UDK 637.12.055:636.2

# EVALUATION CRITERIA OF BOVINE MILK BIOLOGICAL VALUE AND CHEESE PRODUCTION SUITABILITY

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*The article describes the criteria for assessing the biological value of milk on its protein component. It is based on the amino acid (AA) composition of proteins and their relationship , assessed the percentage of each essential AA to its amount in an "ideal protein " ACN identified limiting AA, calculated biologically valuable protein milk system PDAAS. The level of protein content of milk, the fractional composition of proteins and syroprigodnost cows of three breeds under the same type of maintenance and feeding. DNA - typing showed that animals Ukrainian red- motley breed for kappa casein genotype and growth hormone gene desirable for raw milk production for the cheese industry.*

***Keywords:*** *amino acids, biological value, DNA syroprigodnost milk*

**Introduction.** The full functioning of the organism greatly depends on the satisfaction of animal origin high quality protein needs, including milk, which practically fully digestibility. Protein synthesis greatly genetically determined, therefore, is interesting to study the breed characteristics of the milk protein production and its qualitative characteristics both in composition and in the technological properties. Conducting experiments in the same type of keeping and feeding by the action of paratypic factors with the same force and direction vector, to allow an objective evaluate the genetic potential expression of various cattle breeds. Advances in the modern molecular genetics techniques allows to identify some genes that control specific characteristics of milk production - the main proteins genes and hormones, which stimulate their expression, especially genes of kappa-casein and growth hormone. The kappa-casein gene (CSN3) of the *Bos taurus* is located on chromosome 6, among 13 known allelic variants of this gene the two are the most common alleles - A and B. They are the result of two point mutations at positions 136 and 148 bp, which cause the change of amino acid Tyr (A) to Iso (B) and Ala (B) to Asp (A), respectively. The growth hormone gene (GH) is located on chromosome 19 and consists from five exons and four introns, which plays a key role in the protein synthesis regulation, cell allocation, growth of the organism, the lactogenic action characterization and body fat mobilization process affection. AluI restriction polymorphism in the fifth exon of the gene associated with CG transverse, which cause the amino acid change in positions 127 - the Leucine (Leu) to Valine (Val) in the protein product of the gene, that enhances the growth rate of body weight, and lactation of lactating animals [1-6].

**Methods.** In order to study the different cattle breeds milk productivity and quality (breeding factory "Rodina", Bogodukhov district, Kharkov region) the experiment on three groups of animals was implemented: the I group included Simmental cattle, II - Red-and-White cattle and III - Black and White cattle breeds. On the start of experiments the all of animals were on 57-70 day of second and third lactation, with the average daily milk yield 24,1 ± 1,1; 25,6 ± 2,6; 20,7 ± 1,8 kg of milk, respectively. All animals until the end of lactation were in similar conditions of feeding, keeping and individual milking of. The daily milk production were considered. The chemical composition of the milk was estimated by IF-spectrometry by «Bentley-150" analyzer. The fatty acid composition of milk lipids investigated by Hewlett Packard 6890 (USA), the amino acid (AA) of the proteins - by AAA - 339 M analyzer (Czech Republic), other factors were determined by generally accepted standard methods. The polymorphism of QTL (k-casein and growth hormone), which controlled the individual traits of milk production were identify by PCR-RFLP. DNA was isolated from the blood of animals by the method of Kawasaki with modifications. For locus-specify amplification of kappa-casein gene fragment (CSN3) have used primers: F: 5'-GAAATCCCTACCATCAATACC-3 'and R: 5'-CCATCTACCTAGTTTAGATG-3' by the following temperature conditions: 94 ºC -4 min., 94 ºC - 30 sec, 58 ºC - 30 sec, 72 ºC - 30 sec - 35 cycles, 72 ºC - 5 min. The growth hormone gene polymorphism (GH) was determined using the primers: F: 5'-GCTGCTCCTGAGGGCCCTTC-3 'and R: 5'-GCGGCGGCACTTCATGACCC -3'. The PCR temperature mode: DNA denaturation at 95$^{o}$C - 1 min, primers annealing at 62 ° C - 1 min, and DNA chains synthesis at 72$^{o}$C - 1 min, followed by 40 cycles as follows: 94$^{o}$C - 30 sec, 60 ° C - 60 sec , 72$^{o}$C - 120 sec (in the last cycle for 10 min). PCR products were cut by specific endonuclease restriction (Fermentas, Lithuania): HindIII for kappa-casein locus and AluI for growth hormone gene, according to the scheme: $H_2O$ - 3,5 ml, 10x buffer for enzyme - 1.0 ml, restriction - 0 5 ml and 5.0 ml PCR product in 10.0 ml of the mixture. Visualization of the

