MILK AND DAIRY PRODUCTS CONSUMPTION PATTERN AND PREFERENCES IN THE KILINOCHCHI DISTRICT OF SRI LANKA

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Abstract

Current study was carried out in four divisional secretariats of Kilinochchi district to study the consumption pattern and preferences for milk and dairy products. Out of 45,016 households 1000 households were selected using table of random numbers. Information on consumption pattern and preferences for milk and dairy products by the consumers were collected using structured questionnaires. Data were processed using Microsoft Excel 2007 and analyzed using Proc frequency and Chi-square test. Overall around 38% of the households relied on their own source of milk for consumption; in the Kandavali and Poonagary divisional secretariats around 50% of the households relied on their own source of milk. Source of milk from cattle, goat and both averaged to around 76%, 8% and 16%, respectively. Overall consumption pattern of major milk and dairy products viz. was milk powder (26%), yoghurt (19%), fresh milk (15%), curd (14%), flavored milk (11%) and ghee (6%). Consumption level of other dairy products such as cheese, butter and milk toffee averaged to around 3%. Overall reasons for not taking milk for family consumption was do not like to drink milk (73%), insufficient income (20%) and fear of contamination (7%). Chi square test revealed significant association between milk and dairy products and preference order. Most of the households gave first preference for fresh milk (73%) and milk powder (68%) on a nine scale preference order. Most of the households showed a preference order of 2nd (52%) and 3rd (37%) for curd. Significant percentage of households showed preferences for yoghurt, pasteurized milk, cheese, butter, ghee and milk toffee. Fresh milk consumption percentage of 15% is not an appreciable figure; hence, measures should be taken to encourage households to take milk for family consumption as well. Consumption pattern trend of various dairy products will pave way for value addition to milk and generate employment opportunities in the dairy value chain in the study area.

Keywords: Consumption pattern, dairy product, fresh milk, Kilinochchi preferences

Introduction

Milk is said to be the most complete food item because of its great biological value as it contains a variety of nutrients and these nutrients in milk help make it nature's most nearly perfect food. Improving human nutrition plays an important role to achieve food security. Dairy products have a unique contribution to nutritional status as well as health status of the smallholder household members (Melesse and Beyene, 2009). Understanding the consumption pattern and preferences for milk and dairy products will identify bottlenecks that hinder growth of the dairy cattle products value chain and target specific measures for developing market opportunities for producers and processors and for meeting the demand for consumers.

In the Kilinochchi district milk and dairy product consumption pattern is not well understood. Hence the current study was conducted to study the milk and dairy product consumption pattern and preference for milk and dairy products by the households in the Kilinochchi district.

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Materials and Method

The study area

Present study was carried out in four divisional secretariat (DS) divisions of the Kilinochchi district viz. Karachchi, Kandawalai, Poonakary and Pachchilaipalli and contained 45016 households.

Sampling procedure

From the total number of GN divisions 50% of the GN divisions were randomly selected from each DS division and from each GN division 20% of the households were randomly selected. Total numbers of 1000 households were selected for the study through stratified random sampling procedure using Table of Random Numbers.

Questionnaire preparation

A structured questionnaire was designed to conduct cross sectional survey and prepared in such a manner to gather the needed information to fulfill the objectives of the study. Questionnaire included particulars in respect to milk and dairy products consumption pattern and preferences by the households in the Kilinochchi district.

Data collection

Personal interview was conducted with each household head to collect information with the aid of structured questionnaire. Data collection was done for a period of three months; November 2018 to January 2019.

Coding of data

Divisional secretary divisions of Kandawalai, Poonakary, Pachchilapalli and Karachchi were coded 1, 2, 3 and 4 respectively.

Milk consumption pattern

Consumers had source of milk within the household was categorized into 'yes' and 'no'. The sources of own sources of milk were categorized into three groups viz. 'cattle', 'goat' and 'both'. The major reasons for not consuming fresh milk were categorized into 'do not like to consume', 'insufficient income', and 'fear of contamination'.

Milk and dairy products consumption pattern and preferences

The products were categorized into twelve different groups raw milk, pasteurized milk, UHT milk, yoghurt, cheese, butter, curd, powdered milk, flavored milk (packet), flavored milk (cartons), milk toffee and ghee. Preferences for milk and dairy products were ranked on a scale of 1 to 9.

Data entering and statistical analysis

The information collected via questionnaire were fed on MS Excel 2007 spread sheet. Data were analyzed using Pro frequency and Chi-square test. The analysis was performed using SAS 9.1.3 (©2002-2003).

