The comparison of dairy farms in different scales regarding milk production cost and profitability in Turkey: A case study from Hatay province.

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Abstract

The objective of this study is to analyse the members of the Hatay Dairy Cattle Breeders' Association in economic terms. In the study, face-to-face interviews were conducted with 112 producers. The grouping of the dairy farms was done considering the number of milking cows. Farms owning 1 to 9 head milking cows (46,4%) are regarded as the first group enterprises while those with 10 to 20 heads milking cows (29,5%) are the second group enterprises; with 21 to 50 heads milking cows (16,1%) are the third group enterprises and finally with 51 and above heads milking cows (8%) are the fourth group enterprises. The total labor forces are as 3,11, 3,06, 3,95 and 5,07 person (average 3,39 person); total land uses are as 33,43, 77,00, 88,71 and 167,00 da (average 65,89 da); total gross production values are as 28122, 49832, 83023 and 315906 USD (average 66467 USD); gross product values are as 35736, 58158, 92204 and 343982 USD (average 76187 USD); total costs are as 23957, 40029, 60302 and 228478 USD (average 50968 USD); variable cost rates in total costs are as 74,38%, 82,12%, 79,07% and 75,70% (average 77,52%); fixed cost rates in total costs are as 25,62%, 17,88%, 20,93% and 24,30% (average 22,48%); production costs per liter raw milk are as 0,275, 0,285, 0,290 and 0,305 USD (average 0,283 USD) and milk sale prices including primes are as 0,325, 0,328, 0,345 and 0,370 USD (average 0,333 USD) for the group I, II, III and IV dairy enterprises respectively. The results demonstrated that the per liter milk sales price was higher and the cost of per liter milk production was lower in the dairy enterprises having higher number of milking cows (group IV) than the other groups.

Keywords: Cow milk. Enterprise scales. Production cost. Profitability.

1. Introduction

Being an animal product with high nutritional value along with its derivatives, milk has a relevant economic share in the generation of income and direct and indirect jobs. It also contributes to the reduction of migration of people from rural to urban centers (SIMIONATTO et al., 2018). Dairy production systems vary enormously throughout the world in terms of farm size, agro-climatic zones and socio-economic and political settings.

Given current trends of globalization and trade liberalization, only the most competitive farms will remain viable in future milk markets (GARCIA et al., 2006).

The recent increase in food demand and the consequences of this on prices have put the world food supply at risk. This particularly concerns animal products such as milk and meat (NIN et al. 2007), with increasing demand in many emerging countries due to changing nutritional habits and demographic growth (BEGHIN, 2006). In order to meet the needs, it is widely accepted that a "livestock revolution" is required to increase the supply of animal products worldwide (DELGADO, 2003).

In developing countries, this trend will have to be supported by specifically targeting small-scale farms which are the main producers in livestock product chains but whose productivity is often low (FAYE and ALARY, 2001). Sustainability is a new strategic factor for social concern and efficient and economic applicability (PIEDRA-MU et al., 2016). Economic sustainability is defined as the ability of dairy farmers to continue farming (VAN CHALKER et al., 2005). The economic sustainability qualities for dairy farms are liquidity, solvability and profitability.

Profitability is the difference between the value of goods and services produced by the farm and the cost of resources used in its production (BARRY et al., 2000). The economic sustainability of dairy farming is measured by the net profit indicator, which is a more appropriate and widely used indicator for assessing the sustainability of economic activities (LIONTAKIS and TZOURAMANI, 2016). Estimation of milk production cost is an important indicator for measuring the sustainability of dairy enterprises (VAN CHALKER et al.., 2005). In Turkey, the cattle is very important in the production of raw milk and red meat. 90,6% of the total milk produced and 85% of red meat produced is obtained from cattle.

