Wayamba Journal of Animal Science - ISSN :2012-578X; P26-P29, 2010
First Submitted June 22, 2010; Number 1277200115

Assessment of Quality Parameters in Curd and Yoghurt of Small Scale Processors in North Central Province

Weerasekara, W.M.S.I.M[1]., Karunarathne, G.M.C.R[2]. and Gamika A. Prathapsinghe[1]

[1]*Department of Livestock & Avian sciences, Faculty of Livestock Fisheries & Nutrition, Wayamba University of Sri Lanka, Makandura,Gonavila (NWP)*

[2]*Veterinary Investigation Center, Department of Animal Production & Health, Anuradhapura.*

There is a very high potential to produce processed dairy products in North Central Province (NCP). But the lack of knowledge, technical support and less market demand are major constraints that this industry faces today. To assess the quality parameters in curd and yoghurt of small scale processors with respect to the Sri Lankan Standards and to give suggestions to improve the quality and hygienic condition of their products are major objectives of this study. Therefore, a total of 28 small scale processors of curd and yoghurt were selected randomly throughout the NCP, as 14 for each and analysed their products with respect to the Sri Lanka Standard Institution (SLSI) standards by using Sri Lanka Standard Institution (SLSI) reference methods. In curd, Milk solids not fat (MSNF), percent by mass and pH were up to the level of SLSI ($P<0.05$). Fat percent by mass in curd was not up to the level of SLSI ($P>0.05$). Hygienic quality was moderate. In yoghurt, MSNF, percent by mass and milk fat, percent by mass were not up to the level of SLSI ($P>0.05$). Titratable acidity as lactic acid, percent by mass was presented up to the standard ($P<0.05$). Hygienic quality was poor. As a whole the qualities of products are below the expected levels of SLSI, especially milk fat%, MSNF% and hygienic quality. It can be improved by using high quality raw milk, proper storage, reducing the time between milk collection and processing, paying much attention to the hygienic quality of processing area as well as the processor and proper cleaning and sanitization.

Key words: North Central Province, Quality parameters, Small-scale processors, Curd, Yoghurt

Sri Lanka has a total land area of 65,610 sq. km. Of this, around 2 million hectares or 30% is agricultural land. Almost 75% of the agricultural land is under smallholdings and the balance is under estates. The number of smallholdings is estimated at about 1.8 million and of this 90% are less than 2 ha in extent. About 70% smallholdings solely devoted to crop production, the remaining has a mixture of crops and livestock and in few cases solely livestock.

The contribution of the agricultural sector to the national Gross Domestic Production (GDP) was 12.1% in 2008 and the livestock sub sector contributed 0.9%. The dairy industry is important and has tremendous potential in developing the economy in the country. Milk production has been a traditional industry that has survived thousands of years. For many reasons milk, an important food item needs to be available in the market without any shortage. Milk production is important because of the nutrition it provides to the people, and due to the extensive employment opportunities the industry offers. For these reasons the government gives high priority to reaching self-sufficiency in milk production. While recognizing the importance of active participation of the private sector in developing the dairy industry, the government has decided to play a leading role at the beginning and set the stage for rapid development (MLDRI 1995).

According to the National Agricultural Census in 2008, there were 1,195,610 cattle holdings and 318,530 buffalo holdings in the country with average monthly milk production of 17,341,091 Litres and total annual milk production of 208,093,090 Litres (DCS 2008). The 1.15 million cattle and 0.28 million buffalo in 2003 has increased to 1.2 million and 0.32 million respectively, by the year 2008. Hence, there is an increasing trend in the percentage of upgraded dairy animals, including dairy buffalo, in the country. The number of cows in milk has also increased from 0.21 million to 0.25 million in cattle, and from 0.05 million to 0.63 million in buffalo during this period. Dairy farming is predominantly a smallholder mixed crop–livestock farming operation. They mostly feed their animals on natural grasses available in common lands such as on road sides, railway banks, fallow paddy fields, tank beds and other vacant lots, all maintained under rain fed conditions (Presidential Sub-Committee Report 1997).

