ABSTRACT

Butter is one of the most important dairy products for food, being the animal fat that has the highest digestibility. It is produced in special equipment from pasteurized sweet cream, fermented in the presence of selected lactic acid bacteria cultures without dyes or preservatives, being a natural product (39).

According to the standard of FAO / WHO, butter is defined as a fat product derived exclusively from milk that must have at least 80% fat and no more than 2% non-fat dry matter coming from milk. The most common form of butter is made from dairy's milk, but can be also produced from other mammals milk, including sheep, goat, buffalo or yak (39).

The composition of the butter is mainly represented by fat, 80 - 82%, water 15.6 - 17.6%, protein, calcium and phosphorus (1.2%).

Besides the fact that butter is a natural product, it is a rich and easily assimilated source of vitamin A, necessary to improve vision and health of the endocrine system, but also of vitamins E, K and D. In addition, this product is rich in minerals, especially in selenium, which is a powerful antioxidant against free radicals responsible of aging phenomena. As by percentage, the butter contains more selenium than grain or garlic (39).

Butter also provides iodine, an element so necessary to the well functioning of the thyroid gland. Along with a good amount of necessary butyric acid for the colon, another fatty acid from butter is lauric acid, a potent antimicrobial and antifungal substance, also containing other fatty acids, which protect against cancer (39).

In this study, the aim was to investigate, to deepen and to complete the data from the literature with own observations.

The first part contains a bibliographic study, data on the researched objective and in the second part are described the own researches.

The paper updates the information on the current state of knowledge in the field of study:

quality and hygienic requirements of the raw material needed for the manufacture of butter;

classical and modern technologies for butter manufacturing and hygienic requirements of the technological flow;

the structure, composition, quality and hygienic requirements and butter`s methods of

conservation;

In the second part of the work are presented the personal contributions, structured into 5 chapters that include investigation data on:

Research objectives, material and methods;

Investigations on the quality and hygienic condition of the sweet cream;

Investigations on the quality and hygienic condition of the matured cream;

Investigations on the hygienic and alimentary quality of the butter as an end product;

Investigations on the hygiene of the technological flow.

Organoleptic investigations of the sweet cream needed for butter processing as described in Chapter 5 were performed on a total of 190 samples, resulting in inadequate values for the following determinations: regarding the aspect, 2 samples (1.06%) of sweet cream; 5 samples (2.64%) regarding consistency, a sample (0.53%) regarding the color and 6 samples (3.16%) regarding the smell and taste.

Classification of samples in the appropriate or inappropriate category was done according to STAS 7001-88. The determination results are shown in Fig. 5.1 and Table 5.1.

Research on determining the sweet cream fat were performed on a total of 245 samples of which 116 samples of sweet cream with 32% fat and 129 samples of sweet cream 14% fat, resulting for the carried tests carried the following values: of 116 samples of sweet cream type 32, 107 resulting samples (92.24%) were appropriate and 9 samples (7.76%) were inadequate with a fat content under the STAS standard of 32%; of 129 investigated samples of cream sweet type 14 resulted 117 samples (90.69%) appropriate to STAS requirements and 12 samples (9.30%) inadequate with a fat content below 14%.

Interpretation of results was made in accordance with STAS 6352/5-73 where the requirement for fat content is 32% for sweet cream type 32 and 14% for the type 14.The results of measurements are shown in Figures 5.2.a, 5.2.b and Table 5.2.

Sweet cream titratable acidity investigations were performed on a total of 190 samples in two seasons, of which 90 samples in winter (November-April) and 100 samples in summer (May-October). In all 190 samples investigated, the results were negative according to STAS 6348-85 which allows up to 20 ° T for sweet cream. The results are shown in Fig. 5.3 and Table 5.3.

Research on the effectiveness of sweet cream pasteurization, raw material for butter in all 190 samples, showed negative results according to STAS 6348-85.

Ivestigations on determining organochlorine (α HCH, HCH β, γ HCH, total DDT) and organophosphorus pesticides residues were performed on a total number of 154 samples,

respectively 174 samples of sweet cream. Interpretation of results was made in accordance with ANSVSA no.147/2004 Order, with indications made on customs tax (CN) 0401 for milk and sweet cream, fresh, not containing sugar or other sweeteners.

Comparing the obtained normal values with the maximum limits, no exceedances of the MRL were met for organochlorine and organophosphorus residues from sweet cream.