Total cattle presence is 15,943,586 heads while 5,969,048 of total heads are milking cows and the amount of cow milk production is 18.762.319 tons in Turkey (TSI, 2017). In order to improve dairy cattle breeding in Turkey, the organizations that are supoosed to unite dairy cattle breeders have been established. One of these organizations is the Dairy Cattle Breeders Association. The main purpose of this study is to analyse the members of the Hatay Dairy Cattle Breeders Association in economic terms to determine the presence of family and external labor forces, to determine the income and expenses of the dairy enterprises, to calculate the unit cost as well as the absolute and relative profit of the per liter milk produced. Besides, several recommendations for enterprises are going to be made based on the outcomes of the study.

2. Literature Review

Oliveira et al. (2006) reported that with the help of GEROLEITE Project it was possible to reduce the cost of per litre of milk around 14% and the total production cost around 17%. The monthly production and cow productivity increased up to 9% and 4% respectively. In general, their problems were related to low price of the product (milk) paid by the cooperative. The participating group had an average increase in milk production by 9%. In this specific case, this producer reduced its monthly expenses by 24%; its unit cost remained unchanged while the producer has more time to find its new sustainable production footprint. In a way this analysis can prove that production volume is not the most important factor while it is all about keeping the production at competitive costs.

The producers obtained an average increase in productivity around 4%. The average cost of per liter of milk was as 0,19 USD (0,09 - 0,25 USD). It is reported that dairy cattle in Eastern Mediterranean Region of Turkey has addressed the economic analysis of the company. In the study, variable costs accounted for 65,91% of total production costs (YILMAZ et al., 2016). Bozoğlu et al. (2017) stated that the average technical efficiency of the inefficient farms was 0,80 which could reduce the average input utilization of inefficient farms by 20%. The average cost of milk production per liter in efficient and inefficient farms was 0,24 USD and 0,32 USD respectively. In active and inefficient farms, feed and labor costs accounted for 65,30% and 68% of the total cost respectively. For active farms, the average profit per liter was 0,06 USD while it was only 0,01 USD in inefficient farms.

The inefficient farms can maintain their economic stability with the support of the government. The government shoul ensure the efficient use of resources in dairy farming and the link between efficiency and economic sustainability should be considered a policy priority. Dairy farms should estimate, control and reduce the cost of milk production to remain competitive in the market. The future of the dairy industry will depend on the competitiveness of the producers. Milk farmers maintain various management approaches to increase the profit such as minimizing costs to increase profits, minimizing costs per production unit to minimize production costs, minimizing assets per unit of production, marketing milk to achieve best milk price to increase revenue and increasing production to maximize revenue and profit (DHUYVETTER, 2011).

3. Material and Method

3.1. Material

This study was conducted from May 15 to December 31, 2017. The primary data of the study were obtained from the member dairy cattle farms of the Hatay Dairy Cattle Breeders Association (HCBA) through surveys as well as from the owners of these farms through by face to face interviews. In addition to primary data, the data gathered from other institutions and organizations and related research findings form the secondary data of this study.

3.2. Method

In the study, the confidence interval was 95% while the margin of error was around 10%. The survey was implemented among 112 enterprises selected via "Simple Random Sampling Method" (Çicek and Erkan, 1996).

The representations are as below in the formulation:

n = Sample volume

s = Standard deviation

t = 95% confidence limit on t value (1,96)

N = Total number of enterprises

d = acceptable error (10% deviation)

Farms were analysed in four groups and the number of dairy cows of the enterprises were taken into consideration in the formation of the enterprise groups. Group I enterprises were of the farms owning 1 to 9 heads; group II farms with 20-20 heads; group III farms with 21-50 heads and group IV farms with 51 and above. The data obtained from the survey were analyzed via SPSS 22.0 package program.

4. Results and Discussion

4.1. Dairy enterprises number of milking cows

The number of dairy farms and their ratios of each group are shown in Table 1. According to Table 1, 52 (46,4%), 33 (29,5%), 18 (16,1%) and 9 (8%) of the farms were

group I, II, III and IV respectively. Similar outcomes had been reported by Tokmak et al. (2011) and Ünalan et al. (2013).

