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Preparation and Quality Evaluation of *Avocado (Persea Americana)* Pulp Incorporated Yoghurt

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Abstract: This study was aimed to prepare *avocado (Persea Americana)* pulp incorporated yoghurt and determine the nutritional compositions and sensorial properties. The standardized and pasteurized milk from DDC (Dairy Development Corporation) was taken for the preparation of yoghurt. Sensory evaluation of prepared five sample of products was carried out. The sensory evaluation revealed that the product containing 5% *avocado* pulp and 95% milk by volume was found to be best as per the score given by panelist. The *avocado* pulp was found to be rich in crude fat, crude fiber, calcium and crude protein content i.e., 20.98±0.04%, 2.54±0.4%, 11.05±0.04 mg/100g and 1.82±0.02% respectively. The moisture content (%), total solid (%), fat (%), acidity (%), crude protein (%), crude fiber (%), total ash content (%), lactose (%), pH and, total carbohydrate (%) of control sample A was found to 83.12±1.3, 16.88±1.31, 2.89±0.42, 1.125±0.01, 3.56±0.02, 0±0, 0.71±0.14, 4.01±1.1, 4.2±0.2, and 9.72±1.88 respectively. While, the moisture content (%), total solid (%), fat (%), acidity (%), crude protein (%), crude fiber (%), total ash content (%), lactose (%), pH and total carbohydrate (%) of best sample C was found to 82.08±1.5, 17.92±1.25, 3.68±0.40, 1.16±0.02, 3.49±0.07, 0.11±0.07, 0.78±0.12, 3.91±1.2, 4±0.1 and 9.86±2.17 respectively. Shelf-life of control and best sample was studied under refrigeration condition with respect to acidity, syneresis, TPC and total yeast and mold count for 7 days. Increase in ash content, fat and fiber was seen in the best sample C than in control sample A due to the addition of *avocado* pulp.

Keywords: Yoghurt, *Avocado* Pulp, Fruit Flavored Yoghurt, Nutritional Composition, Sensorial Properties, Microbial Quality

1. 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 [29]. Yoghurt is one of the oldest known cultured milk products, with its origin in the Middle East. It would have been made by Nomadic tribesmen, initially from the milk of goats and sheep [24]. Yoghurt is a cultured dairy product produced by fermenting milk, with or without added non-fat dry milk (NFDM) with *Lactobacillus bulgaricus* and *Streptococcus thermophilus* bacteria. It usually contains 12-14% total milk solids and has soft, friable custard like consistency, and a clear and distinct acid flavor. Yoghurt is usually produced by heating the mix to 80-85°C for 30 min to pasteurize it and to modify the milk proteins so that they will provide the proper viscosity and gelation with a minimum of syneresis in the product [20]. Although yoghurt has many desirable properties, it is still prone to deterioration, especially at ambient temperature, within a matter of days and one trend in Middle East has been the search for simple techniques to extend keeping quality even further. The first step was the preparation of condensed or concentrated yoghurt by hanging the yoghurt in animal skins. The product

had a total solid in the range of 25% and acidity of greater than 2% as lactic acid. Nevertheless, even condensed yoghurt becomes unpalatable within a week or two, and salted yoghurt was prepared which became rapidly popular. An alternative preservation process involved the heating of yoghurt for a few hours over low fires of special type of wood, the end product is referred to as "smoked yoghurt" which was preserved over the winter months. However, as refrigeration become widespread, so interest in these traditional products declined and production of new generation of yoghurt emerged. Initially, production was confined to natural yoghurt, but gradually production of fruit yoghurt gave the product an entirely fresh image [28]. Yoghurt is particularly susceptible to attack by yeasts and molds, great care is needed to ensure that the starter is free from these organisms and they do not gain access during packaging [27].

