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Microbiological Characteristics and Physico-chemical Parameters of Fermented Milk Product Ergo-A Traditional Yogurt Product of Ethiopia

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Abstract
Ergo, is a popular traditional fermented milk product of Ethiopia this study aimed to assess the quality aspects of commercial yogurt samples collected from local market through determination of the Physicochemical and microbiological characteristics, in addition to the production of Ergo at laboratory level from cow's milk and goat's milk and assessment of the product quality, The Physicochemical analyses of both commercial and laboratory made Ergo samples revealed a range of pH: 4.4 – 4.49, acidity: 1.5– 2.0, total solids: 33.38– 37.21, solids non-fat: 25.3–29.8, fats: 6.2–7.13, protein: 7.0–8.02, ash: 1.41–1.97, and moisture: 75.95–83.79. The microbiological analysis indicated that the total count of the commercial samples ranged between 3.99-4.3$\log_{10}$ cfu/ml, while the laboratory made Ergo from goat milk and cow milk recorded 14.6$\log_{10}$ cfu/ml and 13.7$\log_{10}$ cfu/ml, respectively. The yeast count in the local commercial Ergo samples ranged between 3.8-3.96$\log_{10}$ cfu/ml, while they were 3.8 $\log_{10}$ cfu/ml in laboratory made Ergo from goat and 4.2 $\log_{10}$ cfu/ml in in all tested samples. The laboratory made Ergo samples were highly accepted by the panelists.
Keywords: Ergo, fermented, Chemical Composition, Acidity, Ethiopia

1. Introduction

Ergo is a traditional, AspontaneouslyB fermented milk product which has some resemblance to yoghurt. It is thick, smooth and of uniform appearance and usually has a white milk color when prepared carefully. The product is semi-solid and has a pleasant odor and taste. It constitutes a primary sour milk product from which other products may be processed. Depending on the temperature, it can be stored for 15–20 days (Gonfa et al., 1994; O'Connor, C.B., 1994). Ergo is produced from raw milk of cattle in all parts of Ethiopia by smallholder farmers. It is also made from milk of goats and camels in the lowland regions in relatively small amounts. As the major fermented dairy product, ergo is popular and is consumed in all parts of the country and by every member of the family. It is known by many different names by the many ethnic groups in the country. Ergo is considered as a special food which serves as a basis for further processing and it is particularly used as a nutritional support to sick people, children and to pregnant and lactating mothers. In addition, it is served to respected guests. In the highlands it is mainly given to male members of the family, whilst in the lowland pastoral regions fresh milk is preferred (O'Connor, C.B., 1992). In addition to being served on its own, ergo is also consumed, either spiced or AnaturalB, as a side dish with different traditional foods, such as markaa (ganfo), injera, qinchea, dabbo and anchotea.

Fermentation is defined as a process leading to the anaerobic breakdown of carbohydrates. Other major compounds than carbohydrates, such as organic acids, proteins and fats, are fermentable in the broader view that fermentation is an energy-yielding oxidation-reduction process (Frank, K. O. 1970, Robinson, R. K. 1990). To the microbiologist, fermentation refers to any anaerobic metabolic pathway that yields energy from organic molecule (the initial food), utilized a different an electron transport system (Jay, D. 1992). Fermentation transform the original food by producing acids, alcohols and volatile compounds that add flavor and aroma, some of these chemicals are antimicrobials and microbicides, they inhibit the growth of undesirable pathogens and spoilage microbes. Thus fermentation preserves food. Generally, fermentation is a self-limiting process. The accumulating acids and/or alcohols eventually kill even the fermenting microorganisms themselves. Ergo made at homes by putting the milk in smoked vessels and stored for 2–4 days to ferment, at an ambient temperature of 16–180 °C, milk depending on the ambient temperature. The relatively low pH of Ergo, ranging from 4.3 to 4.5, enables its further storage (Gonfa et al., 1994; 1999). The objectives of the this study include: the assessment of the quality of Ergo samples collected from different local markets in Addis Ababa through determination of their Physicochemical composition and microbiological characteristics, and production of Ergo at laboratory level from cow's milk and goat's milk and assessment of the product quality.

2. Materials and Methods

2.1 Materials

The samples of Ergo were obtained from local market in Addis Ababa, during the period (June – August, 2015). The samples were kept a low temperature by using refrigerator to suppress microbial growth. Sample of each

cow's and goat's milk were brought from animal farms around the city. The milk samples were transferred to laboratory.

