HOUSEHOLD CONSUMPTION OF FARM FRESH LIQUID MILK AND OTHER DOMESTIC MILK PRODUCTS AND ITS IMPLICATIONS FOR IMPORTS OF MILK IN SRI LANKA

(DRAFT REPORT)

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CHAPTER 1. INTRODUCTION

1.0 Introduction

Sri Lanka is heavily dependent on agriculture which accounted for 19.1% of the Gross Domestic Product (GDP) in 2004, 17.2% in 2005 and in 2007 it is expected to decrease to 16.8% of the GDP. In 2004, the livestock sub sector has contributed to Rs 1539.07 million towards the GDP in agriculture of Rs 15390.78 million (at current prices) and this is only 10% of the GDP. It is estimated that the contribution to the livestock to the agricultural sector is 5.5 percent of the GDP and 1.2 percent to the national GDP (Appraisal of the Sri Lanka Dairy Sector, 1999). However the contribution of this sector to GDP is grossly under estimated by the failure to include the value of draft power hides and skins , manure and with the inclusion of these products the share of livestock sector in agricultural GDP , at current prices could be expected to increase to about 15% .Further due to ethnic conflict in the North and East of the country most of the livestock data is underestimated or missing and with these inclusions the contribution would be much higher than reported (Central Bank of Sri Lanka,2005).

The Agricultural Census of 2001 showed that of the total of 1.75 million holdings nearly 481,672 holdings were with some type of livestock production .Of this 7621 were holdings with only livestock while 162,900 were mainly agricultural crop farms. Livestock farming has been identified as a traditional income generating activity, while satisfying part of the nutritional needs of the rural communities in Sri Lanka, from the ancient time. More than 90 percent of the cattle and buffaloes are owned by rural small holders or by estate labour. In the peasant livestock holdings, nearly 30-60 percent of the gross farm income is generated by livestock activities. Of the 10-11 million farming population in the country nearly 3.5 million are directly involved in livestock activities (Sri Lankan Livestock Policy Review, 1992).

In 2002, the milk production in the country was 349 million litres consisting of 266 million litres of cow milk and 83 million litres of buffalo milk; and in 2003, cow milk

production increased by 2% while buffalo milk production decreased by 0.4% (Central Bank of Sri Lanka, 2003). In 2005 , the national milk production was 192.7 million litres (162 mn litres of cow milk , 31 mn litres buffalo milk) and the estimated production for 2007 is 196.6 million litres (165 mn litres cow milk, 32 mn litres buffalo milk)- Central Bank of Sri Lanka, 2006. The production of domestic milk products was expected to increase from 6.8 – 8.6 million litres between 2006-2007. The national livestock population potentially contributing to dairy production included 1.64 million cattle, 0.76 million buffaloes and 0.54 million goats. In 1996 there were an estimated 697,300 milch cows and 234,800 milch buffaloes. In 2006, 1.2 million neat cattle and 0.3 million buffaloes were reported in the country (Central Bank of Sri Lanka, 2006). More than 70 % of both types are found in the Dry and Intermediate Zones of the country (Ibrahim, 2000). The average milk production per cow is less than one litre per day; where as in the developed countries the average milk production per cow is over 20 litres per day (National Livestock Policy Plan and Recommendations for Implications (41)).For example, in China the average milk yield/cow in specialized household dairy farms was 5342 kg and in state and collective dairy farms it was 6091 kg/cow in 2003 .Here, the labour efficiency in milk production was 88.4 kg/man day in private farms and 97.6 kg/man day in state farms (Fuller et al, 2006). In Sri Lanka, the average minimum price of fresh milk is around Rs.15 per litre, which is assumed to be lower than the cost of farm fresh milk production in the country.

The annual per capita consumption of milk is 19.87 litres, which is much below the level of 41.6 litres, as recommended by the Medical Research Institute, to meet the nutrient requirement of an average Sri Lankan. Hence, there is an urgent need to increase consumption of milk in the country . Further, the current supply of domestic milk production is adequate only to meet only 20% of the country's requirement in 2005 and this is expected to increase up to 30% by 2010 (Central Bank of Sri Lanka,2006). So, the country has to rely heavily on imports of milk and milk products. For example, during the year 2003, 67941 metric tons of milk and milk based products were imported to the country incurring a imported value of Rs.11.5 billion (Central Bank of Sri Lanka ,2003). In 2005 , the annual imports of milk amounted to 36118 metric tons of milk powder or a liquid milk equivalent of 353 litres of milk. Between 1990-2005 , the value of milk

imports has increased from Rs 2321.7- Rs 13041 million (Central Bank of Sri Lanka, 2005) with an annual rate of growth of 30.6% .The principal form of consumption of milk in the country is in the form of whole milk powder (WMP) representing around 75% of the formal milk market. Pasteurized and sterilized milk accounted for around 3% and condensed milk 2% of the formal milk market. Research studies in Asia has shown that WMP and other milk product prices will increase in the future with increase in imports of other milk deficit Asian countries from surplus countries such as Australia, New Zealand, China and India. If proper dairy policies are not implemented towards lifting of the domestic milk industry, the country will loose much more foreign exchange in the future, which could be used for economic development. Hence, study of consumption of domestic milk sector and its constraints is essential in developing demand driven policies required to improve milk production and consumption in the country. Further , proper management of dairy industry will contribute much significantly to the sustainable intensification of smallholder agriculture in the rural sector, there by enhancing the income and welfare of poor households, through their participation in milk production, processing or marketing.

1.1 Objectives of the Study

General Objective:

The general objective of this study is to determine the major household factors affecting consumption of farm fresh liquid milk and other milk products.

Specific objectives

1. To determine the regional variations of household demand of farm fresh liquid milk (FFLM) and other milk products (such as pasteurized milk, sterilized milk, UHT treated milk, whole milk powder (WMP), infant milk powder, non fat milk powder, yoghurt , curd, ice-cream, cream, cheese ghee and other value added milk products) in the wet zone, intermediate dry and dry zone districts.
2. To determine the expenditure share of milk in household food balance sheets to access sufficient knowledge of milk consumption behaviour of the household in the different study districts. The food balance sheet will analyze and compare the

different shares of food expenditures incurred by the households (such as rice , wheat flour, other grains, legumes, vegetables, fruits, spices, milk and milk products, meats and other foods) in their monthly dietary patterns. Those food expenditure shares are regressed with household income, prices of milk and milk products, and demographic factors such as family size, age, sex, religion, traditions, and other socioeconomic conditions. The analysis was mainly done by the use of LA/AIDS model for consumption of milk and milk products with the aim of defining the own price and cross price s elasticity of milk and milk products in the wet zone, intermediate dry and dry zone districts .

3. To determine the major factors affecting the import share of milk and milk products to Sri Lanka for 1975-2002 with the aim of defining the import elasticities of milk and milk products.

The findings of above would help to formulate the government policy implications required to change the consumption behaviour of the households from imported whole milk powder to domestic farm fresh liquid milk and other domestic value added milk products. This would also have some implications for domestic milk production in the country. The results will further help to forecast the changes in milk imports shares and the resulting changes in the foreign exchange savings from milk powder imports.

CHAPTER 2. REVIEW OF LITERATURE

2.0 Importance of Milk

Milk is an important food and it is demanded because of its nutritional and organoleptic properties. Milk is considered as the nearly perfect natural food of human beings and it is defined as the whitish liquid secretion of the mammary glands of the lactating mammals, which contains nutrients such as protein, fat, carbohydrates, vitamins, minerals in such proportions, which act as a team in the body building process and other physical functions (Silva, 1994).

With the understanding that other mammals could sustain the life of a developing child, milk was chosen as one of the main stays of the human diet. In various regions of the world, milk of different mammals is consumed as sources of milk. In Sri Lanka, milk is taken mainly from cows, buffaloes and goats. In Southern Europe goats and sheep are used and water buffaloes are used in Southeast Asia. In cold climate regions reindeer is used as a milk source while camels are used in Middle Eastern countries. The composition of milk is different in each type (Table. 1).

Table. 1 Composition of Milk of Mammals

Mammal	Fat	Protein	Lactose	Minerals	Total solids
Llama	3.15	3.90	5.60	0.80	13.45
Seal	54.00	12.00	000	0.53	66.53
Horse	1.69	2.69	6.14	0.51	10.96
Human	3.70	1.60	6.98	0.21	12.49
Cow	4.00	3.50	4.90	0.70	13.10
Goat	4.09	3.71	4.20	0.78	12.78
Buffalo	12.40	6.05	3.74	0.89	23.08
Reindeer	18.70	11.10	2.70	1.20	33.70
Camel	5.40	4.00	3.30	0.70	12.00
Zebu	4.80	3.00	5.30	0.70	13.80
Elephant	3.12	3.20	7.42	0.63	14.37

The nature of milk production in South and South Asia is varied. For instance while India is a leader in milk production, some countries like Philippines Sri Lanka are at very low production levels (Rutherford, 1999). However in most developing Southeast and South Asian countries dairying is not a major industry. In many countries domestic milk production is supplemented with imported milk products to satisfy domestic milk consumption requirement, as in the Philippines, Malaysia and Thailand. Laos and Indonesia improved their domestic milk sector by importing high quality breeding stock, improved management and artificial insemination programs. However, most countries import fresh and dry milk from surplus countries like Australia, New Zealand, and European Union. Some have intraregional trading in milk and milk products. For instance, Malaysia, Indonesia, China, and Thailand export dry milk even though all of them are net importers of dry and fresh milk (Rutherford, 1999).

2.1 Overview of the Milk Industry in the World

Livestock contributes in supplying about one – sixth of the calories and one –third of the proteins in per capita food supplies in the world. Consumption of livestock products is

four to five times higher in developed countries as compared to the developing countries. In the rural sector of most developing countries livestock plays a major role as source of income and employment. Further, it assists in farming and in converting waste and crop by products into edible foods (Sarma et al, 1985).

Most of the livestock population is available in the developing countries although the production is low as compared to developed countries. About two thirds of the world's cattle, almost all buffaloes, and half of all sheep and goats were found in the tropical regions of Africa, Asia and America that support up to 70% of the world human population (Table 2). Livestock population in the three continents differed due to many aspects such as human population density. Asia and Sub –Saharan Africa has higher population as compared to America (http// dairy world.htm).

Table 2. Livestock, milk and people in Tropical Africa (SSA), Asia and Central and South America (CSA)

	SSA	Asia	CSA	Total (mean)
Bovines, m*	165	509	329	1003
Au, m**	92	240	262	594
Milk in tones	13.2	91.9	44.2	149.3
Milk, kg AU^{-1}	143	382	168	(251)
People, m	519	2886	457	3862
Milk, $Kgcaput^{-1}$ yr^{-1}	25	32	97	(39)

*Source: Sere' et al., 1996 * bovine = cattle & buffalo, AU** = animal unit equals 400kg LW*

Agricultural land for grazing and cropping is 1.6 ha $caput^{-1}$ and in Asia it is low (0.3 ha). The wealth of livestock indicated a different trend ranging from 0.08 animal units $caput^{-1}$ in Asia to 0.18 and 0.57 in SSA and CSA respectively (Table 3). The availability of land as well as the role of people, land and livestock affected in final milk production and its availability in the world (Table 3).

Table 3. Land, Livestock and People in SSA, Asia and CSA

	SSA	Asia	CSA	Total
Grazing, m ha	745	561	587	1843
Crops, m ha	127	358	131	616
HA Au^{-1}	9.5	3.8	2.7	4.1
Ha caput^{-1}	1.68	0.32	1.57	0.6

Source: Ser'e et al., 1996

Milk production in the tropics has some specific characteristics. In Sub Saharan Africa cattle produces more than 60% of the milk, with feeds mainly supplied from common property natural pastures. In Asia cattle produces about half of the milk and most of the remainder comes from buffaloes. Crop residues are the major feed source of Asia. In Latin America milk is mainly produced from cows grazing on privately –owned planted pastures (Walshe et al., 1991).

In Asia Milk production is low compared to other parts of the world, because the livestock are mainly kept for meat. Furthermore the development of dairy production systems of Asia, is strongly driven by cultural preferences and their market forces. As a result India and Pakistan (75kg milk caput^{-1} Yr^{-1}) contributed 96% of all the milk produced in tropical Asia. In South East Asia, where 550 million people live, milk production is very low and their consumption depends mainly on the imports (http//dairy world.htm).

India, which is the main milk producer in Asia, increased its milk production from 17 million tones in 1951 to 54 million tones in 1991. The urban sector (28% of the population) here consumed 56%, or three times as much per capita as the rural population (Table 4). As a result of 40 years of intensive dairy co-operative development under Operational Flood Project the per capita availability has increased to 72 kg per year (Petal, 1997).

Table 4. People and Milk Consumption in India in 1995

		Milk	Consumption
	People, m	**M tonnes**	**Kg caput^{-1} Yr^{-1}**
Rural	660	29.2	47
Urban	254	37.1	148
Total/Mean	914	66.3	72

Source: Aneja and Puri, 1997

Development of the livestock sector in South Asia is constrained by the availability of feed resources like grains, forage, pasture, grasses and legumes, tree fodder and crop residues in these countries. Moreover, the lack of proper infrastructure (including cattle holding, cattle, beef and feed transportation and shipping, processing facilities) and marketing expertise is another limiting factor of developing the milk sector (Lemcke, 1993). In Indonesia post harvest losses are between 5-20% for meat, eggs and milk and loss of live weight at transportation is between 1-3% and 7-10% respectively (Directorate Livestock Services, 1992). The marketing of livestock and livestock products in most developing countries in Asia is often inefficient and handicapped due to its disperse nature of production and the associated need to assemble supplies from many small holders, inadequate transport and refrigeration facilities and large number of intermediaries (Unnevehr, 1991; Anderson, 1992; Rae et al, 1992).

2.2 Overview of the Milk Industry of Sri Lanka

2.2.1 Animal Demography

The cattle and buffalo data showed a decreasing population trend in the country. In 1970, there were 1,596,000 cattle and 736,000 buffaloes but in 2002 it declined to 1,510,000 and 643,000 respectively (Table 5 and Figure 1). However, the populations of milch cows of both cattle and buffaloes has increased over time (Table 6 and Figure 2). According to Ibrahim (1999), the national livestock population potentially contributing to dairy production included 1.64 million cattle, 0.76 million buffaloes and 0.54 million goats. In

1996 there were an estimated 697,300 milch cows and 234,800 milch buffaloes. More than 70 % of both types were in the Dry and Intermediate Zones of the country. On district basis, in the small holding sector (2002), the highest number of neat cattle and buffaloes were in Kurunegala and the highest population of goats and sheep were in Jaffna (Table 7). Figure 3 shows the pattern of distribution of cattle and buffaloes in the districts of Sri Lanka.

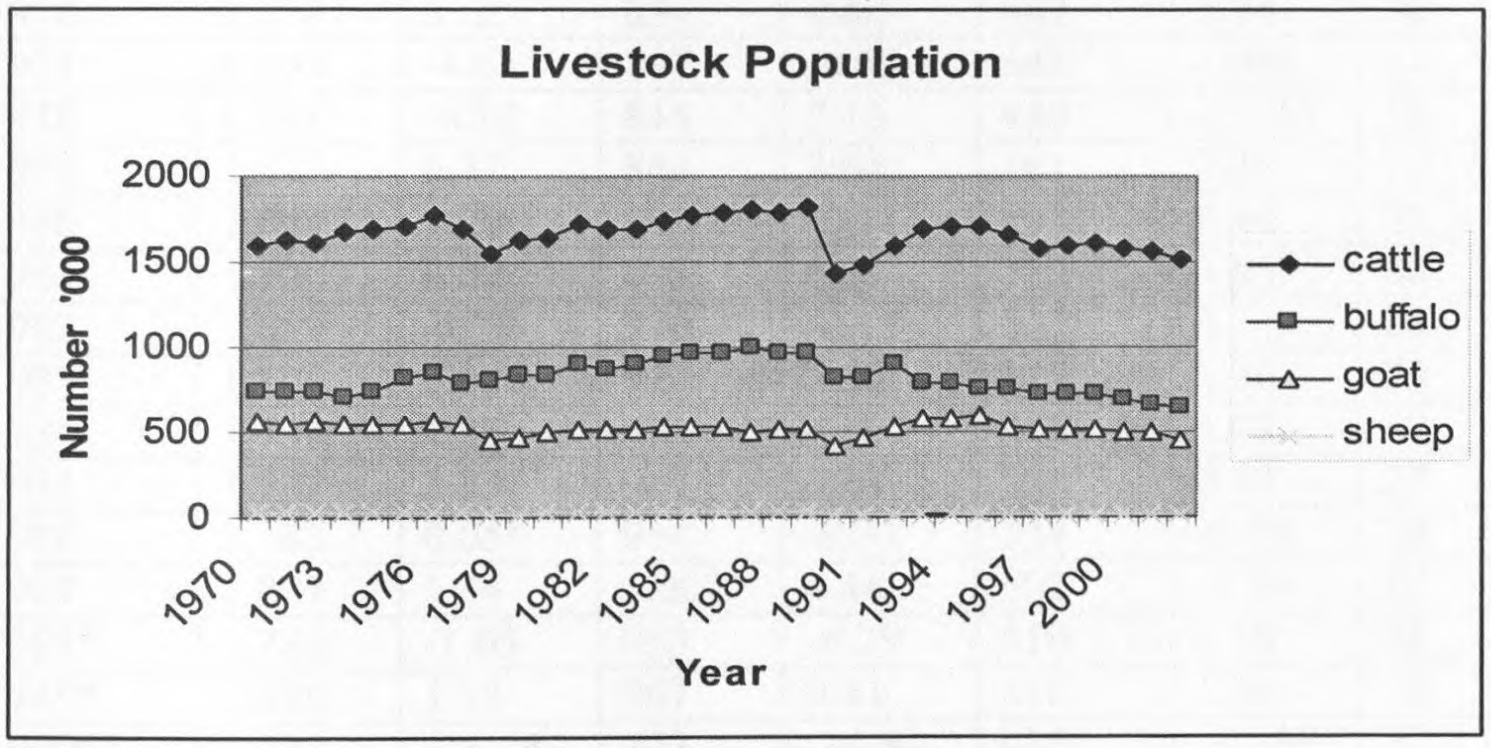

Figure 1: Livestock Population 1970 - 2000

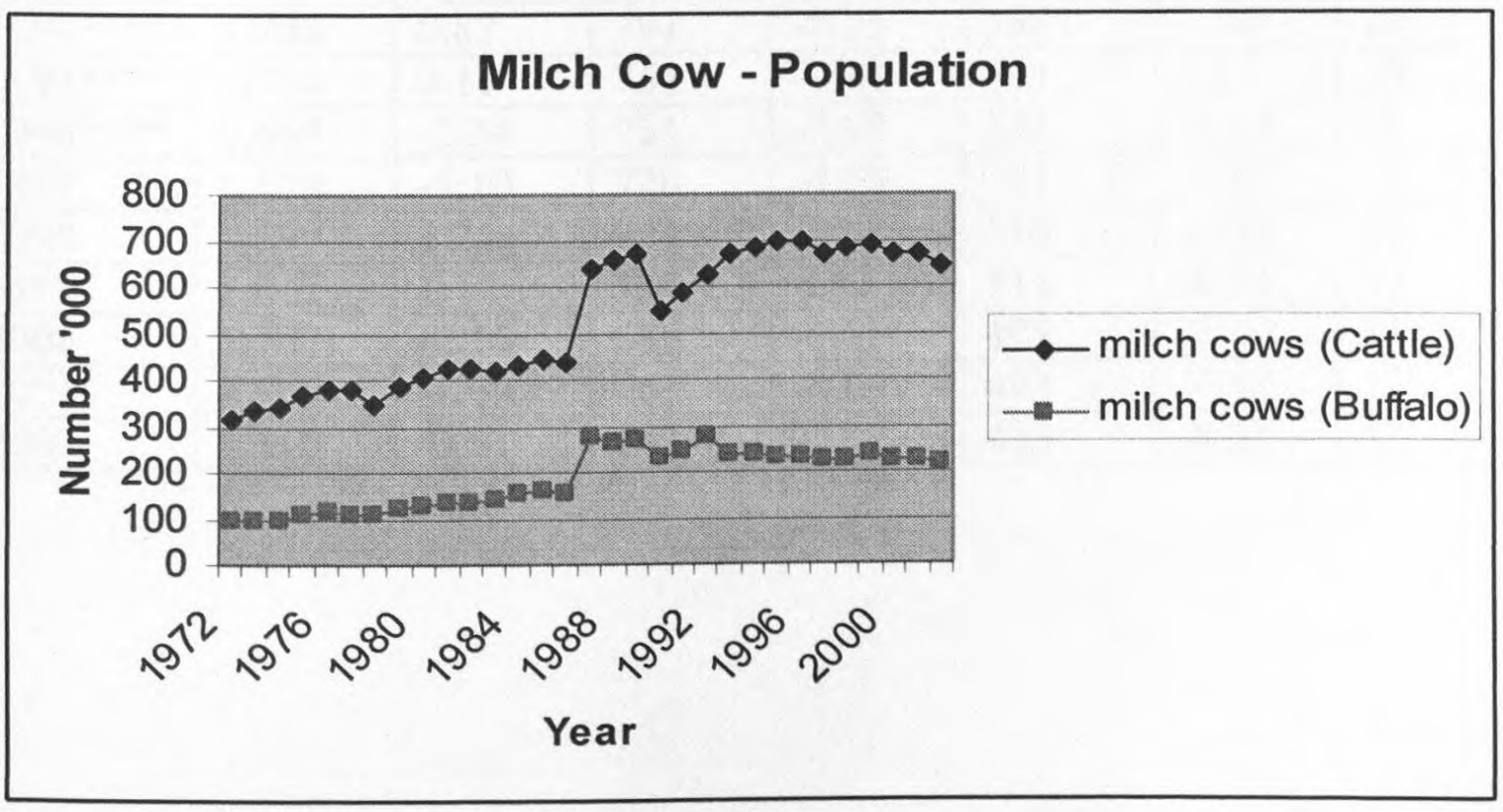

Figure 2: Milch Cow Population in 1972 - 2000

Table 5: Livestock Population –Annual Estimates 1970-2002 (Number'000)

Year	Cattle	% change	Buffaloes	% change	Goats	% change	Sheep	% change
1970	1,596	-	736	-	558	-	27	-
1971	1,625	1.81	737	0.13	546	-2.15	29	7.4
1972	1,617	-0.49	748	1.49	562	2.93	29	0
1973	1,677	3.71	714	-4.54	549	-2.31	27	-6.89
1974	1,686	0.53	736	3.08	547	-0.36	30	11.11
1975	1,712	1.54	818	11.14	547	0	28	-6.67
1976	1,774	3.62	854	4.40	562	2.74	30	7.14
1977	1,692	-4.62	797	-6.67	545	-3.02	27	-10.0
1978	1,541	-8.92	814	2.13	450	-17.43	23	-14.81
1979	1,623	5.32	844	3.68	461	2.45	24	4.34
1980	1,644	1.29	843	-0.11	493	6.94	28	16.67
1981	1,720	4.62	898	6.52	512	3.85	30	7.14
1982	1,699	-1.22	879	-2.11	512	0	28	-6.67
1983	1,700	0.058	910	3.52	519	1.36	29	3.57
1984	1,738	2.23	951	4.50	535	3.08	29	0
1985	1,782	2.53	967	1.68	539	0.74	27	-6.89
1986	1,783	0.056	964	-0.31	534	-0.93	29	7.4
1987	1,807	1.34	1,007	4.46	502	-5.99	27	-6.89
1988*	1,788	-1.05	963	-4.39	510	1.59	28	3.70
1989*	1,820	1.78	967	0.41	518	1.56	30	7.14
1990**	1,433	-21.26	823	-14.89	415	-19.88	22	-26.66
1991**	1,477	3.07	825	0.24	460	10.84	20	-9.09
1992***	1,604	8.59	897	8.72	528	14.78	22	10
1993****	1,688	5.24	793	-11.52	582	10.23	19	-13.63
1994****	1,702	0.82	791	-0.25	588	1.03	20	5.26
1995****	1,704	0.11	764	-3.41	591	0.51	19	-5.00
1996****	1,664	-2.34	761	-3.92	535	-9.47	11	-42.10
1997	1,579	-5.10	726	-4.59	521	-2.61	11	0
1998	1,599	1.26	721	-0.68	519	-0.38	12	9.09
1999	1,617	1.12	728	0.97	514	-0.96	12	0
2000	1,582	-2.16	689	-5.37	495	-3.69	11	-8.33
2001	1,565	-1.07	661	-4.06	493	-0.40	12	9.09
2002	1,510	-3.51	643	-2.72	452	-8.31	12	0

Table 6. Livestock Population by Species and Type – Annual Estimates 1972-2002

(Number '000)

Year	Cattle				Buffalo				Goats	
	Milch cows	Other cows	Bulls	Calves	Milch cows	Other cows	Bulls	Calves	He	She
1972	316	556	335	410	98	247	226	178	203	395
1973	338	582	336	428	95	228	214	173	194	355
1974	343	569	341	433	`94	244	223	175	191	356
1975	366	562	341	443	108	259	261	190	192	355
1976	382	580	339	443	116	265	271	203	196	366
1977	381	540	332	439	107	155	240	194	184	361
1978	350	476	299	417	112	253	251	200	200	289
1979	389	486	313	434	124	259	255	206	166	295
1980	406	467	310	461	128	255	252	208	185	308
1981	423	481	331	487	138	270	257	233	190	322
1982	423	466	331	480	133	271	251	225	192	320
1983	420	474	327	478	140	281	262	228	197	322
1984	432	483	336	488	157	288	264	243	207	328
1985	443	494	341	505	161	289	267	249	213	327
1986	440	505	339	499	158	294	263	249	217	317
1987	641	383	327	457	279	253	247	229	196	307
1988	656	368	327	438	267	235	241	220	196	314
1989	669	366	331	454	269	238	240	221	199	320
1990	546	288	267	333	233	213	196	180	163	252
1991	590	281	257	348	248	206	191	179	178	282
1992	626	309	269	364	277	220	198	201	200	303
1993	671	340	281	396	240	208	172	174	217	366
1994	685	341	285	391	239	209	173	170	219	369
1995	696	333	282	394	232	203	167	162	221	371
1996	697	315	267	364	235	198	166	162	203	232
1997	674	295	259	351	226	188	154	158	195	326
1998	682	306	254	356	227	188	152	154	197	322
1999	690	304	258	365	236	183	152	157	197	317
2000	670	285	244	357	227	173	141	152	192	304
2001	673	285	246	361	228	162	134	138	193	300
2002	648	272	239	351	221	161	128	133	173	280

Source: Department of Census and Statistics

Note: Since 1987 data for certain North and East districts not included due to difficulties in collecting information.

Table 7. Livestock Population by District
Small Holding Sector – Census of Agriculture 2002

(Number)

District	Neat cattle	% of total	Buffaloes	% of total	Goats/ Sheep	% of total
Colombo	9,671	0.90	5,055	1.82	1,939	0.59
Gampaha	31,248	2.92	7,748	2.80	7,384	2.25
Kalutara	14,996	1.40	10,286	3.71	6,189	1.88
Kandy	25,055	2.35	7,523	2.71	12,004	3.65
Matale	23,880	2.24	12,138	4.38	6,572	2.00
Nuwara Eliya	13,244	1.24	3,103	1.12	1,656	0.50
Galle	12,401	1.16	7,341	2.65	3,727	1.14
Matara	13,734	1.28	5,179	1.87	2,838	0.81
Hambantota	45,505	4.26	33,605	12.14	9,359	2.85
Jaffna	47,666	4.46	-	-	65,736	20.04
Killinochchi	31,740	2.97	525	0.18	19,927	6.07
Mannar	21,847	2.04	1,176	0.42	6,647	2.02
Vavuniya	22,690	2.12	723	0.26	6,623	12.01
Mullaitivu	26,109	2.45	3,392	1.22	11,115	3.38
Batticaloa	53,421	5.00	9,534	3.45	28,135	8.57
Ampara	65,438	6.13	9,002	3.25	8,312	2.53
Trincomalee	43,646	4.08	8,660	3.13	9,736	2.96
Kurunegala	167,297	15.67	66,451	24.01	31,575	9.61
Puttalam	65,493	6.13	9,264	3.35	29,195	8.89
Anuradhapura	144,019	13.49	33,623	12.15	35,417	10.78
Polonnaruwa	33,877	3.17	12,490	4.51	6,331	1.93
Badulla	61,796	5.79	2,590	0.93	7,613	2.31
Moneragala	72,792	6.82	12,831	4.63	3,227	0.98
Ratnapura	10,748	1.00	7,172	2.59	2,005	0.61
Kegalle	8,347	0.78	7,261	2.62	5,013	1.53
Sri Lanka	**1,067,160**	**100**	**276,672**	**100**	**328,275**	**100**

Source: Department of Census and Statistics

2.2.2 Milk Production

Milk production in Sri Lanka in 2002, was 349 million litres consisting of 266 million litres of cow milk and 83 million litres of buffalo milk (Central Bank 2002); and in 2003, cow milk production increased by 2% while buffalo milk production decreased by 0.4% (Central Bank of Sri Lanka, 2003). In 2005, the total national milk production was 192.7 million litres consisting of 162 mn litres of cow milk and 31 mn litres of buffalo milk respectively. The estimated milk production for 2006 is 196.6 million litres (Central Bank of Sri Lanka,2006). In the national context, the average milk production per cow was far

below as compared to that in the developed countries. In Sri Lanka, it was less than one litre per day; where as in the developed world the average daily milk production per cow was over 20 litres (National Livestock Policy Plan and Recommendations for Implications, (41)). Nevertheless, the milk production of the country has increased since 1960 irrespective of a decreasing population trend. Of the total annual milk production in 2002, cattle produced more than 76% of total milk and rest was by buffaloes (Table 8 and Figure 4).

Table 8. Annual Milk Production 1960-2002 (Litres)

Year	Cow milk	% change	Buffalo milk	% change	Total	% change
1960	80,401,788	-	27,517,280	-	108,919,068	-
1961	87,729,984	9.11	29,244,560	6.27	116954,544	8.39
1962	78,210,180	-10.85	21,638,868	-2.600	99,849,048	-14.64
1963	110,406,804	41.16	33,470,556	54.67	143,877360	44.09
1964	138,032,244	25.06	29,814,732	-10.92	167,846,976	16.65
1965	124,321,788	-9.93	46,208,304	54.98	170,530,092	1.59
1966	120,345,144	-3.19	39,727,596	-14.02	160,072,740	-6.13
1967	116,841,708	-2.91	38,566,792	-2.92	155,398,500	-3.91
1968	131,198,796	12.28	39,109,896	1.40	170,308,692	9.58
1969	120,747,660	-7.96	36,906,696	-5.63	157,654,356	-7.43
1970	125,255,724	3.73	34,463,328	-6.62	15,971,952	1.30
1971	130,733,100	4.37	38,978,100	13.00	169,711,200	6.25
1972	122,199,300	-6.52	41,812,200	7.27	164,011,500	-3.35
1973	135,214,200	10.65	33,665,400	-19.48	168,870,600	2.96
1974	123,284,300	-8.82	40,764,600	21.08	177,048,900	-2.86
1975	163,764,000	32.83	48,242,700	18.34	212,006,700	29.23
1976	194,911,200	19.01	52,864,200	9.57	247,775,400	16.87
1977	212,202,000	8.87	51,017,400	-3.49	263,219,400	6.23
1978	209,824,200	-1.12	54,822,600	7.45	264,646,800	0.54
1979	196,159,500	-6.51	61,597,800	12.35	257,757,300	-2.60
1680	216,164,700	10.19	64,377,900	4.51	280,542,600	8.83
1981	232,329,600	7.47	73,291,500	13.84	305,621,100	8.93
1982	230,895,900	-0.61	69,552,000	-5.10	300,447,900	-1.69
1983	231,641,100	0.32	82,908,000	19.20	314,549,100	4.69
1984	235,565,100	1.69	88,172,100	6.34	323,737,200	2.92
1985	244,036,800	3.59	98,932,500	12.20	333,969,300	5.94
1986	123,703,800	-49.30	49,453,200	-50.01	176,157,000	-49.51
1987	195,324,000	57.89	79,213,200	60.17	274,537,200	58.54
1988	162,154,800	-16.98	63,496,800	-19.84	225,651,600	-17.80
1989	172,858,800	6.60	65,343,600	2.90	238,202,400	5.56
1990	190,119,600	9.85	58,819,200	-9.98	248,938,800	4.50

1991	208,821,600	9.83	70,888,800	20.51	279,710,400	12.36
1992	232,665,600	11.41	85,293,600	20.32	217,959,200	13.67
1993	244,567,200	5.11	81,118,800	-4.89	325,686,000	2.43
1994	250,498,800	2.42	81,800,400	0.84	332,399,200	2.03
1995	253,447,200	1.17	79,858,800	-3.29	333,306,000	0.07
1996	249,459,600	-1.57	81,936,000	3.57	331,395,600	-0.34
1997	251,928,000	-1.57	79,106,400	-3.45	33,134,400	-0.11
1998	256,336,800	0.98	85,044,000	7.50	341,380,800	3.12
1999	260,346,000	1.75	82,470,000	-3.02	342,816,000	0.42
2000	263,056,800	1.56	82,521,600	0.06	345,578,400	0.81
2001	265,939,200	1.04	82,650,000	0.15	348,589,200	0.87
2002	265,832,400	-0.04	82,914,000	0.31	348,746,400	0.04

Source: Department of Census and Statistics
Note: Figures based on returns finished by Grama Niladharis
Since 1987 the figures for certain North and East Districts are either excluded or estimated

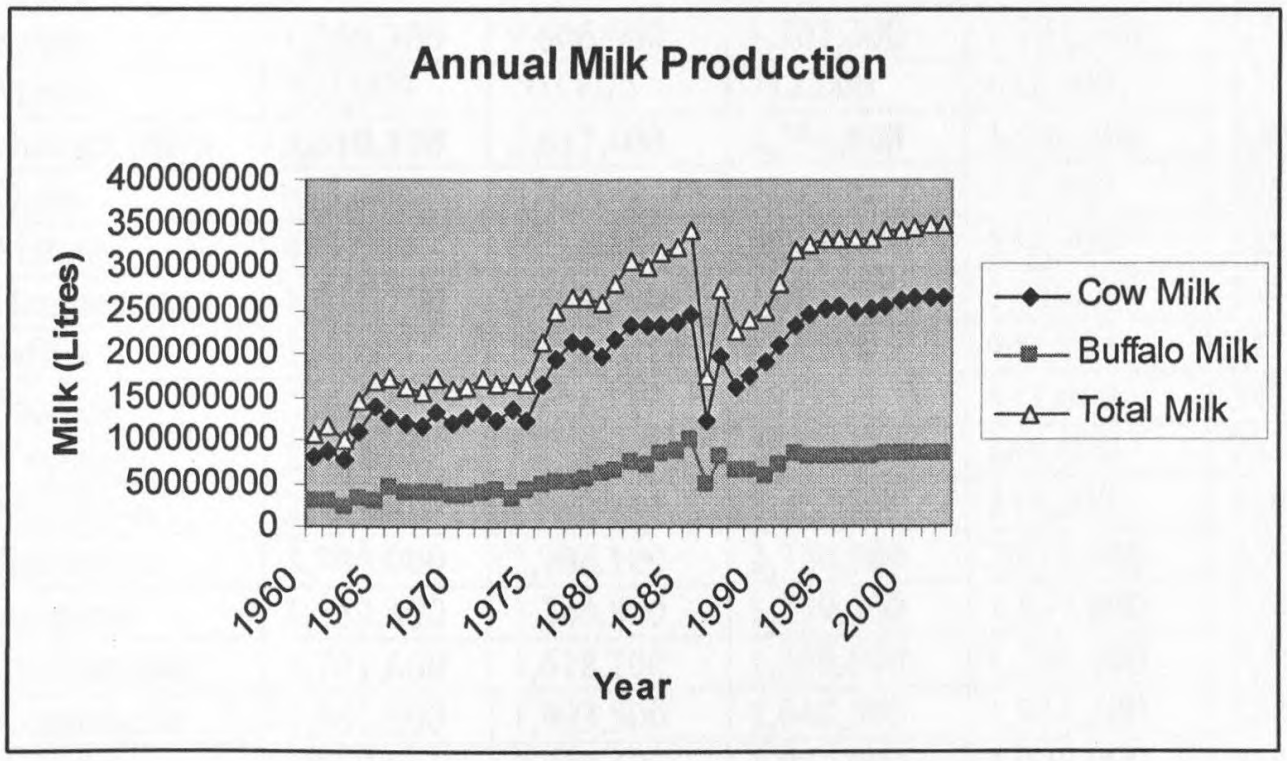

Figure 4: Annual Milk Production 1960 - 2000

According to the monthly average milk production of the country ,the highest production was reported from Nuwara-Eliya where most of the crossbreds were reared. Further, available data indicated that some areas of the country were taking a lead in milk production and Nuwara-Eliya recorded the highest with some other significant districts like Batticaloa, Hambantota, Anuradhapura, Ampara, Badulla, Kandy, Kegalle, and Polonnaruwa . The civil conflict in the North and East, initiated in the 1980's severely affected the development of domestic milk sector especially in Jaffna. (Table 9). According to 1996 data the remaining districts represented around 30% of the annual

milk production of the country (Appraisal of the Sri Lanka Dairy Sector, Main Report, 1999).Moreover, in mid and hill country small holders were the major milk producers, many of whom included dairy in their farming enterprise mix through help from national long term credit programme of crossbred dairy cattle herd improvement. The herd and farm size in Sri Lanka has declined with altitude, but stocking rates per farm has increased implying increased use of off-farm feed sources, derived from coconut or coconut by products (de Jong 1996).