The study on the degree of radioactive contamination of sweet cream for 50 samples examined throughout the period, showed that: 12 samples (24%) had values between 10.1 to 15 Bq / kg, 33 samples (66%) had values between 15.1 to 20.0 Bq / kg and 5 samples (10%) had values between 20.1 to 25.0 Bq / kg. The results are given in Table 5.4 and Figure 5.4.

Interpretation of the obtained results regarding the content of Cs134şi Cs137 isomers, was made under the provisions of EEC Regulation no.2337/90 and MSF Common Order, MAPP and CACAN no. 856/112/91 2002, which has a maximum limit of 370 Bq / kg for milk and milk products.

Investigations regarding the presence of antibiotics, sulfonamides and other inhibitors residues in raw milk for cream sweet, were made on a total of 212 samples throughout the period and showed their absence.

In section 5.4. are presented investigations regarding the degree of contamination of sweet cream with bacterial miroflora. The samples that were analyzed were within the provisions of the M.S: Order no. 975/1998 and CE Regulation no. 2073/2005.

Microbiological research on the NTG / ml carried out for 228 samples of sweet cream showed that variation limits ranged between 1000-48000 UFC / ml. The results are shown in Table 5.5 and Figure 5.5.

The number of coliform bacteria / ml and E. coli investigated on 228 samples of sweet cream showed their absence.

Investigations regarding the detection of Staphylccoccus aureus cp / ml were performed on a total of 228 samples of sweet cream collected from Galati county. All samples that were examined each year, showed negative results.

Investigations regarding the detection of the presence of Salmonella spp/25ml, Listeria monocytogenes / 25ml and Bacillus cereus were performed on a total of 228 samples of sweet cream collected from Galati county. All samples investigated each year, showed that the bacteria were absent from sweet cream. The results are shown in Table 5.5 and Figure 5.5.

In Chapter 6, have been made investigations on the quality and hygienic condition of the matured cream needed for the processing of butter..

Investigation regarding the organoleptic characteristics of the matured cream were

performed on two seasons: November to April and May to September. Troughout the period, of 240 investigated samples of matured cream, 2 samples (0.83%) were inappropriate regarding the aspect, 2 samples (0.83%)were inadequate regarding the consistencyr, 6 samples (2.5%) were inadequate regarding the color and 10 samples (4.17%) were inappropriate regarding the smell and taste.

Classification of samples in the appropriate or inappropriate category was done according to STAS 7001-88.

The analysis of Table 6.1 and Figure 6.1 regarding the organoleptic characteristics of the matured cream, indicates that each year the percentage of inadequate samples is higher in summer compared to winter.

Investigations regarding the fat content of matured cream, collected from the county of Galati, have been made on a total of 240 samples. Throughout the period have been found that, of 118 investigated samples of matured cream type 25, resulted 112 samples (94.91%) appropriate to STAS requirements and 6 samples (5.08%) inadequate with a fat content below 25%.

Interpretation of the results was made in accordance with STAS 6352/5-73 where the requirement for fat content is 30% for cream type 30 and 25% for type 25. The results are shown in Figures 6.2.a, 6.2.b and Table 6.2.

Investigations on the raw material matured cream acidity were conducted on a total of 244 samples, of which 120 samples in winter (November-April) and 124 samples in summer (May-October).

Throughout the period out of 244 investigated samples of matured cream, 235 samples (96.31%) were appropriate with values between 87-90 ° T and 9 samples (36.79%) were inadequate with values over 90 ° T. Classification of samples to the appropriate or inappropriate category was done according to STAS 6353-85, which allows up to 90 ° T for the matured cream.

Variations of the degree of matured cream acidity are shown in Table 6.3 and Figure 6.3.

Investigations regarding the efficiency of pasteurization of matured cream, raw material for butter, eres performed on 240 samples. The results were negative according to STAS 6348-85.

Research regarding the determination of organochlorine (HCH α, β HCH, γ HCH, total DDT) and organophosphorus pesticide residues were performed on 252 samples, respectively 274 samples of matured cream.

Interpretation of results was made in accordance with ANSVSA Order no.147/2004, indicating the custom tax (CN) 0401 for milk and sweet cream, fresh, not containing sugar or other sweeteners.

Matured cream is classified in the position with more than 2% fat, in which case a maximum is expressed in parts per million (ppm) or mg / kg of fat.

Values obtained by gas chromatography AOAC method, regarding the detected content of organochlorine and organophosphorus pesticides from matured cream samples were below the detection limit of 0.01 ppm.

Investigations on radioactive contamination with Cs137 Cs134şi isomers were performed on a total of 80 samples of matured cream, collected from Galati county.