In a study carried out in Niğde Province of Turkey, 80% of farms had 1-15 heads, 5% of farms had 15-29 heads and 5% of farms had 30 heads and more dairy cows while Unalan et al (2013) stated that 51% the dairy farms had 0-9 heads, 41% of farms had 10-29 heads and 8% farms had 30 and more dairy cows.

Table 1: Dairy enterprises' number and rates

Number of milking cows (head)	Number of Farms	(%)
1-9	52	46,4
10-20	33	29,5
21-50	18	16,1
51 and more	9	8,0
Total	112	100,0

4.2. Family labor and land assets of enterprises

Table 2 illustrates the annual labor forces and land uses. In the dairy enterprises, the average family labor is the highest in group I and the lowest is group IV farms. The third and fourth group dairy farms held external labor while group II and III farms lacked external labor. As the scale of groups of farms grows, the rate of using external labor grows as well. External labor utilization rates were set as 45,96% in group IV farms and 39,23% in group III farms. Kan and Direk (2006) stated that the average family and external labor forces of the enterprises was 63,61% and 36,39% respectively. Compared to current research results, the rate of family labor use was higher and the external labor utilization rate was lower.

As for the land use, group IV enterprises had the highest amount of land (147 da). The fourth group farms had higher property land as 127,42, 99 and 80,15 da than group I, II and III farms respectively (Table 2).

Table 2: The labor and land use of dairy enterprises

Labor and land forces	Enterprises				Average
	I	II	III	IV	
Family labor (person)	3,11	3,06	2,62	2,17	2,9
Foreign labor (person)	0,00	0,00	1,33	2,90	0,4
Total labor (person)	3,11	3,06	3,95	5,07	3,3
Property land (da)	19,58	48,00	66,85	147,00	45,7
For rent land (da)	13,85	29,00	21,86	20,00	20,

Total land (da)	33,43	77,00	88,71	167,00	65,8

In terms of the rented land use, the lowest ration was in the first group while the highest was in group II enterprises. While the fourth group enterprises had the highest total land assets, the first group enterprises had the lowest total land assets. The results of the present study were different from the results reported by Aktürk et al. (2005) and Hozman and Akçay (2016). Aktürk et al. (2005) reported that the total land assets, property land and rented land of enterprises were as 80,95, 53,60 and 11,02 da respectively while Hozman ve Akçay (2016) reported that the property land and rented land were as 112,60 and 295,67 da respectively.

4.3. Economic analysis of annual activities of enterprises

Average gross production values are shown in Table 3. Gross production values of enterprises came from raw milk sales, born calf values, breeding animal sales, value increase due to the change in the age of animals, government support and premiums for milk, plant production values, manure sales and slaughtered animal sales (Table 3). The average gross production value was calculated as 66467 USD in all enterprises.

The highest value of the gross production value was found in group IV enterprises and the raw milk sales were the largest income item as 145139 USD of gross production value. The results stated in this study were higher than the ones reported by Kan and Direk (2006). Kan and Direk (2006) stated that the gross production values of enterprises owning 10-25, 26-50 and 50 and more heads milking cows as 13408, 27310 and 75614 USD respectively.

Table 3: The total gross production values of dairy enterprises (USD)

Total gross production items	Enterprises				Average
	I	II	III	IV	
Milk sales	6172	15097	31112	145139	23976
Calf values	4193	6449	9751	32937	8061
Breeding animal sales	3987	7371	10518	24259	7662
Increases of age values	2584	4993	6825	20745	5435
Premium and incentive	1850	2231	4766	18615	3778
Plant production	2959	4637	5455	20319	5250
Manure sales	575	928	1349	4771	1141
Slaughtered animal sales	5802	8126	13247	49121	11164
Total gross production values	28122	49832	83023	315906	66467

The gross product values of the dairy enterprises are shown in Table 4. The average gross product value of the enterprises was calculated as 76187 USD including total gross production value (87,24%), non-agricultural agricultural income (10,20%) and housing rent provision (2,56). As the capacity of dairy cows increased in enterprises, the gross product value increased as well. The average gross production value of the fouth group of enterprises was higher than group I, II and III enterprises as 287784, 266074 and 227883 USD respectively (Table 4).