Table 9. Monthly Average Milk Production By District 1998-2002 ,(Litres)

District	1998	1999	2000	2001	2002
Colombo	638,400	630,700	478,000	535,400	688,400
Gampaha	930,900	983,900	991,300	864,500	802,000
Kalutara	835,200	890,900	897,100	895,000	910,400
Kandy	1,566,300	1,606,600	1,707,300	1,791,800	1,741,500
Matale	702,900	703,600	712,000	638,400	634,200
Nuwara Eliya	**3,610,100**	**3,617,400**	**3,751,500**	**3,948,300**	**3,857,600**
Galle	615,500	618,900	626,400	630,500	596,500
Matara	483,100	513,500	529,100	531,600	525,800
Hambantota	1,415,100	1,484,700	1,564,300	1,439,200	1,492,300
Jaffna	524,600	594,700	487,900	490,600	517,000
Mannar	300,600	248,600	289,000	432,600	347,600
Vavuniya	239,400	242,300	264,400	265,600	235,100
Mullativu	216,200	216,200	216,200	216,200	216,200
Batticaloa	**3,300,000**	**2,996,100**	**2,724,300**	**2,879,800**	**2,918,000**
Amparai	1,352,400	1,344,800	1,559,600	1,634,800	1,601,900
Trincomalee	1,701,600	1,618,200	1,369,600	1,396,500	1,422,500
Kurunegala	1,861,800	1,903,500	1,948,500	1,911,100	**2,082,300**
Puttalam	990,000	1,008,500	1,055,000	1,030,000	913,800
Anuradhapura	1,967,800	1,979,300	2,117,400	2,293,400	**2,203,400**
Polonnaruwa	1,101,800	1,156,500	1,172, 300	1,144,000	1,149,500
Badulla	1,708,400	1,843,400	1,886,100	2,014,800	2,069,500
Monaragala	938,200	934,500	1, 016,300	697,600	720,600
Ratnapura	623,200	614,700	635,600	609,200	605,700
Kegalle	472,800	458,200	461,000	401,200	398,500
Mahawelli H	263,400	269,600	267,300	268,300	323,200
Kilinochchi	88,700	88,700	88,700	88,700	88,700
Total	**2,8448,400**	**28,568,000**	**28,798,200**	**29,049,100**	**29,062,200**

Source: Department of Census and Statistics

Note: Figure based on returns furnished by Grama Niladharis;

However, the domestic milk sector of the country has not reached its maximum potential even though the government is supporting dairying principally through several smallholder development programmes. According to several studies done,livestock extension service, veterinary service, as well as dairy market channels are weak and this impedes the enhancement of domestic milk sector (Appraisal of the Sri Lanka Dairy Sector, Main Report, 1999).

2.2.3 Dairy Production Systems of Sri Lanka

This can be classified by breeds and husbandry practiced, as related to agro-ecology and climate of the country. There are four major agro-climate/land use zones namely, up and mid country, the coconut triangle, the wet lowland, and the dry low land (Table 10, **Figure 5**). In all zones the highest number of cattle and buffaloes were found in the dry lowland, where herd size were also high (Table 11).

Table.10 Cattle and Buffalo Systems: Topography, Climate and Animal Husbandry

Zone	Elevation (m)	Rainfall (mm)	Tem ©	Animal types	Husbandry Practices
Up and Mid Country	>450	>2000	10-32	Pure exotic and crosses; some Zebu crosses	Zero grazing small herds; some tethering
Coconut triangle	<450	1500-2000	21-38	Crosses of exotic breeds. Zebu types. Indigenous animals and crosses. Buffaloes	Limited grazing. Tethered under coconut palms. Medium size herds.
Wet lowlands	<450	1875-2500	24-35	As above	Limited grazing. Medium size herds
Dry lowlands	<450	1000-1750	21-38	Indigenous cattle. Zebu cattle and their crosses. Buffaloes	Free grazing, large nomadic herds. Sedentary small herds in irrigated schemes.

Source: Appraisal of the Sri Lanka dairy Sector, Synthesis Report

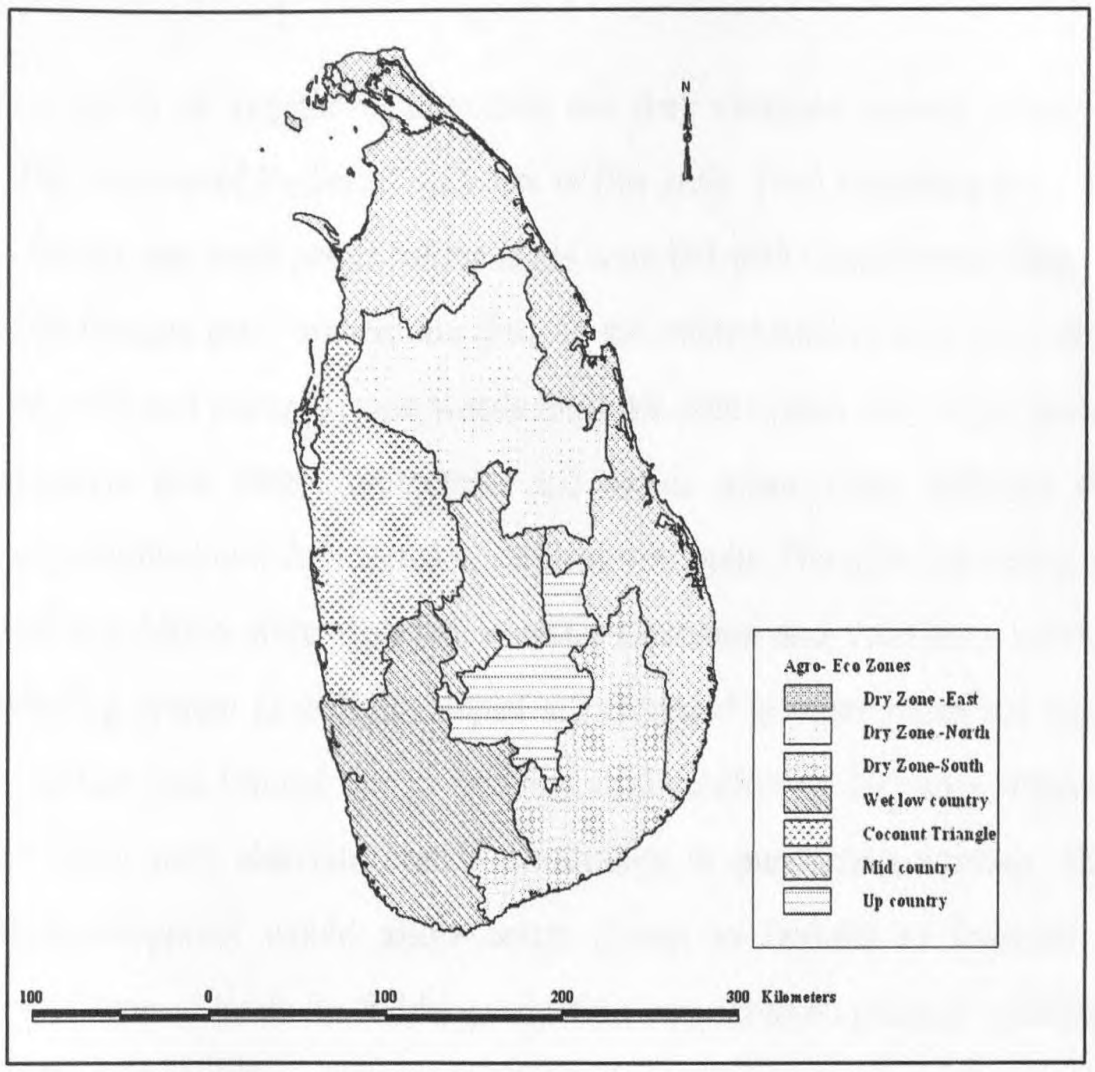

Figure 5. Approximate Agro-Ecological Zones by District

Table.11 Approximate Number of Cattle and Buffaloes in each Agro-Ecological/Land-use Zones

Zone	Cattle	% of total	Buffalo	% of total
Up and Mid country	121,000	7.80	21,700	2.89
Coconut triangle	177,000	11.40	73,000	9.7
Wet lowland	142,000	9.19	137,300	18.2
Dry lowland	1,104,000	7.15	518,900	69.1

* Estimated from Livestock Data, DAPH ,June 1997

2.2.3.1 Upcountry: Tea Estate Dairy/Market Vegetable System

This is situated above 1200 meters of mean sea level. Here the cattle were kept under two systems as estate and village based system. In the estate based system, some European breeds like Ayrshire, Friesian , Jersey and their crosses were reared. Many breeds were kept in enclosed sheds and average milk yield per cow was about 10.3 litres/day or about 2500 liters/cow/lactation. In village based system majority of livestock farmers were

engaged in paddy or vegetable cultivation and they obtained organic manure by cattle rearing. The number of buffaloes was few in this zone. Feed resources were limited but however fodder and weed plants of tea lands were fed with concentrates. More than 60% of the cattle farmers used concentrate feed. In the estate-based system dairy farmers own little or no lands and depends upon weeds from the estate lands and fodder gathered from near waterways and other commercial and public areas. Loan facilities for buying animals were limited and the extension services was poor. The milk collecting companies like Nestle and Milco were engaged in some extension and veterinary services. Here, milk marketing system is well developed as compared to other zones but expansion of dairy production was limited due to feed and land constraints. However improvement to access of credit may alleviate certain constraints in purchasing animals. Further co-operative development would allow better access to farmers to livestock services. Allocation of unused lands for fodder production was another option of uplifting dairy in this zone (Ibrahim, 1999).

2.2.3.2 Mid Country: Kandyan Garden System

The highest proportion of dairy cattle (75%) and pure bred (25%) are in this zone. This zone was characterized by medium intensity dairy production, where daily average milk production was around 6 litres/cow. Artificial insemination (AI) is widespread in the zone and it appears to be increasing. Feed resources was not a severe constraint as in the up country, but about 50% of cattle farmers used concentrate feeding. However there is little incentive for more intensive feeding due to low price for milk. Cattle and buffaloes were often tethered or grazed on paddy lands/bunds of the area. The 'ande' system of cattle loaning contributed much in increasing the herd number in the zone. A number of well-established dairy co-operatives provided services such as concentrate feed on credit, and in some cases AI facilities and loans. Inefficient feeding system and poor extension services were the main barriers of increasing milk production here. Local infrastructural difficulties also affected the extension of the area (Appraisal of Sri Lanka Dairy Sector, Synthesis Report, 1999).

2.2.3.3 Coconut Triangle and Wet Lowlands

In the coconut triangle cattle and buffalo formed an integral part of the farming systems helping in weed control and providing manure for coconut lands. Buffaloes were used extensively for draft purposes in paddy cultivation. Cattle and buffaloes grazed or tethered on the fallow paddy fields as well as on the natural pastures under the coconut plantations and other non-cultivated areas in both zones. Farmers supplemented this with grass cuttings from roadsides. Due to the high availability, coconut poonac and some rice bran were often used. Manure of the livestock was normally used in situ or in crops and sometimes sold (Appraisal Report, 1999). There were few variety of genotype of cattle; zebu, cross breed, local and Indian buffaloes. About 56% were local breeds and 20% purebred while rest was crossbred dairy. Jersey , Sahiwal/Sindhi were preferred cattle breeds for crosses. AI is familiar in the zone and was widespread.

The average milk yield was low as compared to up and mid country zones and it is about 4.6 litres/cow/day. Dairy buffaloes were also common in the zone and their milk was generally used for curd with high local demand. Almost all the major collectors were involved in milk collection and the infrastructure facilities are relatively good. In certain areas well-established co-operatives were engaged in milk marketing. Potential of improving production and the industry was higher as compared to up and mid country zones, due to high availability of land and feed. Labour could be considered as a constraint due to proximity to urban areas (Ibrahim, 1999).

2.2.3.4 Lowland Zone

This zone encompasses a considerable variety of settings from sub-humid forest to dry scrub to large irrigated rice growing areas. Cattle were mainly indigenous zebu, although certain crossbred cattle and improved buffaloes were becoming more common especially in Mahaweli areas. According to the data of farm/household survey (Appraisal of the Sri Lanka Dairy sector, 1999) about 70-74% were indigenous and 21-30% were crossbred for cattle while more than 50% of buffalo were improved types. These cattle and buffalo acted as an insurance fund or capital asset for the peasant farmers and where there is a possibility to sell milk, it is becoming an important source of income.

The daily average milk production of the indigenous breeds was less than 1litre/cow, which was very low compared to other zones. Milk prices were relatively high due to high SNF and fat level of milk. Many herds grazed on common land and in the fallow paddy fields and were brought back to the home shed at night for protection. The feeding of rice was common and almost all farmers did not use concentrates.

Milk collection was poor during rainy seasons as animals were moved off from paddy lands. Milk collection mechanism was also not well developed. However in certain areas curd marketing was well developed (Ibrahim, 1999). Under proper market system and with more productive animals there is a possibility of increasing production here.

2.3 Milk Collection:

Milk collection and marketing in Sri Lanka involved many partners. The formal or processed dairy market consisted of small Dairy Cooperatives, large local Cooperatives, district level Dairy Cooperatives, Dairy Cooperative Unions, and some other collecting points and milk chilling centers controlled by above institutions. This mechanism revolved around collecting small quantities of milk from large number of small holders scattered over long distances, who were incapable of finding direct, reliable marketing sources, i.e. direct consumers or retail outlets. Private companies like MILCO, NESTLE Group (IDPL) as well as government-based co-operatives were leading collectors. Informal market procedure was also active and consisted of small private milk collectors, small local processors of traditional dairy products, and small retailers and dairy producers themselves who sell milk directly to hotels, restaurants and boutiques. Although this may entail some transaction cost producer has certain ability of fixing the price at the final agreement of the deal (Ibrahim, 1999).

According to Census and Statistics data milk production of the country was 348,746,400 litres for year 2002. Of this, all major processors or collectors contributed to about 92,043,000 litres. The balance was collected by informal markets and for family consumption. In the formal sector Milco/Kiriya has collected 47,830,000 litres of total of 92,043,000 litres. However when scrutinizing the milk collecting data one sees that no increment of milk collection has occurred over last few years (1999-2002)- (Table 12).

Table. 12 Annual Milk Collection, 1992- 2002 ('000 litres)

Year	All major Processors	MILCO/ KIRIYA	% of total	NLL/ IDPL	% of total	Others	% of total
1992	90,081	47,211	52.4	34,681	38.4	8,189	9.02
1993	90,981	45,370	49.8	37,349	41.0	8,272	9.03
1994	87,005	44,167	50.7	34,928	40.1	7,910	9.12
1995	97,029	47,622	49.0	40,586	41.8	8,821	9.12
1996	110,105	49,770	45.2	50,325	45.7	10,010	9.09
1997	134,611	77,933	57.8	44,441	33.0	12,237	9.10
1998	100,828	53,369	52.9	38,293	37.9	9,166	9.10
1999	108,863	47,012	43.1	40,079	36.8	21,772	19.99
2000	92,494	43,533	47.0	36,897	39.8	12,064	13.0
2001	102,245	50,296	49.1	38,600	37.7	13,349	13.05
2002	92,043	47,830	51.9	33,480	36.3	10,733	11.66

Source: Ministry of Agriculture and Livestock

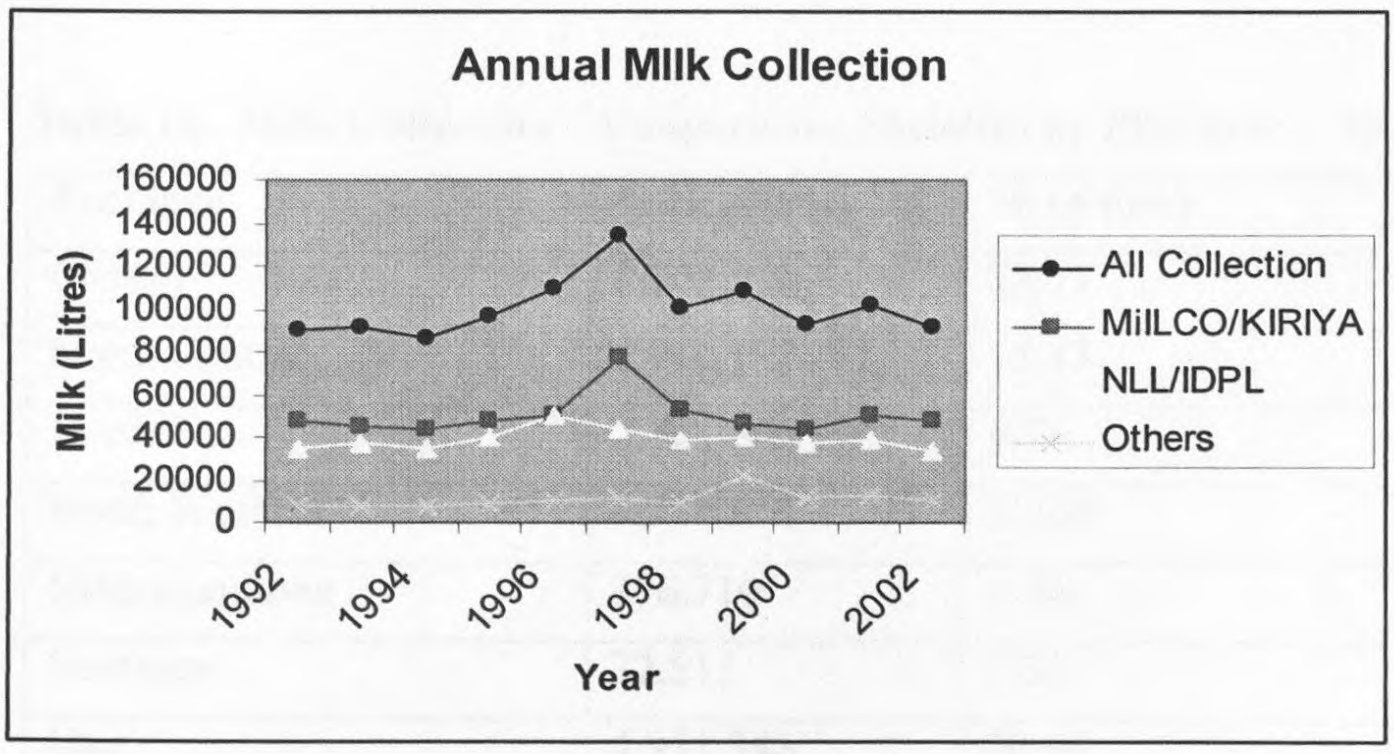

Figure 6: Annual Milk Collection by Sector

The highest portion of fresh milk was collected from Central Province and it was followed by North Central province and North Western province respectively (Table 13).

Table 13. Annual Milk Collection by Province 1998-2002

Province	1998	1999	2000	2001	2002
Central	67,983,700	32,685,391	31,364,674	32,074,461	28,890,790
Uva	42,808,477	10,548,428	9,993,973	10,113,069	9,290,162
Sabaragauwa	3,359,000	1,000,373	927,299	879,102	792,076
N: Central	9,024,300	17,737,727	17,630,768	22,127,085	17,958,873
N: western	11,049,376	11,172,993	11,541,700	11,778,995	11,546,469
Northern	Nil	75,982	20,435	Nil	Nil
Western	11,955,220	4,254,497	3,053,180	3,025,559	3,143,593
Southern	6,952,900	1,684,722	1,941,500	2,595,409	2,631,712
Eastern	21,950,201	5,644,619	5,045,645	6,528,513	5,895,538
Total	**175,083,174**	**84,804,732**	**81,519,174**	**89,122,193**	**80,112,913**

Source: MILCO (PVT) Ltd and Nestle Lanka Ltd
Note: The collection figures for different provinces exclude the milk collected by other processors

The Department of Cooperative Development has collected about 23,824,907 liters of milk for the year 2002. The highest collection was from Central Province, i.e. 6,908,510 litres (Table 14). Well established cooperatives of 300 to 1500 members active in a number of areas in the country handled anywhere from 1000- 7000 liters of milk per day (Appraisal of the Sri Lanka Dairy Sector, Synthesis report, 1999).

Table 14. Milk Collection – Cooperative Societies by Province - 2002

Province	Milk (litres)	% of total
Central	6,908,510	28.79
North Central	3,916,115	16.43
North East	2,321,302	9.74
North Western	4,785,310	20.08
Sabaragamuwa	296,710	1.24
Southern	72,515	0.30
Uva	4,911,345	20.61
Western	613,100	2.57
Total	**23,824,907**	**100**

Source: Department of Cooperative Development

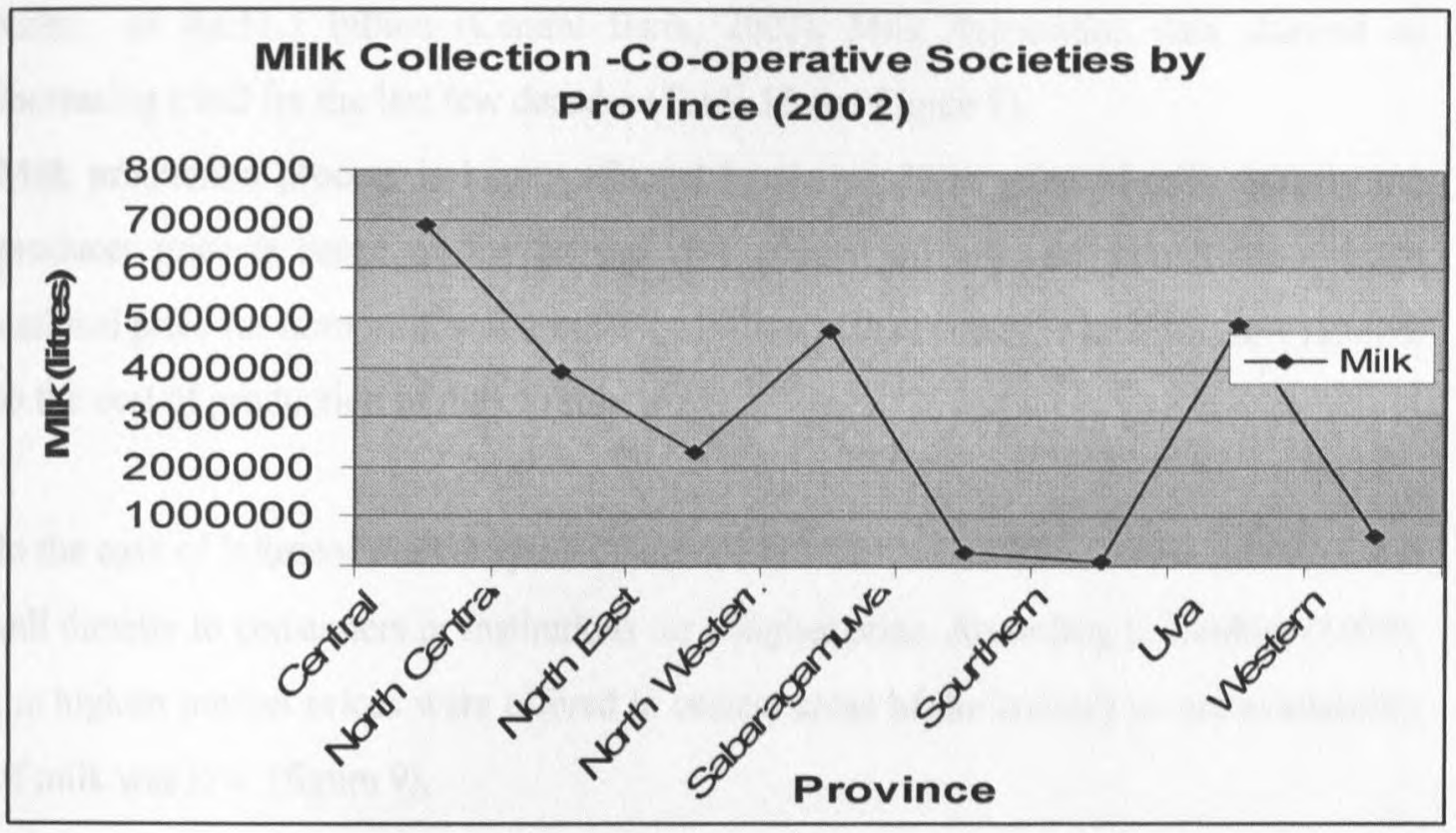

Figure 7: Milk Collection by Co-operative Societies

However, available data showed that the collection mechanism in the country was inefficient and inadequate even though the production shows an increasing trend since 1960. This infers that most of the growth in dairy production has gone to the informal market rather than the formal collecting centers. An extrapolation based on present trend of demand which was based on household data survey, assuming 4% rate of real GDP growth, income and population growth, showed that it will generate a demand of 1,400,000 MT of milk in 2010 from about 698,000MT in 1997 (Appraisal of the Sri Lankan Dairy Sector, 1999).

2.4 Milk Consumption and Importation

The annual per capita consumption of milk of Sri Lanka was 19.87 litres, which is much below the level of 41.6 litres, as recommended by the Medical Research Institute. It has grown by nearly 200% from 13kg/year to 36kg/year since 1981. However, it is somewhat higher than the average consumption of developing countries (32.9 kg/year/capita).

The current supply of domestic sector was adequate only to meet 20% of the country's requirement. So, the country has to rely heavily on imports and during the year 2003, 67,941 metric tons of milk and milk based products were imported incurring an import

value of Rs.11.5 billion (Central Bank, 2003). Milk importation data showed an increasing trend for the last few decades (Table 15 and Figure 8).

Milk production process is highly affected by the producer price of milk. Mostly the producer price is based on the fat and SNF content of milk. At present the average national price for farm milk was around Rs.15/litre in the country, which was low relative to the cost of production of milk (Table 16).

In the case of informal market system the price of milk was different where producer can sell directly to consumers or institutions for a higher price. According to Ibrahim (1999), the highest market prices were offered in coastal areas of the country where availability of milk was low (figure 9).

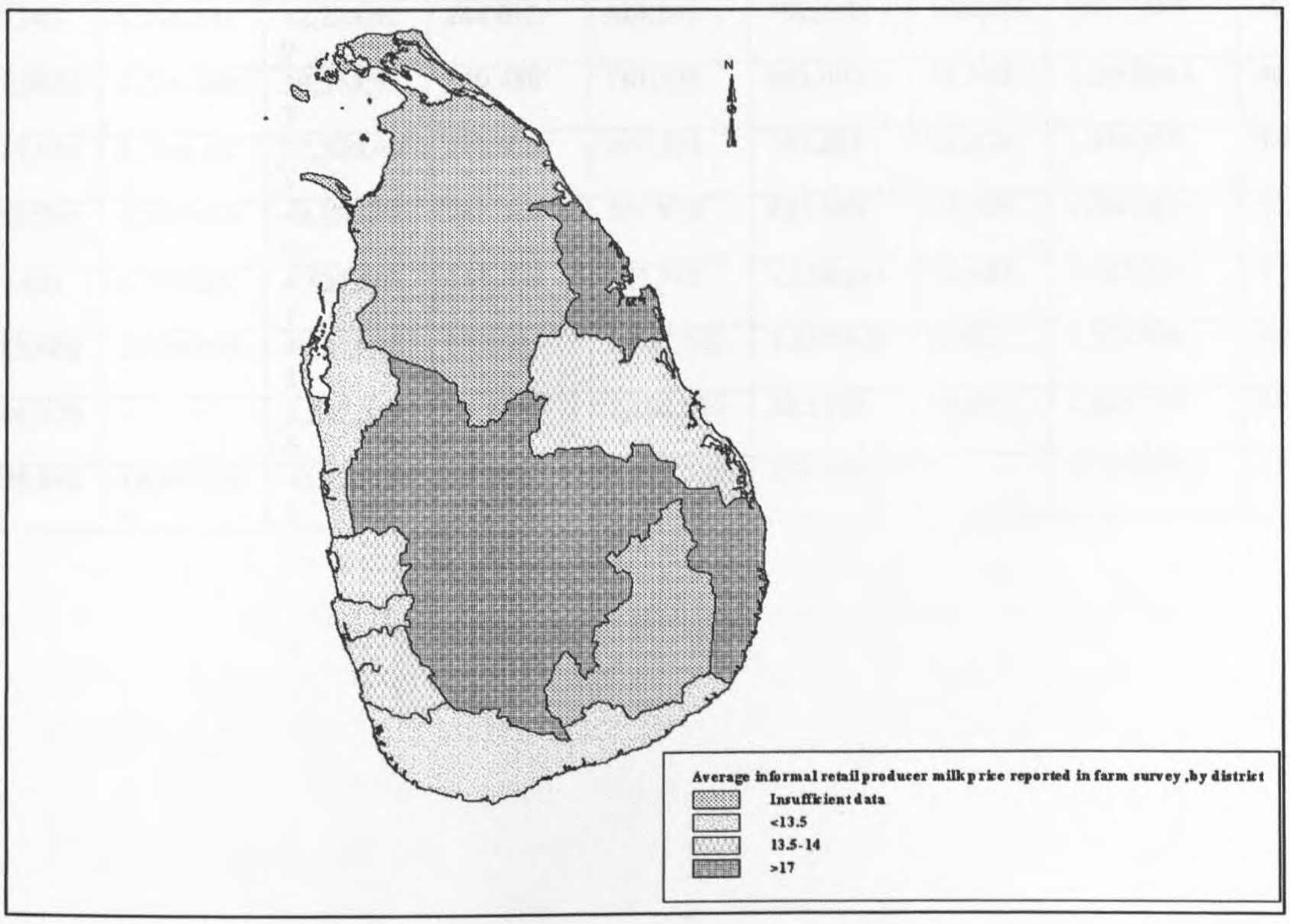

Figure 9: Average informal retail/producer milk price reported in farm survey (source Ibrahim et al, 1999).

Table.15. Import of Milk and Milk Products 1989-2002

Year	Milk &Cream (Kg)	Milk Powder fat< 1.5% (kg)	Milk Powder fat> 1.5% (kg)	Condensed milk (Kg)	Cheese & Curd (Kg)	Butter & other fats & oils delivered from milk (Kg)	Butter & curded milk etc (Kg)	Whey & whey powder (Kg)	Total (Kg)
1989	304,221	3,322,590	31,267,431	194,671	270,188	1,482,679	60,691	-	36,902,471
1990	1,830	3,673,539	2,544,1638	26,979	223,763	823,438	54,771	3,6261,524	66,507,482
1991	3,207	5,590,994	33,747,823	29,355	325,394	2,644,391	277,719	205,175	42,824,058
1992	42,651	3,400,606	25,852,958	239,022	35,1051	2,252,866	28,919	907,125	3,3075,198
1993	2,243	3,734,178	23,112,648	31,245	377,052	953,572	46,042	17,474,302	54,740,318
1994	61,574	8,790,538	36,118,273	447,070	1,636,968	991,548	146,766	880,767	49,07,3504
1995	87,643	4,996,841	42,223,929	284,013	614,536	962,050	108,225	1,007,310	50,184,547
1996	11,9020	4,256,308	38,513,957	309,488	781,125	803,099	54,109	1,,304,014	46,141,120
1997	169,180	4,,114,,023	37,370,491	249,972	706,764	743,561	75,076	1,315,979	4,474,5046
1998	237,005	4,,807064	48,802,776	248,264	801,976	837,145	84,169	1230,023	57,048,422
1999	47,981	5,735633	4,831,5031	165,339	807,781	1,159,261	70,884	1,387,061	5,768,8971
2000	185,080	7,740,405	49,074,368	83,808	1,047,250	1,457,808	5,403	1,538,900	6,1133,022
2001	136,178	-	5,212,5556	76,814	1,190,955	85,1943	19,605	1,025,548	55,426,599
2002	278,888	16,807,549	45,121,,896	74,976	1,046,334	879,460	-	1,583,0743	65,792,177

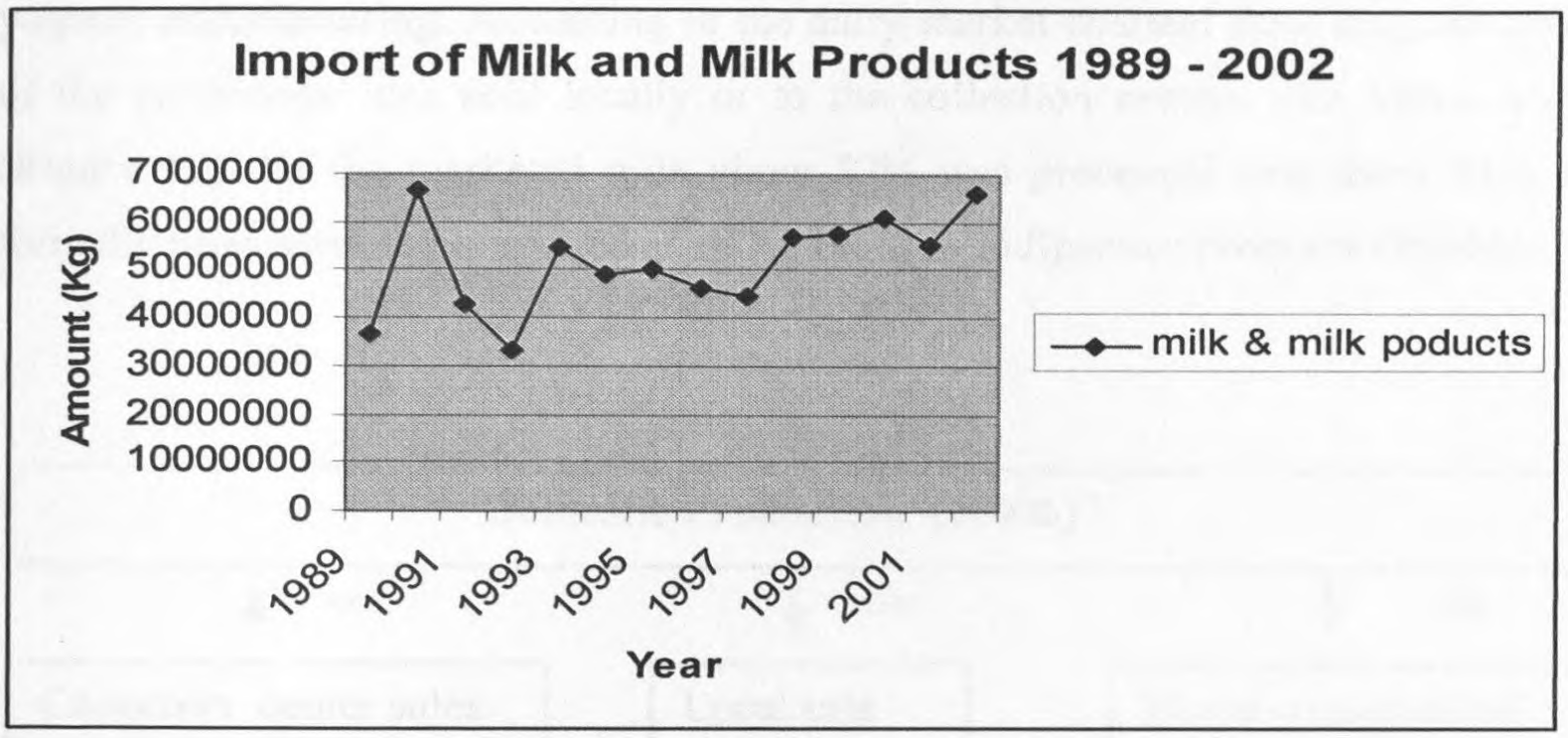

Figure 8: Import of Milk and Milk Products 1989 - 2002

Table 16. Purchase Price of Milk by Milco 1998-2002

Period	Rs. Per Litre
1998 Sep-1999 Feb	12.50
1999 Mar-1999 Sep	13.00
1999 Oct-2000 Aug	13.10
2000 Sep –2001 April	14.03
2001 April –2002May	14.67
2002 June –2002 Nov	15.20

Source: MILCO [Pvt]Ltd
Note: The prices based on Fat 4.2% and SNF 8.4%

2.5 Milk Processing and Market Channels

The milk processing industry comprised of liquid milk processing of locally produced milk and repacking plants using imported milk powder with sometimes combination of local milk. Milco, Nestle Lanka, Ceylon Cold Stores, Lanka Milk Foods and Swiss Cheese Company, Nel Farms, Mini dairies, Coconut Triangle Cooperative Union, Mahaweli Authority, and the National Livestock Development Board were engaged in milk processing industry in Sri Lanka (Appraisal Of the Sri Lanka Dairy Sector, 1999). Imported Powdered Milk was repacked mainly by Lanka Milk Foods and New Zealand Milk Products Ltd. Most of these importing companies were engaged in ice cream manufacturing. Small private milk processing was practiced mainly towards curd and

yoghurt manufacturing. According to the dairy market channel flow diagram about 85% of the production was sold locally or to the collection centers like Milco and Nestle **(Figure 10).** Of the marketed milk about 52% was processed and about 34% was not formally processed and marketed as raw milk or as indigenous products (Ibrahim, 1999).

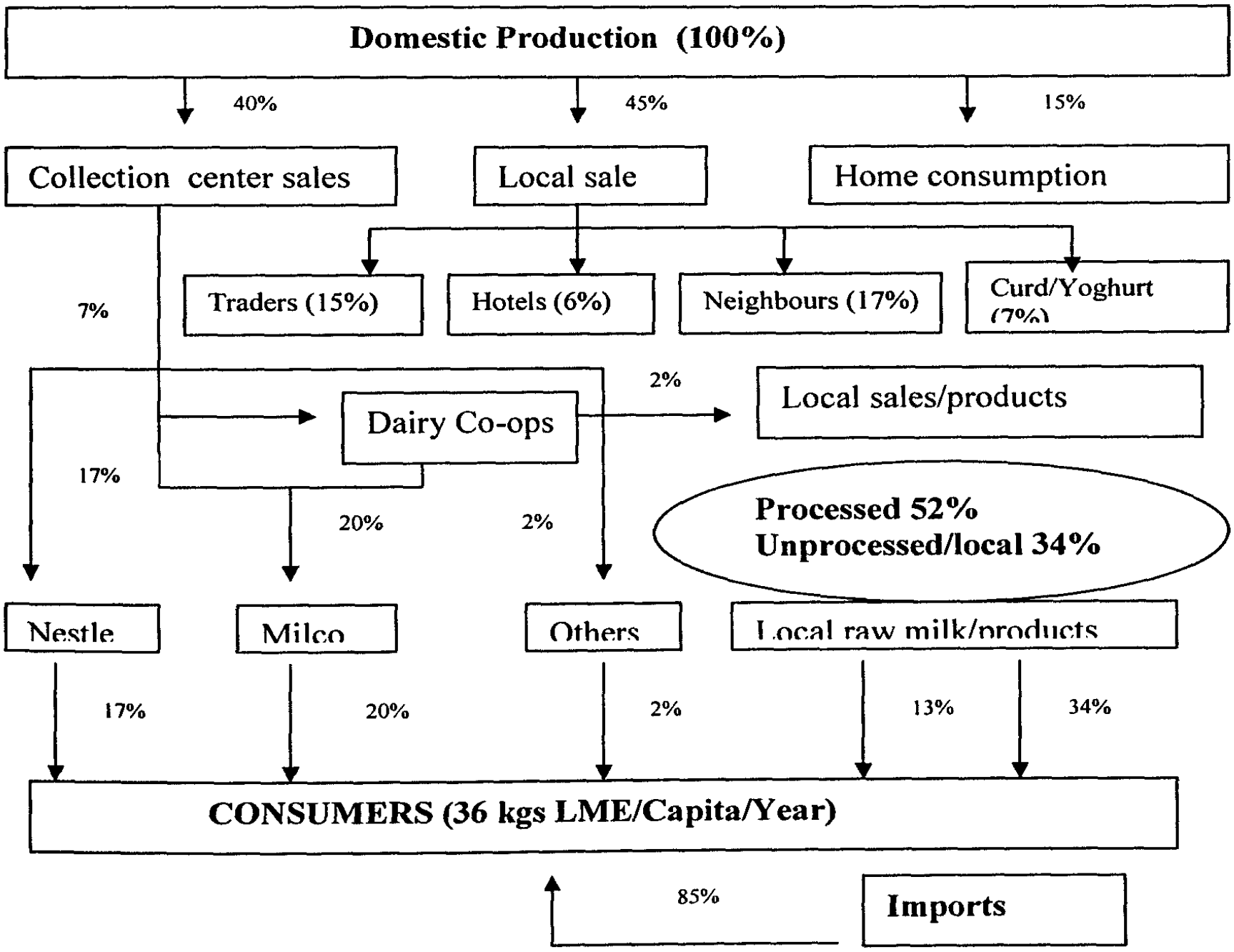

***Figure 10**. Dairy Channel Flow Diagram for Sri Lankan Dairy Sector, (expressed in terms of percent of milk production).*

2.6 Milk Market and Consumer Behaviour

Ibrahim et.al. (1999) reported that an average household spends about 4.3% of the household income on milk and milk products. Of this 20% was spent on liquid milk, 62% for powdered milk and the rest for other milk products. Further findings indicated that a positive relationship existed between income and expenditure for milk and milk products. Results showed that the demand for liquid milk is likely to increase with increase in per capita income. Findings also suggested that consumers perceive milk powder as an inferior good compared to fresh milk.

