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# THE BREEDING OF TSIGAI SHEEP AS A POSSIBILITY TOWARDS THE PROFITABILITY II. FATTY ACID COMPOSITION OF MILK

*J. Csanádi, J. Fenyvessy, I. Bajúsz*
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## ABSTRACT

The fatty acid composition of cow milk stands very close to Hypothetical Ideal Fatty acid composition (HIF) but sheep milk fat has nutritional advantage comparing to cow milk by bulk of references. Some of authors explain it by mainly the higher ratio of unsaturated (UFA) and C4-12 fatty acids. Moreover nowadays is very important to know the amount and the ratio of n-6 and n-3 fatty acid in our foods. Our objective was to explore the fatty acid composition of milk from milking Tsigai sheep. By our findings the physiological evaluation of FA composition of Tsigai sheep milk and its products are more favourable in every aspect than cow milk.

## 1. INTRODUCTION

The beneficial effect of ruminant's milk and milk product for the human health is well known. But the small differences in the milk composition can cause noticeably variance in the physiological effect. The difference between the fatty acid composition of sheep and cow milk is a good instance for it.

According to the results of some authors the fatty acid composition of the sheep milk is similar as the cow milk's one (Adrian 1973, Balatoni, Ketting 1981, Ramos, Juarez, 1984).

Others established noticeable differences regarding fatty acids comparing to the cow milk (Morrison1968, National Institute of Health 2005, Posati, Orr 1976, Sawaya, Safi 1984, Swern 1979, Park et al 2007.) In opinion of some authors first of all the more favourable physiological determination of the sheep milk fat comparing to the cow milk can be explained by the higher ratio of unsaturated and C4:0-12:0 fatty acids (Fenyvessy, Csanádi 1999, Haenlein 2001). Milk and the most of milk products have another special nutritional advantage because they contain n-6 and n-3 fatty acids with optimal ratio (3:1). The feeding determines the fatty acid composition of milk essentially. Authors agree that the pasturage increased the ratio of unsaturated fatty acids included CLA, but the summing up of changes in n6/n3 ratio is unambiguous not so far (Csanádi et al 2007, Boiuattour et al 2007, Lourenço et al 2007, Tsiplakou et al 2007, Sanz Sampelayo et al 2007, Cabiddu et al, 2006, Atti et al 2006).

Our objective was to explore the fatty acid composition of milk from milking Tsigai sheep.

## 2. MATHERIAL AND METHODS

The fatty acid composition of milk from milking Tsigai sheep was determined from individual milk samples (from 8 ewes) and bulk milk samples in a whole (165 day) lactation. The forage of the flock was based on the grazing and was characteristically

extensive type. We analysed separated milk fat samples from daily milk samples (morning + evening milking) were stored in -25°C until the analysis.

*Preparation:* the samples were destroyed in hot water bath with concentrated hydrochloric acid and mixed with ethanol. Afterwards the lipids extracted by ether and petrol ether (< 60°C). After combining the organic phases the solvent was removed by means of a rotating vacuum evaporator.

*Hydrolysis and esterification:* The evaporated samples were boiled with 0.5M methanol sodium hydroxide solution (appr. 5 minutes) and further the boiling was continued for 3 minutes with 14% methanol boron-trifluoride solution. We boiled for another 1 minute adding dried hexane and after cooling down mixed it with salted water solution. After separation of the phases we took 0.5 – 2 µl sample from the organic phase and injected it into Chrompack CP 9000 gas chromatograph.

## 3. RESULTS

The Tsigai's milk fat contains more saturated fatty acids than unsaturated ones as known from the references and the difference was 18.27%. We demonstrate our findings in *Fig. 1.*

The ratio of the unsaturated fatty acids (UFA) was 40.81%, and the polyunsaturated fatty acids (PUFA) was 3.82% in all fatty acids. The amount of C18:1n9c (29.98%) was the highest in all FA and it was higher about 4.0% than in fat of cow's milk.

