Journal Homepage: -www.journalijar.com
INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)
Article DOI:10.21474/IJAR01/6905
DOI URL: http://dx.doi.org/10.21474/IJAR01/6905

RESEARCH ARTICLE

ASSESMENT OF BYOLOGICALY ACTIVE, TRANS FATTY ACIDS AND QUALITATIVE ASSESMENT ON THE BUTTER FROM COAT'S MILK.

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Manuscript Info

Manuscript History

Received: 10 February 2018
Final Accepted: 12 March 2018
Published: April 2018

Keywords:-
Goat's milk, butter, trans fatty acids, indices.

Abstract

The study was conducted with buter produced by goat's milk from three breeds– White Bulgarian Dairy (WBD) and her crosses with Anglo-Nubian (WBDxAN) and Toggenburg goats (WBDxTG) during the lactation to establish the content of natural trans fatty acids (TFA) and to assess the quality of the fatty acid composition of the product as a healthy source in human nutrition.The insurance of livestock with nutritional resource rich of linoleic and alpha linolenic acid on pasture grass rearing goats leads to an increase the quality in the fat fraction of milk in terms of biologically active fatty acids - omega-3, omega-6, CLA, trans and cis-fatty acids and decreases the amount of saturated fatty acids. The assessment of the lipid preventive score, atherogenic and thrombogenic index in the butter produced by it give us an idea of the usefulness of the given product- high lipid preventive score and atherogenic index (over 1.0) and low cholesterolemic index (less than 1.0). the results obtained of butter are characterized by product as high content of trans fatty acids (from 1.04 to 2.21 g/ 100g butter) and high amount of saturated fatty acids content (from 59,68 to 66,66 g/ 100g butter).

Introduction:-

Goat milk is a good source of fatty acids, proteins and minerals. It is classified as a functional food because of its high digestibility, alkalinity, buffer capacity and certain therapeutic properties in human nutrition. Goat milk has technological advantages over cow's milk, such as the smaller size of fat globules, which provides a smoother texture in derived products, lower s1-casein content, which results in smoother products, higher capacity for water retention and lower viscosity. The flavor and taste of goat milk and dairy products is stronger than other types of dairy and dairy products, which would limit their consumption (Gamage et al., 2016). The production of dairy milk products is considered a good alternative for consumers with special needs such as babies, adults and people recovering from various diseases.

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The recommendations of nutritionists are to encourage the use of goat's butter because they contain specific essential fatty acids that have a positive effect on human health. Goat milk, cheese and milk powder are valued globally, but goat's butter, because of its high price, is produced in limited areas of the world and therefore it is necessary to promote its production (Kumar et al., 2012).

The fats in milk are one of the main and most important ingredients for the technological processing and nutritional value of milk. Kompan and Komprej (2012), establish that the fat content of goat's milk is high after birth and decreases during the lactation be caused by two phenomena- a dilution effect resulting from an increase in milk volume until the peak of lactation and a decrease in fat mobilization due to decreasing the amount of plasma non-esterified fatty acids, particularly C18:0 and C18:1 for breast milk synthesis. Volkmann et al., (2014) investigated the impact of feed on dairy goats in the production of quality milk, and demonstrate that the incorporation of a suitable amount of concentrated feed in the diet leads to improving the quality of the milk obtained and achieving a good ratio of omega-6 and omega-3 fatty acids (6:3).

According to EU Regulation No 1924/2006 of the EP and the Council on December 20, 2006, the content of saturated fatty acids and trans fatty acids in solid products does not exceed 1,5 g / 100 g or 0,75 g / 100 ml liquid , and in both cases the content of saturated fatty acids and trans fatty acids does not exceed 10% of the daily energy intake and these foods are referred to as low content of saturated fatty acids. The claim that a food does not contain SFA may only be indicated if the SFA and TFA content does not exceed 0,1 g / 100 g of product or 0,1 g / 100 ml of liquid (Regulation (EC) No 1924 / 2006).

The study was conducted with butter produced by goat's milk from three breed groups– White Bulgarian Dairy (WBD) and her crosses with Anglo-Nubian (WBDxAN) and Toggenburg goats (WBDxTG) during the lactation to establish the content of natural trans fatty acids (TFA) and to assess the quality of the fatty acid composition of the product as a healthy source in human nutrition.

Material and methods:-

It was studied the butter produced by the milk of three native groups - White Bulgarian Dairy (WBD) and her crosses with Anglo-Nubian (WBDxAN) and Toggenburg goats (WBDxTG) during the lactation (3 x 4) for fatty acid composition and establishment of trans fatty acids, biologically active and anticancerogenic substances in the fat fraction.

