American Journal of

Food Technology

Development and Quality Assessment of Date Chocolate Products

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Abstract: Date chocolate products were produced by processing cocoa bean into cocoa powder (fermentation, milling, alkalization, press cake to cocoa butter, grinding, sifting and cocoa powder) and Date fruit into date powder (cleaning, sorting, drying, milling and sifting). The powders (Cocoa and Date) were used in the formulation of four different samples of chocolate mixes. The chemical analysis of the Date chocolates showed that sample C had the highest pH value, this was followed by sample B, while sample A had the lowest value. Sample B had high moisture content, with sample D having the highest. The four samples contained trace amount of fat; the carbohydrate contents of the samples were high, with sample B having the highest, while the protein contents were a bit close with sample D having the highest. Microbiological analysis showed the mesophilic aerobic bacteria plate count and the yeast and mould count are within the range of the standard. The sensory evaluation showed that samples A and B significantly differed (p<0.05) in taste, while samples A and D differed in texture significantly (p<0.05). There was no significant difference (p<0.05) in flavor, color, firmness and overall acceptability for the 4 samples. The use of Date-palm in chocolate production improved the taste and flavor of the product. The use of Date palm with or without sugar produces chocolate with a different texture and sweetness.

Key words: Cocoa beans, date palm, chocolate, microbial analysis, sensory evaluation

INTRODUCTION

Chocolate is produced from fruits of the cocoa tree (*Theobroma cacao*). It may be consumed as a beverage, syrup, flavoring, a coating, or confection in itself. The cocoa pods are spherical or cylindrical up to 30 cm long and contain 20-60 beans pod^{-1}. They take 5-6 months to ripen, when they turn from white, green or red to green, yellow, red or purple (Ihekoronye and Ngoddy, 1985).

Nutritionally, chocolate is mainly an energy source, with only small amounts of nutrients, 50 g bar provides 265 kcal, which is 10% of an average man's daily energy requirement and 14% of woman's. However, chocolate is moderate source of iron. A 56 g bar

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of plain chocolate provides about 8% of the Reference Nutrient Intake (RNI) of iron for a woman and 14% of the (RNI) for a man. Milk chocolate provides about two-third as much iron as plain chocolate (Beckett, 1994). Researchers have shown the health benefits of chocolates, especially in the prevention of cardiovascular disease (Ding *et al.*, 2006).

Date palm fruit (*Phoenix dactylifera* L.) production in the world is only confined to a small number of countries most of them being the Arab countries. They are grown in the Middle East mainly for eating fresh, although, some are dried and compressed into blocks. Hard dates, also called bread or camel dates, are dry and even when fresh, but when dried further, become extremely hard and intensely sweet, they may be left whole or ground into flour (powder), either way, they keep for years as staple food of the Arab world, especially the Nomads (Barreveld, 1993). It can be eaten, either dry or soft out of hand, or may be seeded and stiffed or chopped and used in a great variety of ways: on cereals, in pudding, bread, cakes, cookies, ice-cream coating or candy bar and chocolate (Stefan, 2005). It is highly rich in minerals; contains a high percentage of carbohydrate and dietary fibre; a relative low percentage of fat; (Al-Shahib and Marshall, 2003) and has a rich organoleptic characteristic (Barreveld, 1993).

This study aimed to develop Date chocolate in the formulations of Cocoa powder and Dates, respectively and assessment of its qualities.

MATERIALS AND METHODS

Raw Materials
The Cocoa beans were purchased from a local market at Ibadan, Nigeria. The Date fruits, milk, sugar, lecithin, Nut-Meg, vanilla (Flavor) were purchased at Central Market, Kaduna, Nigeria. This study was carried out at the Food Technology Department, Kaduna State Polytechnic, Kaduna, Nigeria from February 2006 to May 2006.

Production of Cocoa Powder
The wet beans was fermented for 3 days, after which the beans was washed to remove mucilage or pulp and dried in a cabinet dryer at a temperature of 60-70°C for 2 h, 50 min for 3 days then allowed to cool. After cooling it was packaged in a polythene bag.

They were later dried using solar net drying method for 19 days at a temperature of 35-37°C. It was then cleaned and sorted properly to remove foreign matters. The sorted cocoa beans were then heated or roasted to 100-140°C for 45 to 90 min. This helps in developing the flavor and color as well as further reducing the moisture content. The roasted beans were later cracked in a laboratory mill. The cracked beans were winnowed to yield nibs which were grinded by a hammer mill to give chocolate mass. The resultant chocolate mass was ditched using the ditching process. Fat pressing was carried out using muslin. The resultant press cake was neatly placed on a tray to dry. When dried, the press cake blended to obtain the powder, which was sifted using a fine wire mesh to produce cocoa powder.