The name "*avocado*" also refers to the fruit of the tree, which is characterized by an oval or pear-shape, with a rough or leathery skin, and a large seed, it is sometimes known as the *avocado* pear or alligator pear. It is a highly caloric fruit rich in vitamins, minerals, folates, potassium, and fiber, with a unique lipid composition [26]. *Avocado* has the highest level of β-sitosterol, which has been shown in clinical trials to reduce blood levels of low-density cholesterol by blocking cholesterol absorption in the intestine [15]. Fresh *avocado* is rich in moisture and fat is the second important constituent of the fruit so, *avocado* pulp is sensitive to oxidative process during postharvest storage resulting in rancidity and subsequent production of undesirable flavors and reduction in quality [25].

2. Materials and Methods

2.1. Collection of Raw Materials

Avocado was collected from local market of Dhankuta (26.9835°N, 87.3215°E). The standardized (3% fat and 8% SNF) and pasteurized milk produced by Dairy Development Corporation (DDC), 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 of Itahari (26.6646°N, 87.2718°E).

2.2. 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).

2.3. Proximate and Chemical Analysis

Table 1. *Mixing ratio of the samples.*

Sample	Milk (%)	*Avocado* pulp (%)
A	100	0
B	97.5	2.5
C	95	5
D	92.5	7.5
E	90	10

* 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.

Moisture content, crude fat, crude protein, total ash, crude fiber, calcium content, ph, total solid (T. S) and reducing sugar were determined as per described by [23] while carbohydrate content was estimated by difference method as given by [22]. Energy value was expressed as Kcal/100g and was calculated by multiplying the values of crude protein, lipids and carbohydrates by recommended factors (4, 9 and 4 respectively) [31]. Vitamin C was determined as per described by [16]. Degree of syneresis was determined as mentioned by [17].

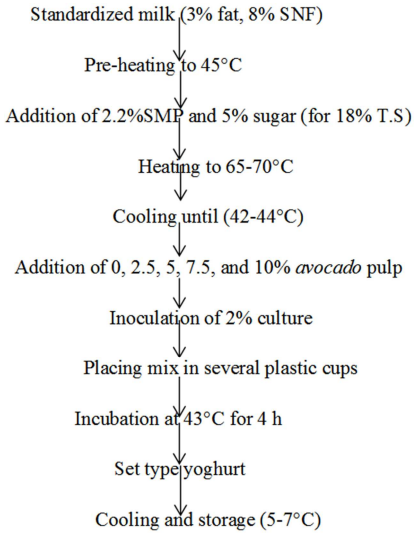

Figure 1. *Preparation process of avocado pulp incorporated yoghurt.*

2.4. Chemical Analysis of Milk

Acidity, fat and protein of milk was determined as [16]. While, lactose, ash content and TSS was determined as described by [23].

2.5. Microbiological Analysis

Yeasts and Molds count was determined by pour plate technique in PDA medium as per [4]. Total Plate Count (TPC) was determined by pour plate technique in Plate Count Agar medium as per [5].

2.6. Sensory Evaluation

Nine panelists were presented with the samples of *yoghurt* to analyze color, texture, flavor, body and overall acceptability by using 9-point hedonic rating test (9-like extremely, 8- like very much, 7- like moderately, 6- like slightly, 5- neither like nor dislike, 4- dislike slightly, 3- dislike moderately, 2- dislike very much, and 1- dislike extremely) [23].

2.7. Statistical Analysis

The data of experimental analysis were performed in triplicate and was analyzed by one- way analysis of variance

(ANOVA) by using software GenStat Release 12.1 (Copyright 2009, VSN International Ltd.). MS-Excel 2019 was used for charts and curves. Tukey's HSD post hoc test ($P<0.05$) was used for separating means.

3 Results and Discussion

3.1. Nutritional Composition of Milk

Proximate composition of milk used is presented in Table 3. The composition of result obtained has little variation over the composition of milk analyzed by [8]. This variation in composition of milk may be due to the species, nutritional aspect of animal, stage of lactation and feeding of animals. The variation may also be due to different processing standard and specification of dairies.

