International Journal of Food Science and Nutrition
www.foodsciencejournal.com
ISSN: 2455-4898
Received: 23-11-2024, Accepted: 24-12-2024, Published: 08-01-2025
Volume 10, Issue 1, 2025, Page No. 88-90

Development of iron enriched yoghurt

Karthikeyan B[1], Thaheer Basha A[2], Ramasamy D[3], Selvan P[4], Kumaravelu N[5]
[1] Assistant Professor, Department of Dairy Technology, College of Food and Dairy Technology, Koduveli, Tanuvas, Chennai, Tamil Nadu
[2] Department of Dairy Technology, College of Food and Dairy Technology, Koduveli, Tanuvas, Chennai, Tamil Nadu
[3] Assistant Professor, Department of Food Processing Technology, College of Food and Dairy Technology, Koduveli, Tanuvas, Chennai, Tamil Nadu
[4] Professor, Department of Food Processing Technology, College of Food and Dairy Technology, Koduveli, Tanuvas, Chennai, Tamil Nadu
[5] Dean, College of Food and Dairy Technology, Koduveli, Tanuvas, Chennai, Tamil Nadu

Abstract
Moringa leaves extract enriched yoghurt is a novel product that combines the nutritional and functional properties of moringa leaves and yoghurt. The aim of this study was to develop and evaluate the enrichment characteristics of moringa leaves into yoghurt. The product was formulated by adding different levels of moringa extract (25%, 50% and 75%) to plain low-fat yoghurt. The product was subjected to physicochemical and sensory analysis i.e pH, Acidity, Moisture, Ash, Protein, Fat, Carbohydrate and Iron. The product was well accepted by the consumers, with high scores for colour, texture, flavour, and overall acceptability. The product had a shelf life of 10 days under refrigerated conditions. The study concluded that Moringa powder Iron enriched yoghurt is a feasible and innovative product that can offer health benefits and sensory appeal to the consumers.

Keywords: Yoghurt, moringa leaves extract, enrichment

Introduction
Yoghurt is made with a lactic fermenting process which creates the distinctive tart flavor and makes yoghurt thick and creamy, yoghurt can be made of cream or milk with varying amounts of fat. It is a good source of protein, energy, vitamins and minerals. As a fermented product, it may also have therapeutic value and may also result in reduced incidences of lactose intolerance. Milk and dairy products do not contain Iron. The Moringa tree, scientifically known as Moringa oleifera, is a highly valued plant species native to the Indian subcontinent. The combination of Moringa extract and yoghurt offers a potent blend of nutritional benefits. Moringa extract, rich in antioxidants, vitamins, and minerals, enhances the immune system, reduces inflammation, and promotes overall well-being. Yoghurt, on the other hand, provides probiotics, which support gut health, boost digestion, and strengthen the immune system. When combined, Moringa extract and yoghurt create a synergistic effect, amplifying their individual benefits. Hence, the study was carried out with the aim of using Moringa extract as a functional ingredient in yoghurt, its effect on physico chemical characteristics, nutritional profile and sensory attributes of yoghurt.

Materials and methods
The study was carried out in the College of Food and Dairy Technology, Tamil Nadu Veterinary and Animal Sciences University, Koduveli, Alamathi, Chennai – 600052.

Preparation of yoghurt
Toned milk is used for the preparation of yoghurt. The milk is heated to 85-90°C. Yoghurt culture (*Lactobacillus bulgaricus* and *Streptococcus thermophilus*) is added to the milk at 42°C. After each cup treated with each concentration of Moringa Powder and Incubated at 45°C for 5 - 6hrs. Then it is stored at 5°C in a refrigerator

Design of Experiment
The yoghurt has been developed with different levels of Moringa extract and dried Moringa powder in different treatments which are produced from the leaves of Moringa *oleifera*.

Experiment I: Moringa extract is prepared by boiling the fresh leaves in water and allowing the moringa extract to concentrate. The concentrate is incorporated in yoghurt at different levels i.e 25%, 50% and 75%.

S No	Treatments	Level of incorporation of Moringa extract in yoghurt
1	MF_1	25% Moringa extract
2	MF_2	50% Moringa extract
3	MF_3	75% Moringa extract

Experiment II: Moringa leaves were dried and made to powder form. The extract is prepared by boiling the dried leaves powder in water and allowing the moringa extract to concentrate. The concentrate is incorporated in yoghurt in different levels i.e 25%, 50% and 75%.