Production of Date Powder
The Date Palm fruits was washed and sorted carefully. They were dried using the solar drying method at a temperature of 30°C which led to its stickiness, because of the sugar content. It was later transferred to a cabinet dryer at temperature of 60-65°C for 3 days. The seeds were removed and grinded into coarse particle size and further blended into fine particles. It was then sifted with a wire mesh and stored in a labelled plastic.

Table 1: Formulation of ingredients in grams for Date Chocolate

	Samples (g)			
Ingredients	A	B	C	D
Cocoa mass	212.38	60	55	65
Cocoa butter	4	4	4	4
Date powder	60	30	30	-
Sugar	25	25	25	25
Milk	25	25	25	25
Lecithin	5	4	4	4
Vanilla	2	2	2	2
Nut meg	1	1	1	1

Table 2: Formulation of ingredients (Percentage) for Date Chocolate

	Sample (%)			
Ingredients	A	B	C	D
Cocoa mass	63.52	39.73	34.59	51.59
Cocoa butter	1.19	2.65	2.51	3.17
Date powder	17.94	19.86	25.16	-
Sugar	7.47	16.55	15.72	19.84
Milk	7.47	16.55	15.72	19.84
Lecithin	1.49	2.65	1.26	2.51
Vanilla	0.59	1.32	2.51	1.58
Nut meg	0.29	0.66	0.63	0.29

Formulation of Ingredients

Table 1 and 2 show the formulation of the ingredients used.

Production of Date Chocolate

The Cocoa powder, the Date Palm powder, nib and other ingredients were mixed in accordance with specific recipes to produce homogenous mass of Date Chocolate, which was later refined so as to have a proper particle size. This was followed by the conching process (Zonis, 2008). The Date Chocolate was finally subjected to tempering so, as to obtain the right physical state. Four samples of Date Chocolate with different formulation (Table 1, 2) were produced.

Packaging

The Date Chocolates were wrapped on aluminium foils and refrigerated.

Reference Test

A multiple comparisons test was used efficiently to evaluate the four samples of the Date chocolate at a time according to the method described by Griffiths (1991).

Sensory Evaluation

Sensory evaluation was conducted on the four different Date Chocolates with the reference codes A, B, C and D to compare with the multiple comparison tests used. The coded samples were presented to a 10-Man panellist. They were asked to compare the standard chocolate with the coded samples. Scores were given to the scales as extremely taste (1) and no difference (5) and extremely taste equalling (8) and other parameters such as color, flavor, texture, overall acceptability were rated (BCCCA, 1996). The method described by Ihekoronye and Ngoddy (1985) was used to analyse the results.

Chemical Analysis

The recommended method of the Association of Official Analytical Chemists was used to determine the proximate composition and pH of samples. All reagents were of analytical grade.

Microbiological Analysis

The yeasts and moulds principle was used for the enumeration of yeasts and moulds in the samples. While, the Aerobic Plate Count Method was used for the enumeration of mesophilic aerobic bacteria in the sample according to the Health Protection Agency (2004) standard methods.

Statistical Analysis

Statistical significance was established using One-Way Analysis of Variance (ANOVA) and data were reported as Mean±SD. Statistical analyses were carried out using SPSS for Windows, version 14.0 (SPSS Inc. Chicago, IL USA).

RESULTS

Proximate Composition

Sample C had a significant ($p<0.05$) higher pH value of 6.62±0.016; this was followed by sample B with a value of 6.47±0.025, while sample A had a significantly ($p<0.05$) low value of 6.28±0.016. Sample B had a significant ($p<0.05$) high moisture content of 56.0 + 0.41%, with sample D having the highest, 59.0 + 0.41%. The carbohydrate contents of the samples were significantly ($p<0.05$) high, with sample B having the highest (37.0±0.41%). The protein contents were significantly ($p<0.05$) high, with sample D having the highest (7.9±0.16%). (Table 3).

Microbiology Analysis

The microbiological analysis (Table 4, 5) showed that mesophilic aerobic bacteria plate count of the samples was $<3 \times10^2$ cfu g^{-1}. The yeast and mould was observed to have fewer growths present, the result indicated 1.35×10^3 and 2.77×10^2 cfu g^{-1}.

Sensory Evaluations

Samples A and B significantly differed ($p<0.05$) in taste (Table 6), while samples A and D differed in texture significantly ($p<0.05$). There was no significant difference ($p<0.05$) in flavor, color, firmness and overall acceptability for the 4 samples.