3.2. Nutritional and Chemical Composition of Avocado Pulp

Proximate and nutritional composition of *avocado* pulp is presented in Table 3. The moisture content was found to be 73.02% which was almost similar to [10] but slightly greater than that of [30, 21] and significantly lower than [19]. The protein content was found to be 1.82%, slightly greater than [21, 19, 10, 13] but lower than that of [30]. The fat content was found to be 20.98%, greater than that of [30, 21] and lower than that of [13, 10]. The crude fiber content was found to be greater than [13], but lower than [21]. The calcium content was found to be lower than that of [30]. Vitamin C content was found to be significantly lower than that of [30] and [13]. Ash content was found to be 1.05%, greater than that of [21, 19] but lower than that of [30].

Table 2. *Chemical composition of milk.*

Parameters	Results
Total soluble solid (°Bx)	8.4±0.3
Acidity as lactic acid (%)	0.15±0.02
Moisture content (%)	88.67±1.1
pH	6.6±0
Lactose (%)	4.32±0.35
Protein (%)	3.3±0.06
Fat (%)	3.03±0.05
S. N. F (%)	8.3±0.014
Total ash content (%)	0.70±0.05

Values are means of triplicate±standard deviations.

Table 3. *Physicochemical analysis of avocado pulp.*

Parameters	Values
Total ash content (%)	1.05±0.057
Crude fat (%)	20.98±0.04
Moisture content (%)	73.02±0.2
Crude fiber (%)	2.54±0.4
Crude protein (%)	1.82±0.02
Calcium (mg/100g)	11.05±0.04
Vitamin C (mg/100g)	7.54±1.14
Reducing sugar	0.36±1.05
Total carbohydrate (%)	0.59±0.09
Total energy (Kcal)	198.46±0.8

*Values are means of triplicate±standard deviations.

Table 4. *Physicochemical analysis of yoghurt.*

Parameters	Control sample (A)	Best sample (C)
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
Parameters	Control sample (A)	Best sample (C)

*Values are means of triplicate±standard deviations.

3.3. Sensory Analysis of Yoghurt Samples

The sample products were subjected to sensory analysis (Figure 2). Statistical analysis showed that there was significant effect ($p<0.05$) on the sensory parameters of the samples at 5% level of significance. Among the product samples, after control sample A, sample C got the highest score and was considered best in terms of sensory attributes.

3.4. Nutritional Analysis of Yoghurt Sample

Acidity was found to be 1.125% for control sample A and 1.16% for best sample C. It is greater than the range (0.6-0.9%) reported by [32]. [9] Reported that addition of fruit juice/pulp increases percent acidity. Acidity was found to be 0.71% for control sample A and 0.78% for best sample C. The result was within the range of value (0.8-1.5%) showed by [2]. [18] Reported that addition of fruit juice/pulp increases ash content which may be due to insoluble solids and fiber content which may contribute in increasing the ash content. Carbohydrate content was found to be 9.72% for control sample A and 9.86% for best sample C, which was almost similar to than the result obtained by [1]. Fat content was found to be 2.89% for control sample A and 3.68% for best sample C, which was lower than the result obtained by [6]. Percentage fat is higher than normal dairy yoghurt which is nearly (3-4%), this may be due to higher percent of fat content in *avocado* pulp.

Moisture content in the yoghurt was found to be 83.12% for control sample A and 82.08% for best sample C which was almost similar to the yogurts prepared from camel milk by [12]. PH was found to be 4.2 for control sample A and 4.0 for best sample C, which showed similarity with the result of [3]. Protein content was found to be 3.56% for control sample A and 3.49% for best sample C, which was almost similar to the result obtained by [1]. Total solid was found to be 16.88% for control sample A and 17.92% for best sample C, which was almost similar to that obtained by [6]. Lactose content was found to be 4.01% for control sample A and 3.91% for best sample C, which was almost similar to that obtained by [18] during the preparation of yoghurt blended with apple and banana.

3.5. Shelf-life Evaluation of Yoghurt Samples

Acidity, syneresis, TPC and total yeast and mold count of control sample A and best sample C was analyzed in laboratory for 7 days (Figures 3, 4 and 5). The rate of increase in acidity for control sample A and best sample C was found to be 0.03% and 0.035% per day respectively. Yoghurt sample was suitable for consumption for 7 days. The rate of increase in syneresis for control sample A and best sample C was found to be 8.53% and 6.96% per day respectively.

