The title: **SUPPLY CHAIN AND QUALITY PROBLEMS IN DAIRY SECTOR**
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Problem statement
Despite the fact that the gradual development of the quality of processed products for the last few years has created an opportunity for the implementation of safe and good quality production – based on harmonised EU laws – consumers have more and more concerns and pay more attention to the quality of products.
However good quality food can only be produced from good quality material.
Our research concentrated on raw cow milk producing farms. An important role was played in our topic selection by the opportunity obtained to investigate dairy farms under a PhD research. The emphasis in this study will be laid on small farms (having 1-20 cows).
Judging the role of small farms in Hungary is quite complicated: they represent only 13.4 percent in terms of milk production (Salamon et al, 2004) which results in a significant portion of analyzers considering them as immaterial market players, but in terms of their number, they are quite considerable players in the Hungarian milk sector. According to the figures of the Hungarian Central Statistical Office (KSH), there are 25,108 cattle farms in Hungary, the 96.63 percent of which have 9 cows on average (3.37 percent have 560 cows). These farms have to face another problem: due to their size, they cannot sell their milk directly to the milk processors. Thus an intermediary enters the food chain here: the milk collecting dairy that buys up milk from the farmers which makes the sales easier (in larger volumes). However, a serious problem should not be ignored: milk received from the farmers goes into a common storage tank. Consequently, this heterogeneous milk results in a poorer quality which makes it more difficult to sell this milk and to offer an adequate price to farmers.
The Hungarian milk sector is in a unique situation. We would like to show some of the problems affecting the sector.

Objectives
This research aimed to find the answers for the questions as follows:
  – What are the most important factors that have an effect on the competitiveness of small dairy farms in Hungary?
  – What are the future perspectives of small raw milk producing farms in Hungary?
  – What is the process of milk qualification in Hungary like?
  – What is the quality like at the different stages of the milk product line ?

Procedures
During our study, primary and secondary data were analyzed. For secondary sources, the data of KSH, the Hungarian Dairy Association and the Ministry of Agriculture and Rural Development, as well as research papers and studies dealing with the Hungarian milk sector (Popp (2004), Salamon et al, (2004), Szűcs et al, (2004), Vágány (2007) etc.) were used, the distribution channels of product lane (Salamon (2009), Salamonné, Huszty A.(2003), Réger B. (2008),

Pónusz – Katona – Vágány (2009) etc.) were used, while questionnaires and personal interviews were made to acquire primary data.

Results

Before we show our results we would like to define our concept of quality, because our researches show that there is no exact definition for quality.
The definition for quality by Grunert et al. (2005) was found the most appropriate. The definition says that there are well-definable parameters for quality which can be called „objective quality".
Objective quality can be regulated, thus quality control aims to examine exact parameters. However the decisions of consumers are not only affected by objective quality but by „subjective quality" as well which – as Steenkamp (1990) says – is based on psychological factors.

I. Results of the questionnaires and personal interviews
A *questionnaire* was used to obtain primary information while the participating farmers were chosen by applying non-probability sampling. As a result, a "defined small region" was chosen for the investigations with three milk collecting dairies in operation. The dairies have 102 farmers as suppliers. These three milk collecting dairies are the suppliers of a large milk processing dairy that produces cartoned milk, yogurt, cottage cheese, sour cream and kephir.
All 102 farmers filled in the questionnaire with the help of an interviewer. The results can be considered representative for the aggregation of farms. A further advantage of this method is that 100 percent of the participants fill in the form which can hardly ever be provided by any other methods.
The questionnaire both included unstructured (open) and structured (closed) questions. After the questionnaire had been prepared a test was held to determine whether it was appropriate for the examinations or not. The results of the test showed that it was necessary to modify the initial questionnaire.
The test clearly showed that farmers would only intend to answer the questions if they do not have to give their name and address. That is why this paper refers to „small region" instead of data on individuals.