Table 4: The gross product values of dairy enterprises (USD)

Gross product items	Enterprises				Average
	I	II	III	IV	
Total gross production values	28122	49832	83023	315906	66467
Non-farm agricultural income	5834	6936	7108	23341	7770
Housing rental fee	1780	1390	2073	4735	1950
Gross product	35736	58158	92204	343982	76187

Expense items of enterprises are illustrated in Table 5. In the enterprises, the variable costs and fixed costs accounted for 74,38% and 25,62% of the total costs. These results differed from those reported by Yılmaz et al. (2016) and Topcu (2004). Yılmaz et al. (2016) reported that the variable cost ratio as 65,89% and fixed cost ratio as 34,11%, while Topcu (2004) stated that the variable cost ratio as 69,53% and fixed cost ratio as 30,47%. When the results were compared, in the present study, higher variable costs and lower fixed cost ratios were reached than both studies. These differences are due to the difference in the scale of the enterprise and the high cost of operating expenses within the total cost, and the high ratio of animal production costs within the operating cost.

The costs of concentrate feed and hay purchasing, veterinary service and artificial insemination expenses in operating costs were as 35,21%, 20,96%, 4,19% and 2,45% respectively. In some studies, the cost of concentrate feed and hay purchasing were as 59,58% and 58,19% (MURAT and SAKARYA, 2012) and 43,89% and 48,81% (TOKMAK et al., 2011). In addition to these, temporary and permanent labor expense rates were found as 2,15% and 6,66% (Table 5).

Table 5: The cost elements of dairy enterprises (USD)

The cost items	Enterprises				Average
	I	II	III	IV	
Total farm costs	23957	40029	60302	228478	50968
A. Variable Costs	**17820**	**32873**	**47679**	**172966**	**39521**
Plant production	1386	1464	2461	7302	2057
Temporary labor	260	1636	1910	2332	1097
Concentrate feed purchase	7632	14838	21206	82394	17944
Corn silage purchase	1495	2964	5598	27263	4658
Hay purchase	2672	5400	5320	28900	6009
Veterinary service cost	959	1235	1641	5157	1487
Medicine and vaccine cost	300	556	811	2623	645
Artifical insemination cost	773	956	1801	3945	1247
Electricity and water expenditure	647	1170	1303	4649	1228
Fuel expenditure	452	625	890	3155	761
Marketing cost	344	498	615	708	462
Other expenses	900	1531	4123	4538	1896
B. Fixed Costs	**6137**	**7156**	**12623**	**55512**	**11447**
Animal depreciation	1327	1532	2275	9033	2159
Building and machine depreciation	281	309	445	1469	411
Building maintenance and repair	242	119	277	2372	382
Permanent labor and family labor	2675	2811	3925	8641	3395
General administrative expenses	204	359	1272	3828	713
Dept interest	550	924	2622	22909	2790
Taxes	123	302	627	2903	480
General insurance	460	472	535	1792	583
Rental fee	275	328	645	2565	534

While the average plant production cost rate formed 4,04% of the total variable cost, the animal production costs rate formed 95,96% of it. Some research results (KAN and DİREK, 2006) align with the results of research while some do not (AKTÜRK et al., 2005). While the rate of animal production cost in total variable costs was reported as 98,59% by Kan and Direk (2006), Aktürk et al. (2005) reported that as 60,06%. The permanent and the family labor (29,66%) had the highest share in fixed cost. It was followed by the dept interest of 21,75% and the animal depreciation of 18,86%. Considering the size of the enterprises, the variable cost of the total operating expenses was the lowest in the first group of enterprises (74,8%) and the highest in group II enterprises (82,12%); the lowest rate of fixed costs was in group II enterprises (17,88%) and the highest was among group I enterprises (25,62%) (Table 5). Animal depreciation rates reported in the current study were higher than the rates of 8,83% and 7,48% reported by Murat and Sakarya (2012) and Tokmak et al. (2011) reported a much lower level than the reported rate of 76,23% (Table 5).