Presently, the country is facing serious economic problems including under-nutrition (>30%), underemployment (>40%), unemployment (approximately 8.9%), and inequality of food security. The dairy sector holds high promise as a means of alleviating these problems (Singh and Pundir, 2002). Therefore, it is the most important of all livestock sub sectors. This is primarily because of the influence it can make on the rural economy. But the domestic milk production only constitutes about 25% of the requirement and the rest is imported (Bandara, 2000). Therefore, government attention is most focused on the dairy sub sector; to develop this sector into a 'local industry'. Hence, government policy on dairy development is aimed at producing 50% of country's requirement of milk by the year 2015. In order to that cattle breeding and development of the market for processed dairy products have been recognized as a critical issues for the dairy sector (MLDRI 1995) with many programmes and schemes implemented during last few decades. Further, the informal market is crucial for ensuring the economic viability of dairy production for many producers as it typically provides higher prices (Ibrahim et al. 1999a and b).

In the development of the dairy sector on modern lines in Sri Lanka, the contribution of North Central Province (NCP) to the total milk production of the country is comparatively high. When consider about the NCP, there are considerably high number of livestock farms and cattle and buffalo population (DCS 2008). Therefore, there is a very high potential for dairy industry. With the pressure on land for pasture production, the main milk production areas have recently been shifted from the mid and upcountry to the Northwest and NCP. It is estimated that formal milk processing utilizes one third of domestic milk production. Another third of domestic milk production is used by the informal sector, which consists of numerous small and medium scale processors, restaurants, canteens, hotels etc (Bandara, 2000).

The exact number of small and medium scale processors is not known, since their businesses are mostly unregistered. Rather than selling milk as it is, selling processed products such as curd and yoghurt lead them to earn more money. Therefore, there is a trend towards to produce processed dairy products. But major constraints for them are lack of knowledge about

production technologies, technical support and less market demand. So, they produced products mainly by using traditional methods. Therefore, quality of the most of the final products is below the expected level of Sri Lanka Standard Institution (SLSI).

Sri Lanka Standard Institution (SLSI) is the apex body in Sri Lanka engaged in standardization activities, such as formulation of national standards, implementing these standards, testing and evaluation of food products. Also they describes officially recognized levels of quality, safety, composition, packaging, and labeling regulation of food products that are appropriate for the Sri Lankan market.

According to the SLSI curd should comply with the requirements specified in table 1, when tested according to the methods prescribed in column 4 of the table.

Table 1: Requirements for curd

Characteristics	Curd	Buffalo Curd	Method of test
(1)	(2)	(3)	(4)
Milk fat, percent by mass, minimum	5.0	7.5	SLS 735 : Part 1
Milk solids not fat, percent by mass, minimum (MSNF)	8.5	8.5	SLS 735 : Part 1 SLS 735 : part 5
pH - maximum	4.5	4.5	Appendix A

The product should conform to the limits given in table 2, when tested according to the method prescribed in column 3 of the table.

\Table 2: Microorganism limit for curd

Micro organism	Limit	Method of test
(1)	(2)	(3)
Coliforms	Absent in 1g	Appendix B

Yoghurt should also comply with the requirements specified in the table 3, when tested according to the methods prescribed in column 5 of the table.

Table 3: Requirements for yoghurt

Characteristics	Yoghurt	Low-fat yoghurt	Non-fat yoghurt	Method of test
(1)	(2)	(3)	(4)	(5)
Milk fat, percent by mass	3.0 Minimum	0.5 - 3.0	Less than 0.5	SLS 735 : Part 1
Milk solids not fat, percent by mass, minimum (MSNF)	8.0	8.0	8.0	SLS 735 : Part 1 SLS 735 : Part 5
Titratable acidity as lactic acid, percent by mass	0.8 – 1.25	0.8 – 1.25	0.8 – 1.25	SLS 735 : Part 2

Yoghurt should also conform to the microbiological limits specified in table 4, when tested according to the methods prescribed in column 3 of the table.