2.7 Labour Supply

As the livestock and dairy sub sector of the milk sector were established in the rural sector (about 70%), mostly women participate in dairy activities. In certain areas women lead the industry while engaging in their day-to-day activities. Moor (1989), Mendis (1989), showed that this was prominent in the coconut triangle and wass mainly a rural small holder based, with members of the family managing cattle and buffalo rearing during their free time. There was no hired labour usage in rural levels except for a few commercial level farms in the country.

2.8 Feed Resources

Feeding is one of the major issues affecting the milk quantity and quality . Feed affects the health status of the animals, which reflects on the profitability of the dairy business. Sri Lanka lacks quality feed throughout the year and this is a severe problem in the domestic milk sub sector, especially at the smallholder level (Ibrahim, 1999).

There are certain natural grazing lands in the country, but these are low in digestibility and crude protein and dry matter production especially in the dry seasons (Table .17). Moreover, high opportunity costs of labour impeded the feasibility of improving intensive use of planted and cut and carry fodder system due to low return from milk. The value of one litre of milk sold at farm gate price was only one thirteenth of a days wage; which was very low as compared to India, which is approximately 1 to 4 in ratio. This low labour gain affected other feed items like cut rice straw, rice weeds and others

(Ibrahim, 1999). Further the low-income generation hindered the affordability of concentrate feeding for the animals.

Table 17. Locations and Areas of Natural Grazing in Sri Lanka

Location	**Hectares**
Dry Zone (non irrigated)	400,000
Coconut Plantation	140,000
Hill country Patana Lands	55,000
Fallow Paddy fields	30,000
Homestead Gardens	20,000
Road sides/Railway establishments	5,500
Others	5,500
Total Area	**655,500**

Source: Appraisal Sri Lanka Dairy Sector, Main Report, 1999

2.9 Veterinary and Extension Services

The Veterinary Research Institute of the Department of Animal Production and Health bears the responsibility of veterinary services, like research, vaccine production, and animal disease diagnostic services etc (Table 18 and 19). In veterinary services, female veterinarians can do a better role in domestic level as women played an important role in livestock production in the rural sector. The available data showed that about 42% of the present veterinarians were females (Ibrahim, 1999). The extension service is aimed at feeding, animal husbandry, and breeding. Veterinary surgeons, livestock officers, and livestock development officers, attached to the Department of Animal Production and Health (DAPH) acted as the main extension body. Apart from this certain private companies and producer organizations, such as Nestles, Milco, and individual co-operatives also conducted livestock extension services. Faculty of Veterinary and Animal Science and Department of Animal science, Faculty of Agriculture, University of Peradeniya also supported in research and extension activities. However weak linkages among these institutions affected much on the functioning of the milk industry i.e. more valuable information was not passed on to the small holders of livestock business.

Efficient collaborative mechanism is imperative if one wants to uplift the dairy extension services (Appraisal Sri Lanka dairy Sector, 1999).

Table 18. Artificial Insemination and Other Breeding Services 1986-2002

(number)

Year	A.I	P.D	Reported A.I Calves	Stud Centres	Stud Bulls	Reported Natural Services
1986	50,667	5,243	3,535	62	193	3,098
1987	46,321	3,742	1,164	58	307	2,504
1988	28,131	5,318	2,457	53	310	2,380
1989	36,182	2,742	2,918	52	289	3,000
1990	46,697	6,551	5,426	51	273	1,998
1991	52,790	5,361	6,597	51	232	3,001
1992	66,901	9,441	7,684	34	202	1,438
1993	73,516	8,105	8,186	-	-	-
1994	83,077	11,555	12,207	-	-	-
1995	96,135	14,242	13,592	-	-	-
1996	109,008	20,060	16,183	-	-	-
1997	115,418	22,152	21,245	-	-	-
1998	122,480	26,105	27,409	-	-	-
1999	116,720	23,769	27,318	-	-	-
2000	131,389	44,286	37,891	-	-	-
2001	134,919	51,715	41,372	-	-	
2002	125,719	40,614	40,928			

Source: Department of Animal production and Health

Table 19. Number of Artificial Inseminations in Different Provinces 1990-2002

Province	1996	1997	1998	1999	2000	2001	2002
Western	16,119	17,247	17,936	17,430	19,674	20,837	18,762
North Western	20,160	20,494	22,127	22,172	29,817	27,903	28,568
Central	39,757	38,640	40,871	38,641	40,224	41,952	39,443
North Central	10,152	10,041	7,774	6,560	6,949	7,451	6,916
Uva	9,368	10,072	12,547	11878	12,698	13,568	11,107
Sabaragamuwa	5,478	4,651	5,204	5,031	5,949	5,619	4,837
Southern	6,020	,6840	7,218	6,081	7,940	8,682	8,722
Northern	865	6,117	7,254	6,794	8,138	8,907	7,364
Eastern	1,089	1,316	1,549	2,133			
Total	**109,008**	**115,418**	**122,480**	**11,6720**	**131,389**	**134,919**	**125,719**

Source: Department of Animal Production and Heath

3.0 Dairy Industry in Asia

This section presents summary of studies done by Rutherford (1999); Beghin(2006) ; Fuller(2006);Rakotoarisoa and Gulati (2006) ; Schluep Campo and Beghin (2005) ; Lee et al (2005) ; Dong (2005) ; Peng and Cox (2005) on evolving dairy markets in Asia and their economic implications.

Recent structural changes in dietary patterns in Asia resulting from economic development has resulted in increasing pressure on the existing production system in non ruminant meat, non ruminant meat and milk. This has significant policy implications for the countries in the region in terms of the self sufficiency goals in these commodities and the associated inter and intra regional trade opportunities in the future (Rutherford,2005). Forcasts of milk between years 2000 and 2010 revealed that India, Laos and Pakistan will be self sufficient in milk production with the possibilities of Indonesia, Thailand and Cambodia becoming self sufficient if current trend continues. The nature of milk production in South and SEAsia is much varied and overall milk production per capita varied widely from a wide range of sources (including cattle, buffalo, goats and sheep) which reflects the relative numbers of each livestock source. For example, the range of milk production in 1993 was from 130 kg/capita in Pakistan (largely from buffalo) and 70 kg/capita in India (cattle and buffalo) tp 1 kg/capita in the Philippines (cattle and buffalo). For countries where pasture and grazing land is scarce , the dairy industry is an important source of beef and veal in addition to milk production (Reeves and Hayman, 1975).According to them dairying is not a major industry in most of the developing countries in Southeast and South Asia. In countries such as Malaysia, Philippines and Thailand domestic milk production is supplemented with imported products to satisfy domestic consumption requirements. The domestic milk production has increased significantly in Laos and Indonesia –via the importation of quality breeding stock , improved management and artificial insemination programs.Most of the traded products in this region are imported from countries such as Australia, New Zealand and the European Union where some intra –regional trade occur. For example, Malaysia,

Indonesia China and Thailand export fresh and dry milk whilst India export dry milk although they are net importers of milk. However Asia will remain a large net importer of dairy products (Dong,2005; Podbury et al.,1995; Rae,1997; Rutherford, 1999).

Maintaining and increasing dairy self sufficiency in Asian countries may occur only at the expense of feed grain self sufficiency. When the necessary expansion of feed grain is constrained , as in the case of much in Asia , the reliance on imported feed grain increases (Hayami etal,1976; Hooke,1989). For example, in the Philippines the value of imports of feed grains (excluding unmilled cereals) quadrupled from 1985-1989 amounting to 13.5% of the total value of agricultural imports (Costales,1990).

Dependence of feed grains in Asian countries has reduced owing to the availability of agro-industrial by products supplementing feed grains, forage, pasture grasses , tree fodder and crop residues.For example, locally available agro industrial by products such as molasses , copra meal and bran , starch processing wastes and brewer's dried grains are available directly from mills in the Philippines. Feed lots in Malaysia also rely on palm kernel cakes a more expensive, higher protein by product of palm oil industry and pineapple wastes from pineapple industry. However, the suitability of by products as ruminant feed sources is often limited by insufficient availability due to seasonality of crop production and higher moisture contents of the by products.Further the opportunity cost of utilising such by products in these countries is also high.For example, copra meal and palm kernel cakes can be exported as livestock feed sources to Europe. Competition has increased between the users pf palm kernel cake in Malaysia , namely domestic feed lots and overseas intensive feed suppliers. As a result, feed lot input costs have risen and the viability of feed lots based on palm kernel cake has declined.

The lack of development of industry support terms of infrastructure (cattle holding, cattle feed transportation and shipping, processing facilities) and marketing expertise in a number of Asian countries is another problem of developing livestock markets in the Asian countries (Lemke, 1993).For example, in Indonesia , post harvest losses are between 5-20% for meat, eggs and milk whilst mortality and loss of live weight during transport have been estimated between 1-3% and 7-10% respectively (Directorate General of Livestock Services,1992). The marketing of livestock and livestock products in Asia's developing countries is often handicapped because of dispersed nature of

production and the associated need to assemble supplies from many small farm holdings , transport discontinuity between locations, inadequate transport infrastructure and refrigeration facilities and a large number of market intermediaries (Unnevhr,1991; Anderson, 1992, Rae etal., 1992). In addition ,many Asian countries suffer from one or more factors hindering their competitiveness in dairy (tropical climate, land, feed scarcity, labor cost, transaction/transport costs).These handicaps explain their net dependence on world dairy markets.

The countries competitiveness are also conditioned by distortions affecting world market prices (Kehren and Tisdell,1998; Peng and Cox, 2005; Podbury et al.,1995). Rakotoarisoa and Gulati (2005) indicated that India could be a competitive exporter of dairy products if Asia liberalized dairy trade by exporting its milk powder to Indonesia, Malaysia, Philippines and Thailand which are large importers of milk powder.Among Asian countries Japan's trade impediments have the largest depressing effect on world market prices faced by Asian countries. Protection in other OECD countries such as EU,Canada, US has a similar distorting effect. If all countries liberalized their dairy markets , India and China would export milk to world markets with higher world prices.The competitiveness ranking of Peng and Cox (2005) is India, China, Other South Asian region (Afghanistan, Bangladesh, Bhutan, Maldives, Nepal, Pakistan and Sri Lanka) ; South East regions (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Phlilippines, Singapore, Thailand and Vietnam); Korea, and Japan. In China the tremendous rise in dairy demand has been driven by several mutually reinforcing factors such as rapid income growth, promotion by the government and dairy industry, changes in urban lifestyle, and development of new, more sophisticated marketing channels.The domestic milk output in China has grown largely by increasing the dairy herd. Substantial increase in milk productivity has been achieved through technology adoption, but inefficiencies has been created due to adaptations of marketing rules, infrastructure, and institutions which did not kept pace with changing environment (Fuller et al, 2006).Although India has become the world's largest milk producer its dairy industry lacks market access. Further , India's dairy products lacks export competitiveness (Rakotoarisoa and Gulati, 2005). In Japan consumption of dairy products has evolved with increasing individual consumption of cheese and fluid milk and the consumption of

butter and milk powder has been stagnating. The higher consumption of cheese is related to increasing consumption of convenience and processed foods. The increase in per capita consumption of milk in Japan is linked to decline in real dairy prices, rise in incomes, change in tastes, and information availability.The Japan's dairy supply is still isolated from world market due to high protection , high transport costs and perishibility of fluid milk (Schleup Campo, Beghin, 2005).Dairy processors have been handicapped by high price of milk, and are not very competitive.Raw fluid milk supply has expanded through substantial yield increases although cost of production is high and dairy farms inefficient.

The future self sufficiency of livestock and livestock products in Asian countries may also be related to the trend in the political environment of these countries. The lack of domestic policies in terms of technological advances in livestock production and growth in demand of feed etc. is likely to lead to an increasing reliance on imported livestock products.Asia is now the largest beef and lives cattle importing region of the world.Live cattle imports are generally favoured over imports of livestock products (beef , milk) via differential tariff and quota policies. The main impetus for such policies is the ability of live cattle to contribute more to domestic value adding than beef or milk imports. This also overcome problems associated with lack of transport ,refrigeration, and other infrastructure facilities.Smaller number of cattle are imported for breeding purposes to boost milk production in the longer term.

The continuation of these policies is likely be given the outcome of the GATT agreements. In general GATT involves neutralising incentives for exports and imports via the removal of import quotas and other quantitative restrictions of their conversion to tariffs; subsequent reduction of the level and dispersion of import tariff rates; compensatory devaluation of the domestic currency; and removal of or reduction of export taxes. For many Asian countries these measures typically formed the core of comprehensive structural adjustment measures adopted to conditional finance available from multilateral financial institutions such as the World Bank and the International Monetary Fund (Shafaeddin, 1994).Goldin et al. has predicted a modest increase of 5.1% in the prices of dairy products due to GATT trade reforms.However Hooke (1989); Granaut and Drysdale (1994; Wu (1995) has indicated that special bilateral agreements

or regional trade agreements will evolve between Asian countries and some of the larger OECD countries which would offset some inflationary effect on prices of livestock products. Dairy markets are among the most distorted worldwide,especially among OECD countries. Japan and Korea typify these highly distorted markets with a complex system of international trade barriers (tariffs, tariff trade quotas) and domestic support (Lee etal,2005; Peng and Cox,2005).Trade barriers is a major form of protection in Asian dairy industries. However these protection has declined due to various causes.Indonesia removed the trade barriers in 1998/99 through structural adjustment policies (Fabiosa,2005).India has reduced its trade barriers over last 20 years (Rakotoarisoa and Gulati,2005).China a member of WTO has also reduced its tariff on dairy products (Fuller, et al.,2005).Other Asian countries being members of WTO reduced their border protection.However some barriers of trade for dairy products are yet operational in Asia.

Trade liberalization would help rationalize domestic dairy production in many countries. Domestic use of fluid milk depends on domestic milk production for which natural protection is high because of high transport costs (Lee et al.,2005).In addition the quality of milk produced remains poor due to organization and structural barriers.For example, milk quality and sanitation remains a major problem in Indonesia because of rigid cooperative structure and lack of basic traceability of milk quality for individual products.

According to Peng and Cox (2005) with regional and global trade liberalization the average price paid for dairy products would fall in Asia. Asian consumers in high tariff countries would benefit from liberalized regional trade through lower prices paid for their dairy products except in India and lesser extent in China where the prices would rise with trade liberalization.As Asian consumers demand for dairy is not price responsive (inelastic) , the lower consumer prices would translate in welfare gains to consumers rather than substantial expansion in consumption. Quality and product choices may improve in India and China with trade integration. These improvements also translate into welfare gains for Asian dairy consumers.

Despite trade barriers Asian dairy markets are dynamic both on the supply and demand of milk with high growth potential (Cox and Zhu,2004; Nin Pratt,2005). Innovations in food processing and structural changes in industrial organization also contributed to sector dynamism (Fuller, 2005). In China new value added products with low trade barriers such as dry whey, lactose are produced. The traditional milk products such as milk powder and butter oil has expanded trade opportunities with new innovations which convert them in to final products after importation.With emergence of vertical integration procurement, processing and other logistics of milk has led to significant growth of direct foreign investment. Such changes in the dairy industries are fostered by transformation of food retailing with large retailers creating a new interface between producers and consumers. This has become a driving force in countries such as China and India.In Indonesia the upper middle income class in urban areas is leading dairy consumption growth (Fabiosa, 2005). Asian dairy consumption has been expanding with income growth, changing demographics and changes in dietary pattern (Fuller et al., 2005, Pingali,2004). Income growth and demographic changes explain nearly 60% of dairy consumption expansion in Asia (Dong,2005). Global consumption patterns show that as income increases the consumption of animal proteins (fish, meat and dairy) increases (Pingali, 2004; Seale et al., 2003). Asian consumer demand for dairy seems to be responsive to income rather than prices (Dong, 2005; Fabiosa, 2005); Fuller et al., 2005; Lee et al.,2005).The emergence of cheese consumption in Asian diets follows changes in dietary patterns of consumers with changes of urban income levels. Inclusion of milk fat in diets of Indian consumers is a change in dietary patterns of consumers. However the milk fat consumption in India is still below that of developed countries (Dong, 2005).Many Asian consumers suffer from lactose intolerance .Hence the consumption of fluid milk and milk fat is likely to remain low than in other countries with comparable income and demographic characteristics (Schelup Campo, and Beghin,2005; Dong,2005).

The promotion of dairy production in Asia has often degenerated to protectionism. Trade liberalization and removal of domestic support tend to induce pro-competitive effects to improve quality , variety and competitiveness of dairy products as in Australia and East Europe. These are effective ways for emergence of Asian dairy

markets.Dairy industry specific policies could foster international technology transfer through better genetic stock and feed , promote human capital in dairy regarding feed and sanitation ,and lead to structural change for quality improvements of dairy products (Beghin, 2006). Dairy yields are low in Asia and macro and trade policies are important to ensure FDI and knowledge transfer. Policies in reducing transaction costs (transport, refrigeration) are also important for dairy industries. India has some potential to supply milk powder in addition to countries such as New Zealand, Argentina, Chile and Brazil the newly emerging dairy export markets. With the removal of dairy subsidies by EU countries large dairy supplies will be removed fro world markets.

CHAPTER 3. METHODOLOGY

3.1 Data Collection

The study was focused mainly on the primary data collected at field level. After scrutinizing the demographical and other characteristics related to fresh milk production and consumption pattern of milk in the country five districts, which could represent all the three zones of the country were selected purposely. Nuwara Eliya, Matara , Colombo, Gampaha ,Kegalle were selected in representing the wet zone; Anuradhapura, Polonnaruwa,Moneragala for the dry zone and Kurunegala ,Badulla for intermediate dry zones respectively. From each district 2-4 A.G.A divisions were purposely selected and were finalized after discussions with the key government officers in the district such as assistant government agents, directors in planning, veterinary officers, and agricultural officers. From each A.G.A divisions 2-4 Gramasewaka divisions (GS) were selected randomly (Table 20 and Figure 11)). Households were interviewed randomly from each Gramasewaka division giving consideration for higher number of households from urban areas where demand for milk is higher and the population size was larger as compared to rural and estate areas. Higher number of households were selected from estate sector in Nuwara Eliya district where milk production in estates or estate workers played a major role in the industry. In Colombo and Matara more households were interviewed from urban sector and in Anuradhapura and Kurunegala both urban and rural sectors were considered in equal proportions. In total, 600-650 households were interviewed from all ten districts with a minimum of 60 households from each district (Table 21).

A pre tested structured questionnaire was used in household survey in collecting primary data like demographic characteristics, socio-economic characteristics, milk consumption and production data and other.

The required secondary data, especially the data regarding the milk importation and prices were collected from government agencies like Department of Census and Statistics, Ministry of Agriculture and Livestock, Livestock Planning Unit , Department of Customs and Central Bank of Sri Lanka.

Table 20. Selected Districts and A.G.A Divisions

District	**No. A.G.A Divisions**	**Selected A.G.A Divisions**	**Gramasewaka Divisions**
Nuwara - Eliya	05	Kothmale	Sangilipalama (471A), Pundalu-Oya North (468 E), Ramboda (472), Helboda (474J)
		Nuwara-Eliya	Nuwara-Eliya East (535H), Nuwara Eliya North (535L)
Colombo	09	Hanwella	Seetagama (432-F), Awissawella (432), Aradanakanda (432-E)
		Moratuwa	Moratumulla-East (558), Moratumulla West (558 –B), Telawela-North (549-B)
Matara	12	Weligama	Kapparagoda (386C). Kapparagoda (386), Weligama East
		Matara Four Gravets	Kadaweediya-South (417-B), Walpola (417-C), Tudawa-East (420-C)
Anuradhapura	10	Nuwaragampalata Central	I stage 1st part (248), I stage 2nd part (249)
		Kahatagasdigiliya	Kokmaduwa(201), Mahamassalewa (230), Kahatagasdigiliya-West (232)
Kurunegala	18	Mahawa	Munemalgamuwa (156), Digana(158), Atewerale (157), Daladagama (196)
		Kurunegala	Kurunegala North (834), Gattuwana(833)
		Mawathgama	676 Mawatagama North, 677 Mawathagama South
Monaragala	10	Moneragala	Viharamulla(129F), Tissa para, Nakkala
		Kataragama	Kandasunrindugama, Kataragama
Polonnaruwa	06	Polonnaruwa	Ganamgolla(161), Kaduruwela west (183), polonnaruwa town(172), Samagipura (54)
		Hingurakgoda	Higuhrakgod(74), Jayanthipura(48)

Gampaha	13	Dompe	Kirindiwela(385), Kapugoda(418A), Pugoda(422)
		Minuwangoda	M-central(125), m-east(137), Ambagahawatte(126/3)
Badulla	08	Weliamada	Dikpitiya(58), Diyarabaa(58D)
		Badulla	Hegoda(79), Badulupitiya(78), Kailagoda(78G)
Kegalle	10	Kegalle	Golahela(51E), Higgoda(A59)
		Dehiovita	Dehioita(159B), Vellangala(125A)

Table 21. Districts and Sample Size of Each District

District	**Sample Size**			**Total**
	Urban	**Rural**	**Estate**	
Nuwara-Eliya	20	04	38	62
Colombo	40	23	0	63
Matara	40	22	0	62
Anuradhapura	31	34	0	65
Kurunegala	32	27	05	64
Monaragala	40	20	0	60
Polonnaruwa	29	30	0	59
Gampaha	38	20	0	58
Badulla	30	29	4	63
Kegalle	25	20	9	54
Total	**315**	**229**	**13**	**610**

3.2 Analysis of Data

All the possible analysis in sector basis, district basis as well as all island based were used in explaining the findings of the research project. In the case of milk importation econometric analysis was used.

3.2.1 Tabular and Graphical Analysis

Tabular and graphical analysis was mainly used to present the basic results of the study in all ten districts to capture the regional variations of demand for different types of milk and milk products consumed. The milk and milk products were grouped into four categories as fresh milk (FM), Whole milk powder (WMP), other milk (OM), and other milk products (OMP) for analysis (Table 22). Fresh milk contained cow, buffalo and goat milk; WMP contained infant, non fat and full fat powdered dry milk forms while the other milk contained with pasteurized, sterilized and UHT milk and ice-cream, yoghurt, cheese and curd were categorized under other milk products. The analyses were used to determine the relationships between demand for farm fresh liquid milk and its determinants such as demographic variables (age, sex, family size, race) religion, employment characters, income of households, attitudes of households, taste and preferences, distance to milk market, quality of milk and other socio economic conditions. In addition , food balance sheets for each district were prepared based on the above analysis

Table 22. Grouped Milk and Milk Products

Fresh Milk	Whole Milk Powder	Other Milk	Other Milk Products
Cow Milk	Infant Milk	Pasteurized Milk	Ice –Cream
Buffalo Milk	Non Fat Milk	Sterilized Milk	Yoghurt
Goat Milk	Full fat Milk	UHT Milk	Cheese & Curd

3.2.2 Econometric Analysis

The econometric analysis of the household demand for farm fresh liquid milk and other milk products was based on Almost Ideal Demand System (AIDS) model of Deaton and

Muellbauer (1980). The demand system included four commodity items as, fresh milk, whole milk powder, other milk and other milk products. The algebraic form of AIDS can be presented as below:

$$W_i = \alpha_i + \sum_j \gamma_{ij} \ln P_j + \beta_i \ln (Y/P^*) + \theta I \ln S \; ; 1,2,3.....(1)$$

Where,

W_i = average budget share of the i^{th} commodity (eg; farm fresh liquid milk, whole milk powder, other milk, other milk products)

P_j = the j^{th} commodity price;

Y/P^* = real expenditure of milk/milk products;

S = household size, age, sex, and other socio economic variables relevant to demand of farm fresh liquid milk and other products

Deaton and Muellbauer (1980) suggested approximating the price index P* by Stone' geometric price index as shown below

$\ln P^* = \Sigma W_k \ln P_k$,which is price index used to deflate the income

For the AIDS model to be consistent with the properties of individual consumer demand theory, the structural parameters of equation (1) must satisfy, Engle aggregation

($\Sigma\alpha_i = 1$, $\Sigma\beta_i = 0$, $\Sigma\theta I = 0$); homogeneity ($\Sigma j\ \gamma_{ij} = \theta_i = 0$); symmetry ($\gamma_{ij} = \gamma_{ji}$).

Alternatively these restrictions can be tested on the behavioral hypothesis implied by the theory of consumer demand.

The Marshellian demand elasticities corresponding to the linear version of AIDS are;

$$E_{ii} = -1 + \gamma_{ii} / W_i + W_i \quad \text{(own price)} \qquad (2)$$

$$E_{ij} = \gamma_{ij}/W_i + W_j \quad \text{(cross price)} \qquad (3)$$

$$E_y = \beta_i / W_i + 1 \quad \text{(expenditure)} \qquad (4)$$

The systems of demand equations were estimated by using the two stage least square (2SLS) of statistical Analysis System (SAS).

Import demand share equations were used in analyzing the milk imports of WMP and other imports of milk products. These could be specified as ,

$$\mathbf{Sit} = \delta i + \Phi ij\ \mathbf{CIFpjt} + \theta\ iYt + \Sigma k \omega ik\ D_k + \varepsilon_{it}$$

Where,

Sit = volume share of supply of imported WMP and other milk products from importing countries such as Australia, New Zealand, and other importing countries,

t= 1975, 1976,.....2001.

CIFpjt = avearge unit import value(CIF) of imported WMP and other milk products,

Yt = GNP of Sri Lanka for t = 1975-2001,

Dk = dummy variables for months (k= 1 for January, 2 = February..),

ε_{it} = stochastic error term.

The system of equations were estimated by using Cochrane-Orcutt procedure provided in Shazam (White,1997) to account for autocorrelation of order 1 (AR1).

CHAPTER 4: RESULTS AND DISCUSSION

This chapter contains the results of the field survey conducted among sampled households in the wet zone , intermediate dry zone and dry zone districts of Sri Lanka. The wet zone districts comprises of Colombo, Kegalle, Gampaha, and Matara. The dry zone districts were Anuradhapura, Moneragala and Polonnaruwa. Kurunegala and Badulla were the representative district of the intermediate dry zone. The first section of this chapter consists of general results of the field survey followed by the regression results of the analytical model.

Demographic Characteristics

Nearly 87 % of the sampled households were Sinhalese, 13% Muslims and 10% Tamils respectively. Nearly 97% of them were Buddhists, 9% Hindus and 3% Islam. The entire sample from Moneragala were Buddhists .The average family size of households in the districts were 4-5 per household with a variation of 2.7 in Kegalle to 4.75 in Nuwara Eliya (Appendix Table 1). More than 40% of the sampled households obtained their education up to the primary level or higher with the highest in Kegalle (82.3%) and lowest in Anuradhapura (19.2%).The urban sector recorded a higher proportion of tertiary education in the districts as compared to the rural sector (Figure 1;Appendix Table 2).

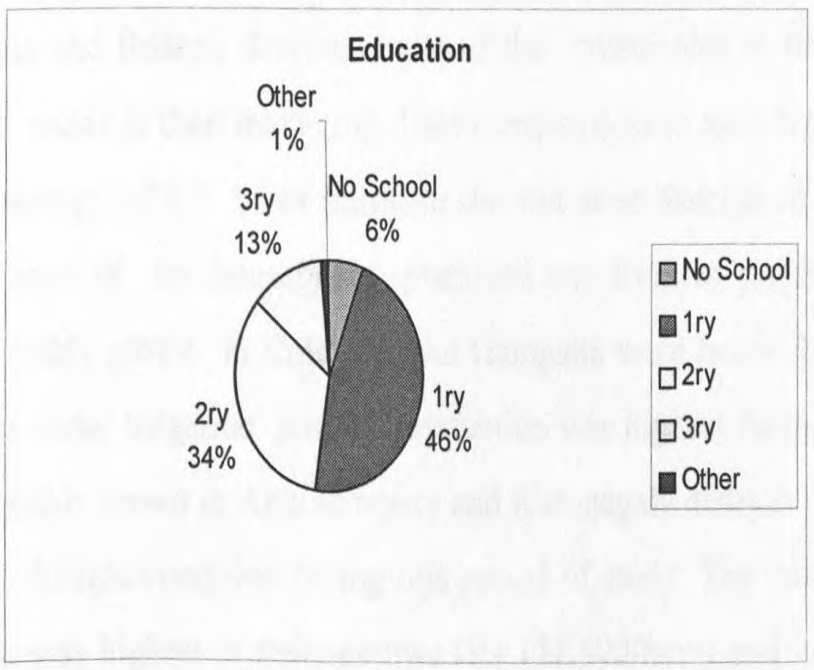

Figure 1 – Educational Characteristics of the Study Districts (% of households)

Majority of the households were employed in the public and private sectors (54%) and most of them worked on full time basis (52%). No part time employees were reported from public sector and the highest number of public sector employees were from Badulla district. Majority of private sector employees among the households was from Colombo district (Appendix Table 3). Among the households only a small proportion were involved in full time farming and self employment. A higher proportion of households in farming was reported from Polonnaruwa and none from Colombo district.

More than 20% of the households in each district were covered by a safety net such as " Samurdhi". The households that obtain "Samurdhi" gets an monthly income of less than Rs 500. This result is an indication of the poverty of the households in the study area.

The average household monthly income was Rs 13498 for all the districts with a minimum of Rs 10384 in Kegalle and maximum of Rs 18255 in Polonnaruwa districts. However an unequal distribution of income is apparent among the rural and estate sectors in all the districts . For example, the average urban household income in Kegalle district was Rs 23645 as compared to Rs 2013 in the estate sector (Appendix Table 4).

Land Use Pattern

The average farm holding of the households was nearly 2.00 acres with a range of 0.16 acre /farm in Badulla to 2.60/farm in Colombo district. With the exception of Moneragala and Badulla districts ,most of the households in the other dry zone districts cultivated paddy as their main crop. Polonnaruwa district recorded the highest paddy extent with an average of 8.2 acres /farm. In the wet zone districts of Nuwara Eliya and Matara districts none of the households practiced any form of paddy cultivation. The average extent of paddy grown in Colombo and Gampaha were below 1 acre. Almost all extent of paddy was under irrigation and the production was highest during the yala season. The low extent of paddy grown in Anuradhapura and Kurunegala districts reported may be due to the prolonged draught condition during this period of study. The income earned through paddy cultivation was highest in Polonnaruwa (Rs 171,500/farm) and lowest in Gampaha districts (Rs 12,600/farm) –Appendix Table 5).With the exception of Moneragala , Kegalle and Gampaha districts none of the other districts reported of any perennial crop production. Cash

crop cultivation (particularly vegetables) was mainly reported from Nuwara Eliya district and perennials from Matara district. (Appendix Table 6, Appendix Table 7).

The average holding size of home garden for all the districts was about 61 perch/household. The highest average holding size was reported from Monearagala and it is approximately evenly distributed in both rural and urban sectors. The lowest was from Badulla , which was mainly due to the estate housing schemes that were limited only to 5 – 10 perch/household. The largest holding size in both sectors in each district was reported from Monaragala district. There was considerable amount of income generated through home gardening. The highest was from Kegalle district, related to the rubber cultivation in the estate sector, and the lowest from Monaragala district. A average household in all the districts earned more than Rs.600 monthly by home gardening. (Appendix Table 8).

Livestock Production

The average farm herd size of cattle for all the districts was about 4 with a cow . The highest number of cattle herd was reported from Anuradhapura and the lowest from Kegalle (Figure 4). The rural sector of the districts had the highest number of cattle/ herd except in Nuwara Eliya where they were reared in the estate sector. Majority of the cows in the districts were with in their first three lactations (Appendix Table 9). Buffaloes and goats were reported only from Anuradhapura and Kurunegala districts.

Poultry was the other livestock type reared by the households, as reported only in three districts . Poultry was reared for eggs in Matara and Nuwara Eliya districts where average number of birds per flock ranged from 10 – 48 birds /farm respectively (Appendix Table 10).

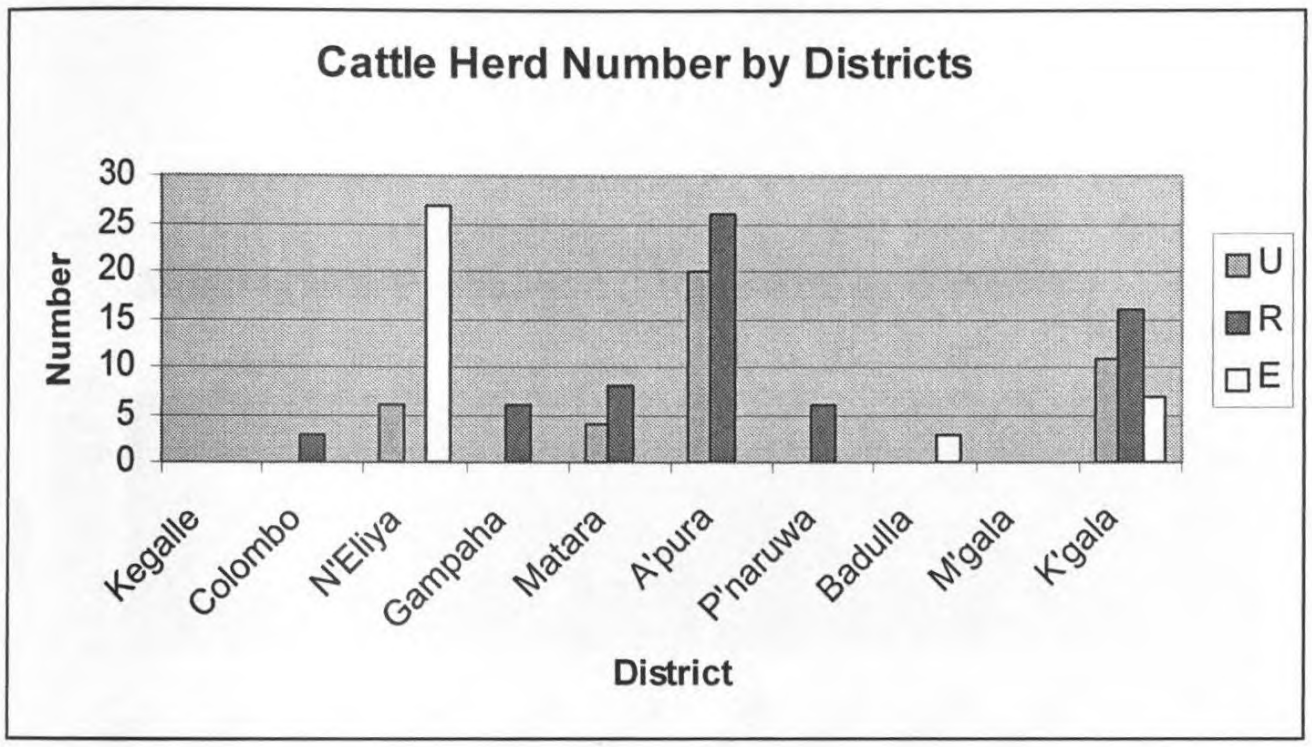

Figure 1 : Cattle-Herd Number by Districts

In general livestock rearing in the districts was very scarce. Highest farm monthly average milk production (360 litres) was reported from Anuradhapura district followed by Nuwara Eliya (310 litres) and Kurunegala (210 litres) . Anuradhapura and Kurunegala districts has greater number of cows and Nuwara Eliya more crossbred or pure bred animals with higher milk yield per farm (Appendix Table 11 and Figure 5). Milk production of Kurunegala and Anuradhapura was affected by the prolonged drought condition of the area at the time of the field survey. Some of the households has completely stopped milking their cows for more than a year due to prevailing draught condition in these districts. In the rural and estate sectors most of the farm milk produced was generally consumed by the households. The low farm milk farm production in most of the districts reflected on their low consumption of liquid milk and dependence on other milk and milk products . The highest monthly consumption of milk of farm production was reported from Kurunegala district (30 litres or 26% of total). The households normally sold the rest of their daily milk production with the market price of milk varying between Rs.14.00 – 15.00/litre in all the districts. Nuwara Eliya district reported of the highest monthly income (Rs.7807/farm) generated from farm milk due to its higher farm production capacity (Appendix Table 11 and Figure 6).

