

Nutritional and sensory characteristics of oat milk based yoghurt

SHRISTI GUPTA*¹ AND GITA BISLA²

¹Research Scholar and ²Associate Professor

Department of Food Science and Nutrition, Banasthali Vidyapeeth, Tonk (Rajasthan) India

ABSTRACT

Oat grains are good source of protein, fibre, minerals and many other compounds that show antioxidant activity with their vitamins, avenanthramides, phenolic acids, sterols, phytic acid and flavonoids. Oat milk was used as an alternative raw material of cow milk, for production of yoghurt. Oat milk was prepared from oat flakes and its composition was standardized to match with bovine milk properties. After that, five variants (40:60, 60:40, 80:20, 100:00) of yoghurt was prepared by using different proportions of oat milk and cow milk. These variants of oat milk based yoghurt, went through organoleptic evaluation by 9 point hedonic scale by a semi trained panel members and 60:40 ratio of oat and cow's milk based yoghurt were accepted. The nutritional properties of developed oat milk and oat milk yoghurt was compared with that of the standard cow milk and cow milk yoghurt. The use of oat milk by replacing cow milk in yoghurt decreases fat content and the major problems associated with cow milk fat, cholesterol and lactose contents and this increasing desire for oat milk based yoghurt.

Key Words : Bovine milk, Cow milk yoghurt, Oat milk yoghurt, Nutritional and organoleptic properties

INTRODUCTION

Oats is the most widespread cereals found for nutritional purposes. Oats is an important cereal crop can be used as flakes, oatmeal, bran in breakfast cereals (Saarusree, 2013). Oats known locally as "jau" are an annual plant and can be planted either in autumn (for late summer harvest) or in the spring (for early autumn harvest). Oats are grown on the feet of Himalayas, such as in the Himachal Pradesh, state of India (Ahmad et al, 2014). Oat grains are a good source of quality protein with balanced amino acid, fibre (β -glucan), carbohydrates and minerals has a well-balanced nutritional composition (Rasane et al, 2015). Oat milk contains high percentage of minerals (iron, calcium, sodium, magnesium, and potassium) and vitamins A, D, E and B1. Oat milk can be consumed as shakes and drinks may be used for baking and cooking, for soups, sauces, cakes and pancakes (Kahraman, 2011). Consumption of oat based beverages is a simple and delicious way for consumers to get

cholesterol- management benefits. Oat milk can be a multipurpose ingredient for manufacturers to use in the growth of new products that encourage health while helping to contribute to the population's dietary fibre needs (β -glucan) (Tate and Lyle, 2014).

Yoghurt is one of the popular fermented dairy products broadly consumed all over the world. It is achieved by lactic acid fermentation of milk by the action of a starter culture containing *Lactobacillus delbrueckii ssp. Bulgaricus* and *Streptococcus thermophiles* (Fadela et al., 2009). Yoghurt has medical uses because of the probiotic characteristics, in helping out on a variety of gastrointestinal conditions and in preventing antibiotic associated diarrhea (Mazahreh and Ershidat, 2009).

The objective of this study is to use oat milk as an alternative to the expensive cow milk to produce yoghurt by incorporating oat milk in pure and blend form. Then, sensory acceptability of developed yoghurt was tested and to compare nutritional composition of most acceptable oat yoghurt with bovine milk yoghurt.

METHODOLOGY

Preparation of oat milk:

Hundred grams of oat flakes were used for the preparation for 1 litre of oat milk. The concentration of water was added in developing oat milk to make it comparable to cow's milk. Oat flakes were soaked overnight (12 hours) in water and covered with a cloth. Then ingredients thoroughly whizzed in a mixer grinder (about 2 minutes) to prepare oat milk. Milk was strained through a fine sieve or muslin cloth into a bowl. Milk was stored in a clean glass jar in the fridge and used the milk for preparation of products and chemical analysis.

Yoghurt:

The oat milk was homogenized and warmed to 90°C for 3 minute for pasteurization and held for 30 minutes. Then it was cooled to inoculation temperature of 45°C in closed vessel. It is then inoculated with 2.0 g/100 ml of starter culture (Danisco YO F02 Mix Culture). The inoculated milk is incubated to 45°C until a pH of 4.4 was attained in approximately 5 hours. When the pH end point was achieved, it was stored in a 6°C cold temperature

Five variants of yoghurt were prepared by incorporating cow milk and oat milk (S-100:00 cow milk and oat milk, A- 40:60 oat milk and cow milk, B-60:40 oat milk and cow milk, C-80:20 oat milk and cow milk and D-100:00 oat milk and cow milk) in different ratio and shown in Table 1.