The most important result can be summarized as follows:
1. The analysis of the answers to questionnaires show that the most popular cattle kind in small farms is the Hungarian speckled cow (59 per cent) while the Holstein-Friesian cattle is more popular (41 per cent) in farms that keep more cows. The reason for the higher occurrence of the Hungarian speckled cow in small farms – according to the questionnaire survey – is the fact that although it produces less milk (being a kind in dual utilization) it can be sold at a higher weight than the Holstein-Friesian cattle which is rather specialized for milk production.
2. The results of the investigated farms also paint an interesting picture in terms of forage crop fields.
   57 percent of the farmers use their own land to produce their forage crop demand, 21% rent land while 22 percent of the farmers *neither own land nor rent* land.
   The majority of the farmers who neither own nor rent land keep a low number of cows. 91 percent of them keep 1 up to 3 cows

Farmers who neither own nor rent land were asked what methods they chose to feed their cows. The answers show that they are allowed to use the grassland or the pastures of other farmers provided they maintain the condition of the land. It is assumed that this situation cannot be maintained in the long term, thus the future of farmers who neither own land nor rent any will be in danger.

3. Answers related to the quality and the safety of milk gave interesting results. 33 percent of the farmers milk their cows manually, 50 percent of them use pails while 17 percent of them apply milking machines (Figure 1).
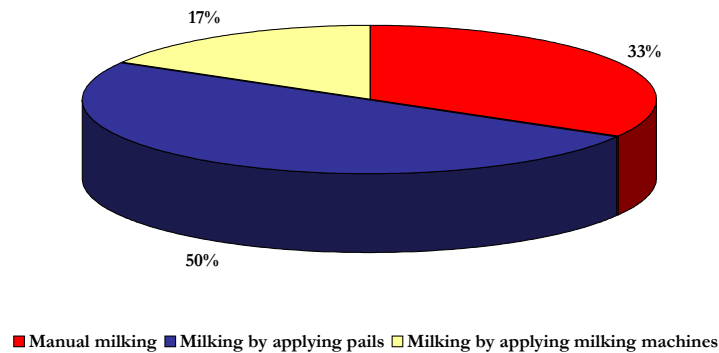

17%

33%

50%

■ Manual milking ■ Milking by applying pails □ Milking by applying milking machines

Figure 1: The distribution of the milking methods in the farms investigated.
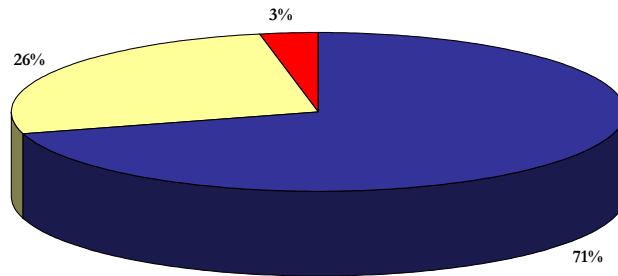Source: Own research

Farmers who keep only a few cows did not find it useful or effective to use milking machines. However a rise in the number of cows induced an improvement in the technological level of milking. As a result, it is almost impossible for farms that keep only a few cows to fully meet hygienic requirements. The reason for that is not the wrong attitude of farmers but the low level of technology.

4. The findings related to the cooling of milk are as follows:

Cooling is one of the most critical points in the process of milk production. Thus it was interesting to know what methods farmers use to cool milk and to maintain its temperature. It was assumed that farmers put a great emphasis on milk cooling but the results painted a different picture.

71 percent of the farmers use cold water to cool milk while 26 percent of them apply a milk refrigerator. 3 percent of farmers *do not cool the milk at all*. (Figure 2)

Farmers who do not cool the milk were asked by the interviewer why they do not do that. The answers show that after milking the cows farmers immediately (after filtering) deliver the milk to the dairy where it is put in the milk cooler of the dairy. Thus their milk is cooled in the dairy. Since the appropriate temperature is a very necessary condition for quality and safe cow milk production therefore these farms will not be allowed to produce milk in the future. The farmers are aware of that fact.

3%

26%

71%

■ Milk is cooled with cold water   □ A refrigerator is applied for cooling milk   ■ Milk is not cooled at all

Figure 2: The method for milk cooling in the farms investigated.
Source: Own research

5. The results of the questions related to the application of food safety and quality management are as follows:

    When preparing the questionnaire – based on literature sources and own experience – it was assumed that a very low number of small farms investigated in the framework of this research would use any method for quality and safety management.

