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ATHEROGENIC POTENTIAL OF SEMI-FAT TRAPPIST CHEESE

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SUMMARY
In this work we presented results of producton of sami-fat Trappist cheese made from milk with low content of milk fat (2,5%), with low atherogenic potential but with its characteristic sensor features. In most countries researchers for many years, beside data about nutritiv value of cheese, such as milk fat, insert a data about saturated fatty acid, cholesterol and energy value. Content of this components depends of total fat in cheese. It is believed that higher ingestion of cholesterol and saturated fatty acid can elevate level of cholesterol in blood and speed up pathogenesis of atherosclerosis. Products with low content of milk fat are more and more popular because people are more interesting for their health. Because the Trappist cheese is famous, it is significant to reduce atherogenic potential in it. If the atherogenic potential is low in Trappist cheese there will be no more conestion between ingesting this kind of cheese and developement of heart and blood vessels sikness.
The content of fatty acid in standardized milk was examined with special tending put on content (41,79%)of atherogenic saturated fatty acids (Lauric acid, $C_{12:0}$, Miristic acid, $C_{14:0}$, Palmitic acid, $C_{16:0}$). It is declared the total content of saturated (58,59%), monosaturated(26,18%) and polyunsaturated(4,01%) fatty acids. The level of cholesterol was also exemined and it was 8,25mg/100g. We calculated the atherogenic index(AI) using the data about content of milk fat, content of atherogenic fatty acid and cholesterol. Atherogenic index was 1,95. From this milk we made a Trappist cheese with lower content of fat. This cheese had 24% of fat, 42,60-42,98% of atherogenic fatty acid and 39,84-39,89mg/100g of cholesterol. Atherogenic index was 12,32. Compared with our previous research, when milk had 3,0-3,2% milk fat and atherogenic index(AI) of cheese was 18,8 atherogenic units, we made cheese with atherogenic index lower for 34,69%. Energy value of this cheese was 1537-1574kJ (369-378 kcal)/100g wich is also important factor for atherogenic potential of Trappist cheese. We folow the atherogenic potential during the ripening of this cheese and we concluded significant decrement of cholesterol after 90 days (12,3%) with no transformation of fatty acid. We made semi-hard and semi-fat Trappist with the sensor features characteristic for this kind of cheese. From health care point of wiev this cheese is valuble because the atherogenic potential is low. This method of lowering the atherogenic potential can be used in production of different kind of cheese.
Key words:
Trappist cheese, Content of fatty acid, cholesterol, atherogenic index, atherogenic potential.

1. INTRODUCTION

Trappist is very valued and searched cheese on the worlds market, known according to mild taste on milk and walnut, then on elastic and plastic dough and cross section with smaller number of regularily distributed holes of the lentil size, as well as of big nutritive value. Produced anywhere (France, Canada, Germany,

Hungary, Croatia, Serbia, Bosnia etc.) it is recognized cheese and beloved by consumers.

However, the recommendations to consumers to choose the chees and other milk products with low fat content, atherogenic fatty acids, cholesterol and energy might to bring a decrease of consumption of Trappist as well as other fatty cheeses. Manufacturers of cheeses within the data given about the nutritive value of cheese in the mayority of countries already for a long time besides the data of butterfat, write also those of saturated fatty acids and cholesterol, as well as about energy value, so that the consumers are well informed. Classicaly it is considered that increased intake of fats, cholesterol and saturated fatty acids increase cholesterol level in the blood, which has as consequence higher appearance and further developement of the the arteruisclerosis process, Veresbaranyi et al.(17). There are several methods for reduction of atherogenic potential such as biological method therough the starter cultures, studied by Vujičić et al., (15,16) in different sorts of cheeses. The method applied in this investigation is technological, where the reduction of fat was carried out in milk for cheese, and process of cheese making was adapted to kind of cheese and saving of its characteristic sensory traits. The aim of this work is production of sami-fat Trappist with reduced atherogenic potential, that could affect on increase of production of milk and cheese as well as on change of unfavourable attitude toward cheese as source of cholesterol and other atherogenic compounds.

