Freshness in milk

Individual work
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PREFACE

This project has been written in relation to the individual work at the The University of Copenhagen, Faculty of Life Sciences, Autumn 2007

The main topic in this report is milk freshness.

I would like to thank Jannie Vestergaard, my supervisour, for her good suggestions, help and encouragement. Also I thank Food Science department stuff who made it possible to use kitchen and all what was needed for carring out the consumer tests.

Frederiksberg, 31th of August

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1.Introduction

1.1 Milk value and its role

Milk is as ancient as mankind itself, as it is created to feed the mammalian infant. All species of mammals, from man to whales, produce milk for this purpose. The role of milk in nature is to nourish and provide immunological protection for the mammalian young and it has high nutritional value. Milk that was used in consumer test was treated in a way that nutritional value would remain. The main goal was to see how consumer perceive different milk. The role of milk in the traditional diet has varied remarkably in different regions of the world. The tropical countries have not been traditional milk consumers, whereas the more northern regions of the world, Europe (especially Scandinavia) and North America, have traditionally consumed far more milk and milk products in their diet. (1)

1.2 Milk freshness

Milk freshness can be described differently by consumers with different demographic characteristics and consumption habits. Fresh milk can be just after milking cow but also not spoiled milk can be fresh. In tropical countries where high temperatures and lack of refrigeration has led to the inability to produce and store fresh milk, it has consumed immediately as warm milk after milking, by boiling milk, or by conversion into more stable products such as fermented milks. Nowdays its not allowed to sell milk in shop or market that hasnt been pastorized its known that even pastorized milk is fresh until expiary. Fresh milk does not contain lactic acid, but it may be present in stored milk as a result of microbial growth. (2)

There was one experiment in Switzerland about apple freshness. Authors came to a conclusion that it is usually texture-related. Freshness can be hypothesized in this study by perception of the aging of the product and by judging its texture and as it seen aging is important for product freshness. Interviewed 1,081 consumers attitude on food labelled "fresh" referred on the age of the food. In the test came out that generally women accorded more importance for freshness attributes comparing with men.

Heiss (1986) found close relationship between the hedonic aspects and the freshness of food, with " fresh" being equivalent to good, healthy or natural while "industrially treated" would correspond to an inferior value, denaturated or artificial.(2)

1.3 If there is any effect on milk and consumer preference choosing with different amounts of white clover fed cows

Goal was to find out if there was some effect on milk while cows were fed with different amounts of white clover. Or is there any difference if cow eats only dry matter or grass. Plant metabolites, there are flavonoids, as well as the fatty acid composition of legumes that can affect the chemical, functional and sensorial properties of milk as shown by Cabiddu et al. (2001) for dairy sheep and Bertilsson et al. (2002) in dairy cows. Mixed grass–legume pastures including white clover can be beneficial to consumers' health by increasing the conjugated linoleic acid content of milk and dairy products (Dhiman et al., 1999). In addition, provisional data indicate that some forage legumes can enrich the milk polyunsaturated fatty acid concentration and in this way affect the flavor of dairy products. However, despite these benefits, polyunsaturated acids are also prone to be oxidized, resulting in potentially dangerous free radicals.(3)

1.4 Organic production situation nowadays and its importance for consumers

The one point was that milk samples used in consumer test were from organic agriculture, also consumers were asked if they prefer organic milk instead conventional. People may choose organic milk for health benefits, or environmental and animal rights' issues. But when evaluating the health claims, until now, research does not support a health advantage of organic over conventional milk for any segment of the population. (4)

A literature review shows that the current animal health situation in organic livestock production is not significantly different from that on conventional farms. A high incidence of disease is often found to be associated with the farm management, resources limitations and the lack of training and education of farmers in disease prevention and animal health promotion. There is often lack of veterinarians, consultants and inspectors. Therefore would be useful to have more practise and trainings. Nowdays people are becoming more concerned about their health and living conditions. In my opinion there is a increase of health shops and people interest for oranic products, becouse people are getting more concerned about their health. It is reviewed by Williamson (2007) that organic foods become popular as some consumers have more concern about impact of intensification[1] on the nutrient composition and the health implications of pesticide residues and pharmaceuticals found in our foods. The authenticity of organic foods can be a concern for the consumer, as they rarely look very different from mainstream foods. Therefore, clear labeling and strict regulations have been set. For a product to be labeled 'organic', it must have been produced in line with the EU Regulation [Council Regulation (EC) No 1804/ 1999 of 19 July 1999]. (5)

The EU Regulation provides a framework which should ensure that the living conditions of organic livestock are acceptable, and better than the minimum conditions required in conventional livestock production. Organic premiums are under similar pressure as

[1] Intensification - its essential to meet required productivity and has relied upon the use of inorganic fertilizers, herbicides and pesticides. However, some producers have opted to produce foodstuffs organically, which has been supported by some consumers and become somewhat of a niche market.

conventional prices, and when faced with limited resources and conflicting aims farmers do not always give animal health the highest priority. Thus, there is a need for strategies which ensure that the goals of good animal health and food safety on organic farms can be achieved throughout the EU by measures that are adapted to local conditions.(6)
One of the ways to increase the economic value of foods, including milk and dairy proteins, is by producing "organic" products, which are reported to be 15–20% more profitable than conventional farm produce.(7)

1.5 Organic milk

Milk that is certified as organic must come from cows that have not been treated with growth hormone (BGH) that is used to increase milk production.(4)
The production of organic foods is increasing in developed countries: Denmark is systematically developing this area (at present, ~ 3% of all food at the retail level is organic and the level is much higher for milk; it is predicted that 50% of Danish milk will be organic by ~ 2010). (7)

1.5.1No antibiotics

A second characteristic of organic milk is that these cows are not treated with antibiotics. If a cow in an organic herd does need to be treated with antibiotics, she is not returned to the herd for a period of 12 months. Yet in conventional herds, milk from cows that receive antibiotics is not used until tests show it is antibiotic-free. Tanks of milk are routinely tested to ensure no antibiotic content.(4)

1.5.2 milking cow feeding

A third requirement of organic milk is that cows' feed is grown without pesticides, whether the feed is grass or grain. Using organic feed may support sustainable farming practices, yet research has not found if it affects the nutritional value of the cows' milk.(4)

1.5.3 Grazing time

The final requirement for organic milk is that cows must have "access to pasture." Many consumers assume this means cows graze in fields most of the year. But, the current standard does not require a specific length of time in pasture. A cow can graze in pasture only a limited time and still produce milk that is certified organic.(4)

1.6 Milk treatment and technology

Technological advances came very recently in the history of milk consumption, and generations have turned milk processing from an art to a science. The availability and distribution of milk and milk products in todays modern world is a blend of the centuries old knowledge of traditional milk products with the application of modern science and technology.