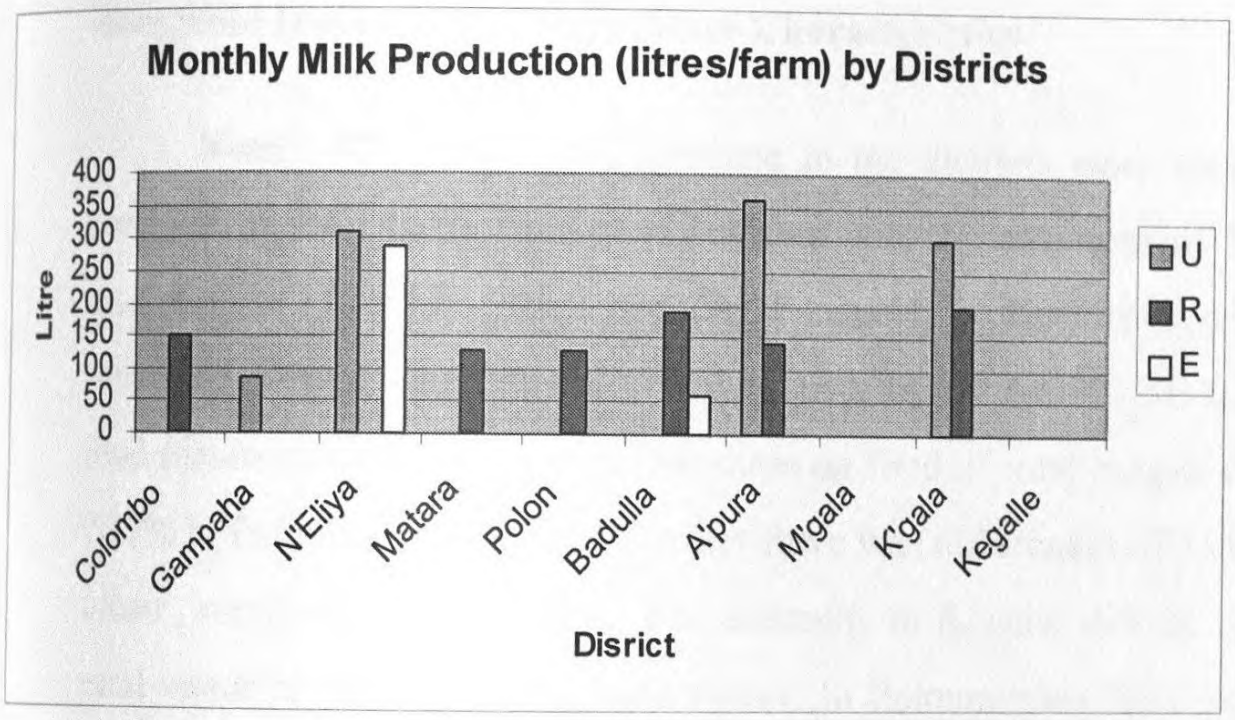

Figure 5- Monthly Farm Milk Production

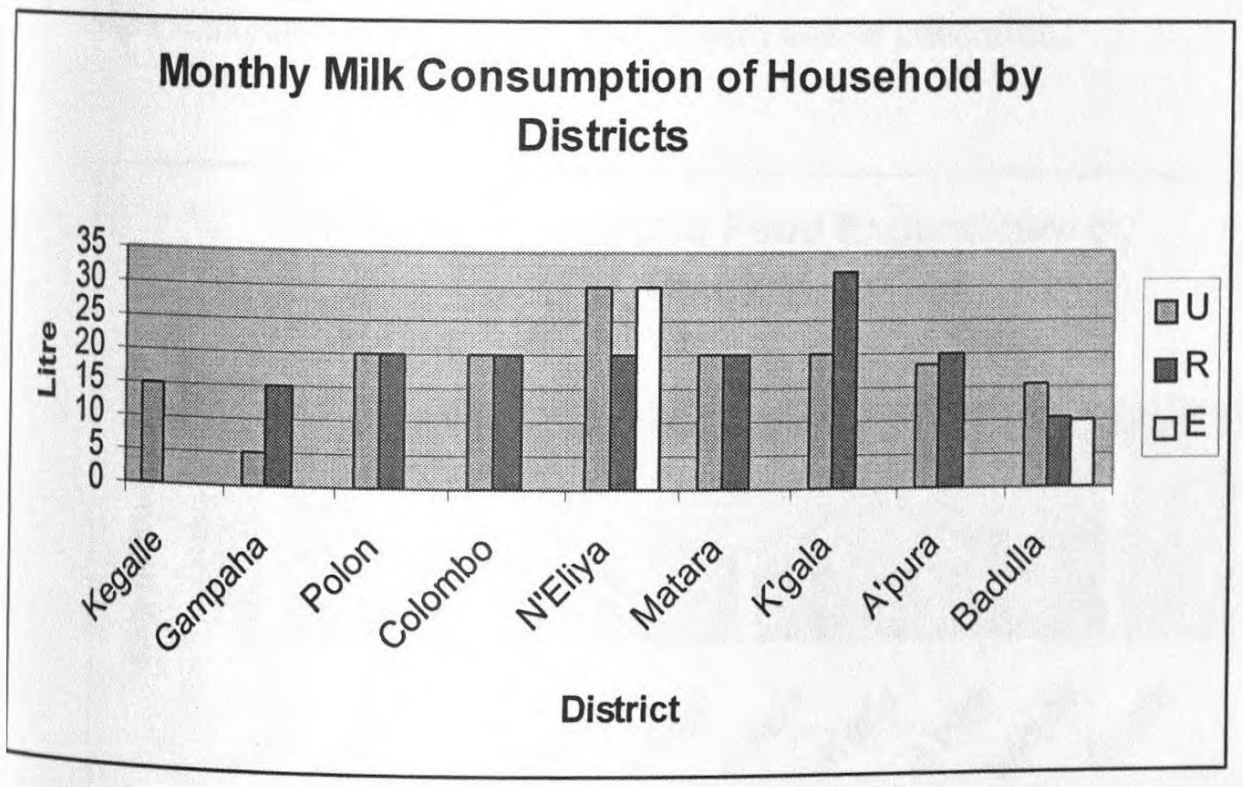

Figure 6 – Monthly Milk Consumption of Farm Production

Income generated by selling livestock was a supplementary source of income of the poor farming households in Anuradhapura and Kurunegala districts. The average selling price of

animals were low in these districts as compared to sale price of crossbred cattle in Nuwara Eliya (Appendix Table 12).

Household Income and Expenditure Characteristics

Nearly 46% of the total income in the districts were spent by households for the purchase of their basic food requirements with a minimum of 26.4% in Colombo to a maximum of 64.6% of total household income in Kegalle district (Appendix Table 13). Nearly 63.4 % of total expenditure was spent by households for the purchase of their basic food requirements. The expenditure share on food of total ranged from 52.4% in Kegalle to 76.7% in Polonnauwa districts. Further there was differences of food expenditure among the urban , rural and estate sectors. For example, in Kegalle district it was from 45.4% in the rural sector to 57.7% in the estate sector. In Polonnaruwa food expenditure ranged from 72.7% in rural to 80.6% in the estate sector (Appendix Table 14).In all the districts the highest expenditure was for food, health and or education.

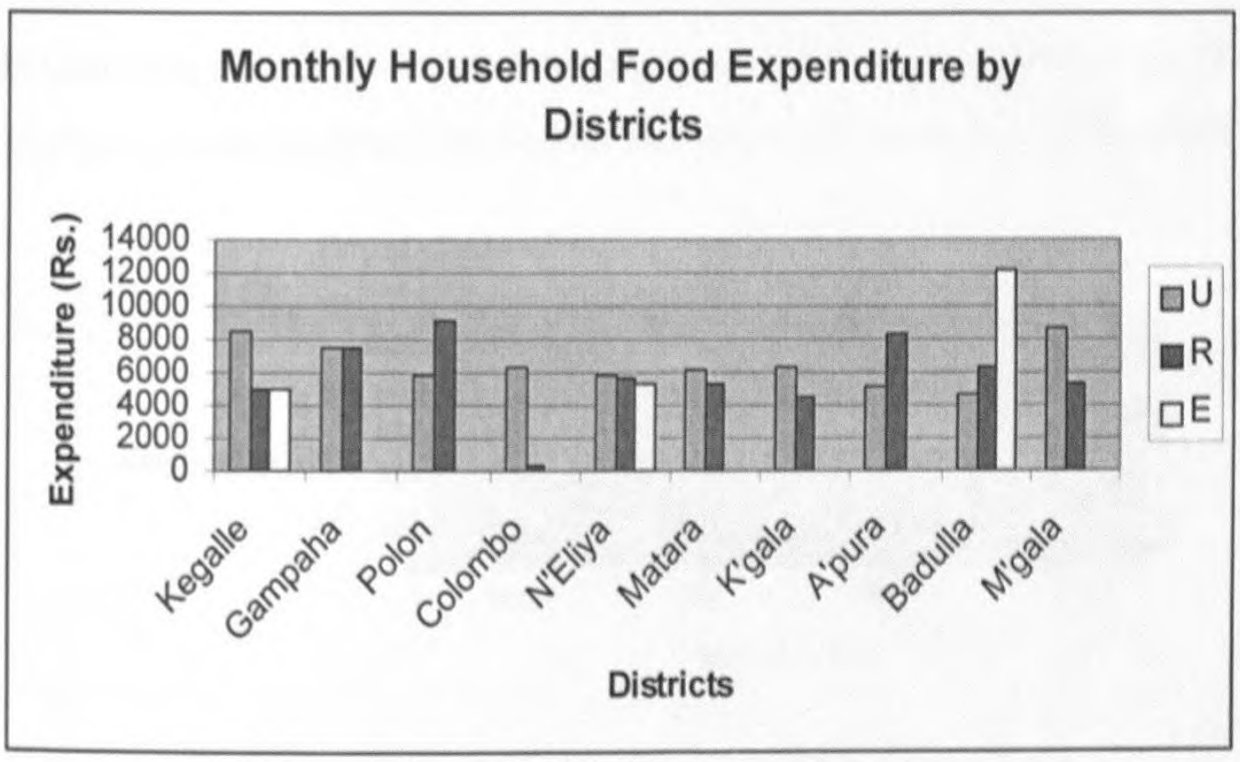

Figure 7- Monthly Household Food Expenditure in the Districts

The amount of expenditure on milk and milk products of total was relatively low (7.3%) in all districts .The highest expenditure for milk and milk products was reported from the

Colombo district (Appendix Table 15) and the lowest food expenditure was reported from Polonnaruwa (4.4 %). In Kegalle , the expenditure share of whole milk powder (WMP) of total was higher than fresh milk (FM) or other milk products (OMP).- Figure 8(a) in all sectors. The expenditure for FM was marginal indicating its short supply. The rural sector consumed a higher proportion of WMP as compared to urban and estate sectors.

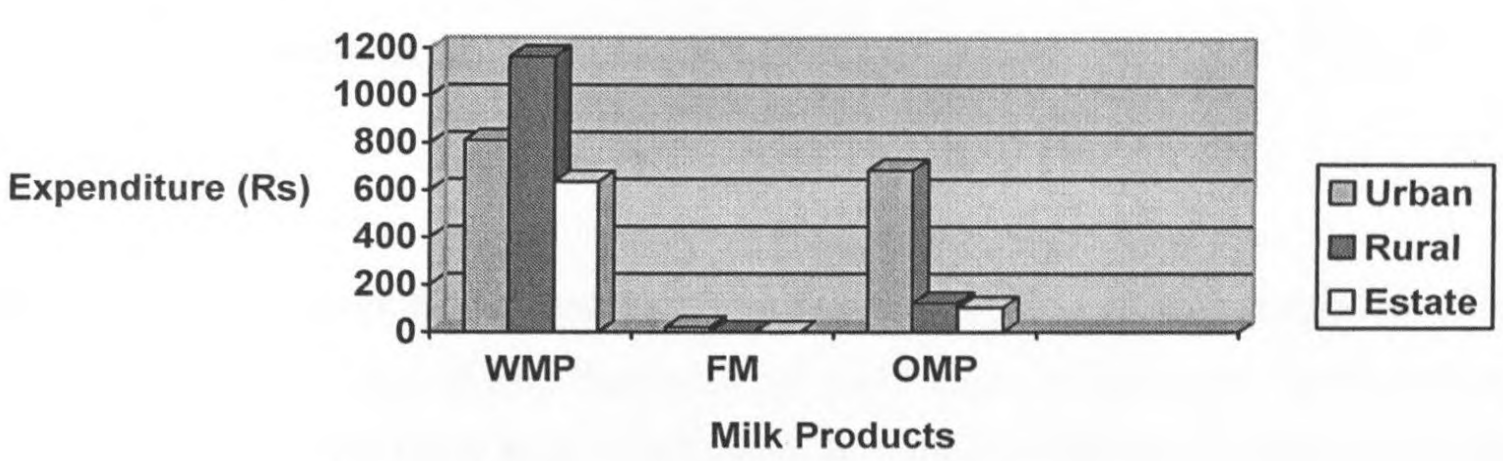

Figure 8 (a) – Expenditure of Milk and Milk Products among Households in Kegalle District

In Gampaha district the expenditure share of WMP was higher than OMP and FM and this pattern of consumption of the households was identical to that of Kegalle district (Figure 8b).

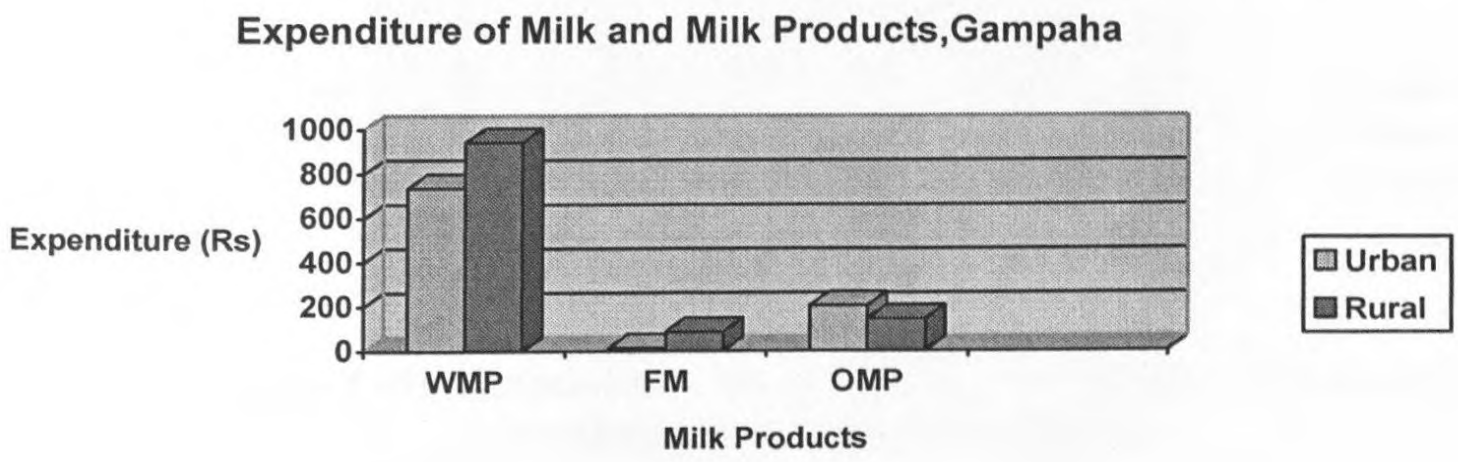

Figure 8(b)- Expenditure of Milk and Milk Products among Households in Gampaha District

In Colombo district the expenditure share of WMP and OMP shares were higher than FM .The variation among the urban and rural sectors were the same as in the earlier districts (Figure 8c) .

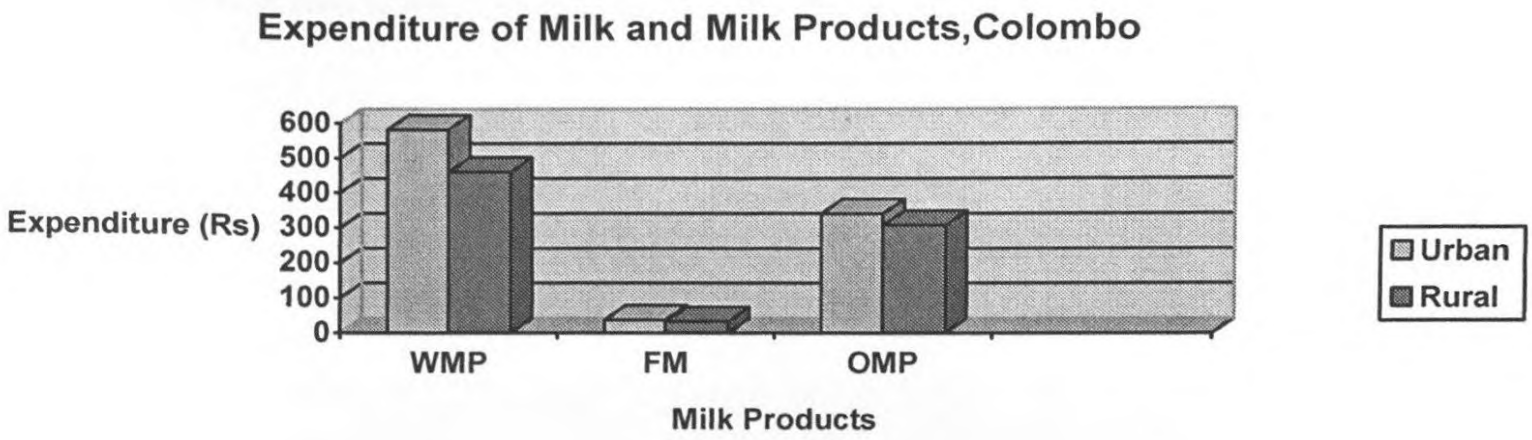

Figure 8 (c)-Expenditure of Milk and Milk Products among Households in Colombo District

In Nuwara Eliya district the expenditure share of WMP continued to dominate in all sectors. However the level of FM consumption was higher in the estate sector than the level of OMP in all sectors (Figure 8 (d)). This may be related to the higher farm production of FM in the estate sector in this district.

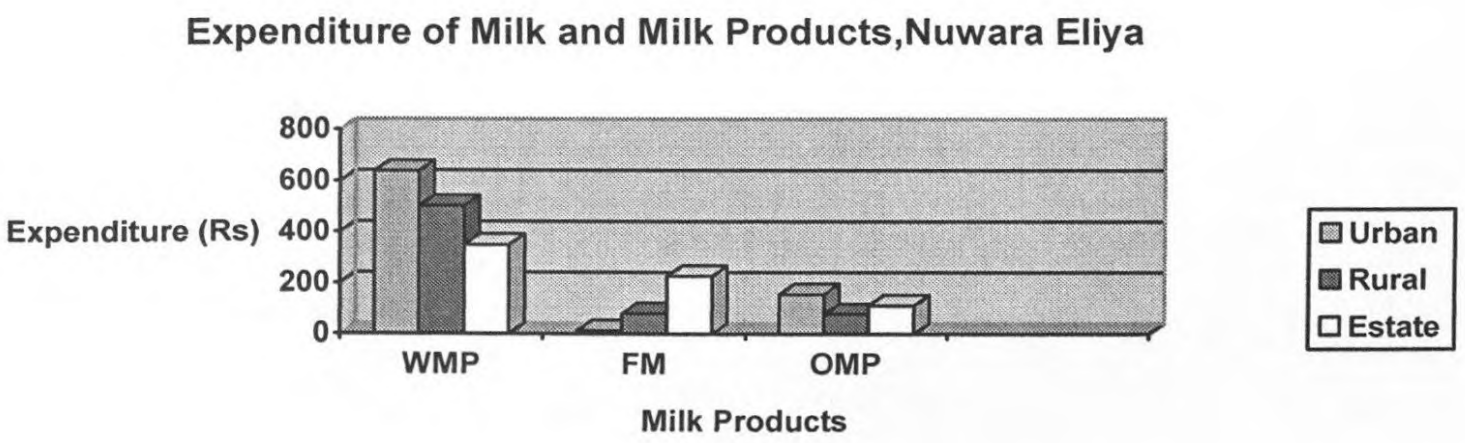

Figure 8 (d) – Expenditure Share of Milk and Milk Products among Households in Nuwara Eliya District

In Matara district the trend in the consumption of milk products appears to be the same as in the above districts (Figure 8 (e)). In general WMP expenditure share was higher in all wet

zone districts. The FM has a slightly higher expenditure share in the estate sector in Nuwara Eliya district.

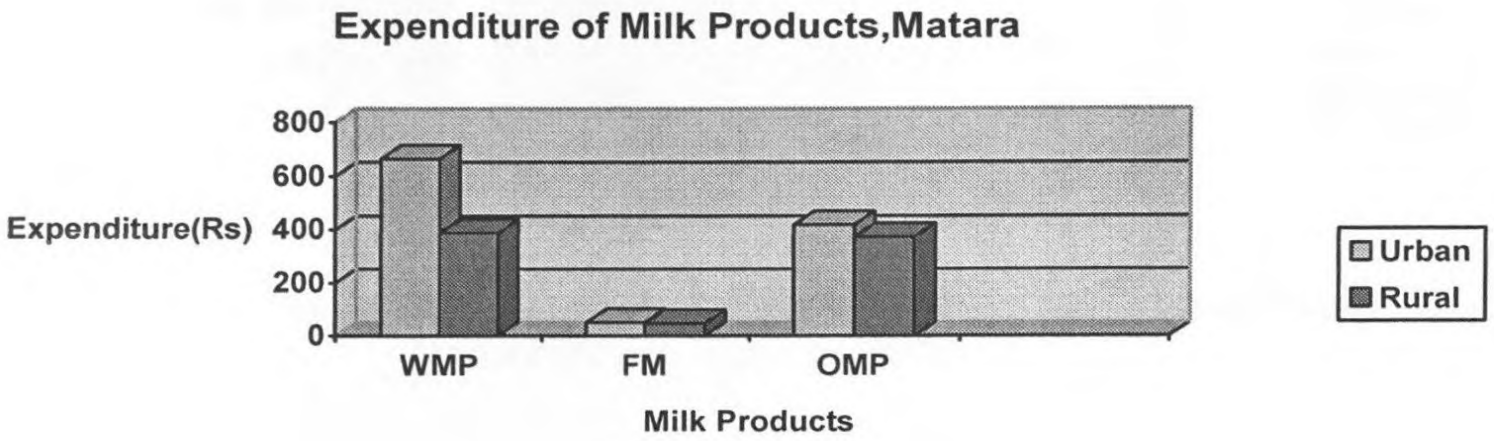

Figure 8 (e)-Expenditure Share on Milk Products among Households in Matara District

In the Dry zone district such as in Polonnaruwa WMP dominated consumption of the other type of milk products such as FM and OMP (Figure 8 (f)).The expenditure share of fresh milk was slightly higher in the rural than the urban sector.

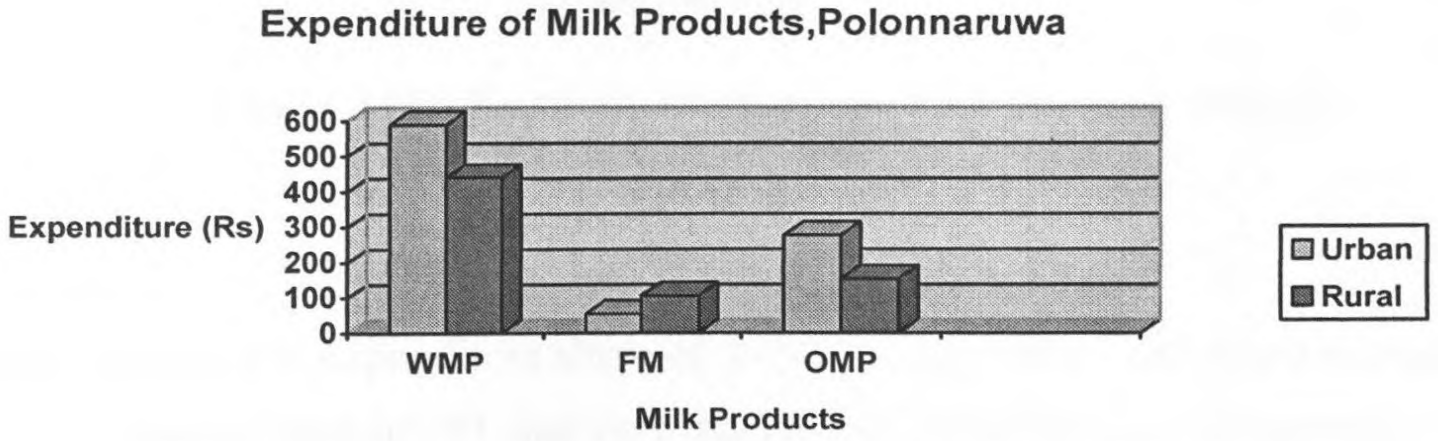

Figure 8 (f)- Expenditure Share of Milk Products among Households in Polonnaruwa District

In Badulla district although the use of WMP,FM and OMP were similar to that of other districts (Figure 8(f)). In Anuradhapura district the consumption of FM among urban sector was low as compared to the other milk products (Figure 8 (h)).

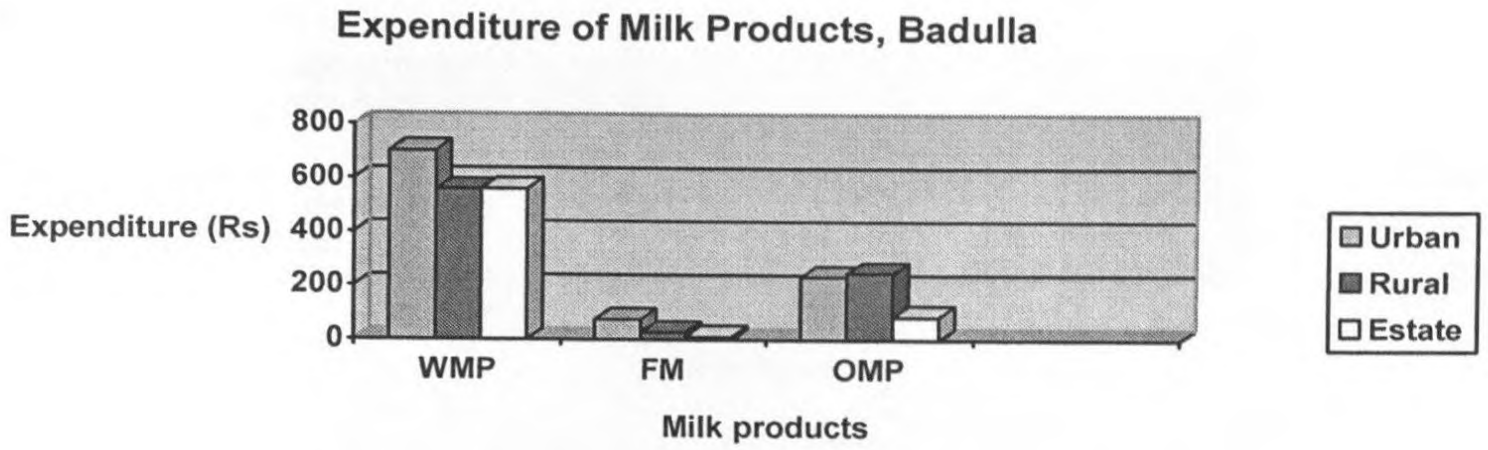

Figure 8(g)-Expenditure Share of Milk Products among Households in Badulla District

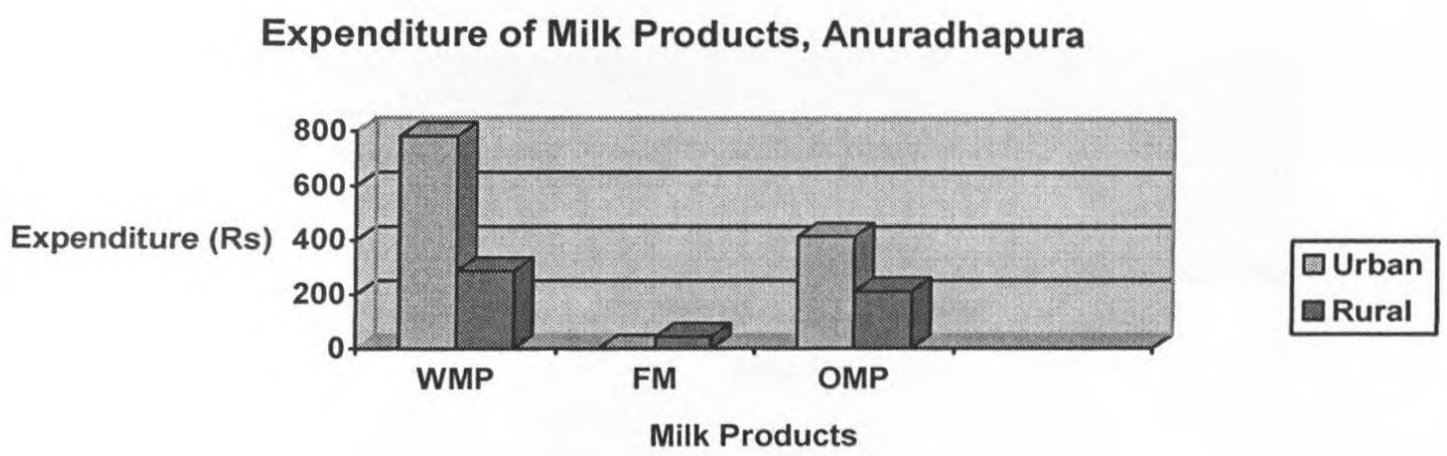

Figure 8 (h)- Expenditure Shares of Milk Products among Households in Anuradhapura District

In Kurunegala district the expenditure share of WMP in both urban and estate sectors were similar and the consumption of FM was very marginal (Figure 8 (i)). In Moneragala the FM consumption was absent in all sectors (Figure 8 (j)).

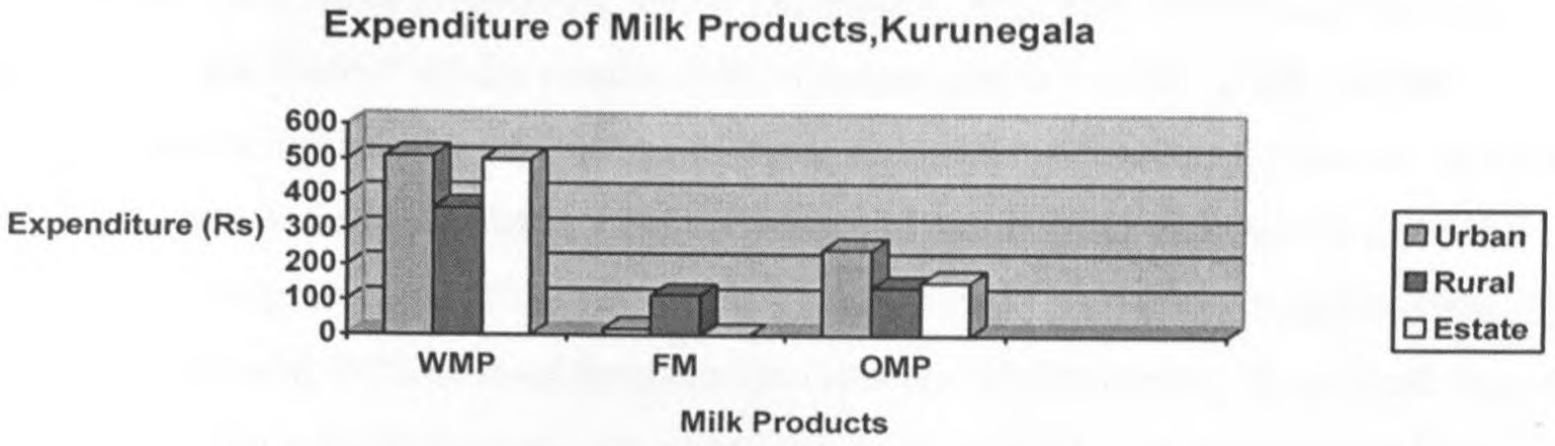

Figure 8 (i)- Expenditure Share of Milk Products among Households in Kurunegala District

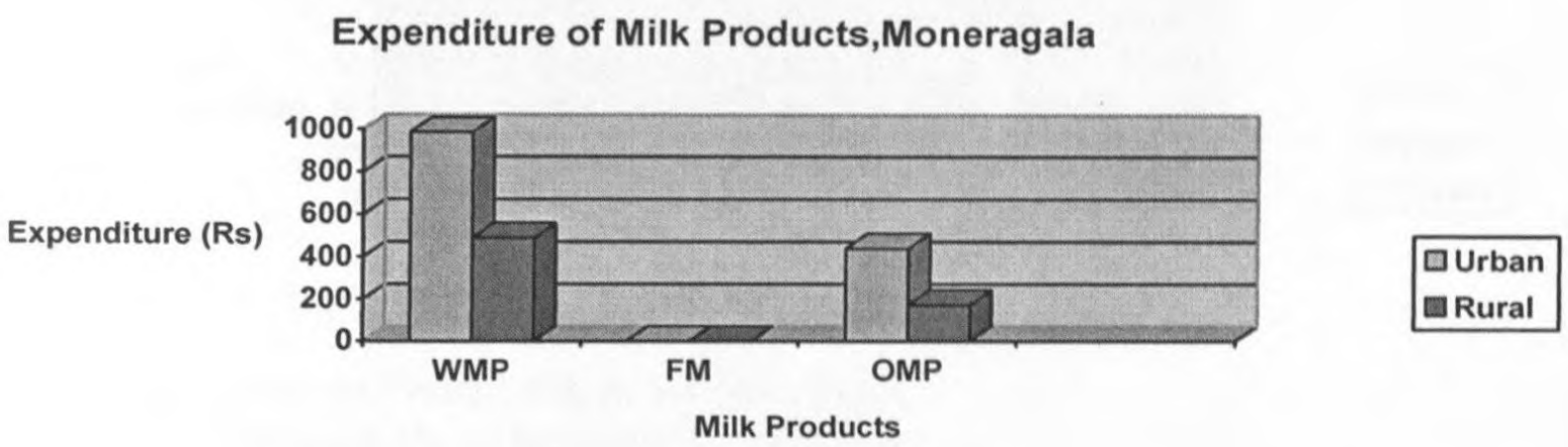

Figure 8 (j)- Expenditure Share of Milk Products among Households in Moneragala District

In general, the consumption of WMP was higher and the level of OMP was higher than the FM consumption in all districts. The expenditure on full fat milk powder (26-28% fat) was higher than infant milk or non fat milk powder. A relatively low expenditure was reported for pasteurized and sterilized milk by households in the districts. In districts such as Gampaha , Matara, Colombo,Kegalle ,Moneragala and Badulla reported of relatively higher consumption of other milk products such as yoghurt, curd and ice cream. In districts such as Matara and Moneragala the production and market availability of value added milk products such as curd resulted in its higher consumption level.

The highest consumption of fresh milk was reported from Nuwara Eliya district. In this district nearly 20% of urban ,25% of rural and 42% of estate household consumed fresh milk ((Appendix Table 16), Figure 9(a)).The daily average household consumption of fresh

milk ranged from 1-1.5 litres (Appendix Table 16, Figure 9(a). This is followed by households in Matara district where nearly 20% of urban and 9% of the rural sectors consumed farm fresh liquid milk with an daily average household consumption of around 1 litre. Among other wet zone districts , 13% of the urban households in Kegalle district reported of consuming around 0.75 litres of fresh milk daily . In Anuradhapura district , nearly 42% of urban and 24% of rural households reported of consuming farm fresh liquid milk (Figure 9(b) with a daily average consumption level of 0.92-1 litre per household. The average consumption of farm fresh liquid milk in the other districts of the dry and intermediate dry zone was above that in the wet zone (other than Nuwara Eliya).

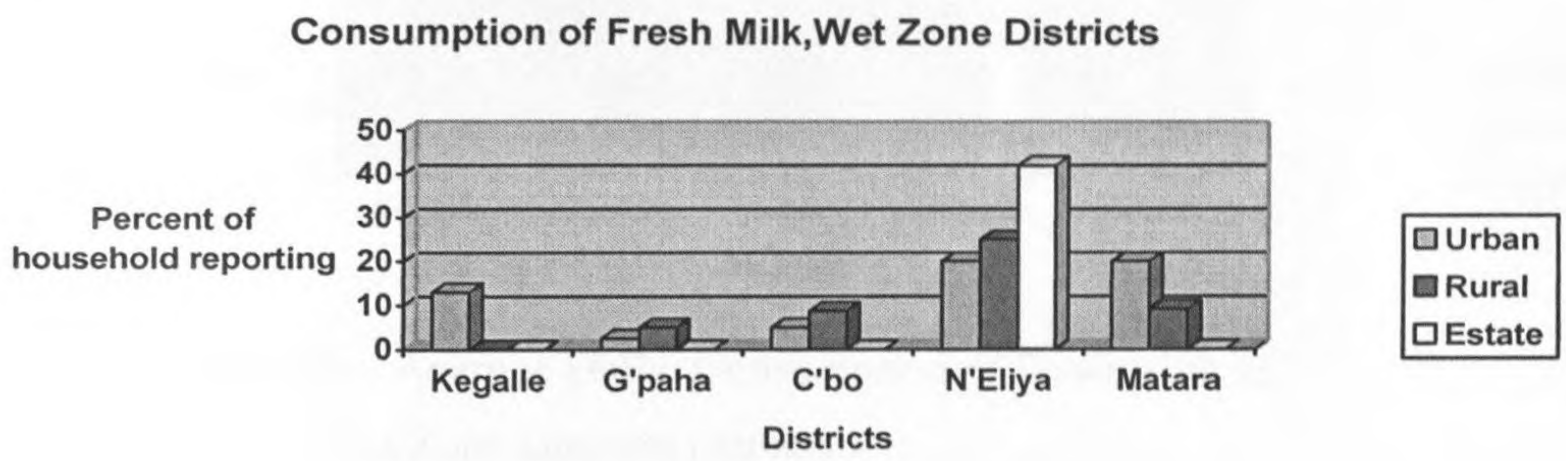

Figure 9(a)-Consumption of Fresh Milk in the Wet Zone Districts (% of household reporting)

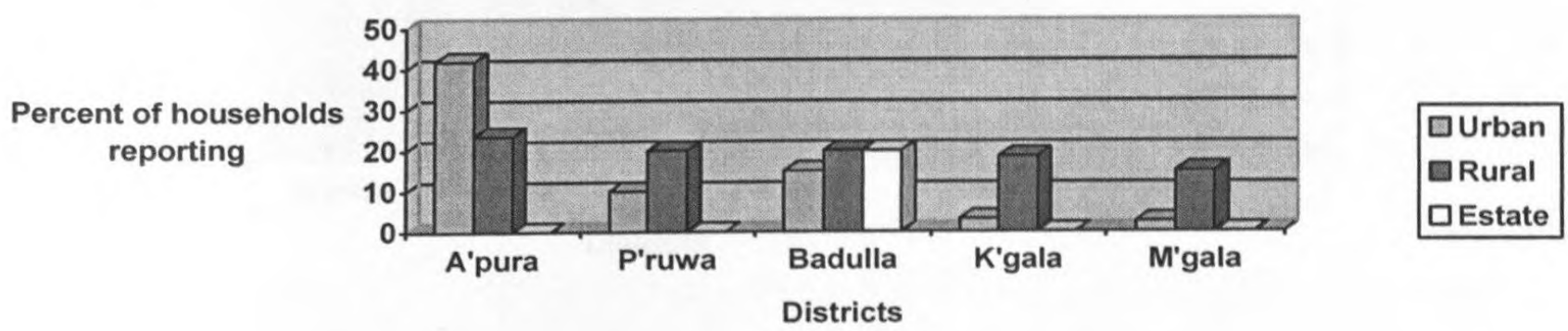

Figure 9(b)- Consumption of Fresh Milk in the Dry and Intermediate Dry Zone Districts (% households reporting)

However the average consumption of fresh milk was low with a daily household average of 1.95 litres in the wet zone districts and 2.26 litres in the dry and intermediate dry zone districts. The higher consumption of fresh liquid milk in the Nuwara Eliya and Anuradhapura districts were attributed to its greater availability and accessibility in these districts. In most

of these districts the households produced their own milk. The most reliable milk source was on farm or neighbouring farms . The exception was in Anuradhapura district where cycle vendors employed by MILCO company transported the fresh milk delivery to the households. In some districts such as Kegalle, Gampaha, Colombo, Badulla, Kurunegala, Polonnaruwa households consumed fresh milk in the mornings. In other districts the consumption may be either in mornings or evenings or both.