The extraction of total lipids was carried out by the Roese-Gottlieb method, using diethyl ether and petroleum ether and subsequent methylation with sodium methylate (CH3ONa, Merck, Darmstadt) and drying with $NaHSO_4.H_2O$. Fatty acid methyl esters (FAME) were analyzed using a Shimadzu-2010 gas chromatograph (Kioto, Japan) equipped with a flame ionization detector and an automatic injection system (AOC-2010i). The analysis was performed on a CP 7420 capillary column (100m x 0.25mm i.d., 0.2μm film, Varian Inc., Palo Alto, CA). Hydrogen is used as the carrier gas, and as a make-up gas - nitrogen. Four-step furnace mode is programmed - the column's initial temperature is 80 ° C / min, maintained for 15 minutes, then increased by 12ºC / min to 170ºC and maintained for 20 minutes, followed by a further increase of 4ºC / min 186ºC for 19 minutes and up to 220ºC with 4ºC / min until the process is complete.

The qualitative assessment of the butter samples includes the following: lipid preventive score, atherogenic and thrombogenic index (Ulbricht and Southgate, 1991), the ratio between hyper- and hypocholesterolemic fatty acids (Ivanova and Hadzhinikolova, 2015), trans fatty acids and the amount of saturated fatty acids (Regulation (EC) No 1924/2006).

LPS= FAT +2x SFA- MUFA- 0,5 PUFA

AI= 12:0+ 4×14:0 +16:0 /[ΣMUFAs+PUFA n6+PUFA n3]

TI=(14:0+16:0+18:0)/[0.5×ΣMUFAs+0.5×PUFA n6+3×PUFA n−3+PUFA n3/ PUFA n6]

h/H=(C18:1n-9+C18:1n-7+C18:2n-6+C18:3n-3+C18:3n-6+C20:3n-6+C20:4n-6+C20:5n-3+C22:4n-6+C22:5n-3+C22:6n-3)/(C14:0+C16:0)

The data were processed using the variation statistics methods using the statistical package of the EXCEL 2013 computer program.

Results and discussion:-

The saturated fatty acids in the analysesd butter obtained from the goat milk from WBD and her crosses with Anglo-Nubian (WBDxAN) and Toggenburg goats (WBDxTG) vary during the lactation period, as in WBD being the highest on September - 77.83 g / 100g fat, while WBDxAN being on April - 78.85 g / 100 g fat and 82.03 g / 100 g fat on July at WBDxTG. The lowest content of saturated fatty acids was found in WBD from 72.91 to 77.83 g / 100g of fat, while at WBDxTG - the highest from77.16 to 80.02 g / 100g fat. The monounsaturated fatty acids in the analyzed butter are the highest in WBD (25.94 g / 100g fat) and WBDxAN (24.26 g / 100g fat) on July, whereas in WBDxTG (22.40 g / 100g of fat) on September and the lowest on September at WBD (21.88 g / 100 g fat), on April at WBDxAN (21.27 g / 100 g fat), while at WBDxTG (17.80 g / 100 g of fat) was on July. WBD is characterized by a high content of monounsaturated fatty acids over the entire period from 25.94 to 21.88 g / 100g fat, and WBDxTG with the MUFA lowest content from 22.40 to 17.80 g / 100g fat with a tendency to reduction. Polyunsaturated fatty acids have the highest concentration in all three breeds in April, respectively 3.96 g / 100g fat on WBD, 3.58 g / 100g fat, at WBDxAN and 3.93 g / 100g fat at WBDxTG. The trans isomers in the butter obtained from the WBD milk range from 1.16 to 2.66 g / 100 g fat, in WBDxAN from 1.00 to 2.45 g / 100 g fat and from 1.39 to 2.48 g / 100 g fat at WBDxTG. Therefore, after processing, negligible variation in the values of the individual groups was observed. Cis isomers during the analyzed period have the highest values for WBD from 18.90 to 21.99 g / 100 g fat and the lowest at WBDxTG from 14.80 to 19.78 g / 100 g fat. The trans vaccenic acid in butter obtained from the milk of different goat breeds has higher values at the beginning of the study period and half the lower at the end of lactation. Trans vaccenic acid is most well suited for butter from milk of WBD (from 0.66 to 1.64 g / 100g fat), followed by butter from milk of WBDxAN (from 0.69 to 1.41 g / 100g fat) and WBDxTG (from 0.62 to 1.42 g / 100 g fat). Conjugated linoleic acid has the lowest concentration in butter obtained from milk of WBDxTG goats from 0.33 to 0.49 g / 100 g fat and highest content in WBD from 0.44 to 0.56 g / 100 g fat. CLA marks its peak on July with the butter from WBD and WBDxAN, while the butter from WBDxTG on April. The biologically active omega-3 in the butter varies within a narrow range from 0.95 to 1.08 g / 100g fat in WBD, from 0.88 to 1.08 g / 100g fat in WBDxAN and from 0.92 to 0.99 g / 100g fat in WBDxTG and have the highest content on April. The omega-6 fatty acids in the butter from the three groups of goats are relatively stable, with the lowest content in September - 2.28 g / 100g fat in WBD, 2.02 g / 100g fat in WBDxAN and 2.14 g / 100g fat in WBDxTG. The ratio between the two groups of fatty acids at WBD is from 2.39 to 2.07, in WBDxAN from 2.09 to 2.47 and in WBDxTG from 2.14 to 2.55 (Table 1).