1.6.1 infusion pasteurization

It was worked out new technology called infusion pasteurization. The purpose was to have more natural milk without much treatment. There was developed a mathematical model where heat and mass transfer from steam to milk in the presence of the
air. By direct heating systems it was possible to reach highest heating rates: injecting steam into the product or distributing milk in a steam vessel – its called infusion pasteurization. With the infuser it was possible to increase and decrease the temperature of the milk by more than 200K within 1 second.(8)

1.6.2 Homogenization

Homogenization is in milk processing, where the aim is to prevent or delay the natural separation of cream from the rest of the emulsion. The fat in milk normally separates from the water and collects at the top. Homogenization is the process of breaking up that fat into smaller sizes so that it no longer separates from the milk, allowing the sale of non-separating 2% and whole milk. This is accomplished by forcing the milk at high pressure through small orifices.(9)

1.6.2 Raw milk and normal pasteurization

Louis Pasteur (December 27, 1822 – September 28, 1895) was a French chemist best known for his remarkable breakthroughs in microbiology. He is best known to the general public for showing how to stop milk and wine from going sour - this process came to be called pasteurization.(10)

Pasteurization is typically associated with milk, first suggested by Franz von Soxhlet in 1886. **Pasteurization** is the process of heating liquids for the purpose of destroying viruses and harmful organisms such as bacteria, protozoa, molds, and yeasts.(11) Normally pasteurized milk is highly nutritious and perishable products with limited keeping ability. Milk can be spoiled by a contaminating microorganisms, also by microorganisms that survive the pasteurization. The rate of spoilage is quite dependent on the distribution temperature. Obviously good quality raw milk is also important for the quality of the processed pasteurized milk. Several investigations and practical experience have shown the opposite effect of the increased pasteurization temperature therefore milk is faster to spoil. Improving the raw milk quality is a important task, it implies training and education at the farm and milk handling level. There are measures in obtaining a good quality raw milk: healthy herds and good hygiene during milking and storage.(12)

1.7 Evaluation methods

One important goal in this test was to find out which evaluation method was more liked by consmures and which gave better evaluation results.

1.7.1 Best-worst scaling

First consumer test questionaire was with best-worst evaluation method.
The purpose was to find out wich of two was better for evaluation, more acceptable by consumers and also easier to receive good results.

Best-worst scaling was formally introduced by Finn and Louviere (1992) who proposed and studied a discrete choise task that asked a person to select both the best and the worst option in set of options. He required participants to select the best and worst, smallest and largest, most and least like, etc.

1.7.2 Hedonic nine point scale

Second consumer test evaluation method was in hedonic nine point scale. The goal was to receive more sencitive results. The nine-point hedonic scale (belongs into affective category) is probably the most useful sensory method and it occupies a unique niche for sensory evaluation. Since its development (Jones *et al.,* 1995; Peryam and Haynes, 1957), it has been used with a wide variety of products and with great success. This scale is very easy to understand and with minimal instruction. Results have been eemarkably stable and easy to see differences.(13)

1.7.3 Best-worst scaling versus hedonic nine-point scale

One good thing about best-worst method is that it's less „noisy" compared with 9 point hedonic scale, with the ending points „dislike very much" and „like very much". In best and worst method can choose something that is liked most or least only in one way.

Marley & Louviere (2005) stated that one of the advantages best-worst scaling over traditional descrete choise tasks that they take person's propensity to identify and respond more consistently to extreme options.

2. Materials and methods

First consumer test took place on the 30.05.2007. and second on 13.06.2007
On the first evaluation consumers were asked to evaluate milk in best – worst scale. And milk freshness also in best – worst scale. On the second evaluation they were asked to evaluate liking on a nine-point hedonic scale, with the end points „dislike very much" and „like very much". As well milk freshness in nine-point hedonic scale. To addition they were asked to mark the number of milk that they periceived „the worst" and „the best" and „least fresh" and „most fresh" milk.

2.1 Consumer test I (white clover amount in diet)

There were 7 milks from 7 different organic farms, but only 3 samples where used in consumer test. Milk should be as fresh as possible and with the same signs and treatment to receive attainable evaluation results.

2.1.1 Planning and preparing for test

It is good to inform students about milk test earlier so that they could arrange their coming on test that day.

Questionnaires should be printed out the day before or even earlier. If the goal is to get 100 volunteers then 110 papers could be printed in advance. Cups should be numbered (3-digit random numbering) before evaluation day. Each number should consist of 3 numbers. In case its good to have some cups more.

Have to start pouring milk into cups about 2 hours before start. To manage in time its advantage to have helpers, at least one person. Had to prepair alltogether 400 cups. Cups should be covered with lid and put into fridge until going to canteen, so that they will keep cold temperature. Lids are important to keep the taste and aroma and also against leaking when puting milk cups to fridge and later delivering to consumers. Had to prepare to take with: pens, black bag for empty cups, jar for pouring out remaining milk and napkins for cleaning. Have to put milk from fridge into icebox , to mantain cold, when taking to canteen.

2.1.2 Carry out the test in the canteen

When delivering milk to consumers have to remind them to shake milk well before tasting, becouse usually milk fat collects on the top of milk. It will take proximately 3 minutes for each consumer to complete the test. And it will take time all together about 4 hours to finish test in canteen. Afterwords have to pour remained milk out and clean equipments that were used.

2.1.3 Consumers and methods

A total of 72 untrained volunteers (mainly students only few precentage of others) with the age 20-56 years, took part in consumer panel. There were 47 females and 25 males. The test took place on 30.05.2007 in the University of Copenhagen canteen, Faculty of Life Sciences (Thorvaldsensvej 40, Frederiksberg, Denmark) at11 am. – 15 pm.

There were 4 milk samples that were evaluated with worst and best scale, „least liked" and „most liked"and „least fresh" and „most fresh"

Demographic questions where asked like: sex, nationality, age, occupation, how often do you drink milk?, how many liters do you drink per week?, what kind of milk do you usually drink?(type, brand,fat-%), and some quiestions that were related to consumer behaviour like: if freshness is important to me, I always look at the production date/or expiry date before I buy the milk.

2.1.4 Milk samples and backround

There where 3 samples and one reference milk Grambogård that was purchased in shop Magazin on evaluation day morning. Milk samples were tapped on 29/5-2007. All milk samples contained proximately 3,5% of fat. Grambogård milk is conventional, unhomogenized and low pasteurized. Milks from individual farms EMS-HF-L-33, OA-J-MIHI-70, HM-HF-HI-60 are organic, normally pasteurized and not homogenized. EMS-HF-L-33 contains 33% of white clover in cow diet. Cow race is Holstein Friesian.

OA-J-MIHI-70 has 70% of white clover in diet. Cow race is Jersey. HM-HF-HI-60 has 60% of white clover in their diet. Cow race is Holstein Friesian. EMC-HF-L-33 milk has low amount of white clover in the grass compared with OA-J-MIHI-70 that has medium to high amount of white clover and HM-HF-HI-60 high amount of white clover in the grass. (Table 1)

2.1.5 Statistical analyses

Analysis of varriance (ANOVA) has been done with SPSS version 13.0

Table 1: Data over the 4 different milks used in I consumer test

Name	%Fat	Date of tapped milk	Cow race [a]	White clover content in diet [b]	Milk
Grambogård	3,5	29/5-2007			
Esben Møller Christensen(EMC)	Full fat	29/5-2007	HF	L-low amount of white clover	EMC-HF-L-33
Ole Andresen(OA)	Full fat	29/5-2007	J	MIHI-medium to high amount of white clover	OA-J-MIHI-70
Heino Mølholm(HM)	Full fat	29/5-2007	HF	HI-high amount of white clover	HM-HF-HI-60

[a] **HF=Holstein-Friesland; J=Jersey**

[b] **L=low, MIHI=medium to high; H=high**

2.2 Consumer test II (Infusion and normal pasteurized milk)

2.2.1 Planning and preparing for test

The method is described in section 2.2.1

2.2.2 Carry out the test in the canteen

Second consumer test took place again at The canteen of University of Copenhagen, Faculty of Life Sciences (Thorvaldsensvej 40, Frederiksberg, Denmark) from 11 am. – 15 pm. First test showed good results about people habbit to consume milk daily so it was advantage to make this test again in the same place.

