



“FORMULATION AND EVALUATION OF COCONUT HAUSTORIUM INCORPORATED PRODUCTS”

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Abstract

Coconut Haustorium is the germination occurred from the coconut. Coconut apples, jungle bread, coconut pearl are the other common names of coconut haustorium. It contains several interesting bioactive constituents and possesses health promoting properties. Coconut apple is best for cancer patients, cardiac patients, pregnant ladies etc. In the present study nutrient analysis of coconut haustorium revealed the presence total carbohydrate, protein, fat, amino acids and vitaminC. Products such as Coconut Apple Balls, Coconut Apple Steamed Rolls, Coconut Apple Shell Cake, and Coconut Apple Halwa were prepared from coconut haustorium and sensory evaluation of the formulated products were done by 20 selected panel members using a score card.

Keywords: Coconut haustorium, bioactive constituents, nutrients.

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Introduction

Cocos nucifera, popularly known as coconut tree, is a perennial, monocot tree, belonging to the family Arecaceae. The tree, native to Southeast Asia and Melanesia, is distributed throughout the tropics and sub-tropics of the world (Chan and Elevitch, 2006). Coconut is useful in multiple ways to human kind and plays a major role in ecological balance and economic importance. Due to its versatile utilization, it is widely acclaimed as ‘Kalpavriksha’ or ‘Tree of Heaven’ (Batugal *et al.*, 2005).

The coconut shell has three eyes, out of which two eyes are non-functional and called blind eyes and the remaining is called soft eye which act as germ-pore (Smit, 1970). The matured coconut has only one embryo, which is embedded in the endosperm, is situated beneath the germ-pore (Nathanael, 1959; Desai, 1988). Interestingly coconut does not have dormancy, under suitable conditions of moisture and temperature, it starts germinate approximately after two months from sowing of nuts (Chan and Elevitch, 2006).

Coconut is considered as germinated when the shoot is visible just above the husk. The appearance of shoot above the husk varies with varieties and also in the same variety (Davis and Anandan, 1956). The first morphological sign of germination is the enlargement of embryo and protrusion of the apical mass outside the shell (Karthi, 1981). The cotyledon surface secretes various hydrolytic enzymes, which mobilize the reserved nutrients from the endosperm for the growing seedlings (Davies and Slack, 1981). Since coconut have tiny embryo and copious endosperm, the basal part of the embryo develops in to a spongy absorbent tissue called coconut “**haustorium**”.

The haustorium consists of loosely connected thin walled cells with large interspace between them (Child, 1974). It initially absorbs food materials from the coconut water and later from the kernel (Menon and Pandalai, 1958). The appearance of shoot above the coconut husk is observed only six weeks after germination (Davis and Anandan, 1956).

Coconut haustorium is a spongy absorbent tissue formed from the basal part of coconut embryo during germination. Anatomically, coconut haustorium has two parts, carbohydrate rich inner white portion and the oil rich outer yellow portion. The outer yellow portion has undulated structure with numerous serrations, the active multi- enzymes involved in the digestion of

complex nutrient reserves are present in the highly corrugated surface of the yellow portion (Arivalagan, 2018).

The cotyledon of coconut, also known as **coconut apple, jungle bread, queen’s bread, sprout** and **pearl**, is a white, off-white or creamy, spongy structure, formed during the germination of zygotic embryo. They form the basis of nutrition for the developing plant. Cotyledons are found to possess parenchyma cells with few vascular tissues. Though the cotyledons of coconut are being consumed by people at large, they have been explored only for their role in clonal propagation (Nguyen *et al.*, 2015).

Available literature on the coconut haustorium is limited to cytological and histo-chemical changes in profile of starch, glucose, fructose & sucrose content etc. Systematic study on complete nutritional composition of haustorium is not clearly available and no one studied about the formulation of food items with coconut haustorium properly. Presently, in most of the coconut processing industries and houses, most of the germinated stored coconuts were utilized for the preparation of oil and other products. Detailed study on the nutrients of haustorium and formulation of products will help to provide knowledge about the benefits of coconut haustorium and formulation of nutrient rich food items with coconut haustorium.

Objectives

- To formulate products using coconut haustorium.
- To evaluate the sensory qualities of the products.
- To determine the nutrient composition of coconut haustorium.