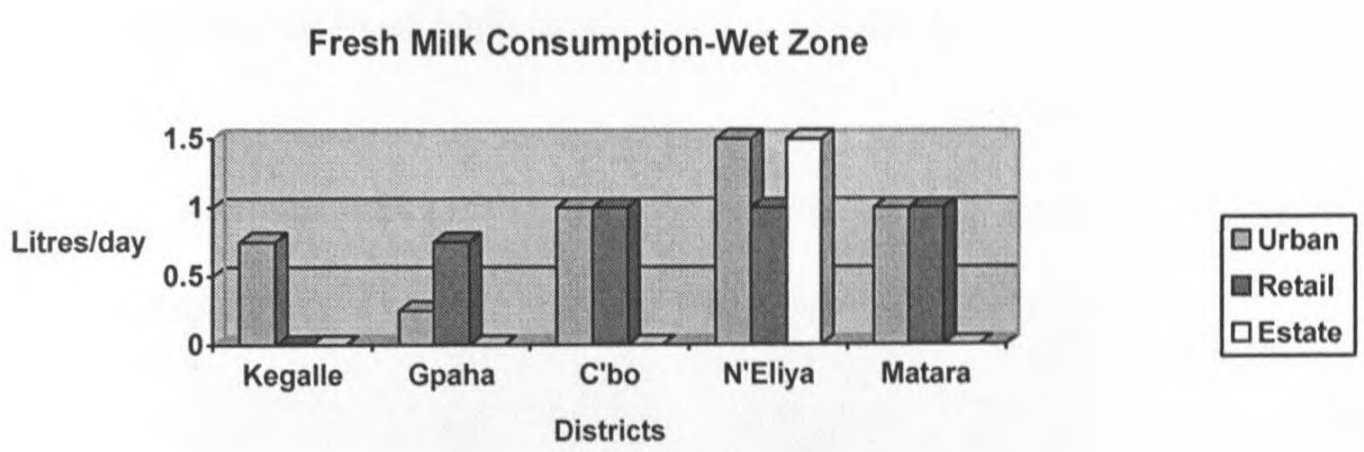

Figure 9(a)- Average Daily Consumption of Fresh Milk in Wet Zone Districts (litres)

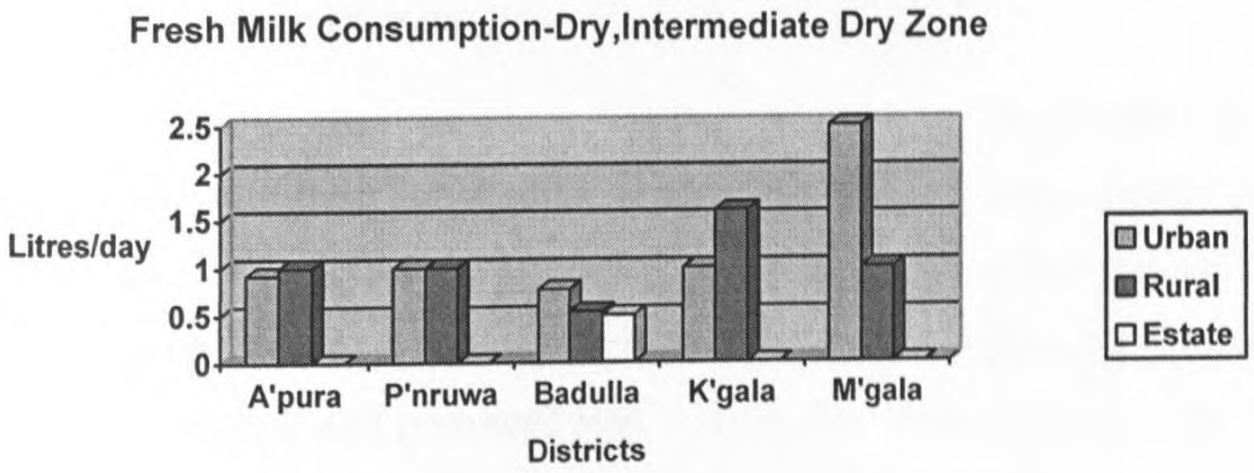

Figure 9 (b) – Average Daily Consumption of Fresh Milk in Dry Zone and Intermediate Dry Zone Districts

The highest average market retail price of fresh liquid milk was reported from Gampaha and Colombo districts in the wet zone and Badulla ,Polonnaruwa districts in the dry zone (Figure 10(a),Fig 10 (b)).

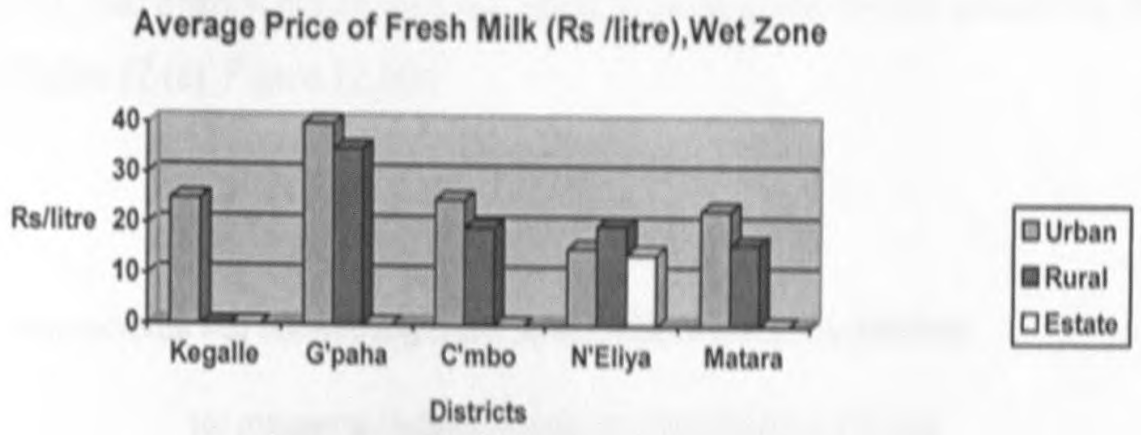

Figure 10 (a)–Average Price of Fresh Milk in the Wet Zone Districts

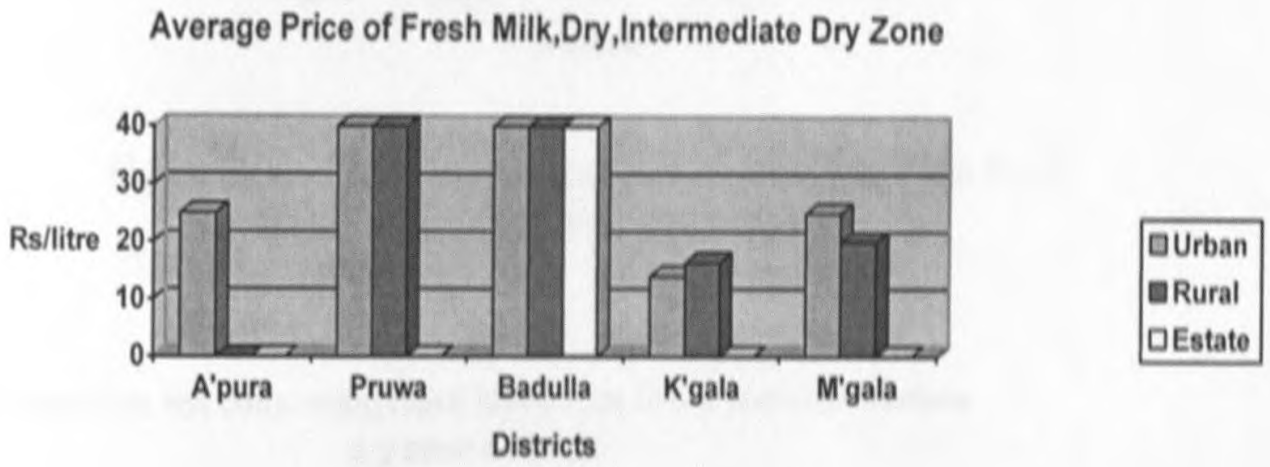

Figure 10(b)- Average Price of Fresh Milk in the Dry and Intermediate Dry Zone Districts

Majority of the households cited reasons such as easy accessibility ,good quality and health as the primary reasons for fresh liquid milk consumption .However none of them (other than rural sectors in Matara) indicated the low price of farm milk to be a major reason for its low/non consumption .Most of the household in the districts do not consume farm fresh liquid milk but substitute it with powdered milk (Appendix Table 17, Figure 11). The main reason for their adoption pattern included reasons such as non availability , high price ,bad quality of milk , health reasons and others (Figure 12). These reasons differ by the rural, urban and estate sectors. For example, in the urban wet zone districts of Gampaha and Nuwara Eliya health reasons was cited by majority of the households for not consuming fresh liquid milk. In urban sector of Colombo and Matara districts the high price of fresh milk was given as the prime reason for not consuming fresh milk (Figure 12(a) . In the rural sector of these districts bad quality of milk (Kegalle), non availability (Gampaha), high price (Colombo, Gampaha) were the main reasons given (Figure 12 (b). In the dry zone districts

high price of milk, bad quality, health were the prime reasons given for not consuming fresh liquid milk (Figure 12 (c) ,Figure 12 (d).).

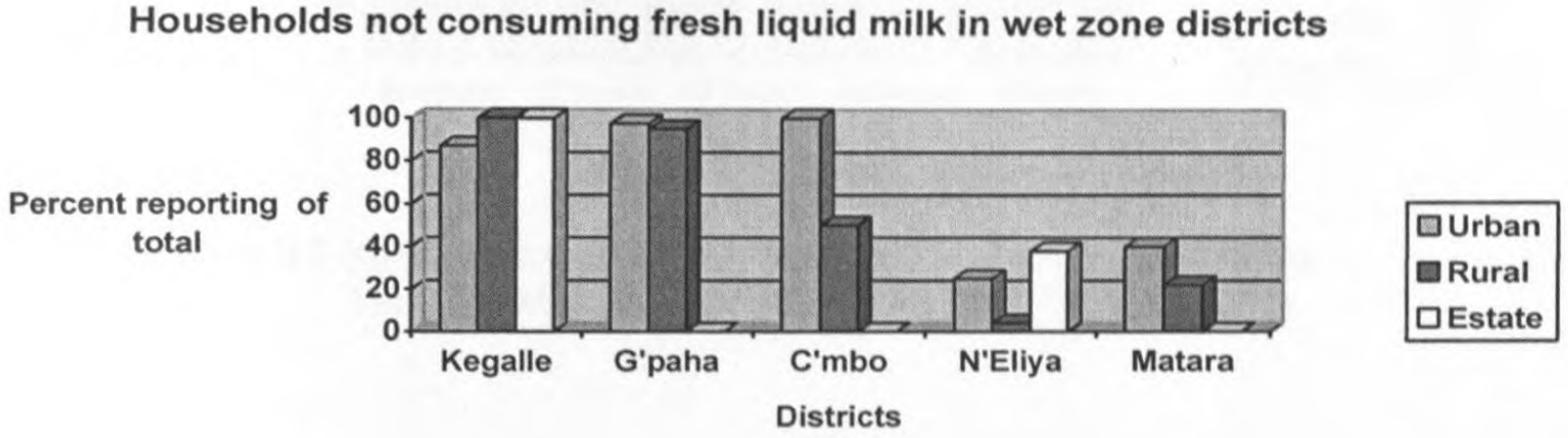

Figure 11(a) - Percent of Households not consuming Farm Fresh Liquid Milk in the Wet Zone Districts

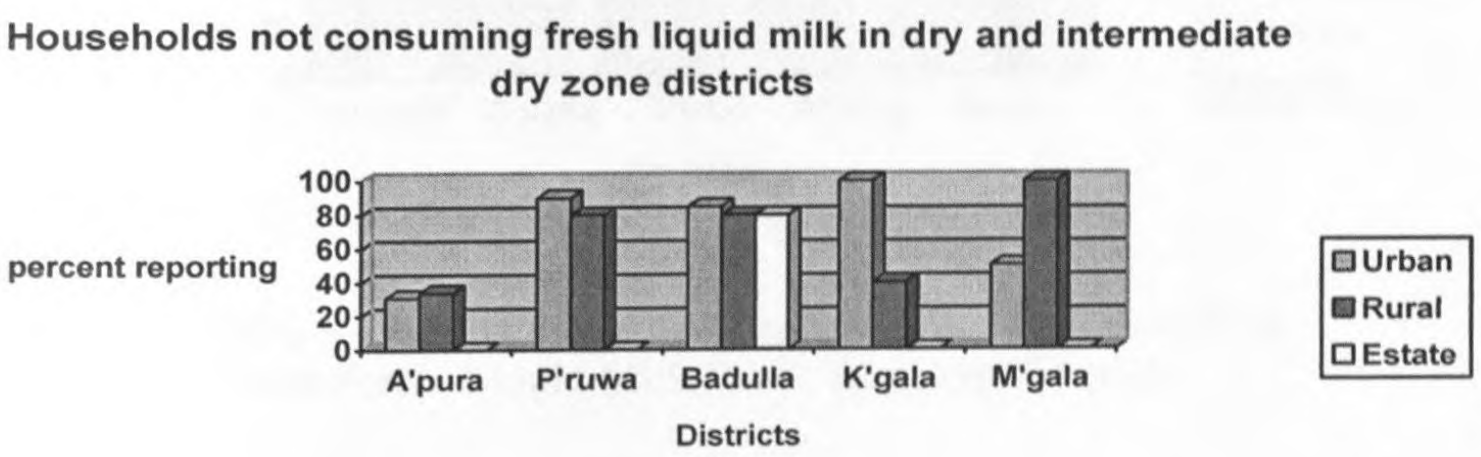

Figure 11 (b)- Percent of Households not consuming Farm Fresh Liquid Milk in Dry and Intermediate Dry Zone Districts

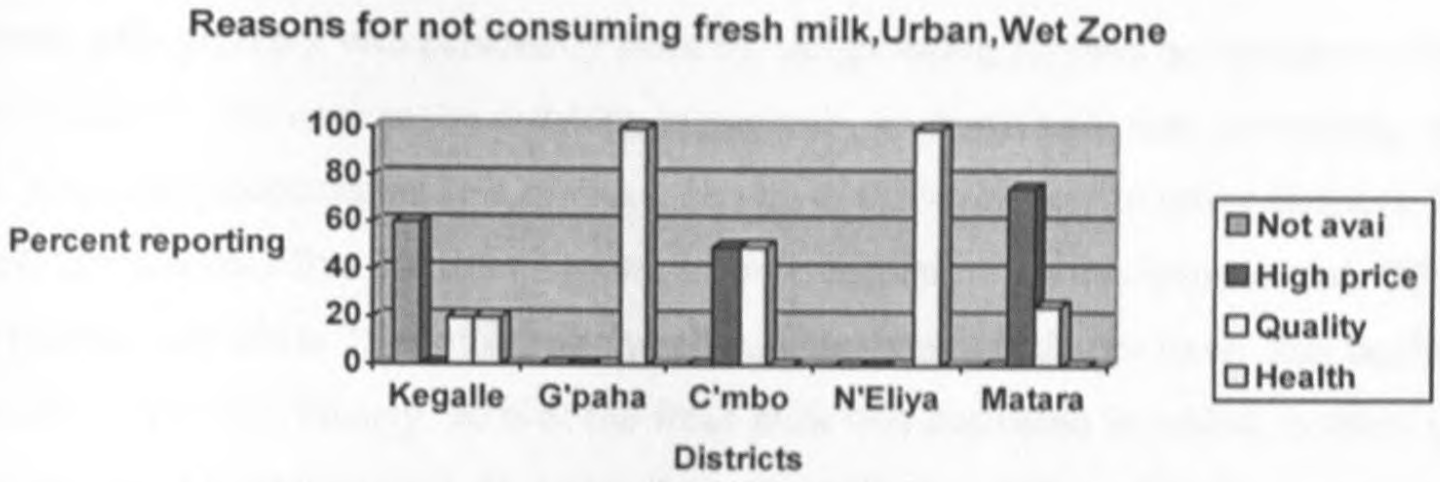

Figure 12 (a)-Reasons given by Households for not consuming
Farm Fresh Liquid Milk ,Urban Wet Zone Districts

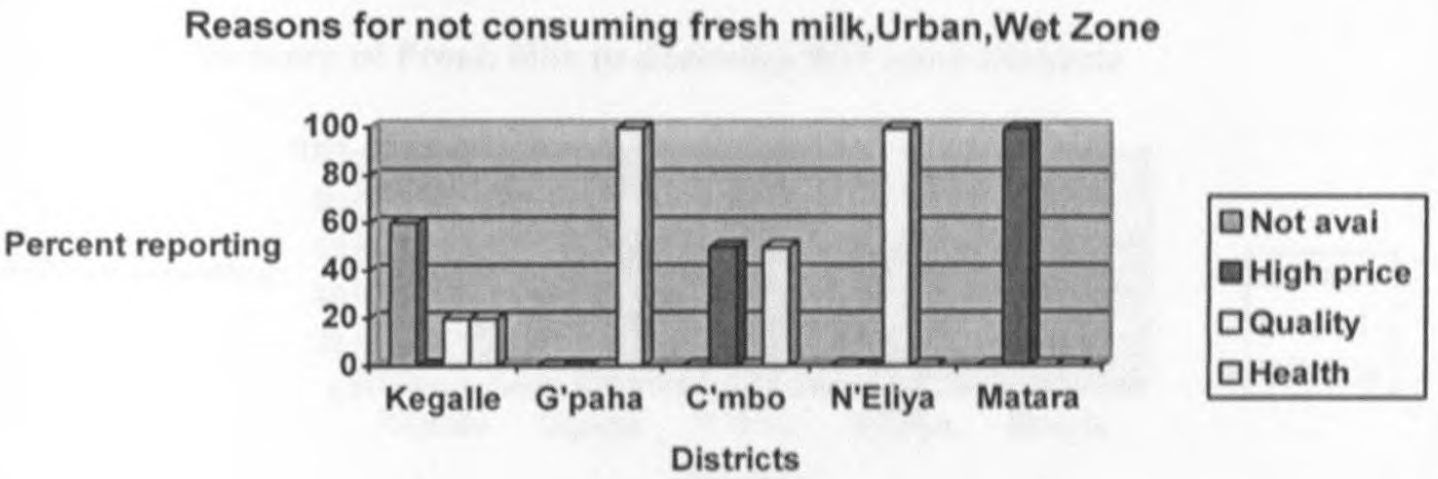

Figure 12 (b) – Reasons given by households for not consuming
Farm Fresh Liquid Milk,Rural Wet Zone Districts

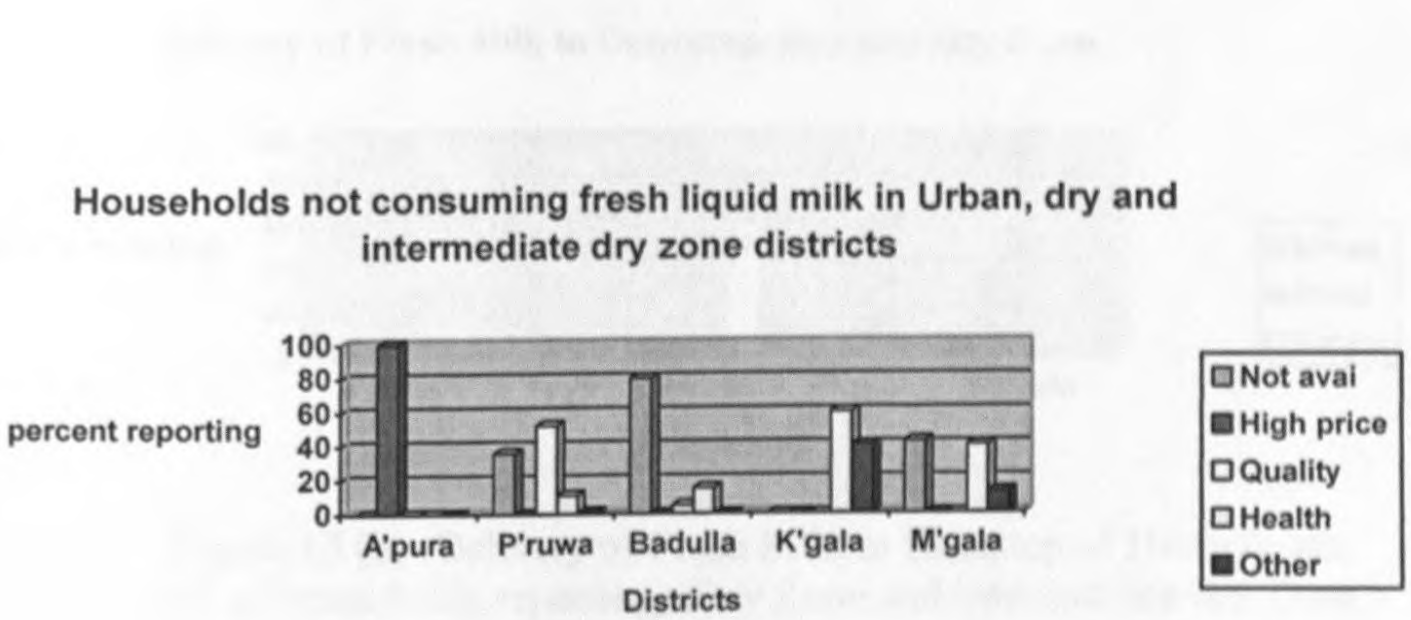

Figure 12 ©- Reasons given by household for not consuming
Farm Fresh Liquid Milk, Urban, Dry and IDry Zone Districts

The fresh milk delivery was personally done by neighboring farmers or transported by bicycle vendors and vans in the districts. In general , the fresh milk was commonly delivered to the household doorstep as in Colombo. However this may vary in other districts. For example in Nuwara Eliya district this form of milk delivery was available to only 25% of the urban households while 75% of urban and all rural households do not have this facility (Appendix Table 18). Nearly 70% of the fresh milk was delivered in sealed bottles (except in Matara and Anuradhapura). In Anuradhapura , milk was delivered in large containers and filled in to bottles at the selling points (Appendix Table 19). Majority of the households were satisfied with different forms of delivery of milk adopted in the districts..

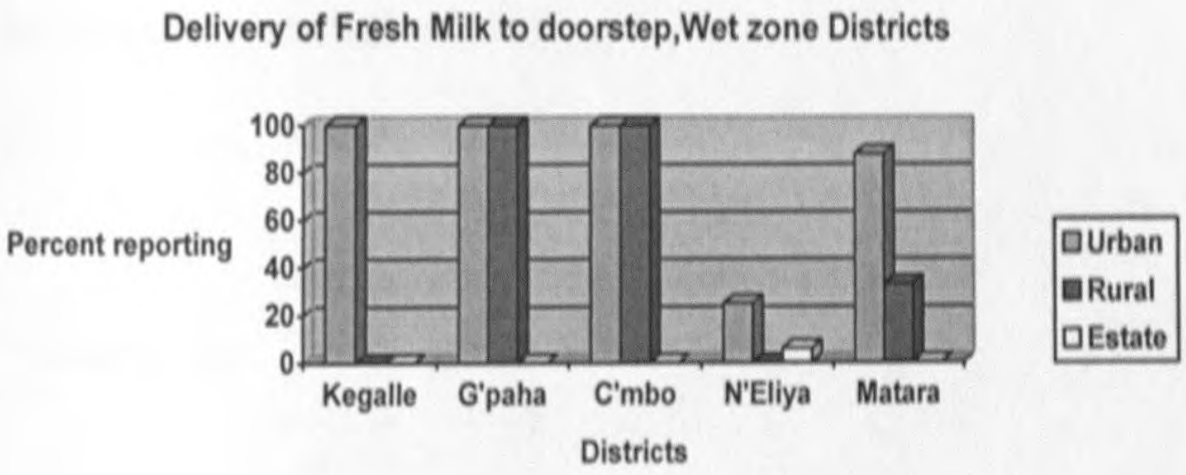

Figure 13(a)- Delivery of Fresh Milk to Doorstep of Households , (% of households reporting), Wet Zone Districts

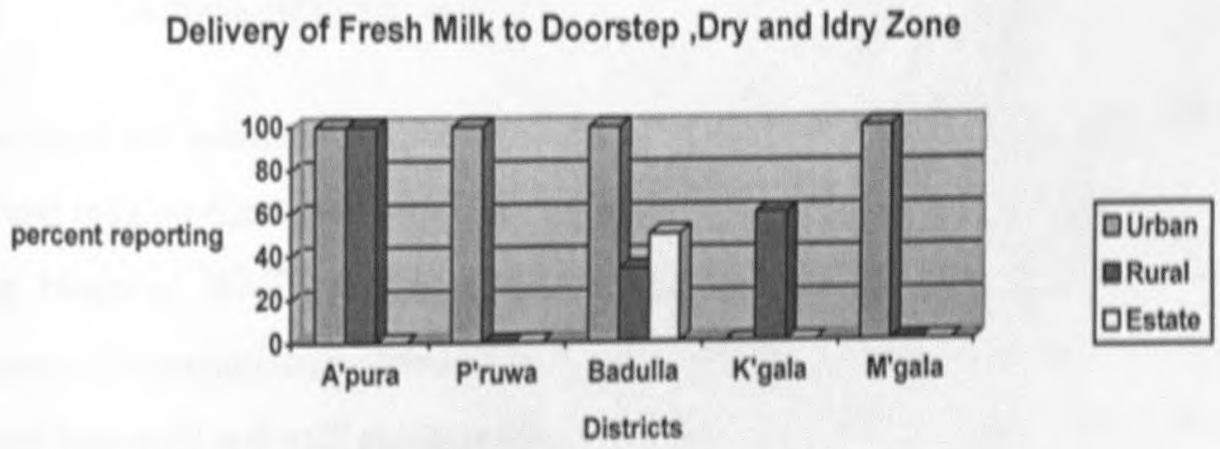

Figure 13 (b)- Delivery of Fresh Milk to Doorstep of Households, (% of households reporting) ,Dry Zone and Intermediate dry Zone

In most of the districts fresh milk was purchased in the mornings (Anuradhapura, Colombo) and for some districts households reported of purchasing milk at any time of the day (Nuwara Eliya and Matara)- Appendix Table 20.Majority of the households in the districts were satisfied with the times of purchasing of milk. The milk available at the time of purchase was of good quality (exceptions are from Matara and estate sector in Nuwara Eliya).- Appendix Table 21.

Prices of Fresh Milk and other Milk Products

Majority of the households in the districts indicated that the price of WMP, OMP and other milk was too high as compared to fresh milk .(Appendix Table 22;Figure 14). Varying proportions of them felt that the price of fresh milk in the districts was fair as compared to other milk and milk products (Figure 15 (a) ,Figure 15 (b)).

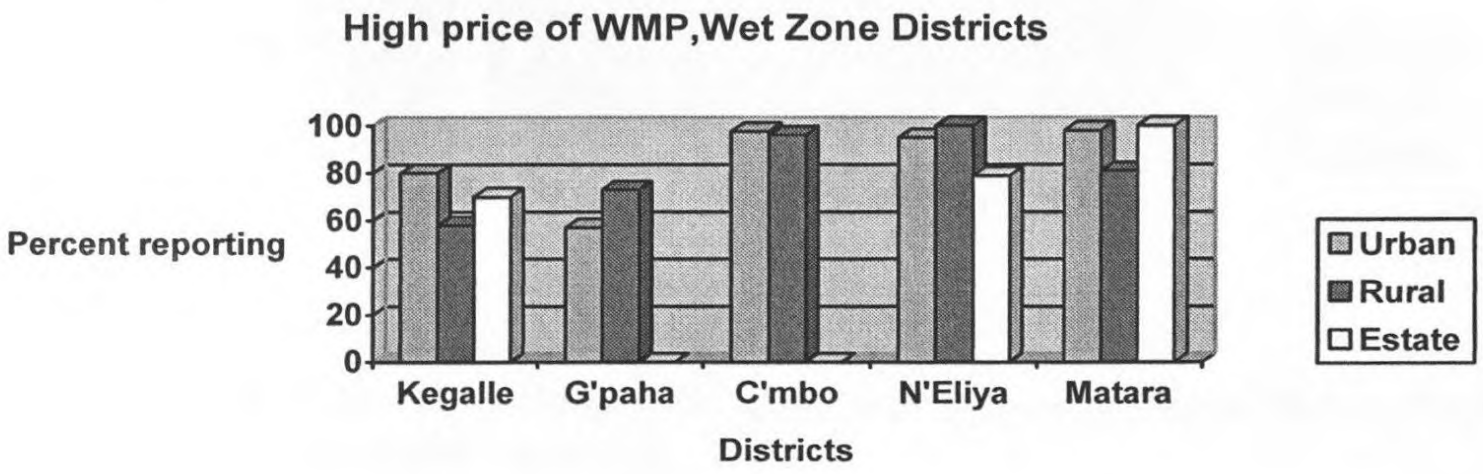

Figure 14 (a)- Household Attitude of High Price for WMP, Wet Zone Districts , (Percent reporting)

However most the households were not much aware of the market prices for different forms of milk and milk products ahead of their purchases .They were influenced to purchase different brands of WMP and other milk products based on mass media advertisements and other forms of communications used by milk processing firms. Majority of the households purchased their milk and milk products from boutiques which were within 0.5 km from their homesteads.

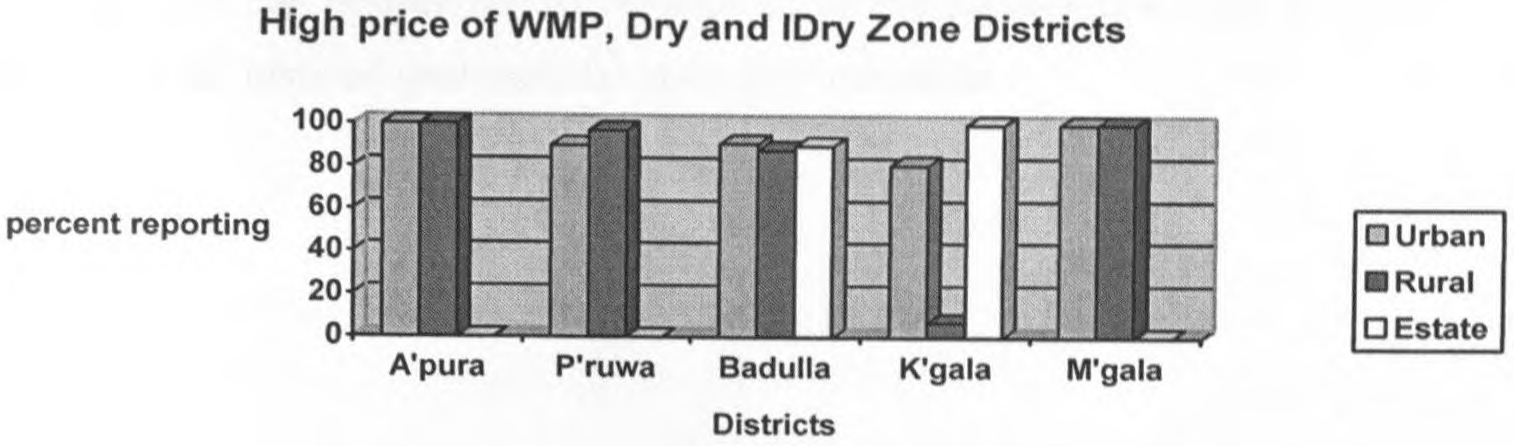

Figure 14 (b)- Household Attitude of High Price of WMP, Dry and IDry Zone Districts (Percent reporting)

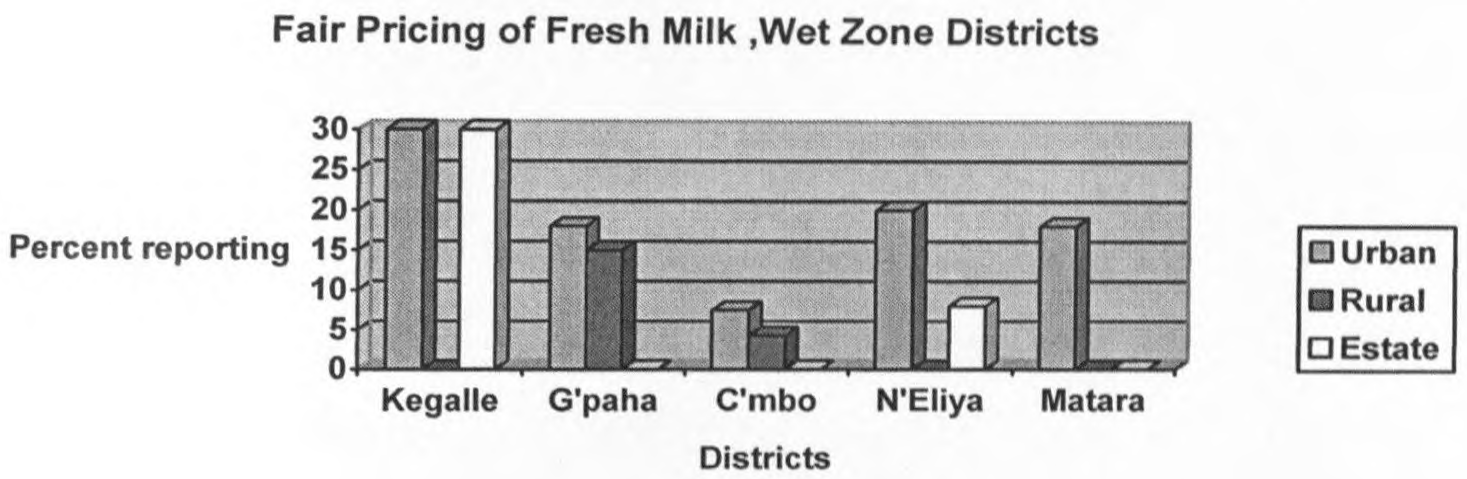

Figure 15 (a)- Household Attitude of Fair Pricing of Fresh Milk in Wet Zone Districts (Percent reporting)

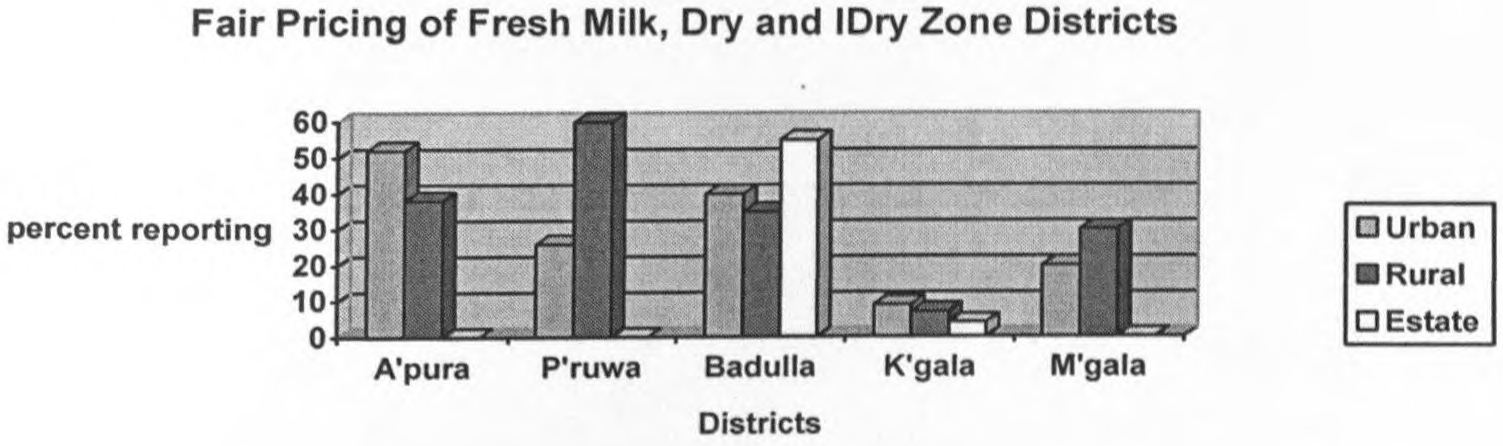

Figure 15 (a)- Household Attitude of Fair Pricing of Fresh Milk in Wet Zone Districts (Percent reporting)

Nearly 5.3% of the households in Nuwara Eliya reported of consuming goat milk. They mentioned the ready availability, taste and quality of goat milk available for their adoption.

However majority of the households in Nuwara Eliya and Kurunegala cited the poor availability and bad taste of goat milk for their non adoption .