2.2.3 Consumers and methods

70 volunteers (30 male and 40 female) tested and evaluated milk. The youngest consumer age was 14 and oldest 56, mainly students and some scientific and university workers. The evaluation methods were „worst" and „best" and nine-point likingscale. The test was arranged the same way as

first only milk samples where different and qustionaire was changed little bit. See in addition section 2.1.3

2.2.4 Milk samples and backround

Reference milk, Gård mælk was purchased on the same day morning from Irma. It contained 3,5% of fat and was not homogenized. LP_15_72 milk is normally pastorized: 72C for 15 seconds.

INFP_0.7_90 milk was infusionpastorized in 90C for 0,7 seconds. INFP_0.7_120 milk was infusionpastorized in120C for 0,7 seconds. (Table 2)

Table 2: Data over the 4 different milks used for the II consumer test

Milk treatment	Date of tapped milk	Sample code
Not homogenized, normally pasteurized	12/6-2007	Gård mælk
0.7 seconds, 120C	12/6-2007	INFP_0.7_120
0,7 seconds, 90C	12/6-2007	INFP_0.7_90
Reference milk, normally pasteurized 72C, 15 sek	12/6-2007	LP_15_72

3. Results and discussion

Preffered milk was usually evaluated in every scale with better mark and least preffered with less better marks.

Test results showed that, when buying milk, consumers are alert to check out the date and expire date on the milk baggage, on the nine-point scale it was rated with average 6 points.
Freshness was important factor for consumers when buying milk; they gave 6 points for freshness in nine-point hedonic scale.

3.1 I consumer test (white clover amount in diet)

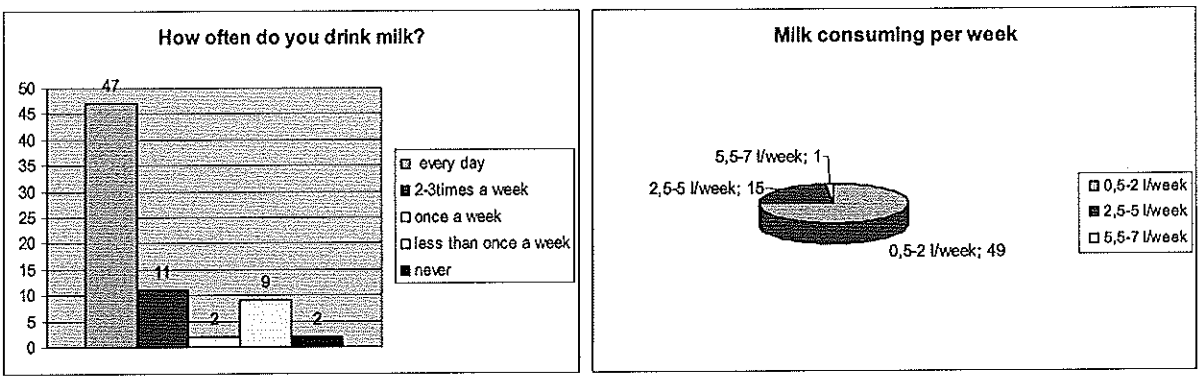

Figure: a. (How often do you drink milk?) and b. (Milk consuming per week)

From 73 people only 2 never drink milk. There were 11 consumers who drink milk 2-3 times a week, 9 consumers less than once a week. Average milk consumption per week is from 0, 5 – 2 liters. As the consumers told they drink milk usually with coffee and not so much pure milk.

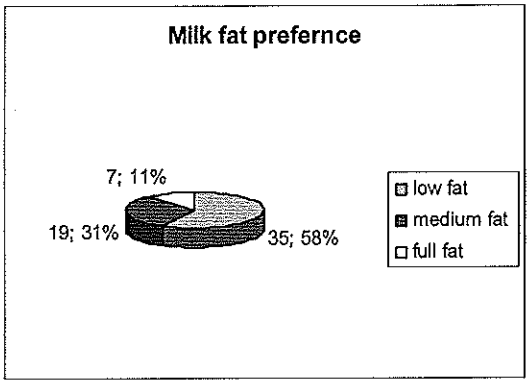

Figure: c. (Milk fat preference)

As the results showed consumers prefer low fat milk (Figure 2) to full fat. They choose it probably because they don't liked creamy taste. Benefit on health can have one impact on choosing low fat milk, because milk fat is generally considered cholesterol rising and it contains large amount of saturated fatty acids. There was one experiment; young men were fed with modified fat and present Danish milk fat. As the experiment indicates any positive effect was obscured while there weren't no signs of lower cholesterolemic fatty acids in the body.(14)

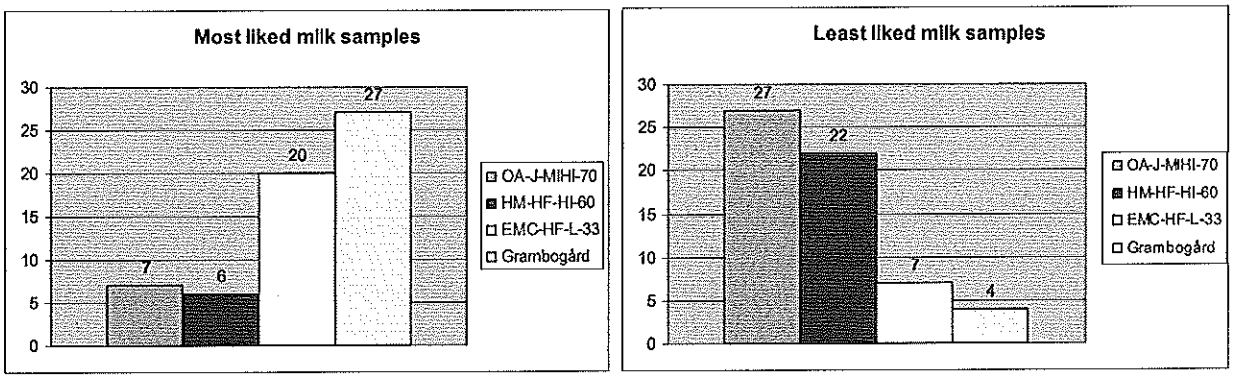

Figure: d. (Most liked milk samples) and e. (Least liked milk samples)

27 consumers liked Grambogård milk most. They are not used to drink milk that is straight from farm and not so much treated. HM-HF-HI-60 was liked only by 6 people. Milk HM-HF-HI-60 and OA-J-MIHI-70 wasn't so liked because consumers told that this milk was too creamy and had yellowish colour. They preferred more pure, white and light milk. 27 consumers preferred Grambogård, probably because people are more used with milk that tastes like shop milk. It is usually homogenized, pasteurised and it has taste of cooked milk. Milk that was directly from farm had more creamy taste and it has yellowish colour, because it wasn't homogenized.
There is quite significant difference in milk liking to taking in account different white clover amount in cow diet. With Low and Medium to high amount of white clover milk has higher liking marks compared with high clover amount milk OA-J-MIHI-70, that has 70% of white clover.