Ingredient	S	A	B	C	D
Cow milk (ml)	100 ml	60 ml	40 ml	20 ml	-
Oat milk (ml)	-	40 ml	60 ml	80 ml	100 ml

S- 100% Standard milk Yoghurt

A- 40% Oat milk Yoghurt

B- 60% Oat milk Yoghurt

C- 80% Oat milk Yoghurt

D- 100% Oat milk Yoghurt

The product Oat yoghurt was then ready for analysis and sensory evaluation.

Sensory evaluation:

The sensory evaluation of yoghurt was carried out using 9-point Hedonic rating scale by 15 semi-trained panel members selected by triangle difference test. Color, appearance, flavor, mouth feel and overall acceptability

were considered for evaluation (Stone and Sidel, 2004).

Nutrient analysis:

Nutrient analysis was done for oat milk and the most acceptable yoghurt by sensory evaluation using standard methods of AOAC (2002). Moisture content was determined by drying of sample in an oven at 80°C for 24 hrs. Crude protein was determined by micro Kjeldahl method. Fat and ash content were determined by soxhlet method and dry ashing method, respectively. Iron (NIN, 2003) and calcium (Sharma, 2008) content were evaluated by Wong's method and titrametric method respectively.

Statistical analysis:

The data were processed for the analysis of mean and standard deviation by Microsoft office excel.

RESULTS AND DISCUSSION

Proximate composition of oat milk:

The results of the proximate composition of oat milk are shown in Table 2 and Fig. 1.

Moisture content:

The moisture contents of bovine milk and oat milk were 87.8 and 90.6 %, respectively. The moisture content of oat milk was found to be higher than bovine milk.

Nutrients/100g	Bovine milk	Oat milk
Moisture (g/100g)	87.8±0.87	90.6±0.87
Ash (g/100g)	0.7±0.15	0.42±0.09
Fat (g/100g)	3.3±0.57	0.14±0.05
Protein (g/100g)	3.3±0.04	1.87±0.01

Values represents in Mean±SD

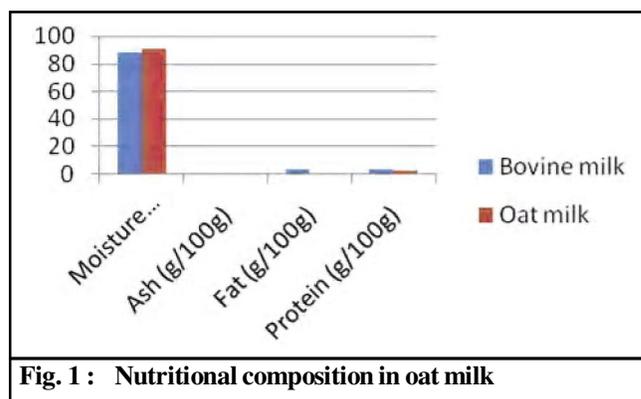


Fig. 1 : Nutritional composition in oat milk

Ash content:

Ash content of oat milk was 0.42 g/100g found to be lower in comparison to standard cow’s milk which contains 0.7g/100g ash.

Fat content:

The results show that fat content of oat milk was 0.14 g/100g which was lower than the standard cow’s milk that contain 3.3 g/100g fat.

Protein content:

The results reveals that the protein content of oat milk was found 1.87 g/100g which was lower than the standard cow’s milk that contain 3.3g/100g protein content.

Minerals estimation of oat milk:

The results of the minerals estimation of oat milk are shown in Table 3 and Fig. 2.

