Short Communication

Effect of sources of coconut water and acidulants on physico chemical properties of *nata-de-coco*

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Abstract

A study was conducted to find out the effect of sources of coconut water and acidulants on the physico-chemical properties of *nata-de-coco (nata)*. Coconut water from WCT and CDO showed significant effect on the physico-chemical properties of *nata.* Days to *nata* formation (17.25), thickness of *nata* (8.62 mm), weight of *nata* (378.12 g*)*, TSS (8.72^0 Brix) and total sugars (1.20g $100g^{-1}$) were significantly high when coconut water from CDO was used. However, protein (0.12%) was significantly high when nut water from WCT was used. Fibre (%) and moisture (%) were not influenced by sources of coconut water. Acidulants such as acetic acid and bilimbi juice were on par in their effect on physico-chemical properties of *nata.* Sugar content of the substrate, measured as total soluble solids (TSS° Brix) is the most important factor which determines the yield of *nata*.

Key words: Acetic acid, Bilimbi juice, CDO, Nata-de-coco, Sucrose, WCT.

Nata-de-coco is the bacterial cellulose produced by the bacteria *Acetobacter xylinium* at the air-liquid inter-phase of coconut water. It is a chewy, translucent, jelly like food product formed by the fermentation of coconut water. It is mostly sweetened as a candy or dessert and can accompany various food stuffs like drinks, ice cream, puddings and fruit mixes. *Nata* is gaining popularity because of its high dietary fibre content and low calorific value. Conventionally nut water collected in the copra production centres is from mature nuts of WCT, which contain less sugar (sucrose) and hence, results in low yield of *nata.* Sugar in the form of sucrose is an important determinant of yield of *nata-de-coco* (Jagannath et al., 2008). Cellulose producing bacteria *Acetobacter xylinium* grow best at a pH of 4.2 and synthetic acetic acid is commonly used for maintaining this favorable pH. It is observed that nut water from CDO contains more sugar than that found in WCT. Bilimbi fruit (*Averrhoa bilimbi*) juice is highly acidic, and can maintain a pH of 4.2. Therefore, it is important to explore the suitability of nut water from CDO as substrate, and to find out a more common source of acidulant for *nata* production. With this background, the present study was undertaken to find out the effects of sources of nut water and acidulants on the physico- chemical properties of *nata-de-coco*.

There were eight treatments with three replications in a completely randomized design (CRD). Treatments consisted of two sources of nut water (WCT and CDO), with or without added sucrose (10%), and two acidulant sources [acetic acid and bilimbi fruit (*Averrhoea bilimbi*) juice], thus making a total of eight treatments.

T_1: Nut water from WCT added with sucrose, acetic acid

T_2: Nut water from WCT added with sucrose, bilimbi juice

T_3: Nut water from WCT added without sucrose,

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acetic acid

T_4: Nut water from WCT added without sucrose, bilimbi juice

T_5: Nut water from CDO added with sucrose, acetic acid

T_6: Nut water from CDO added with sucrose, bilimbi juice

T_7: Nut water from CDO added without sucrose, acetic acid

T_8: Nut water from CDO added without sucrose, bilimbi juice.

To nut water from WCT/CDO (1000 ml) with or without added sucrose (100 g), ammonium sulphate (5 g) was added and pH was brought to 4.2 by using either acetic acid (3 ml) or bilimbi fruit juice (25 ml). To this *Acetobacter xylinium* starter culture (100 ml) and mother liquor (100 ml) were added, poured into plastic trays of 23x13cm and kept covered for *nata* production at ambient temperature for 15-20 days. *Nata* sheets were harvested when uniformly thick (8-10 mm), washed thoroughly in distilled water, cut into cubes, boiled for 15 minutes to remove the traces of acid, put in sugar syrup (65^0 Brix) and stored in glass bottles. Evaluation of *nata* was done on physico-chemical properties like days to *nata* formation, thickness of *nata* (mm), weight (g), TSS (^{0} Brix), acidity (%), total sugar (g 100 g^{-1}), fibre (%) and moisture (%). The data was analyzed statistically using Web Based Agricultural Statistics Software Package (WASP), and correlation analysis was done using OPSTAT statistical software.

Two sources of coconut water WCT/CDO showed significant effect on the physico-chemical properties of *nata-de-coco* (Tables 1 and 2). There was no *nata* production in the treatments where no sucrose was added. This may be because cellulose production by *Acetobacter xylinum* was affected by concentration of sugars present in the medium. Similar results were reported by Embuscado et al. (1994) and Jagannath et al. (2008). Days to *nata* production (17.25 days), thickness of *nata* (8.62 mm) and weight of *nata* (378.12 g*)* were significantly high when nut water from CDO was used. This may be because nut water from WCT contained less sugar than CDO. Similar results were reported by Thampan (1998), Sabapathy and Kumar (1999) and Prades et al. (2012).

