Effect of Adding Green Mint on the Physiochemical Properties and Sensory Evaluation of Yogurt

A Research Project

Submitted to the Department of Food Technology in Partial Fulfillment of the Requirements for the Degree of BSc. in Food Technology

By

Muhammed Omar Qatto

Supervised by

Mrs. Chnar Sulayman Hadi

Erbil - KURDISTAN

November 2023

Abstract

Yogurts are one of the most consumed dairy products, especially in Western and Middle East countries. This research work was conducted to quantify the components in the yoghurts produced from mint as well as their composite with fresh cow milk yoghurt serving as the control. The yoghurts were hygienically produced under clean environment and evaluated to determine the sensory evaluation in addition to the moisture content, Ash content, pH, titratable acidity and Brix. The results obtained were statistically analyzed and discussed. Fortification of yoghurt with 3g of mint has shown to increase the nutritional benefit of the yoghurt. The obtained results showed that moisture content, pH and brix of the yoghurt increased in direct proportion with fortification by $85.740 \pm 0.76^{a,}$ 4.0 ± 0.00^{c} and 10.0 ± 0.00^{d} respectively. while, ash content and titratable acidity decreased. On the other hand, the result that obtained from sensory evaluation, there was no significance difference ($p<0.05$) between all the yoghurt samples in the appearance, color and smell. However, there was a significance difference ($p<0.05$) between all the yoghurt samples in the flavor, texture and overall acceptability.

Keywords: Cow milk, Mint, Fortification, Physiochemical composition, Sensory evaluation.

1 Introduction

Yoghurt is a viscous fermented milk product with a smooth texture and mildly sour flavour produced by converting lactose to lactic acid during the fermentation process. The word "Yoghurt" comes from the Turkish word "Yogurmak", meaning to thicken, coagulate or curdle (Fisberg and Machado, 2015).

Yoghurt is a dairy food produced by fermentation of milk usually is made via the fermentation process by lactic acid bacteria. The FAO/WHO Codex Alimentarius Commission defined yoghurt as a coagulated milk product obtained by lactic acid fermentation (Ehirim and Onyeneke, 2013). Today, in the production of most yogurt, pasteurized milk is fermented with a starter culture containing lactic acid bacteria such as *Lactobacillus bulgaricus* and *Streptococcus thermophilus* (Roy *et al.*, 2015).

Yogurt is a semi-solid acidified dairy product that was first introduced at the end of the 19th century; the traditional production process (milk fermentation) offered a means to preserve milk before the advent of heat treatment (Chandan and Kilara, 2013).

Nutritionally, yogurt excelled as one of the most consumed healthy and nutritious food around the world, which also offers the potential to deliver nutritious components to the human diet (Ivanov and Dimitrova, 2019). Also, it helps in the reduction of gastrointestinal disorders (irritable and inflammatory bowel diseases) and helps in weight control (Mckinley, 2005). Moreover, yoghurt is known to combat constipation, treatment of diarrhea and dysentery by curbing the growth of the bacteria that causes these ailments, its anti-carcinogenic effect and ability to lower blood cholesterol is also on record (Kamruzzaman *et al.*, 2002).

Nevertheless, the need for fortification arises because foods fortified are enriched with more nutrients regardless of the nutrients embedded in the whole food. Some studies have been carried out on fortification of yoghurt. Examples include the production of yoghurt enriched with Mint Plants (Hutsol *et al*., 2023). The result showed yoghurt enriched with coconut cake has high nutritive value in terms of protein, carbohydrate, ash content and fiber content compared to the plain yoghurt.

The genus mint (Mentha) belongs to the Lamiaceae family and is an aromatic plant includes 42 species, 15 hybrids, and hundreds of subspecies, varieties, and cultivars (Salehi *et al*., 2018). Mint is widely grown in Europe, Asia, Egypt, South Africa and Arabia. Traditionally, Mint leaves are used as a tea in the treatment of headaches, fever, digestive disorders and various minor conditions. In modern medicine, mint is widely used in the treatment of gastrointestinal disorders. Mint is an excellent source of micro and macronutrients such as vitamins, minerals, phenolic compounds, dietary fiber and antioxidants also it is a rich source of Iron (McKay and Blumberg, 2006). This research was aimed, the effect of mint (Mentha) on the nutritional value and sensory evaluation of local cow milk yogurt.