Results and Discussion

Consumption Pattern

Major dairy products consumed in the study area were milk powder, milk, yoghurt, curd, flavoured milk, cheese, butter, ghee and milk toffee (Table 1). Households consuming fresh milk in the study area were around 15%. Alwis *et al*. (2009) stated that fresh milk consumption has suffered ruthless competition from soft drinks and powdered milk. They further stated that huge campaigns to promote consumption of different brand names of powdered milk are another reason low level of fresh milk consumption. The major reason given for not consuming milk in the study area 'do not like to consume milk' (73%) is in agreement with the findings

of Lakmali and Abeynayake (2016) who stated consumer attitude is the major influential factor on decision making to purchase fresh milk.

Table 1: Consumption pattern, source of milk and preferences for milk and dairy products by divisional secretariat in the Kilinochchi district

	Kandawalai	Poonagary	Pachchilaipalli	Karachchi	Overall	X^2P value
Consumption pattern						
Products						
Fresh milk	14.93	18.83	16.32	13.21	15.01	<0.0001
Pasteurized milk	00.00	00.00	00.15	00.06	00.06	
UHT milk	00.56	02.25	00.00	00.00	00.46	
Yoghurt	19.40	20.03	17.79	18.40	18.71	
Cheese	02.05	00.35	03.24	04.78	03.32	
Butter	01.68	00.69	01.91	03.54	02.46	
Curd	14.55	13.64	16.76	13.09	14.12	
Powdered milk	26.68	27.98	21.47	26.71	25.90	
Flavoured milk	11.38	11.40	09.26	11.14	10.86	
Pasteurized flavoured milk	00.00	00.00	00.00	00.12	00.06	
Milk toffee	04.10	00.86	03.82	02.36	02.66	
Ghee	04.66	03.97	09.26	06.60	06.39	
Total	100	100	100	100	100	
Own Source of milk						
Yes	48.75	50.56	39.44	29.38	38.10	<0.0001
No	51.25	49.44	60.56	70.63	61.90	
Total	100	100	100	100	100	
Source of milk						
Cattle	75.64	70.33	84.51	74.47	75.59	0.0526
Goat	05.13	06.59	04.23	12.77	08.14	
Both	19.23	23.08	11.27	12.77	16.27	
Total	100	100	100	100	100	
Reason for not taking milk for family consumption						
Do not like to consume	83.33	71.43	00.00	70.00	73.33	0.5264
Insufficient income	16.67	14.29	100.00	20.00	20.00	
Fear of contamination	00.00	14.29	00.00	10.00	6.67	
Total	100	100	100	100	100	

Order of preferences and the consumption pattern indicates that households in the Kilinochchi district consume a variety of milk products in addition to raw milk (Table 2). Consumption and preferences for variety of dairy products indicate, there is a potential for value addition of milk in small, medium and large scale production which will not only enhance the nutritional status but also will pave way for generation of employment opportunities for the people in the Kilinochchi district and others in the value chain. Contradicting percentages between order of preference for fresh milk (71% -first rank) and its consumption percentage (15%) reveals that educating the farmers regarding the importance of fresh milk will increase the fresh milk consumption in the study area. Schmid (2006) emphasized fresh milk is the best milk from the nutritional stand point due to the availability of heat liable elements; in milk powder some of the elements are destroyed by heat.

Table 2: Households' preference for milk and dairy products by DS division in the Kilinochchi district (%)

Rank	1	2	3	4	5	6	7	8	9	X^2P value
Raw milk	71.37	19.27	04.58	01.53	01.72	01.15	00.19	00.19	00.00	<0.0001
Pasteurized milk	00.00	00.00	00.00	50.00	50.00	00.00	00.00	00.00	00.00	
UHT milk	00.00	18.75	56.25	12.50	12.50	00.00	00.00	00.00	00.00	
Yoghurt	00.77	31.70	34.15	23.43	07.96	01.53	00.46	00.00	00.00	
Cheese	00.00	07.76	10.34	34.48	28.45	12.07	06.03	00.86	00.00	
Butter	00.00	05.95	19.05	17.86	22.62	25.00	07.14	02.38	00.00	
Curd	00.20	52.14	37.27	06.11	02.85	01.22	00.20	00.00	00.00	
Powdered milk	68.29	26.19	03.31	01.99	00.11	00.11	00.00	00.00	00.00	
Flavoured milk	00.52	13.87	31.68	26.96	16.23	06.28	02.62	01.31	00.52	
Pasteurized flavoured milk	00.00	00.00	50.00	00.00	50.00	00.00	00.00	00.00	00.00	
Milk toffee	00.00	05.38	12.90	24.73	16.13	16.13	10.75	09.68	04.30	
Ghee	00.00	07.17	31.39	29.15	19.28	09.42	03.14	00.45	00.00	
Overall	28.65	25.55	20.08	13.12	07.22	03.38	01.29	00.54	00.17	

Conclusion

In the study area, percentage of households consuming powered milk exceeded fresh milk consumption. Households consume other dairy products too. There is a possibility to value addition to milk which will generate employment opportunities.