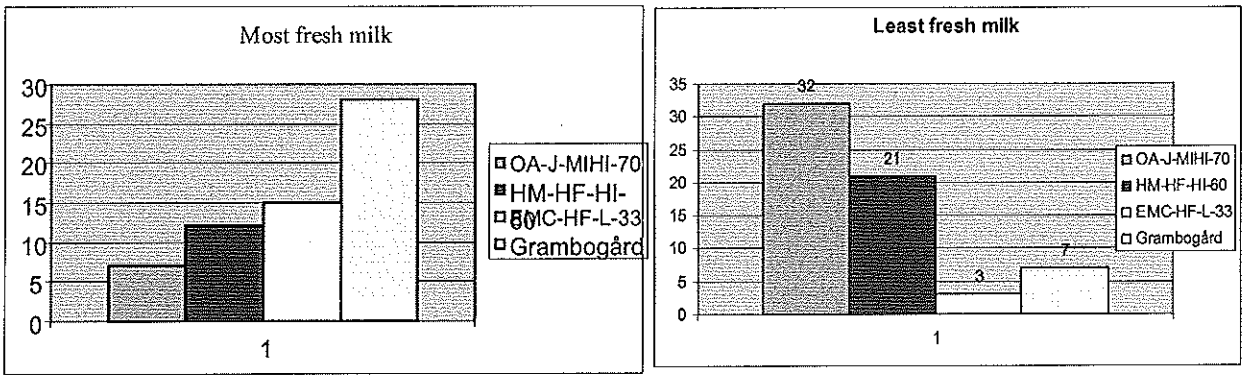

Figure: f. (Most fresh milk) and g. (Least fresh milk)

32 consumers perceived OA-J-MIHI-70 least fresh and 3 consumers found EMC-HF-L-33 least fresh. Least liked milk sample was OA-J-MIHI-70 milk probably because it had yellowish colour and creamy taste. As a result when consumers didn't liked certain milk (Figure. e) they evaluated it also as least fresh (Figure g.). OA-J-MIHI-70 was marked as least liked and least fresh.
About 28 consumers perceived Grambogård milk most fresh. 7 consumers found OA-J-MIHI-70 fresh.

3.2 II consumer test (Infusion and normal pasteurized milk)

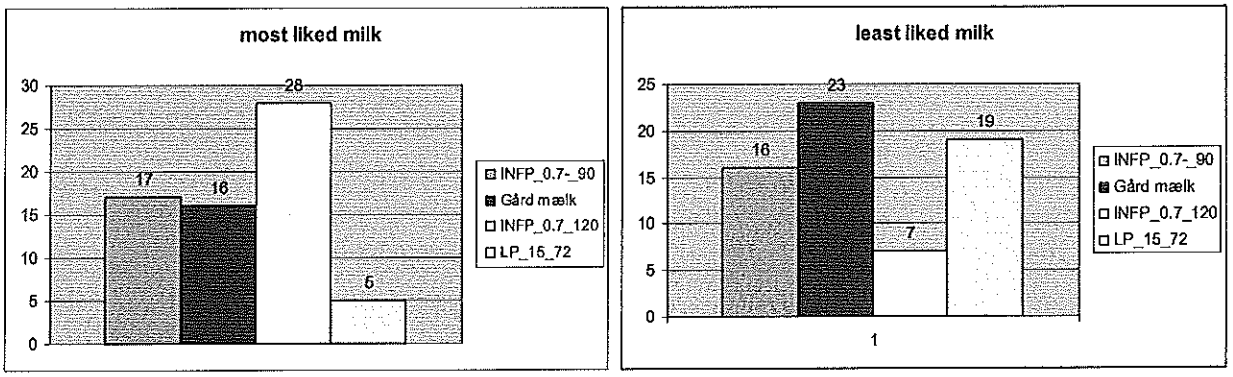

Figure: h. (Most liked milk) and i. (Least liked milk)

28 consumers liked most INFP_0.7_120 milk and 5 persons liked LP_15_72 milk.
Its interesting to see that 16 consumers liked Gård mælk and 23 consumers didnt like it at all.
23 consumers preffered least Gård mælk and only 7 liked least INFP_0.7_120 milk.
INFP_0.7_90 showed good results becouse it had mild and good taste. I heard from consumers that Gårdmælk had taste of hey that's why they didn't liked it much.

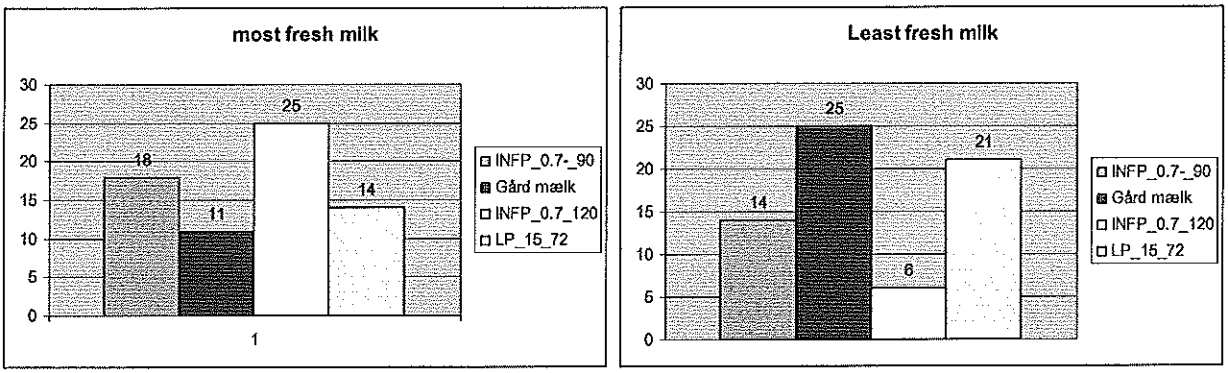

Figure: j. (Most fresh milk) and k. (Least fresh milk)

25 consumers found INFP_0.7_120 to be most fresh and 11 consumers perceived Gård mælk most fresh.
25 consumers perceived Gård mælk least fresh and only 6 consumers INFP_0.7_120 least fresh. There is remarkable difference in preffering infusion pastorized milk comparing with normal pastorized and Gårdmælk as being reference milk.

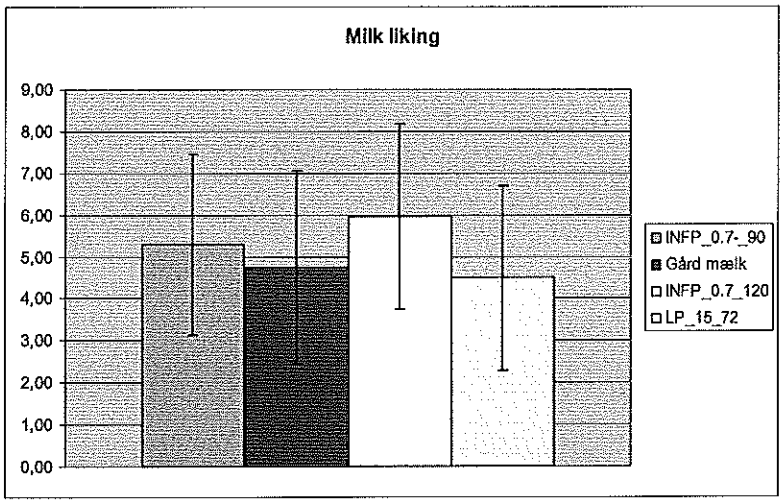

Figure: l. (Milk liking)