Table 4: Microorganism limits for yoghurt

Test organism	Limit	Method of test
(1)	(2)	(3)
Coliforms	Not more than 1 per g	Appendix A
Yeast	Not more than 1000 per g	Appendix A
Moulds	Not more than 1 per g	Appendix A

Most farmers produce curd and yoghurt under very poor hygienic conditions. As a result, qualities of these products are questionable and poor. Many pathogenic microbes such as E. coli, Staphylococcus aureus, fungi and mould species at levels way above safety levels have been found in many curd samples obtained from the market (Bandara, 2000). Therefore, in order to improve the market demand, it can improve the quality of those products up to the SLSI standards.

MATERIALS & METHODS

MacConkey Agar (Himedia laboratories private limited, India), Peptone water (Himedia laboratories private limited, India), Sabouraud Dextrose Agar (Himedia laboratories private limited, India), NaOH (Merck specialities private limited, India), Gerber Sulphuric (Techno pharmchem, India), Amyl Alcohol (Hemsons international private limited, India), 68% Ethyl alcohol (Hayman limited, U.K) were used in this study.

Sampling

A total of 28 small and medium scale processors of curd and yoghurt were selected randomly throughout the NCP, as 14 for each. The number of containers to be selected from a lot was done in accordance with the following table.

Table 5: Scale of sampling

No. of containers in the lot	No. of containers to be selected
Up to 90	5
91 - 150	6
151 - 200	7
201 & above	8

Media preparation for total coliform count

MacConkey Agar (0.83g) was measured into a conical flask and 15mL of distilled water was added to it. Then it was heated for boiling to dissolve the medium completely by using a hot plate and stirrer. After that media was autoclaved in 15lbs pressure at 1210C for 15 minutes. Then it was cooled to 45-500C. Finally it was poured into a sterilized Petri dish. According to that 28 agar plates were prepared.

Total coliform count

The sample (1g) was taken and it was diluted up to 10mL by using peptone water. Then 1mL of that was inoculated on MacConkey agar plate. After that it was incubated at 370C for 24-48 hours. Finally colonies were counted. (1 Colony = 10 coliforms)

Media preparation for yeast & molds

Sabouraud Dextrose Agar (0.98g) was measured into a conical flask and 15mL of distilled water was added to it. Then it was heated for boiling to dissolve the medium completely by using a hot plate and stirrer. After that media was autoclaved in 15lbs pressure at 1210C for 15 minutes. Then it was cooled to 45- 500C. Finally it was poured in to a sterilized Petri dish. According to that 14 agar plates were prepared.

Total yeast & mold count

The sample (0.5g) was taken and it was diluted up to 10mL by using peptone water. Then 1mL of that was inoculated on Sabouraud Dextrose Agar plate. After that it was incubated at 370C for 2-5 days. Finally yeast and mold colonies were counted separately

Total solid content

Sterilized Petri dishes were taken and cooled in a desicator. Then those were labeled and the weight of each was taken with the lid (M0). After that 2-5g of sample was taken (M1) directly to the petri dish and it was spread evenly to obtain a thin layer. Then the lid was closed and it was dried in an oven at 1020C for 2 hours. Next it was transferred to a desicator. After it was reached the room temperature the weight was taken (M2). This was repeated at 30 minute intervals, until a stable value was reached.

Total solid content as % by mass = M2- M0/ M1*100

Sample preparation for pH, acidity & fat analysis

Sample (10g) was taken into a universal bottle. Then it was diluted by using 10mL of distilled water and the content was thoroughly mixed.

pH analysis

About 50mL of diluted sample of curd was prepared and pH was measured by using the pH meter.

Analysis of fat

10mL of Gerber sulphuric was added in to a butyrometer by using a 10mL pipette. Then 10.94mL of thoroughly mixed diluted sample was added to it. Next 1mL of amyl alcohol was added and the butyrometer was closed firmly with a stopper. After that the content was mixed thoroughly. Then it was centrifuged at 1100 r.p.m. for 4 minutes. Finally it was placed in a water bath at 650C for 4minutes and then the reading was taken to the nearest 0.05%.