    The results of the questionnaire proved the assumptions to be right. 6 percent of the farmers use the HACCP system. Other quality management, quality control or food safety systems are not applied. Farmers gave the following answers to the question why they do not use these systems (Figure 3):

17%

9%

25%

49%
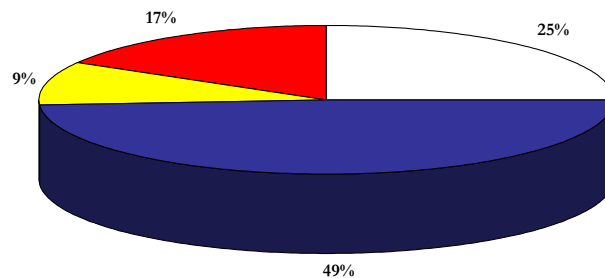
□ Unaware of quality management systems
■ Quality management systems are too expensive
□ Quality management systems require too much extra work
■ Quality management systems are too expensive and require too much extra work

Figure 3: The reasons why farmers do not apply quality management systems
Source: Own research

49 percent of the farmers find these systems too expensive, 25 percent of the farmers do not know them, 17 percent of them think that they are too expensive and require a lot of extra work while 9 percent of them think that the application of these systems need too much extra work.

53 percent of the farmers said that the situation of milk production was disastrous, 36 percent of them thought that it was bad and 11 percent of them said that it was acceptable. None of the farmers said that the current situation of milk production was good or outstanding neither in terms of their own enterprise nor the whole sector which also met the previous expectations.
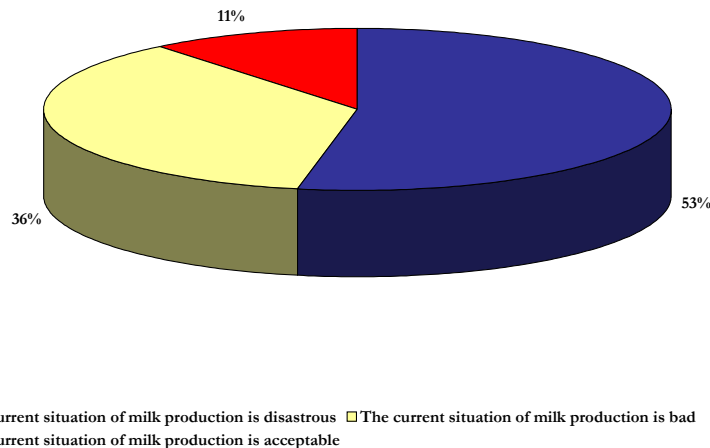

■ The current situation of milk production is disastrous □ The current situation of milk production is bad
■ The current situation of milk production is acceptable

Figure 4: The opinion of farmers participating in the research on the situation of milk production
Source: own research

One and a half years after the questionnaire survey 50 of the previously investigated farms were selected randomly and then visited again to find out what had happened to them since then.
It was assumed that their situation had not changed a lot. The results however did not prove the assumptions to be right. 22 of the 50 visited farms had finished dealing with keeping cows and 10 out of the remaining 28 farms said that they would intend to finish dealing with milk production.

The answers for the questions related to why farmers gave up dealing with milk production were as follows:
  – the person who dealt with animal husbandry in the family died and the other person cannot look after the animals alone (20 percent),
  – a nearby dairy was closed down, thus farmers cannot sell the milk (40 percent),
  – the price of milk is very low therefore it is not profitable to deal with animal husbandry (100 percent),

While the investigations were being carried out, there was an opportunity in the region for the examined farms: a foreign farmer intended to start producing cheese in the small region. The farmer carried out a survey on the situation of milk production in the town and the surrounding villages and found that the farmers did not intend to sell the milk to his enterprise. The reason for that was the fact that the composition of milk produced by the farmers did not meet the requirements for cheese production. Meeting higher requirements for quality would only have been possible by changes in cow kinds which would require high new investments by obtaining a significant amount of new capital. Since the required new sources were not available for the farmers and their average age was very high, therefore they only had short term plans and could not afford to make the necessary changes in their farming activity.

There was also an opportunity for farmers in the region to establish a dairy where they could have processed the milk and then sell it in plastic bag form to the inhabitants of the small region. Unfortunately, lack of cooperation between the farmers and some of the problems already mentioned above left this opportunity unused.