results carried out by DNA fragments electrophoretic methods in 2% agarose gel.

**Results.** Simmental cattle milk productivity during lactation generally was 5221 ± 232, Ukrainian Red-and-White dairy cattle - 5389 ± 314; Ukrainian Black-and-White - 4541 ± 285 kg, which is better than the valuation requirements for the breed. The animals of URW breed are overtops by milk yield the Simmental cattle by 3.2%, and the UBW - by 11.9% ($p < 0.05$). The milk fat production of Simmental and UBW breeds were close enough and during lactation it was 169.3 and 164.8 kg, and for URW - 207.4 kg of milk fat, which is higher than the Simmental and UBW cattle on 22.5 and 25, 8%. The amount of protein per lactation of Simmental was 159.2 kg, URW -167.1 kg, UBW - 136.2 kg, and the comparative advantage of the URW cattle to milk protein produce was associated with their higher milk yield with relatively few lesser concentration. The energy value of one kilogram of milk by Simmental cattle was 662.6 kcal, URW - 673.7, UBW - 673.9, in general, the energy value of milk yield per lactation was 13609.6, 15200.5 and 12812.4 MJ, respectively.

Milk protein status analysis showed that the total number of amino acids in milk was close enough for animal from different breeds: 32-32,3 g / kg, as well as the sum of essential amino acids (SEAA): 14.5-15 g / kg. SEAA share of the total amino acids in the milk of Simmental, Red-and-White and Black-and-White cattle were respectively 46.2, 46.1 and 46.7%.

As well known, in 100 g of high biological protein the value of SEAA should be not less than 40 g, and the ratio of SEAA to total nitrogen of protein (g/1g nitrogen) is not less than 2.5. In the analyzed milk of Simmental, Red-and-White and Black-and-white animals, these values were, respectively, 39.9, 41.4, 40.2 and 2.5 g, 2.58, 2.51 g / g of nitrogen. Total SEAA content in milk in relation to their number in the "ideal" protein (calculated in relation to the needs of an adult man) for cattle of I, II and III groups was, respectively, 49.2, 63.9, 52.1 mg / g of protein. The milk protein amino-acid score (AAS,%) was calculated from percentage of each SEAA of milk protein in relation to its content in the "ideal" protein (Table 1).

Table 1

**The milk protein amino acid score to the 'ideal' protein**

| Name of the essential amino acids, SEAA | SEAA "ideal" protein, mg/g* | The milk of cattle breeds | | | | | |
|---|---|---|---|---|---|---|---|
| | | Simmental | | Red-and-White | | Black-and-White | |
| | | SEAA, mg/g | Score, % | SEAA, mg/g | Score, % | SEAA, mg/g | Score, % |
| Lysine | 55 | 59 | 107,3 | 65,4 | 118,9 | 58,8 | 117,6 |
| Methionine + Cysteine | 35 | 31,2 | 89,1 | 28,0 | 80,0 | 34,0 | 97,1 |
| Threonine | 40 | 40,6 | 101,9 | 49,8 | 124,5 | 37,1 | 92,7 |
| Histidine | | 21,8 | | 15,5 | | 18,5 | |
| Arginine | | 40,6 | | 37,4 | | 40,2 | |
| Valine | 50 | 53,1 | 106,2 | 56,1 | 112,2 | 52,6 | 105,2 |
| Leucine | 70 | 93,7 | 133,8 | 99,6 | 142,3 | 92,8 | 132,3 |
| Isoleucine | 40 | 40,6 | 101,5 | 40,4 | 101,0 | 43,3 | 108,2 |
| Phenylalanine + Tyrosine | 60 | 81,0 | 133,3 | 74,7 | 124,5 | 83,5 | 137,0 |

