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Proximate Composition, Antioxidant Activity and Sensory Properties of Fortified Avocado Pulp Yogurt

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Abstract: The aim of this research is to study the effect of addition of avocado pulp in yoghurt. The obtained 4 variants coded C (0%), I (5%), II (7.5%) and III (15%) of avocado incorporated yoghurt were manufactured in laboratory. Chemical composition, pH, titrable acidity, syneresis, phenolic estimation, total antioxidant activity and sensory characteristics of yogurt fortified with avocado (*Persea Americana* Mill) pulp were determined in the present study. The yogurt samples with the highest avocado pulp content had approximately 2.5-fold higher total phenolic content determined by the Folin-Ciocalteu method and 3-fold higher antioxidant capacity evaluated as DPPH• and ferric reducing antioxidant power compared to that of the control. Avocado pulp incorporation had significantly increased the ash (0.31- 0.48%), fat (2.49- 4.13%), total solids (12.49- 19.53%), solid no fat content (9.89- 15.33%) ($p < 0.05$) and decreased the values of serum separation. The pH and acidity (%) of control sample C were found to be 4.54; 1.12%, while for the fortified yogurt samples the values varied between 4.60 to 4.67, and 0.70 to 0.95%, respectively. After sensory evaluation, yogurt with 15% avocado pulp added scored highest for overall acceptability, but there was no significant difference for color and texture among 3 treatments (p values > 0.05). It was found that consuming fortified yogurt with avocado pulp could contribute to improving the nutritional value, antioxidant capacity of this assortment of dairy product and may enhance polyphenols with the potential to exert synergistic effects on human health.

• Introduction

Yoghurt is a fermented product obtained through an anaerobic fermentation of lactose in milk by relevant microorganisms most of which are classified as pro-biotic [1]. Yoghurt is a cultured dairy product produced by fermenting milk, with or without added non-fat dry milk (NFD) with *Lactobacillus bulgaricus* and *Streptococcus thermophilus* bacteria [2]. Fruit additions have an increasing effect on yoghurt consumption (Erdogan K. and Zekai T, 2003). Among different types of fruits avocado is a common food in tropics (Bates P, 1968). Avocado is a medium energy dense (1.7 kcal/g) fruit because it contains about 80% water and dietary fiber. Unlike other fruits, avocados are low in sugar and contain 15% monounsaturated fatty acids rich oil, which helps to increase the bioavailability of carotenoids [3]. Avocado is rich in bioactive compounds as vitamin E and one to two times of protein than other fruits [4, 5]. When it comes to quenching a consumer's thirsty for healthy yoghurt drinks, natural products are more concerned [6,7]. Thus, keeping a view in importance of adding natural avocado pulp in yoghurt drinks this study was planned to determine the best avocado incorporation rate in yoghurt and the optimizing the organoleptic and chemical characteristics of product.

• Material and method

• Collection of Raw Materials

Avocado was collected from local market. The standardized (3% fat and 8% SNF) and pasteurized milk produced by University farm, skimmed milk powder (S. M. P), sugar, starter culture pack containing *L. bulgaricus* and *S. thermophilus* in correct proportion (1:1) and plastic cups were bought from market.

• Preparation of Avocado Pulp Incorporated Yoghurt

Yoghurt preparation was done as that of [6] but with slight modifications (Figure 1). Sugar and S. M. P were kept constant to all formulations at the rate of 5% and 2.2% respectively to the amount of milk used (Table 1).