The farmers were also asked some questions about the competitiveness of small farms. The questions were compiled according to a questionnaire that the Hungarian Dairy Council uses to make surveys among farms that sell milk directly to the milk processing industry. Farmers were asked to set up an order of importance from the factors affecting competitiveness shown in Table 2 (farmers of course were not aware of the results of the survey by the Hungarian Dairy Council). The results were as follows:

Table 1: Factors affecting competitiveness in Hungary

Factors	1-9 cows	10-19 cows	20-29 cows	30-99 cows	100-299 cows	300-499 cows	More than 500 cows	Average	Order of importance by the farms examined
Capital supply	1	1	1	1	1	1	1	1	1
Lack of quotas	2	2	2	2	3	3	4	3	5
Market regulations	3	3	3	3	2	2	2	2	4
Forage crop area	5	5	5	5	4	4	3	5	2
Lack of information	4	4	4	4	5	5	5	4	3
Lack of qualified employees	6	6	6	6	6	6	6	6	6

Source: Own research based on a survey by the Hungarian Milk Council, 2003

The farmers participating in the research found capital supply the most significant factor in terms of competitiveness while they found the lack of qualified employees the least important one. Farmers agree in the importance of those two factors independently from the number of cows kept on the farm. However there were significant differences in their opinion on the importance of the other factors.

The data of the Hungarian Dairy Council shows that farms with the number of cows between 1 and 99 found the lack of quotas the most significant problem while farms keeping more than 100 cows found market regulations the most important factor.

Farms with a high number of cows found the availability of an appropriate size of forage crop land an important factor while the lack of information is a significant problem for farms keeping less than 100 cows.

The order of importance of the factors based on the opinion of farmers participating in this research was as follows (Table 1):

The farms participating in this research found capital supply the factor that has the most effect on competitiveness. However the next factor in the order of importance was forage crop land. It can be explained by the lack of the availability of forage crop land – which was already dealt with when analysing the questionnaire – and the fact that in many cases farmers only do each other a favour when using each other's land.

Farms that do not have an appropriate size of forage crop land – either their own or rented – will not be able to produce milk in the future.

The third factor in the order of importance was relevant information at the right time. Farmers said that the flow of information in our days is not appropriate. They are not aware of what kinds of subsidies are available for them and what opportunities they have to improve farming.

New market regulations – similarly to information – usually do not reach farmers or they are only known by a part of them.

Small farms did not find the lack of qualified employees and the lack of quotas important factors. The results of the research show that small dairy farms cannot maintain their activity for the long term, their competitiveness is low and their knowledge on quality is not significant.

II. The process of milk qualification in Hungary

The rapid control of the examination results of raw milk qualification and the timely forwarding to the producers and the processors is a prerequisite. The results are immediately available after the measurements by the advanced and high capacity equipment of the certification laboratory and the attached computer system.
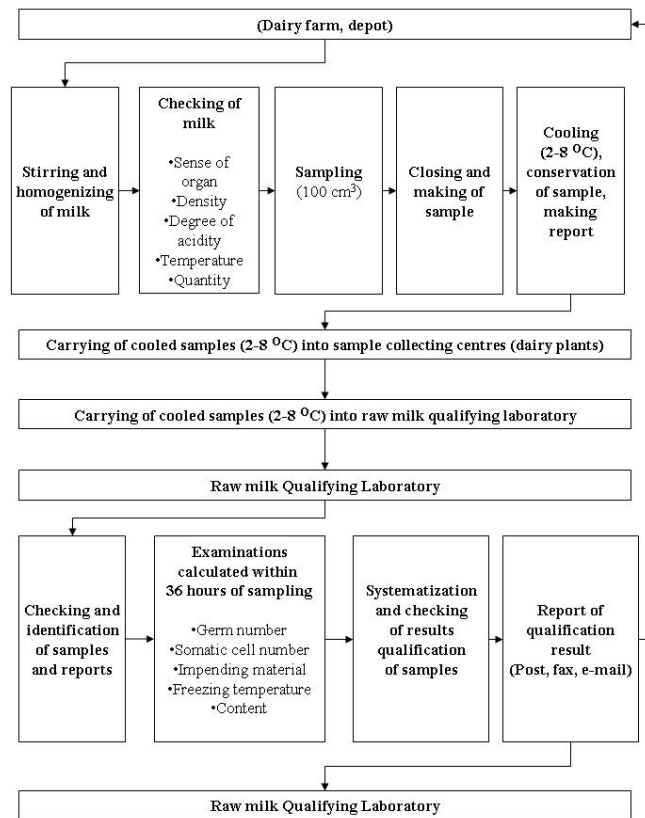