2 Materials and Methods

2.1 Materials

The experiment was conducted in the laboratory of the department of food technology, agricultural engineering science, Salaheddin university. All Fresh milk samples were collected from dairy farm of Grdarasha and divided into four classes which are sample A was control, sample B was fortified with 1g of mint, sample C was fortified with 2g of mint and sample D was fortified with 3g of mint. Extract powdered mint, and starter culture collected from local market. The materials and equipment used for the Laboratory work include: fresh cow milk, powder mint, plastic bowls, stirrer, thermometer, pH meter, analytical weighing balance, refractometer, starter culture, sensory evaluation cups, table, masking tape, oven, petri dish, desiccator, tong, crucible, spatula, conical flask and muffle furnace.

2.2 Methods

The dried mint was purchased from local market and blended using the master chef blender then added to fresh milk samples. The milk samples were strained (sieved) through muslin cloth and pasteurized (i.e heated to 85 °C for 15 minutes) to kill any undesirable bacteria. The pasteurized mint milk was then cooled to 45 °C and dispensed into an air-tight plastic container. After that (5g) old starter culture was added. It was then incubated and allowed to stand for 4 hours for fermentation and refrigerated to 4 °C (Hayaty *et al*., 2014; Ezeonu *et al*., 2016).

2.3 Determination of Moisture Content

The percentage of moisture content was determined by oven method as described by (Igbabul *et al*., 2014). Briefly, 2g of yoghurt samples was dried in the oven for 24 hours at 100℃. The percentage moisture content was calculated by the following formula.

$$\% \text{ Moisture} = \frac{W1-W2}{W1} * 100$$

Where:

W_1= Initial weight of sample; W_2= Weight of the dried sample.

2.4 Determination of Ash Content

The dry ashing method of (AOAC, 2005) was used. A clean crucible was dried in an oven and transferred into a desiccator to cool. The crucible was weighed and recorded as W_1. Using a spatula, 5g yoghurt sample was weighed into the crucible, it was weighed and recorded as W_2. The pre-ashed sample was transferred into a muffle furnace (Vecster ECF3, UK) set at 550 °C for complete ashing of the sample. Ashing was complete when the colour of the sample changes to whitish-ash. The crucible containing the ashed sample was removed and kept in a desiccator to cool after which it was weighed and recorded as W_3. The ash content of the analyzed sample was calculated by using the formula:

$$\% \text{ Ash Content} = \frac{W3-W1}{W2-W1} * 100$$

Where:

W_1 = weight of empty crucible, W_2 = weight of crucible+ weight of sample before ashing, W_3 = weight of crucible+ weight of sample after ashing

2.5 Determination of pH value

This was measured using a Seven Easy Mettler Toledo pH meter that had been calibrated with a buffer solution at pH 7.0 and 4.0 (Mettler Toledo, Switzerland) (AOAC, 2005).

2.6 Determination of Titratable Acidity (Ta)

The Ta values of each yoghurt sample was determined after mixing each yoghurt sample with 10ml hot distilled water (90 °C) and titrating with 0.1N NaOH containing 0.5% phenolphthalein as an indicator to an end point of faint color (AOAC (2005). The % lactic acid produced as a result of fermentation in the sample was calculated thus:

Titre value × 0.09 × 100% Titre value = Volume of sample solution used Where; 0.09 is a conversion factor.

2.7 °Brix Determination

The Brix value (sugar content) of the mint flavored yogurt was determined by using a refractometer. The sample plate was cleaned and dried. A few drops of the sample were placed on the plate, which was then closed. The refractometer was held up to a natural light source and the reading was recorded (Ademosun *et al*., 2019).

2.8 Sensory Evaluation

The sensory properties of samples were evaluated by a trained panel consisting of 10 assessors (including students in Food Technology Departments). Different kinds of yoghurt samples were served at 7 to 10 °C in plastic cups and coded with three-digit numbers. A test form (questionnaire) comprising five sensory attributes, namely, color, taste, flavor, texture and overall acceptability, was given to each of the assessor. A standard 9-point scale was used for the evaluation of sensory characteristics of the samples (Hayaty *et al*., 2014).