** - The scale of the FAO / WHO of SEAA adequacy in relation to human needs.*

AAC of SEAA amounts in Simmental, Red-and-White, Black-and-White cattle breed's milk protein was respectively 114,0;118,3;114,9 %.

For the milk proteins of all studied breeds the limiting (PDCAAS min 1) was sulfur-containing methionine, the content of which with cystine was from 80 - 97.1 % of its value on the scale of adequacy to the "ideal" protein. In the milk protein of Simmental and Red-and-White cattle the threonine content exceeded its content in an "ideal" protein, but the milk protein of Black-and-White breed animals score of this amino acid was at 92.7 %, which gives reason to take it as a limiting amino acid of milk from cows of these breed (PDCAAS min 2).

The biological value of the protein also was estimated to corrected by the limiting AA coefficient digestibility (PDCAAS) recommended of the expert council of FAO / WHO (1989) for the protein quality evaluation. In calculating the PDCAAS (Protein Digestibility corrected Amino Acid score) - corrected by the limiting amino acid, considering digestibility of milk protein (95%), and adapted to the needs of adults, used the formula of G. Schaafsma. The calculations indicated that the most balanced in AA composition to the needs of adult was milk protein of Black-and-White cows, whose digestibility by PDCAAS min 1 (Threonine) was 88.1% and PDCAAS min 2 (Methionine + Cystine) 92 28%, while PDCAAS of Simmental milk protein (Methionine + Cystine) was equal to 84.6%, and Red-and-White cows milk protein - 76%.

The proteins biological value are characterized also such parameters as utilization (the degree of the metabolism) and utility (the consumption with benefit, digestibility). Coefficient of utility (UC) of amino acid composition is characterized the SEAA balance to physiologically necessary standard (reference value). As higher the value of the coefficient of utility, as better protein amino acids balanced and as the rationally they may be used by the body. The results of the calculation of the UC of each of cow's milk protein SEAA are shown in Table 2.

Table 2

**The utility coefficient of each SEAA of cow's milk protein**

| Name of the essential amino acids, SEAA | The milk from cattle breeds | | |
|---|---|---|---|
| | simmental | Red-and-White | Black-and-White |
| Lysine | 0,83 | 0,67 | 0,87 |
| Methionine +Cysteine | 1,00 | 1,00 | 0,95 |
| Threonine | 0,87 | 0,64 | 1,00 |
| Valine | 0,83 | 0,71 | 0,88 |
| Leucine | 0,66 | 0,56 | 0,70 |
| Isoleucine | 0,87 | 0,79 | 0,86 |
| Phenylalanine + Tyrosine | 0,67 | 0,64 | 0,66 |

Based on these data the utility coefficient of SEAA milk proteins (UC) was calculated. For Simmental cow's milk protein, for example:

UC = (59·107,3·0,83) + (31,2·89,1·1) + (40,6·101,9·0,87) + (53,1·106,2·0,83) + (23,7·133,8·0,66) + (40,6·101,5·0,87) + (81·133,3·0,67) = 35408/399,2 = 88,7 %.

The coefficient of utility, analogous calculated for milk protein Red-and-White cattle, was 32999,6:414 = 79.71% and for milk proteins Black-and-White cow's taking into account the first limiting amino acid threonine was 37249,88:402,1 = 92.64 %, and with limiting sum of (methionine + cystine) - 38962,3:402,1 = 96.89%.

These data are confirmed by comparing optimal SEAA relationships (relative to methionine-cystine) in the formula of the "ideal" protein and milk protein of studied breeds (Table 3). The nearest to the ideal the amino acid formula of milk protein of Black-and-White cows, the maximum differences were observed in the AA formula of milk protein Red-and-White cows, the AA formula of Simmental milk proteins takes intermediate values.