Interpretation of the obtained results regarding the content of Cs134 and Cs137 isomers, has been made under the provisions of EEC Regulation no.2337/90 and M.S.F. Common Order, M.A.A.P. and CACAN no. 856/112/91 from 2002, which has a maximum of 370 Bq / kg for milk and milk products.

Throughout the total period, out of 80 investigated matured cream samples for the detection of Cs134şi Cs137 isomers resulted 7 samples (8.75%) with values between 10.1 to 15 Bq / kg, 67 samples (83.75%) with values between 15.1 to 20 Bq / kg and 6 samples (7.5%) with values between 20.1 to 25.0 Bq / kg. The results are given in Table 6.4 and Figure 6.4.

Investigations regarding the most probable number of coliform bacteria and E.coli from matured cream, have been made on a total of 244 samples.

Interpretation of the obtained results was made in accordance with the M.S. Order no. 975/1998, EC Regulation no. 2073/2005 and CE Regulation no. 1441/2007. Microbiological norms specify a maximum of 100 E. coli cfu / ml, and for coliform a maximum of 10/ml for the matured cream.

From the analysis of the most probable average number of investigated coliform bacteria on 244 samples of matured cream results: 242 appropriate samples (99.18%) with the NCP <10 ml and 2 samples (0.82%), with the NCP > 10 ml inadequate to MS Norm 975/1998. The results are given in Table 6.5 and Figure 6.5.

From the analysis of the average NCP / ml of investigated E. coli on 244 samples of matured cream during 2004, 2005 and 2006 results: 242 appropriate samples (99.18%) with the NCP <100 ml and 2 samples (0,82%), with the NCP> 100 ml inappropriate to CE Regulation no.1441/2007. The results are given in Table 6.5 and Figure 6.5.

Research regarding the detection of the number of Staphylococcus aureus cp / ml were

performed on a total of 244 samples of matured cream. From the analysis of the average NCP / ml of investigated Staphylococcus aureus during 2004, 2005 and 2006 results: 242 appropriate samples (99.18%) with the NCP <1 ml and 2 samples (0.82%), with the NCP> 1 ml inappropriate to Order no. 975 / 1998. The results are given in Table 6.5 and Figure 6.5.

The detecting of Salmonella spp / 25g, Listeria monocytogenes / 25g and Bacillus cereus presence in matured cream, was performed on a total of 244 samples. All matured cream samples studied throughout these years showed negative results.

Investigations regarding the detection of the presence of yeasts and molds were made on a total of 244 samples. All matured cream samples investigated each year, showed no fungal flora. The obtained results regarding the number of yeasts and molds are shown in Table 6.5 and Figure 6.5.

Chapter 7 regarding the alimentary and hygienic quality of butter as an end product is divided into four sections in which were carried out organoleptic, physico-chemical determinations on the freshness and integrity (authenticity) and also microbiological investigations.

Investigations regarding the organoleptic examination of the butter varieties were performed both on inland butter (Galati, Braila, Bacau, Suceava, Satu Mare, Covasna) and imports (Germany, France, Italy, Denmark) on a total of 468 samples, of which 260 indigenous and 208 samples of imported butter.

Throughout the period, in 260 indigenous butter samples investigated for the classification by scoring of the organoleptic characteristics has been found that in the category of 19 points were 85 samples (32.69%) regarding the appearance, color, smell and taste, and 2 samples (0.77%) under 19 points regarding the consistency. In the category of 17 points (superior type butter) were 87 samples (33.46%) regarding the appearance, odor and taste, 2 samples (0.77%) under 17 points regarding the consistency and one sample (0.38%) regarding the color.

In the 13 points category (IInd quality butter) were 88 samples (33.85%) regarding the taste and smell, and under 13 points category were 4 samples (1.54%) regarding the color and consistency and one sample (0.38%) regarding the aspect. Organoleptic determinations results in local butter are given in Table 7.1 and Figure 7.1.

Troughout the investigated period, in 208 imported butter samples classified by scoring of the organoleptic characteristics has been found that within the category of 19 points were 109 samples (52.40%) regarding the appearance, texture, smell and taste, and 5 samples (2.40%) under 19 points regarding the color. In the 17 points category for superior butter were

99 samples (47.6%) regarding the smell and taste, and under 17 points category were 6 samples (2.88%) regarding the color (white and slightly shiny at surface and section), 2 samples (0.96%) regarding the consistency and one sample (0.48%) regarding the aspect (presenting clear water droplets and accidental air voids in fresh section). The results of organoleptic determinations on imported butter are given in Table 7.2 and Figure 7.2.