2. MATERIAL AND METHOD

Technological process of manufacturing was carried out in Mlekoprodukt Zrenjanin in mechanized line for semi-hard cheese, milk was standardized to 2,5 % of butter fat and the process of production was performed by adapting of some phases of technological process to production of cheese using the milk with smaller amounts of fat. Besides the customary analysis and following the proces of manufacturing itself, then milk composition and cheese, factors important for atherogenic potential have been followed. Composition of fatty acids of milk and cheese was determined, than cholesterol and energy content on the basis of which the atherogenic potential of Trappist was estimated according to formula of Lepšanović et al.(9).

Cholesterol was determined according to method of Rudel and Morris(12) and fatty acids by means of gas chomatography method JUS E.K.8.038 (6). Milk and cheese composition was measured by methods and analyses of Carić et al.(1).

3. RESULTS OF INVESTIGATION AND DISCUSSION

Numerous data¸showing the significancy of fats and fatty acids in nutrition of humans and its effect on health(11,2).

Unsaturated fatty acids are considered as the most healthy fats.

When the production of cheese is in question, the fat has the importance in formation of taste and smell, as well as in achieving tenderness and smelting of cheese, (3).

In Table 1 are sown the results of analysis of fatty acids in milk and Trappist cheese immediatelly after processing, salting and during ripening . There are many proofs that fats rich in saturated fatty acids increase the cholesterol level in blood. However, according to new knowledges, it does not rely to all saturated fatty acids. It was proven that only some individual saturated fatty acids have the atherogenic effect, Connor (2) such as lauric(C12:0), miristic (C.14:0) and palmitic(C16:0).

Milk for cheese (with 2,5% of fat) had as total 41,75% of these atherogenic acids. After 30 days cheese contained 42,54% of these acids, and after90 days 42,98%. For elaidinic (C18:1n 9t) monounsaturated trans-fatty acid in milk and cheese found from 3,78 to 4,095 it is considered that it increases level of "harmful" cholesterol(LDL) in serum in relation to oleic(C18:1 cis), which affects on reduction of that cholesterol(LDL) which in milk and cheese is found in significant amounts (11-21%). Number and position of double bond in chain is very important for biological function o fatty acids and their stability.Palmitoleic (C16:1cis) is monosaturated fatty acid (about1,8%) that affects on reduction of harmful cholesterol. Unsaturated fatty acids are the most healthy fats.

The main polyunsaturated fatty acids found in milk is linolenic (C18:2) 3,47% in milk and 3,28-3,37% in cheese, while the others were detected in small amounts.

Unsaturated fatty acids reduce the cholesterol level in plasma and level of harmful cholesterol. The level of cholesterol is in correlation with cardiovascular disease. Fatty acid such as oleic(C18: 1cis-9) and stearic(C18:0) are esentially neutral on cholesterol and they have positive effect on health (4,5,9).

Table 1. Fatty acids composition of milk and cheese in certain phases of manufacturin and ripening