CHAPTER 5- MILK CONSUMPTION MODELS

This chapter includes the regression results of the AIDS model estimations of the wet zone , intermediate dry and dry zone districts and for Sri Lanka. It also includes the regression results of the Import share equations estimated by Cochrane-Orcutt procedure and a summary of the results.

The results for AIDS model was only for the estimation for whole milk powder and fresh liquid milk in all the districts of Sri Lanka.

5.1 AIDS Model Estimations in the Wet Zone Districts

5.1.1 Nuwara Eliya District

This section shows the econometrics estimates and interpretation of coefficients of the household demand for farm fresh liquid milk and other milk products in Nuwara Eliya district. Table 5.1 shows the results of the budget share equation for whole milk powder in the district.

Table 5.1 Demand Coefficients of Whole Milk Powder (WMP) of Households

Endogenous variable: Budget share of whole milk powder

Exogenous Variables	Coefficient estimates	t value
Intercept	-4..9462	5.44**
Price of whole milk powder	-0.5153	55.69**
Price of fresh milk	0.0173	1.70
Price of other milk	0.0181	1.35
Price of other milk products	0.0091	0.11
Household expenditure	0.0262	0.28
Household size	- 0.4229	2.50**

** : Significant at 1% level.

$F = 923.48$; $R^2 = 0.780$

The model was significant at 1% level of significance. The coefficients for household size, and price of whole milk powder were significant in the equation.The coefficient for price of whole milk powder was negative as theoretically expected .This indicated that the demand for whole milk powder would fall with an increase in the price of whole milk powder. Although not significant the coefficients for price of fresh milk, prices of other milk and prices of other milk products were positive indicating that they were close substitutes to whole milk powder. Similarly higher the household income higher would be the demand for whole milk powder. However the income coefficient was not significant in the results.

The own price elasticity and cross price elasticity between whole milk powder and other types of milk consumed by households in Nuwara Eliya district is shown in Table 5.2 The own elasticity of whole milk powder was -0.1118 which indicated that with an increase of price of whole milk powder by 10%, the demand for whole milk would decrease by 1.1 % among households in Nuwara Eliya district. The cross price elasticity of whole milk powder and fresh milk was 0.0013 .The result indicated that with an increase of price of fresh milk by 10% would result in an increase of demand of whole milk powder by 0.01 % i.e. a by a negligible amount. The cross price elasticity between whole milk powder and other milk , other milk products were 0.0015 , 0.00007 respectively.

Table 5.2 – Own Elasticity and Cross Price Elasticity between WMP and Other Types of Milk Consumed and Expenditure Elasticity in Nuwara Eliya District

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	OMP ε_{ij}	Expenditure elasticity η_i
WMP	-0.1118	0.0013	0.0015	0.00007	0.0987

The elasticity estimates for whole milk powder among households in Nuwara Eliya district was low and inelastic. The low elasticity of whole milk powder indicated that the demand is not responsive to price changes i.e. whole milk powder is an essential commodity in the food balance sheet of the households in the district. The expenditure elasticity of whole milk

powder was 0.0987. This indicated that when the expenditure of household increases by 10% the demand for WMP would change by 0.98%.

Table 5.3 shows the budget share equation estimates for farm fresh liquid milk in Nuwara Eliya district.

Table 5.3 Demand Coefficients of Farm Fresh Liquid Milk of Households
Endogenous variable: Budget share of Farm Fresh Milk

Exogenous Variables	Coefficient estimates	t value
Intercept	-5..2412	1.93*
Price of whole milk powder	0.0132	2.01*
Price of fresh milk	-0.6075	20.14**
Price of other milk	0.0022	0.05
Price of other milk products	0.0138	0.56
Household income	0.0879	0.32

** : Significant at 1% level; * Significant at 5% level.
F= 135.65; R^2= 0.924

The model was significant at 1% level with a R^2=0.92 indicating that 92% of the variation of the dependent variable was shown by the included variables of the model. The price of fresh milk was significant with the expected sign indicating that high price of fresh milk would reduce the demand for fresh milk in the district. The coefficients for whole milk powder, price of other milk, and prices of other milk products were with theoretical expected signs showing they were substitutes for fresh milk . However only the coefficients of whole milk powder was significant in the model.

The own price elasticity of fresh milk was low and inelastic (-0.0252) with the expected sign. The results indicated that with an increase of 10% of price of fresh milk would result in a 0.2% decrease of demand of fresh milk among households in the district. The cross price

elasticity of fresh milk with prices of whole milk powder, milk products and other milk products were low and inelastic and were not significant (Table 5.4).

Table 5.4 – Own Elasticity and Cross Price Elasticity between WMP and Other Types of Milk Consumed and Expenditure Elasticity in Nuwara Eliya District

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	OMP ε_{ij}	Expenditure elasticity η_i
FM	0.0002	-0.0252	0.00003	0.0002	0.0169

The expenditure elasticity of fresh milk was positive and inelastic.The result indicated that an increase of expenditure share of household of 10% would result in a change of demand of fresh milk by nearly 0.1%.

5.1.2 Colombo District

This section shows the econometric estimations of the farm demand equations for whole milk powder and farm fresh liquid milk in Colombo district. Table 5.5 shows the budget share equation estimations of whole milk powder in Colombo district.

Table 5.5 Demand Coefficients of Whole Milk Powder (WMP) of Households

Endogenous variable: Budget share of whole milk powder

Exogenous Variables	Coefficient estimates	t value
Intercept	-5.0583	3.60**
Price of whole milk powder	-0.5510	34.65**
Price of fresh milk	0.0469	2.31*
Price of other milk	0.0177	1.68
Price of other milk products	0.01397	2.89*
Household income	0.1197	0.83
Household size	- 0.4229	2.50**

** : Significant at 1% level; * significant at 1% level

$F = 282.03$; $R^2 = 0.960$

The model was significant at 1% level with a high R^2= 0.96 indicating that 96% of the variation of the budget share of whole milk powder in Colombo district was shown by the included variables of the model. The price of whole milk powder, price of fresh milk and prices of other milk products were significant in the model. The signs of the variables were in accordance with the theoretical expectations indicating that farm fresh liquid milk other milk and other milk products were substitutes to whole milk powder in Colombo district..
The own price elasticity of whole milk powder was inelastic (-0.6254) which indicated that with a 10% increase of whole milk powder price the demand for whole milk powder among Colombo households would increase by 6.2% (Table 5.6).

Table 5.6 – Own Elasticity and Cross Price Elasticity between WMP and Other Types of Milk Consumed and Expenditure Elasticity in Colombo District

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	OMP ε_{ij}	Expenditure elasticity η_i
WMP	-0.6254	0.3744	0.0571	0.2853	0.1086

Further, the cross price elasticity of whole milk powder and farm fresh liquid milk was inelastic (0.3754) indicating that with a price increase of 10% of whole milk powder the demand for farm fresh liquid milk among households in Colombo district would increase by 3.7%. With a similar increase of the price of milk powder the demand for other milk and other milk products among households would increase by 0.5% and 2.8% respectively.The expenditure elasticity whole milk powder is low and inelastic (0.1086).

Table 5.7 shows the budget share equation estimates for farm fresh liquid milk in Nuwara Eliya district.

Table 5.7 Demand Coefficients of Farm Fresh Liquid Milk of Households In Colombo District

Endogenous variable: Budget share of Farm Fresh Milk

Exogenous Variables	Coefficient estimates	t value
Intercept	-9.3848	3.70*
Price of whole milk powder	0.0379	1.32
Price of fresh milk	-0.4760	12.99**
Price of other milk	0.0052	0.27
Price of other milk products	0.0048	0.19
Household income	0.3782	1.46

** : Significant at 1% level; * Significant at 5% level.
F= 38.07; R^2= 0.0.769

The model was significant at 1% level and with a R^2= 0.77 indicating that nearly 77% of the variation of the endogenous variable was shown by the included variables of the model. All the variables were with the theoretical expected signs with the coefficient for farm fresh liquid milk significant. The results indicated that whole milk powder, other milk and other milk products were substitutes for farm fresh liquid milk among households in Colombo district.

The own price elasticity for farm fresh liquid milk among households in Colombo district was inelastic (-0.4826) .The results indicated that an increase of 10% of the price of fresh milk would decrease its consumption of fresh milk by by nearly 4.8% (Table 5.8).

Table 5.6 – Own Elasticity and Cross Price Elasticity between WMP and Other Types of Milk Consumed and Expenditure Elasticity in Colombo District

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	OMP ε_{ij}	Expenditure elasticity η_i
FM	0.2170	-0.4826	-0.2170	-0.3035	0.4435

The elasticity results for other milk and other milk products were not in accordance with the theoretical expectations but were not significant. The expenditure elasticity of farm fresh liquid milk was inelastic as expected among the households in Colombo district.

5.1.3 Gampaha District

This section describes the results of the budget share estimations and the elasticities of demand for whole milk powder and farm fresh liquid milk for Gampaha district.Table 5.7 shows the results of the budget share equation for whole milk powder in the district.

Table 5.7 Demand Coefficients of Whole Milk Powder (WMP) of Households

Endogenous variable: Budget share of whole milk powder

Exogenous Variables	Coefficient estimates	t value
Intercept	-1.2238	0.65
Price of whole milk powder	-0.1313	3.89*
Price of fresh milk	0.0210	4.31*
Price of other milk	0.00035	0.37
Price of other milk products	0.0066	0.68
Household income	0.0299	0.31

** : Significant at 1% level; * significant at 5% level

$F= 30.09$; $R^2= 0.360$

The model is significant at 5% level with a $R^2= 0.36$ indicating that nearly 36% of the variation of the budget share in Gampaha district could be explained by the included variables in the model. The exogenous variables price of whole milk powder and price of fresh milk were significant. All the variables used in the model were with the expected signs indicating that fresh milk , other milk and other milk products were substitutes for whole milk powder among households in Gampaha district.

The price elasticity of whole milk powder in the district was inelastic (-0-9802) indicating that with an increase of the price of whole milk powder by 10% would decrease its demand by nearly 9.8% (Table 5.8).

Table 5.8 – Own Elasticity and Cross Price Elasticity between WMP and Other Types of Milk Consumed and Expenditure Elasticity in Gampaha District

	WMP	FM	OM	OMP	Expenditure
	ε_{ii}	ε_{ij}	ε_{ij}	ε_{ij}	elasticity η_i
WMP	-0.9802	0.1015	-0.0138	0.2729	0.0293

The cross price elasticity between whole milk powder and fresh milk was inelastic and low.The elasticity value for whole milk powder and other milk was in not in accordance with the theoretical expectations .The expenditure elasticity indicated that with an increase of a 10% increase in the expenditure of food would result in nearly 0.3% of increase of the expenditure for purchase of whole milk powder.

Table 5.9 shows the estimates for budget share equation for farm fresh liquid milk in Gampaha district.

Table 5.9 Demand Coefficients of Farm Fresh Liquid Milk of Households

In Gampaha District

Endogenous variable: Budget share of Farm Fresh Milk

Exogenous Variables	Coefficient estimates	t value
Intercept	-1.5490	4.81**
Price of whole milk powder	0.1410	1.15
Price of fresh milk	-0.5355	13.83**
Price of other milk	0.0006	0.20
Price of other milk products	0.0002	0.13
Household income	0.0115	0.71

** : Significant at 1% level; * Significant at 5% level.

F= 42.00; R^2= 0.97

The own price elasticity of fresh milk was inelastic and low (-0.5369).The results indicated that with an increase of 10% of fresh milk will result in 5.3% in decrease of demand for fresh liquid milk. However the cross price elasticity between fresh milk and whole milk powder was highly elastic , a result that deviates from the cross price elasticity of fresh milk and whole milk powder in other wet zone districts.(Table 6.0)

Table 6.0 – Own Elasticity and Cross Price Elasticity between FM and Other Types of Milk Consumed and Expenditure Elasticity in Gampaha District

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	OMP ε_{ij}	Expenditure elasticity η_i
FM	5.422	-0.5369	2.170	0.0685	0.0115

Similarly the cross price elasticity between fresh milk and other milk was elastic indicating that with an increase of price of other milk by 1% would result in an increase of demand of fresh milk by 2.2%, a result which was different from other districts. The expenditure elasticity results indicated that with an increase of 1% in food expenditure of households will result in an 0.01% increase in expenditure due to changes in fresh milk consumption in the district..

5.1.5 Matara District

This section describes the results of the budget share estimations and the elasticities of demand for whole milk powder and farm fresh liquid milk for Matara district.Table 6.1 shows the results of the budget share equation for whole milk powder in the district.

Table 6.1 Demand Coefficients of Whole Milk Powder (WMP) of Households

Endogenous variable: Budget share of whole milk powder

Exogenous Variables	Coefficient estimates	t value
Intercept	- 4.1025	1.07
Price of whole milk powder	-0. 4851	10.46**
Price of fresh milk	0.0790	2.98*
Price of other milk	0.0297	1.06
Price of other milk products	0.0068	0.70
Household income	0.2129	0.53

** : Significant at 1% level; * significant at 5% level
F= 31.98; R^2= 0.744

The model was significant at 1% level and with a R^2= 0.74 indicating that 74% of the variation of budget share of Matara district was explained by the included variables of the model. All the coefficients of the variables were with the theoretical expected signs with coefficients for price of whole milk powder and fresh liquid milk being significant.
The own price elasticity of whole milk powder was low and inelastic (-0.5103).The results indicated that with an increase of 10% of price of whole milk powder will decrease its demand by nearly 5.1% (Table 6.2) .

Table 6.2 – Own Elasticity and Cross Price Elasticity between WMP and Other Types of Milk Consumed and Expenditure Elasticity in Matara District

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	OMP ε_{ij}	Expenditure elasticity η_i
WMP	-0.5103	0.7165	0.1365	-0.1328	0.1962

The cross price elasticity of whole milk powder and fresh milk was inelastic and the result showed that fresh milk a close substitute to whole milk powder in Matara district. The results for cross price elasticity for other milk was not in accordance to the theoretical expectations. The expenditure elasticity for whole milk powder was low and inelastic. The results indicated that with an increase of 1% of food expenditure of households in the district

would result in 0.2% increase in expenditure due to additional whole milk powder purchases.

Table 6.3 shows the estimates for budget share equation for farm fresh liquid milk in Matara district.

Table 6.3 Demand Coefficients of Farm Fresh Liquid Milk of Households in Matara District

Endogenous variable: Budget share of Farm Fresh Milk

Exogenous Variables	Coefficient estimates	t value
Intercept	-6.7800	2.62**
Price of whole milk powder	0.0584	1.86*
Price of fresh milk	-0.5835	21.58**
Price of other milk	0.0035	0.18
Price of other milk products	0.0162	0.23
Household income	0.1924	0.70

** : Significant at 1% level; * Significant at 5% level.
F= 102.05; R^2= 0.90

The model was significant at 1% with a R^2=0.90 indicating that nearly 90% of the variation of the budget share was explained by the included exogenous variables. All the coefficients were with the expected signs and coefficients for price of whole milk powder and price of fresh milk were significant. The signs for prices of other milk, prices of other milk products indicated that they were substitutes for fresh liquid milk.

Table 6.4 shows the demand elasticities for fresh milk with whole milk powder, other milk and other milk products. The own price elasticity of fresh milk was inelastic and low indicating that the households were not price responsive to the changes of demand of milk.The cross price elasticity between fresh milk and whole milk powder was elastic and the results indicated that with an increase of price of whole milk powder by 1% will increase the demand for fresh milk five fold.

Table 6.4 – Own Elasticity and Cross Price Elasticity between FM and Other Types of Milk Consumed and Expenditure Elasticity in Matara District

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	OMP ε_{ij}	Expenditure elasticity η_i
FM	0.4002	-0.4469	0.090	0.1702	0.0335

Similarly the cross price elasticity between fresh milk and other milk among the households in the district were elastic. The expenditure elasticity for fresh milk in the district was low and inelastic.

5.1.6 Kegalle District

This section describes the results of the budget share estimations and the elasticities of demand for whole milk powder and farm fresh liquid milk for Kegalle district. Table 6.5 shows the results of the budget share equation for whole milk powder in the district.

Table 6.5 Demand Coefficients of Whole Milk Powder (WMP) of Households

Endogenous variable: Budget share of whole milk powder

Exogenous Variables	Coefficient estimates	t value
Intercept	-5.9513	2.30*
Price of whole milk powder	-0. 4923	22.70**
Price of fresh milk	0.0264	0.71
Price of other milk	-0.0555	1.27
Price of other milk products	0.0171	0.80
Farming dummy	0.8280	2.01*
Household income	0.0169	0.16

** : Significant at 1% level; * significant at 5% level

$F= 84.63$; $R^2= 0.913$

The model was significant at 1% level with $R^2=0.91$ indicating that nearly 91% of the variation of the budget share could be explained by the included variables in the equation.

All coefficients (except that for other milk) has the theoretical expected signs with coefficients for price of whole milk powder and farming dummy being significant in the model.

The own price elasticity of whole milk powder was low and inelastic (-0.4985) indicating that with an increase of price of whole milk powder by 1% would reduce its demand by nearly 0.5% (Table 6.6) .

Table 6.6 – Own Elasticity and Cross Price Elasticity between WMP and Other Types of Milk Consumed and Expenditure Elasticity in Kegalle District

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	OMP ε_{ij}	Expenditure elasticity η_i
WMP	-0.4985	2.015	-4.28	1.30	0.0160

The cross price elasticity between whole milk powder and fresh milk was positive (i.e they are substitutes) and elastic. The result indicated that with a increase of whole milk powder by 1% the demand for fresh milk will increase by 2% in the district. A positive and elastic demand also existed between whole milk powder and other milk products.

The expenditure elasticity of whole milk powder was 0.0160 .This result indicated that with the increase of consumer expenditure of households by 1% would increase he expenditure of whole milk powder marginally.

Table 6.7 shows the estimates for budget share equation for farm fresh liquid milk in Matara district.

Table 6.7 Demand Coefficients of Farm Fresh Liquid Milk of Households in Kegalle District

Endogenous variable: Budget share of Farm Fresh Milk

Exogenous Variables	Coefficient estimates	t value
Intercept	-12.4456	2.63**
Price of whole milk powder	0.1278	3.17**
Price of fresh milk	-0.1567	2.24*
Price of other milk	0.1108	1.35
Price of other milk products	0.0290	0.72
Household income	0.5069	1.05

** : Significant at 1% level; * Significant at 5% level.
F= 14.25; R^2= 0.368

The model was significant with R^2=0.36 with expected theoretical signs of all the included variables in the model. The coefficients for price of whole milk powder and price of fresh milk was significant. The own price elasticity of fresh milk was low and inelastic.However the cross price elasticity between fresh milk and whole milk powder as well as other milk products were elastic (Table 6.8)

Table 6.8 – Own Elasticity and Cross Price Elasticity between FM and Other Types of Milk Consumed and Expenditure Elasticity in Kegalle District

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	OMP ε_{ij}	Expenditure elasticity η_i
FM	4.210	-0.1557	2.732	0.7850	0.5055

5.2 AIDS Model estimations for Intermediate Dry Zone

The results for Kurunegala and Badulla districts IDS model estimations are shown below.

5.2.1 Kurunegala District

This section describes the results of the budget share estimations and the elasticities of demand for whole milk powder and farm fresh liquid milk for Kurunegala district. Table 6.9 shows the results of the budget share equation for whole milk powder in the district.

Table 6.9 Demand Coefficients of Whole Milk Powder (WMP) of Households

Endogenous variable: Budget share of whole milk powder

Exogenous Variables	Coefficient estimates	t value
Intercept	- 5.9513	2.30
Price of whole milk powder	-0. 4923	22.70**
Price of fresh milk	0.0264	2.71*
Price of other milk	0.0555	1.27
Price of other milk products	0.0171	0.80
Household income	0.0169	0.60

** : Significant at 1% level; * significant at 5% level

F= 84.63; R^2= 0.913

The model is significant with a R^2=0.85 with coefficients for whole milk powder and fresh milk significant. However all the variables were with the theoretical expected signs.

Indication that fresh liquid milk , other milk and other milk products were close substitutes to whole milk powder among households in the district.

The own price elasticity of whole milk powder among households was inelastic and low indicating that an an increase of 10% of the price of whole milk powder will result in decrease of demand of 5.3% among households in Kurunegala district (Table 7.0) .

Table 7.0 – Own Elasticity and Cross Price Elasticity between WMP and Other Types of Milk Consumed and Expenditure Elasticity in Kurunegala District

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	OMP ε_{ij}	Expenditure elasticity η_i
WMP	-0.5336	0.3131	0.6769	0.1969	0.0156

The cross price elasticity between whole milk powder and fresh milk is low and inelastic .The results indicated that with an increase of 10% of fresh milk would result in a increase of demand of whole milk powder by 3.1%.Similarly the cross price elasticity between whole milk powder and other milk , other milk products were low and inelastic. The expenditure elasticity of whole milk powder was also low and inelastic.

Table 7.1 shows the estimates for budget share equation for farm fresh liquid milk in Kurunegala district.

The model is significant with a R^2=0.36 with variables with theoretically expected signs and coefficients for price of whole milk powder and price of fresh milk being significant. The results for whole milk powder, other milk and other milk products indicated that these are close substitutes to fresh milk among households in the district.

Table 7.1- Demand Coefficients of Farm Fresh Liquid Milk of Households in Kurunegala District

Endogenous variable: Budget share of Farm Fresh Milk

Exogenous Variables	Coefficient estimates	t value
Intercept	-12.4456	2.63**
Price of whole milk powder	0.1278	3.17*
Price of fresh milk	-0.1567	2.24*
Price of other milk	0.1108	1.35
Price of other milk products	0.0290	0.72
Household income	0.5070	1.05

** : Significant at 1% level; * Significant at 5% level.

F= 14.25; R^2= 0.368

The own price elasticity of fresh milk was low and inelastic (-0.1560) indicating that with an increase of price of fresh milk by 10% would decrease its consumption by 1.6%. However the cross price elasticity between fresh milk and whole milk powder, other milk and other milk products were elastic .For example increase of whole milk powder by 1% would increase the consumption of fresh milk by 6.3%. Similarly an increase of price of other milk and other milk products would increase the consumption of fresh milk by 5.5% and 1.4% respectively (Table 7.2).

Table 7.2 – Own Elasticity and Cross Price Elasticity between FM and Other Types of Milk Consumed and Expenditure Elasticity in Kurunegala District

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	OMP ε_{ij}	Expenditure elasticity η_i
FM	6.340	-0.1560	5.490	1.400	0.5059

The expenditure elasticity of fresh milk was inelastic indicating that with an increase of 1% of expenditure of food will result in the increase of fresh milk expenditure by 0.5% among the households in the district. The cross price elasticity results indicated that the households in the district are price responsive to changes in the prices of close substitutes for fresh milk.

5.2.2 Badulla District

This section describes the results of the budget share estimations and the elasticities of demand for whole milk powder and farm fresh liquid milk for Badulla district. Table 7.3 shows the results of the budget share equation for whole milk powder in the district.

Table 7.3 Demand Coefficients of Whole Milk Powder (WMP) of Households

Endogenous variable: Budget share of whole milk powder

Exogenous Variables	Coefficient estimates	t value
Intercept	- 2.4302	12.07**
Price of whole milk powder	-0. 4014	73.24**
Price of fresh milk	0.01175	2.13*
Price of other milk	0.0100	1.09
Price of other milk products	0.0021	0.56
Household income	0.0668	1.17

** : Significant at 1% level; * significant at 5% level

$F= 64.41$; $R^2= 0.941$

The model was significant at 1% level with a R^2=0.94 indicating that nearly 94% of the variation of the budget share could be explained by the included variables in the model.All the coefficients were with the expected signs and with that of price of whole milk powder and price of fresh milk being significant.

The own price elasticity for whole milk powder was low and inelastic (0-5006) indicating that with a price increase of 1% in whole milk powder would reduce its demand by nearly 0.5%.The cross price elasticity between whole milk powder , fresh milk and other milk were low and inelastic but the result confirms that they were close substitutes to whole milk powder (Table 7.4). The results of cross price elasticity between whole milk powder and other milk products were contradictory to the earlier results.

Table 7.4 – Own Elasticity and Cross Price Elasticity between WMP and Other Types of Milk Consumed and Expenditure Elasticity in Badulla District

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	OMP ε_{ij}	Expenditure elasticity η_i
WMP	-0.4106	0.2302	0.0056	-0.0041	0.0587

The expenditure elasticity of whole milk powder for the households in Badulla district was low and inelastic.

Table 7.5 shows the coefficients for budget share equations for fresh farm milk in Badulla district.

Table 7.5 Demand Coefficients of Farm Fresh Liquid Milk of Households in Badulla District

Endogenous variable: Budget share of Farm Fresh Milk

Exogenous Variables	Coefficient estimates	t value
Intercept	-2.4157	5.56**
Price of whole milk powder	0.0209	1.51
Price of fresh milk	-0.5319	38.15**
Price of other milk	0.0105	1.09
Price of other milk products	0.0023	0.56
Household income	0.5680	1.17

** : Significant at 1% level; * Significant at 5% level.
F= 29.87 R^2= 0.964

The model is significant with a R^2 =0.96 with all coefficients of variables having the expected signs and the coefficient of price of fresh milk was significant.. The results indicated that whole milk powder, other milk and other milk products were close substitutes to farm fresh liquid milk among the households in Badulla district.

Table 7.6 shows the own price and cross price of fresh milk among households in Badulla district. The own price elasticity of farm fresh milk was low and inelastic indicating that the households were not price responsive. The cross price elasticity between farm fresh milk and other forms of milk and milk products were close substitutes and inelastic.

Table 7.6 – Own Elasticity and Cross Price Elasticity between FM and Other Types of Milk Consumed and Expenditure Elasticity in Badulla District

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	OMP ε_{ij}	Expenditure elasticity η_i
FM	0.3026	-0.5498	0.1316	0.0285	0.1495

The expenditure elasticity for fresh milk indicated that with an increase of 1% of expenditure of all foods the expenditure for fresh milk among households in Badulla district will increase by 0.1%.

5.3 AIDS Model estimations for Dry Zone

The results of AIDS model estimations for Polonnaruwa,Anuradhapura and Moneragala districts are shown below.

5.3.1 Polonnaruwa

This section describes the results of the budget share estimations and the elasticities of demand for whole milk powder and farm fresh liquid milk for Polonnaruwa district. Table 7.7 shows the results of the budget share equation for whole milk powder in the district. The model is significant at 1% level with a R^2=0.98 with all coefficients with expected signs. The coefficients for price of whole milk powder and price of fresh milk were significant.The results indicated that fresh milk, other milk and other milk products were close substitutes to whole milk powder among households in Polonnaruwa district.

Table 7.7 Demand Coefficients of Whole Milk Powder (WMP) of Households

Endogenous variable: Budget share of whole milk powder

Exogenous Variables	Coefficient estimates	t value
Intercept	- 2.4302	11.45**
Price of whole milk powder	-0. 4684	69.48**
Price of fresh milk	0.01375	2.02*
Price of other milk	0.0105	1.04
Price of other milk products	0.0023	0.54
Household income	0.0568	1.11

** : Significant at 1% level; * significant at 5% level

F= 159.4; R^2= 0.989

The own price elasticity of whole milk powder in the district was low and inelastic indicating that with 1% increase in price of whole milk powder the demand for whole milk powder will reduce by nearly 0.5% (Table 7.8).

Table 7.8 – Own Elasticity and Cross Price Elasticity between WMP and Other Types of Milk Consumed and Expenditure Elasticity in Polonnaruwa District

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	OMP ε_{ij}	Expenditure elasticity η_i
WMP	-0.5006	0.1322	0.0088	-0.0248	0.0529

The cross price elasticity between whole milk powder and fresh milk and other milk were low and inelastic. However the cross price elasticity between whole milk powder and other milk products was not in accordance with theoretical expectation. The expenditure elasticity for whole milk powder in the district was low and inelastic.

Table 7.9 shows the coefficients for budget share equations for fresh farm milk in Polonnaruwa district.

Table 7.9 Demand Coefficients of Farm Fresh Liquid Milk of Households in Polonnaruwa District

Endogenous variable: Budget share of Farm Fresh Milk

Exogenous Variables	Coefficient estimates	t value
Intercept	-2.4157	5.28**
Price of whole milk powder	0.0209	1.44
Price of fresh milk	-0.5319	36.19**
Price of other milk	0.0130	0.60
Price of other milk products	0.0084	0.89
Household income	0.1563	1.41

** : Significant at 1% level; * Significant at 5% level.
F= 289.93 R^2= 0.964

The model is significant with a R^2=0.96 and all the coefficients were with expected signs. The coefficients for price of fresh milk was significant. The results confirms that whole milk powder, other milk and other milk products were close substitutes for fresh milk among households in Polonnaruwa district.

The own price elasticity of fresh milk is low and inelastic (-0.5377) indicating an increase of 1% of price of fresh milk would decrease its demand by nearly 0.5%.The cross price elasticity between fresh milk and whole milk powder was elastic (1.1 935). This result indicated that with an increase of price of whole milk powder by 1% would result in an increase of demand of fresh milk by 1.2%. The cross price elasticity of fresh milk with other milk and other milk products were low and inelastic (Table 8.0).

Table 8.0 – Own Elasticity and Cross Price Elasticity between FM and Other Types of Milk Consumed and Expenditure Elasticity in Polonnaruwa District

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	OMP ε_{ij}	Expenditure elasticity η_i
FM	1.1935	-0.5377	0.6839	0.3870	0.1539

The expenditure elasticity of fresh milk was low and inelastic among households in Polonnaruwa district.

5.3.2 Anuradhapura District

This section describes the results of the budget share estimations and the elasticities of demand for whole milk powder and farm fresh liquid milk for Anuradhapura district. Table 8.1 shows the results of the budget share equation for whole milk powder in the district.

Table 8.1 Demand Coefficients of Whole Milk Powder (WMP) of Households

Endogenous variable: Budget share of whole milk powder

Exogenous Variables	Coefficient estimates	t value
Intercept	-17.7680	3.99**
Price of whole milk powder	-0. 4249	12.04**
Price of fresh milk	0.1121	3.08**
Price of other milk	0.0126	0.19
Price of other milk products	0.0314	0.57
Household income	1.2060	2.61**

** : Significant at 1% level; * significant at 5% level

F= 50.61 R^2= 0.810

The model is significant at 1% level and a R^2=0.81 indicating that nearly 81% of the variation of the budget share is explained by the included variables in the model.All the coefficients were with the expected signs with coefficients for price of whole milk powder , price of fresh milk and household income significant.

The own price elasticity of whole milk powder is low and inelastic (-0.3644) .The result indicated that with an increase of 1% of price of whole milk powder the demand will reduce by nearly 0.4% (Table 8.2).The cross price elasticity of whole milk powder and fresh milk shows that they were close substitutes and inelastic.The cross price elasticity estimates for whole milk powder with other milk and other milk products were not accordance with theoretical expected results.

Table 8.2 – Own Elasticity and Cross Price Elasticity between WMP and Other Types of Milk Consumed and Expenditure Elasticity in Anuradhapura District

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	OMP ε_{ij}	Expenditure elasticity η_i
WMP	-0.3644	0.3533	-1.0305	-0.7691	1.1251

The expenditure elasticity of whole milk powder was elastic and the results indicated that with an increase of food expenditure of the households by 1% would result in an increase of expenditure of whole milk powder by nearly 1.1%.

Table 8.3 shows the coefficients for budget share equations for fresh farm milk in Anuradhapura district.

Table 8.3 Demand Coefficients of Farm Fresh Liquid Milk of Households in Anuradhapura District

Endogenous variable: Budget share of Farm Fresh Milk

Exogenous Variables	Coefficient estimates	t value
Intercept	-19.8993	3.72**
Price of whole milk powder	0.0490	1.16
Price of fresh milk	-0.4580	10.48**
Price of other milk	0.0089	0.11
Price of other milk products	0.0032	0.50
Household income	1.5113	2.73*

** : Significant at 1% level; * Significant at 5% level.

F= 32.94 R^2 = 0.736

The model is significant at 1% level with a R^2= 0.74 and all coefficients were with the expected signs.The coefficients for price of fresh milk and household income were significant. The results indicated that all forms of milk were close substitute for farm fresh milk in the district.

The own price elasticity for farm fresh milk in the district was low and inelastic (-0.4028). The results for cross price elasticity between farm fresh milk and all other forms of milk were not in accordance with the theoretical expectations (Table 8.4) .

Table 8.4– Own Elasticity and Cross Price Elasticity between FM and Other Types of Milk Consumed and Expenditure Elasticity in Anuradhapura District

	WMP	FM	OM	OMP	Expenditure
	ε_{ii}	ε_{ij}	ε_{ij}	ε_{ij}	elasticity η_i
FM	-0.5281	-0.4028	-1.3333	-1.4478	1.4396

The expenditure elasticity of fresh milk was elastic indicating that an increase of the household food expenditure by 1% would increase the expenditure for farm fresh liquid milk by nearly 1.4%.

5.3.3 Moneragala District

This section describes the results of the budget share estimations and the elasticities of demand for whole milk powder and farm fresh liquid milk for Moneragala district. Table 8.5 shows the results of the budget share equation for whole milk powder in the district.

The model was significant at 1% level with R^2= 0.710 indicating that nearly 71% of the variation of the endogenous variables was explained by the included variables in the model.The household size, per capita food expenditure, education , and price of whole milk powder was significant with all variables having the theoretical signs of the coefficients. According to the results fresh milk and other milk products were substitutes for whole milk powder.

Table 8.5 Demand Coefficients of Whole Milk Powder (WMP) of Households

Endogenous variable: Budget share of whole milk powder

Exogenous Variables	Coefficient estimates	t value
Intercept	-687.138	0.68
Price of whole milk powder	-2.2405	2.57*
Price of fresh milk	41.0383	1.60
Price of other milk	0.1095	0.10
Household size	91.2113	2.42*
Age of household	4.7578	3.38**
Education	347.665	2.65*
Per capita food expenditure	0.2296	3.38*

** : Significant at 1% level; * significant at 5% level

$F = 27.80; R^2 = 0.710$

The own price elasticity for whole milk powder in the district was low and inelastic (-0.2323). The results for cross price elasticity between farm fresh milk and all other forms of milk were not in accordance with the theoretical expectations (Table 8.6) .

The cross price elasticity between whole milk powder and fresh milk was elastic but was not significant.

Table 8.6– Own Elasticity and Cross Price Elasticity between WMP and Other Types of Milk Consumed and Expenditure Elasticity in Moneragala District

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	Expenditure elasticity η_i
WMP	-0.2323	2.535	0.0485	0.00028

The expenditure elasticity of fresh milk was inelastic indicating that an increase of the household food expenditure would have a marginal increase in the demand for whole milk powder.

Table 8.7 shows the coefficients for budget share equations for other milk products in Moneragala district.The model was significant at 5% level and a $R^2 = 0.62$.The coefficients

for per capita food expenditure and price of fresh milk significant in the equation. All the coefficients in the equation were of the expected theoretical signs.

Table 8.7 Demand Coefficients of Other Milk Products of Households in Moneragala District

Endogenous variable: Budget share of Other Milk Products

Exogenous Variables	Coefficient estimates	t value
Intercept	1527.00	2.41*
Price of whole milk powder	3.9813	2.42*
Price of fresh milk	45.7772	2.59*
Price of other milk products	-2.2722	2.26*
Household size	34.3883	1.28
Education	113.2799	1.21
Age of household	3.9464	1.76
Per capita food expenditure	0.1359	2.80*

** : Significant at 1% level; * Significant at 5% level.
F= 18.97; $R^2 = 0.618$

The own price elasticity of other milk products was low and inelastic (-0.2380). The result indicated that with a price increase of 1% the demand for other milk products will decrease by a marginal 0.23%. The cross price elasticity between other milk products and whole milk powder was 0.7202 indicating with a 1% change in the price of whole milk powder the demand for other milk products will increase by 0.72% and these are close substitutes.A similar result for cross elasticity between other milk products and fresh milk in the district. (Table 8.8).

Table 8.8– Own Elasticity and Cross Price Elasticity between Other Milk Products Consumed and Expenditure Elasticity in Moneragala District

	OMP ε_{ii}	WMP ε_{ij}	FM ε_{ij}	Expenditure elasticity η_i
OMP	-0.2374	0.7202	0.6965	0.0007

5.4 Dairy Consumption Models for Sri Lanka

The pooled data of all the districts used in the study was included in the LAAID model for Sri Lanka. In the model dummy for wet zone (WZ=1 otherwise 0) dry zone (DZ=1 otherwise 0) was used with the dummy for intermediate zone as a control. All the variables used in the above models were tested here.This section included demand equation estimations of all the milk and milk products (whole milk powder,fresh milk, other milk and other milk products) of the households in all the districts.

5.4.1 Whole Milk Powder

Table 8.9 shows the demand equation for whole milk powder in all the districts in the study in log form . The model is significant with R^2= 0.876. All the variables used in the equation (except the price of other milk) were of the expected theoretical signs with coefficients for fresh milk, whole milk powder and dummy for dry zone being significant. The own price elasticity of whole milk powder is inelastic (-0.5478) and low indicating that the households demand was not very responsive to changes in price of whole milk powder. (Table 9.0).

Table 8.5 Demand Coefficients of Whole Milk Powder (WMP) of Households in all Districts

Endogenous variable: Budget share of whole milk powder

Exogenous Variables	Coefficient estimates	t value
Intercept	-6.5957	5.05**
Price of whole milk powder	-0.4852	39.38**
Price of fresh milk	0.0613	4.44**
Price of other milk	-0.0017	0.13
Price of other milk products	0.0019	0.14
Household income	0.4799	0.56
Dummy for wet zone	0.0476	0.24
Dummy for dry zone	0.4799	2.02*

** : Significant at 1% level; * significant at 5% level
F= 309.6;R^2= 0.875

The cross price elasticity between whole milk powder and fresh milk was inelastic and low (0.3882) indicating that a 1% change in the price of fresh milk would increase the demand of whole milk powder by a marginal 0.4%. The cross price elasticity between whole milk powder and other milk products was negative indicating it was complementary to whole milk powder , a result that is contradictory to the earlier results of the demand equation.