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DETERMINATION OF TIME REQUIREMENT FOR GOOD QUALITY SILAGE PROCESSING UNDER DIFFERENT CONCENTRATION OF COMMERCIALLY AVAILABLE LACTIC ACID BACTERIA

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Abstract

Lactic acid bacteria (LAB) is responsible for silage fermentation while reducing the pH. The duration requires to silage making vary from 45 to 60 days, depending on the types of the material used. Reduction of this time duration by adding commercially available LAB is still under investigations. Therefore, the present study mainly aimed to determine the time requirement for good quality silage processing under different concentrations of commercially available LAB using different fodder, grass and combination of fodders and to identify the forage species that should produce good quality silage within a short period. The study was carried out at the Department of Animal Science, Faculty of Agriculture, Eastern University, Sri Lanka from July to December 2022. Two factor factorial design was used [Different LAB concentrations (0%, 25%, 50%, 75% and 100%) and forage type (Maize, CO3, and Super Napier, *Brachiaria brizantha*, Super Napier+ Maize) as factors]. Five treatments were replicated four times each. The minimum time duration required to prepare olive green colored silage was measured and just after obtaining the color of the samples in addition to the physical appraisal such as odor, texture and the presence or absence of molds. Samples were analyzed for chemical composition and pH contents. Graphical representations were used to elaborate the time durations obtained for each treatment. All the data were analyzed by Minitab version 17. Combined silage required the lowest time to process good quality silage while the best significant physical and chemical performances were also found in the combined silage ($p<0.05$). There were no significant differences in required time, physical and chemical compositions under different LAB concentrations in the same forage ($p>0.05$). Conclusively, combined silage resulted good quality silage within 7 days when treated with LAB while identifying that Super Napier+ Maize was the best forage species that could produce good quality silage within the short time duration when treated with LAB.

Keywords: Forage, lactic acid bacteria, pasture, proximate analysis, silage

Introduction

The arability of pasture and forage available during the wet season often exceed animal requirements, however, the accumulated pasture and forage become coarse and lose most of their nutritive value with maturity. The excess grasses harvested at optimum nutritive value could be conserved as silage for dry season feeding when pasture is very scarce so as to sustain milk production. Silage is a type of feed made from grass or other green plants that have been cut, fermented in anaerobic circumstances in a silo, and then stored (Kim *et al*., 2021). Lactic acid bacteria (LAB) is responsible for the silage fermentation while reducing the pH of silage. Wang *et al*., (2021) revealed that this reduction of pH because of due to LAB are capable of fermenting carbohydrates to make lactic acid. Grass silage consists with 4.3 - 4.7 pH where cone silage consists with 3.7-4.0 pH (Kung *et al.*, 2018). During quick anaerobic primary silage fermentation, LAB act as a biological silage supplement which offers steady feed value and secondary metabolic products (Kim *et al*., 2021). The duration required to silage making vary

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from 45 to 60 days, depending on the types of material used (FAO, 2020). Reduction of this long-time duration by adding commercially available LAB was still under investigations. Hence, it's a timely need to develop a procedure by using commercially available LAB to reduce the required time duration for silage processing. The present study mainly aimed (i) to determine the time requirement for good quality silage process under different concentrations of commercially available LAB by using different fodder, grass and combination of fodder grasses and (ii) to identify the forage species that should produce good quality silage within a short time duration.