Table 4 presents the data describing the relationship of milk protein fractions of studied breeds.

Table 3

**The amino acid protein formula by methionine on a FAO / WHO scale and milk proteins studied breeds**

| Amino-acid formula | Methionine+ Cysteine | Lysine | Threonine | Valine | Leucine | Isoleucine | Phenylalanine + Tyrosine |
|---|---|---|---|---|---|---|---|
| On a FAO / WHO scale (egg protein) | 1,0 | 1,57 | 1,14 | 1,43 | 2,00 | 1,14 | 1,71 |
| SEAA Simmental milk protein, % to standard | 1,0 | 1,82 +15,9 | 1,30 +14,0 | 1,70 +18,8 | 3,00 +150 | 1,30 +14,0 | 2,6 +51,2 |
| SEAA Red-and-White milk protein, % to standard | 1,0 | 2,30 +46,5 | 1,77 +55,3 | 2,00 39,8 | 3,55 +77,5 | 1,44 26,3 | 2,66 +55,5 |
| SEAA Black-and-White milk protein, % to standard | 1,0 | 1,72 9,5 | 1,09 -4,4 | 1,54 +7,7 | 2,72 +36,0 | 1,27 11,4 | 2,45 +43,2 |

Is of interest the similar values of the "true" milk protein of the studied breeds and the trend towards increased of casein in the milk (81.4%) for the Red-and-White cattle (against 79.4 - 79.7% for Simmental and Black-and-White cattle, respectively). In cheese production the most valuable are the α-and β-casein fraction, the total share of which was: the Simmental - 84.9%, the Red-and-White - 87.3%, the Black-and-White - 84.5% of the total casein contains, suggesting a possible to more efficient use of Red-and-White cattle milk for production of cheese.

Table 4

**Mass fraction and fractional composition of milk protein of studied breeds (%)**

| Characteristics | The milk from cows by breeds | | |
|---|---|---|---|
| | simmental | Red-and-White | Black-and-White |
| Protein content (total, Nx6,38) | 3,53±0,05 | 3,59±0,05 | 3,46±0,06 |
| Protein content (true, N x6,38) | 3,30±0,02 | 3,34±0,02 | 3,27±0,02 |
| including casein | 2,62±0,05 | 2,72±0,04 | 2,58±0,06 |
| α | 1,09±0,03 | 1,21±0,04 | 0,89±0,03 |
| β | 1,14±0,03 | 1,16±0,03 | 1,29±0,03 |
| γ | 0,39±0,04 | 0,35±0,03 | 0,40±0,04 |
| albumin | 0,55±0,03 | 0,45±0,03 | 0,54±0,04 |
| globulin | 0,13±0,01 | 0,17±0,02 | 0,15±0,01 |

The Gamma-fraction of casein is a part of the losses of nitrogen-containing substances in the cheese production. The highest proportion of this fraction (15.5%) was observed for Black-and-White cows, and the lowest (12.7%) - for the Red-and-White cattle. Total share of milk serum proteins that are lost in the cheese production was the lowest for the Red-and-White cows - 18.6%, slightly higher for Simmental - 20.6%, and the highest - 21.7% for Black-and-White dairy cattle.

The milk coagulation by the action of rennet enzyme was: for Simmental cows through (34,1 ± 0,7), for Red-and-White - through (36,4 ± 0,6), for Black-and-White cattle through (35,7 ± 0, 5)

minutes, so the milk of cows of all studied breeds relates to the desired type II for cheese production. The method of protein coagulation determining is represented in Figure 1.


Figure 1. The rennet-fermentation test.

During the rennet-fermentative test, clots, according to ГОСТ 9225, have been attributed to class I or II. From the 20 studied samples of cows Simmental milk the 18 samples (90%) were classified as class I and 2 (10%) as class II; the Red-and-White cow's milk - 17 (85%) as class I and 3 (15%) as class II; for the Black-and-White cow's milk - 16 (80%) as class I, and 4 (20%) as class II. The milk samples of class III by quality of rennet clot were not found.

