

**ANALYSIS OF GENE POLYMORPHISM AT LOCUS OF MYOSTATIN, LEPTIN,  
β-LACTOGLOBULIN AND κ-KASEIN GENES AT SOME UKRAINIAN  
BREEDS OF CATTLE**

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**INTRODUCTION**

Effects of polygenes on economically important traits is one of the central problems in selection of livestock. Today it is known only small number of structural genes whose polymorphism is directly related with manifestation of valuable traits in animals. This study was focused on possibility of genetical revealing and evaluation of economically important traits at cattle (muscle hypertrophy, growth performance and compositional and technological properties of milk) with utilization such marker genes as myostatin (MSTN), leptin (LEP), β-lactoglobulin (BLG) and kappa-casein (CASK) genes. All these genes occur rare example of direct relation between polymorphism of structural genes and development of economically important traits. An investigation in present study was undertaken to clarify the polymorphism of these genes at some local Ukrainian breeds, such as Ukrainian White Head cattle (UWH), Ukrainian Gray cattle (UG) and Polish red cattle (PR).

Among these breeds UG is most ancient. On morphological and productive data, the UG is supposed to derive directly from the wild type of cattle. During long time UG was not exposed to improving selection and that's why its genofond is exceptional. UWH breed of cattle was emerged from autochtone UG breed. Conversely UWH breed was intensively selected for milk yield last time. PR breed of cattle, included in the FAO "Preservation of Animal Genomic Resources", is also exposed for intensive selection for milk and meat yield. All these breeds are distinguishing by high fertility, high resistance to diseases and low feed requirements.

**MATERIAL AND METHODS**

The analysis was covered 190 cows and heifers of Ukrainian local breeds of cattle. Investigation of MSTN, CASK, BLG and LEP gene polymorphism was performed with PCR-RFLP technique as described by Zietkiewicz *et al.* (1994). For CASK, LEP, and BLG genes the primer sequences, amplification conditions and restriction nucleases were those described by Kaminski and Figel (1993), Pomp D. *et al.* (1997) and Medrano and Aquilar-Cordova (1990) respectively. For analysing of MSTN gene polymorphism two pairs of primers accordingly to Grobet *et al.* (1997, 1998) were designed: first one - for revealing 11-bp deletion in the 3-rd exon of the MSTN gene (*nt821-del11*) caused double muscling in the Belgian Blue cattle and second one - for revealing G-A transition in the same region (*C313Y*), that is typical for Piedmontese animals.

## RESULTS AND DISCUSSION

The results obtained in this study show significant difference in allele frequency of genes investigated between Ukrainian autochtone breeds of cattle. The most significant frequency of leptin allele B was found at UWH cattle (0.239). At UG and PR cattle it was around 0.05. Accordingly to our data rare and most valuable C-variant of the leptin gene exists only in AC combination. It was found at UWH cattle (0.022) and PRcattle (0.125).

For BLG-loci the most significant frequency of B-allele was found at UG (0.692) and PR (0.721). Among existing allele variants of BLG gene B-allele is considered as most valuable.

**Table 1. Number of animals classified according to LEP, BLG, CASK-genotypes and allele frequencies**

Breeds	leptin			β-lactoglobulin			kappa-kasein		
	Geno-type	n	Allele frequency	Geno-type	n	Allele frequency	Geno-type	n	Allele frequency
<b>Gray Ukrainian</b>	AA	16	A -0.944	AA	4	A -0.308	AA	4	A 0.544
	AB	2	B -0.056	AB	8	B -0.692	AB	23	B -0.446
				BB	14		BB	1	
	total	18		total	26		total	28	
<b>Ukrainian White head</b>	AA	12	A -0.739	AA	6	A -0.500	AA	19	A -0.793
	AB	9	B -0.239	AB		B -0.500	AB	8	B -0.207
	BB	1	C -0.022	BB	15		BB	2	
	AC	1			6				
	total	23		total			total		
								29	
					27				
<b>Red Polish (Ukraine)</b>	AA	8	A -0.833	AA	5	A -0.279	AA	10	A -0.615
	AB	1	B -0.042	AB	19	B -0.721	AB	28	B -0.385
	AC	3	C -0.125	BB	28		BB	1	
	total	2		total	52		total	39	

