

MICROBIAL EVALUATION OF FRESH COW MILK ICE CREAM SWEETENED WITH DATE PALM FRUITS (*Phoenix dactylifera*) OR TIGER-NUT (*Cyperus esculentus*)

Muhammad, A.L. Inusa, S.K. and Abdussamad, A.M

Department of Animal Science, Faculty of Agriculture,
Bayero University, PMB 3011, Kano

Corresponding author: elnaseerameena@gmail.com

ABSTRACT

The current study was conducted to evaluate the microbial quality of fresh cow milk ice cream sweetened with date palm fruit syrup or tiger-nut extract. The experiment was laid in completely randomized design (CRD) with four treatments at 5% v/v of sugar, date palm fruits syrup and tiger-nuts extract. Microbiological study revealed that, Aerobic Plate Count (APC, CFU/ml) was highest in negative control sample and lowest in ice cream samples sweetened with date palm fruit syrup while Total Staphylococcus Count (TSC, CFU/ml) was recorded highest in tiger nut sweetened ice cream samples and lowest in ice cream samples sweetened with date palm fruit syrup. It is concluded that date palm fruit syrup or tiger-nut extract can be used as natural sweetener and flavouring agent in ice cream production with high nutritional value. Therefore, it is recommended that further study should be conducted to determine the effect of using these natural sweeteners at varying levels of concentration in ice cream processing.

Key words: Cow milk, Date palm fruit syrup, Tiger-nuts extract, Ice cream

INTRODUCTION

In sub-Saharan Africa, the problem of malnutrition is widespread. This could be solved by developing simple, appropriate and affordable food production and processing technologies (Muhammad & Abdulqadeer, 2011). Milk and milk products have been used as important foods for man since the dawn of civilization and were regarded as the best cornerstone on which to build nourishing diets (Muhammad, 2008). Milk processors produce wide range of milk products which include liquid milk, fermented milks, cheeses, butter and ghee, condensed milk, evaporated milks, dry milk or powder milk, cream, casein and whey products (O'Connor, 1995).

Ice cream as a dairy product has a high nutritional value, it provides the body with substantial key nutrient including bone strengthening calcium and blood pressure lowering potassium and energizing B vitamins (Goff & Hartel, 2013). Date fruits assume great importance in human nutrition owing to their rich content of essential nutrients. Due to its rich composition of carbohydrates, dietary fiber, fatty acids, vitamins and proteins, it is assuming great importance in human nutrition (Alanazi, 2010). Tiger-nut extract is a very nutritious and refreshing drink, both for young and old. It is tremendously high in starch, glucose, and proteins and also rich in minerals like potassium, phosphorus, vitamins E and C. (Belewu and Abodunrin, 2008). Therefore, fresh cow milk ice cream prepared with date palm fruit syrup or tiger nut extract is expected to improve its nutritional benefits.

The main objective of this study was to evaluate the microbiological quality of fresh cow milk ice cream sweetened with date palm fruits syrup or tiger-nuts extract.

MATERIALS AND METHODS

The experiment was conducted at the Instrumentation Laboratory of the Department of Animal Science, Bayero University, Kano. The State lies on latitudes 10° 33'N to 12° 23'N and longitudes 7° 45'E to 9° 29'E, with a population of 9,383,682 (NPC, 2006). Bayero University (New Campus) is located along Gwarzo Road, Kano. The University lies on latitude 11°57'56.27" and longitude 8°25'51.22". The Instrumentation laboratory of the Department of Animal Science, Faculty of Agriculture lies on latitude 11°58'35.9" and longitude 008°25'32.6" with ambient temperature range of 28°C to 30°C. It conducts chemical analyses of experimental samples for research using available instruments. The laboratory also undertakes teaching and demonstrations with respect to practical components of both undergraduate and postgraduate programmes in Animal Science.

Sources of Experimental Materials and Their Preparation

The fresh cow milk for the study was obtained from Garko Agric Services Limited, a semi-urban dairy enterprise located at the Southern outskirts of Kano city. Dried date palm fruits were obtained from the Nigeria Institute for Oil Palm Research (NIFOR), Date Palm Research Sub-Station, Dutse, Jigawa State. Dried tiger-nuts of brown variety were obtained from Rimi market in Kano Metropolis. Skim milk powder, sugar and stabilizer for the ice cream preparation were also purchased from Singer Market also in Kano Metropolis.

Date palm syrup was produced according to the method of Khalil, Abd El-Sari, Hafiz and Ahmad (2002). Dried Date Palm Fruits were cleaned, deseeded using sharp knife, crushed with mortar and pestle, washed thoroughly, boiled with water to 80°C for 30 minutes, blended with an electric blender after cooling in a cold water bath and filtered through very fine sieve (0.5mm). The residue pulp was rewashed with sufficient amount of hot water and filtered again. The extract was further cooked at 60°C for 5 minutes to reduce the water content with regular stirring to prevent burning at the bottom of the pot until it becomes thick (forming a syrup). The prepared extract made into syrup was kept in pre sterilized glass bottles for use in the preparation of the experimental ice cream.