On the results of DNA testing, the polymorphism of kappa-casein and growth hormone genes was established for three cattle breeds, with A, B and L, V allelic variants, respectively (Figure 2).

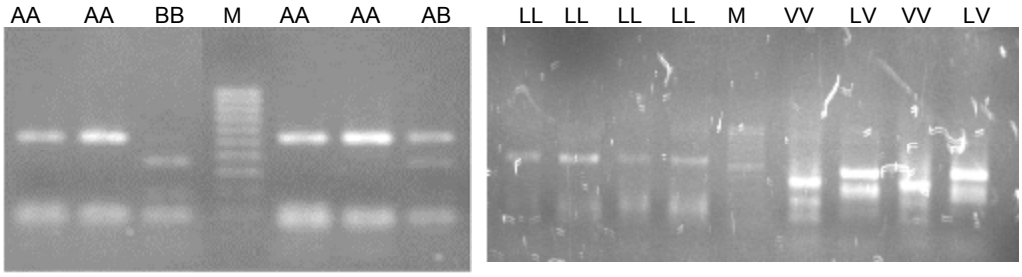


Figure 2. The genotype of studied animals determination by PCR-RFLP:
a) the kappa-casein gene, b) the growth hormone gene,
M - M50 DNA size marker.

By the kappa-casein gene alleles distribution, the highest number of A allele, which is associated with increased total milk yield, was characterized the Simmental cattle, which exceeded the Black-and-White cattle by milk production, and slightly different from the Red-and-White dairy cattle (4541±285 and 5389±314 kg, respectively). The frequency of B allelic variants was higher for the Red-and-White milk cattle - 0,500. B allele is associated with a higher protein content in milk, high yield of cheese, better coagulation properties of milk, so the genotype BB has advantages of technological parameters of protein-milk products (Table 5).

Table 5

**Genetic structure of the studied cattle breeds by kappa-casein and growth hormone genes and their main productive parameters**

| Breeds | The kappa-casein gene | | | | | The growth hormone gene | | | | Milk productivity, kg/lactation | Milk fat, % | Protein content, % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | allele frequency | | genotype frequency | | | allele frequency | | genotype frequency | | | | |
| | A | B | AA | AB | BB | L | V | LL | LV | | | |
| Black-and-White | 0,625 | 0,375 | 0,500 | 0,250 | 0,250 | 0,875 | 0,125 | 0,750 | 0,250 | 4541 | 3,27 | 3,27 |
| Red-and-White | 0,500 | 0,500 | 0,250 | 0,500 | 0,250 | 0,625 | 0,375 | 0,275 | 0,725 | 5389 | 4,12 | 3,34 |
| Simmental | 0,750 | 0,250 | 0,500 | 0,500 | - | 0,875 | 0,125 | 0,750 | 0,250 | 5221 | 3,36 | 3,30 |

The frequency of the homozygous AA genotype of Black-and-White and Simmental animals was high and nearly equal. With the greatest frequency (50%) for Simmental and Red-and-White animals represented heterozygote genotype AB, compared to the studied animals Black-and-White breed, which indicates to significant opportunities for further breeding work with these cattle. The high frequency of the desired to produce high quality cheese homozygous genotype BB characterized the investigated animals of Ukrainian Red-and-White and Black-and-White dairy breeds (0.250). Also for these animals is characterized the increased, as compared with animals of Black-and-White cattle,

milk protein and fat content (3.30±0,02 - 3.34±0,02 and 3.36 - 4.12).

By the growth hormone gene for all researched cattle breeds the L allele variants advantage with a frequency of 0.625 to 0 875 was detected. High frequency of V allele (0,325) compared with Black-and-White and Simmental cattle are characterized Red-and-White animals, that also characterized by a large number of animals with heterozygous genotype LV (72,5%). V allelic variant associated with increased milk yield, so better performing per yield, number of milk fat and protein are characterized the LV heterozygous animals Red-and-White breed (milk yield - 5389±314 kg, true milk protein - 3,34±0,02 and fat - 4,12). Animals with homozygous genotype VV in the studied breeds were not identified.