Analysis of titratable acidity

9mL of diluted sample was pipetted into a conical flask. Then 10 drops of 1% phenolphthalein indicator were added. After that it was titrated with 0.1N NaOH while agitating the sample continuously until a permanent very pale pink colour is observed. Finally the amount of titratable acidity was calculated as lactic acid.

Lactic acid% = (Volume of 0.1 N alkali * 0.009* 100)/ Volume of sample

Statistical Analysis

Data were analysed by using Minitab. The comparison of existing quality parameters and SLSI standards were analyzed by using one sample t-test.

RESULTS

For curd

When analysing the samples for fat, out of 14, only six samples were complied with the SLSI requirements others were below that. Therefore as a whole, fat percent by mass in curd was not up to the level of SLSI (P>0.05). But milk solids not fat, percent by mass was up to the level of SLSI (P<0.05). In there only three samples were deviated from that. The pH was up to the level of SLSI and all samples were complied with requirements (P<0.05).

When consider about the hygienic quality it should be free from coliforms. In here, coliforms were present in 21% of samples while others were good (Table 6).

Table 6: Number of coliforms/g present in curd

Case No	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Coliforms /g	0	0	0	0	0	0	0	**40**	0	0	0	**20**	0	**230**

For yoghurt

In yoghurts milk fat, percent by mass was not up to the level of SLSI (P>0.05). In most of the samples fat percent by mass were below the expected level. When consider about the milk solids not fat, percent by mass, it was also not complied with the SLSI standards (P>0.05). However, titratable acidity as lactic acid, percent by mass was present up to the standard (P<0.05) with three exceptions.

When consider about the hygienic quality it should be free from coliforms, less than 1000/g yeasts and less than 1/g moulds. But here 14.3% samples contained considerably high number of coliforms, and another 42.9% contained yeast beyond the limit. In addition to that in all samples, moulds were present beyond the level (Table 7).

Table 7: Number of micro organisms present in yoghurt

Case No	Microorganism					
	Coliforms /g		Yeast /g		Moulds /g	
	Limit	Observed No	Limit	Observed No	Limit	Observed No
1	<1	**40**	<1000	600	<1	**50**
2	<1	0	<1000	<10	<1	**<10**
3	<1	0	<1000	**1100**	<1	**10**
4	<1	0	<1000	500	<1	**<10**
5	<1	0	<1000	<10	<1	**<10**
6	<1	0	<1000	<10	<1	**<10**
7	<1	**70**	<1000	**1200**	<1	**<10**
8	<1	0	<1000	<10	<1	**<10**
9	<1	0	<1000	<10	<1	**<10**
10	<1	0	<1000	<10	<1	**<10**
11	<1	0	<1000	<10	<1	**<10**
12	<1	0	<1000	<10	<1	**<10**
13	<1	0	<1000	**>1000**	<1	**10**
14	<1	0	<1000	**>1000**	<1	**10**

Discussion

Contribution of NCP to the total milk production of the country is comparatively high. When consider about the existing prices rather than selling milk, it is profitable to produce value added products. In addition, those fermented dairy products are most valuable therapeutic foods which have high nutritional value and health benefits. Some important benefits are reduce the risk of high blood pressure, beneficial for strong bones and teeth, good for lactose intolerance people, beneficial for patients of osteoporosis if having daily, and good for patients with constipation and colon cancer. Therefore, dairy farmers can add value to their milk by processing and marketing their own products, such as yogurt and curd. When consider about the situation in NCP, there is a high production of curd and yoghurt by small and medium scale processors. But after the analysis of the quality of those products, it was found that milk fat content was low. That can happen due to the usage of low quality milk which is low in fat. So, when they are buying milk especially they should concern about the milk fat content. At least it should have 2.0-3.5% fat. Milk fat content can be influenced by the genetics, breed, feed that used to feed animal and disease conditions. When consider about the yoghurt production, in addition to fat content, MSNF content was low. It also can happen due to the usage of poor quality raw milk. So, it has to concern about the lactometer reading when reception of milk. MSNF content in milk can also be influenced by the above discussed factors.

