THE PRODUCTION OF A NEW ICE MILK

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Abstract

Chufa milk, water extract of chufa tubers, was used as partially substitute at 10, 20, 30, 40, 50 and 60% of buffalos skim milk in the processing of ice milk. The pH and melting resistance of the produced ice milk were increased as the substituent level increased.

Mean while the overrun percentage was slightly decreased as the substituent level increased. The microbiological analysis indicated that the total bacterial (T.C). Spore formers (S.P) and Coliform count were decreased as the substituent level increased. Whereas pathogenic bacteria (*salmonella & shigella* and *Staphylococcus*) were not detected in all samples.

In addition to the previous results a good sensory characteristics of the produced ice milk at all level of substitution encourage the use of chufa milk as partially substitute of buffalo's skim milk in the processing of ice milk.

Key words. Chufa tubers, (*Cyperus esculents L*), Chufa milk, nouvelle ice milk and sensory evaluation.

INTRODUCTION

The increasing demand for local agricultural sources that can supply our requirements for food and raw material stimulates the research to explore and evaluate the chemical potentialities of our agricultural resources. One of the agricultural crops which worth evaluation for such purposes are the chufa plant. The plant, which is known since the ancient Egyptians, gives a copious crop and attracted the attention as a new source for oil, starch and sugars.

Chufa is soaked in water overnight and the best known application of chufa in food technology being in production of horchata chufa (milk of chufa). It is also used successfully as lavouring agent in ice cream Coskuner *et al.* (2002).

Chufa milk has been recommended as a whole milk substitute for babies allergic to mothers and cows milk Mokady and Dolev (1970).

The main goal of this work was to produce chufa and use it as partially substitute of buffalos skim milk in the processing of new ice milk product. One has to emphasis that the cost of the new product is relatively sheep compared with the use of buffalos milk.

MATERIALS AND METHODS

Materials

Chufa tubers (*Cyperus esculentus L*) obtained from the Sugar Crops Research Institute, A.R.C., Giza

Fresh skim buffaloes' milk and cream were obtained Faculty of Agriculture, Cairo University, Egypt. Skim milk powder, sugar and vanilla were purchased from local market. Ice gel 156 (Emulsifier and stabilizer) was purchased from the Egyptian Company for Milk Products and Additives.

Methods: -

1- Germination of Chufa tubers

Chufa tubers was soaked until the rootlet appears (1mm). Water was added to the germinated seeds, at a ratios of 1:3, 1:4, 1:5 and 1:6 and blended using homogenizer then was drained in muslin cloth to remove fibers. The filtrate was considered as the chufa milk (horchata)

2-Preparation of ice milk mixes

Three replicates of ice milk mixes (3Kg each) were prepared using germinated chufa tubers extracts as a substitute of fresh skim buffalo's skim milk at the levels, 0, 10, 20, 30, 40, 50 and 60 % resp. All mixes were standardized to contain 6% fat and 11% solid not fat (SNF) using fresh cream and skim milk powder as well as 13 % sugar, 0.1 % stabilizer & emulsifier and 0.1 % vanilla. All mixes were heat treated at 85 °c for 5 min. then cooled to 5 °c and 0.1 % vanilla was added. Thereafter, the mixes were aged at 6 °c for 24 hr before freezing as reported by Arbuckle (1986) using hard ice cream machine (Taylor, Model, 103) .The resultant ice milk was filled into PVC cups (cap.100 ml) covered and hardened in deep freezer at (- 16 °c) for 24 hours before analysis. The composition of seven different ice milk mixes are shown in Table (1).

Table 1. The composition of ice milk mixes.

INGREDIENTS KG	TREATMENTS						
	Control	T_1 10%*	T_2 20%*	T_3 30%*	T_4 40%*	T_5 50%*	T_6 60%*
Fresh skim buffalos milk (0% Fat and 9%S.N.F)	2.030	1.8890	1.6840	1.5004	1.312	1.113	0.908
Chufa milk	- - - -	0.2099	0.4210	0.6430	0.874	1.113	1.362
Skim milk powder {97%Fat)	0.127	0.1104	0.0940	0.078	0.059	0.041	0.023
Cream (40% Fat and .4%S.N.F)	0.450	0.398	0.4095	0.386	0.364	0.340	0.314
Sugar	0.390	0.390	0.390	0.390	0.390	0.390	0.390
Emulsfiere & Stabilizer	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Vanilla	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Total	0.003	0.003	0.003	0.003	0.003	0.003	0.003

*Chufa milk

3-Chemical analysis

Chufa tubers and the extract (chufa milk) were analyzed for their total solids (T.S %), total protein (%), ash and fiber according to the methods outlined in A.O.A.C (2000). Total carbohydrates were determined according to Montgomery (1961). The prepared mixes and ice cream were analyzed for their titratable acidity, pH value as reported by Ling (1963), specific gravity (Winton, 1958), weight per gallon (Burke, 1947). Viscosity was determined using a viscometer L model DV –111 according to Johnson *et al.* (1995) and freezing point as mentioned in FAO (1977). Overrun % of ice milk was measured according to Arbuckle (1986) while melting resistance was determined as reported by Reid and Painter (1933).