All studied animals were tested for blood group with their genotypes determination on the basis of serological tests (reaction of hemolysis). The study of bovine red blood cell antigens to allow determined for the animals of Black and White dairy breed the high frequency of the $O^{/}$ and $J_2^{/}$ antigens (q = 0,363 and q = 0,181, respectively) on the EAB system and on the EAC system - antigens $R_2$, $C_2$ , E (q = 0,250-0,333); on the system EAS - mostly $H^{/}$. For Ukrainian Red-spotted breed animals on the system EAB was identified a high fraction of $A_2$ antigen (q = 0,750) and on the EAC system - W antigen (q = 0,500); on the EAS system - $H^{/}$ (q = 0,600). For the Simmental cattle observed the B-blood group system alleles frequency distribution with the advantage of $B_2G_2(K)Y_2O^{/}$, detected a significant frequency of red blood cell antigenic factors of EAC system - E and W (q = 0,250 and q = 0,375, respectively) and $H^{/}$ of EAS-system with frequency q = 0, 571 (Table 6).

Table 6

**The blood types of the studied animals of three cattle breeds**

| № | Name, number | Blood groups systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | F | J | L | M | S | Z |
| Ukrainian Black-and-White dairy breed | | | | | | | | | | |
| 1 | Afeliya UA6300314519 | -/- | $J_2^{/}O^{/}$ | $C_2ER_2L^{/}$ | F/F | -/- | -/- | -/- | $H^{/}$ | -/- |
| 2 | Viena UA6300314714 | -/- | $O^{/}G^{//}$ | $C_2ER_2$ | F/F | J | L | -/- | $H^{/}$ | -/- |
| 3 | Lasunya UA6300314734 | -/- | $G_2O_2G^{/}O^{/}$ | $R_2$ | F/F | -/-- | -/- | M | $H^{/}$ | -/- |
| 4 | Chudna UA6300314518 | $A_2$ | $(J_2^{/})O^{/}(Q^{/})$ | $C_2ER_2L^{/}$ | F/F | J | L | -/- | $H^{/}$ | -/- |
| Ukrainian Red-and-White dairy breed | | | | | | | | | | |
| 5 | Lyuta UA6300314883 | $A_2$ | $B_2Y_2I^{/}$ | W | F/F | -/- | -/- | -/- | $S_1H^{/}U^{//}$ | Z |
| 6 | Laska UA6300314989 | -/- | $G_2O^{/}$ | $C_2W$ | F/F | -/- | -/- | -/- | $H^{/}$ | Z |
| 7 | Mechta UA6300315424 | $A_2$ | $I^{/}Q^{/}$ | W | F/V | -/- | -/- | -/- | $H^{/}$ | -/- |
| 8 | Luna UA6300315425 | $A_2$ | $I_2Q^{/}$ | $R_2L^{/}$ | F/V | J | L | -/- | -/- | -/- |
| Simmental | | | | | | | | | | |
| 9 | Marta UA6300315385 | -/- | $B_2G_2(K)Y_2O^{/}$ | $R_2$ | F/V | -/- | L | -/- | $H^{/}U^{/}$ | -/- |
| 10 | Amazonka UA6300315147 | -/- | $I_2E_3^{/}I^{/}G^{//}$ | $EW(L^{/})$ | F/F | -/- | -/- | -/- | $H^{/}U^{//}$ | Z |
| 11 | Beluga UA6300315036 | -/- | $I_2O_2T_1G^{/}I^{/}Q^{/}G^{//}$ | W | F/F | J | -/- | -/- | $S_1H^{/}$ | -/- |
| 12 | Leska UA6300315025 | $A_2$ | $B_2G_2(K)Y_2O^{/}$ | $C_2EW$ | F/F | J | -/- | -/- | $H^{/}$ | -/- |

**Conclusions:**

1. Under similar conditions of housing, feeding and milking the cattle of Red-and-White breeds have been exceeded the Simmental and Black-and-White analogs by milk yield, fat and protein products.