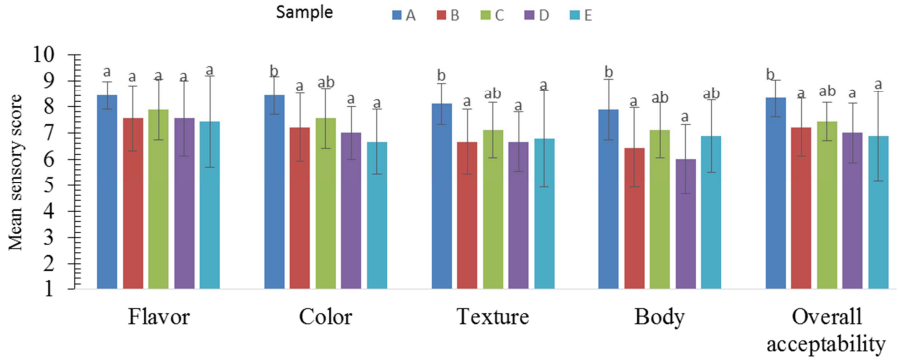

Figure 2. *Sensory analysis of the different samples of avocado pulp incorporated yoghurt. Error bars show standard deviation and error bars bearing different superscript differs (P<0.05).*

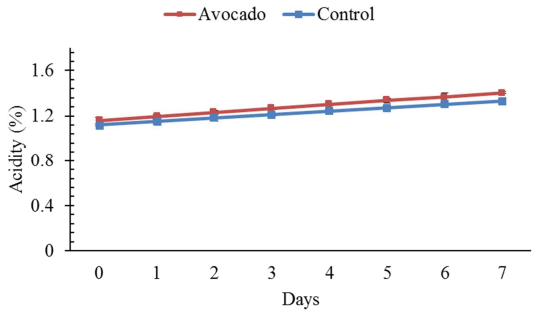

Figure 3. *Change in acidity under refrigeration with respect to the number of days.*

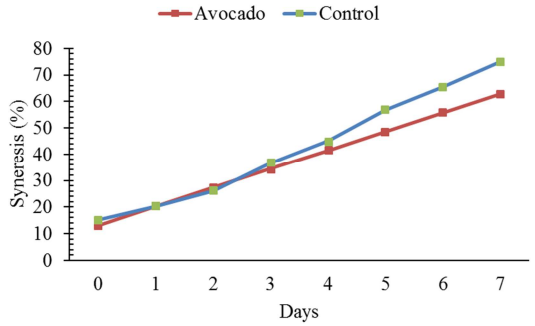

Figure 4. *Change in syneresis under refrigeration with respect to the number of days.*

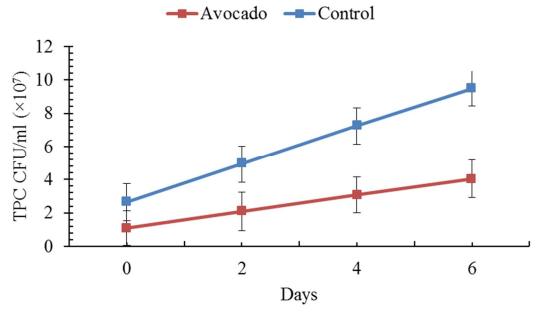

Figure 5. *Change in total plate count under refrigeration with respect to the number of days.*

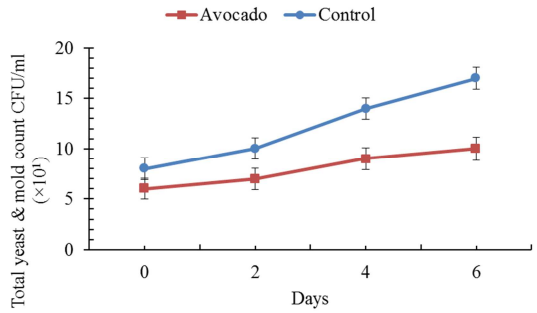

Figure 6. *Change in total yeast and mold count under refrigeration with respect to the number of days.*

The rate of increase of total plate count of control sample A and best sample C was found to be 0.65×10^7 CFU/ml per day and 0.49×10^7 CFU/ml per day respectively. The increase in TPC of yoghurt is due to the production of lactic acid even at low temperature. This result obtained was greater than [2] and [14]. It is generally accepted that the yoghurt should contain 10^7 CFU of viable bacteria per ml of yoghurt [7].