INFP_0.7_90 (ab), Gårdmælk (a), INFP_0.7_120 (b), LP_15_72 (a)
Different letters (a,b, ab) indicating significant differences. Figure 1. shows that INFP_0.7_90 and INFP_0.7_120 are little bit more liked by consumers then Gårdmælk and LP_15_72

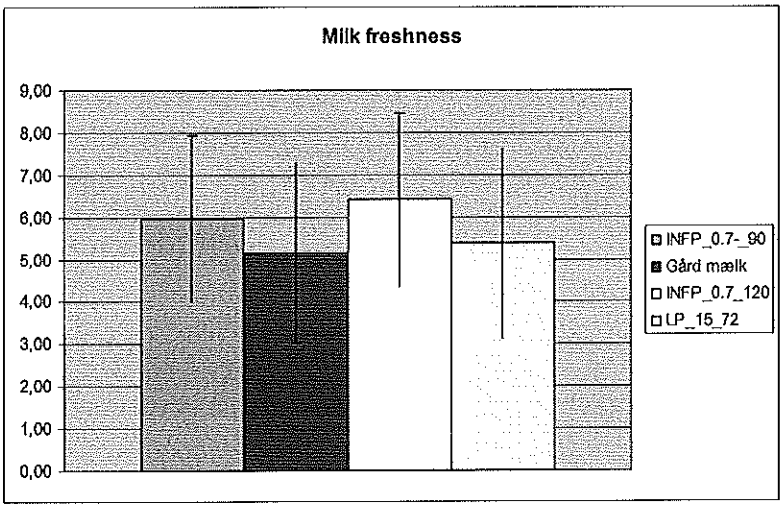

Figure: m. (milk freshness)

INFP_0.7_90 (ab), Gårdmælk (a), INFP_0.7_120 (b), LP_15_72 (a)
Different letters (a,b) indicating significant differences. On the figure m. can clearly see that consumers perceived freshest milk INFP_0.7_90 and INFP_0.7_120 compared with Gårdmælk and LP_15_72. This is positive sign for infusion pasteurization technology; because both milk liking and freshness (Figure l. and Figure m.) were liked more with infusion treatment.

3.3 Pros and cons

To get reliable results have to have more participans, at least 100.
Like the test showed consumers liked infusionpastorized milk compared with normal pasteurized and reference milk. Ofcourse it wasnt easy to find reference milk that would be with exactly the same treatment and freshness as the milk straight from farm.

Under controlled conditions with best-worst evaluation method it would be possible to receive better results and with less errors. As it came out from consumer test there was desparity in evaluation. In the second test, there were worst-best-, and nine-point hedonic scale both. Sometimes consumers marked only on the one scale and forgot to mark on another, therefore couldnt take into account their results.

Sometimes consumers forgot to shake milk well and therefore perceived milk too fat. Usually after shaking and opening caps milk dropped little bit on the table so it was useful to have napkins.

Some consumer didn't understood exactly how to fill the questionnaire and filled it wrongly and unfortunately it wasn't possible to take their results into account.

Many consumers didn't know meaning of "organic" milk, therefore didn't made any evaluation in that part.

Eating could affect milk tasting and evaluating, as the test was during lunch break.

In general I can say about the test, that there were more good results than bad.

4. Conclusion

The main goal was to see how consumers perceive milk freshness and how they like milk samples they had to evaluate. Eventhough there were around 70 consumers in both tests, the results from hedonic and best-worst scale about liking and freshness came out quite remarkable. Can say that freshness of milk strongly depends on preference of the milk. In general fresh milk can be described as cold. Attribute "fresh" can be described as being equivalent to good, healthy or natural while "industrially treated" would correspond to an inferior value, denaturated or artificial.

White clover amount in cow diet affected greatly milk preference by consumers, they liked milk that had lower amount of white clover in cow diet compared with high amount.

One purpose was to see what kind evaluation method was better liked by consumers – best-worst or nine-point scale. Best-worst scaling wasnt so preffered than nine-point scale, becouse it was little bit confusing and therefore came some errors into data.

Second consumer test milk had undergone different treatment (infusion pasteurization), it should be more natural compared compared with traditional. So the purpose was to see how consumers react on milk taste. The test showed that consumers liked milk which was infusion pastorized compared with reference-, and normal pasteurized milk.

As the milk was from different organic farms, consumers were asked if it is important for them to buy organic milk. The results showed that preference for organic milk was bit higher than average. Some students asked during the test, what does word „organic" mean.

Further studies of milk freshness could be perfomed with assessors or consumers under controlled conditions, can be proximately 40-50 people, hereby can be obtained reliable data.

At the end I would like to say that I learned a lot from writing this report. Firstly I learned how to plan and carry out consumer test and secondly I experienced how to write report individually, that has to sum up all practical work that was done, statistical analyses and also how to look for scientific material. In general I can say that I am satisfied with this data and results.

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NOTES

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Appendix 1: I consumer test questionnaire

Consumer test - MILK
30.05.2007

Sex: _____ Nationality:_____ Age:_____

Occupation: _____

How often do you drink milk?

☐ every day ☐ 2-3 times a week ☐ once a week

☐ less than once a week ☐ never

How many liters do you drink per week? _____

What milk do you usually drink? Type and brand _____

Fat-% _____

Do you take a look on milk expiring date before buying it? _____

Which milk do you like most? And which do you like least?

Least liked	Milk samples	Most liked
	407	
	633	
	145	

Least fresh	Milk samples	Most fresh
	407	
	633	
	145	

Thanks a lot for your participation ☺

Appendix 2: II Consumer test questionnaire

Consumer test - MILK
13.06.2007

Sex: _____Nationality:_____ Age:_____Occupation: _____

How often do you drink milk?
□every day □2-3 times a week □once a week □less than once a week □never

---

How much do you **LIKE** the milk?

	Do not like at all				**Neutral**				**Like very much**
407	□	□	□	□	□	□	□	□	□
633	□	□	□	□	□	□	□	□	□
145	□	□	□	□	□	□	□	□	□
182	□	□	□	□	□	□	□	□	□

Which milk do you LIKE **most**?
Code (just one!): _____

And which do you LIKE **least**?
Code (just one!):_____

How **FRESH** do you find the milk?

	Not fresh at all				**Neutral**				**Very fresh**
407	□	□	□	□	□	□	□	□	□
633	□	□	□	□	□	□	□	□	□
145	□	□	□	□	□	□	□	□	□
182	□	□	□	□	□	□	□	□	□

Which milk is MOST **fresh**?
Code (just one!): _____

Which milk is LEAST **fresh**?
Code (just one!): _____

I prefer to drink organic milk

I strongly disagree				**Neutral**				**I strongly agree**
□	□	□	□	□	□	□	□	□

Appendix 3
I Consumer test

Sex	Nationality	Age	Occupation	milk drink every day	2-3 times a week	once a week	less than once a week	never
M	Dk	23	student	1				
M	Turkey	24	student	1				
F	Dk	23	student		1			
M	Dk	28	student	1				
F	China	37	postdoc					
M		38	researcher	1				
F	Dk	24	student	1				
M	Dk	25	student	1				
M	Dk	22	student		1			
M	Australian	38	scientist	1				
F	Dk	28	student		1			
F	Dk	27	student	1				
F	Dk	24	student		1			
M	Dk	23	student	1				
F	Estonian	23	student				1	
F	Dk	24	student		1			
F	Dk	23	student	1				
F	Greek	23	student		1			
M	Dk	27	student	1				
M	Dk	24	student	1				
F	French	21	student	1				
F	Dk	21	student	1				
F	Swedish	21	student	1				
F	Swedish	23	student	1				

