Effect of Feeding Strategies on the Production and Composition of Milk in Small Scale Dairy Farms in the Thirunelvely Area of the Jaffna District

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Abstract

The objective of the study was to identify the local feeding strategies adopted by the small-scale dairy farms in selected areas of the Jaffna district, documentthe composition of feed ingredients in the study area and to determine the effect of feeding strategies on milk yield and milk composition. Information was collected from 53 farmers through personal interviews. Out of the 53 farms, twenty dairy farms were monitored in monthly visits, records were maintained for feeds, milk production and sampling of milk also was conducted for chemical analysis. Samples of feeds used on the farm also were taken and chemical composition of feeds was analyzed. Eleven feedstuffs identified were grouped into: HFLP feeds - High fiber low protein; HFHP feeds - High fiber high protein feeds and LFHP feeds - Low fiber high protein feeds. Four feeding strategies were identified: strategy 1 uses HFLP and LFHP; strategy 2 uses HFLP and HFHP and strategy 3 HFLP, HFHP and LFHP feeds. Out of the 53 farms, percentages of farmers followed strategy 1, 2 and 3 were 28.31, 16.98 and 54.71, respectively. Feeding strategies did not influence milk protein; it had significant effect on milk yield, milk fat content, and dry matter intake. Milk yield and milk fat content were high in strategy 2.

Key words: Feeding strategy, Milk yield, Milk composition, Thriunelvely, Jaffna

Introduction

The vast majority of the dairy farmers in the Jaffna district are small scale producers with 62,269 farm families and 30,408 farm labourers (Vakeesan *et al.*, 2010). Jaffna district consisted 5.32 % of the national cattle population (Department of Census and Statistics, 2011). This showed 0.5 % increase in cattle population than the year 2010.

The major milk marketing outlets in the Jaffna district are Jaffna District Development Cooperative Society (JDDCS), Livestock Breeders Cooperative Society and Nestle Lanka (Pvt) Ltd. The competition between the collectors has led to a reasonable farm gate price for milk. Therefore, the improvement of livestock production is expected to increase the income generation of farming families.

Feed composition does exert a strong effect on milk composition (Jenkins and McGuire, 2006). Therefore, diet composition is considered as a factor that on one hand insides directly on production costs, but on the other hand it enables the manipulation of milk solids composition (Coleman *et al.*, 2010). Ability of farmers to provide adequate nutrition and management of Jersey cross cattle is problematic. Hence, the present study focused on the effect of different feeding strategies on small scale dairy production systems in Thirunelvely area of the Jaffna district.

The specific objectives of the study were to identify the local feeding strategies adopted by the small-scale dairy farmers, determine the composition of feed ingredients used and to study the effect of feeding strategies on milk yield and milk composition in selected areas of the Jaffna district.

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Materials and Methods

Data collection

The study included the dairy farmers who are the members of the Thirunelvely milk collecting centre of the JDDCS. Out of fifty three farms, twenty farms were selected for the present study using a table of random numbers. Selected farms were visited every month from November 2011 to July 2012 when data on feeding and milk yield were recorded. In addition, sampling of milk was done for composition analysis. Further, a structured questionnaire was used to collect baseline information on the available percentage of breeds and management practices.

Feed samples

Out of the twenty farms selected, from each farm three samples from each feed/feedstuffs during a period of 3 months were taken. Total of 90 samples consisted 10 feed/feedstuffs. Feed samples were classified according to the nutritional characteristics. The nutrient components considered were crude protein (CP), crude fiber (CF), dry matter (DM), ash and crude fat content. Daily dry matter intake of feed, production cost and income generated through dairy farm was also recorded.

Animals

Total of 20 cattle were recorded for milk production and for each cattle 3 samples were taken. Ten animals were selected from each system of intensive and extensive management, respectively Milk samples from these animals were taken for three months and samples were replicated thrice. Cows were milked twice a day; for the morning 5.00am to 6.00am and for the evening 1.30pm to 2.30pm. Hand milking was practiced in all farms. Variables recorded were daily milk yield per cow and daily milk yield per herd per day. Total of 180 milk samples were collected. Samples were collected in sterilized bottles and stored in a refrigerator.

Chemical analysis

Collected feed samples were thoroughly mixed and composite samples were taken for chemical analysis. Feed samples were analyzed for dry matter and ash content according to standard procedures; crude protein, crude fibre and ether extract were determined by Kjeldahl method, modified Weende' method and Soxhlet method, respectively.