The rate of increase of total yeast and mold count of control sample A and best sample C was found to be 0.83×10^1 CFU/ml per day and 0.66×10^1 CFU/ml per day respectively. The yeasts and molds count could be due to the result of contamination from air incorporation during preparation of different formulations of yoghurt. In addition, contamination may be occurred in yoghurt samples from different fruit homogenates and during filling of the products in plastic cups as recorded by [11].

3.6. Cost Evaluation

The price for 100 ml of *avocado* pulp incorporated yoghurt was found to be Rs. 11.21 with the inclusion of 20% overhead cost, packaging cost was not included.

4. Conclusion

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.

Authors' Contribution

Author Anish Dangal managed the formal laboratory analysis, performed the statistical analysis, managed the references and wrote the first draft of manuscript. Author Parbat Katwal designed the study, performed the survey, managed the formal laboratory analysis and managed the references. Author Sabin Bahadur Khatri designed the study and project administrator. Author Sangam Dahal managed the references, data curation and validation.

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Afodunrinbi, A. T. and Onyeukwu, G. C. (2000). Yoghurt from coconut and tigernuts. *Afr. J. Food Technology.* 5, 132-134.

[2] Ahmed, F. (2011). Study on the quality and storage stability of laboratory made and local market yogurt. Master of Science in Food Engineering. Thesis. Department of Food Technology and Rural Industries, Bangladesh Agricultural Univ, Mymensingh., Bangladesh.

[3] Akpan, U. G., Mohammed, A. D. and Aminu, I. (2007). Effect of preservative on the shelf Life of yoghurt produced from soya beans milk. *Leornardo Elect. J. Pract. Technol.* 11, 131-142.

[4] BIS. (1999). "Method for Yeast and Mould Count of Foodstuffs and animal feeds". New Delhi. Bureau of Indian Standard.

[5] BIS. (2012). "Microbiology of food and animal feeding stuffs — horizontal method for the enumeration of micro-organisms — colony-count technique at 30°C". New Delhi. Bureau of Indian Standard.

[6] Biswas, A. R. (2013). Yoghurt from cow milk and coconut milk- a kinetic approach. Master of Science In Food Engineering. Thesis. Department of Food Technology and Rural Industries Bangladesh Agricultural Univ., Bangladesh.

[7] Chougrani F., Cheriguene A. and Bensoltane A. Sensorial and Physico- Chemical Characteristics of Yoghurt Manufactured with Ewe's and Skim Milk, *World Journal of Dairy & Food Sciences*4 (2), pp. 136-140, (2009).

[8] Dahal, S. (2009). Preparation of probiotic yoghurt using probiotic DVS culture and quality evaluation. B. Tech.(Food) Dissertation. Tribhuvan Univ, Central Campus of Technology., Nepal.

[9] Desai, S. R., Toro, V. A. and Joshi, S. V. (1994). Utilization of different fruits in the manufacture of yogurt. *Ind. J. Dairy Sci*. 47 (10), 870-874.

[10] DFTQC. (2017). "Nepalese Food Composition Table 2017". Department of Food Technology and Quality Control (Ministry of Agriculture Development, Nepal Government.), Nepal. p. 23. Retrieved from www.dftqc.gov.np.

[11] El-Batawy, Azza, M. and Farahat, O. I. Proteolytic Activity and Some Properties of Stirred Fruit Yoghurt Made Using Some Fruits Containing Proteolytic Enzymes, *World Journal of Dairy & Food Sciences* 8 (1), pp. 38-44, (2013).