2.9 Statistical analysis

Statistical analysis was done in triplicates and the results were expressed as means of three values. One-way analysis of variance (ANOVA) was used to compare means at the significant level $p<0.05$. All analysis was performed by IBM SPSS (22 Version).

3 Results and Discussion

3.1 Physiochemical Properties of the Mint Yoghurt Sample

All mint-flavored yoghurt samples were labelled as A, B, C and D. All four samples were analyzed for their proximate compositions such as moisture, ash, total acidity, pH and brix. The results are summarized in Tables 1 and 2.

The result of the proximate compositions of the all-mint flavored yoghurt samples are displayed in Table 1. The moisture content of samples A, B, C and D were found to be 83.366, 76.400, 81.492 and 85.740 respectively. This result showed that sample D has highest moisture content while B sample has lowest moisture content. However, our results are in good agreement with previously reported values of 78.62 to 82.41% (Igbabul *et al*., 2014).

The ash content was low in all the samples, with C sample having the highest value of 1.18%, which may be due to dietary intake and metabolic activity of the cow. The lowest ash content was recorded in sample A of 0.98%, this was found to be significantly different ($p<0.05$) in ash content between C and A samples. According to (Ezeonu *et al*., 2016) yoghurt should contain ash content of 0.60 – 0.81 %.

The lowest mean value of titratable acidity of mint yogurt samples was found in sample D of 1.33%, as the highest value was found in sample C of 1.53%. Some authors reported approximately similar results (Ademosun *et al*., 2019). This might be due to the acid production in the yogurt samples during storage as a result of the fermentation of lactose by the action of starter cultures (Bakirci and Kavaz, 2008).

°Brix is the measurement of the soluble solid in a food product. The sugar content in yogurt is measured in °Brix. The sample D had significantly higher Brix values than the all-mint yogurt samples. Whereas, the sample B recorded lower Brix value. The results are in agreement with literature that was done on the five samples of yogurt and ranged from 7.0 to 10.80 (Othman *et al*., 2019). During fermentation, the sugar content is reduced (Hoang *et al*., 2016).

Table 1: Physicochemical properties of mint yogurt samples

Samples	Parameters				
	% Moisture	% Ash	% Total Acidity	pH	ºBrix
A	83.366 ± 3.42^{a}	0.98 ± 0.11^{a}	1.43 ± 0.15^{a}	3.7 ± 0.05^{b}	9.00 ± 0.28^{b}
B	76.400 ± 3.79^{a}	0.99 ± 0.00^{a}	1.50 ± 0.10^{a}	3.8 ± 0.10^{b}	8.00 ± 0.00^{a}
C	81.492 ± 3.19^{a}	1.18 ± 0.11^{ab}	1.53 ± 0.11^{a}	3.6 ± 0.00^{a}	9.50 ± 0.00^{c}
D	85.740 ± 0.76^{a}	1.04 ± 0.07^{a}	1.33 ± 0.11^{a}	4.0 ± 0.00^{c}	10.0 ± 0.00^{d}

Where sample **A**= Control, **B**= added 1g of mint, **C**= added 2g of mint and **D**= added 3g of mint
Each value is expressed as mean ± standard deviation (n = 3). Different alphabet superscripts in the same row indicate significant differences ($p<0.05$) according to the Duncan test.