Methodology

Selection of Topic:

“Formulation and Evaluation of Coconut Haustorium Incorporated Products” was selected as the topic. The main purpose of selecting this topic is to prove that formulation of food items is also possible using germinated or sprouted coconut. There has been a false belief that sprouted or germinated coconuts are useless and considered as post-harvest waste. So this study brings new idea about the nutritional importance and health benefits of coconut haustorium (coconut apple) developed inside the coconut as a part of germination.

Collection of Samples:

The samples used for the study is coconut haustorium. The samples are collected from different houses located in Kanyakumari District,

Tamil Nadu. Correct picture of coconut haustorium is given below

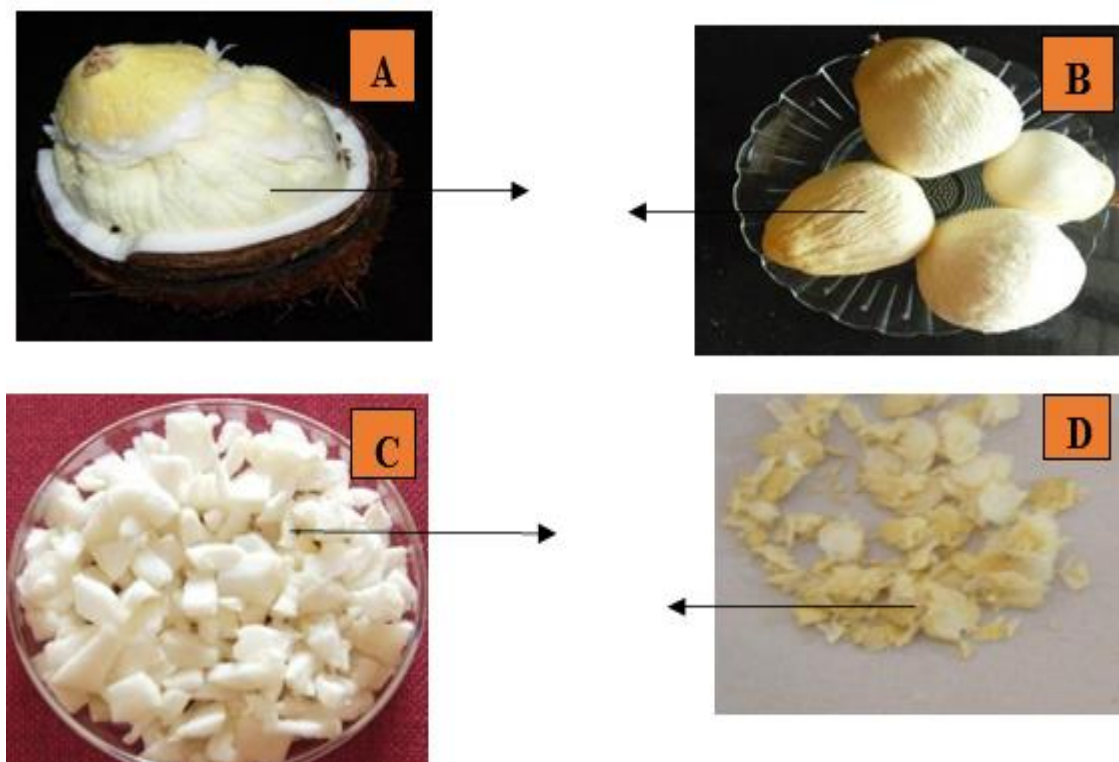


Figure. Coconut haustorium. Germinated coconut was dehusked and haustorium was separated out from the nut and both white and yellow portions were separated carefully and presented. A: Cut opened germinated coconut with haustorium; B: coconut haustorium separated from germinated coconut C: Inner white portion of haustorium and D: Outer yellow portion of haustorium.

Weighing and Measuring

The collected samples are grated and weighed for food formulation.

Nutrient Analysis

Nutrient analysis is a branch of analytical chemistry. Its interest lies in determining not only what, but also how much of component may be present in the food. (Marris B, Jawbs, 1999). Nutrient analysis was done for the fresh coconut haustorium especially for carbohydrate, protein,

fat, amino acids, crude fibre and vitamin C.

Formulation of the Products

Coconut Haustorium was selected for the preparation of the products. The products such as Coconut Apple Balls (CAB), Coconut Apple Steamed Rolls (CASR)), Coconut Apple Shell Cake (CASC) and Coconut Apple Halwa (CAH) were prepared based on standard procedures.