Fatty acidc (%)	Milk for Trappist	Trappist during making and ripening				
		After pressing	After salting	Cheese after ripening(days)		
				7	40	90
Butyric $C_{4:0}$	1,56	0,68	0,75	1,09	0,92	0,8
Caproinic $C_{6:0}$	0,93	0,93	0,99	1,07	1,43	1,37
Caprylic $C_{8:0}$	0,94	0,94	0,96	0,96	1,05	0,82
Capric $C_{10::0}$	2,67	2,67	2,65	2,67	2,71	2,81
Undecanoic $C_{11:0}$	0,33	0,42	0,41	0,42	0,43	0,37
Lauric $C_{12:0}$	**3,38**	**3,55**	**3,53**	**3,49**	**3,52**	**3,54**
Tridecanois $C_{13:0}$	n.d.	0,30	0,30	0,30	0,30	0,33
Miristic $C_{14:0}$	**10,44**	**10,73**	**10,72**	**10,47**	**10,73**	**11,03**
Miristinoleic $C_{14:1}$	1,36	1,41	1,39	1,39	1,39	1,48
Pentadecanoic $C_{15:0}$	1,54	1,57	1,57	1,56	1,56	1,66
Cis-10-Pentadecanoic $C_{15:1}$	n.d.	0,03	0,03	0,03	n.d.	n.d.
Palmitic $C_{16:0}$	**27,97**	**28,34**	**28,46**	**28,37**	**28,29**	**28,41**
Palmitoleic $C_{16:1}$	1,80	1,86	1,85	1,82	1,82	1,81
Heptacanoic $C_{17:0}$	0,64	0,69	0,70	0,68	0,67	0,68
Cis 10 heptadecanoic $C_{17:1}$	n.d.	n.d.	n.d.	0,34	0,34	0,34
Stearic $C_{18:0}$	7,98	7,93	8,07	8,04	7,90	8,02
Elaidinic $C_{18:1n\ 9\ t}$	3,78	4,08	4,09	4,09	4,05	4,06
Oleic $C_{18:1n\ 9\ c}$	10,24	21,70	21,56	21,46	21,19	21,61
Linolelaidinic C $_{18:2\ n\ 6\ t}$	n.d.	0,10	0,10	0,44	0,43	0,49
Linolic C $_{18:2\ n\ 6\ c}$	3,47	3,31	3,28	3,27	3,37	3,33
Gama Linolenic $_{18:2\ n\ 6\ t}$	n.d.	0,1	0,11	0,07	0,10	n.d.
Linolenic $C_{18:3\ n\ 3}$	n.d.	0,08	0,06	0,03	0,08	0,14
Arachidonic $C_{20:0}$	n.d.	0,15	0,14	n.d.	0,14	n.d.
Heneicosanovic+Eikosenic $C_{21:0}+C_{20:1}$	n.d.	0,46	0,46	n.d.	0,97	1,10
cis-11,14-Eikosadienoic $C_{20:2}$	0,54	0,07	0,07	n.d.	0,06	n.d.
cis-8,11,14-Eikosatrienoic $C_{20:3n6}$	n.d.	0,14	0,14	n.d.	0,167	n.d.
cis-11,14,17-Eikosatrienoic $C_{20:3n3}$	n.d.	0,02	0,02	n.d.	n.d.	n.d.
Trikosanoic $C_{23:0}$	n.d.	0,21	n.d.	0,21	0,19	0,174
Lignocerinic $C_{24:0}$	0,21	n.d.	0,01	n.d.	0,042	n.d.
Cis-5,8,11,14,17,-Eicosapentaenoic $_{20:5\ n\ 3}$	n.d.	0,03 0,05	0,05 n.d.	n.d. n.d.	0,033 n.d.	n.d. n.d.
Total	88,65	92,53	92,46	91,41	93,32	93,27
N.d.	11,35	8,02	7,36	8,50	5,65	6,73

N.d. not detected fatty acid

The main components of human diet which increasing the level of cholesterol in blood are: increased intake of cholesterol and saturated fatty acidc and also big energy intake which contribute to the obesity, Lepšanović et al (7,8).

Tabela 2. Atherogenic potential of milk and Trappist cheese

Milk/cheese	Energy value kJ /kcal	Fatty acids(%)				Cholesterol (mg /100g)	Atherogenic Index (AI)
		Satu	Mono	Poly	ATHERO		
Milk for cheese, 2,5%m.f.	189 / 45	58,59	26,18	4,01	41,79	8,25	1,95
Chesse after pressing	1076/ 258	59,25	28,92	4,29	42,62	40,18	12,34
Chesse after salting	1442/ 346	59,46	28,92	4,29	42,71	39,79	11,91
Cheese after 7 days of ripening	1520/ 365	59,6	29,13	3,81	42,60	39,01	12,28
Cheese after 40 days of ripening	1537 /369	60,40	29,76	4,19	42,54	39,84	12,32
Cheese after 90 days of ripening	1574 /378	60,01	29,3	3,96	42,98	37,89	12,31

Satu- total saturated fatty acid (%)
Mono-total monosaturated fatty acid(%)
Poly – total polyunsaturated fatty acids(%)
Atero- atherogenic fatty acids(%)

If the AI of certain foods is lower, its atherogenic potential is lower. The value of atherogenic index should not be over 50 units in the wholw sum, Lepšanović et al. (9). In selection of milk and milk products and cheeses it is necessary to take into consideration not only about atherogenic potential (expressed as atherogenic index, AI), than about total energy value of product, because that is element too, which affects on the cholesterol level in nutrition. Sami-fat Trappist in comparison with full-fat cheese, because of minimum 15% less fat, has smaller energy value too.