S No	Treatments	Level of incorporation of Moringa extract in yoghurt
1	MD_4	25% Moringa powder extract
2	MD_5	50% Moringa powder extract
3	MD_6	75% Moringa powder extract

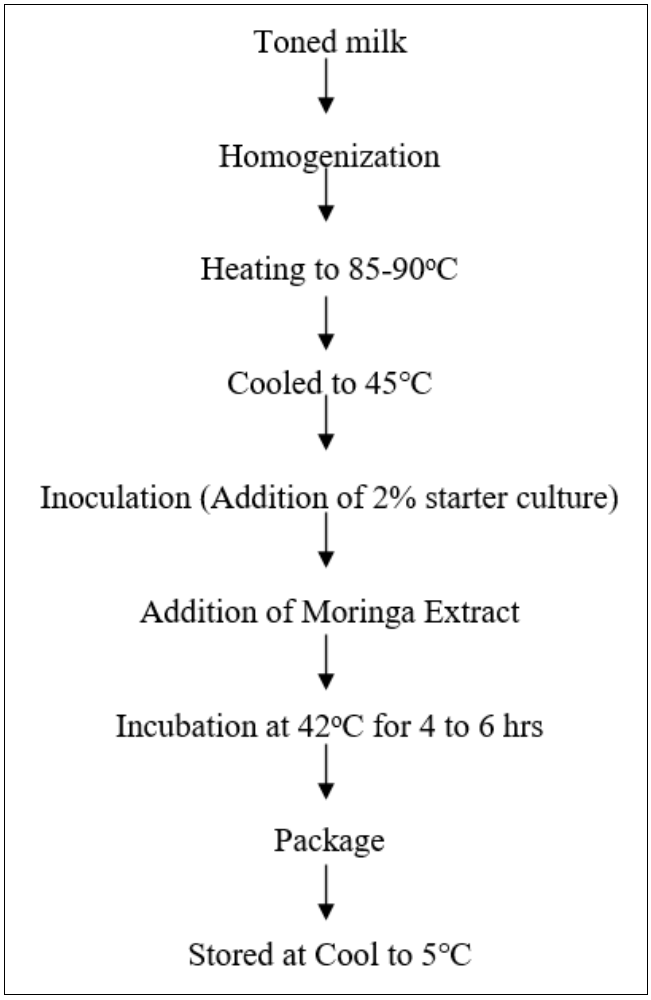

Fig 1: Flowchart for the Preparation of Yoghurt

Evaluation of sensory properties

The yoghurt is packed in cups and then stored at refriferation temperature. The sensory panellists (20 semi trained) were academic staff and students of college of food and dairy Technology, Koduveli. The panellist were instructed to assess the quality of yoghurt on the basis of sensory attributes such as color and appearance, flavour, body and texture, taste and overall acceptability using 9-point hedonic scale where 9 = like extremely, 8 = like very much, 7 = like moderately, 6=like slightly, 5= nither like or dislike, 4 = dislike slightly, 3 = dislike moderately, 2 = dislike very much and 1 = dislike extremely. The analysis of two different treatments in six replications were done, and the results were reported as average.

Evaluation of Proximate composition

Physico chemical characteristics of Cookies

The moisture content was determined using a Hot Air Oven by measuring the mass of the sample before and after moisture removal through evaporation. The iron content was estimated as per the standard method. The ash content was analyzed using a Muffle Furnace, where the organic matter was incinerated, leaving behind the mineral residue. The protein content was assessed using the Kjeldahl Apparatus, which quantifies nitrogen content to estimate protein levels. The fiber content was measured using a Fiber Analyzer, while the fat content of yoghurt was determined. The carbohydrate content was calculated by the difference method, subtracting the sum of moisture, protein, fat, ash, and fiber contents from 100.

