugar concentrate has made its popularity as a flavoring reagent in confectionery and baking products. In addition, emphasis on the consumption of natural foods has resulted in the use of palm sugar concentrate as an alternative sweetener (Panyakul, 1995). Palmyrah palm [*Borassus flabell* (fer)] is found in Bangladesh, Cambodia, China South-Central, India, Malaya, Myanmar, and Socotra, Sri Lanka (Theivendirarajah, 2008).

Rahut *et al.* (2012) conducted the study on composite flour cake and palmyra palm incorporated cake. The result indicates that the palmyra palm pulp

was incorporated at 10, 20 and 30 per cent level with composite flour cake, the cake volume and specific volume of these samples were affected directly. The sensory characteristics *viz.*, colour, flavour, taste, texture and overall acceptability of these cakes were changed due to the incorporation of palmyra palm pulp.

Vengaiyah *et al.* (2017) revived value added food products from palmyrah palm. Sucrose content 12% w/w and purity of about 80% the sap forms a suitable material for production of sugar. Palm sugar can be substituted to cane sugar in all preparations. It has high dietetic values and healing properties against disease of the eye. It contains Protein (0.24%), fat (0.37%), minerals (0.5%), carbohydrate (98.89%), calcium (0.08%), phosphorus (0.06%), iron (30 mg/100g), nicotinic acid (4.02 mg/100g) and riboflavin (229 mg/100g) with calorific value of 398 k.calories/100g.

Khongsak *et al.* (2018) revealed that palm sugars exhibited better nutritional qualities than refined cane sugars. Palm sugars in both syrup and powder contained a high content of fructose and glucose. They also exhibited better antioxidant properties, high content of phenolic compounds and flavonoids.

Jaggery (*Gur*) is a natural sweetener made by concentration of sugarcane juice, contains all minerals and vitamins present in sugarcane juice. To utilize jaggery in place of sugar, muffins were prepared by replacing 84% sugar with 42, 63 and 84% jaggery. Different levels of eggs namely 42, 63 and 84% were also tried for jaggery muffins. Muffins prepared with 84% each of jaggery and eggs had acceptable quality characteristics. During 21 days storage period, the muffins with jaggery were less soft, showed lower overall quality score than the muffins with sugar, muffins with jaggery were acceptable and both the muffins were found to be microbiologically safe (Archana *et al.*, 2018).

Bread was produced from the flour blends using white sugar (sucrose) and/or date palm fruit sugar (DPFS) representing 50 or 100% sugar replacement. The protein, ash, and crude fibre contents of the breads were significantly improved compared with the control, especially breads containing 100% DPFS. Multigrain breads showed low GI, especially those with >20% whole wheat substitution and 100% date palm fruit sugar (DPFS) (Aderonke, 2019).

## ■ RESEARCH METHODS

### Critical inputs:

Technology assessed			
Sr. No.	Treatments	Technology	Ingredients
1.	TO <sub>1</sub>	Palm sugar cookies	Refined wheat flour, palm sugar and dalda were used to prepare cookies
2.	TO <sub>2</sub>	Jaggery cookies	Refined wheat flour, jaggery and dalda were used to prepare cookies
3.	FP	White sugar cookies	Refined wheat flour, powdered sugar and dalda were used to prepare cookies

Technology option (TO<sub>1</sub>), Technology option (TO<sub>2</sub>), Farmer practice (FP)

The ingredients selected for the preparation of cookies were refined wheat flour, powdered sugar, palm sugar, jaggery and dalda. All the required ingredients were purchased from the local markets and departmental stores. The formula and cost for the preparation of cookies is given in Table A and B.

### Preparation of cookies:

Cookies were prepared using refined wheat flour with palm sugar (TO<sub>1</sub>), Jaggery (TO<sub>2</sub>) and White sugar

(FP). Cookies were prepared using refined wheat flour, alternative sugar and dalda in the ratio of 50:25:25 respectively as given in Table A and B. The dough was rolled into uniform sheet of desired size (thickness of 0.6cm and 4cm diameter) and was cut into circular shapes using cookies cutter and baked in an oven at 180°C for 20 min. After 6 hrs, the cookies were packed in Polythene bags (200gauge) and stored at room temperature. The cookies were evaluated for their sensory qualities for one month at 3 days intervals during the storage period (Fig. A, B and C).

### Sensory evaluation:

Cookies were evaluated organoleptically for color, flavor, texture and overall acceptability. One piece from each lot of cookies was presented to 10 panelists as randomly coded samples and the taste panelists were recorded to rate the sample for color, flavor, texture and overall acceptability on a 1-9 point scale, where 1=dislike extremely; 2=dislike very much; 3=dislike moderately; 4=dislike slightly; 5= neither like nor dislike; 6=like slightly; 7= like moderately; 8= like very much; 9=like extremely. The mean of sensory scores for attributes were recorded (Watts *et al.*, 1989).