Figure 5: The process of milk qualification in Hungary

Source: Császár-Unger, 2005

III. The stages and distribution channels of product line of milk

The use of the capacities of dairy industry have improved in the previous two years, however, it remained very low. The butter and milk powder producing companies making losses were shut down, and at the same time several investments concentrating on economic operation were made. In 2005 according to the data from the Agricultural Economics Research Institute and the Hungarian Central Statistical Office there were around 50 dairy processing companies in Hungary. Despite the high number of processing companies the concentration is relatively high (calculations made on the basis of purchase show that the largest company represents around 30%, the five largest ones around 63% and the ten largest ones around 80%.) During the previous years the large companies have grown steadily and the small ones have kept on shrinking further. In the context of EU-15 processing industry is characterised by much stronger concentration. The Hungarian product line shows the following characteristics:
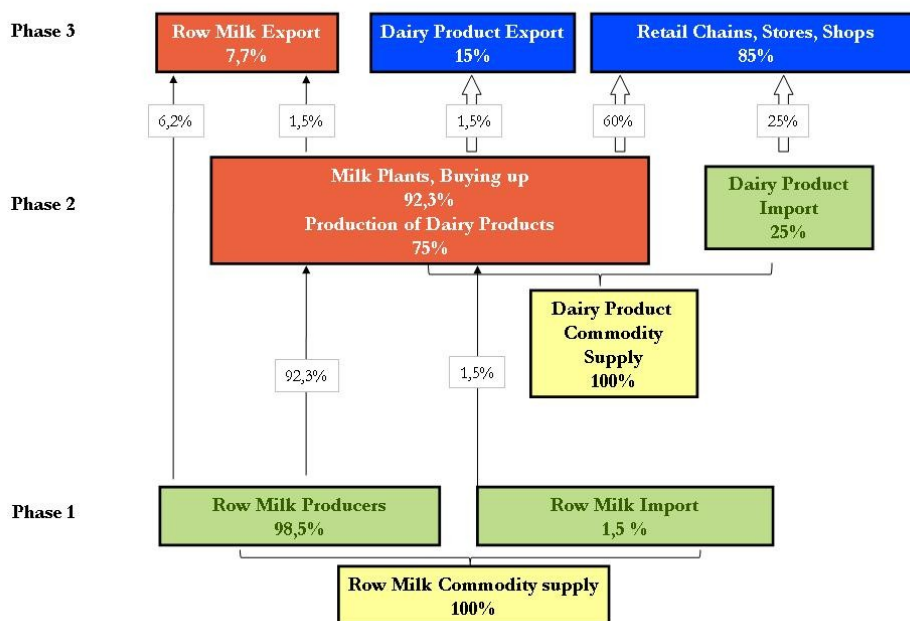

Figure 6: The stages and distribution channels of product lane of milk[1]
Source: Agricultural Economics Research Institute, 2007

More than 90% of the raw milk produced in Hungary went to the processing companies, in addition to the mainly one line producer selling 6.2% of the total Hungarian production was exported and import made up 1.6% (the situation of raw milk can be seen in the tables of the Annex).

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[1] Raw milk consumers with red colours [Raw Milk Export (7,7%), Milk Plants (92,3%)]
Dairy products final consumers with blue colour [Dairy products export (15%), Retail chains (85%)]
Thin arrows show the way of raw products, thick arrows show the way of processed products
Total commodity supplies with yellow colour

The whole sector's purchase is characterised by long term contracts (at least one year), which is important because of the perishability of milk and continuous production.

IV. Cost related income in the main dairy products

Almost half of the gross price is made up of raw material production, while cost-related profitability is only 3-4%.
The processor contributes to the price with 16-37% with a cost-related income of 4-42%. Marketing receives another 18-24% of the gross price but only by a very high profitability rate.