Material and Methods

The research study was carried out at the Department of Animal Science, Faculty of Agriculture, Eastern University, Sri Lanka from July to December 2022. All the forages (fodder grass and pasture grass) required for the study were obtained from the Livestock Farm, Faculty of Agriculture, Eastern University, Sri Lanka. Maize, CO3, and Super Napier were selected as fodder grasses while *Brachiaria brizantha (Signal grass)* was selected as the pasture grass. Super Napier + Maize was selected as the combination of forage. All the forage was cut at the flowering stage and chopped into an approximately 2 cm pieces by using electrical chopper. Commercially available LAB culture which contained 5×10^6 CFU/ 10 g of sample were used. Five grams from the original samples was dissolved in 5 L of distilled water. This 5L was used as the total LAB solution and added particular volumes of each and every treatment according to the determination. Two factor factorial design was used for the experiment by selecting different concentrations of LAB (0%; No added LAB, 25%: 25 ml of LAB solution with 75 ml distilled water, 50%; 50 ml of LAB solution with 50 ml distilled water, 75%; 75 ml of LAB solution with 25 ml distilled water and 100%; 100 ml of LAB solution) as one factor and type of forage as the second factor (Table 1). Five treatments were used and each treatment was four times replicated.

Table 1: Factorial arrangement of the experiment

	Factor 1	Factor 2 (Concentrations of LAB)				
		0% (a)	25% (b)	50% (c)	75% (d)	100% (e)
T1	CO3	T1[a]	T1[b]	T1c	T1d	T1e
T2	Maize	T2[a]	T2[b]	T2c	T2d	T2e
T3	Super Napier	T3[a]	T3[b]	T3c	T3d	T3e
T4	*B. brizantha*	T4[a]	T4[b]	T4c	T4d	T4e
T5	Super Napier+Maize	T5[a]	T5[b]	T5c	T5d	T5e

Slightly wilted chopped grasses were mixed well with different concentration level of LAB solutions and filled to plastic bottles (1 kg for each bottle) and compressed well to remove the internal air and sealed properly by covering the lid. Then bottles were placed in a dark room to avoid the exposure to direct sunlight. The minimum time duration required to prepare olive green colored silage was measured by comparing with a standard color code of the olive color once every three days until obtained the optimum expected color. After achieving the optimum color, the bottles were opened and samples were used for the further analysis of odor, texture, and mold as physical observations by sensory appraisals. Samples (Duplicates) were analyzed for their dry matter (DM), crude protein (CP), crude fiber (CF), ether extract (EE), nitrogenfree extract (NFE), ash, and pH contents as described by AOAC (2002). Graphical representations

were used to elaborate the time durations obtained for each treatment. Time durations, proximate analysis results obtained for process silage under each treatment were analyzed by general linear model of ANOVA by using Minitab version 17, and Turkey test with 5 % significant level was used to compare means.

Results and Discussion

The required time durations for obtaining good quality silage under different LAB concentrations from different forages were showed in Figure 1. This revealed that the time requirement for processing good quality silage can be reduced by adding LAB even though it was not significantly differed among the different concentrations of LAB ($p>0.05$). It can be suggested that we can induce the conversion of starch and sugars present in forages effectively by adding whatever the amount of LAB. Combined silage required the lowest time to process good quality silage among the four different LAB concentrations used in the present study. This time requirement is very low when compared with the previous findings and it could be suggested as a significant of the present study (Kim *et al.*, 2021).