Tsigai's milk fat also contains other PUFA as C20:2n 0.46%, C20:3n3 0.12%, C20:4n6 0.15%, and C22:2n 0.15%.

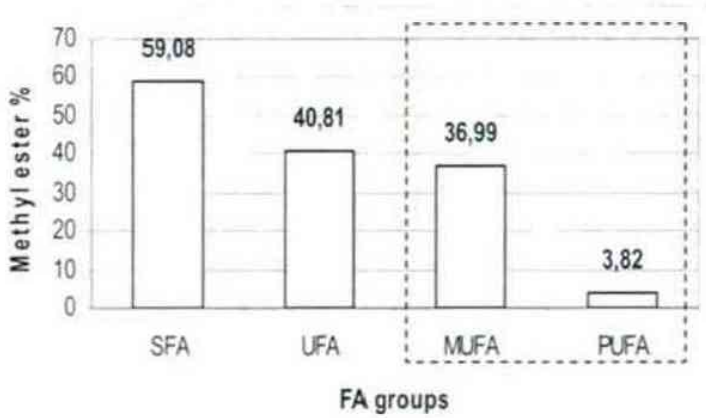


***Figure 1. Different nutritional fatty acid groups in Tsigai sheep milk fat***

The ratio of SFA/UFA and the amount of PUFA confirm that the sheep milk has advantages in the human nutrition.

*Table 1.* contains the statistical data of the bulk milk samples during the investigated lactation period.

***Table 1. The nutritional Fatty Acid groups in the lactation (n=6)***

| FA groups | Mean | SD | SD% | Max | Min |
|---|---|---|---|---|---|
| UFA | 40.81 | 4.91 | 12.03 | 45.26 | 33.74 |
| SFA | 59.18 | 4.88 | 8.24 | 66.16 | 54.69 |
| MUFA | 36.99 | 4.81 | 13.01 | 41.34 | 29.97 |
| PUFA | 3.82 | 0.14 | 3.55 | 4.00 | 3.66 |

The changes in the ratio of the different FA groups was smallest in PUFA groups (0.36%), while in the case of other groups were similar 11.37-11.52% but the SD% of SFA was only 8.24 contrary to the highest SD% of MUFA (13.01). The ratio of UFA was higher than the SFA's ratio was lower in samples. The highest value of UFA (45.21%) was founded in May contrary to the smallest 33.74% in September what was related to feeding.

Data showed in the Table 2. confirm that the fatty acid composition of Tsiagi's milk fat stands very close to the Hypothetical Ideal Fatty Acid composition.

The ratio of SFA, UFA and oleic acid meet the requirements of HIF and the ratio of short chain fatty acids stand very close to it. It should be noted that the milk fat contains essential fatty acids as Linoleic and Linolenic acid but the ratio of this fatty acids, mainly Linoleic acid don't reach the requirements, but the newest researches proved that the optimal n-6/n-3 ratio is lower than showed in the *table 2.*

***Table 2. Comparison of the Tsigai sheep milk fat to Hypothetical Ideal Fatty acid composition (HIF)***

| Fatty acids | HIF % | Tsigai% |
|---|---|---|
| Saturated fatty acids | 53-62 | 59.08 |
| Short and medium chain fatty acids in total saturated FA (C4-C12)* | *10-12* | 9.23 |
| Unsaturated fatty acids | 38-47 | 40.81 |
| Oleic acid (C18:1n9c) | *28-32* | 29.98 |
| Linoleic acid (C18:2n6c) | *7-12* | 2.15 |
| Linolenic acid (C18:3n3) | *0.5-1.0* | 0.75 |

So Tsigai's milk fat suit to requirements of HIF (as the milk fat from different species) except that it contains about 5.0% less essential fatty acids mainly Linoleic acid.