The method described by Mordi, Ozumba and Elemo (2011) was used with slight modification in the preparation of the tiger-nut extract. Fresh tiger-nuts of brown variety were manually sorted and cleaned to remove foreign particles and unwanted materials. The nuts were soaked in portable water at a ratio of 1:2 (nut: water) overnight. The soaked nut in addition with 1.5L of water was blended in a household blender at a maximum velocity of speed for 3 minutes to get fine paste. The extract was then filtered through very fine sieve (0.5 mm) and then kept in pre sterilized glass bottles for use in the preparation of the experimental ice cream.

The experimental ice cream samples were prepared according to the method of Schmidt (2004). The samples were packaged into well labelled plastic containers and processed further to harden at -28 to -30°C for 24hr in a freezer which were thereafter subjected to physico-chemical, microbial and sensory analysis.

Determination of Microbiological Quality of the Experimental Ice cream

The prepared ice cream samples were subjected to microbiological analysis as it is a product in which micro organism can survive and grow. Samples were subjected to qualitative microbial analysis to determine the presence or absence of both Gram positive and Gram negative bacteria. They were examined quantitatively to determine the number of bacteria present in each sample. Aerobic Plate Count (APC) and Total Staphylococcus Count (TSC) were examined using Nutrient and Mackonkey agars.

Experimental Design and Data Analysis

The experiment was laid in completely randomized design (CRD) with four treatments each containing 5% v/v of sugar, date palm fruits syrup and tiger nuts extract. Treatment 1 was the control, Treatment 2 was ice cream sweetened with date palm fruits syrup, Treatment 3 was ice cream sweetened with tiger-nuts extract and Treatment 4 was the negative control. Statistical analyses were carried out using GraphPad InStat Package (GraphPad InStat® version 3.05). Kruskal-Wallis Tests was used to determine the microbial quality of the experimental ice cream samples and means with significant differences were separated using Dunn's Multiple Comparison Test.

RESULTS AND DISCUSSION

Table 1: Summary Statistics (including Kruskal–Wallis Statistic) for the Effect of Type of Sweetener on Aerobic Plate Count ($\times 10^{-5}$ CFU/ml) in Fresh Cow Milk ice Cream

Group	n	Median	Minimum	Maximum	Sum of Ranks	Mean of Ranks	Kruskal–Wallis KW (Corrected for ties)
Control	3	1.25	1.18	1.80	16.5	5.500	5.921 ^{ns}
Date	3	1.20	1.15	1.25	8.5	2.833	
Tiger-nut	3	1.70	1.30	1.85	27.0	9.000	
Negative	3	1.55	1.30	1.85	26.0	8.667	

^{ns}= not significant

Table 2: Summary Statistics (including Kruskal–Wallis Statistic) for the Effect of Type of Sweetener on Total *Staphylococcus* Count ($\times 10^{-4}$ CFU/ml) in Fresh Cow Milk ice Cream

Group	n	Median	Minimum	Maximum	Sum of Ranks	Mean of Ranks	Kruskal–Wallis KW (Corrected for ties)
Control	3	1.05	1.03	1.10	20	6.667	7.529 ^{ns}
Date	3	1.02	1.00	1.05	10	3.500	
Tiger-nut	3	1.40	1.31	1.44	33	11.000	
Negative	3	1.04	1.02	1.05	14	4.833	

^{ns}= not significant

The results of the microbiological analysis obtained in the present study were focused on examining the microbial quality of the experimental ice cream samples. It was found that the aerobic plate count (APC, CFU/ml) and total *Staphylococcus* count (TSC, CFU/ml) were not significantly ($P > 0.05$) different among the ice cream samples. APC was highest in negative control samples and lowest in ice cream samples sweetened with date palm fruit syrup. This however disagrees with the findings of Tammam *et al.* (2014) who found higher contamination when date syrup was used as sugar substitute and natural flavouring agent in ice cream manufacture. Also, TSC was higher in ice cream samples sweetened with tiger-nut extract and lower in those prepared with date palm fruit syrup. This compares favourably with the findings of Moustafa, Mahmoud, Wagih and Mohamed (2016) who reported higher bacterial count in control samples of probiotic ice cream made with tiger-nut extract.

The lower counts of APC in the treated samples may be due to antimicrobial effect of date palm fruit as reported by Al-Farsi *et al.* (2007). It might also be due to the high levels of sugar in the samples which permits lower moisture concentration in the samples (Al-Shahib & Marshall, 2003). The low coliform count enhances the safety of ice cream and could extend the shelf life of the product.

CONCLUSION AND RECOMMENDATION

The findings from this study show that date palm fruit syrup and tiger-nut extract could be used as natural sweetener and flavouring agent in ice cream preparation for enhanced nutritional value whose microbiological quality was also greatly enhanced. Further study should be conducted to determine the effect of using these natural sweeteners at varying levels in ice cream processing.

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Table 2: Summary Statistics (including Kruskal–Wallis Statistic) for the Effect of Type of Sweetener on Total *Staphylococcus* Count ($\times 10^{-4}$ CFU/ml) in Fresh Cow Milk ice Cream

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