Nutrients/100g	Bovine milk	Oat milk
Iron (mg/100g)	0.1±0.05	0.65±0.05
Calcium (mg/100g)	112±0.07	49.1±0.1

Values represents in Mean±SD

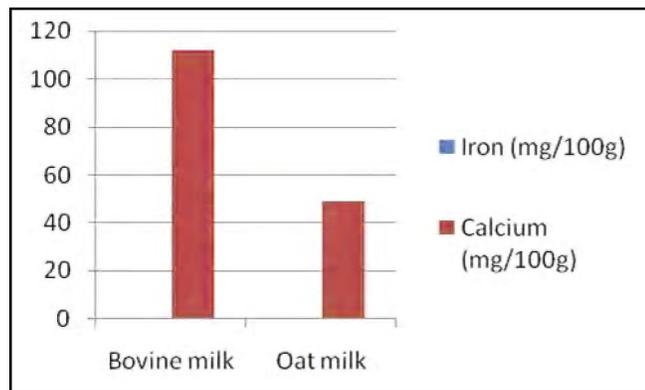


Fig. 2 : Nutritional composition in oat milk

Iron content:

Iron content of oat milk was found as 0.65 mg/100g which was higher than the standard cow’s milk that contain 0.1 mg/100g iron content.

Calcium content:

The results shows that calcium content in oat milk was 49.1 mg/100g that was lower than the standard cow’s milk that contain 112 mg/100g calcium content.

Sensory acceptability of oat milk based yoghurt:

Sensory analysis results show (Table 4 and Fig. 3) that the mean scores of the oatyoghurt (A) made of 40% oat milk and 60% bovine milk was in the ranges of liked slightly to liked moderately in all attributes like color, appearance, flavor, texture, taste and overall acceptability (6.4±0.51-7.0±0.81) as compared to bovine standard yoghurt (S).

Oat yoghurt (B) made by 60% oat milk and 40% bovine milk was liked moderately to liked very much in attributes like appearance, color, flavor, taste texture, and overall acceptability (8.5±.52-8.6±0.51) as compared to standard yoghurt.

The mean scores of sensory evaluation of oat yoghurt (C) made of 80% oat milk and 20 % bovine milk

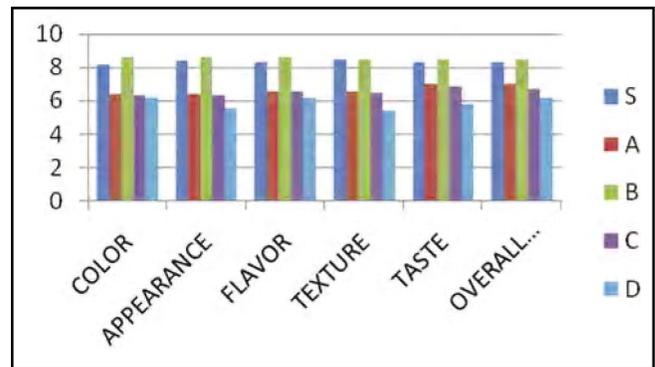


Fig. 3 : Mean sensory score of oat yoghurt

Attributes	S	A	B	C	D
Color	8.2±1.03	6.4±0.51	8.6±0.51	6.3±0.48	6.2±0.63
Appearance	8.4±0.69	6.4±0.51	8.6±0.51	6.3±0.48	5.6±0.69
Flavor	8.3±0.67	6.6±0.51	8.6±0.51	6.6±0.84	6.2±0.63
Texture	8.5±0.70	6.6±0.51	8.5±0.52	6.5±0.70	5.4±0.51
Taste	8.3±0.67	7.0±0.47	8.5±0.52	6.9±0.73	5.8±0.63
Overall acceptability	8.3±0.82	7.0±0.81	8.5±0.52	6.7±0.67	6.2±0.6

Values represents in Mean±SD

was in the range of liked slightly in attributes like appearance, color, flavor, taste texture, and overall acceptability (6.3 ± 0.48 - 6.9 ± 0.73).

Oat yoghurt (D) made of 100% of oat milk was neither liked nor disliked to disliked slightly (5.4 ± 0.41 - 6.2 ± 0.48) in attributes like appearance, color, flavor, taste texture, and overall acceptability.

Therefore, yoghurt (B) made of 60% oat milk and 40% bovine milk was found to be the most acceptable yoghurt and the standard milk yoghurt got highest scores among the all samples and liked very much by the semi trained panel members on 9 point hedonic scale.