4-Microbiolgical examinations

The resultant fresh ice milks were microbiologically examined for total bacterial count, spore forming, *salmonella & shigella, staphylococcus* bacterial count and coliforms group according to A. P. H. A (1992).

5-Sensory evaluation:

Twenty panelists evaluated the organoleptic properties of each batch ice milk as reported by Abd El-Rahman (2003).

RESULTS AND DISCUSSION

1- **Chemical composition of used raw materials:**

Data presented in Table (2) show the chemical composition of chufa tubers. The results indicate that chufa tubers had higher carbohydrates and fat contents than the other components. The obtained results are in agreement with Linssen *et al.* (1989) Who reported that the carbohydrates (starch + sucrose), and fat were 47.9 and 25.5% resp. While lower values for protein, ash and fiber were reported by the same authors (it were 5.1, 2.2% and 9.6% resp.)

Chufa milk was prepared as water extract of chufa tubers different ratios 1:3, 1:4, 1:5 and 1:6 (chufa tubers : water). It was found that chufa milk of 1:4 ratio was the best extract because its total solid (15.42%) is nearly the same as that of buffalo's skim milk. For this, the chufa milk (water extract 1:4) was used in this study. The data presented in Table (2) showed the chemical composition of chufa milk was the moisture (84.59%), carbohydrate (10.18%), protein (0.89), fat (4%) and ash (0.33%).

Properties of Ice milk mixes: -

The results in Table (3) show that the titratable acidity is slightly decreased as the substitution level increased with chufa milk. These results were agreed with those obtained by Salem *et al.* (1989), and Azzam (1992) who found a decreasing in the titratable acidity of ice milk mixes containing soy protein concentrate. Also these results were in agreement with the results reported by Abd El-Rahman (2003) who found that decreasing in the titratable acidity of ice milk mixes prepared from barley extracts as substitute of fresh buffalos skim milk. The trend of pH value of ice milk mixes of all treatments, behaved oppositely to acidity. Specific gravity and weight / gallon behaved as pH: these results are in agreement with Abd El-Rahman (2003).The viscosity of ice milk mixes had a similar trend .On the other hand the freezing point of the all mixes decreased as the substitution level increased. These results are in agreement with that reported by Abd El-Rahman (2003).

Properties of the resulted ice milk:

Data presented in Table (4) illustrate the properties of the resultant ice milk. It is clear that the titratable acidity and pH value of the ice milk had the same values and trend of the ice milk mixes. these results are agreement with the results reported by Abd El-Rahman (2003). The overrun percentage had slightly decreased as substitution level increased with chufa milk. The data in the same Table that the melting resistance of ice milk samples increased as the substitution level increased. These results were in agreement with Abd El Rahman (2001), who found increment the melting resistance of ice milk containing peanut extract. Where as the samples of 40, 50 and 60% substitution level were completely melted after 90 min. at 30°C.

Data in Table (5) show that the total count (T.C) decreased as the substitution level increased with chufa milk extract. These results were in agreement with Abd El Rahman (2001), who found that the total count (T.C) decreased as the substitution level of peanut extract increased in the spore formers count (S. P.), behaved the same trend to the (T.C). These results perhaps due as the decreased of the quantitative of skim milk powder as the substitution level increased with chufa milk (in preparation of ice milk mixes).

Regarding to coliforms, it was decreased as substitution level increased, but it was not detected at substitution level 40, 50 and 60% chufa milk. Concerning the salmonella, shigella and staphylococci they were undetected in the all samples. These may be due to the heat treatment of the mixes. These results were in agreement with Abd El Rahman (2001),

Data presented in Table (6) indicated that the flavor scores were highest in the control, while the rate of replacement with chufa milk had little effect on the flavor, although some of the panelists preferred T_6 with 60% replacement as having a new ice milk flavor. These results were in agreement with Abd El Rahman (2001), Body&textur behaved as the same manner of the flavor, while, the melting resistance scores increased as the substitution level increased with chufa milk. These results were agreed with those obtained by Salem *et al.* (1989), and Azzam (1992) and Abd El-Rahman (2003).

Table 2. The chemical composition of chufa tubers and chufa milk.