M	Dk	22	student		1			
F	Dk	50	student		1			
F	Dk	24	student	1				
F	Dk	24	student	1				
F	Dk	24	student	1				
F	Canadian	24	student				1	
F	Dk	21	student	1				
F	Dk	25	student	1				
F	Dk	22	student	1				
F	Dk	22	student	1				
F	Dk	22	student	1				
F	Dk	22	student	1				
F	Dk	21	student		1			
F	Dk	21	student		1			
F	Dk	20	student		1			
F	Dk	22	student	1				
M	Dk	24	student	1				
F	Polish	24	student		1			
M	Italian	26	student	1				
F	Spanish	23	student	1				
M	Spanish	24	student	1				
F	Italian	24	student		1			
F	Swedish	25	student	1				
F	Dk	22	student				1	
F	Dk	27	student	1				
M	Dk	56	professor	1				
M	Greek	30	researcher	1				
M	Dk	32	Phd.student	1				
F	Dk	30	Phd.student	1				
F	Dk	23	student					1
M	Dk	26	student					1
M	Dk	25	student	1				

F	Dk	22	student	1				
F	Dk	26	student	1				
M	Dk	25	student	1				
F	Polish	22	student	1				
F	Dk	26	student	1				
F	Dk	28	student		1			
M	Dk	22	student	1				
M	Italian	33	student	1				

Sex	Nationality	Age	Occupation	l/week	type/brand	fat-%	worst milk	best milk
M	Dk	23	student	2	minimælk	0,5	633	182
M	Turkey	24	student	2		1,0-1,5	145	182
F	Dk	23	student	1,5	Kløver milk	0,1	633	145
M	Dk	28	student	3	Naturmælk	3,5	633	182
F	China	37	postdoc	0,5		1,5	407	182
M		38	researcher	2		5	633	182
F	Dk	24	student	1-1,5	Arla skummetmælk	0,1	145	407
M	Dk	25	student	2	skim mælk		633	182
M	Dk	22	student	0,5-1	Arla letmælk		633	182
M	Australian	38	scientist	1			633	182
F	Dk	28	student	1	Arla Letmælk, øko	1,5	633	182
F	Dk	27	student	4	Arla minimælk	0,4	145	182
F	Dk	24	student	1	minimælk	0,4	633	182
M	Dk	23	student	0,5	Arla, Kløver letmælk	1,5	407	145
F	Estonian	23	student	0,5	minimælk	0,5	633	182
F	Dk	24	student	1	Arla minimælk	0,5	145	182
F	Dk	23	student	1	skummet, minimælk	0,1	182	633
F	Greek	23	student	2		1,5	145	633
M	Dk	27	student		letmælk		633	407
M	Dk	24	student	0,5	Skummetmælk	0,1	182	407
F	French	21	student	4		1,5	145	182

F	Dk	21	student	1	Arla skummetmælk	1	633	407
F	Swedish	21	student	1,5	Arla	3	182	145
F	Swedish	23	student	1,5	Arla	0,5	633	407
M	Dk	22	student	1,5	Arla	0,5	633	407
F	Dk	50	student	2	Øko letmælk	1	633	145
F	Dk	24	student	1,5	skummet mælk	0,1	633	407
F	Dk	24	student	2	skim mælk, minimælk	0,1-0,5	633	407
F	Dk	24	student	3	minimælk	0,5	633	407
F	Canadian	24	student	0,5	skimmælk		145	182
F	Dk	21	student	0,5	Egelykke minimælk		145	407
F	Dk	25	student	2	Arla	0,1	145	633
F	Dk	22	student	3	Øllingegaard skummetmælk	0,1	145	182
F	Dk	22	student	3	Hirtshals minimælk	0,5	145	407
F	Dk	22	student	2	Øllingegaard minimælk	0,4	145	633
F	Dk	22	student	1	Skummetmælk	0,1	145	407
F	Dk	21	student	1	Arla Øko skummetmælk	0,1	145	182
F	Dk	21	student	2	Thise økologisk	0,1	145	407
F	Dk	20	student	1,5	Egekilde skummetmiælk	0,5	633	182
F	Dk	22	student	2	minimælk			182
M	Dk	24	student	2,5		0,5-1,5	145	633
F	Polish	24	student	1		2	633	145
M	Italian	26	student	2		0,5-1,5	145	182
F	Spanish	23	student	1	Arla	0,5-1,5	145	182
M	Spanish	24	student	3	Sødmælk	3	633	182
F	Italian	24	student	1	Letmælk, sødmelk, øko	3,5	182	407
F	Swedish	25	student	1	Arla	0,5	633	407
F	Dk	22	student	1	Skummetmælk	0,1	633	407
F	Dk	27	student	1	øko	0,5	145	407
M	Dk	56	professor	1	Letmælk		633	145
M	Greek	30	researcher	5	biological	1,5	407	633
M	Dk	32	Phd.student	2	Thiese	3,6	145	182

F	Dk	23	student	0			633	182
M	Dk	26	student				407	633
M	Dk	25	student	7	Arla, letmælk	1,5	145	407
F	Dk	22	student	1	øko	0,5	633	145
F	Dk	26	student	3	Arla, Letmælk	1,5	145	633
M	Dk	25	student	4	Arla, letmælk	1,5	633	182
F	Polish	22	student	1-1,5	minimælk	0,5	633	407
F	Dk	26	student	4	Organic harmonie, thiese	0,1	407	182
F	Dk	28	student	3	minimælk		145	407
M	Dk	22	student	2	organic	1,5	145	633

Sex	Nationality	Age	Occupation	least fresh	most fresh	freshness	date/expiray
M	Dk	23	student	633	145	6	6
M	Turkey	24	student	145	182	6	7
F	Dk	23	student	407	145	5	7
M	Dk	28	student	633	182	7	5
F	China	37	postdoc	145	182	7	7
M		38	researcher	633	182	7	7
F	Dk	24	student	145	182	6	6
M	Dk	25	student	633	182	7	7
M	Dk	22	student	633	182	7	6
M	Australian	38	scientist	633	145	7	7
F	Dk	28	student	633	182	6	7
F	Dk	27	student	633	182	7	7
F	Dk	24	student	145	182	6	6
M	Dk	23	student	633	182	7	7
F	Estonian	23	student	145	182	6	5
F	Dk	24	student	145	633	6	6
F	Dk	23	student	182	145	5	6
F	Greek	23	student	145	182	7	7
M	Dk	27	student	633	407	7	5