2.2 Microbiological Analysis

The microbiological analyses were carried out in all Ergo samples to determine the total viable count, yeasts count, coliforms count, E.coli test and moulds count according to the methods described by (Harrigan, W. F. and Mccance, M. E. 1976).

2.3 Chemical Analysis of Ergo Samples

The chemical analyses were carried out in all Ergo samples to determine the pH values and the contents of titratable acidity (TA), ash, protein, total soluble solids (TSS), solids nonfat (SNF), moisture and fat according to (AOAC,2000) methods.

2.4 Preparation of Laboratory made Ergo (LME)

Two litters fresh milk of each of cow's and goat's milk where heated on medium high heat to 85^{o}c, stirring constantly. Once the milk has reached 85^{o}c, remove pot of milk from heat and place in cold water bath to cool 10^{o}c, stirring constantly, and then add 8gm. of selective starter cultures for each sample , then Each sample kept in small smoked jar for 7 hours on 10^{o}c, The more consistent the temperature, the more consistent your yogurt results

2.5 Assessment of LME

The quality of laboratory made Ergo (LME) was determined using chemical, microbiological and sensory methods.

2.6 Sensory evaluation of laboratory made Ergo

The cow's and goat's Ergo were subjected to sensory evaluation using 10 panelists at the third day of production. The panelists were asked to rate or to judge samples to be tasted under 9 scales, about the appearance, texture, color, flavor, and the overall acceptability. Each panelist was provided with water for rinsing. The samples were given codes before being tested.

2.7 Statistical Analysis

The data obtained from sensory evaluation were subjected to a simple descriptive statistics and least significant difference test, so as to determine whether there were significant differences in the data or not

Table 1.Microbiological analysis (log10cfu/ml) of Commercial and laboratory made ergo samples

Parameters	R[a] (log_{10} cfu/ml)	D[b] (log_{10} cfu/ml)	C[c] (log_{10} cfu/ml)	Goat's (log_{10}cfu/ml)	Cow's (log_{10}cfu/ml)
Total count	3.89	4.02	4.1	14.5	13.5
Coliform count	3.39	3.89	1.25	9.5	10.3
Yeast count	3.98	3.91	3.90	3.7	4
Mould count	3.83	3.61	3.89	3.4	4.90
E. coli	0	0	0	0	0

*R.D, C sample purchase from local market

3. Results and Discussion

3.1. Microbiological Characteristics

The microbiological characteristics of the commercial ergo and laboratory made ergo samples are shown in Table (1), total count of the commercial samples Ergo ranged between 3.89-4.1log_{10} cfu/ml, while the laboratory made ergo from goat milk (LMEG) and cow milk (LMEC) recorded 14.5 log_{10} cfu/ml in goat's Ergo and 13.5 log_{10} cfu/ml in cow's Ergo. The higher microbiological load of laboratory made ergo samples could be attributed to conduction of the microbiological analysis for LME after 4 days, while the commercial samples were analyzed immediately after production. The same table also showed that the coliform count was 3.37log_{10} cfu/ml, 3.89 log_{10} cfu/ml, and 1.24log_{10} cfu/ml in R, D and C samples, respectively. While the coli-form count of 9.5log_{10}cfu /ml in LMEG and 10.5 log10 cfu/ml in LMEG.

The yeast count in the commercial ergo samples ranged between 3.9-3.96log_{10} cfu/ml, while they were 3.8log_{10} cfu/ml in goats and 4.0log_{10} cfu/ml in cow's laboratory made ergo, respectively. The observable difference was a round 0.06 among the three groups. The mould count ranged between 3.61-3.89log_{10} cfu/ml in the commercial samples, while those of the goat's was 3.4log_{10} cfu/ml and the cow's laboratory made ergo was 4.9log_{10}cfu/ml. The counts of yeast and mould of the commercial and laboratory made ergo had relatively closely related values. The low count may be due to smoke the jar of ergo which was not appropriate for their

growth. The E. coli count was not detected in all ergo samples.

Generally, the microbiological analyses indicate that ergo samples were safe for consumption since all counts of microbiological groups were below the standard levels ac-cording to the Ethiopian Standards (ES ISO 29981:2012), which states that the acceptable standards of coli-form, yeast and mould counts was about 10, the total count was about 50, and, however, the E. coli count was not detected.

3.2. Chemical Analysis

Table (2) shows that the pH of commercial samples ranged between 4.45-4.48, which was relatively similar to those of laboratory made ergo samples (4.49 in goat's milk ergo and 4.40 in cow's milk ergo). The acidity values were also similar and amount to 1.5-2.0, 1.58 and 1.54 (lactic acid %) in the commercial ergo samples, goat's milk ergo samples and cow's milk ergo samples). The increase in acidity was due to the fermentation process which resulted in higher acid concentration that reduced the pH values of ergo samples.