As to polymorphism of kappa-kasein gene at animals tested in present study - the highest frequency of allele B was mentioned at GU cattle : (0.446) and PR cattle (0.385). Gene of kappa-kasein is highly variable within the milk cattle. Today there are known numerous variants of this gene (A,B,C,E,F,G,H,I,A1) (Prinzenberg et al. 1999). Among them B-variant of protein have been recognized as superior for milk quality in European cattle breeds. Accordingly to our data high frequency of allele B is typical for autochtone breeds of cattle probably due to their traditionally conserved breeding. In contrast to UG and PR cattle B allele frequency at UWH cattle (0.207), is more typical for commercial breeds, as holstein cattle whose index is closer to 0.150-0.239 (Glazko *et al.*, 2001 ; Zhuravel *et al.*, 1998).

Gene of myostatin is a potentially useful target for genetic manipulation. The number of mutation found suggest that myostatin is a highly variable within the beef cattle (Karim *et al.*, 2000) and mutations of MSTN gene are wide-spread not only in double-musced breeds of cattle but also in other breeds at carriers-heterosygotes (Oblap *et al.*, 2001). The 11-bp deletion

responsible for double-muscling in the Belgian Blue cattle was found only at 8 cattle of PR breed among 131 animal tested and C313Y mutation at 34 animal tested from the same breed was not found at all.

### CONCLUSION

The results of genetic monitoring of Ukrainian autochtone breeds of cattle clearly show that its genofond can be successfully used in practical breeding for meat yield and milk composition improving. It is necessary to take in consideration that conditions of maintenance and reproduction for cattle in Ukraine don't correspond to west standarts and sufficiently long time these conditions will be difficult. In this aspect the questions of cattle breeds adaptation to local and environmental conditions and their low feed requirements acquire notable importance. Due to this fact the local breeds of cattle may be valuable genetical source. In this context the study presented can make an important contribution to our understanding of genetic specificity of local breeds of Ukrainian cattle and creation cattle selection strategy in Ukraine for next years.

### REFERENCES

- Zietkiewicz, E., Rafalski, A. and Labuda, D. (1994) *Genomics* **20** : 176.
- Kaminski, S. and Figiel, L. (1993) *Genet. Pol.* **34** : 65-72.
- Pomp, D., Zou, T., Clutter, A.C. and Barendse W. (1997) *J. Anim. Sci.* **75** : 1427.
- Medrano, J.F. and Aquilar-Cordova, E. (1990) *Anim. Biotech.* **1** : 73-77.
- Grobet, L., Martin, L.J.R., Poncelet, D., Pirrotin, D., Brouwers, B., Riquet, J., Schoeberlein A., Dunner, S., Menissier, F., Massabanda, J., Friers, R., Hansert, R. and Georges, M. (1997) *Nature Genet.* **17** :71-74.
- Grobet, L., Poncelet, D., Royo, L.J., Brouwers, B., Pirrotin, D., Micyaux, C.H., Menissier, F., Zanotti, M., Dunner, S. and Georges, M. (1998) *Mamm. Genome* **9** : 210-213.
- Prinzenberg, E.M., Krause, I. and Erhard, G. (1999) *Anim. Biotech.* **10** : 49-62.
- Glazko, V.I., Oblap, R.V., Zwierzchowski, L. and Tarasiuk, S.I. (2001) *Cytol.and Genet.* **2** : 19-25.
- Zhuravel, E.V., Glazko, V.I. and Filenko, A.L. (1998) *Agroecol. Biotech.* **2** : 305-315.
- Karim, L., Coppieters, W., Grobert, L., Valentini, A. and Georges, M. (2000) *Anim. Genet.* **31** : 396-399.
- Oblap, R.V., Tryapitcina, N.V. and Glazko, V.I. (2001) *Herald Agrosci.* **2** : 57.