In milk sampales, density of milk, total solids and crude protein contents were determined by AOAC (1995). Milk fat content was analyzed using an electronic milk analyzer.

Statistical analysis

The data collected were analyzed using GLM of SAS. Mean separation was carried out using Duncan multiple range test.

Results and Discussion

According to the questionnaire survey, 54.71 % of the farmers adopted intensive management system and rest of the farmers adopted to semi – intensive system. In the surveyed area extensive system was not practiced. The main cattle breed found in this area was upgraded Jersey. Only 83% of the farmers provided sheds for the animals.

Diet composition

The type of feed/feedstuffs used as diet components and the chemical composition of the feedstuff are given in Table 1. One of the feedstuffs used by all farmers was paddy straw. Paddy straw is the one of the roughages which is high in CF and the second main home grown feedstuffs were cut and carry herbage Glricidia spp. The mean CP content was 18.31%. Common pasture grass mainly weeds constitute another source of medium quality forage with a mean CF content 37.84% and CP content of 0.51%. Mean DM content was

26.36% for the mixture of weeds fed to the herds. Non-typical forage found only in one farm was sorghum, which had a mean CF content of 30.28%. The most commonly used bought-in feedstuffs are commercial compound dairy concentrates. In all farms, the concentrate mixture was obtained by mixing diary mash, broken beans, rice bran, coconut poonac and gingerly poonac. Mean CP and DM content of the dairy concentrates were 11.45% and 72.09%, respectively.

Based on the nutrient content, feed/feedstuff was classified into three feed groups. Three feed groups were high fiber low protein feeds (HFLP), high fiber high protein feeds (HFHP) and low fiber high protein feeds (LFHP). Considering the different feed groups three feeding strategies were identified which were: strategy 1 used HFLP and LFHP; strategy 2 used HFLP and LFHP; strategy 3 used HFLP, LFHP and LFLP feeds.

Gross chemical composition of the feedstuff

Strategy 1: Combines two feed groups, high fiber low protein feeds and low fiber high protein feeds. Feeding strategy 1 was adopted by 28.31 % farms.

Strategy 2: Includes two feed groups, high fiber low protein feeds and high fiber high protein feeds. Feeding strategy 2 was adopted by 16.98 % farms.

Strategy 3: This comprised all three feed groups. Strategy 3 was followed by 54.71 % farms.

Table 1. Gross chemical composition of the feedstuff in the diets in each feed group

	HFLP			
	PAS	**SOR**	**CPG**	
DM	62.1 ± 38.77	17.0 ± 0.7	26.3 ± 0.35	
ASH	10.1 ± 0.30	11.0 ± 1.56	15.2 ± 1.84	
CP	0.3 ± 0.03	1.2 ± 0.02	0.5 ± 0.08	
CF	90.2 ± 10.29	30.2 ± 0.07	37.8 ± 15.13	
EE	0	2.4 ± 0	0	
	HFHP			
	DHS	**BB**	**RB**	**GLI**
DM	89.1 ± 0.13	88.6 ± 0.10	90.1 ± 0.08	28.4 ± 0.22
ASH	5.8 ± 0.10	4.5 ± 0.10	10.3 ± 0.04	13.6 ± 0.14
CP	1.1 ± 0.57	1.1 ± 0.02	8.6 ± 0.08	18.3 ± 0.29
CF	67.0 ± 6.67	73.7 ± 2.10	9.0 ± 0.76	4.4 ± 2.43
EE	0.7 ± 0.35	0.6 ± 0.1	13.9 ± 0.47	2.6 ± 0.35
	LFHP			
	CCC	**COP**	**GIP**	
DM	88.9 ± 0.19	89.7 ± 0.14	91.6 ± 0.37	
ASH	6.1 ± 0.30	5.8 ± 0.04	12.6 ± 0.01	
CP	12.5 ± 0.06	16.5 ± 1.73	25.4 ± 2.58	
CF	11.6 ± 6.20	15.8 ± 1.46	18.6 ± 0.47	
EE	3.9 ± 0.2	8.1 ± 0.51	10.7 ± 2.08	

DM dry matter, CP crude protein, CF crude fiber, EE ether extract, PAS paddy straw, SOR sorghum, CPG common pasture grass, DHS dhal straw, BB broken beans, RB rice bran, GLI Gliricidia, CCC commercial concentrate compound, COP coconut poonac, GIP gingelli poonac