[12] Eshraga, A., Elgasim, A., Efadil, E. and Isam, A. (2011). Physicochemical, microbiological and sensory characteristics of yoghurt produced from camel milk during storage. *Elec. J. Envi. Agri. Food. chemi*. 10 (6), 2305-2313.

[13] Ghosh, S. P. (2000). Avocado production in India. 24-30.

[14] Goodluck, T. M., Bobai, M. and De, N. (2014). Microbiological quality assessment of bottled yogurt of different brands sold in Central Market, Kaduna Metropolis, Kaduna, Nigeria. *Int. J. Curr. Microbiol. App. Sci*. 3 (2), 20-27.

[15] Heinemann, T., Axtmann, G. and Bergmann, K. v. (1993). Comparison of intestinal absorption of cholesterol with different plant sterols in man. *European J. clinical investigation*. 23 (12), 827-831.

[16] KC, J. B. and Rai, B. K. (2007). "Basic Food Analysis Handbook." (1st ed.). Prompt Printers Pvt. Ltd. Anamnagar, Kathmandu, Nepal.

[17] Lee, W. J. and Lucey, J. A. (2004). Structure and physical properties of yoghurt gels. *J. Dairy Sci.* 87, 3153.

[18] Mahmood, A. and Gilani, A. H. (2008). Quality of stirred buffalo milk yoghurt blended with apple and banana. *The Pakistan J. Agri. Sci.* 45, 13.

[19] Mooz, E. D., Gaiano, N. M., Shimano, M. Y. H., Amancio, R. D. and Spoto, M. H. F. (2012). Physical and chemical characterization of the pulp of different varieties of *avocado* targeting oil extraction potential. 32, 274-280.

[20] Morr, C. V. (1985). Functionality of heated milk proteins in dairy and related foods. *J. Dairy Sci*. 18, 273.

[21] Owusu, A. A. (2012). Formulation and shelf life evaluation of *avocado* (*Persea americana)* fruit spread.

[22] Pearson, D. (1981). "The Chemical Analysis of Foods.". Churchill Livingstone. London, UK.

[23] Ranganna, S. (2007). Handbook of analysis and quality control for fruit and vegetable products. 2nd ed. Tata McGraw Hill Pub. Co. Ltd., New Delhi.

[24] Schmidt, P. H. (1992). Cultured milk products. *In:* "The Technology of Dairy Products". (R. Early, Ed.). pp. 66-70 80-81. New York. VCH Publisher Inc.

[25] Shrestha, A. (2019). Assessment of Oxidative Rancidity of *Avocado* Oil Produced by Screw Pressing and Solvent Extraction Methods. B. Tech Dissertation. Tribhuvan Univ., Nepal.

[26] Slater, G. G., Shankman, S., Shepherd, J. S. and Alfin-Slater, R. B. (1975). Seasonal variation in the composition of California avocados. *J. Agric. Food chem.* 23 (3), 468-474.

[27] Tamime, A. Y. and Deeth, H. C. (1980). Yogurt: technology and biochemistry. *J. Food Prot*. 43, 939-977.

[28] Tamime, A. Y. and Robinson, R. K. (1985). "Yoghurt Science and Technology" (2nd ed.). Pergamon Press. New York.

[29] Tull, A. (1996). "Food and Nutrition". Oxford University Press UK.

[30] USDA (U.S. Department of Agriculture). (2011). Avocado, almond, pistachio and walnut Composition. Nutrient Data Laboratory. USDA National Nutrient Database for Standard Reference, Release 24. U.S. Department of Agriculture. Washington, DC.

[31] Valdez-Solana, M. A., Mejía-García, V. Y., Téllez-Valencia, A., García-Arenas, G., Salas-Pacheco, J., Alba-Romero, J. J., & Sierra-Campos, E. (2015). *Nutritional Content and Elemental and Phytochemical Analyses of Moringa oleifera Grown in Mexico*. https://doi.org/10.1155/2015/860381.

[32] Yulina, N. (2010). Manufacture of fermented coco-milk drink containing lactic acid bacteria culture. *Afr. J. Food Sci.* 4 (9), 558-562.