Interpretation of organoleptic examination results was done according to STAS 278-86, evaluating each sensory characteristics by comparison with the specification of the scoring scale.

Investigations regarding the water content of inland and imported butter were made on a total of 464 samples, of which 254 indigenous and 210 samples of imported butter. Interpretation of results was done according to STAS 6352/4-85, which states that the percentage of water for extra butter has a maximum of 17 ± 0.5%, for superior butter has a maximum of 20 ± 0.5% and for the IInd quality butter has a maximum of 35 ± 0.5%.

Troughout the total period out of 254 investigated samples of inland butter have resulted: 251 samples (98.82%) of extra butter which corresponded to STAS norm and 3 inadequate samples (1.18%) with a water content over the STAS norm of 17%, 252 samples (99.21%) of superior butter that corresponded to STAS norm and 2 inappropriate samples (0.79%) with a water content over the STAS norm of 20% and 250 samples (98.43%) of IInd quality butter that corresponded to STAS norm and 4 inadequate samples (1.57%) with a water content over the STAS norm of 35%. The results are given in Table 7.3 and Figure 7.3.

Out of 210 investigated samples of imported butter resulted: 208 samples (99.05%) of extra and superior butter that corresponded to the STAS norm from our country and 2 samples (2.63%) which showed a higher than 17% water content 17% for extra butter and 20% for superior butter.

The results are given in Table 7.4 and Figure 7.4.

Investigations regarding the fat content both for local (Galati, Braila, Bacau, Suceava, Satu Mare, Covasna) and imported butter (Germany, France, Denmark, Italy) were performed on a total of 464 samples, of which 254 indigenous and 210 samples of imported butter during 2004, 2005 and 2006. Interpretation of results was done according to the STAS 6352/4-85' in which case the fat content requirement for extra butter is 83 ± 0.5%, for superior butter is 80 ± 0.5% and for IInd quality butter is 65 ± 0.5%.

Troughout the total period has beens found that out of 254 investigated samples of inland butter resulted: 251 samples (98.82%) of extra butter which corresponded to STAS and 3 samples (1.18%) with a fat content inappropriate and under the provisions of STAS, 252

samples (99.21%) of superior butter that corresponded to STAS norm and 2 samples (0.79%) with a fat content inappropriate under the STAS provisions and 250 samples (98.43%) of IInd quality butter that corresponded to STAS and 4 samples (1.57%) with a fat content inadequate to STAS norm. The results are given in Table 7.5 and Figure 7.5.

Out of 210 investigated samples of imported butter resulted: 208 samples (99.05%) of extra and superior butter that corresponded to the STAS from our country and 2 samples (2.63%) which had a lower fat content than the one specified. The results are given in Table 7.6 and Figure 7.6.

Investigations on non-fat dry matter content of both local utter (Galati, Braila, Bacau, Suceava, Satu Mare, Covasna) and imported butter (Germany, France, Italy, Denmark) were performed on a total of 464 samples, of which 254 indigenous and 210 samples of imported butter during 2004, 2005 and 2006. Interpretation of results was done according to STAS norm 6352/4-85, which states that the percentage of non-fat dry matter for extra butter has a maximum of 1 ± 0.5%, for superior butter has a maximum of 1.2 ± 0.5% and for the IInd quality butter has a maximum of 1.5 ± 0.5%.

Troughout the total period have been found that out of 254 investigated samples of local butter resulted: 251 samples (98.82%) of extra butter which corresponded to STAS and 3 samples (1.18%) contained an inappropriate amount of non-fat dry matter and over the provisions of STAS norm of 1%, 252 samples (99.21%) of superior butter corresponded to STAS norm and 2 samples (0.79%) contained an inappropriate amount of non-fat dry matter and over the provisions of STAS norm of 1.2% and 250 samples (98.43%) of IInd quality butter that corresponded to STAS and 4 samples (1.57%) contained an inappropriate amount of non-fat dry matter and over the provisions of STAS norm of 1.5%. The results are given in Table 7.7 and Figure 7.7.

Troughout the total period have been found that out of 210 investigated samples of imported butter resulted: 208 samples (99.05%) of extra and superior butter that corresponded to STAS from our country and 2 samples (2.63%) that presented a higher content of non-fat dry matter of 1% for extra butter and 1.2% for superior butter. The results are given in Table 7.8 and Figure 7.8.

