

Quality Evaluation of Avocado (*Persea americana*) Fruit Yoghurt Made from Buffalo Milk

K.D.T. Hettige^{1*}, C.S. Ranadheera¹, N.W.I.A. Jayawardena¹ and J.K. Vidanarachchi²

¹Department of Animal & Food Sciences, Faculty of Agriculture, Rajarata University of Sri Lanka, Anuradhapura, Department of Animal Science, Faculty of Agriculture, University of Peradeniya, Peradeniya.

Abstract

Buffalo milk is well suited for the development of processed dairy products due to the high content of total solids. Yoghurt is a fermented dairy product obtained from milk fermented by lactic acid bacteria. Incorporation of fruits with yoghurt may increase the nutritional value and consumer acceptability. This research was designed to develop avocado incorporated buffalo milk yoghurt with high consumer acceptability. Yoghurt samples were prepared with different percentages of avocado puree as follows: 0% (control), 5%, 10% and 15%. Best level of avocado puree was determined by a sensory evaluation with fifteen semi trained panellists using five point hedonic scale. Titratable acidity (%), pH, syneresis (%), water holding capacity (%) and coliform, yeast and mould counts of the yoghurts were assessed during the storage (5°C, 4 weeks). Results of the sensory evaluation revealed that 10% avocado incorporated yoghurts were significantly ($p < 0.05$) preferred over other groups by the panellists. During storage, pH and titratable acidity of 10% avocado yoghurts were varied from 4.38 ± 0.02 to 3.72 ± 0.03 and $0.93 \pm 0.15\%$ to $1.80 \pm 0.10\%$, respectively. No coliform counts were observed in any of the yoghurt samples. Yeast and mould counts were higher in 10% avocado incorporated yoghurts than the control. The appearance of yoghurt from control was not promising after three weeks of storage. Incorporation of 10% avocado puree into yoghurt is possible and the product can be stored for two weeks in refrigerated condition while buffalo milk yoghurt without avocado can be stored for three weeks without major quality deterioration.

Key words: Avocado, Buffalo milk, Fruit yoghurt

Introduction

Yoghurt is a fermented milk product produced through the transformation of lactose into lactic acid by use of selected microorganisms of *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus*. At present, fruit yoghurts are popular among consumers (Ranadheera *et al.*, 2012). Avocado is a nutritious fruit with a creamy texture and buttery flavor and it is rich in mono-unsaturated fatty acids such as oleic and palmitoleic acids as well as omega-6 poly-unsaturated fatty acid linoleic acid (Makkieh, 2009). Moreover, 100 g of avocado provides 6.7 g of dietary fibers, which is about 18% of the recommended daily intake. Dietary fibers help to lower blood cholesterol levels (Makkieh, 2009). Plant products may also contain prebiotic compounds which facilitate the growth and survival of beneficial microorganisms in dairy products as well as in the gut (Vidanarachchi *et al.*, 2009). Although, milk is obtained mainly from dairy cows, milk from goat, buffalo, sheep, yak, donkey and camel is also used in various parts of the

world. In particular, buffalo milk is consumed largely in South Asia. However, research on development of fruit incorporated yoghurt from buffalo milk is scarce. This research aims to develop a formulation of buffalo milk with avocado puree in yoghurt manufacturing.

Materials and Methods

The experiment was carried out at the Faculty of Agriculture, Rajarata University of Sri Lanka. Buffalo milk, well ripened avocado fruits, stabilizers (pectin and gelatin) and direct vat set yogurt culture (CHR Hansen, Denmark) containing *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus* were used for the manufacturing of yoghurt. Preliminary studies were conducted to find out the best methods and levels of ingredients to develop a satisfactory final product. First preliminary study was conducted to find out the effective way of adding avocado to yoghurt (dried powder form or

puree form). Preliminary study 2 was carried out to control browning reactions of avocado. Different levels of citric acid (0%, 0.5% and 1.0%) were added to the avocado pulp in order to prevent browning reaction. Preliminary study 3 was conducted to find out the best stabilizer combination and their levels for an optimum yoghurt texture. Stabilizer levels of 0.5% and 1.0% were tested with different combinations as follows: 0.5% pectin + 0% gelatin; 0.25% pectin + 0.25% gelatin; 0% pectin + 0.5% gelatin; 1.0% pectin + 0% gelatin; 0.5% pectin + 0.5% gelatin; 0% pectin + 1.0% gelatin.