Table 1:-Fatty acids composition of butter, produced by goat's milk from WBD and her crosses with AN and TG (g/ 100g fat)

FA profile	WBD		WBDxAN		WBDxTG	
	X	SD	X	SD	X	SD
∑ CLA	0,55a*	0,06	0,40	0,05	0,38	0,11
∑ C-18:1Trans-FA	2,22	0,66	2,03	0,56	1,95	0,55
∑ C-18:1Cis-FA	20,95	1,77	19,89	1,98	17,33	2,49
SFA	74,72	2,71	76,65	1,94	79,00	2,64
MUFA	24,56	2,32	23,21	1,68	20,42	2,37
PUFA	3,84	0,17	3,46	0,21	3,59	0,31
∑n-3	1,05	0,08	0,96	0,10	0,96	0,03
∑n-6	2,33	0,07	2,20	0,15	2,34	0,20
∑n-6/∑n-3	2,23	0,16	2,29	0,19	2,44	0,13
Branched FA	1,17	0,10	1,17	0,10	1,15	0,01
CLA	0,51a*	0,06	0,38	0,04	0,36	0,12

WBD/ WBDxAN, *P≤0.05

The lipid preventive score in butter from goat milk ranges from 174.38 to 195.61 g/100g butter. It is the lowest in butter from goat's milk of WBD from 174.38 to 185.57 g / 100g product, whereas in WBDxAN milk ranges from 179.48 to 187.71 g / 100g product and at WBDxTG from 184.20 to 186.08 g / 100 g product. The analysed butter is characterized by an increase in LPS at the end of lactation, which is determined by the increase in saturated fatty acids in the test samples. The atherogenic index in the tested butters of three goat breeds ranges from 2.13 to 3.69. Butter from WBD milk has the lowest AI values from 2.13 to 3.21. The thrombogenic index maintains the trend of changes in the atherogenic index in butter from goat's milk but with slightly higher values, respectively, for WBD of 2.65 to 3.06, for WBDxAN from 2.78 to 3.11 and for WBDxTG from 3.15 to 3.74. The analysed goat's butter is

characterized by a low cholesterol index (less than 1.0). The butter obtained by milk from WBD has a h / H from 0.47 to 0.69, in WBDxAN from 0.56 to 0.64 and in WBDxTG from 0.39 to 0.50. Trans fatty acids naturally produced are important for human nutrition and are the subject of a number of scientific studies. The butter from milk of different goat breeds has TFA content in WBD from 1.13 to 2.22 g / 100 g butter, in WBDxAN from 1.11 to 2.05 g / 100 g butter and in WBDxTG from 1, 04 to 2.13 g / 100 g butter. The results obtained for the samples that we have received give us reason to refer them to TFA high content products under Regulation (EC) No 1924/2006. The content of saturated fatty acids in the analysed butter from goat's milk ranges from lactation as follows in WBD from 59.68 to 64.48 g / 100 g product, at WBDxAN ranging from 61.27 to 64.43 g / 100 g butter and at WBDxTG from 63.65 to 66.66 g / 100 g butter. This defines them as butter with a high content of saturated fatty acids (Table 2).

Table 2:-Quality parameters of butter, produced by goat's milk from WBD and her crosses with AN and TG (g/ 100g product/ butter)

Parameters	WBD		WBDxAN		WBDxTG	
	X	SD	X	SD	X	SD
LPS	178,37	6,24	182,69	4,40	188,63	6,12
AI	2,50	0,62	2,60	0,20	3,24	0,40
TI	2,78	0,24	2,94	0,17	3,37	0,33
h/H	0,61	0,12	0,59	0,04	0,45c*	0,05
TFA (g/ 100g product)	1,57	0,58	1,51	0,49	1,52	0,56
SFA+TFA (g/ 100g product)	61,34	2,72	62,82	1,58	64,72	1,68

Conclusion:-

The content of biologically active fatty acids in the analyzed yogurts increases twice – CLA and dietary trans fatty acids.The results obtained for the butter of different goat breeds refer to products with a high content of TFA (from 1.04 to 2.21 g/ 100g butter) and high content of saturated fatty acids (from 59.68 to 66.66 g/ 100g butter).

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