Table 2. Cost Related Income in the Main Products of Diary Sector in Hungary

	Cost Related Income (%)		
	Carton milk	Trappista Cheese	Sour Cream in Cup
Distribution	34,73	82,73	38,48
Processing	6,77	4,11	42,52
Basic Material Production	4,11	3,28	3,45

Source: Juhász, 2005 and Nábrádi, 2008.

Conclusions
The investigations proved that the situation of farms that deliver milk to milk collecting dairies is more insecure than other farms in terms of food safety and quality management. The quality of the mixture of milk delivered to the milk collecting dairy is questionable. Thus the future of farms investigated in this research is insecure. Milk collecting dairies – largely due to higher hygienic and food safety requirements – will have to finish their activity which may force small dairy farms to finish their activity as well.

The factors that have an effect on the competitiveness of small farms were determined in this research. The investigations showed that the three most significant factors that affect competitiveness (in order of importance) are capital supply, forage crop area and information supply. The results of literature processing, questionnaires and personal interviews proved that farms which neither own nor rent land will have to finish their activity in the future. Farmers that stop their activity should be subsidized by rural development programmes.

Education should play a very important role in making a quality-oriented view more popular which is very significant for every participant of the food chain. Quality raw material production should be given more emphasis in the further education of farmers within adult education.

If the presented disparity of the cost related profitability remains at the different stages of the product line Hungarian producers will stop production and the distributors (with their undue profitability level) will have to satisfy their needs from export and they are likely to make losses in the long term.

The problem is more serious than one would think at the first look because a lot of farmers in rural areas who deal with milk production – often do not have any other choice – lose significant financial sources.

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Annex1. Data of the processors in Hungary between 1998-2008

	Quantity [ton]										
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total	1 662 734	1 637 436	1 711 336	1 730 493	1 723 678	1 671 010	1 550 813	1 411 293	1 279 861	1 196 607	1 059 487
Extra	1 268 491	1 291 985	1 415 789	1 478 045	1 469 281	1 517 654	1 517 513	1 384 820	1 254 120	1 183 947	1 046 851
I. class	191 534	177 076	154 478	137 602	169 219	88 609	0	0	0	0	0
II. class	97 196	85 372	81 414	68 758	52 032	14 093	0	0	0	0	0
III. class	34 330	25 297	15 416	15 577	11 697	3 475	0	0	0	0	0
Other	71 183	57 706	44 239	30 511	21 449	47 179	33 300	26 474	25 741	12 660	1 059 487

Source: Own research based on a survey by the Hungarian Dairy Association, 2009

	Share [%]										
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total	100	100	100	100	100	100	100	100	100	100	100
Extra	76	79	83	85	85	91	98	98,12	98	98,94	98,81
I. class	12	11	9	8	10	5	-	-	-	-	-
II. class	6	5	4,50	4	3	1	-	-	-	-	-
III. class	2	1,5	1	1	1	0	-	-	-	-	-
Other	4	3,5	2,50	2	1	3	2	1,88	2	1,06	1,19

Source: Own research based on a survey by the Hungarian Milk Council, 2009

	Average price [Ft/l]										
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Extra	58,10	62,91	65,52	73,65	78,17	75,83	62,39	63,06	62,49	70,57	80,91
I. class	54,08	57,15	59,28	65,44	68,52	66,05	-	-	-	-	-
II. class	44,71	46,55	47,82	52,53	54,71	55,25	-	-	-	-	-
III. class	42,47	44,81	43,81	49,79	51,67	50,41	-	-	-	-	-
Other	39,02	40,14	41,75	44,95	48,1	46,02	48,31	48,12	47,97	53,78	61,91

Source: Own research based on a survey by the Hungarian Dairy Association, 2009

	Average fat and protein content [%]										
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Average fat content	3,66	3,71	3,67	3,66	3,67	3,62	3,64	3,61	3,58	3,64	3,68
Average protein content	3,33	3,29	3,25	3,29	3,28	3,18	3,20	3,21	3,19	3,23	3,24

Source: Own research based on a survey by the Hungarian Dairy Association, 2009

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