

NUTRIENT ANALYSIS OF *COCONUT NUCIFERA* JAGGERY AND SENSORY PROPERTIES OF THE FORMULATED PRODUCT

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Abstract- Given the rising popularity of healthy eating and the general disapproval of excessive sugar consumption, consumers frequently want to replace refined sugar with other sweeteners, such coconut sugar. The bulk of other commercially available sugars pale in comparison to coconut sugar as a healthy sweetener. It takes a lot of time and resources to process sap from trees, which is collected and then transported, stored, and evaporated. Coconut sugar is traditionally produced by evaporating sap until reaching its saturated liquid and formed a crystalline structure. This study investigated the comparison of coconut sugar made by traditional method with commercial coconut sugar and other sweeteners available in market. Due to its great nutritional content and low glycemic index, consumers are willing to change sweetener option.

Key word: Coconut nucifera, jaggery

INTRODUCTION

Palms are believed to be among the oldest flowering plants in the world. The five major economic palms of the world are coconut (*Cocos nucifera*), African oil palm (*Elaeis guineensis*), date palm (*Phoenix dactylifera*), betel nut palm (*Areca catechu*) and pejbaye (*Bactris gasipaes*). Among these, coconut produces inflorescences all through the year and so can be tapped. In India, it is called 'tree of heaven', 'tree of life', etc. For centuries, many palm species including coconut have been tapped to produce fresh juice (sweet toddy), fermented drinks (toddy, wine, arak), syrup (honey), sugar and jaggery. Coconut sugar is also known as coconut palm sugar, coco sugar or coco sap sugar. Unlike cane sugar which supplies only calories, coconut sugar supplies calories and nutrients. It has high mineral content compared to unrefined and refined cane sugar, and is a rich source of potassium, magnesium, zinc and iron. In addition, it contains all essential amino acids required for protein synthesis, and is rich in vitamins like B1, B2, B3 and B6. Compared to unrefined cane sugar, coconut sugar has two, four and ten times the amount of iron, magnesium and zinc respectively (Hebbar et al., 2015).

Coconut (*C. nucifera*) belongs to the family of the Arecaceae (Palmae), the subfamily Coccoideae. There are mainly two distinct groups of coconut i.e. tall and dwarf. The tall varieties grow slowly and bear fruits 6 to 10 years after planting. Its copra, oil, and fiber are of good quality. (NMCE, 2007). Coconut sugar is prepared by the concentration of inflorescence sap, popularly called as neera or Kalparasa, collected by tapping the unopened coconut spadix. The sap in its original form contains 14–16% sucrose which upon heating at 90–95 °C turns into long threads followed by agitation or beating to form a crystalline or amorphous sugar (Hebber et al., 2022).

Coconut sugar powder is produced conventionally by heating the coconut sap until it reaches a saturated solution, and crystalline coconut sugar powder is finally formed. Coconut sugar was also produced by drying the coconut sap using spray drying and vacuum drying. The dried coconut sugar produced had a mainly amorphous structure in contrast with the crystalline structure of coconut sugar obtained with the conventional method (Nurhadi et al., 2020).

Substitution of refined sugar with coconut sugar which is made from coconut inflorescence sap may be a healthy alternative in cake as it has low glycemic index, supplies calories and nutrients. It has two, four and ten times the amount of iron, magnesium and zinc respectively. Besides, it contains all essential amino acids required for protein synthesis, and is rich in vitamins like B1, B2, B3 and B6 It is gluten free, light brown in colour and has caramel, malty, sweet, and roasty smell (Beegum et al., 2022)

Customers today are increasingly more aware of natural ingredients. Consumers' growing emphasis on naturalness has had a significant impact on the food industry. Consumers in most nations often reject the food products that they do not perceive as natural. The demand for sweeteners made from natural sources has skyrocketed in recent decades (Philippe et al., 2014).

Consumers often try to replace refined sugars with alternative sweeteners such as coconut blossom sugar, because of an increased interest in healthy diets and the negative public attention focused on high sugar consumption. Traders advertise the fact that coconut blossom sugar is traditionally produced by small farmers, the palm trees grow organically in mixed cultivation with further crops, and the sugar contains little fructose and has a lower glycemic index than conventional refined cane or beet sugar (Wrage et al., 2019).