M	Dk	24	student	182	407	7	7
F	French	21	student	182	633	6	5
F	Dk	21	student	145	407	7	7
F	Swedish	21	student	182	145	6	7
F	Swedish	23	student	633	407	7	7
M	Dk	22	student	182	407	2	2
F	Dk	50	student	633	145	7	7
F	Dk	24	student	633	407	7	7
F	Dk	24	student	633	407	6	7
F	Dk	24	student	633	407	7	6
F	Canadian	24	student	145	633	6	6
F	Dk	21	student	633	407	5	5
F	Dk	25	student	145	407	6	7
F	Dk	22	student	145	633	7	7
F	Dk	22	student	145	407	7	7
F	Dk	22	student	145	182	7	7
F	Dk	22	student	182	633	7	7
F	Dk	21	student	145	182	7	7
F	Dk	21	student	633	407	6	6
F	Dk	20	student	633	182	7	7
F	Dk	22	student		633	7	7
M	Dk	24	student	145	182	6	6
F	Polish	24	student	633	407	7	7
M	Italian	26	student	145	182	6	7
F	Spanish	23	student	633	182	7	5
M	Spanish	24	student	633	145	6	4
F	Italian	24	student	633	145	6	1
F	Swedish	25	student	633	407	7	3
F	Dk	22	student	633	145	7	7
F	Dk	27	student	145	633	5	7
M	Dk	56	professor	633	145	5	5
M	Greek	30	researcher	407	182	7	7

M	Dk	32	Phd.student	145	182	4	7
F	Dk	23	student	633	182	7	7
M	Dk	26	student	182	633	7	7
M	Dk	25	student	633	407	4	3
F	Dk	22	student	633	145	6	6
F	Dk	26	student	633	182	7	7
M	Dk	25	student	633	182	7	7
F	Polish	22	student	633	182	7	7
F	Dk	26	student	145	182	7	7
F	Dk	28	student	145	182	5	5
M	Dk	22	student	145	182	6	1

Appendix 4
II consmer test

				How often do you drink milk?					
Sex	Nationality	Age	Occupation	every day	2-3times a week	once a week	less than once a week	never	how often do you drink milk?
F	Dk	27	student	1					1
F	Dk	25	student				1		4
M	Dk	21	Biotechnology		1				2
F	Dk	21	student	1					1
F	Dk	22	student	1					1
F	Dk	47	lab-tech		1				2
M	Dk	32	Phd student	1					1
M	Dk	51	Researcher	1					1
M	Dk	22	student	1					1
M	Dk	24	student	1					1
M	Dk	46		1					1
M	Dk	37		1					1
F	Polish	24	student		1				2
F	Dk	20	student				1		4
F	Swedish	23	student	1					1
M	Austria	26	student				1		4
M	Dk	23	student	1					1
M	Dk	28			1				2
M	Swedish	22	student	1					1
F	Swedish	23	student				1		4
F	Swedish	21	student	1					1
F	Dk	25	student	1					1

F	Dk	24	student	1					1
F	Dk	23	student	1					1
M	Dk	22	student	1					1
M	Dk	23	student	1					1
F	French	23	student	1					1
M	French	23	student	1					1
F	French	23	student	1					1
F	French	21	student		1				2
M	Indian	27	student	1					1
	Belgium	21		1					1
F	Dk	25	student	1	1				2
F	Dk	21	student		1				2
M	Dk	29	student		1				2
F	Dk	26	student	1					1
F	Palestinan	23	student		1				2
F	Dk	27	student	1					1
F	French	23	student	1					1
F	Swedish	28	student	1					1
M	Spanish	24	student	1					1
M	Dk	26	student				1		4
M	Dk	27	student		1				2
M	Dk	28	student	1					1
F	Dk	26	student	1					1
M	Dk	26	student			1			3
F	Spanish	28	student	1					1
F		21	student	1					1
F	Greek	23	student			1			3
F	Spanish	23	student	1					1
F	Dk	20	student				1		4
M	Dk	24	student		1				2
M	Dk	26	student					1	5
F	Estonian	24	student				1		4

F	Russian	26	Phd student	1					1
M	Dk	14	student	1					1
F	Dk	46	Assoc. Prof	1					1
M	Dk	27	student	1					1
F	Dk	21	student	1					1
M	Dk	35	student	1					1
M	Spanish	24	student				1		4
F	Dk	26	student					1	5
F	Dk	27	student	1					1
M	Lithuanian	21	student	1					1
F	Dk	29	student	1					1
F	Dk	26	student	1					1
M	Dk	30	student	1					1
M	Dk	30	student	1					1
F	French	25	student				1		4
F	Dk	56	staff	1					1
		26,44		47	11	2	9	2	

				How much do you like mik?				Which milk do you like most?			
Sex	Nationality	Age	Occupation	INFP_0.7_90	Gård mælk	INFP_0.7_120	LP_15_72	INFP_0.7_90	Gård mælk	INFP_0.7_120	LP_15_72
F	Dk	27	student	8	6	8	7			1	
F	Dk	25	student	7	4	8	6			1	
M	Dk	21	Biotechnology	6	7	3	2		1		
F	Dk	21	student	4	1	1	3	1			
F	Dk	22	student	7	1	2	4	1			
F	Dk	47	lab-tech	7	4	6	4	1			
M	Dk	32	Phd student	8	3	8	4	1			
M	Dk	51	Researcher	8	9	6	5		1		

M	Dk	22	student	6	4	5	2	1			
M	Dk	24	student	2	1	7	1				
M	Dk	46		5	5	8	1				
M	Dk	37		7	5	6	1	1			
F	Polish	24	student	9	1	9	7			1	
F	Dk	20	student	4	5	9	6			1	
F	Swedish	23	student	8		3	1	1			
M	Austria	26	student	8	7	9	5			1	
M	Dk	23	student	2	5	2	3		1		
M	Dk	28		6	1	5	4	1			
M	Swedish	22	student	8	1	7	4	1			
F	Swedish	23	student	2	1	5	5				1
F	Swedish	21	student	6	2	4	4				
F	Dk	25	student	4	5	6	3			1	
F	Dk	24	student	6	5	6	5			1	
F	Dk	23	student	5	1	7	7			1	
M	Dk	22	student	6	6	5	6			1	
M	Dk	23	student	7	7	8	8			1	
F	French	23	student	2	9	1	5		1		
M	French	23	student	3	4	6	2			1	
F	French	23	student	7	4	5	3	1			
F	French	21	student	5	3	8	7			1	
M	Indian	27	student	9	7	8	8	1			
	Belgium	21		7	3	6	1	1			
F	Dk	25	student	3	5	7	6			1	
F	Dk	21	student	4	3	5	5				1
M	Dk	29	student	9	8	9	9				1
F	Dk	26	student	9	2	4	1	1			
F	Palestina n	23	student	5	3	8	7			1	
F	Dk	27	student	5	2	8	7			1	
F	French	23	student	7	6	7	6			1	

F	Swedish	28	student	3	8	4	3	1			
M	Spanish	24	student	3	6	2	3		1		
M	Dk	26	student	7	6	8	7			1	
M	Dk	27	student	4	2	7	5			1	
M	Dk	28	student	7	8	6	3		1		
F	Dk	26	student	8	4	9	5			1	
M	Dk	26	student	7	4	7	6	1			
F	Spanish	28	student	2	5	6	4			1	
F		21	student	2	4	3	2		1		
F	Greek	23	student	5	6	8	3			1	
F	Spanish	23	student	3	9	8	1		1		
F	Dk	20	student	3	5	7	6			1	
M	Dk	24	student	5	6	2	2		1		
M	Dk	26	student	3	5	8	7				
F	Estonian	24	student	8	3	9	4			1	
F	Russian	26	Phd student	4	9	9	6		1		
M	Dk	14	student	5	5	7	4			1	
F	Dk	46	Assoc. Prof	4	8	5	7		1		
M	Dk	27	student	3	5	6	4			1	
F	Dk	21	student	4	7	6	5		1		
M	Dk	35	student	6	4	7	3			1	
M	Spanish	24	student	6	5	8	7			1	
F	Dk	26	student	3	2	1	1	1			
F	Dk	27	student	6	6	2	1		1		
M	Lithuania n	21	student	8	9	7	8		1		
F	Dk	29	student	3	4	4	6				1
F	Dk	26	student	2	3	5	4	1			
M	Dk	30	student	4	6	7	7			1	
M	Dk	30	student	7	4	5	8				1
F	French	25	student	3	8	4	6		1		
F	Dk	56	staff	2	6	5	1		1		