After finding out the best citric acid level and stabilizer combination, yoghurt samples were prepared with different percentages of avocado puree (T1; 0%, T2; 5%, T3; 10% and T4; 15%) and titratable acidity and pH of yoghurt samples were measured in every 3 days during storage (5 °C, 4 weeks).

A sensory evaluation was carried out to find out the best formulation with the help of 15 semi trained panelists using a five point hedonic scale. Consumer ratings for color, odor, flavor, texture and overall acceptability were measured and the most preferred product was selected for further studies.

Total solids, ash content, fat, protein, syneresis and water holding capacity (%) were measured for the

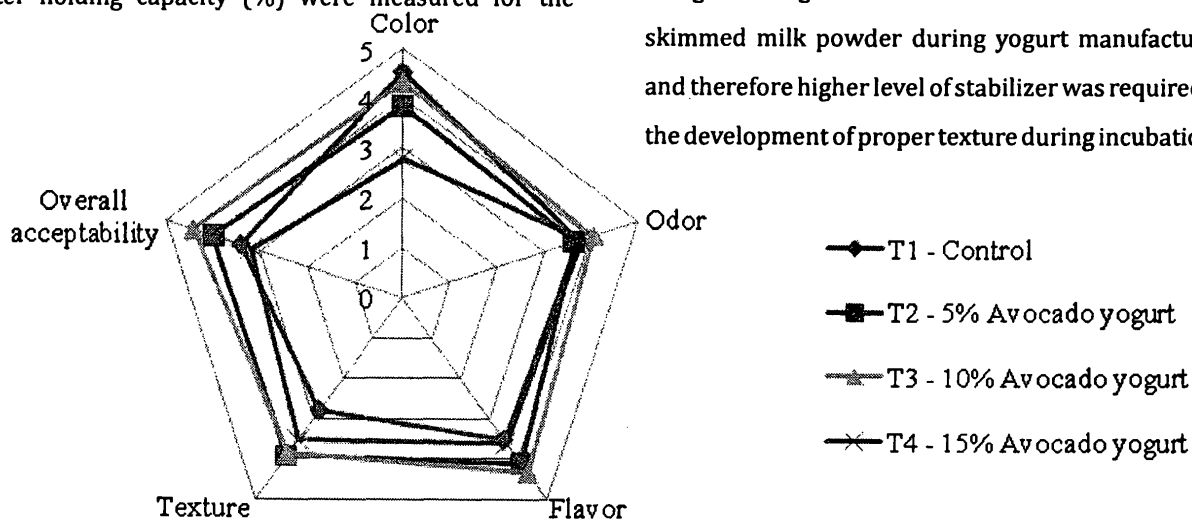


Figure 1: Sensory properties of avocado incorporated yogurts made from buffalo milk

control and the selected product using the standard procedures triplicates (AOAC, 1995). Coliform and yeast and mold counts were measured during refrigerated storage at weekly intervals according to the standard microbiological enumerations described by Sri Lanka Standards (Sri Lanka Standards Institution, 2009). Parametric data were analyzed using ANOVA in SAS and sensory data were analyzed using Friedman non-parametric test in MINITAB software.

Results and Discussion

Preliminary study 1 revealed that the puree form was the most effective way of adding avocado to yogurt. Results of the preliminary study two revealed that the best citric acid level was 1.0% (w/w) to the pulp and it could be stored for three weeks without any color change at 5 °C.

The best total stabilizer percentage was 1.0% and best combination was 50% pectin + 50% gelatin. 100% pectin out of the total stabilizer amount have resulted a poor watery texture while 100% gelatin have resulted a too hard texture. Use of 0.5% total stabilizer level have resulted a poor and watery texture probably because of low total solid content in yogurt. In this study buffalo milk was not properly homogenized using a homogenizer and was not standardized with skimmed milk powder during yogurt manufacturing and therefore higher level of stabilizer was required for the development of proper texture during incubation.