Table 8.6– Own Elasticity and Cross Price Elasticity between WMP and Other Types of Milk Consumed and Expenditure Elasticity for All Districts

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	OMP	Expenditure elasticity η_i
WMP	-0.5478	0.3882	-0.0876	-0.0604	0.0659

5.4.2 Farm Fresh Liquid Milk

Table 8.7 shows the coefficients for budget share equations for fresh farm milk in all districts.

Table 8.7 Demand Coefficients of Farm Fresh Liquid Milk of Households in All Districts

Endogenous variable: Budget share of Farm Fresh Milk

Exogenous Variables	Coefficient estimates	t value
Intercept	-11.3207	6.11**
Price of whole milk powder	0.05331	3.05*
Price of fresh milk	-0.4864	24.81**
Price of other milk	0.00009	0.18
Price of other milk products	0.00301	0.16
Household income	0.6032	3.20**
Dummy for wet zone	0.2269	0.82
Dummy for dry zone	-0.0921	0.27

** : Significant at 1% level; * Significant at 5% level.
F=120.98; R^2 = 0.733

The model was significant at 1% level with R^2=0.73 with all coefficients having the expected theoretical signs.The coefficients for price of whole milk powder , price of fresh milk and household income were significant. The signs of the coefficients for price whole milk powder, other milk and other milk products suggested that they were substitutes for fresh milk.

Table 8.8 shows the own price elasticity of demand and cross price elasticity of demand between fresh milk and milk products and expenditure elasticity for all districts.

Table 8.8– Own Elasticity and Cross Price Elasticity between FM and Other Types of Milk Consumed and Expenditure Elasticity of All Districts

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	OMP ε_{ij}	Expenditure elasticity η_i
FM	1.0690	-0.4826	-0.5990	-0.5078	0.5846

The own price elasticity of fresh milk was low and inelastic (-0.4826).The cross price elasticity between fresh milk and whole milk powder is positive (i.e they are substitutes) and elastic. The result indicated that with an price increase of 1% of whole milk powder the demand for fresh milk will increase by nearly 1.1%.The cross price elasticity between fresh milk and other milk (other milk products) was negative indicating that they are complementary products to fresh milk ,a result that deviates from that of the demand equation. The expenditure elasticity of fresh milk was low and inelastic (Table 8.8).

5.4.3 Other Milk

Table 8.9 shows the coefficients for budget share equations for other milk in all districts.The model was significant with a R^2= 0.924 and all coefficients were with the theoretical expected signs. The coefficients for price of other milk and income was significant.The results indicated that whole milk powder, fresh milk and other milk products being substitutes for other milk in all districts.

The own price elasticity of other milk was low and inelastic (-0.7857) indicating that with a change of price of other milk by 1% will reduce its demand by merely 0.8% (Table 9.0).The cross price elasticity of other milk with whole milk and other milk was positive (i.e. they are substitutes) and inelastic.However the cross price elasticity between other milk and fresh liquid milk was elastic (2.7857).The result indicated that with a 1% change in the price of fresh milk the demand for other milk will increase by 2.8%.

Table 8.9 Demand Coefficients of Other Milk of Households in All Districts

Endogenous variable: Budget share of Other Milk

Exogenous Variables	Coefficient estimates	t value
Intercept	-8.0384	11.02**
Price of whole milk powder	0.00261	0.38
Price of fresh milk	0.0082	1.06
Price of other milk	-0.4013	55.15**
Price of other milk products	0.0014	0.19
Household income	0.1342	2.12*
Dummy for wet zone	0.0831	0.76
Dummy for dry zone	-0.1607	1.21

** : Significant at 1% level; * Significant at 5% level.
F=540.85; $R^2 = 0.925$

Table 9.0– Own Elasticity and Cross Price Elasticity between Other Milk and Other Types of Milk Consumed and Expenditure Elasticity of All Districts

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	OMP ε_{ij}	Expenditure elasticity η_i
OM	0.7857	2.2857	-0.4020	0.3571	0.1338

The expenditure elasticity of other milk was low and inelastic (0.1338) and the result indicated that with a change of expenditure of households by 1% the demand for other milk will increase only by a marginal 0.1%.

5.4.4 Other Milk Products

The estimates of the budget share equation for other milk products are shown in Table 9.1.

Table 9.1 - Demand Coefficients of Other Milk Products of Households in All Districts

Endogenous variable: Budget share of Other Milk Products

Exogenous Variables	Coefficient estimates	t value
Intercept	-7.5722	4.17**
Price of whole milk powder	0.0189	1.58
Price of fresh milk	0.0180	0.94
Price of other milk	0.0287	1.58
Price of other milk products	-0.4511	24.33**
Household income	0.3070	2.16*
Dummy for wet zone	-0.7953	2.93**
Dummy for dry zone	-0.0913	0.78

F= 100.13 ;** : Significant at 1%; * Significant at 5% ;R^2=0.695

The model was significant at 1% level with a R^2= 0.69 indicating that 69% of the variation of the endogenous variable, the budget share of other milk products was shown by the included exogenous variables in the equation. All the coefficients were of the expected theoretical signs. The coefficients for price of other milk products , household income and dummy for wet zone districts were significant in the equation.

The own price elasticity of other milk products was low and inelastic (-0.4583).The cross price elasticity of whole milk powder and fresh milk were negative indicating that they are complements to other milk products , a deviation from the expected results (Table 9.1).

Table 9.1– Own Elasticity and Cross Price Elasticity between Other Milk Products and Other Types of Milk Consumed and Expenditure Elasticity of All Districts

	WMP ε_{ii}	FM ε_{ij}	OM ε_{ij}	OMP ε_{ij}	Expenditure elasticity η_i
OMP	-0.0264	-0.0412	0.1334	-0.4583	0.2895

The expenditure elasticity of other milk products was low and inelastic.

Import Share Equation for Milk and Milk Products ,Sri Lanka

The import share equations for milk powder, fluid milk and cream,condensed milk, butter cheese and ghee as endogenous variables , were fitted as a function of exogenous vaiables such as unit import values of type of milk and milk products , exchange rate, GNP and trend variables for the period of 1975-2001 in log-log form and estimated by the Cochrane-Orcutt procedure. The results are discussed below.

Import Share of Milk Powder

Table 9.2 shows the results of the import share of milk powder equation which was fitted in log-log form.The model was significant at 1% level and a R^2= 0.857 indicating that nearly 86% of the variation of the import share of milk powder was shown by the exogenous variables included in the equation.

Table 9.2 –Import Share of Whole Milk Powder,Sri Lanka,1975-2001

Endogenous variable: Import share of whole milk powder

Exogenous Variables	Coefficient estimates	t value
Intercept	6.6664	2.02*
Imported price of whole milk powder	-0.7669	5.75**
Imported price of condensed milk	0.2335	2.20*
Imported price of milk and cream	0.1618	2.81**
Imported price of butter,cheese and ghee	0.0563	0.80
Exchange rate	0.4942	1.15
GNP	0.1022	0.15
Trend	0.0492	2.11*

** : Significant at 1% level; * Significant at 5% level.

F= 17.22; $R^2 = 0.857$

All the coefficients were with the theoretical expected signs and imported prices of whole milk powder ,condensed milk and fluid milk and cream were significant in the equation. The appreciation of the exchange rate would increase the demand for import of whole milk powder. An increase of GNP also would increase the demand of whole milk powder. The result also showed that the demand of whole milk powder has a positive trend. However the coefficients for exchange rate, GNP and trend were not significant in the demand equation.

Import Share of Milk and Cream

Table 9.3 shows the results of the import share of liquid milk and cream equation in log-log form.The model is significant at 1% level and a R^2= 0..850 indicating that nearly 85% of the variation of the import share of milk and cream was shown by the exogenous variables included in the equation.

Table 9.3 –Import Share of Milk and Cream,Sri Lanka,1975-2001

Endogenous variable: Import share of milk and cream

Exogenous Variables	Coefficient estimates	t value
Intercept	33.4589	1.90
Imported price of whole milk powder	0.4709	0.66
Imported price of condensed milk	0.9343	1.65
Imported price of milk and cream	-0.4783	2.55*
Imported price of butter,cheese and ghee	1.6408	4.39**
Exchange rate	5.3534	2.32*
GNP	8.2475	2.25*
Trend	0.0353	0.28

** : Significant at 1% level; * Significant at 5% level.

F= 16.31; $R^2 = 0.850$

All the coefficients of the import share of milk and cream were of the expected theoretical signs with coefficients for imported prices of milk and cream and prices of butter ,cheese and ghee, exchange rate, GNP being significant.

Import Share of Condensed Milk

Table 9.4 shows the results of the import share of condensed milk equation fitted in log-log form.The model is significant and a R^2= 0.74 indicating that nearly 74% of the variation of the import share of condensed milk was shown by the exogenous variables included in the equation.

Table 9.4 –Import Share of Condensed Milk ,Sri Lanka,1975-2001

Endogenous variable: Import share of condensed milk

Exogenous Variables	Coefficient estimates	t value
Intercept	-22.3154	1.97
Imported price of whole milk powder	0.8038	1.75
Imported price of condensed milk	-1.1307	3.10**
Imported price of milk and cream	-0.3713	1.75
Imported price of butter,cheese and ghee	0.0563	0.80
Exchange rate	0.4942	1.15
GNP	0.1022	0.25
Trend	0.0492	2.11*

** : Significant at 1% level; * Significant at 5% level.

F= 8.13; $R^2 = 0.739$

All the coefficients with the exception of imported price of milk and cream were of the expected theoretical signs. The coefficients for imported price of condensed milk and trend were significant. The negative sign of the imported price of milk and cream indicated its complementarity with liquid milk.

Import Share of Butter,Cheese and Ghee

Table 9.5 shows the results of the import share of milk products such as butter, cheese and ghee equation in log-log form.The model is significant at 1% level and a R^2= 0.90 indicating that nearly 90% of the variation of the import share of butter, cheese and ghee was shown by the exogenous variables included in the equation.

Table 9.5 –Import Share of Milk Products, Sri Lanka,1975-2001

Endogenous variable: Import share of milk products

Exogenous Variables	Coefficient estimates	t value
Intercept	11.3349	2.53*
Imported price of whole milk powder	0.1143	0.63
Imported price of condensed milk	0.0989	0.69
Imported price of milk and cream	0.0647	0.83
Imported price of butter,cheese and ghee	-0.7482	7.87**
Exchange rate	1.3824	2.36*
GNP	1.3237.	1.42
Trend	0.0300	0.95

** : Significant at 1% level; * Significant at 5% level.

F= 24.26; R^2 = 0.895

All the variables were with the expected theoretical signs and coefficients for imported prices of butter,cheese and ghee and exchange rates were significant.

Table 9.6 shows the import elasticity of demand of milk and milk products. The own price elasticity of all milk and milk products were negative. The results indicated that with increase of prices of any of these milk or milk products the imported share would decrease differently. Among these condensed milk has a elastic demand as compared to inelastic demand of other milk products.

Table 9.6 - Import Elasticity of Demand for Milk and Milk Products,Sri Lanka 1975-2002

	WMP	MC	BCG	CM	Income Elasticity
WMP	-0.7669	0.1618	0.0563	-0.2335	0.1022
MC	0.4709	-0.4783	1.6408	0.9344	8.2475
BCG	0.1143	0.0647	-0.7482	0.0989	1.3237
CM	0.8038	-0.3713	0.3278	-1.1307	5.2682

WMP- Whole Milk Powder
MC – Milk and Cream
BCG- Butter, Cheese and Ghee
CM – Condensed milk

The cross price elasticity of imported demand of milk and milk products were positive (being substitutes) and inelastic The exceptions include cross price elasticity between fluid milk and butter, cheese and ghee being elastic and cross price elasticity between whole milk powder and condensed milk being negative (complements).

The income elasticity of milk and milk products was positive. The values were elastic for all milk products other than imported whole milk powder. The results indicated that with higher GNP the response towards importing value added milk products has increased over the last decade..

CHAPTER 6: SUMMARY AND POLICY IMPLICATION

This chapter includes the summary of the study and policy implications based on the results of the study.

The average cow milk production in Sri Lanka is 156 million litres with an annual growth of 2%. The buffalo milk production is 30 million litres with an annual growth of 0.4% (Central Bank of Sri Lanka, 2005) .The annual milk consumption requirement in the country is 750 million litres(i.e. the self sufficiency of milk in the country is around 15-20%) and the balance domestic requirement required to be imported. Further the annual per capita consumption of milk of 19.87 litres is much below the level of 41.6 litres as recommended by the Medical Research Institute, to meet the nutrient requirement of an average Sri Lankan. Hence there is an urgent need to increase the consumption of milk in the country to meet the domestic requirement and average nutrient needs. The high imports of milk and milk products may also be related to the very low import tariff policy, low world price of milk imported and free access of imported milk and attitude of milk consumers in the country for imported whole milk powder over the last decade. The Sri Lankan dairy consumers have gained from subsidized exports of milk and milk products from European Economic Union (EU) and from other countries.Domestic production and marketing of milk under these condition has been difficult with the result that production and marketing of domestically produced milk has been quite static and low . Further the cost of production of domestic milk has escalated in the country mainly due to high cost of feeds, labour and other inputs. The annual imports of milk in 2005 amounted to 36118 metric tons of whole milk powder which on a liquid milk equivalent accounted for 353 litres of liquid milk.. In 1990 the value of imported milk amounted to Rs 2321.7 million and this has further increased to Rs 13401 million in 2005 (Central Bank of Sri Lanka, 2005). The principal form of milk marketing in the country is in the form of whole milk powder (WMP) representing around 75% formal market. Pasteurized and sterilized milk accounted for around 3% and sweetened condensed milk around 2% of the formal milk market.

The escalation of government expenditure of milk imports in the world market is related to increase of world price due to changes in demand and supply of milk in the

exporting countries, changes in tariff rates, freight and transport cost, WTO agreements and other related factors. The reduction of milk imports (mainly milk powder) is essential for the government to conserve the much needed foreign exchange required for the development of the agriculture and industrial and other sectors in the economy. Hence much emphasis is given by the Ministry of Agriculture and Livestock currently to increase the domestic fresh liquid milk consumption of the consumers and to change their attitudes away from consumption of imported powdered milk.

The general objective of this study is to determine the major household factors affecting consumption of milk and other milk products in wet zone, intermediate dry zone and dry zone districts and to determine the import demand of milk and milk products for Sri Lanka .Farm household data was obtained from Colombo,Nuwara Eliya, Gampaha, Kegalle Matara (Wet Zone), Kurunegala ,Badulla (Intermediate Dry Zone),Anuradhapura, Polonnaruwa , Moneragala (Dry Zone) districts for a total of 600 randomly selected households representing the urban, rural and estate sectors using a structured questionnaire between 2004- 2005 . LA/AIDS model was used in estimating the elasticity of demand of milk and milk products for different districts in which the field survey was conducted .Further time series for the period of 1975-2004 was used in estimating the import share demand equations for different milk and milk products imported based on which the import elasticity of demand was estimated for Sri Lanka.

The average family size in the districts was 4-5 household with more than 40% of households having primary education. The urban households were better educated than the rural sector. Most of the households were employed in public or private sectors, full time with a small proportion in full time farming and self employment. Nearly 20% of the households were covered by safety net such as " Samurdhi Programme". The average household monthly income was around Rs 13498 for all the districts with a minimum of Rs 10384 in Kegalle to Rs 18255 in Polonnaruwa districts. The households own average farm holdings of around 2 acres/farm. Paddy was the major crop in the dry zone districts as compared to low extents under paddy in the wet zone districts. Vegetables was the main crop in Nuwara Eliya and Perennials were grown mainly in Matara districts.

The average herd size of cattle reared among households was 4 consisting of a cow . The rural sector of the districts has the highest number of cattle/herd (except in Nuwara Eliya district). Majority of the cows were within their third lactation.Buffalo and goats were reported only from Anuradhapura and Kurunegala districts.The monthly milk production in the districts were low and this was reflected in their low consumption of milk among households in the districts with the highest milk consumption reported from Kuruneagala district (30 litres/month or 26% of total).The surplus milk produced were sold at prices ranging from Rs 14-15/litre. Nuwara Eliya district reported of highest farm income from milk production (Rs 7807).

Nearly 46% of the total income received by households in the districts for the purchase of food requirements. Of the total food expenditure nearly 63% were spent on purchase of basic food such as rice, wheat flour, milk, sugar and others. In all the districts the highest expenditure borne by households was for food, health and education. The expenditure for milk/milk products were relatively low (7.3%) with the highest from Colombo district .and the lowest from Polonnaruwa district. The expenditure was highest for whole milk powder as compared to fresh milk or other milk products. The consumption of fresh milk among households were marginal indicating with its short supply. The rural sector consumed higher proportion of milk powder as compared to urban or estate sectors in the districts.In general the consumption of whole milk powder was higher than the level of other milk products (OMP) which in turn was higher than fresh milk consumption among households in the districts. The highest consumption of fresh milk (1-1 ½ litres/household) was reported from Nuwara Eliya district in the wet zone . In general, the consumption of fresh milk among dry zone districts was higher than that of wet zone districts. The average consumption of fresh milk among wet zone (1.95 litres/household) and dry zone districts (2.26 litres/ household) was low. Majority of consumers felt that the price for fresh milk was relatively low as compared prices for whole milk powder and other milk products.The purchase of branded whole milk powder was common and was influenced by level of advertisements and other types of mass media communications of the milk processing and packaging firms.

The results LA/AIDS model for wet zone , intermediate dry zone and dry zone districts indicated that in general the own price elasticity of whole milk powder, fresh milk,

of these districts were low and inelastic indicating that the households were not very responsive to changes of prices of these milk products. The variation of own price elasticity of whole milk powder in the wet zone districts ranged from -0.1118 in Nuwara Eliya to -0.9802 in Gampaha districts. In the dry and intermediate dry zone districts the own price elasticity of whole milk powder ranged from -0.2323 in Moneragala to -0.5336 in Kurunegala. The own price elasticity of fresh milk in the wet zone districts ranged from -0.0252 in Nuwara Eliya to -0.5369 in Matara districts. In the dry zone and intermediate dry zone the own price elasticity of fresh milk varied from -0.1560 in Kurunegala to -0.5498 in Badulla districts.

The cross price elasticity between whole milk powder and fresh milk ,other milk and other milk products among households were low and inelastic .The sign of the coefficients was positive indicating that these were close substitutes (with some exceptions) to whole milk powder. However the level of substitution between these products were very marginal. For example, the cross price elasticity between whole milk powder and fresh milk among the wet zone districts ranged from 0.0013 in Nuwara Eliya to 0.3744 in Colombo district. The cross price elasticity between whole milk powder and fresh milk in the dry zone districts varied from 0.1322 in Polonnaruwa to 2.535 in Moneragala districts .

The cross price elasticity between fresh milk, whole milk powder, other milk and other milk products deviates from elastic-inelastic values among districts . The signs of the coefficients of the coefficients were also positive (with some exceptions) confirming that whole milk powder, other milk and other milk products were close substitutes to fresh milk. However the substitution values affirm that the level of substitution of the households were very high – low in the districts . For example, the cross price elasticity between fresh milk and whole milk powder among the households of the wet zone districts ranged from -0.4028 in Matara (complementary, inelastic) to 6.340 in Kurunegala (substitute, elastic) districts. In Colombo district the cross price elasticity between fresh milk and whole milk powder was 0.0002 indicating that the substitutability of fresh milk with whole milk powder among households was negligible in this district.

The expenditure elasticity of whole milk powder, fresh milk in the districts were low and inelastic indicating that the milk products were basic necessities in their food balance sheets. For example in the wet zone districts the expenditure elasticity of whole milk powder varies from 0.0160 in Kegalle district to 0.1962 in Matara district and in the dry zone districts this value ranged from 0.00028 in Moneragala district to 1.1251 (elastic) in Anuradhapura district. For fresh milk ,the expenditure elasticity in the wet zone districts varied from 0.0110 in Gampaha district to 0.5055 in Kegalle district and in the dry zone this value deviated from 0.1459 in Badulla district to 1.4396 (elastic) in Anuradhapura district.

The import share equation for whole milk powder indicated a that the demand of whole milk powder in Sri Lanka would decrease with an increase of price of whole milk powder significantly. However the import demand elasticity of whole milk powder was low and inelastic (-0.7669) . Further, an increase of imported prices of fresh milk,cream and condensed milk would increase the demand for whole milk powder significantly indicating that these are close substitutes to whole milk powder .The cross price elasticity between whole milk powder imports and fresh milk and with condensed milk was 0.1618 , 0.2335 respectively. The import share of whole milk powder is affected by exchange rate and GNP but not significantly. The income elasticity of whole milk powder although small, indicated that it is a normal good. The result indicated that with increase of GNP the import share of whole milk powder would increase.

The import share equation for fresh milk and cream also shows expected theoretical results with own price elasticity of imported demand being negative and inelastic (-0.4783) indicating that with an increase of 1% in the price of imported price of milk and cream its demand would reduce by nearly 0.5%. The results also shows that whole milk powder , imported condensed milk, butter, cheese and ghee being close substitutes with all cross price elasticities being inelastic, and the cross price elasticity of fresh milk with butter, cheese and ghee being significant. In this equation GNP and exchange rate significantly affects the demand for imported fresh milk. The result shows that when the exchange rate appreciates the demand for imports of fresh milk and cream increases.

The import share equation for condensed milk shows elastic own price elasticity

(-1.1307) for condensed milk. The cross price elasticity of fresh milk and cream was negative (complements) and inelastic but not significant. Both GNP and exchange rate showed theoretically accepted results (but not significant).

The import demand for butter, cheese and ghee was inelastic (-0.7482) and significant. The exchange rate was significant in the import share equation of butter, cheese and ghee.

The trend variable influences dairy imports positively in most of the estimated systems. This results indicated that some variables other than prices of imported milk or milk products, expenditure e.g. variables representing demographic dynamics (population density, aging of population, female participation in labour force, employment capacity of workers) may be influencing the imported demand of milk and milk products.

Policy Implications :

The results here shows some policy implication with relation to farm fresh milk , whole milk powder household consumption and imports. The results of household survey indicated that whole milk powder, farm fresh liquid milk were household basic food necessities. However the availability of farm fresh liquid milk was low in most of the districts (except Nuwara Eliya, Polonnaruwa, Kurunegala) and hence the households have no other alternative than to increase their demand for whole milk powder for their daily family needs. The results also shows that farm fresh liquid milk is a close substitute for whole milk powder and the prices of fresh milk is low in the districts as compared to whole milk powder and other milk products. Hence the substitution effect between whole milk powder and fresh milk (i.e cross price elasticity) would become higher if supply of fresh milk was readily made available to the household. However the study also indicated that the low quality of fresh milk available to the households as a main constraint in developing the farm fresh liquid milk market and changing the attitude of fresh milk consumption among households. Challenges are mostly in ensuring animal health and improvements in hygiene of milking. Improvements in infrastructure for collection of milk, storage , inspections may be important

The cross price elasticity between fresh milk and whole milk powder prices

indicated the potential benefit to small milk producers , especially those self owned producers supplying dairy farmer cooperatives and milk processors such as MILCO , NESTLE , as the removal of any policy distortions in the dairy market would lead to whole milk powder price increase. However it is not certain that the impacts of whole milk powder increase would be significant for most of the dairy farms as only a small percentage of milk produced in the country is derived from farmer cooperatives or processed by major domestic processing firms as most of the consumption requirements of the country are yet imported Most of the fresh milk in the country is yet traded in informal markets (boutiques, farms, production farms). The country produces only a small percent of whole milk powder of total requirement from domestically produced fresh liquid milk (small milk equivalent). Therefore the impact of price increase of whole milk powder on average farm gate fresh milk prices would be minimal, unless there is a surge of proportion of domestic milk purchased by domestic processors as the dairy industry improves its production, collection and processing ability to respond to strong domestic demand.

The consumption of dairy products in Sri Lanka has risen rapidly ahead of its required supply. In addition to great purchasing power , shifting preferences prompted by a new awareness of the consumers of the nutritive benefits of milk have greatly increased demand for milk products. Part of the domestic milk requirement (around 20%) was contributed by the emerging domestic dairy industry. Increase of dairy herd, adoption of new technologies has driven the supply of milk forward but very much below the required demand. This may be related to inefficiencies in the dairy sector which led to low productivity of cows , problems of infrastructure, low profit margins in dairying due to increase of rise of labour wages , feed prices ,stagnating and low price of milk , comparative advantage of milk and others. The increase of demand for dairy products will continue in the country with increase of per capita incomes of households, urbanization , growth of industrial sector , construction and services sector and development. The advertising and promotion of dairy products will accelerate contributing to the demand of dairy products by the households. However if the domestic dairy industry is to be successful in keeping pace with consumption, it will have to actualize the tremendous potential for scale economies of milk production, collection, and processing through innovative organizational structure of

rural households. Further productivity of cows should rise with improvement of dairy herd. The expansion of dairy herd numbers with increase in productivity may significantly increase dairy industry's competition with other livestock sectors for feed grains, quality forages, and protein feeds. The institutions of the dairy industry (both public as well as private) required to coordinate the domestic milk production and milk processing. The increase of domestic production is a must to decrease the high imports of milk products to needs of domestic demand.

Several researchers has predicted that Asia is and will remain a large net importer of dairy products (Dong,2005; Podbury et al, 1995; Rae,1997; Rutherfod,1999).The major factors hindering the competitiveness in dairy in these countries include factors such as climate, land and feed scarcity, labour cost, transaction/transport costs. These explain their dependence on world dairy markets. Countries competitiveness levels are also conditioned by distortions affecting world market prices. With global free trade Asian countries such as India and China would become exporters of whole milk powder. In these countries prices for dairy products such as milk powder are likely to rise with world or regional trade liberalization and associated higher world prices for dairy products leading to increase in producer surplus and decrease in consumer surplus. The consumers in the importing countries will benefit from trade liberalization and producer surplus here would decrease leading to net losses in dairy production. It has been estimated that the Asia's net dairy product imports will increase to 230 thousand metric tons annually and most of it will come from surplus countries such as Australia and New Zealand (Peng et al., 2006).

However both dairy consumption and production in Asian countries show upward trend in the next decade. This is mostly driven by factors such as growth in income and population. Although the increase in world prices for dairy products have negative effect on Asian dairy demand growth , the effect is expected to be relatively modest as demand for dairy in these countries is price inelastic. Therefore , besides keeping the dairy price reasonable to insure poor households have access to dairy products, policy makers seeking to increase domestic dairy consumption could also focus on strategies that would lead to growth of domestic economy and increase income. In addition, with improvement of domestic economy and infrastructure , transportation , storage are expected to improve which would improve access to fresh dairy products for more consumers. Asian consumption has an

impact on world market and as consumption rises , world dairy prices will also increase. The world dairy exporters benefit from escalating prices as well as expanding dairy markets.

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APPENDIX TABLES

Appendix Table 1 – General Characteristics of the Households in the Districts

Zone	District	Sector	Ethnicity %				Religion %			
			Sinhal	Tam	Moo	Oth	Buddhi	Hind	Isla	Christia
WZ	K'galle	Urban(30)	84	10	6	0	80	6.6	6.6	6.6
		Rural(20)	100	0	0	0	100	0	0	0
		Estate(10)	90	0	10	0	90	0	10	0
	Colombo	Urban(40)	97.50	3.12	0	0	67.50	2.5	0	30
		Rural (23)	100	0	0	0	82.61	0	0	11.39
	N'Eliya	Urban(20)	75.00	20	0.05	0	65	20	0	15
		Rural (4)	100	0	0	0	100	0	0	0
		Estate(38)	5	95	0	0	5.26	89.47	0	5.26
	Matara	Urban(40)	87.50	0	12.5	0	85.00	0	12.50	2.50
		Rural(22)	100.00	0	0	0	90.91	0	0	9.09
	G'paha	Urban(40)	95	0	5	0	85	0	5	10
		Rural	100	0	0	0	100	0	0	0
DZ	A'pura	Urban(31)	96.77	0	3.23	0	96.77	0	3.23	0
		Rural (34)	94.12	0	5.88	0	94.12	0	5.88	0
	P'naruwa	Urban30	97	0	3	0	97	0	3	0
		Rural30	100	0	0	0	100	0	0	0
	Monaragala	Urban40	100	0	0	0	100	0	0	0
		Rural20	95	5	0	0	95	5	0	0
IZ	K'gala	Urban(32)	90.62	3.12	6.25	0	84.37	3.12	6.25	6.25
		Rural (27)	92.52	7.40	0	0	92.52	7.4	0	0
		Estate(5)	40	40	20	0	40	40	20	0

Appendix Table 2 - Educational Characteristics of the Households in the Districts.

Zone	District	Sector	Ave: Fam Size	Education % reported				Other training
				No schooling	Primary	Secondary	Tertiar	
WZ	Kegalle	Urban(30)	4.3	0	57	37	6	0
		Rural(20)	2.6	0	90	10	0	0
		Estate(10)	1.4	0	100	0	0	0
	Colombo	Urban (40)	4	5.72	15.92	42.67	31.21	4.45
		Rural(23)	4.17	10.34	16.09	51.72	20.69	1.14
	N'eliya	Urban (20)	4.65	9.89	24.17	39.56	19.78	6.59
		Rural (4)	4.25	5.88	17.64	23.52	47.05	5.88
		Estate (38)	5.34	20.20	45.95	31.31	2.52	0
	Matara	Urban (40)	4.2	1.8	13.2	38.32	42.51	4.19
		Rural(22)	4.7	7.8	23.5	38.23	28.43	1.96
	G'paha	Urban(40)	4.1	5	53	42	0	0
		Rural(20)	2.1	5	75	20	0	0
DZ	Polonnaruwa	Urban(34)	4.46	0	90	10	0	0
		Rural(35)	4.5	0	84	16	0	0
	Badulla	Urban(20)	4.55	0	60	35	5	0
		Rural(20)	4.65	0	95	5	0	0
		Estate(20	5	30	70	0	0	0
	A'pura	Urban (31)	4.51	7.85	12.14	35	40	5
		Rural (34)	3.91	7.59	26.32	41.35	24.81	0
	Monaragala	U40	4.25	0	17.5	82.5	0	0
		R20	2.35	0	85	15	0	0
IZ	K'gala	Urban (32)	4.03	20	31.42	42.85	5.71	0
		Rural (27)	4.25	9.28	23.57	42.14	23.57	1.43
		Estate(5)	5.8	10.34	8.04	37.93	42.53	1.15

* Other training includes degrees, diplomas and vocational training.

Appendix Table 3: Occupational Characteristics of the Households in Districts.

District	Sector	Employment % reported										Ave: HH Income/ family
		Farming		Public		Private trade		Self employ		Other		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Wet Zone												
Kegalle	Urban	3	0	47	0	0	0	17	0	33	0	23645
	Rural	30	0	10	0	5	0	30	0	25	0	5673
	Estate	0	0	0	0	0	0	100	0	0	0	2013
Colombo	U(40)	0	0	35.38	0	43.08	4.62	4.62	4.61	4.62	3.07	18600
	R(23)	0	0	45.24	0	30.95	4.76	7.14	0	11.91	0	12387
G'paha	Urban	7.5		35		27.5		22.5	0	7.5		17587
	Rural	25		15		10		30	0	20		7562
N'Eliya	U 20)	11.29	0	51.61	0	12.9	3.22	3.22	0	17.74	0	16540
	R (4)	0	0	45.45	0	18.18	9.09	18.18	0	9.091	0	9875
	E(38)	11.69	0	7.792	0	15.58	6.49	3.89	1.29	41.56	10.4	9373.54
Matara	U(40)	14.9	0	35.8	0	38.8	4.62	8.95	2.98	4.62	3.07	15450
	R(22)	10	0	22.5	0	22.5	2.5	20	7.5	17.5	2.5	15750
Dry & IZ												
K'gala	U(32)	5	0	48	0	37.5	2.5	2.5	0	2.5	2.5	10800
	R(27)	9.1	3.63	22	0	25.5	9.1	3.63	5.45	12.7	9.09	11333.3
	E(5)	0	0	18	0	36.4	0	0	0	27.3	18.2	14992.2
Polonnaruwa	Urban	40		20		13		20		7		20433.33
	Rural	43		23		20		6		3		16076.66
Badulla	Urban	5		55		35		0		5		17475
	Rural	5		55		20		0		20		13550
	Estate	15		5		25		5		50		10010
A'pura	U(31)	3.77	0	54.71	0	33.96	0	3.77	1.88	0	1.88	16281
	R(34)	42.5	0	37.5	0	12.5	2.5	2.5	0	0	2.5	8250
Monaragala	U	5		28		5		50		12		18614
	R	25		40		5		30		0		5460

Appendix Table 4- Income Distribution of Households in Districts(%).

D	S	High >Rs.10000	Medium Rs. 5000-10000	Low Rs 1000-5000	Poor/v. poor <Rs.1000
Wet Zone					
Kegalle	U	67	23	10	0
	R	25	25	40	10
	E	10	30	60	0
G'paha	U	85	15	0	0
	R	70	30	0	0
N'Eliya	U	70	30	0	0
	R	50	50	0	0
	E	37	50	13	0
Colombo	U				
	R				
Matara	U	85	6	0	0
	R	52	38	10	0
Dry & IZ					
K'gala	U	74	25	1	0
	R	49	51	0	0
	E	40	60	0	0
Badulla	U	95	5	0	0
	R	75	5	10	0
	E	40	45	15	0
P'naruwa	U	100	0	0	0
	R	73	7	20	0
A'pura	U				
	R				
M'gala	U	85	7	8	0
	R	60	30	10	0

Zone	District	Sector	extent/ family	Irrigated		Rainfed		Production		Income	
				Ave: Size-	%	Ave: Size-	%	Maha	Yala	Maha	Yala
WZ	Kegalle	Urban	0	0	0	0	0	0	0	0	0
		Rural	0.5	0	0	0.50	100	20	0	335	0
		Estate	0.08	0	0	0.08	100	3.4	0	114	0
	Colombo	Urban(40)	0.23	0.92	92.5	0	0	0	45	0	337.5
		Rural(23)	0.41	1.05	105	0	0	0	83	0	1130
	G'paha	Urban	0.19	2	0	0	0	0	0	0	2
		Rural	0.83	1		6.7		268	38	4433	630
	N'Eliya	0									
	Matara	0									
IZ	K'gala	Urban (32)	0.09	0.09	0.09	0	0	0	0	0	0
		Rural (27)	0.88	0.67	59.2	0.22	18.51	25	45	407	593
		Estate(5)	0	0	0	0	0	0	0	0	0
DZ	Polonnaruwa	Urban	7.67	0.17	37	0.08		154	306	5067	0
		Rural	8.66	0.28	63	0		0	519	0	5717
	Badulla	Urban	0	0	. 0	0	0	0	0	440	0
		Rural	0	0	0	0	0	0	0	4355	0
		Estate	0	0	0	0	0	0	0	0	0
	A'pura	Urban (31)	0.25	2	160	0	0	0	0	0	0
		Rural (34)	1.5	1.96	196.	0	0	125	300	738	1382

Appendix Table 5- Land Use Pattern ,Production and Income in Paddy of Households

Appendix Table 6: Cash Crop Cultivation of Households in Nuwara Eliya District.

Zone	Sector	Main Crops	Total extent/ family	Ave.size	%	Incom e(Rs./ Yr)
WZ	Urban	Chilies	0.125	0.833	80	7000
	Estate	Onion Potato	0.053	0.5	50	7500

Zone	District	Sector	Main Crops	Total extent/ family	Ave: Size	%	Production		Income	
							Maha	Yala	Maha	Yala
WZ	Kegalle	Urban	Tea	0					0	0
		Rural	Rubber	1.12					5050	0
		Estate	Coconut	8					3125	0
	G'paha	Urban	Tea						500	
		Rural	Rubber Coconut						1800	
	Matara	Urban	Tea Rubber Coconut	0.1	1.33	133			1150	
	Monara gala	Rural		0	0	0	0	0	300	0

Appendix Table 7 – Perennial Crop Cultivation of Households in Districts

Zone	District	Sector	Ave:Holding size(perches)	Ave: monthly Income
WZ	Kegalle	U(40)	27.2	0
		R(10)	136	0
		E(10)	35.2	0
	Colombo	Urban (40)	43.1	180.62
		Rural (23)	94.13	419.56
	N'Eliya	Urban (20)	44	275.8
		Rural (4)	80	87.5
		Estate(38)	11	0
	Matara	Urban (40)	32	611.25
		Rural(22)	87.7	2925
	G'paha	U	60.8	0
		R	132.8	0
IZ	K'gala	Urban (32)	61.06	233.6
		Rural (27)	61.37	146.3
		Estate(5)	13	30
DZ	Polonnaruwa	U	21.76	0
		R	76	0
	Badulla	U	12.8	0
		R	60.8	0
		E	1.6	0
	A'pura	Urban (31)	16.65	0
		Rural (34)	98.82	69.71
	Monaragala	Urban	139.2	0
		Rural	120	0

Appendix Table 8- Home Garden Cultivation of Households in Districts

Appendix Table 9- Livestock Demography Characteristics in the Districts

Dairy Sector-Cattle							
Zone	District	Sector	Type	Ave: Number/farm	Lactating Number		
					1-3	3-7	>7
WZ	K'lle	0					
	Colombo	R	Cows	1	1	0	0
			Heifers	0	0	0	0
			Calves	1	0	0	0
	G'paha	U	Cows	3	1	0	0
			Heifers	1	0	0	0
			Calves	1	0	0	0
	Matara	U	Cows	2	1	0	0
			Heifers	0	0	0	0
			Calves	1	0	0	0
		R	Cows	2.5	2	1	0
			Heifers	1	0	0	0
			Calves	1.5	0	0	0
	N'Eliya	U	Cows	1	2	1	0
			Heifers	0.3	0	0	0
			Calves	1	0	0	0
		E	Cows	1.6	10	8	4
			Heifers	0.9	0	0	0
			Calves	1.6	0	0	0
		E	Cows	3	0	0	0
		R	Cows	4	0	0	0
			Heifers	2	0	0	0
	M'gala	0					
	A'pura	U	Cows	7	2	2	0
			Heifers	2	0	0	0
			Calves	7	0	0	0
		R	Cows	7.2	3	5	3
			Heifers	2.8	0	0	0
			Calves	3.8	0	0	0
IZ	K'gala	U	Cows	3	2	3	0
			Heifers	0	0	0	0
			Calves	2.5	0	0	0
		R	Cows	4	5	5	0
			Heifers	0.9	0	0	0
			Calves	0.8	0	0	0
		E	Cows	2	0	0	0
			Heifers	0	0	0	0
			Calves	5	0	0	0

Buffalo Production Characteristics

Dairy Sector-Buffalo							
Zone	District	Sector	Type	Ave. Number/farm	Lactating Number		
					1-3	3-7	>7
WZ	Kegalle	0					
IZ	Kurunegala	R	Cows	5	0	3-7	>7
DZ	Anuradhapura	R	Cows	6	0	0	0
			Heifers	1	2	4	1
			Calves	3 71	0	0	0
Dry	Badulla	0					
Dry	Polonnaruwa	0					
	M'gala	0					

Goat Production Characteristics

Dairy Sector-Goat							
Zone	District	Sector	Type	Ave Number/farm	Lactating Number		
					1-3	3-7	>7
WZ	Kegalle	0					
	G'paha	0					
IZ	Kurunegala	U	Cows	10	0	0	0
			Heifers	9	0	0	0
			Calves	4	0	0	0
Dry	Anuradhapura	R	Cows	20	0	0	0
			Heifers	5	0	0	0
Dry	Badulla	0					
Dry	Polonnaruwa	0					
	M'gala	0					

Appendix Table 10 – Other Livestock Production Characteristics (Poultry)

Appendix Table 11: Livestock Purchasing Patterns (Year 2003 – 2006) in the Districts.