				Which do you like least?				How fresh do you find the milk?			
Sex	Nationality	Age	Occupation	INFP_0.7-_90	Gård mælk	INFP_0.7_120	LP_15_72	INFP_0.7-_90	Gård mælk	INFP_0.7_120	LP_15_72
F	Dk	27	student		1			8	6	8	6
F	Dk	25	student		1			6	2	7	5
M	Dk	21	Biotechnology				1	5	8	5	3
F	Dk	21	student			1		5	2	1	4
F	Dk	22	student		1			6	3	2	4
F	Dk	47	lab-tech		1			7	4	7	6
M	Dk	32	Phd student		1			8	2	8	5
M	Dk	51	Researcher				1	9	8	7	4
M	Dk	22	student				1	6	6	5	1
M	Dk	24	student					5	5	8	5
M	Dk	46						5	5	9	1
M	Dk	37					1	5	3	5	1
F	Polish	24	student		1			9	6	9	9
F	Dk	20	student	1				2	4	9	6
F	Swedish	23	student				1	6		7	1
M	Austria	26	student				1	7	8	8	7
M	Dk	23	student	1							
M	Dk	28			1			6	1	5	4
M	Swedish	22	student		1			7	1	7	4
F	Swedish	23	student		1			7	1	7	7
F	Swedish	21	student					6	5	5	5
F	Dk	25	student	1				7	8	9	9
F	Dk	24	student		1			6	4	6	5
F	Dk	23	student		1			3	6	8	8

M	Dk	22	student	1				6	4	4	5
M	Dk	23	student	1				7	7	8	8
F	French	23	student			1		9	9	9	6
M	French	23	student				1	6	5	4	7
F	French	23	student				1	9	4	5	8
F	French	21	student		1			5	3	8	7
M	Indian	27	student					9	8	8	8
	Belgium	21					1	6	4	5	7
F	Dk	25	student	1				4	6	6	6
F	Dk	21	student		1			4	3	5	5
M	Dk	29	student			1		9	8	9	9
F	Dk	26	student				1	9	5	5	3
F	Palestina n	23	student		1			9	8	9	8
F	Dk	27	student		1			8	7	8	7
F	French	23	student		1			5	4	7	7
F	Swedish	28	student		1			7	2	7	8
M	Spanish	24	student			1		3	5	3	5
M	Dk	26	student		1			7	4	8	6
M	Dk	27	student		1			5	3	6	4
M	Dk	28	student				1	7	7	7	3
F	Dk	26	student		1			8	6	8	8
M	Dk	26	student		1			7	4	5	6
F	Spanish	28	student	1				4	5	6	5
F		21	student	1				3	4	3	2
F	Greek	23	student				1	3	5	7	5
F	Spanish	23	student				1	2	9	5	4
F	Dk	20	student	1				9	9	9	9
M	Dk	24	student			1		6	3	3	4
M	Dk	26	student					4	7	9	3
F	Estonian	24	student				1	8	6	9	3
F	Russian	26	Phd student	1				8		9	5

M	Dk	14	student				1	2	5	7	5
F	Dk	46	Assoc. Prof	1				5	8	7	8
M	Dk	27	student	1				3	5	6	4
F	Dk	21	student	1				5	6	7	6
M	Dk	35	student				1	6	6	7	4
M	Spanish	24	student		1			7	8	7	8
F	Dk	26	student				1	7	5	4	2
F	Dk	27	student				1	6	7	2	1
M	Lithuanian	21	student			1		8	6	8	7
F	Dk	29	student	1				3	3	3	6
F	Dk	26	student			1		5	5	7	6
M	Dk	30	student	1				5	7	7	6
M	Dk	30	student		1			4	5	7	8
F	French	25	student	1				6	1	2	8
F	Dk	56	staff				1	3	5	5	1

				Which milk is most fresh?				Which milk is least fresh?				
Sex	Nationality	Age	Occupation	INFP_0.7_90	Gård mælk	INFP_0.7_120	LP_15_72	INFP_0.7_90	Gård mælk	INFP_0.7_120	LP_15_72	organic milk
F	Dk	27	student			1					1	9
F	Dk	25	student			1			1			7
M	Dk	21	Biotechnology		1						1	9
F	Dk	21	student	1						1		5
F	Dk	22	student	1						1		6
F	Dk	47	lab-tech	1					1			9
M	Dk	32	Phd student	1							1	9
M	Dk	51	Researcher	1							1	9

M	Dk	22	student		1						1	1
M	Dk	24	student			1			1			2
M	Dk	46				1					1	
M	Dk	37		1							1	5
F	Polish	24	student			1			1			5
F	Dk	20	student	1						1		5
F	Swedish	23	student				1			1		1
M	Austria	26	student			1					1	9
M	Dk	23	student		1					1		1
M	Dk	28		1					1			5
M	Swedish	22	student	1					1			8
F	Swedish	23	student				1		1			5
F	Swedish	21	student	1							1	5
F	Dk	25	student			1					1	6
F	Dk	24	student			1			1			5
F	Dk	23	student									9
M	Dk	22	student		1			1				8
M	Dk	23	student			1		1				5
F	French	23	student				1		1			5
M	French	23	student				1			1		7
F	French	23	student	1					1			7
F	French	21	student			1			1			6
M	Indian	27	student	1								9
	Belgium	21					1		1			
F	Dk	25	student				1	1				7
F	Dk	21	student				1		1			5
M	Dk	29	student				1		1			9
F	Dk	26	student	1							1	9
F	Palestinan	23	student	1								9
F	Dk	27	student			1			1			9
F	French	23	student				1		1			9
F	Swedish	28	student				1		1			9

M	Spanish	24	student				1				1	5
M	Dk	26	student			1			1			4
M	Dk	27	student			1			1			5
M	Dk	28	student		1						1	8
F	Dk	26	student			1			1			9
M	Dk	26	student	1					1			9
F	Spanish	28	student			1		1				8
F		21	student		1			1				5
F	Greek	23	student			1		1				9
F	Spanish	23	student		1						1	5
F	Dk	20	student									9
M	Dk	24	student	1					1			3
M	Dk	26	student			1					1	1
F	Estonian	24	student			1					1	9
F	Russian	26	Phd student			1					1	8
M	Dk	14	student			1		1				8
F	Dk	46	Assoc. Prof		1			1				4
M	Dk	27	student			1		1				5
F	Dk	21	student			1		1				5
M	Dk	35	student			1					1	9
M	Spanish	24	student		1			1				9
F	Dk	26	student	1							1	6
F	Dk	27	student		1						1	7
M	Lithuanian	21	student	1					1			9
F	Dk	29	student				1		1			8
F	Dk	26	student			1		1				9
M	Dk	30	student		1			1				8
M	Dk	30	student				1	1				8
F	French	25	student				1		1			8
F	Dk	56	staff			1					1	9