Coconut Apple Balls



Ingredients



Coconut Apple Balls

Coconut Apple Steamed Rolls



Ingredients



Coconut Apple Steamed Rolls

Coconut Apple Shell Cake



Ingredients



Coconut Apple Shell Cake

Coconut Apple Halwa



Ingredients



Coconut Apple Halwa

Sensory Evaluation of the Formulated Products

The prepared products were subjected to sensory analysis to find out the acceptability. The formulated products were organoleptically evaluated by using numerical score card. Sensory assessment were evaluated on the quality description i.e., appearance, texture, taste, color,

flavor, and overall acceptability. The sensory evaluation was carried out for the products such as coconut apple halwa, coconut apple balls, coconut apple steamed roll and coconut apple shell cake. The products were evaluated by a panel of 20 semi trained panel members from the Department of Nutrition and Dietetics, Muslim Arts College, Thiruvithancode, Kanyakumari District.



Sensory Evaluation of Formulated products

Statistical Analysis:

All the above said observation was statically analyzed. The collected data were interpreted through statistical analysis namely mean, standard deviation and standard error mean.

The nutrients of coconut haustorium such as carbohydrate, protein, fat, amino acid, crude fibre, vitamin C and minerals such as, sodium, potassium and calcium were analysed. The nutrients were analysed using different methods such as anthrone method, bradford’s, colorimetric method, ninhydrin method etc.

**Result and Discussion
Nutrient Analysis**

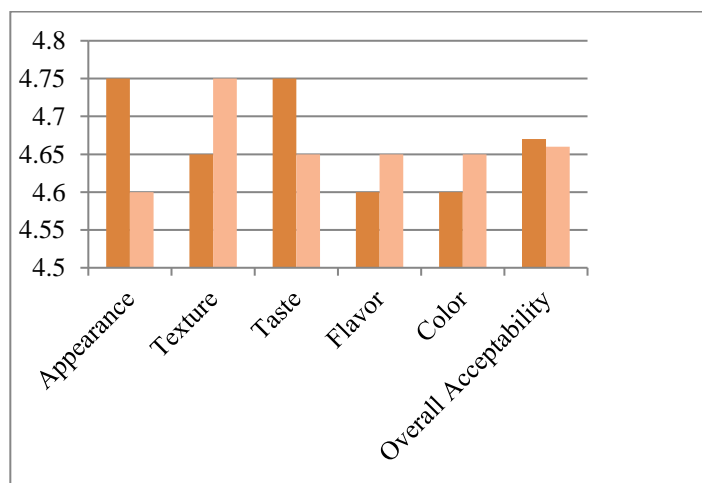
NUTRIENTS	UNIT
Carbohydrate	34.82 mg/g
Protein	6.5 µg/1ml
Fat	0.6 %
Amino Acids	24.83 µg/1ml
Crude Fibre	16.8 %
Vitamin C	276.28 mg/100g

Sensory Evaluation:

The sensory analysis of the formulated products is given in the following table.

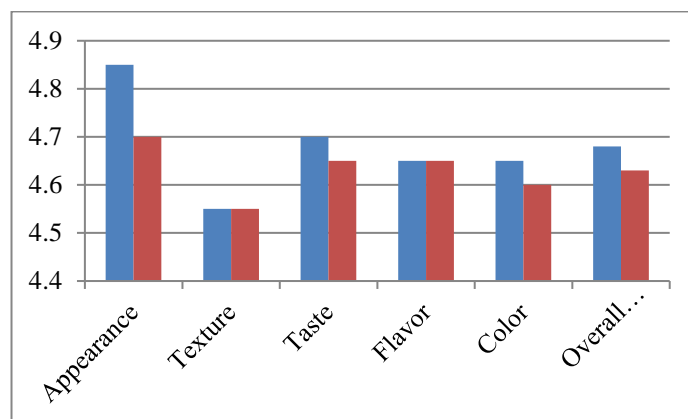
Sensory Evaluation of Coconut Apple Balls

Sensory Parameters	Sample(CAB)		Standard	
	M ± S.D	S. M. E	M ± S.D	S. M. E
Appearance	4.75 ± 0.44	0.09	4.6± 0.49	0.11
Texture	4.65 ± 0.48	0.11	4.75±0.44	0.09
Taste	4.75 ± 0.44	0.09	4.65± 0.48	0.11
Flavour	4.6 ± 0.49	0.11	4.65± 0.48	0.11
Colour	4.6 ± 0.49	0.11	4.65± 0.48	0.11
Overall acceptability	4.67 ± 0.44	0.09	4.66± 0.4	0.08