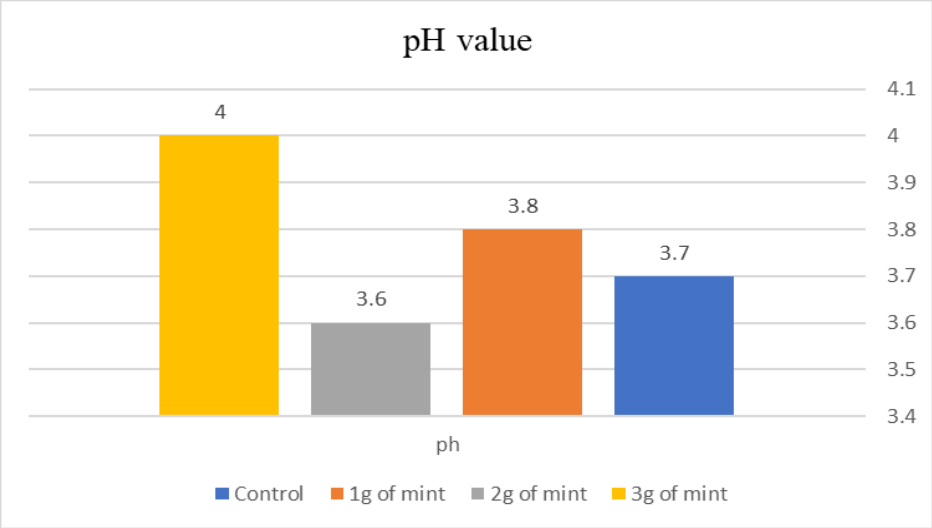

Figure1: pH value of mint milk yogurt samples

As seen in figure 1. The pH value of the mint yoghurt samples ranged from 3.6 in 1g mint milk yogurt to 4.0 in 3g mint milk yoghurt. Ehirim and Onyeneke (2013) reported that pH value of yoghurt should range between 4.00 and 4.90, as much water in yoghurt makes it less viscous and affects texture and mouth feel.

3.2 Sensory Evaluation of Mint Yogurt Samples

The result of the sensory properties of the yoghurt samples analyzed is presented in Table 2. From the result, the control sample cow milk yoghurt was rated highest for appearance, texture, flavor, smell and overall acceptability. Control sample yoghurt was rated highest in the texture and was significantly different from (sample B) 1g mint milk yoghurt and (sample C) 2g mint milk yoghurt and 3g mint milk yoghurt. However, the lower scores for appearance, texture, flavor, smell and overall acceptability were indicated in (sample D) 3g mint milk yoghurt. Overall, By adding more mint powder, the overall acceptability of 3g mint milk yogurt was scored lowest by panelists ($p<0.05$). However, statistically significant differences were found between the scores of samples with 1,2 and 3g percent mint powder addition.

Table 2: Sensory Evaluation of the Mint Milk yoghurt samples

Samples	Appearance	Texture	Flavor	Color	Smell	Overall Acceptability
A	7.8 ± 0.82^{a}	8.0 ± 0.00^{b}	8.2 ± 0.83^{b}	8.0 ± 1.00^{a}	7.2 ± 1.48^{a}	8.2 ± 0.83^{b}
B	6.7 ± 1.20^{a}	6.0 ± 1.10^{ab}	6.6 ± 2.70^{ab}	6.4 ± 1.67^{a}	5.6 ± 3.10^{a}	6.6 ± 1.14^{a}
C	5.6 ± 1.67^{a}	5.4 ± 1.20^{a}	5.6 ± 1.94^{ab}	5.6 ± 1.51^{a}	6.6 ± 1.51^{a}	6.2 ± 0.44^{a}
D	6.4 ± 1.23^{a}	5.4 ± 1.14^{a}	5.0 ± 2.00^{a}	5.8 ± 2.58^{a}	5.6 ± 1.94^{a}	5.6 ± 1.67^{a}

Conclusion

In conclusion, various amounts of mint used in production of mint milk yogurt and the effects of these additives on physiochemical and sensory properties of the product were examined. The moisture content of 1g (sample B) mint milk yogurt sample was found to be lower than the control. While ash content of 2g (sample C) recorded higher percent than control. The titratable acidity, pH and brix of mint yogurt samples increased by fortification of mint. The overall acceptability values of the mint yogurt samples containing 3g mint flavor was found to be lower than the other types of mint yogurt samples. Finally, it was concluded that yoghurts from the mint milk yoghurt obtained from plant sources can serve as a close substitute for yoghurt produced from fresh cow milk.

References

Ademosun, O.T., Ajanaku, K.O., Adebayo, A.H., Oloyede, M.O., Okere, D.U., Akinsiku, A.A., Ajayi, S.O., Ajanaku, C.O., Dokunmu, T.M. and Owolabi, A.O., 2019. Physico-chemical, microbial and organoleptic properties of yoghurt fortified with tomato juice. *Journal of Food and Nutrition Research*, *7*(11), pp.810-814.

AOAC (2005) Association of Official Analytical Chemists. (18th edn), Official methods of analysis, Washington DC, USA, pp. 188-189.