Proximate composition of oat yoghurt:

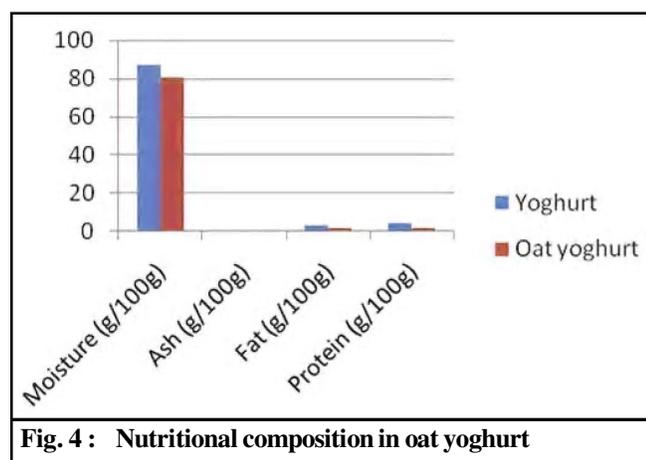
The oat yoghurt (B) was most accepted by the panel members and since oat yoghurt (B) was going further chemical testing.

Moisture content:

The moisture contents of cow milk yoghurt and oat milk yoghurt were 86.81 and 80.9 %, respectively. The moisture content of oat milk was found to be lower than cow milk yoghurt (Table 5 and Fig. 4).

Nutrients/100g	Yoghurt	Oat yoghurt
Moisture (g/100g)	86.81 ± 0.56	80.9 ± 1.08
Ash (g/100g)	0.63 ± 0.04	0.83 ± 0.11
Fat (g/100g)	3.47 ± 0.2	2.18 ± 0.10
Protein (g/100g)	4.62 ± 0.09	1.99 ± 0.10

Values represents in Mean \pm SD



Protein content:

The results reveals that the protein content of oat milk yoghurt was found 1.99g/100g which was lower than

the standard cow's milk yoghurt that contain 4.62 g/100g protein content.

Fat content:

The results show that fat content of oat milk yoghurt was 2.18 g/100g which was lower than the standard cow's milk yoghurt that contain 3.47 g/100g fat.

Ash content:

Ash content of oat milk yoghurt was 0.83 g/100g found to be higher in comparison to standard cow's milk which contains 0.63g/100g ash.

Mineral estimation of oat yoghurt:

Iron content:

Iron content of oat milk yoghurt was found as 1.55 mg/100g which was higher than the standard cow's milk yoghurt that contain 1.06 mg/ 100g iron content (Table 6 and Fig. 5).

Table 6 : Mineral estimation in oat yoghurt

Nutrients/100g	Yoghurt	Oat yoghurt
Iron (mg/100g)	1.06 ± 0.3	1.55 ± 0.05
Calcium (mg/100g)	49.60 ± 0.52	119.3 ± 0.40

Values represents in Mean \pm SD

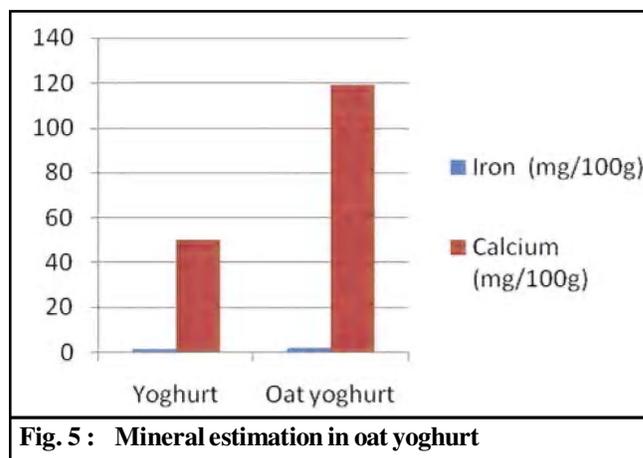


Fig. 5 : Mineral estimation in oat yoghurt

Calcium content:

The results show the calcium content in oat milk yoghurt was 119.3 mg/100g found to be higher than standard cow's milk yoghurt that contain 49.60 mg/100g.

Conclusion:

Yoghurt can be prepared from oat milk (a plant protein) which is easily available and can be made accessible to the rural people at affordable price and with

easy development process. The oat milk yoghurt compares well with cow milk yoghurt in terms of nutrient composition and sensory evaluation. The oat yoghurt can be fortified with vitamins and minerals to fulfill the nutritional requirement of consumers. Hence, there is a need for further research in oat milk and oat yoghurt as an alternative to cow milk and cow milk yoghurt.

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