Zone	District	Sector	Type	Ave: No/Farm
WZ	Colombo	U	Not observed	0
		R	Not observed	0
	N'Eliya	U	Layer	10
		R	Not observed	0
		E	Layer	10
	Matara	U	Layer	55
		R	Layer	40
	Kegalle	U	layer	4
		R	Broiler	1018
		E	0	0
	Gampaha	U	layer	10
		R	0	0
DZ	Badulla	U	layer	0
		R	layer	14
		E	layer	16
	A'pura	U	Not observed	0
		R	Broiler	40

Zone	District	Sector	Type	Milk Amount (L)	Price /Litre (Rs)	Consumption (L)	Selling (L)	Selling days	Income (Rs)
WZ	Kegalle	Not observed							
	Colombo	R	Cows	150	14	30	120	30	1680
	G'paha	U	Cows	4.25	30	2	2.25	20	3375
	N'Eliya	U	Cows	310	15	30	280	30	3875
		E	Cows	289	14	31.2	253.8	30	3932.7
	Matara								
		R	Cows	130	15	20	110	30	1616.67
DZ	Polonnaruwa	R	Cows	6.5	0	4.5	2	20	1200
	Badulla	R	Cows	9.5	40	1.75	5.75	20	4600
		E	Cows	3	40	0	3	20	2400
	A'pura	U	Cows	360	14	30	330	30	4620
		R	Cows	63.3	14.6	17.14	64.29	30	942.85
			Buffaloes	77.1	17	0	77.14	30	1311.43
IZ	K'gala	U	Cows	210	14	90	120	30	1680
			Buffaloes	9	0	0	0	0	0
			Goats	4	0	0	0	0	0

District	Sector	Type	Ave: no Purchased	Ave: value/animal	Ave: Income (Rs)	Total average income (Rs)
Kegalle	Not observed					
Colombo	Not observed					
G'paha	U	Cows	0	0	30000	750
		Buffaloes	0	0	0	0
		Goats	0	0	0	0
	E	Cows	0	16125	0	4608
Matara	Not observed					
Polon	Not observed					
Badulla	Not observed					
A'pura	U	Cows	1	6000	6000	6000
	R	Cows	1.22	5454.5	6666.67	1444
		Buffaloes	1.14	5250	6000	0
		Goats	4	2250	9000	0
Monaragala	U					
	R	Cows	2	4000	8000	8000

Appendix Table 12- Dairy Production Patterns in the Districts

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Appendix Table 13: Income and Expenditure Characteristics of Households in the Districts

13.1 Wet Zone

District	Sector	Item	Expenditure	% out of total expenditure
Kegalle	U	Food	8470	45.36
		Fuel and light	1261.6	6.75
		Health	1781.66	9.54
		Education	1830	9.80
		Liquor & Tobacco	706.66	3.78
		Transport	1389.33	7.44
		Electricity	705.7	3.77
		Telephone	1145.5	6.13
		Water	410.5	2.19
		others	970	5.19
	R	Food	4960	54.24
		Fuel and light	195.35	2.13
		Health	1115	12.19

		Education	720	7.87
		Liquor & Tobacco	122.25	1.33
		Transport	817.7	8.94
		Electricity	289	3.16
		Telephone	225	2.46
		Water	0	0
		others	700	7.65
	E	Food	4950	57.71
		Fuel and light	86.5	0.47
		Health	1365	7.46
		Education	585	3.19
		Liquor & Tobacco	515	2.81
		Transport	577	3.15
		Electricity	223	1.21
		Telephone	100	0.54
		Water	35	0.19
		others	140	0.76
G'paha	U	Food	7518.75	56.40
		Fuel and light	551.9	4.14
		Health	903.75	6.77
		Education	1278.75	9.59
		Liquor & Tobacco	60	0.45
		Transport	1257.75	9.43
		Electricity	555.3	4.16
		Telephone	621.87	4.66
		Water	69.25	0.51
		others	512.5	3.84
	R	Food	7500	57.87
		Fuel and light	295.8	2.28
		Health	1287.5	9.93
		Education	755	5.82
		Liquor & Tobacco	325	2.50
		Transport	1080.4	8.33
		Electricity	489.5	3.77
		Telephone	630	4.86
		Water	0	0
		others	595	4.59
Colombo	U(40)	Food	6300	58.71
		Fuel and light	476.7	4
		Health	273.7	4.4
		Education	1010	9.46
		Liquor & Tobacco	243.8	2.27
		Transport	727.5	6.78
		Electricity	417.6	3.89
		Telephone	486.3	4.53
		Water	162.47	1.51
		others	632.5	5.9
	R(23)	Food	251.43	64.25
		Fuel and light	8.03	2.07
		Health	9.16	2.34
		Education	29.67	7.58

		Liquor & Tobacco	7.08	1.84
		Transport	15.02	3.84
		Electricity	19.99	5.1
		Telephone	25.7	6.57
		Water	4.15	1.06
		others	20.98	5.36
	U(20)	Food	5875	53.14
		Fuel and light	250.9	2.27
		Health	122.5	1.1
		Education	1975	17.9
		Liquor & Tobacco	460	4.16
		Transport	395	3.57
		Electricity	504.3	4.56
		Telephone	665	6.01
		Water	185	1.67
		others	622.5	5.63
	R(4)	Food	5625	81.38
		Fuel and light	24.25	0.35
		Health	600	8.68
		Education	0	0
N'Eliya		Liquor & Tobacco	2.71	2.71
		Transport	3.25	3.25
		Electricity	3.6	3.6
		Telephone	0	0
		Water	0	0
		others	0	0
	E(38)	Food	5186	68.25
		Fuel and light	148.9	1.95
		Health	574.3	7.55
		Education	542.6	7.13
		Liquor & Tobacco	524.7	6.9
		Transport	209.7	2.75
		Electricity	189.7	2.5
		Telephone	71.39	0.93
		Water	5.26	0.07
		others	150.3	1.98
Matara	U(40)	Food	6162.5	60.7
		Fuel and light	396.25	3.9
		Health	197.5	165
		Education	1106.3	10.87
		Liquor & Tobacco	160	1.58
		Transport	803.7	7.9
		Electricity	380	3.4
		Telephone	473.7	4.7
		Water	147.75	1.45
		others	383.75	3.78
	R(22)	Food	4886.4	62.8
		Fuel and light	217.04	2.8
		Health	311.26	4
		Education	44.55	5.72
		Liquor & Tobacco	147.2	1.9

		Transport	397.7	5.11
		Electricity	353.86	4.55
		Telephone	477.27	6.13
		Water	50	0.64
		others	490.9	6.31

13.2 Dry and Intermediate Zones

District	Sector	Item	Expenditure	% out of total expenditure
K'Gala	U(32)	Food	6343.75	64
		Fuel and light	336.5	3.34
		Health	571.7	5.76
		Education	687.5	6.93
		Liquor & Tobacco	430.5	4.34
		Transport	287.5	2.9
		Electricity	409.53	4.13
		Telephone	408.43	4.12
		Water	63.43	0.63
		others	318.11	3.2
	R(27)	Food	4574.7	69.1
		Fuel and light	112	1.69
		Health	518.5	7.83
		Education	153.7	2.32
		Liquor & Tobacco	203.7	3.07
		Transport	696.3	10.57
		Electricity	251.7	3.8
		Telephone	55.5	0.83
		Water	7.4	0.11
		others	46.26	0.69
	E(5)	Food	4800	60.73
		Fuel and light	390	4.93
		Health	580	7.33
		Education	890	11.26
		Liquor & Tobacco	1209	15.29
		Transport	100	1.26
		Electricity	198	2.5
		Telephone	0	0
		Water	36	0.45
		others	0	0
A'pura	U(31)	Food	6581	61.87
		Fuel and light	322.63	3.03
		Health	146.77	1.38
		Education	1717.7	16.05
		Liquor & Tobacco	87.09	0.81
		Transport	595.16	5.6

		Electricity	464.02	4.4
		Telephone	427.4	4.01
		Water	213.38	2
		others	81	0.76
	R(34)	Food	4884.7	76.22
		Fuel and light	153.6	2.39
		Health	86.66	1.4
		Education	563.75	8.79
		Liquor & Tobacco	286.23	4.5
		Transport	120.44	1.87
		Electricity	218.2	3.4
		Telephone	33.5	0.52
		Water	54.2	0.84
		others	8.25	0.13
Polon	U	Food	7733.33	72.69
		Fueland light	627.73	5.90
		Health	336.66	3.16
		Education	428.33	4.02
		Liquor & Tobacco	151.66	1.42
		Transport	423.33	3.97
		Electricity	373.33	3.50
		Telephone	294	2.76
		Water	113.33	1.06
		Others	156.66	1.47
	R	Food	6150	80.61
		Fuel and light	250.76	3.28
		Health	158.33	2.07
		Education	204	2.67
		Liquor & Tobacco	136.66	1.79
		Transport	305.66	4.00
		Electricity	211.66	2.77
		Telephone	88.33	1.15
		Water	0	0
		Others	123.33	1.61
Badulla	U	Food	7000	59.03
		Fuel and light	538	4.53
		Health	1030	8.68
		Education	1285	10.83
		Liquor & Tobacco	160	1.34
		Transport	665	5.60
		Electricity	455	3.83
		Telephone	365	3.07
		Water	121.25	1.022
		others	237.5	2.00
	R	Food	6400	73.32
		Fuel and light	73.6	0.84

		Health	600	6.87
		Education	450	5.15
		Liquor & Tobacco	157.5	1.80
		Transport	615	7.04
		Electricity	300.75	3.44
		Telephone	57.5	0.65
		Water	0	0
		others	73.75	0.84
	E	Food	6075	74.75
		Fuel and light	27.2	0.22
		Health	727.5	6.13
		Education	382.5	3.22
		Liquor & Tobacco	207.5	1.75
		Transport	240	2.02
		Electricity	319	2.69
		Telephone	75	0.63
		Water	0	0
		others	72.5	0.61
Monaragala	U	Food	8598.75	55.67
		Fuel and light	396.5	2.56
		Health	645	4.17
		Education	2420.25	15.66
		Liquor & Tobacco	151	0.97
		Transport	1106.25	7.16
		Electricity	961.5	6.22
		Telephone	689.45	4.46
		Water	404	2.61
		others	72.5	0.46
	R	Food	5400	54.08
		Fuel and light	62.5	0.62
		Health	640	6.40
		Education	585	5.85
		Liquor & Tobacco	55	0.55
		Transport	1495	14.97
		Electricity	667.75	6.68
		Telephone	840	8.41
		Water	239.25	2.39
		others	0	0

Appendix Table 14- Average Expenditure for Milk and Milk Products for Households in the Districts

District	% Expenditure out of food expenditure (Rs.)			
	WMP	FM	OM	OMP
Colombo	9.43	0.64	0.77	5.11
Nuwara Eliya	12.78	3.7	0.20	2.60

Matara	7.96	1.49	0.51	7.00
Kurunegala	7.00	1.00	0	3.00
Anuradhapura	6.31	2.91	0.01	5.22
Kegalle	17	0.5	7	10.6
Gampaha	27.2	6	0.9	26.5
Polonnaruiwa	7.33	0.884	0	3.75
Badulla	9.23	0.55	0.02	2.8
Monaragala	7.06	0.058	0	2.75

Appendix Table 15- Fresh Milk Consumption Patterns and Source of the Districts.
15.1 Wet Zone

D	S	Con %	Ave amt/day	Ave: price/L	source					
					Own	Nei	Coop	Milco/ Kot	SM	Any
Kegalle	U	13	0.75	25	0	1	0	0	0	0
	R	0	0	0	0	0	0	0	0	0
	E	0	0	0	0	0	0	0	0	0
Colombo	U	5	1	25	0	100	0	0	0	0
	R	8.7	1	19.5	50	50	0	0	0	0
N'Eliya	U	20	1.5	15.37	75	25	0	0	0	0
	R	25	1	20	0	100	0	0	0	0
	E	42.11	1.5	14.34	100	0	0	0	0	0
Matara	U	20	1	23	87.5	12.5	0	0	0	0
	R	9.09	1	16.3	66.6	33.3	0	0	0	0
Gampaha	U	5	0.75	35	0	1	0	0	0	0
	R	2.5	0.25	80	0	0	0	1	0	0

15.2 Dry and Intermediate Zones

Kurunegala	U	3.12	1	14	100	0	0	0	0	0
	R	18.52	1.6	16.4	60	40	0	0	0	0
	E	0	0	0	0	0	0	0	0	0
A'pura	U	41.93	0.92	28.92	7.69	0	0	92.3	0	0
	R	23.52	1	0	100	0	0	0	0	0
Badulla	U	15	0.77	40	0	1	0	0	0	0
	R	20	0.53	40	2	2	0	0	0	0
	E	20	0.5	40	2	2	0	0	0	0
P'naruwa	U	10	1	40	0	2	0	0	1	0
	R	20	1	40	5	1	0	0	0	0
M'gala	U	3	1	20	0	0	1	0	0	0
	R	15	0.7	25	0	0	0	0	0	1

Appendix Table 16: Fresh Milk consuming time of the Households in the Districts.

16.1 Wet Zone

Sector	Con %	Source								Ave amt/day	Ave: price/L	Reasons for consumption					Consuming time			
		Own	Nei	Coop	Milco	Kot	SM	Gro	Any			Easy acces	Low price	Good qualit	Good healt	Other	Morn	Even	Both	Any
Kegalle																				
Urban	13	0	1	0	0	0	0	0	0	0.75	25	0	0	0	1	0	1	0	0	0
Rural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gampaha																				
Urban	2.5	0	0	0	0	0	0	1	0	0.25	80	0	0	0	1	0	1	0	0	0
Rural	5	0	2	0	0	0	0	0	0	0.75	35	0	0	0	1	0	1	0	0	0
Colombo																				
Urban	5	100	0	0	0	0	0	0	0	1	25	0	0	50	50	0	100	0	0	0
Rural	8.7	50	0	0	0	0	0	0	0	1	19.5	100	0	0	0	0	50	0	50	0
N'Eliya																				
	20	75	25	0	0	0	0	0	0	1.5	15	25	0	0	0	75	75	25	0	0
Rural	25	0	0	0	0	0	100	0	0	1	20	0	0	0	100	0	0	0	0	100
Estate	42	100	0	0	0	0	0	0	0	1.5	14.	62	0	0	0	37	25	75	0	0
Matara																				
Urban	20	87.5	12.5	0	0	0	0	0	0	1	23	0	0	75	25	0	100	0	0	0
Rural	9.0	33.3	0	0	0	0	0	0	0	1	16		66.6	0	33.3	0	0	100	0	0

16.2 Dry and Intermediate Zones

Sector	Con %	Source								Ave amt/day	Ave: price/L	Reasons for consumption					Consuming time			
		Own	Nei	Coop	Milco	Kot	SM	Gro	Any			Easy acces	Low price	Good qualit	Good healt	Other	Morn	Even	Both	Any
Badulla																				
Urban	15	0	1	0	0	0	0	1	1	0.77	40	0	0	0	3	0	3	0	0	0
Rural	20	2	2	0	0	0	0	0	0	0.53	40	4	0	0	0	0	4	0	0	0
Estate	20	2	2	0	0	0	0	0	0	0.5	40	4	0	0	0	0	3	0	0	0
Polonnaruwa																				
Urban	10	0	2	0	0	0	1	0	0	1	40	0	0	0	3	0	3	0	0	0
Rural	20	5	1	0	0	0	0	0	0	1	40	0	0	6	0	0	6	0	0	0
A'pura																				
Urban																				
Rural																				
M'gala																				
Urban																				
Rural																				

Appendix Table 17: Reasons for Consumption of Fresh Milk of the Households in the Districts.

D	S	% Consumed	Reasons %				
			High availability	Low price	Good Taste/ quality	Good for health	Other
Wet Zone							
Kegalle	U	13	0	0	100	0	0
	R	0	0	0	0	0	0
	E	0	0	0	0	0	0
G'paha	U	2.5	0	100	0	0	0
	R	5	0	100	0	0	0
Colombo	U40	0	0	0	0	0	0
	R23	50	0	50	50	0	0
N'Eliya	U20	75	0	0	0	75	25
	R 4	100	0	0	100	0	0
	E38	37.5	0	0	0	100	0
Matara	U40	0	0	0	0	0	0
	R22	33.4	0	100	0	0	0
Dry & IZ							
K'gala	U32	0	0	0	0	0	0
	R27	60	0	20	20	20	0
	E 5	100	0	0	0	0	0
A'pura	U31	38.47	0	100	0	0	0
	R34	12.5	0	0	100	0	0
P'naruwa	U	10	0	0	0	0	0
	R	20	0	0	0	0	0
M'gala	U	50	0	50	0	0	
	R	100	0	0	0	0	
Badulla	U	15	0	0	0	0	0
	R	20	0	0	0	0	0
	E	20	0	0	0	0	0

Appendix Table 18: Fresh Milk Delivery Patterns of the Households in the Districts.

Districts	Sector	Delivery				
		Neigh: farmer	bicycle	van	No delivery	Delivery to doorstep %
Wet Zone						
Kegalle	U	0	1	0	0	100
	R	0	0	0	0	0
	E	0	0	0	0	0
G'paha	U	0	0	1	0	100
	R	1	1	0	0	100
Colombo	U 40	0	100	0	0	100
	R 23	50	50	0	0	100
N'Eliya	U 20	25	0	0	75	25
	R 4	0	0	0	100	00
	E 38	6.25	0	0	93.8	6.25
Matara	U 40	12.5	75	0	12.5	87.5
	R 22	0	33.3	0	66.6	33.3
Dry & IZ						
K'gala	U 32	0	0	0	100	0
	R 27	40	20	0	40	60
A'pura	U 31	0	92.31	0	7.692	100
	R 34	25	0	0	75	100
P'naruwa	U	2	2	0	0	100
	R	0	0	0	6	0
Badulla	U	1	1	0	0	34
	R	2	2	0	0	50
	E	1	1	0	0	34
M'gala	U	0	0	1	0	100
	R	0	0	0	3	0

Appendix Table 19: Mode of Fresh Milk Delivery of the Households in the Districts.

Districts	Sector	Sealed (% of total)	Opened (% of total)	Any other (% of total)	Satis; of mode of delivery
Wet Zone					
Kegalle	U	100	0	0	100%
	R	0	0	0	0
	E	0	0	0	0
G'paha	U	1	0	0	100
	R	1	0	0	100
Colombo	U	100	0	0	100
	R	50	0	50	100
N'Eliya	U	100	0	0	100
	R	100	0	0	100
	E	44	0	56	100
Matara	U	75	0	25	100
	R	33.3	66.7	0	80
Dry & IZ					
K'gala	U	100	0	0	100
	R	40	0	60	80
	E	0	0	0	0
A'pura	U	0	7.7	92.3	100
	R	25	75	0	100
P'naruwa	U	0	0	100	yes
	R	0	0	100	yes
Badulla	U	2	1	0	100
	R	0	2	2	100
	E	0	3	1	100
M'gala	U	100	0	0	100
	R	0	100	0	100

Appendix Table 20: Purchasing Time of Fresh Milk by Households in the Districts.

Z	D	S	Purchasing time				
			Morn (% of total)	Even (% of total)	After (% of total)	Any (% of total)	Sati: of purchasing time (%)
WZ	Kegalle	U	100	0	0	0	100
		R	0	0	0	0	0
		E	0	0	0	0	0
	G'paha	U	100	0	0	0	100
		R	100	0	0	0	100
	N'Eliya	U	0	25	0	75	100
		R	0	25	0	75	100
		E	0	18.75	0	81.25	100
	Colombo	U	50	0	0	50	100
		R	100	0	0	0	100
	Matara	U	87.5	0	0	12.5	100
		R	33.3	0	0	66.7	100
IZ	K'gala	U	0	0	0	100	100
		R	40	0	0	60	100
		E	0	0	0	0	0
DZ	A'pura	U	92.3	0	0	7.69	100
		R	62.5	0	0	37.46	100
	Badulla	U	100	0	0	0	100
		R	100	0	0	0	100
		E	100	0	0	0	100
	P'naruwa	U	100	0	0	0	100
		R	100	0	0	0	100
	M'gala	U	100	0	0	0	100
		R	100	0	0	0	100

Appendix Table 21: Quality of Purchased Fresh Milk by Households in the Districts.

Z	D	S	High (% of total)	Medium (% of total)	Low (% of total)	Any other (% of total)
WZ	G'paha	U	100	0	0	0
		R	100	0	0	0
	Colombo	U	100	0	0	0
		R	50	50	0	0
	Kegalle	U	100	0	0	0
		R	0	0	0	0
		E	0	0	0	0
	N'Eliya	U	100	0	0	0
		R	100	0	0	0
		E	93.25	6.75	0	0
	Matara	U	37.5	62.5	0	0
		R	66.7	33.3	0	0
IZ	K'gala	U	100	0	0	0
		R	80	20	0	0
		E	0	0	0	0
DZ	A'pura	U	100	0	0	0
		R	100	0	0	0
	Badulla	U	100	0	0	0
		R	100	0	0	0
		E	100	0	0	0
	P'naruwa	U	100	0	0	0
		R	100	0	0	0
	M'gala	U	100	0	0	0
		R	100	0	0	0

Appendix Table 22: Reasons for not Consuming Fresh Milk by Households in the Districts.

Z	D	S	% not consumed	Reasons %				
				No availability	High price	Bad quality	Bad for health	Other
WZ	Kegalle	U	87	60	0	20	20	0
		R	100	0	0	100	0	0
		E	100	0	0	100	0	0
	G'paha	U	97.5	0	0	0	100	0
		R	95	0	0	0	100	0
	Colombo	U 40	100	0	50	50	0	0
		R 23	50	0	50	0	50	0
	N'Eliya	U 20	25	0	0	0	100	0
		R 4	0	0	0	100	0	0
		E 38	62.5	0	0	0	100	0
	Matara	U 40	100	0	75	25	0	0
		R 22	66.6	0	100	0	0	0
IZ	K'gala	U 32	100	0	0	0	60	40
		R 27	40	0	20	20	20	40
		E 5	0	0	0	0	0	0
DZ	A'pura	U 31	61.53	0	100	0	0	0
		R 34	87.5	0	0	100	0	0
	Badulla	U	85	80	0	5	15	0
		R	80	100	0	0	0	0
		E	80	100	0	0	0	0
	P'naruwa	U	90	36	0	52	11	1
		R	80	20	20	12.5	47.5	0
	M'gala	U	97	40	0	30	20	10
		R	85	50	0	30	20	0

Appendix Table 23: Household Attitude for Price of Milk and Milk Products in the Districts

23.1 Wet Zone

D	S	Item	Price			
			High %	Fair %	Low %	No idea %
Kegalle	U	Fresh milk	43	30	0	27
		WMP	80	7	0	13
		Other milk	43	16	0	41
		O: M: products	61	22	0	17
	R	Fresh milk	55	0	0	45
		WMP	58	7	0	35
		Other milk	57	5	0	38
		O: M: products	58	12	0	30
	E	Fresh milk	50	30	0	20
		WMP	70	7	0	23
		Other milk	50	17	0	33
		O: M: products	57	17	0	26
G'paha	U	Fresh milk	35	18	3	44
		WMP	57	2	0	41
		Other milk	52	7	0	41
		O: M: products	56	13	0	31
	R	Fresh milk	25	15	0	60
		WMP	73	2	0	25
		Other milk	35	2	0	63
		O: M: products	65	9	0	26
Colombo	U (40)	Fresh milk	32.5	7.5	0	60
		WMP	97.5	2.5	0	0
		Other milk	97.5	2.5	0	0
		O: M: P	92.5	5	0	2.5

	R (23)	Fresh milk	39.13	4.348	13	43.48
		WMP	95.65	0	0	4.34
		Other milk	95.65	0	0	4.34
			73.91	17.39	0	8.69
		O: M: P				
N'Eliya	U (20)	Fresh milk	10	20	35	30
		WMP	95	0	0	5
		Other milk	90	0	0	10
		O: M: P	65	10	0	25
	R (4)	Fresh milk	50	0	0	50
		WMP	100	0	0	0
		Other milk	75	0	0	25
		O: M: P	25	0	0	75
	E (38)	Fresh milk	28.95	7.89	42.11	15.8
		WMP	78.95	5.26	0	15.8
		Other milk	52.63	2.63	0	44.7
		O: M:P	44.74	13.16	2.63	39.5
Matara	U (40)	Fresh milk	22.5	17.5	12.5	47.5
		WMP	97.5	0	0	2.5
		Other milk	97.5	0	0	2.5
		O: M: P	85	12.5	0	2.5
	R (22)	Fresh milk	100	0	0	0
		WMP	100	0	0	0
		Other milk	86.36	13.63	0	0
		O: M: P	72.72	9.09	9.09	0

23.2 Dry and Intermediate Zones

K'gala	U (32)	Fresh milk	31.25	9.37	12.5	46.88
		WMP	81.25	6.25	0	12.5
		Other milk	78.13	3.12	0	18.75
		O: M: P	75	6.25	0	18.75
	R (27)	Fresh milk	44.44	7.40	25.9	18.52
		WMP	7.40	3.70	0	7.40
		Other milk	9.37	3.70	0	11.11
		O: M: P	77.78	3.70	3.7	14.81
	E (5)	Fresh milk	60	0	20	20
		WMP	100	0	0	0
		Other milk	80	0	0	20
		O: M: P	80	0	0	20
A'pura	U (31)	Fresh milk	6.45	51.61	16.13	25.81
		WMP	96.77	3.22	0	0
		Other milk	96.77	3.22	0	0
		O: M:P	83.87	16.13	0	0
	R (34)	Fresh milk	38.23	23.53	8	5
		WMP	97.05	0	0	2.94
		Other milk	94.11	0	0	5.88
		O: M: P	90.62	8.82	0	5.88
P'naruwa	U	Fresh milk	16	26	0	58
		WMP	90	0	0	10
		Other milk	23	0	0	77
		O: M:P	60	40	0	0
	R	Fresh milk	13	60	0	27
		WMP	97	3	0	0
		Other milk	13	0	0	87
		O: M:P	77	23	0	0
Badulla	U	Fresh milk	20	40	0	40
		WMP	91	2	0	8
		Other milk	70	5	0	25
		O: M:P	45	17	0	28

	R	Fresh milk	10	35	0	55
		WMP	88.3	0	0	11.7
		Other milk	45	0	0	55
		O: M:P	63	3	0	31
	E	Fresh milk	15	55	0	30
		WMP	90	0	0	10
		Other milk	43	0	0	57
		O: M:P	55	12.5	0	32.5
M'gala	U	Fresh milk	0	0	0	100
		WMP	21	12.5		66.5
		Other milk	0	0	0	100
		O: M:P	0	0	0	100
	R	Fresh milk	0	0	0	100
		WMP	0	0	0	100
		Other milk	0	0	0	100
		O: M:P	0	0	0	100

Appendix Table 14 (a)- Average Monthly Expenditure in Milk and Milk Products in the Districts.
Wet Zone:

District	Sector	Food Item		Expenditure	% of food expenditure	% of total expenditure
Kegalle	U	All except milk products		5515.8	65.12	79.38
		WMP	F fat	925.3		
			Infant	26.5		
			N fat	129.6	6.75	5.18
		FM	Cow	25		
			Buffalo	1		
			Goat	0	0.5	0.12
		OM	UHT	18.6		
			Pasr:	3.3		
			Ster:	4	1.3	0.11
		OMP	yogurt	144.2		
			curd	80		
			Ice cream	59.3	7.28	1.35
	R	All except milk products		4592.85	92.59	
		WMP	F fat	473.4		87.36
			Infant	0		
			N fat	109.35		
		FM	Cow	0	6.44	3.66
			Buffalo	0		
			Goat	0		
		OM	UHT	0	0	0
			Pasr:	0		
			Ster:	0		
		OMP	yogurt	32.4	0	0
			curd	23		
			Ice cream	6	1.88	0.38
	E	All except milk products		4286.1	86.58	70.84
		WMP	F fat	619		
			Infant	0		
			N fat	16.5	4.56	3.5
		FM	Cow	0		
			Buffalo	0		
			Goat	0	0	0
		OM	UHT	37.2		
			Pasr:	0		
			Ster:	0	0.25	0.2
		OMP	yogurt	65.8		
			curd	33.5		
			Ice cream	31.5	1.49	0.71
G'paha	U	All except milk products		2804.57	70.55	84.44
		WMP	F fat	350.5	7.07	4

			Infant	17.5		
			N fat	80		
		FM	Cow	41.25		
			Buffalo	0		
			Goat	0	0.36	0.07
		OM	UHT	1.5		
			Pasr	3		
			Ster.	0	0.09	0
		OMP	yogurt	64.675		
			curd	22		
			Ice cream	45	7.14	1
	R	All except milk products		10609.0	74.78	80.97
		WMP	F fat	1279.25		
			Infant	0		
			N fat	230	11.19	4.13
		FM	Cow	28		
			Buffalo	0		
			Goat	0	3.64	0.39
		OM	UHT	3		
			Pasr:	0		
			Ster:	0	0.52	0
		OMP	yogurt	159.9		
			curd	132		
			Ice cream	87.75	10.53	1.26
Colombo	U	All except milk products		4864	83.52	45.33
		WMP	F fat	574.8	9.99	5.43
			Infant	0		
			N fat	7.5		
		FM	Cow	37.5	0.64	0.35
			Buffalo	0		
			Goat	0		
		OM	UHT	18.75	0.33	0.18
			Pasr:	0		
			Ster	0.5		
		OMP	yogurt	112.3	5.51	2.99
			curd	74.88		
			Ice cream	134.3		
	R	All except milk products		4395	84.6	48.84
		WMP	F fat	460.4	8.863	5.12
			Infant	0		
			N fat	0		
		FM	Cow	32.6	0.62	0.36
			Buffalo	0		
			Goat	0		
		OM	UHT	58.69	1.21	0.71
			Pasr:	4.35		
			Ster.	0		
		OMP	yogurt	80.21	4.699	2.72
			curd	79.56		
			Ice cream	84.35		
N'Eliya	U	All except milk products		2682	52.48	76.87

		WMP	Ffat	515.50	4.16	6.1
			Infant	31		
			Nonfat	92		
		FM	Cow	0	0.25	0.35
			Buffalo	0		
			Goat	12.5		
		OM	UHT	0	3.04	4.46
			Pasr:	0		
			Ster:	105.8		
		OMP	yogurt	10		
			curd	39.75		
			Ice cream			
	R	All except milk products		2183	76.82	31.58
		WMP	Ffat	351.3	17.64	7.25
			Infant	150		
			Nonfat	0		
		FM	Cow	80	2.81	1.56
			Buffalo	0		
			Goat	0		
		OM	UHT	0	0	0
			Pasr:	0		
			Ster:	0		
		OMP	yogurt	30	2.34	0.96
			curd	47.5		
			Ice cream			
	E	All except milk products		4422	126.8	86.54
		WMP	Ffat	334.2	3.48	2.37
			Infant	7.1		
			Nonfat	7.89		
		FM	Cow	226.8	6.5	4.44
			Buffalo	0		
			Goat	0		
		OM	UHT	5.26	0.15	0.1
			Pasr:	0		
			Ster:	0		
		OMP	yogurt	51.58	1.07	1.42
			curd	7.24		
			Ice cream	47.5		
Matara	U	All except milk products		5091.8	81.7	50.15
		WMP	Ffat	489.37	3.55	5.2
			Infant	40.75		
			Nonfat	134.12		

		FM	Cow	0		
			Buffalo	0	0.87	0.61
			Goat	50		
		OM	UHT	1.25		
			Pasr:	2.5	6.67	4.1
			Ster:	128.87		
		OMP	yogurt	156.75		
			curd	129.12	5	2.8
			Ice cream			
	R	All except milk products		4382	84.2	56.34
		WMP	Ffat	355.45	7.43	4.97
			Infant	31.6		
			Nonfat	0		
		FM	Cow	46.36	0.82	0.59
			Buffalo	0		
			Goat	0		
		OM	UHT	15.45	0.29	0.19
			Pasr:	0		
			Ster:	0		
		OMP	yogurt	157		
			curd	129	5	2.8
			Ice cream			

Dry and Intermediate Dry Zones:

District	Sector	Food Item		Expenditure	% of food expenditure	% of total expenditure
Kurunegala	U 32	All except milk products		5501.84	0.87	0.52
		WMP	F fat	457.18	0.08	0.04
			Infant	33.75		
			N fat	20		
		FM	Cow	18.75	0.00	0.00
			Buffalo	0		
			Goat	0		
		OM	UHT	3.75	0.00	0.00
			Pasr:	0		
			Ster:	3.12		
		OMP	yogurt	150	0.51	0.3
			curd	17.03		
			Iceerea	70.62		
	R	All except milk products		4641.41	0.88	0.63
		WMP	F fat	363.70	0.06	0.04
			Infant	0		
			N fat	0		
		FM	Cow	115.55	0.02	0.01
			Buffalo	0		
			Goat	0		

		OM	UHT	1.11	0.00	0.00
			Pasr:	0		
			Ster:	0		
		OMP	yogurt	63.14	0.78	0.72
			curd	20.18		
			Ice cream	53.518		
	E	All except milk products		5625.4	117.19	89.59
		WMP	Ffat	500		
			Infant	0		
			N fat	0	3.47	2.65
		FM	Cow	0		
			Buffalo	0		
			Goat	0	0	0
		OM	UHT	0		
			Pasr:	0		
			Ster:	0	0	0
		OMP	yogurt	91		
			curd	14		
			Ice cream	48	1.06	0.8
Monaragala	U	All except milk products		8876.87	103.23	72
		WMP	Ffat	969.4		0.19
			Infant	0		0
			N fat	7.5		0
		FM	Cow	10		0
			Buffalo	0		0
			Goat	0		0
		OM	UHT	0		0
			Pasr:	0		0
			Ster:	104.82		0
		OMP	yogurt	284.87		0.02
			curd	49.5		0.05
			Ice cream	0		0.00
	R	All except milk products		5233.15		
		WMP	Ffat	488.4	2.83	
			Infant	0		
			N fat	0		
		FM	Cow	0	0	
			Buffalo	0		
			Goat	0		
		OM	UHT	0	0	
			Pasr:	0		
			Ster:	0		
		OMP	yogurt	67.25	1	
			curd	5.5		
			Ice cream	100		

Badulla	U	All except milk products		4305.65	61.50	79
		WMP	F fat	637.5		
			Infant	0		
			N fat	65	3.34	8.25
		FM	Cow	75		
			Buffalo	0		
			Goat	0	0.35	0.48
		OM	UHT	4		
			Pasr:	1		
			Ster:	0	0.02	0.03
		OMP	Yogurt	111.8		
			Curd	66		
			Ice cream	51	1.11	1.49
	R	All except milk products		4186.55	65.41	82.03
		WMP	F fat	547.5		
			Infant	0		
			N fat	10	2.9	3.63
		FM	Cow	27.5		
			Buffalo	0		
			Goat	0	0.14	0.17
		OM	UHT	0	0	0
			Pasr:	0		
			Ster:	0		
		OMP	yogurt	126.75		
			curd	84		
			Ice cream	36	1.28	1.6
	E	All except milk products		4174.85	68.72	85.49
		WMP	F fat	540		
			Infant	0		
			N fat	20	3.02	3.81
		FM	Cow	11.75		
			Buffalo	0		
			Goat	0	.06	.08
		OM	UHT	0	0	0
			Pasr:	0		
			Ster:	0		
		OMP	yogurt	38.35		
			curd	48		
			Ice cream	0	0.47	0.40
P'naruwa	U	All except milk products		4600.6	74	59
		WMP	F fat	570.6	7.37	1.03
			Infant	0		
			N fat	0		
		FM	Cow	53.5	.00	.00
			Buffalo	0		
			Goat	0		
		OM	UHT	0	.05	.04
			Pasr:	10		
			Ster:	0		

		OMP	Yogurt	156	1.64	1.24
			Curd	46.6		
			Ice cream	55.3		
	R	All except milk products		4107.5	66	85.4
		WMP	F fat	423.3	2.4	2.04
			Infant	0		
			N fat	17		
		FM	Cow	106.3	0.56	0.46
			Buffalo	0		
			Goat	0		
		OM	UHT	0	0	0
			Pasr:	0		
			Ster:	0		
		OMP	yogurt	102	1.25	1
			curd	40		
			Ice cream	12		
A'pura	U	All except milk products		5218	81.17	51.36
		WMP	Ffat	412.4	2.67	1.69
			Infant	28.06		
			Nonfat	21.65		
		FM	Cow	320.3	4.98	3.15
			Buffalo	0		
			Goat	0		
		OM	UHT	0.45	0.00	0.00
			Pasr:	0		
			Ster:	0		
		OMP	yogurt	113.9	7.75	4.91
			curd	117.1		
			Ice cream	182		
	R	All except milk products		4721	82.8	70.68
		WMP	Ffat	285.9	5.43	4.28
			Infant	0		
			Nonfat	0		
		FM	Cow	44.11	0.83	0.66
			Buffalo	0		
			Goat	0		
		OM	UHT	0	0	0
			Pasr:	0		
			Ster:	0		
		OMP	yogurt	90.88	3.1	2.44
			curd	68.82		
			Ice cream	51.47		

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