Table 1. Physico-chemical characters of *nata-de-coco*

Treatment	Days to *nata-de-coco* formation	Thickness of *nata* (mm)	Weight (g)	TSS (^{o}Brix)	Acidity (%)	Total sugar (g 100 g^{-1})	Protein (%)	Fibre (%)	Moisture (%)
T_1	15.50	8.00	372.00	8.17	0.60	1.03	0.13	2.84	71.94
T_2	16.00	7.25	352.70	7.35	0.60	0.97	0.12	2.95	70.76
T_3	-	-	-	-	-	-	-	-	-
T_4	-	-	-	-	-	-	-	-	-
T_5	17.00	8.75	378.50	8.72	0.60	1.26	0.05	2.75	72.34
T_6	17.50	8.50	377.75	8.62	0.60	1.25	0.06	3.03	72.27
T_7	-	-	-	-	-	-	-	-	-
T_8	-	-	-	-	-	-	-	-	-
CD (0.05)	1.09	0.94	15.24	0.86	NS	0.05	0.01	NS	NS

Table 2. Effect of sources of coconut water and acidulants on physico chemical characters of *nata.*

	Days to *nata* formation	Thickness of *nata* (mm)	Weight (g)	TSS (^{0}Brix)	Acidity (%)	Total sugar (g 100g^{-1})	Protein (%)	Moisture (%)	Fibre (%)
Mean (Tall)	15.75	7.62	362.38	7.76	0.60	1.00	0.12	71.35	2.90
Mean (Dwarf)	17.25	8.62	378.12	8.68	0.60	1.26	0.05	72.31	2.89
CD (Source of nata)	0.78	0.68	10.90	0.62	NS	0.04	0.008	NS	NS
Mean (Acetic acid)	16.25	8.38	375.25	8.45	0.60	1.15	0.08	72.15	2.80
Mean(bilimbi juice)	16.75	7.88	365.25	7.99	0.60	1.12	0.09	71.52	2.99
CD (Source of acid)	NS	NS	NS	NS	NS	NS	NS	NS	NS
CD (Interaction)	NS	NS	NS	NS	NS	NS	0.011	NS	NS

Chemical properties of *nata* such as TSS, total sugars and protein were influenced by sources of coconut water. TSS (8.68° Brix) and total sugars (1.26 g) were high in *nata* produced from nut water of CDO. This result is in line with the earlier observation that nut water from CDO recorded high TSS (5.25º Brix) than that from WCT (4.83º Brix). Prades et al. (2012) reported similar results. *Nata* produced from WCT nut water recorded higher protein (0.12 %) than that from CDO nut water (0.05 %). This may be because WCT nut water may contain more protein than that found in CDO nut water. This result is in confirmity with the reports of Enonuya (1988) and Santoso et al. (1999). Acidity, fibre and moisture contents were not affected by sources of coconut water.

Acetic acid and bilimbi juice were on par in their effect on the physico-chemical properties of *nata* (Table 2). These brought down the pH of nut water to 4.2, which favoured the growth of *Acetobacter xylinum* as reported by Vandamme et al. (1998).

Correlation studies revealed a strong relation among various physico-chemical properties of *nata* (Table 3). Thickness of *nata* was positively and significantly correlated to weight of *nata,* total sugar, TSS and had a positive correlation to fibre content. Weight of *nata* showed positive, significant correlation to total sugar and TSS and positive correlation to fibre content. Total sugar content of *nata* was positively and significantly correlated to TSS, and fibre content. TSS showed positive, significant correlation to fibre content. TSS of *nata* showed strong positive correlation to days to *nata* formation, thickness of *nata,* weight and total sugar. Those treatments in which sucrose was not added recorded no *nata* production. This proved conclusively that other factors being equal, TSS recorded highest positive influence on the physico-chemical properties of *nata.*

From the study it was found that days to *nata* formation, thickness, weight, TSS, total sugars were high when nut water from CDO was used, while protein content was high when water from WCT was used for *nata* production. Bilimbi juice was effective in lowering the pH of the substrates and at the same time did not influence the physico-chemical properties of *nata.* Correlation studies revealed that TSS of *nata* showed strong positive correlation to highest number of physico-chemical properties. Treatments in which sucrose was not added recorded no *nata* formation. It is inferred that other factors being equal, TSS showed highest influence on physico-chemical properties of *nata.* Further studies are required for utilization of nut water from CDO for commercial production of *nata.*

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Table 3. Correlation of physico chemical characters of *nata*

	Days to *nata* formation	Thickness of *nata*	Weight	Total sugar	TSS	Fibre
Days to nata formation	1					
Thickness of nata	0.180	1				
Weight	0.154	0.948**	1			
Total sugar	0.570**	0.573**	0.635**	1		
TSS	0.407*	0.599**	0.683**	0.935**	1	
Fibre	0.486*	0.007	0.015	0.509*	0.452*	1

**.Correlation is significant at the 0.01 level *. Correlation is significant at the 0.05 level

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