Nowadays, the usual diet in industrial countries contains much less n-3 fatty acids than the diet of a century ago. The diet from a century ago had much less n-3 than the diet of early hunter-gatherers (Simopoulos 2001). We can also look at the ratio of n-3 to n-6 in comparisons of their diets. These changes have been accompanied by increased rates of many diseases – the so-called diseases of civilization – that involve inflammatory processes. There is now very strong evidence (National Institute of Health 2005.) that several of these diseases are ameliorated by increasing dietary n-3 fatty acids, and good evidence for many others. There is also more preliminary evidence showing that dietary n-3 can ease symptoms in several psychiatric disorders (De Caterina, Basta 2006).

Therefore it is very important to investigate the amount and the ratio of n-6 and n-3 fatty acids in foodstuffs and its raw materials. We show the evaluation of Tsigai's milk fat related n-6/n-3 ratio in *Fig. 2.*

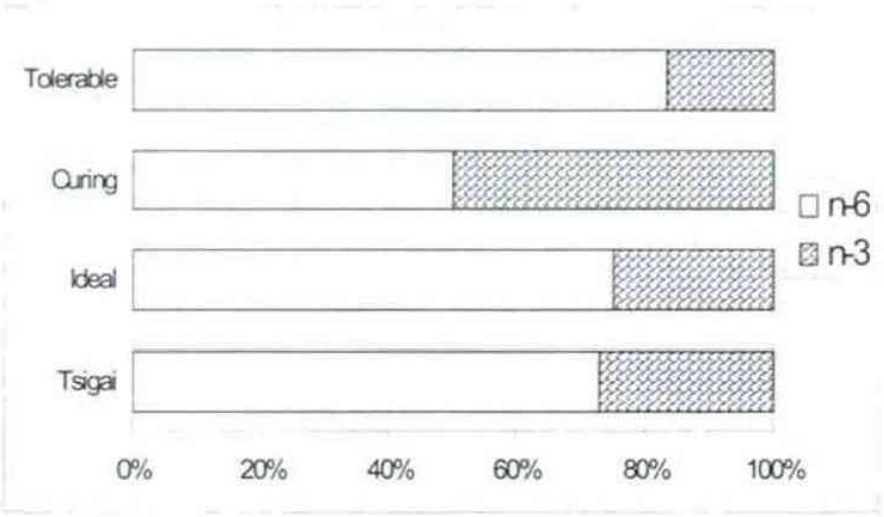


***Fig 2. The place of Tsigai sheep milk fat related the ω-6/ω-n3 fatty acid ratio in the diet***

Tsigai's milk fat contains n-6 and n-3 fatty acids as we mentioned at the Table 2. However the n-6/n-3 ratio in Tsigai's milk fat is optimal in the point of view of the human nutrition but the consuming of milk products per se is not enough for the supplying of daily necessity. N-3 fatty acid presented in Tsigai's milk fat is about 80% of α-Linolenic acid has the most beneficial properties in the viewpoint of the nutrition.

## 4. CONCLUSION

The fatty acid composition of Tsigai milk basically not vary from the other data published in the literature (published mainly in the last decade) but it has some beneficial difference.

Tsigai milk fat stands very close to the hypothetical ideal fatty acid composition as cow milk fat as well. We can state that Tsigai's milk fat contains the investigated n-6/n-3 fatty acids in optimal (healthy) ratio (2.68).

The SFA/UFA ratio also optimal in Tsigai sheep milk fat as in the goat and cow milk, but the amount of unsaturated fatty acid is lower a bit.

The oleic acid ratio *(C18:1n9c)* is noticeably higher in Tsigai sheep milk than in milk from other sheep genotypes and from cow milk.

Based on the references seems that the feeding oilseeds or vegetable oils and the pasturage has no same beneficial effect on the increasing of unsaturated oils and the n6/n3 ratio. But the decreasing of atherogenicity index of milk is an unequivocal fact.

The explored differences confirm that sheep milk (milk fat) has more beneficial nutritional aspects compared to cow milk and mainly to other fat from any food (e.g. meat or sunflower oil per se). The advantage of the FA composition of sheep milk can be reach for customers only if the consumption of the sheep milk products would be advanced also in Hungary.

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