Results and discussion

1. Sensory evaluation of Control and Fresh Moringa Extract incorporated yoghurt and Dried Moringa leaves Extract incorporated yoghurt

Table 1: Sensory attributes of Control and Fresh Moringa Extract incorporated yoghurt and Dried Moringa leaves Extract incorporated yoghurt

Sensory attributes	Control	MF_1	MF_2	MF_3	MD_1	MD_2	MD_3
Color and appearence	8.3	7.2	8.1	6.9	6.4	8.2	6.9
Flavor	8.5	6.9	7.4	7.2	7.2	8.1	7.2
Body and Texture	8.2	7.4	7.9	6.5	6.9	7.5	6.5
Taste	7.7	6.5	7.1	6.1	6.8	7.9	6.1
Overall acceptability	8.1	7.0	7.6	6.6	6.8	7.9	6.6

MF_1 - Yoghurt incorporated with 25% Fresh Moringa Extract
MF_2 - Yoghurt incorporated with 50% Fresh Moringa Extract
MF_3 -Yoghurt incorporated with 75% Fresh Moringa Extract
MD_1 -Yoghurt incorporated with 25% Moringa dried powder extract
MD_2 -Yoghurt incorporated with 50% Moringa dried powder extract
MD_3 -Yoghurt incorporated with 75% Moringa dried powder extrac

The observations with regard to sensory evaluation of of Control and Moringa extract incorporated yoghurt are given in Table No.1. The Color and appearance, Flavour, Body and texture and Overall acceptability of Control sample were 8.3, 8.5, 8.2, 7.7 and 8.1 respectively. The values of Color and appearance, Flavour, Body and texture and Overall acceptability of Moringa extract yoghurt added at level of 25 per cent (MF_1) were 7.2, 6.9, 7.4, 6.5 and 7.0 respectively. The values of Color and appearance, Flavour, Body and texture and Overall acceptability of Moringa extract yoghurt added at level of 50 per cent (MF_2) were 8.1, 7.4, 7.9, 7.1 and 7.6 respectively. The values of Color and appearance, Flavour, Body and texture and Overall acceptability of Moringa extract yoghurt added at level of 75 per cent (MF_3) were 6.9, 7.2, 6.5, 6.1 and 6.6 respectively.

The observations with regard to sensory evaluation of of Control and Moringa extract incorporated yoghurt are given in Table No.1. The Color and appearance, Flavour, Body and texture and Overall acceptability of Control sample were 8.3, 8.5, 8.2, 7.7 and 8.1 respectively. The values of Color and appearance, Flavour, Body and texture and Overall acceptability of Moringa extract yoghurt added at level of 25 per cent (MD_1)) were 6.4, 7.2, 6.9, 6.8 and 6.8 respectively. The values of Color and appearance, Flavour, Body and texture and Overall acceptability of Moringa extract yoghurt added at level of 50 per cent (MD_2) were 8.2, 8.1, 7.5, 7.9 and 7.9 respectively. The values of Color and appearance, Flavour, Body and texture and Overall acceptability of Moringa extract yoghurt added at level of 75 per cent (MD_3) were 6.9, 7.2, 6.5, 6.1 and 6.6 respectively.

The Moringa oleifera leaf powder addition decreases the color of the product but produced green color to products which may be attributed to the greenish colour of Moringa oleifera leaf powder incorporated. These results agreed with Madukwe *et al*. (2013) [2] Increase in the level of addition of Moringa oleifera leaf powder reduced the attractive bright colour of the product and lowered the scores, who reported that the colour of the control was preferred over Moringa

beverages. Futher addition of Moringa oleifera leaf powder reduced bright appearance of the product. This is in accordance with Silva *et al*. (2021) [3].

The addition of Moringa extract to yogurt caused a significant decrease in the flavor and taste score, compared to the control yogurt. This is in accordance with Zhang *et al*. (2018) [4]. The addition of Moringa oleifera leaf powder and fresh leaves extract in yoghurt reduced the pleasant flavour of the product and lowered the scores, which may be attributed to the bitter taste of Moringa oleifera leaves incorporated.

The body and texture score are also declined as compared to control. The amount of *Moringa oleifera* leaf powder increased and simultaneously the fiber content also increased this might be and interaction between the Moringa oleifera leaf powder with milk constituents and other non-dairy ingredients. Daba *et al*. (2016) [5] found that the plain yoghurt sample had the highest degree for the body and texture compared to the yoghurt samples fortified with fenugreek and Moringa oleifera seed flours.