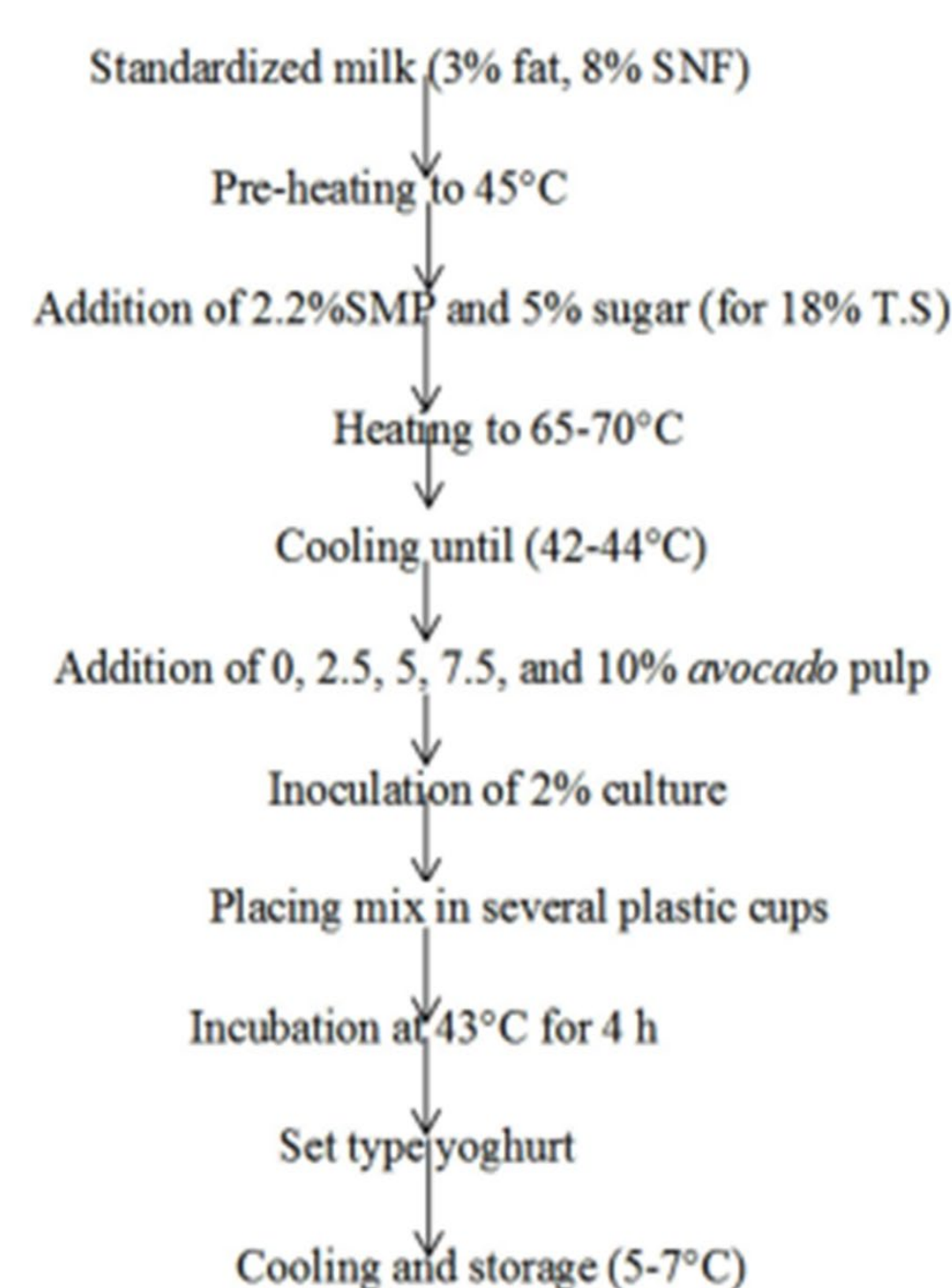


Figure 1. Preparation process of avocado pulp incorporated yoghurt.

Table 1. Mixing ratio of the samples

Sample	Milk (%)	Avocado pulp (%)
C	100	0
I	95	5
II	92.5	7.5
III	85	15

Proximate and Chemical Analysis

Moisture content, crude fat, crude protein, total ash, pH, total solid (T. S) and reducing sugar were determined as per described by [8] while carbohydrate content was estimated by difference method as given by [9]. Total polyphenols content was determined as per described by [10]. Degree of syneresis was determined as mentioned by [11].