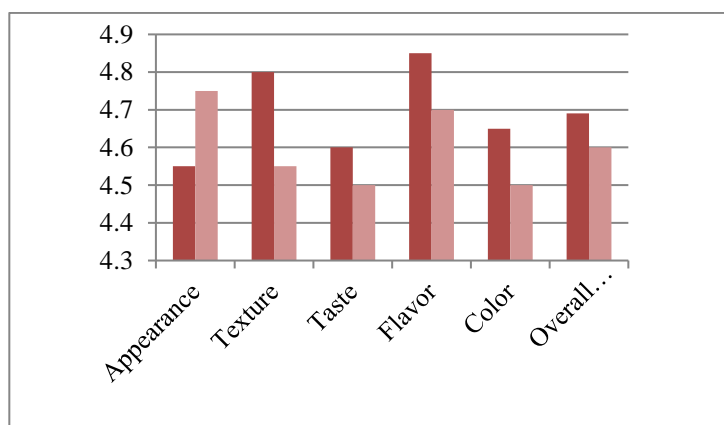
Sensory Evaluation of Coconut Apple Steamed Rolls

Sensory Parameters	Sample(CASR)		Standard	
	M ± S.D	S. M. E	M ± S.D	S. M. E
Appearance	4.85 ± 0.36	0.08	4.7± 0.46	0.10
Texture	4.55 ± 0.5	0.11	4.55±0.5	0.11
Taste	4.7 ± 0.46	0.10	4.65± 0.48	0.11
Flavour	4.65 ± 0.48	0.11	4.65± 0.48	0.11
Colour	4.65 ± 0.48	0.11	4.6± 0.49	0.11
Overall acceptability	4.68 ± 0.36	0.08	4.63± 0.4	0.08



Sensory Evaluation of Coconut Apple Shell Cake

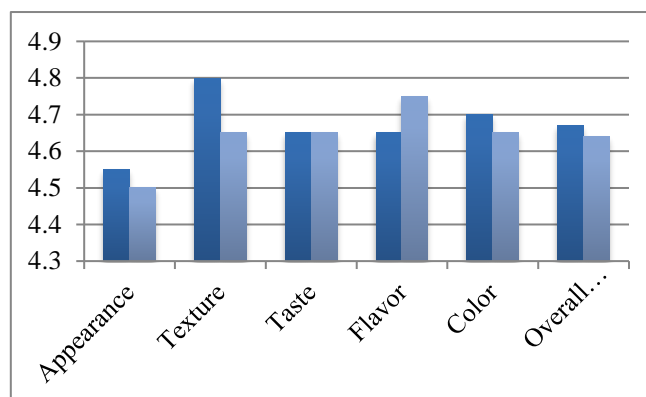
Sensory Parameters	Sample(CASC)		Standard	
	M ± S.D	S. M. E	M ± S.D	S. M. E
Appearance	4.55 ± 0.5	0.11	4.75 ±0.44	0.09
Texture	4.8 ± 0.4	0.08	4.55± 0.5	0.11
Taste	4.6 ± 0.49	0.11	4.5± 0.06	0.01
Flavour	4.85 ± 0.36	0.08	4.7± 0.46	0.10
Colour	4.65 ± 0.48	0.11	4.5± 0.06	0.01
Overall acceptability	4.69 ± 0.4	0.08	4.6± 0.3	0.06



Sensory Evaluation of Coconut Apple Halwa

Sensory Parameters	Sample(CAH)		Standard	
	M ± S.D	S. M. E	M ± S.D	S. M. E
Appearance	4.55 ± 0.5	0.11	4.5± 0.06	0.11
Texture	4.8 ± 0.4	0.08	4.65± 0.46	0.1
Taste	4.65 ± 0.48	0.11	4.65± 0.5	0.1

Flavour	4.65 ± 0.48	0.11	4.75± 0.49	0.09
Colour	4.7 ± 0.46	0.10	4.65± 0.5	0.1
Overall acceptability	4.67 ± 0.4	0.08	4.64± 0.46	0.08



Conclusion:

The results of the present study indicated that the coconut haustorium (coconut apple) is rich in nutrients that are very beneficial for various health benefits and also prevents various diseases. This could be attributed to the fact that high amount of nutrients such as carbohydrate, protein, fat, amino acids, crude fibre and vitamin C were presented in the coconut haustorium. Different types of food products can be prepared using fresh coconut haustorium and it is socio-economic friendly. We can use the germinated or sprouted coconut leftover as a part of post-harvest waste. The coconut haustorium can be consumed by all the age groups and all types of diseased patients, especially cancer patients and pregnant ladies.

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