**Table A : Formula used for the preparation of cookies in trial**

Items	TO <sub>1</sub>		TO <sub>2</sub>		FP	
	Kg	Rs.	Kg	Rs.	Kg	Rs.
Wheat flour	1	60.00	1	60.00	1	60.00
Palm sugar	1/2	200.00	-	-	-	-
Powdered Jaggery	-	-	1/2	25.00	-	-
Powdered sugar	-	-	-	-	1/2	20.00
Dalda	1/2	55.00	1/2	55.00	1/2	55.00
Other expenses	-	20.00	-	20.00	-	20.00
Total	2	335.00	2	160.00	2	155.00

Technology option (TO<sub>1</sub>), Technology option (TO<sub>2</sub>), Farmer practice (FP)

**Table B: Formula used for the preparation of cookies in bulk production**

Items	TO <sub>1</sub>		TO <sub>2</sub>		FP	
	Kg	Rs.	Kg	Rs.	Kg	Rs.
Wheat flour	50	3000	50	3000	50	3000
Palm sugar	25	10000	-	-	-	-
Powdered Jaggery	-	-	25	1250	-	-
Powdered sugar	-	-	-	-	25	1000
Dalda	25	2750	25	2750	25	2750
Other expenses	-	1000	-	1000	-	1000
Total	100	16750	100	8000	100	7750

TO<sub>1</sub> - Palm sugar, TO<sub>2</sub> - Powdered jaggery, FP - White sugar

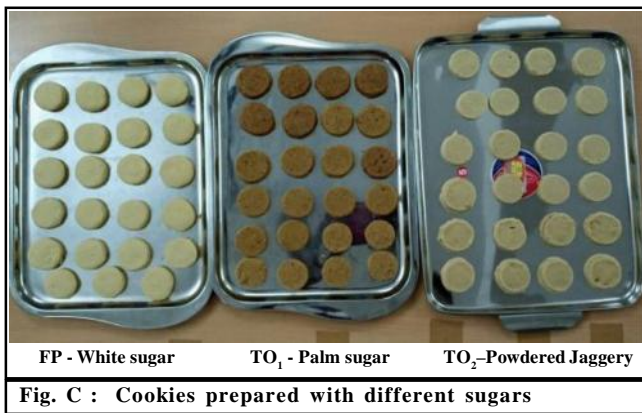


Demonstration of cookies for farm women



Demonstration of cookies for farmers

Fig. A & B: Technology transmission to the farm women and farmers



FP - White sugar TO<sub>1</sub> - Palm sugar TO<sub>2</sub> - Powdered Jaggery

Fig. C : Cookies prepared with different sugars

### RESEARCH FINDINGS AND DISCUSSION

Table 1 shows that the trials were demonstrated with white sugar, palm sugar and jaggery for the bulk production of cookies (80kg). The cookies were acceptable for the period of 30 days. The net returns and BC ratio of palm sugar cookies and jaggery cookies

were higher than the farmer practice.

### Sensory evaluation of the cookies:

Cookies samples containing white sugar, palm sugar and jaggery were subjected to sensory evaluation. The color, flavor, texture and overall acceptability of different cookies samples were evaluated by a panel of 10 tasters. The mean score for organoleptic preference are presented in Table 2. The highest score for jaggery cookies (8.7) followed by white sugar cookies (8.5) and the lowest score for palm sugar cookies (8.1) was preceded at end of the storage period. The shelf life of the cookies prepared by using white sugar, jaggery and palm sugar was same (30 days). Slight changes were observed in organoleptic score of all type of cookies. It is concluded that the jaggery cookies and palm sugar cookies can be used as a replacement for white sugar cookies.

Table 1 : Performance of the technology

Technology option	No. of trials	Production / Unit (kg)	Gross Cost (Rs. / Unit)	Net returns (Rs.)	BC ratio
FP	5	80 kg	7750	10020	1:2.29
TO <sub>1</sub>	5	80 kg	16750	25000	1:2.49
TO <sub>2</sub>	5	80 kg	8000	12540	1:2.57

FP - White sugar cookies, TO<sub>1</sub> - Palm sugar cookies, TO<sub>2</sub> - Jaggery cookies

Table 2 : Mean value of sensory evaluation of the cookies

Technological options	Organoleptic scores		
	1 <sup>st</sup> Day	15 <sup>th</sup>	30 <sup>th</sup> Day
FP - White sugar cookies	9.0	8.7	8.5
TO <sub>1</sub> - Palm sugar cookies	8.5	8.3	8.1
TO <sub>2</sub> - Jaggery cookies	9.0	8.8	8.7

### Feed back of the farmers involved:

The farmers and entrepreneurs are very much satisfied about the taste of the jaggery cookies and palm sugar cookies. They are planning to prepare this type of cookies for sale. The cost of white sugar is very less when compared to jaggery and palm sugar. Hence, the cost of the palm sugar and jaggery cookies is also high. It is a difficult task to reach the marketability of the product.

### Feed back to the scientist who developed the technology:

White sugar leads to many health hazards. Regular consumption of palm sugar positively impacts digestive health. By activating digestive enzymes, the sweetener helps with regular bowel movement and cleanses the system. Among many other ailments that palm jaggery helps relieve cold and cough is the most common one. Jaggery helps boost resistance against infections, hence building stronger immunity. Hence, it can be replaced by either jaggery or palm sugar.

### Summary and Conclusion:

This study has demonstrated that addition of palm sugar and jaggery to the formulation of cookies has improved the cookies sensory quality attributes. Based on the scores of sensory evaluation, the jaggery cookies was found to be highly acceptable than the other cookies. This technology dissemination to farmers can be helpful in increasing the utilization and consumption of palm sugar and jaggery in regular diet. Further studies may include the detailed analysis of nutritional constituents and functional properties of palm sugar and jaggery incorporated cookies.

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