Other major problem is the hygienic quality of the products. According to the results, it seems poor. Especially some products contained coliforms. It causes lot of stomach aches and lead to diarrheal conditions. In yoghurts, there are yeasts and moulds too. It may produce toxic substances which lead

to various disease conditions in human. Those microorganism contaminations happen due to the unhygienic conditions in the processing area. Many producers do not have proper separate processing area. Most of them use a part of their own house where all family members go here and there oftenly. Other than that some of them may have cough, diarrhea, fever, sneezing, and skin diseases like health problems. So product can be easily contaminated. Also they do not much consider about the health condition of the processor and sanitary conditions like cleaning. Most do not clean the area daily. So, microorganisms can grow easily and contaminate the products continuously. So, proper cleaning is essential. Some use outside huts for processing and keep products in a room in side the house for incubation. There, products can be easily contaminated through wind, dust, and insects while transferring. Most of places that observed are not suitable for the processing because they are not covered properly even animals can enter. Hence the quality is poor. That is mainly due to their ignorance and poverty. Therefore, overall quality and shelf life are low. Due to that marketing of their products is a big problem for them. By solving that problem it can create an attractive market and also can increase the production. On the other hand it will invisibly help to increase the milk production in the country. Hence it is essential step to evaluate the quality with Sri Lankan standards and suggest them ways that they can improve their production. So it can be improved by using proper storage for raw milk and processed products, doing proper cleaning and sanitization of equipment and processing area and reducing the time between milk collection and processing. By that it can remove remaining food particles and control the growth of microorganisms. As sanitizers H2O2, chlorine, oxonia, acepton like chemicals and detergents like teapol, britol etc can be used. Also, it has to concern about the personal hygiene. There can use clean clothing, good discipline when processing and sanitization.

CONCLUSIONS

The qualities of products are below the expected levels of SLSI, especially milk fat%, MSNF% and hygienic quality.

It can be improved by using high quality raw milk, proper storage, reducing the time between milk collection and processing, paying much attention to the hygienic quality of processing area as well as the processor and proper cleaning and sanitization.

REFERENCES

1. Bandara, B.H.W.M.U.S. 2000. The current status of smallholder dairy systems in Sri Lanka, Department of Animal Production and Health, Peradeniya, Sri Lanka.
2. DCS (Department of Census and Statistics). 2008. Agriculture and Environment Statistics Division.
3. Ibrahim M.N.M., Staal S.J., Daniel S.L.A. and Thorpe W. 1999a. Appraisal of the Sri Lanka dairy sector. Volume 1. Synthesis report. Department of Animal Science, University of Peradeniya; ILRI (International Livestock Research Institute), Nairobi, Kenya; and Ministry of Livestock Development and Estate Infrastructure, Colombo, Sri Lanka.
4. Ibrahim M.N.M., Staal S.J., Daniel S.L.A. and Thorpe W. 1999b. Appraisal of the Sri Lanka dairy sector. Volume 2. Main report. Department of Animal Science, University of Peradeniya; ILRI (International Livestock Research Institute), Nairobi, Kenya; and Ministry of Livestock Development and Estate Infrastructure, Colombo, Sri Lanka.
5. MLDEI (Ministry of Livestock Development and Estate Infrastructure). 2000. Policy strategy for dairy industry. Ministry of Livestock Development and Estate Infrastructure, Colombo, Sri Lanka.
6. MLDRI (Ministry of Livestock Development and Rural Industry). 1995. Policy and programmes. Ministry of Livestock Development and Rural Industry, Colombo, Sri Lanka.
7. Presidential Sub-Committee Report. 1997. Dairy industry in Sri Lanka: Status, limitations and suggestions for revival. Presidential Sub-Committee on Animal Production and Health Sector, Colombo, Sri Lanka.
8. Singh, K. and Pundir, R.S. 2002. Problems and prospects of smallholder dairy production and marketing in South Asia: An overview. South–South Workshop.