The total solid % ranged between 33.38-37.21 in the local commercial ergo samples, while they were 34.02 and 34.35 in the laboratory made goat's milk ergo and cow's laboratory made ergo, respectively. The solid-non-fat (SNF) % ranged between 26.9-29.9 in the local commercial ergo samples, while those of the laboratory made ergo were 28.4 in LMEG and 25.3 in LMEG. The Ethiopia Standard stated that the value of solids non fat should not exceed 8.2 and the fat should not exceed 3 in yoghurt product, i.e. there were obvious differences between the present study findings and the values recommended by (ES ISO 29981:2012). However, the increase in SNF could be attributed to the solid ingredients added to the formula such as fenugreek and cumin seeds. The same table showed that fat, protein, and ash ranged between 6.2-7.0%, 7.0-8.0%, and 1.41-1.99%, respectively, in the commercial samples, while they were 6.69% and 7.13%, 7.90% and 8.03%, and 1.6% and 1.76%, respectively, in the laboratory made goat's and cow's ergo, respectively.

The moisture content was 83.68%, 82.15% and 75.92% in C samples, D samples and R samples, respectively, while the LMEC and LMEG contained 78.13% and 80%, respectively. The protein content was found to be 7.0 % in both R and D commercial ergo samples and 8.0 in C ergo samples. The test for Ash (%), revealed that the R, D and C ergo samples contained 1.99 %, 1.41 % and 1.99 %, respectively. On the other hand, the protein (%) was found to be 7.90 in laboratory made ergo prepared from cow's milk, and 8.03 in laboratory made ergo prepared from cow's milk goat's milk. The test for ash (%), revealed that the various ergo samples contained a range of 1.41 to 1-99% indicating relatively lower amounts of minerals in laboratory made ergo samples compared with commercial ergo samples. All ergo samples contained relatively higher fat contents which ranged be-tween 7.13 to 6.2 %.

3.3. Sensory Evaluation

Table (3) summarizes the mean for sensory attributes as determined by panelists for the two types of laboratory made ergo. The results indicated that the panelists mostly preferred the goat's ergo color than that of cow's ergo (i.e. the cow's milk relatively got a yellow color, and this color may probably reflected in the ergo product). The panelists were relatively similar in their judgments about the appearance and flavor of both goat's and cow's ergo (i.e. the additives acts to improve the unacceptable flavor of the goat's milk). Generally, the panelists considerably accepted the ergo made by goat's milk than that made by cow's milk.

Table 2.Chemical analysis and pH of commercial ergo samples

Parameters	R	D	C	LMEG	LMEC
pH	4.45	4.47	4.48	4.49	4.40
Acidity (%)	1.5	2.0	1.54	1.58	1.50
Total solids (%)	37.21	33.45	33.38	34.02	34.35
Solids non-fat(%)	29.9	27.2	26.9	28.9	25.30
Fats (%)	7.0	6.2	6.5	6.69	7.13
Protein (%)	7.0	7.0	8.0	7.90	8.03
Ash (%)	1.99	1.81	1.92	1.41	1.56
Moisture (%)	83.68	82.15	75.95	80	78.13

LMEG: laboratory made ergo from goat' milk R, C, D purchase from local market
LMEC: laboratory made ergo from cow' milk

Table 3.The mean for sensory attributes as determined by panelists for both laboratories made Ergo

Character	Goat's milk ergo	Cow's milk ergo
Appearance	7.5 a	7.6 a
Texture	7 b	7.6 a
Color	7.7 a	7 b
Flavor	6.6 c	6.7 c
Over all acceptability	7.5 a	6.7 c

*Means in the same raw bearing the same letters are not significantly different

4. Conclusions

The objectives of this study were to evaluate the quality characteristics of ergo samples collected from different local markets in Addis Ababa and comparing to the characteristics with those of ergo samples produced at laboratory level. The chemical analysis revealed that, the pH in both commercial and laboratory produce ergo samples were less than that of fresh milk samples. The total solids (%), solid non-fat (%), fat (%) and protein (%) in both commercial and laboratory produce ergo samples, were greater than that of fresh milk samples. The microbiological analyses revealed that ergo product made in laboratory is more acceptable to consumption. All samples were accepted by panelists who preferred the goat's laboratory made ergo more than the cow's laboratory made ergo.

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