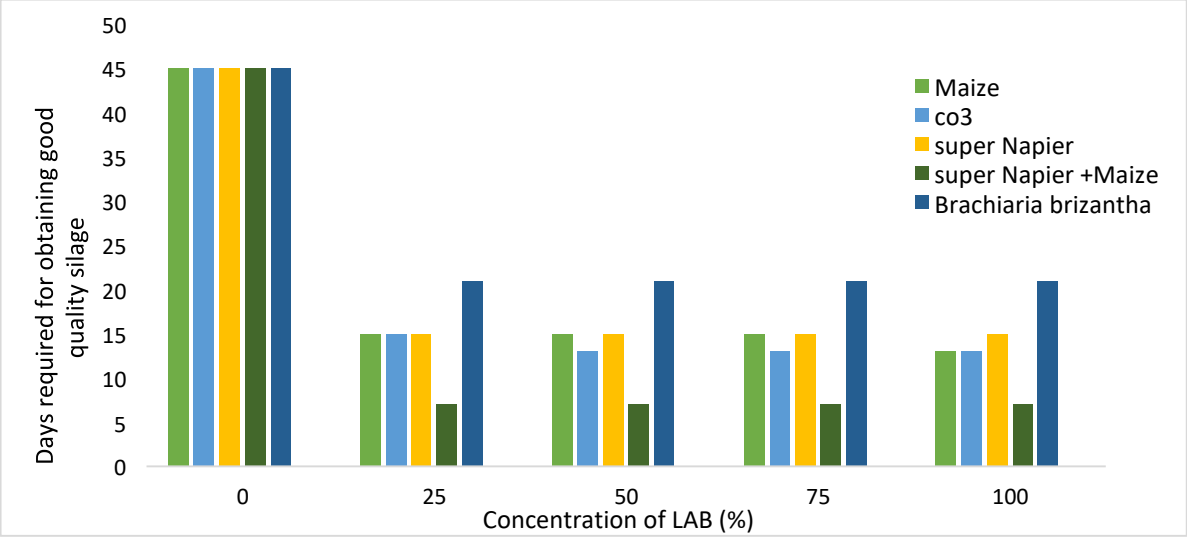

Figure 1: Time requirement for processing good quality silage under different LAB concentrations from different forages

The overall physical observations of prepared silage from different forages were presented in Table 2. These observations were also closely similar with the previous findings (Asaolu, 2018; Delena and Fulpagare, 2015) The combined silage was observed with a deep olive green color within shorter period of time. It was reported that the content of sugars and starch was increased with the maturity of grass while decreasing the cellulose and residues in maize (De Boever *et al.*, 1993). It could be suggested as a reason for that the present observations of time reduction for processing good quality silage with combination of fodders especially with maize.

Table 2: Physical attributes of silage resulted from different forages

Attribute	Maize	CO3	Super Napier	*B. brizantha*	Super Napier+ Maize
Color	Olive green	Olive green	Deep olive green	Olive green	Deep olive green
Odor	Pleasant	Pleasant	Fruity	Fairly pleasant	Pleasant
Texture	Firm	Firm	Firm	Soft	Firm
Mold	Free	Free	Free	Free	Free

The chemical composition and pH of prepared silage was elaborated in Table 3. There was a marked difference in DM of silage prepared by Super Napier and combined silage ($p< 0.05$). Delena and Fulpagare (2015) reported that the dry matter content was decreased after the ensiling process. The present findings were closely similar with the previous findings of Super Napier while more or less similar with the maize whereas the DM of maize and CO3 silage in present study was quite lower. Moreover, the pH, Ash content obtained for the present study were closely aligned with the previous findings (Delena and Fulpagare, 2015; Nusrathali *et al.*, 2021).

Table 3: Chemical Composition and the pH of silages resulted from different forages

Attribute	Maize	CO3	Super Napier	*B. brizantha*	Super Napier + Maize
DM (%)	14.45 ± 1.53^{bc}	14.52 ± 0.87^{bc}	13.22 ± 0.78^{c}	18.26 ± 0.41^{ab}	19.13 ± 0.46^{a}
EE (%)	1.66 ± 0.42^{a}	2.73 ± 0.16^{a}	1.39 ± 0.34^{a}	1.20 ± 0.25^{a}	2.30 ± 0.30^{a}
CF (%)	36.8 ± 0.63^{b}	37.4 ± 1.12^{b}	41.7 ± 2.24^{ab}	46.3 ± 0.71^{a}	40.3 ± 0.93^{ab}
CP (%)	4.04 ± 0.36^{c}	7.99 ± 0.27^{a}	3.69 ± 0.50^{c}	5.46 ± 0.46^{bc}	7.33 ± 0.42^{ab}
NFE (%)	44.86 ± 1.54^{a}	36.71 ± 2.11^{a}	38.65 ± 3.51^{a}	35.84 ± 1.04^{a}	40.39 ± 1.43^{a}
Ash (%)	13.22 ± 0.76^{ab}	14.56 ± 0.82^{a}	13.97 ± 0.82^{a}	11.51 ± 1.07^{ab}	9.95 ± 0.85^{b}
pH value	4.67 ± 0.12^{c}	5.23 ± 0.03^{ab}	5.29 ± 0.07^{a}	5.18 ± 0.14^{ab}	4.92 ± 0.04^{bc}

Means with different superscripts in the same row are significantly different ($p<0.05$).

The observations for the chemical compositions of EE, CF, CP, NFE were not significantly different among forage types ($p>0.05$). Furthermore, those observations including DM were not markedly differed among different LAB concentrations under different forages as well ($p> 0.05$).

Conclusions

Super Napier+Maize combination resulted a good quality of silage within 7 days treated with LAB. The control treatments for Maize, CO_3, Super Napier, *Brachiaria brizantha* and Super Napier + Maize took 45 days to achieve good quality silage. Therefore, Super Napier + Maize was identified as the forage species that produced good quality silage within the short period of time when treated with LAB.

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