Investigations regarding the acidity both for the local (Galati, Braila, Bacau, Suceava, Satu Mare, Covasna) and imported butter (Germany, France, Italy, Denmark), were carried in the Faculty of Veterinary Science Iași, the Sanitary Veterinary and Food Safety Department Laboratory Galați and the Faculty of Science and Food Engineering Galați on a total of 452 samples, of which 242 indigenous and 210 samples of imported butter during 2004, 2005 and

2006.

Interpretation of results was done according to current regulations, where the maximum acidity is of 2 degrees for extra and superior butter and of 2.8 degrees for Ist quality butter and 3.5 degrees for the IInd quality butter (STAS 278 - 86).

Troughout the total period have been found that out of 242 samples of extra and higher butter and also IInd quality local butter, 237 (97.93%) had values with less than 2 acidity degrees, 4 samples (1, 65%) presented 2.4 acidity degrees and one sample (0.41%) recorded 2.8 acidity degrees. The results of acidity determinations on imported butter are shown in Table 7.9.

From Table 7.10 analysis regarding the imported butter acidity, investigations made on 210 samples during 2004, 2005 and 2006, appears that all extra and superior butter samples showed lower values than 2 degrees, fitting in STAS norm of our country.

Investigations regarding the peroxide value from both local (Galati, Braila, Bacau, Suceava, Satu Mare, Covasna) and imported butter (Germany, France, Denmark, Italy) have been made on a total of 452 samples, of which 242 indigenous and 210 samples of imported butter.

From tables 7.9 and 7.10 analysis regarding the peroxide value for local and imported butter, has been found that all samples have showed lower values than 0.1 g of iodine per 100 g butter, values under current regulations.

Investigations regarding epihidrinic aldehyde and pasteurization efficiency (presence of peroxidase) both in local and imported butter, are found in tables 7.9 and 7.10 and that all tests were negative.

Research on the detection of soluble (Reichert-Meissl index) and insoluble volatile fatty acids (Polenske index) of local (Galati, Braila, Bacau, Suceava, Satu Mare, Covasna) and imported butter (Germany, France, Denmark,Italy) have been made on a total of 452 samples, of which 242 indigenous and 210 samples of imported butter. All samples were negative.

Research on organophosphorus and organochlorine pesticide content of indigenous and imported butter throughout the investigated period showed that the results were below the detection limit of 0.01 ppm. Interpretation of results was made in accordance with ANSVSA Order no. 147/2004, with indications to custom tax (NC) 040 500 for butter or other fats and oils derived from milk.

Butter is classified as a product with more than 2% fat, in which case a maximum is expressed in parts per million (ppm) or mg / kg of fat.

Investigations regarding heavy metals and arsenic content in indigenous and imported butter have not showed any positive samples.

Investigations regarding the radioactivity of both local (Galati, Braila, Bacau, Suceava, Satu Mare, Covasna) and imported butter (Germany, France, Italy, Denmark) were performed on a total of 267 samples from which 125 indigenous and 142 samples of imported. Interpretation of the obtained results on the content of Cs134 and Cs137 isomers, was based on MSF Common Order, MAPP and CNCAN, no. 856/112/91 from 2002, which states a maximum limit of 370 Bq / kg for dairy product.

In all investigated samples of local and imported butter each year, there were not detected Cs137 Cs134 isomers. Research regarding the detection of bacterial and fungal flora for local and imported butter, in all years were negative. Interpretation of results was made in accordance with the M.S. Order MS no. 975/1998, CE Regulation no. 2073/2005 and CE Regulation no. 1441 2007.

Microbiological investigations regarding the technological flow hygiene are presented in Chapter 8 and over three sections. Determination of NTG / m³ and NTM / m has been achieved for two objectives: determining of the warehouse air and of the station air while working.

The limits of variation of bacterial load for the entire inestigated period 2004, 2005 and 2006 ranged from 200 to 400 with an average of 275. NTM / m³ had values between 10 and 150 with an average of 68 / m for the entire period. Mean values of NTG / m³ and NTM / m³ were within standard norms.

Research regarding the assessment of sanitation tests for work surfaces, containers, equipment, protective equipment (gowns, caps, aprons, gloves), were made before the starting of the work with an average of 1.25 NTG/m2 for work surfaces, 0.83 for containers, 0.93 for machinery and for protection equipment was absent in all these years.

The number of coliform bacteria / 10 cm2 for the entire period showed the absence from work surfaces, equipment, containers and protective equipment.

This paper has a great theoretical and practical interest and includes personal contributions presented during eight chapters, which describes some aspects of quality and hygiene of butter in relation to manufacturing technology.