2. Proximate analysis of Control and Moringa extract incorporated Yoghurt

Table 1: Proximate composition of Control and Moringa extract incorporated Yoghurt

S. No	Parameters	Control	MF_2	MD_2
1	Moisture Content (%)	87.19	90.65	91.67
2	Protein (%)	3.73	2.81	2.76
3	Crude Fibre (%)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)
4	Fat (%)	3.20	3.0	3.20
5	Ash (%)	0.77	0.61	0.54
6	Carbohydrate (%)	5.37	3.63	3.19
7	Iron (%)	BDL(DL:0.1)	BDL(DL:0.1)	1.11
9	pH	4.64	4.28	4.25

MF_2 - Yoghurt incorporated with 50% Fresh Moringa Extract
MD_2 - Yoghurt incorporated with 50% Moringa Powder Extract

The observations with regard to proximate analysis of control and Moringa extract incorporated yoghurt are given in Table No.1. The values of proximate analysis (%) of Control sample for Moisture, Crude Protein, Crude Fibre, Ether Extract, Total ash, Carbohydrate, Iron and pH were 87.19, 3.73, BDL(DL:0.1), 3.20, 0.77, 5.37, BDL(DL:0.1) and 4.64 respectively. The values of proximate analysis (%) of Moringa extract yoghurt added at level of 50 per cent (MF_2) for Moisture, Crude Protein, Crude Fibre, Ether Extract, Total ash, Carbohydrate, Iron and pH were 90.65, 2.81, BDL(DL:0.1), 3.0, 0.61, 3.63, BDL(DL:0.1) and 4.28 respectively. The values of proximate analysis (%) of Moringa extract yoghurt added at level of 50 per cent (MD_2) for Moisture, Crude Protein, Crude Fibre, Ether Extract, Total ash, Carbohydrate, Iron and pH were 91.67, 2.76, BDL(DL:0.1), 3.20, 0.54, 3.19, 1.11 and 4.25 respectively.

The effects of Moringa extract on the proximate composition of yoghurt were presented in Table. 2 revealed that the moisture content was increased in both treatments than control. The protein content of both treatments (MF_2 and MD_2) were decreased than the control. The percentage of Fat remain same as that of control. The percentage of Ash and Carbohydrates were decreased as compared to control. The values of Iron (%) of Moringa extract yoghurt added at level of 50 per cent (MD_2) showed Iron enrichment the remaining treatment (MF_2) and control recorded the Iron value Below Detectable Limit (BDL). The results are in accordance with the findings of Kim *et al*. (1992) [1], who observed a gradual decrease in pH on increasing the level of incorporation of phenolic components in the yoghurt.

Conclusion

A process for the preparation of Iron enriched yoghurt was developed. The unit operations of process including homogenization, heating, cooling, inoculation, incubation, refrigeration was standardized for laboratory conditions. Sensory analysis revealed maximum scores for the Iron enriched yoghurt prepared by the addition of Moringa powder and yoghurt in the ratio of 1:2 when compared to other samples in terms of colour and appearance, body and texture, smell, taste, overall acceptability. From the proximate analysis, it was found that treatment 1:2 ratio of Moringa powder and yoghurt had good amount of protein (2.76%), fat (3.0%) and Iron (1.11%).

Acknowledgement

Part of the project work was submitted to College of food and Dairy Technology, Koduveli, Tamil Nadu Veterinary and Animal Sciences University, Chennai - 52 by the project student in partial fulfilment for the award of B. Tech degree.

References

1. Kim EA, Lee KW, Park YH, Kwak HS. The study of lactic acid bacteria in yogurt during delivery and storage. Korean Journal of Dairy Science (Korea Republic),1992:14(3):260-268.
2. Madukwe EU, Ezeugwu JO, Eme PE. Nutrient composition and sensory evaluation of dry Moringa oleifera aqueous extract, 2013.
3. Silva Egdso, Anaya K, Bezerra Mdf, Macêdo Cs, Urbano Sa, Borba Lhf, *et al*. Physicochemical and sensory evaluation of Greek style yoghurt with bovine colostrum. Food Science and Technology, 2021.
4. Zhang T, Jeong CH, Cheng WN, Bae H, Seo HG, Petriello MC, *et al*. Moringa extract enhances the fermentative, textural, and bioactive properties of yogurt,2019:101:276-284.
5. Daba M. Miracle tree: A review on multi-purposes of Moringa oleifera and its implication for climate change mitigation. Journal of Earth Science and Climatic Change,2016:7:1. DOI: 10.4172/21577617.1000366