Table 2. Mean gross chemical composition of feed groups (% on dry matter basis)

Feed Group	DM	ASH	CP	CF	EE
HFLP	35.19 ± 23.82	12.16 ± 3.56	0.71 ± 0.50	52.77 ± 32.63	0.25 ± 0
HFHP	74.09 ± 30.44	8.62 ± 4.19	7.13 ± 9.25	38.40 ± 37.09	4.48 ± 6.36
LFHP	90.11 ± 1.37	8.19 ± 3.83	17.58 ± 5.60	15.37 ± 3.54	7.61 ± 3.46

Table 3. Effect of feeding strategies on milk composition, total DMI and DMI per feed group

	Strategy 1	Strategy 2	Strategy 3
Milk yield (Kg/cow/day)	5.48 ± 2.89^{b}	7.66 ± 2.94^{a}	6.80 ± 2.90^{a}
Milk protein content (%)	3.05 ± 0.1^{a}	2.99 ± 0.33^{a}	3.01 ± 0.21^{a}
Milk fat content (%)	4.1 ± 0.30^{b}	4.59 ± 0.18^{a}	4.38 ±0.34^{ab}
Total DMI(Kg/cow/day)	2.43 ± 1.02^{b}	5.03 ± 0.06^{a}	3.98 ± 0.93^{ab}
HFLP DMI (Kg/cow/day)	1.71 ± 1.07^{a}	3.66 ± 6.12^{a}	1.66 ± 1.11^{a}
HFHP DMI (Kg/cow/day)	0.03 ±0.09^{b}	0.83 ± 1.47^{a}	0.94 ± 0.75^{a}
LFHP DMI K(g/cow/day)	0.67 ± 0.56^{b}	0.55 ± 0.74^{b}	1.37 ± 0.94^{a}
CP DMI (Kg/cow/day)	0.09 ± 0.07^{b}	0.17 ± 0.19^{ab}	0.27 ± 0.20^{a}

Diet composition and classification of feeds

Ten feed stuffs were identified, of which four were produced in the farms and the rest were bought out side of the farm.

HFLP feeds: This included fibrous residues arising from crops grown for human consumption, such as paddy straws, sorghum and common pasture grass. Crop residues were characterized by their high fiber content (52.77%) and low levels of crude protein (0.714%) (Table 2).

HFHP feeds: By-products derived from crop production (bean straw) and industrial processing (bran from cereal milling, rice and maize bran), fall into this category of feeds which had less fibre content (38.4 % of DM) than those in the first category but had relatively high amounts of crude protein content (7.13 % DM). Leaves from tree legumes *Glyricidia* that had 17.31 % CP can also be considered in this category (Table 2).

LFHP feeds: These are the feeds traditionally called concentrates and include oilseed meals and cakes (coconut poonac, commercial concentrates and gingili poonac). Oil seed meals and cakes may contain variable amounts of crude protein. But in the current study, coconut poonac contained 16.55 % crude protein on dry matter basis while gingili poonac had 23.63 % crude protein on dry matter basis. (Jayasuriya, 2002) reported that, the above feed groups provide valuable sources of good quality protein for ruminant animals.

Dry matter intake

Feeding strategies show significant influence on DM intake of crude protein and crude protein intake was comparatively high in strategy 3 this is in agreement with the findings of Grant (1997). He confirmed that concentrates containing a mixture of cereals and by-products with a high content of digestible fiber may be the most appropriate option for dairy cows in many cases.

Milk composition

Usage of different feeding strategies had significant effect on milk yield (Table 3). The increased milk yield in strategy 2 may be due to the usage of high protein and high fiber feeds mainly legume leaves (*Gliricidia*) to the animals.

In the feeding strategy 1, milk fat content was low and protein content was high. This finding is in agreement with Heinrichs *et al.* (1997), who stated that the increasing amount of concentrate feed increases the

protein content and decreases the fat content. But in feeding strategy 2, fat content was high and protein content was low. Price of the milk is determined by the percentage of milk fat content under Asian perspective. Therefore, feeding strategy 2 would be preferred than strategy 1 under Asian condition. This may due to using mixture of high fiber low protein feeds and low fiber high protein feeds. The strategy 3 is intermediate to both 1 and 2.

Three feeding strategies identified in the current study did not significantly influence the milk components crude protein and total solids. However, there was a significant influence of feeding strategies on milk yield and milk fat content. Feeding strategy two had a significantly higher value for milk yield and milk fat compared to the other two strategies.

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