Coconut sugar and syrup contain well over 100 different types of compounds, including carbohydrates, free amino acids, proteins, minerals, vitamins, aromatic compounds and phenolics (Saraiva et al., 2023)

In light of the above, the present review investigates the health effects and nutritional profile linked with consuming coconut sugar, its potential food industry applications and sustainability issues, and its primary safety–quality parameters, plus a chemical analysis of its major components.

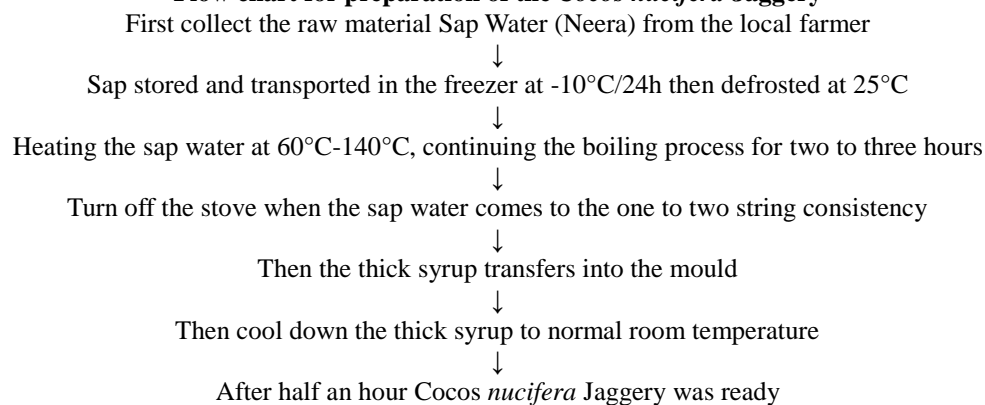
MATERIALS AND METHODS

Materials required:

The sample used in the study was SAP WATER (Neera). The raw materials of this jaggery SAP WATER (Neera) were collected from local farmers. The experiment was conducted in a laboratory at the Department of Food Science and Nutrition, The American College, Madurai, Tamil Nadu.

Processing of *Cocos nucifera* Jaggery

Flow chart for preparation of the *Cocos nucifera* Jaggery



Nutrient content of *Cocos nucifera* Jaggery

The nutrient content of *Cocos nucifera* palm jaggery such as Energy, carbohydrate, fibre, protein, fat, Iron, phosphorus, calcium, selenium, magnesium, potassium, vitamin C, vitamin B1, vitamin B2, vitamin B6, vitamin B9, cholesterol, was assessed. These properties showed that coconut sap could be served as a potential healthier sugar source compared with sugar palm and sugarcane juices.

Formulation of the products

Based on the benefits, I have selected the *Cocos nucifera* jaggery for the preparation of cake. For the formulation of recipes, the samples were added but the recipe were varied with different types of sweeteners. The sweeteners are sugar, palm jaggery, jaggery, *Cocos nucifera* jaggery.

Formulation of Cake

The Cake was prepared using the standard procedure. The ingredient such as wheat flour 100gm, coconut nucifera jaggery 100gm, butter 100gm, egg 2 no's, salt, milk 15ml, baking powder were used for the preparation of cake. Preheat the oven at 180°C for 10 minutes. Beat the butter and *Cocos nucifera* jaggery together in a large bowl with an electric beater until it attain the fluffy and add eggs one by one and beat for 1minute. Mix the dry ingredients - the wheat flour, baking powder & salt combined. The cake batter is ready. Pour the cake batter in a greased cake mould. And bake it at 180°C for 30 to 35 minutes. Bake until the cakes are lightly golden on top. After that transfer to racks and let it cool for 10 minutes. And now the cake is ready to serve. There were four variations in sweetener such as Standard cake using table sugar (V0), palm jaggery cake (V1), jaggery cake (V2) and coconut nucifera jaggery cake (V3).