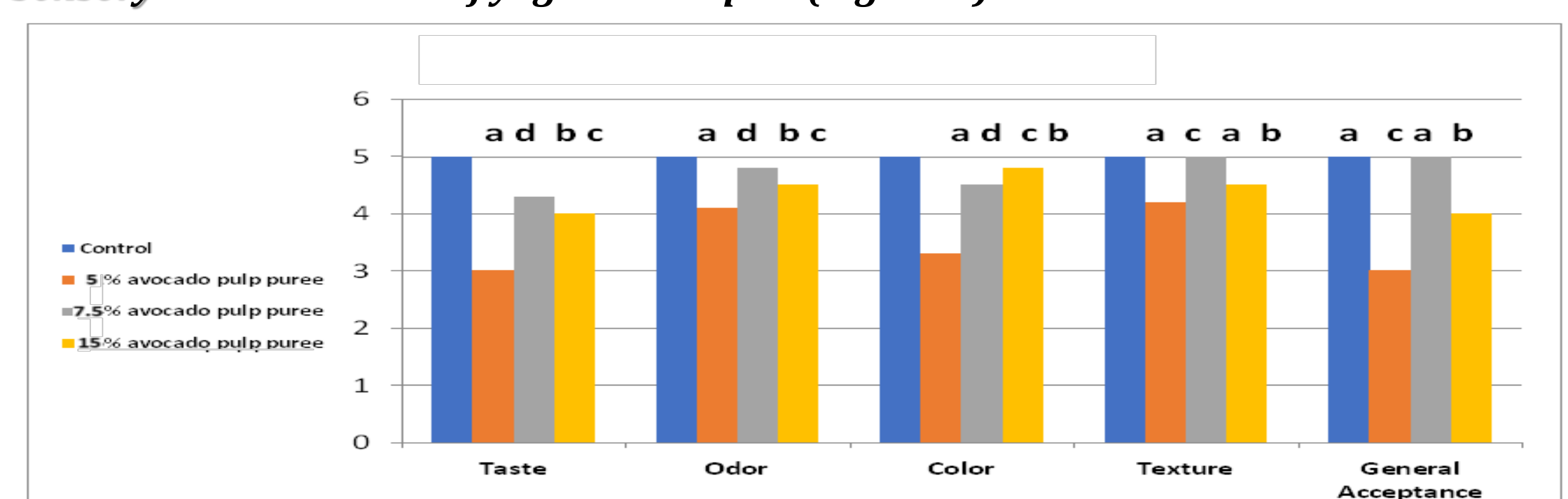
• Results and discussions

Proximate and Nutritional Composition of Yogurt samples

Table 2. Physicochemical analysis of yoghurt

Parameters	Control sample (C)	Best sample (III)
Ph	4.2 ± 0.2	4.0 ± 0.1
Protein (%)	3.56 ± 0.02	3.49 ± 0.07
Moisture content (%)	83.12 ± 1.3	82.08 ± 1.5
Acidity (%)	1.125 ± 0.01	1.16 ± 0.02
Fat (%)	2.89 ± 0.42	3.68 ± 0.40
Crude fiber (%)	0 ± 0.0	0.11 ± 0.07
Total ash content (%)	0.71 ± 0.14	0.78 ± 0.12
Total solids (%)	16.88 ± 1.31	17.92 ± 1.5
Lactose (%)	4.01 ± 1.1	3.91 ± 1.2
Total carbohydrate (%)	9.72 ± 1.88	9.86 ± 2.17

Sensory characteristics of yoghurt samples (Figure 2)



Total phenolic content and antioxidant activity of yoghurt during refrigeration

Table 3. Total phenolic content and antioxidant activity of yoghurt during refrigeration

Storage period at 4°C/day	Concentration of avocado pulp (%)	Antioxidant activity (%)	Total phenolic (mg.100g ⁻¹ FW)
	0 (control)	10.31 ^f ± 0.15	0.44 ^g ± 0.22
	5	12.85 ^d ± 0.26	1.01 ^e ± 0.36
	7.5	14.98 ^b ± 0.11	1.95 ^b ± 0.14
	15	16.50 ^a ± 0.35	2.22 ^a ± 0.26
7	0 (control)	8.30 ^e ± 0.13	0.30 ^h ± 0.34
	5	11.43 ^e ± 0.06	0.88 ^f ± 0.13
	7.5	12.90 ^d ± 0.41	1.42 ^d ± 0.11
	15	13.88 ^c ± 0.22	1.70 ^c ± 0.32

• Conclusions

Avocado has got medicinal, nutritional and economic benefits. This economic and social importance of avocado aids in the benefit that its cultivation gives to producers, marketers, processors, and consumers. Avocado is considered a highly desirable addition to a healthy diet. The prepared yoghurt sample containing 5% avocado pulp and 95% milk by volume was found to be superior in consumer acceptance compared to other samples. It was found that the nutritional quality of prepared yogurt was increased by addition of avocado pulp. Therefore, this study aided to improve the nutritional value of yoghurt to some extent. Storage of fortified samples with avocado for seven days led to a significant increase in antioxidant activity, and total phenol content compared to the control.