According to the sensory evaluation 10% avocado incorporated yoghurts were preferred by the panelists over others (Figure 1).

The titratable acidity of yogurt samples gradually increased while pH gradually decreased during storage. For example, titratable acidity of 10% avocado yogurts increased from $0.93 \pm 0.15\%$ to $1.80 \pm 0.10\%$ while pH decreased from 4.38 ± 0.02 to 3.72 ± 0.03 during storage. Ranadheera *et al.* (2012) have also observed a similar trend for acidity development in plain and stirred fruit yogurts during storage. Usually post acidification causes this acidity development in fermented dairy products during refrigerated storage. Fat content of 10% avocado yogurt ($4.08 \pm 0.14\%$) was significantly ($p < 0.05$) higher compared to the control ($2.91 \pm 0.14\%$). Avocado is a fat rich fruit and incorporation of avocado to yogurt may have increased the fat content in yogurts. Protein contents of 10% avocado yogurt and control samples were $4.11 \pm 0.05\%$ and 3.78 ± 0.04 , respectively. Generally, both samples possessed higher protein level compared to cow milk yoghurt, because buffalo milk contains higher percentage of proteins compared to cow milk. The total solids and ash contents were $22.29 \pm 0.13\%$ and $0.82 \pm 0.05\%$, respectively in control and $24.76 \pm 0.41\%$ and $0.92 \pm 0.04\%$, respectively in 10% avocado yogurts. Syneresis of yoghurt samples increased from $37.56 \pm 1.93\%$ to $50.07 \pm 1.93\%$ (in control) and $21.24 \pm 1.71\%$ to $32.17 \pm 2.66\%$ (in 10% avocado yogurts). The low values of syneresis in 10% avocado yogurt could be due its firm texture as a result of addition of avocado puree. Water holding capacity decreased from $61.65 \pm 0.61\%$ to $46.63 \pm 0.72\%$ in control and $44.17 \pm 1.64\%$ to $38.33 \pm 4.01\%$ in 10% avocado yogurts during storage.

During the storage period, coliforms were not detected in both samples. Higher levels of yeast and mould counts were observed in 10% avocado yoghurt samples (3×10^3 CFU/g at 4th week) compared to the control (7.9×10^2

CFU/g at 4th week). According to the Sri Lanka Standards Institution (2009), yeast and mould counts were within the acceptable limits (1×10^3 CFU/g) for two weeks in 10% avocado yoghurt samples, while four weeks in control. Yeast and mould counts increased rapidly in 10% avocado yoghurts after two weeks and this could be due to higher growth of yeast and moulds in avocado compared to milk. Usually fruit yogurt contains more yeast and moulds than plain yoghurt (Ranadheera *et al.*, 2012).

Therefore, incorporation of avocado puree with buffalo milk yogurt is possible and based on the sensory evaluation, microbial and physico-chemical data, 10% avocado yoghurt was selected as the best product. The best product can be stored for two weeks in refrigerated condition and yoghurt from control can be stored for three weeks without major quality deterioration.

References

- AOAC, 1995. Official method of analysis, 16th edition. Arlington, Association of Official Analytical Chemists, Washington.
- Makkieh, K. 2009. The Advantages of Avocado, *Healthy Eating*, [online][Accessed on 20.05.2013], available at, <http://healthyeating.sfgate.com/advantages-avocado-2524.html>.
- Ranadheera R.D.C.S., Evans C.A., Adams M.C. and Baines S.K. 2012. Probiotic viability and physico-chemical and sensory properties of plain and stirred fruit yogurts made from goat's milk. *Food Chemistry*, 135: 1411-1418.

Sri Lanka Standards Institution 2009 Specification for
fermented milk products – yoghurt. 824: part 2.

Vidanarachchi, J.K. Iji P.A. Mikkelsen L.L. Sims I. and
Choct M. 2009. Isolation and
characterisation of water-soluble prebiotic
compounds from Australian and New
Zealand Plants. *Carbohydrate Polymers*, 77:
670-676.

o