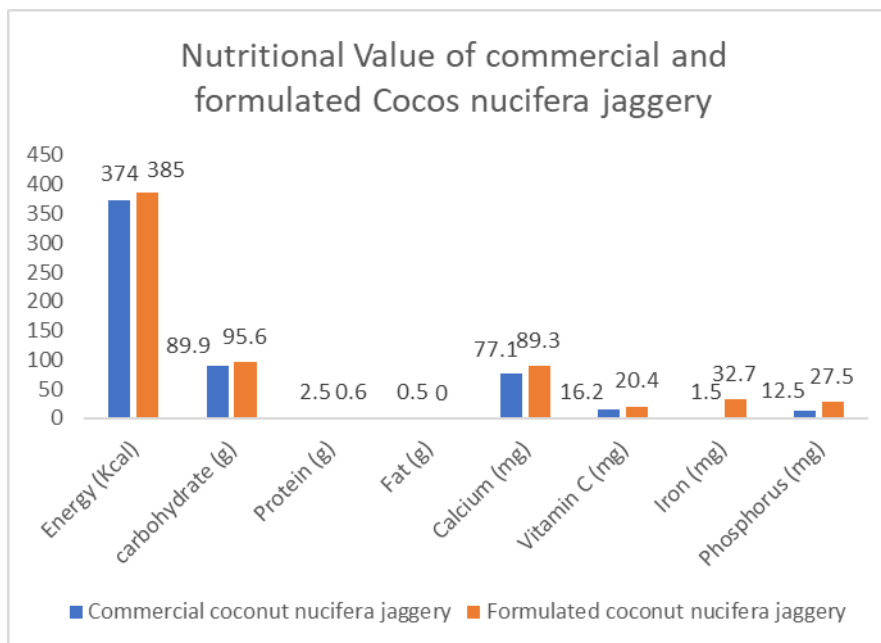
Sensory Evaluation for the formulated product

Sensory assessments were formulated based on the quality descriptions i.e) appearance, colour, flavour, taste and texture. The sensory evaluation was carried out for the developed cake. Products were evaluated by a panel of 10 semi trained judges from the Department of Food Science and Nutrition, The American College, Madurai. A 9-point Hedonic scale ranging from 1 to 9, were used to evaluate the acceptability off the sample. Data analysed are mean values of each determination \pm standard deviation (SD). Data were analysed using the statistical software of SPSS. The results were expressed as mean \pm standard deviation (SD).

RESULT AND DISCUSSION

3.1 Nutrient Composition of *Cocos nucifera* jaggery

Chart – 1



The nutrient content of the Commercial product and Formulated product of *Cocos nucifera* jaggery powder, indicate that the Energy is 374 Kcal and 385 Kcal; Carbohydrate is 89.9 g and 95.6 g; protein is 2.5 g and 0.6 g; fat is 0.5 g and <0.1 g; calcium is 77.1 mg and 89.3 mg; vitamin C is 16.2 mg and 20.4 mg; iron is 1.5 mg and 32.7 mg; Phosphorus is 12.5 mg and 27.5 mg.

Formulation and Sensory Evaluation of cake

There are four different cakes prepared using various sweeteners such as Standard cake using table sugar (V0), palm jaggery cake (V1), jaggery cake (V2), and coconut nucifera jaggery cake (V3). It helps to enhance the nutrient content of the product.

Table – 1 Mean and standard deviation for the developed wheat Cake

Sweetener	Appearance	Colour	Texture	Flavour	Taste	Overall acceptability
Sugar (V0)	8.5±0.547	8.6±0.516	8.1±0.408	8±0.632	8±0.894	8.1±0.408
Palm jaggery (V1)	8.5±0.547	8.6±0.816	8±0.632	8±0.983	7.8±0.752	8±0.894
Jaggery (V2)	8.6±0.516	8.5±0.836	8±0.894	8±0.632	8.1±0.408	8.5±0.408
Cocos nucifera jaggery (V3)	9±0.01	8.5±0.408	8.5±0.547	9±0.516	9±0.516	9±0.516

The mean and standard deviation was calculated for the wheat cake which has added four variant sweeteners they are *Cocos nucifera* jaggery, Palm jaggery, Jaggery, Sugar. The mean and standard deviation was calculated for appearance, colour, texture, flavour, taste, over all acceptance. The formulated samples were evaluated by sensory evaluation, from this the *Cocos nucifera* jaggery wheat cake was accepted by many people compared to other sweeteners.

Conclusion:

The remarkable aspect is that from a functional and nutritional point of view, these cakes contained significantly higher levels of nutrients than the traditional bakery products prepared with other sweeteners. Coconut sap also contained higher amounts of vitamin C as compared to sugar palm and sugarcane juices. Hence, coconut sap could be a better potential source for the production of healthier sugar.

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