Table 3: Proximate composition of date chocolate

	Samples			
Parameters (%)	A	B	C	D
pH	6.28±0.016	6.47±0.025	6.62±0.016	6.32±0.025
Moisture	58.0±0.41	56.0±0.41	57.0±1.63	59.0±0.41
Fat	Trace	Trace	Trace	Trace
Protein	7.80±0.28	7.00±0.41	7.10±0.16	7.90±0.16
Carbohydrate	34.2±0.16	37.0±0.41	35.9±0.82	33.1±0.16

Means±SD are significantly different ($p<0.05$)

Table 4: Result of mesophilic bacteria, yeast and mould counts

Samples	Aerobic plate count (cfu g^{-1})	Yeast and mould (cfu g^{-1})
A	$<3\times10^2$	$<3.00\times10^2$
B	$<3\times10^2$	1.35×10^3
C	$<3\times10^2$	2.77×10^2
D	$<3\times10^2$	$<3.00\times10^2$

Table 5: Microbial examination of yeast and mould

Physical appearance	Gram reaction	Morphological characteristics	Organism
Dish 10^{-3} spread colony and flowering shapes	Positive	Cluster, purple color and non-septed hyphae, spores and chain shape	*Streptococci*
Dish 10^{-2} oval and circle shape	Positive	Circle and chain shapes, purple color and septed hyphae	*Bacillus*

Table 6: Result of sensory evaluation

Samples	Taste	Color	Firmness	Texture	Flavor	Overall acceptability
A	6.0 ± 0.41^a	2.6 ± 0.49^a	3.4 ± 0.33^a	4.2 ± 0.16^b	3.6 ± 0.48^a	5.4 ± 0.33^a
B	4.4 ± 0.33^b	3.4 ± 0.16^b	3.1 ± 0.15^b	2.4 ± 0.33^a	3.6 ± 0.49^b	4.9 ± 0.16^b
C	3.5 ± 0.41^b	2.7 ± 0.21^c	4.7 ± 0.24^c	2.8 ± 0.33^a	3.3 ± 0.24^c	5.8 ± 0.33^c
D	3.1 ± 0.16^c	2.6 ± 0.24^d	2.3 ± 0.25^d	3.3 ± 0.24^d	4.5 ± 0.41^d	5.9 ± 0.41^d
LSD	1.2 ± 0.16	2.0 ± 0.62	2.7 ± 0.41	1.0 ± 0.41	3.1 ± 0.12	2.9 ± 0.41

Mean±SD with different superscripts are significantly different with a>b>c>d ($p<0.05$)

DISCUSSION

The use of sugar and its substitution in foods has been discussed over the years with respect to: the role of sugars in foods; substitution of sugars with alternative sweeteners; product development, marketing and labelling; target consumers for sugar-reduced products; and outlook for products made with alternative sweeteners (Jardine *et al.*, 1990).

This study was carried out to develop Date chocolate from Date palm and cocoa beans.

Proximate Composition

The pH value of sample A which was the lowest, can be attributed to its high proportion of cocoa mass. The International Cocoa Organization (2001) described the moisture contents of the 4 samples as higher to chocolate. This high moisture content may be due to the use of milk. The proportional amount of cocoa-butter used in the production of the four samples may be responsible for the trace amount of fat. This is of great importance as it helps in reducing rancidity thus prolonging the shelf-life of the Date chocolates. Research has shown that cocoa butter does not raise cholesterol as might be predicted by its saturated fatty acid content, because of the neutral effects of stearic acid on blood cholesterol levels (Kondo *et al.*, 1996). Forty years of research have shown that cocoa butter has a neutral effect on blood cholesterol (Knight, 1999). Some studies have also observed a modest reduction in blood pressure and flow-mediated dilation after consuming dark chocolate daily. The carbohydrate contents of the samples were high, with sample B having the highest. This contrast earlier report by the International Cocoa Organization (2001) that carbohydrate content of chocolate is 26.0%. The protein contents of the samples were a bit close with sample D having the highest which makes the Date chocolate a moderate source of protein.

Microbiological Analysis

The results (Tables 4, 5) conform to the standard of microbiological analysis and earlier reports by Cook and Meursing (1982), Beckett (1994) and Mabbett (1998) which suggested that the quality criteria for cocoa mass include figures for the number of yeasts found per gram-maximum of 50 and for alkalised cocoa powder a normal maximum of 50 with a limit of 100.

Sensory Evaluation

Samples A and B significantly differed (p<0.05) in taste, while samples A and D differed in texture significantly (p<0.05). There was no significant difference (p<0.05) in flavor, color, firmness and overall acceptability for the four samples. Clapperton and Piggott (1979), Roberts and Vickers (1994), Walters and Allchurch (1994), Bende and Nordin (1997), Hughson and Boakes (2002) and Labbe *et al.* (2004) had concluded that training and experience increases sensory ability. Thus, familiarity with product category by the panelists need to be taken into consideration, coupled with the fact they did not need so much training on sensory method of profiling (Bitnes *et al.*, 2007). This may explain their preference.

CONCLUSION

The use of Date-palm in chocolate production improved the taste and flavor of the product. The use of Date palm as an alternative sweetener with or without sugar produces chocolate with a different texture and sweetness.

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