4.4. The annual economic success criterions of dairy enterprises

The annual economic achievement criteria of the enterprises are shown in Table 6. According to Table 3, the average amount of pure yield, gross profit, net profit, agricultural income, economic profitability, financial profitability, rantability factor, capital turnover rate and capital turnover values were found as 28543 USD, 26922 USD, 25190 USD, 27812 USD, 19.91%, 44.48%, 35.62%, 49.45% and 2, 19 years respectively (Table 6). Although gross product, gross profit, net profit and agricultural income were higher in the fourth group enterprises than other groups enterprises, the economic and financial profitability ratios were lower (10,86% and 25,19%).

Rantability factor, capital turnover rate and capital turnover were more advantageous in the IVth group enterprises (40,98%, 70,20% and 1,42 years) (Table 6). In this study, the results of gross profit, net profit, economic profitability, financial profitability were found higher than the results of the studies conducted in this regard (ŞAHİN et al., 2001; DAĞISTAN, 2002; AKTÜRK et al., 2005; KAN and DİREK, 2006; ÖZTÜRK and KARKACIER, 2008; TOKMAK et al., 2011). Gross profit was reported by Şahin et al. (2001) as 303 USD, by Aktürk et al. (2005) as 4925 USD and by Öztürk and Karkacıer (2008) as 4925 USD respectively. Economic rantability value was found as 7,27% in Dağıstan (2002), as 2,54% in Kan and Direk (2006) and as 7,25% in Tokmak et al. (2011).

The financial rantability value was as 4,81% in Dağıstan (2002) and as 7,25% in Tokmak et al. (2011). Some research results reported were quite close to the current research results obtained in terms of the rentability factor (DAĞISTAN, 2002; SEMERCİ et al., 2016). The value of the average capital turnover rate of the enterprises was similar to the value reported in Kan and Direk (2006) (52.27%).

Table 6: The results of annual economic success criterions

Success indicators	Enterprises				Average
	I	II	III	IV	
Pure yield (USD)	12604	19381	35169	140978	28543
Gross profit (USD)	10302	16959	35344	142640	26922
Net profit (USD)	11779	18129	31902	115504	25190
Agricultural income (USD)	14454	20940	32988	119834	27812
Economic profitability (%)	19,03	20,50	25,89	10,86	19,91
Financial profitability (%)	49,87	44,40	38,70	25,19	44,48
Rantability factor (%)	35,27	33,32	38,14	40,98	35,62
Capital turnover rate (%)	35,37	58,11	63,86	70,20	49,45

Capital turnover (years)	2,83	1,72	1,57	1,42	2,19

4.5. The revenues analysis of dairy enterprises

Income analysis is conducted in order to determine the profitability of the production activity and the ability to meet the expenses. Therefore, the total, fixed and variable costs of the enterprises are proportionate to the gross product. In order for enterprises to continue this production, the low proportion of the rate of gross costs will increase the success of the enterprises. On the ratio of variable costs to gross product, similar results were reported in Dağıstan (2002). However, the ratio of fixed costs to gross product and the total costs were lower than those of Dağıstan (2002).