2. The milk protein of the studied cattle are characterized by high biological usefulness: part of essential amino acids was 39,9-41,4 g, and their ratio to 1 g of nitrogen - 2,5 -2,58 g.

3. Established the highest "chemical" AAC essential amino acids of milk proteins of Red-and-White cows (118%) against 114% for Simmental and 115% for Black-and-White cattle.

4. The evaluation corrected by limiting AA AAS (PDCAAS) showed that the best balance of milk proteins have a Black-and-White breed (88-92%) with a coefficient of utility 93-96%, the milk protein of Red-and-White cattle are relatively lowest PDCAAS – 76 % with a coefficient of utility 80%, and the milk proteins of Simmental occupy an intermediate position (PDCAAS = 84,6% with a coefficient of utility 88,7%).

5. At similar mass fraction of "true" protein in the milk of the studied breeds was detected trend to increased of casein level and the sum of its α and β fraction, and the lowest part of serum proteins in the milk of Red-and-White cows compared to Simmental and Black-and-White animals.

6. By the coagulation and rennet-fermentative test the milk of studied breeds meets the requirements for milk raw in cheese production.

7. The studied cattle DNA typing allowed to identify the Red-and-White dairy breed animals as carriers with high frequency desired for the production of cheese B alleles and homozygous BB genotype of kappa-casein gene and the V-allele and heterozygous LV genotype of the hormone growth gene, is the economically significant selective criterion for high quality cheese productivity dairy breeds specialized.

8. Complex estimation of genetic polymorphisms of kappa-casein and growth hormone genes are more perspective for determining the genetic potential of cattle.

9. For the studied animal of three breed was detected the complex VVLV genotype (by k-casein

and GH genes) with the best productive characteristics for the dairy cattle (milk yield - 5389 kg, fat - 4.12%, milk protein - 3.34%).

10. Identified erythrocyte antigens specter of studied animals is typical for these cattle breeds.

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***Аль-Бази Мезхер Камиль, Шаповалов С.О., Шкавро Н.Н., Федотова Л.Н., Русько Н.П. КРИТЕРИИ ОЦЕНКИ БИОЛОГИЧЕСКОЙ ЦЕННОСТИ И СЫРОПРИГОДНОСТИ МОЛОКА КОРОВ РАЗЛИЧНЫХ ПОРОД***


*В статье изложен критерии оценки биологической ценности молока по его белковой составляющей. В основу положен аминокислотный (АК) состав белков и их соотношение, проведена оценка процентного соотношения каждой незаменимой АК к ее количеству в «идеальном белке» АКС, выявлены лимитирующие АК, рассчитана биологическая полноценность белка молока по системе PDAAS. Исследован уровень белковости молока, фракционный состав белков и сыропригодность молока коров трех пород в условиях однотипного содержания и кормления. ДНК - типирование показало, что животные украинской красно-пестрой породы за генотипом каппа казеина и за геном гормона роста желательны для производства молока сырья для сыроваренной промышленности.*



***Ключевые слова**: аминокислоты, биологическая ценность, ДНК, сыропригодность, молоко*


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*У статті викладено критерії оцінки біологічної цінності молока за його білкової складової. В основу покладено амінокислотний (АК) склад білків і їх співвідношення, проведена оцінка процентного співвідношення кожної незамінною АК до її кількості в «ідеальному білку» АКС, виявлені лімітуючі АК, розрахована біологічна повноцінність білка молока за системою PDAAS. Досліджено рівень білковості молока, фракційний склад білків і сиропрігодность молока корів трьох порід в умовах однотипного утримання і годівлі. ДНК - типування показало, що тварини української червоно-рябої породи за генотипом каппа казеїну і за геном гормону росту бажані для виробництва молока сировини для сироварної промисловості.*



***Ключові слова**: амінокислоти, біологічна цінність, ДНК, сиропридатність, молоко*

Дата надходження до редакції: 22.07.2014 р.
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