COMPONENT%	CHUFA TUBERS	CHUFA MILK
Moisture	8.0	84.59
Carbohydrate	47.0	10.18
Protein	5.5	0.89
Fat	27.0	4.0
Ash	2.5	0.33
Fiber	10.1	---

Table 3. Some physicochemical properties of ice milk mixes as affected by substituting with chufa milk.

PROPERTIES	SUBSTITUTION LEVEL						
	Control	T_1 10%*	T_2 20%*	T_3 30%*	T_4 40%*	T_5 50%*	T_6 60%*
Titratable acidity%	0.20	0.20	0.19	0.19	0.18	0.16	0.15
PH	6.40	6.41	6.6	6.61	6.7	6.8	7.0
Specific gravity	1.025	1.1045	1.1069	1.1075	1.1089	1.1090	1.1092
Weigh/gallon(lb)	9.2004	9.2171	9.2371	9.2421	9.2533	9.2547	9.2562
Viscosity (c.p)	2.12	2.2	2.25	2.36	2.42	2.56	2.72
Freezing point(°c)	-2.0	-2.20	-2.25	-2.30	-2.50	-2.70	-2.75

*Chufa milk

Table 4. Some physicochemical properties of ice milk as affected by substituting with chufa milk.

PROPERTIES	SUBSTITUTION LEVEL						
	Control	T_1 10%*	T_2 20%*	T_3 30%*	T_4 40%*	T_5 50%*	T_6 60%*
Titratable acidity%	0.20	0.20	0.189	0.19	0.18	0.16	0.15
PH	6.40	6.40	6.61	6.61	6.75	6.89	7.0
Overrun%	50.90	35.6	32.40	32.0	30.6	28.0	25.70
Melting resistance as loss% at 30°c after 15 min	50.56	40.43	39.08	36.10	30.5	25.09	25.00
after 30 min	70.5	50.14	45.05	40.07	37.60	35.90	35.06
after 45 min	100	70.06	57.5	55.80	53.72	50.80	50.00
after 60 min	---	100	90.60	75.8	65.60	62.03	60.08
after 75 min	---	---	---	100	80.0	70.01	75.0
after 90min	---	---	---	---	100	100	100

*Chufa milk

Table 5. Microbiological analysis of ice milk as affected by substituting with chufa milk.

PROPERTIES	SUBSTITUTION LEVEL						
	Control	T_1 10%*	T_2 20%*	T_3 30%*	T_4 40%*	T_5 50%*	T_6 60%*
[a]T.C (10^4)	80	65.5	53.5	8	5.5	5	5
[b]S.P (10^1)	24	22.5	20.5	13.5	4.5	4.0	3.5
[e]Coli (S)	6.0	5.0	3.0	2.0	N.D	N.D	N.D
[c]Sal & Shi (S)	N.D	N.D	*N.D*	N.D	N.D	N.D	N.D
[d]Staph.(S)	N.D	N.D	N.D	N.D	N.D	N.D	N.D

[a]Chufa milk

[a]T.C: Total Count [b]SP: Spore forming [c]Sal&Shi: Salmonell & Shigella [d]Staph: Staphylococcus [e] Coli: Eschericia coli

Table 6. Sensory properties of ice milk as affected by substituting with chufa milk.

PROPERTIES	SUBSTITUTION LEVEL						
	Control	T_1 10%*	T_2 20%*	T_3 30%*	T_4 40%*	T_5 50%*	T_6 60%*
Flavor (50)	48	45	44	42	40	39	38
Body & Text. (40)	38.5	39	39	39	38	37	36
Melting resistance (10)	6.5	7	7.5	8	8.5	9	9
Total (100)	93	91	90.5	89	86.5	85	83

*Chufa milk

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إنتاج نوع جديد من المثلج اللبني

هاله عبد المنعم عبد الرحمن ، نادية حسني علي عاصم

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تم استخدام المستخلص المائي لحب العزيز كبديل للبن الفرز الجاموسي في إنتاج المثلج اللبني بمستويات استبدال صفر ، ١٠ ، ٢٠ ، ٣٠ ، ٤٠ ، ٥٠ ، ٦٠% ولقد أظهرت النتائج تزايد الـ pH والمقاومة للأنصهار بتزايد نسب الأستبدال . بينما تناقصت قليلاً النسب المئوية للريع بتزايد نسب الأستبدال مقارنة بعينة الكنترول .

وحدث تناقص في مجاميع العد الكلي والبكتريا المتجرثمة والكوليفورم بتزايد نسب الأستبدال بينما لم تظهر البكتريا المرضية في جميع العينات .أوضحت نتائج التحكيم الحسي إمكانية أستخدام لبن حب العزيز بنجاح في تصنيع المثلجات اللبنيه بجميع نسب الأستبدال التي أستخدمت من (١٠ : ٦٠%)