Table 7: The results of revenues analysis

Productivity elements (USD)	Enterprises				Average
	I	II	III	IV	
Variable cost/Gross product	0,499	0,565	0,517	0,503	0,522
Fixed cost/Gross product	0,172	0,139	0,137	0,161	0,156
Total cost/ Gross product	0,670	0,688	0,654	0,664	0,672

4.6. The raw milk production cost and profitability of dairy enterprises

Total amount of raw milk sales, production costs, support and incentive amounts, sales prices and net, absolute and relative profits of enterprises are shown in Table 8. According to Table 8, the lowest cost of per kg milk was realized in the first group enterprises, while the highest cost in the IVth group enterprises. In the fourth group, the enterprises sold more raw milk than other group enterprises (321283 kg) despite normal milk support (0,013 USD), cooled milk support (0,026 USD), support to member of the Dairy Cattle Breeders Association (0,031 USD) and milk analysis support (0,005 USD).

The total annual milk sales revenues were higher than those in other group enterprises. At the same time, the IVth group enterprises market raw milk at a higher price due to quality, cooled and analyzed milk sold. The highest absolute and relative profits were found in the second group enterprises while the lowest absolute and relative profits were found in the

fourth group enterprises (Table 9). The results conducted by Oliveira et al. (2006) were slightly higher than the average per liter milk cost.

Table 8: The milk production costs and revenues according to different sizes enterprises

Cost and revenues (USD)	Enterprises				Average
	I	II	III	IV	
COST					
Annual total amount of milk sold (kg)	17870	37636	73329	321283	56988
Annual total milk production cost	4914	10726	21265	97991	16734
Production cost per liter raw milk	0,275	0,285	0,290	0,305	0,283
REVENUES					
Annual total support and premium	786	1656	3995	24096	3431
Amount of support and premium	0,044	0,044	0,054	0,075	0,048
Milk sale price without support	0,281	0,284	0,291	0,295	0,285
Milk sale price including primes	0,325	0,328	0,345	0,370	0,333
Annual total milk sales revenue	5808	12345	25299	118874	19952
Annual net profit of milk sales	894	1619	4034	20883	3219
Absolute profit	0,050	0,043	0,055	0,065	0,050
Relative profit	1,182	1,151	1,190	1,213	1,177

5. Conclusions and Recommendations

The results show that dairy enterprises which have less milking cows yield the lowest milk production costs, low milk yield, high feed prices and shortages of feed, insufficient regular veterinary control and low adoption of technology especially in rural areas where the costs are even lower. Despite the low cost of milk production on small-scale farms, mainly because of their low input costs, both milk yields and the efficiency with which farm inputs are used are very limited. In the fourth group, the production cost of per liter of milk (0, 305 USD) and the selling price (0,370 USD) were the highest.

As the number of dairy cows increases in dairy enterprises, milk sales prices of enterprises are also increasing. The relative profit is increasing as the number of dairy cows increases. The increase in the price of feed causes a rise in the cost of milk production and thus productivity is negatively affected. The increase in producer costs causes the enterprises to quit this business.

For this reason, it is of great significance to carry out unity activities effectively in order to ensure that the supports to be given are sufficient and the farmers make their voices heard in this regard. Producers of animal husbandry should be informed and trained while

there should be pioneers in finding solutions to their problems. The studies clearly demonstrate that the genetic potential of dairy farms and programs that improve dairy farm management will lead to higher farm production, thus allowing farmers to access better marketing opportunities.

The latter will enable them to increase their milk earnings and to invest in more dairy businesses. As a result, for dairy development to be sustainable and to ensure the food security, the following are to be done immediately: making product markets work better, improving access to financial services and reducing exposure to uninsured risks, enhancing the performance of producer organisations promoting innovation through science and technology, making agriculture more sustainable and a provider of environmental services, adequate infrastructure and marketing opportunities, access to reliable markets for increased milk production, promotion through government policy, availability of credit for purchasing of livestock and planting pastures, available productive and adapted forage species, ready access to information, a farm management system which ensures adequate feed throughout the year, management of animal wastes, disease control measures and adequate hygiene for milk collection.

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