Tabela 3. Composition of milk for cheese during phases of making and ripening

Parameters of quality (%)	Milk for Trappist	Trappist during making and ripening				
		After pressing	After salting	Cheese during ripening (days)		
				7	40	90
Fat	2,5	24,0	23,5	24,0	24,0	24,0
Protein	3,25	29,85	25,32	29,93	29,09	31,64
Lactosis	4,58	1,45	1,42	1,43	0,96	0,89
Ash	0,69	2,69	2,72	2,74	3,76	3,62
Dry matter	10,33	54,68	57,61	59,61	60,08	59,99
Fat in dry matter	-	44,80	39,92	39,42	39,94	40,00
Water	-	45,31	42,38	40,39	39,92	40,01
NaCl	-	-	1,29	1,28	1,31	1,30
Water in fat free dry matter	-	60,01	55,03	52,79	52,52	52,64

Energy intake is also one of factors which effects on atherogenic potential of feed. However the difference in energy value of full-fat cheese(Popović et al.(14) and semi-fat cheese is not so big (up to 10%) but the difference in the AI is big (about 35%). On the basis ofthat there is advantage in using AI in evaluation of most suitable

composition of cheese with recpect to contens of cholesterol and atherogenic saturated fatty acids, which is an agreement with studies of Lepšanović (9 ,10).

On the basis of composition of milk and cheese and cheese in individual phases, it is seen that the fat percentage was decreased and that the other indices were within limits of normal values. Ripened cheese according to composition was in the group of semi-hard , semi-fat cheeses. Owing to good quality of crude milk as to correct leading of the technological process. Trappist had characteristic sensory traits Fig 1.

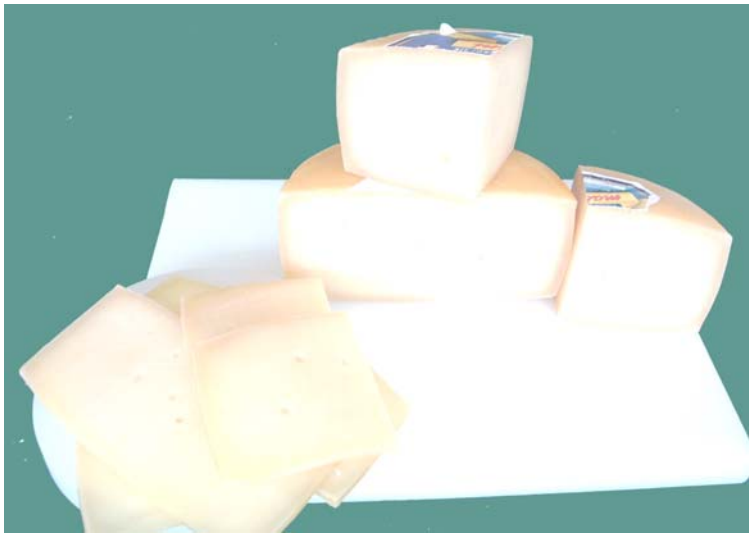

Fig. 1. Appearance of semi-fat Trappist

4. CONCLUSION

On the basis of the results obtained, the folowing conclusions be inferred:

- By standardization of milk for cheese to 2,5% of butterfat the content of atherogenic saturated fatty acids is reduced to 42,60-42,98%, then cholesterol content to 39,84-39,89mg/100g and atherogenic index(AI) to 12,28-12,31 atherogenic units. Along with reduced energy value of 1537-1574 kJ(369-378kcal)/100g the factors achived which influence on decrease of atherogenic potential and increase of health values. Semi-fat Trappist has 34,69% smaller AI in relation to full-fat cheese and to 10% smaller energy value.
- In the course of ripening process, reduction of cholesterol content occured(12,3%) and insignificant transformations of fatty acids.
- With respect to composition and characteristics Trappist production is in semi-hard (52,62-52,64% of water in fat free dry matter), semi-fat cheese(39.94-40,00%)with characteristic sensory traits.
- Applied method of production of semi-fat Trappist, with reduced content of atherogenic components, may be the method, for production of this and similar cheeses, aiming to get higher health values of these products.

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