Bakirci, I. and Kavaz, A., 2008. An investigation of some properties of banana yogurts made with commercial ABT-2 starter culture during storage. *International Journal of Dairy Technology*, *61*(3), pp.270-276.

Chandan, R.C. and Kilara, A. eds., 2013. *Manufacturing yogurt and fermented milks* (pp. 294-295). Hoboken, NJ, USA: Wiley-Blackwell.

Ehirim, F.N. and Onyeneke, E.N., 2013. Physico-chemical and organoleptic properties of yoghurt manufactured with cow milk and goat milk. *Academic Research International*, *4*(4), p.245.

Ezeonu, C.S., Tatah, V.S., Nwokwu, C.D. and Jackson, S.M., 2016. Quantification of physicochemical components in yoghurts from coconut, tiger nut and fresh cow milk. *Advances in Biotechnology and Microbiology*, *1*(5), p.555573.

Fisberg, M. and Machado, R., 2015. History of yogurt and current patterns of consumption. *Nutrition reviews*, *73*(suppl_1), pp.4-7.

Hayaty Nejad, J., Mohamadi Sani, A. and Hojjatoleslamy, M., 2014. Sensory acceptability and quality of flavored yogurt enriched with Spinacia oleracea extract. *Nutrition & Food Science*, *44*(3), pp.182-192.

Hoang, N.X., Ferng, S., Ting, C.H., Huang, W.H., Chiou, R.Y.Y. and Hsu, C.K., 2016. Optimizing the initial moromi fermentation conditions to improve the quality of soy sauce. *LWT*, *74*, pp.242-250.

Hutsol, T., Priss, O., Kiurcheva, L., Serdiuk, M., Panasiewicz, K., Jakubus, M., Barabasz, W., Furyk-Grabowska, K. and Kukharets, M., 2023. Mint Plants (Mentha) as a Promising Source of Biologically Active Substances to Combat Hidden Hunger. *Sustainability*, *15*(15), p.11648.

Igbabul, B., Shember, J. and Amove, J., 2014. Physicochemical, microbiological and sensory evaluation of yoghurt sold in Makurdi metropolis. *African Journal of Food Science and Technology*, *5*(6), pp.129-135.

Ivanov, G.Y. and Dimitrova, M.R., 2019. Functional yogurt fortified with phenolic compounds extracted from strawberry press residues and fermented with probiotic lactic acid bacteria. *Pakistan Journal of Nutrition*, *18*(6), pp.530-537.

Kamruzzaman, M., Islam, M.N., Rahman, M.M., Parvin, S. and Rahman, M.F., 2002. Evaporation rate of moisture from dahi (yogurt) during storage at refrigerated condition. *Pakistan journal of nutrition*, *1*(5), pp.209-211.

McKay, D.L. and Blumberg, J.B., 2006. A review of the bioactivity and potential health benefits of peppermint tea (Mentha piperita L.). *Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives*, *20*(8), pp.619-633.

Mckinley, M.C., 2005. The nutrition and health benefits of yoghurt. *International journal of dairy technology*, *58*(1), pp.1-12.

Othman, N., Hamid, H.A. and Suleiman, N., 2019. Physicochemical properties and sensory evaluation of yogurt nutritionally enriched with papaya. *Food Res*, *3*(6), pp.791-797.

Roy, D.K.D., Saha, T., Akter, M., Hosain, M., Khatun, H. and Roy, M.C., 2015. Quality evaluation of yogurt supplemented with fruit pulp (banana, papaya, and water melon). *International Journal of Nutrition and Food Sciences*, *4*(6), pp.695-699.

Salehi, B., Stojanović-Radić, Z., Matejić, J., Sharopov, F., Antolak, H., Kręgiel, D., Sen, S., Sharifi-Rad, M., Acharya, K., Sharifi-Rad, R. and Martorell, M., 2018. Plants of genus Mentha: From farm to food factory. *Plants*, *7*(3), p.70.

Ugboma, C.J., Amadi, L.O. and Okpara, J.C., 2023. Sensory Property, Physicochemical and Bacteriological Examination of Home-made and Commercial Yoghurt Produced and Marketed in Port Harcourt Metropolis, Nigeria. *Journal of Applied Sciences and Environmental Management*, *27*(4), pp.717-725.