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GENOTYPE X DIET INTERACTIONS WITH MEAT MASS OF MAIN CARCASS PARTS IN BROILER CHICKENS

INTERAKCIJE GENOTIP X SUSTAVA HRANIDBE KOD MASE MESA OSNOVNIH DIJELOVA TRUPA BROJLERSKIH PILIĆA

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SUMMARY

This paper examines genotype x diet interactions with meat mass of main carcass parts (breast, drumstick and thigh) in broiler chickens. The study was conducted in chickens of proveniences Cobb 500 and Hubbard Classic, which were fed variety of energy - protein feed mixtures (mixture I – energy stronger with higher E:P ratio and mixture II – protein stronger with lower E:P ratio). Chickens were fattened to 49 days of age. Randomly selected chickens were sacrificed and processed in dressing percentage "ready for grilling" at the end of 35^{th}, 42^{nd} and 49^{th} day of age. Each carcass was separated at the most important edible parts. Their yields and share were determinate and put in relationship with body weight before the slaughtering. The existence of interactions was confirmed in chickens of same age, the analysis of variance in Statistic computer program, subprogram ANOVA, while the definition of treatments where interaction appeared was proven by LSD test at the level of 0.01% accuracy. Genotypes x diet interactions were demonstrated in all age groups only in the analysis of breast meat mass. Cobb chickens fed mixture I on 42^{nd} and 49^{th} days of age and those fed mixture II on 35^{th} day of fattening had significantly more breast meat than Hubbard chickens. The interaction in mass of drumstick meat was proven on 35^{th} day of age, while in mass of thigh meat it was demonstrated in the last week of fattening. Cobb chickens fed protein stronger meal had significantly more meat on drumstick, while chickens fed energy stronger mixture appeared to have more mass of meat on thigh. Hubbard chickens that used mixture II had insignificant greater mass of meat in most important parts of carcass during the 35^{th} and 42^{nd} days of fattening.

Genotype x diet interactions are responsible for no more than 2% of the total variations, but although the influence is rather weak, they should be implemented in most of the analyses.

Key words: genotype x diet interactions, main parts of carcass, meat mass, broiler chickens

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INTRODUCTION

The study on interactions in poultry production became very important in the fifties of last century, particularly in the period when a small number of poultry selection houses began to create new lines, distributed all over the world to realize their genetic potential in different environment conditions.

From the most current available literature, the interaction genotype x diet in broiler chickens had no significant effect in the published work of Horn et al. (1987). On the contrary, Sorenson (1977), Cherry et al. (1987) and Orban and Roland (1990) found highly significant genotype x diet interactions. The existence of these interactions has been confirmed by researchers Marks and Britton (1978) and Iotsius and Danius (1984) and Nikolova (2007).

Smith et al. (1998) found the impact of genotype x diet interactions on body weight of chickens, feed consumption and some slaughter parameters (the carcass mass, the proportion of breast and abdominal fat mass). In the research of Corzo et al. (2005), the effect of diet x line interaction was observed on the 28th day of age, when differences emerged in the growth of different lines fed mixtures of different protein value, which proves that the lines of chickens fed high protein mixtures had better feed conversion. On 42nd day of chicken age, line x diet interactions occurred in the fillet and share of breast meat. Lines that were fed high protein feed had a better share in contrast to the other lines in various combinations of feed.

The interactions between genotype and diet clearly exist. Cherry et al. (1978) and Have et al. (1981) found that the influence of diet on the deposition of fat is not the same for different genotypes. Practically the effects of energy: protein ratio in diet on the fat deposition showed significant differences between the lines.

The aim of this study was to determine the existence of genotype x diet interactions in meat mass of major parts of carcass (breast, drumstick and thigh) under the influence of different energy and protein diets in broiler chickens with different genotypes.

MATERIAL AND METHODS

The analysis was conducted in chickens of Cobb Classic 500 and Hubbard Classic proveniences, that were fed a variety of energy and protein mixtures (mixture I - energy stronger with higher E: P ratio and mixture II - protein stronger and lower E: P ratio, table 1). Chickens were fattened 7 weeks and at the end of 5th, 6th and 7th week randomly selected chickens were sacrificed and processed in dressing percentage "ready for the grill."

Tablica 1. Kemijski sastav i nutritivna vrijednost smjese 1 i smjese 2 za hranidbu brojlera
Table 1. Chemical composition and nutritive value of mixture 1 and mixture 2 for broiler diet

Kemijski sastav Chemical composition	Starter (1-2 ned.) Starter (1-2 wk.)	Grover (3 ned.) Grower (3 wk.)	Finišer 1 (4-5 ned.) Finisher 1 (4-5 wk.)	Finišer 2 (6-7 ned.) Finisher 2 (6-7 wk.)
Smjesa 1, Mixture 1				
ME, kcal/kg	3069,08	3197,20	3225,20	3212,30
Sirove bjelančevine,% Crude protein, %	23,03	22,04	21,06	19,20
Odnos energija : bjelančevine Energy : Protein ratio	133,27	145,04	153,14	167,35
Smjesa 2 - Mixture 2				
ME, kcal/kg	3047,38	3107,70	3099,52	3100,58
Sirove bjelančevine,% Crude protein, %	23,54	22,55	22,02	21,95
Odnos energija : bjelančevine Energy : Protein ratio	129,47	137,83	140,76	141,24

Each carcass was separated at the most important edible parts. Their yields and share were determinate and put in relationship with body weight before the slaughtering. The existence of interactions was tested by chickens of the same age, analysis of variance in computer program Statistic, subprogram ANOVA, and the definition of treatment in which the interaction appeared was proven by LSD test at the 0.01% accuracy.

RESULTS AND DISCUSSION

The mass of chicken breast meat of different genotypes and different systems of feeding is shown in Table 2.

In the chickens of 35th day of age, the largest meat mass from the breast was obtained in the Cobb 500 chickens fed mixture II (250.14 g), and the lowest in Hubbard chickens fed mixture I (214.86 g). Cobb 500 chickens fed mixture II were significantly higher in breast meat than chickens fed Hubbard mixture I, but both genotypes fed protein stronger meals had more breast meat.

Cobb 500 chickens fed mixture I had the highest mass of breast meat on 42nd and 49th day (340.36 g and 469.04 g). At the same time the least meat in chicken's breasts on 42nd day of age was established in Hubbard chickens that were fed mixture I (312.97 g). Hubbard chickens fed protein stronger meal had the lowest breast meat mass on 49th of age (390.43 g).

Tablica 2. Interakcije genotip x sustava hranidbe kod mase mesa prsa
Table 2. Genotype x diet interactions in the mass of breast meat

Dob/Učinak - Age/Effect	X	S.D.	Interakcija Interaction
35. dan, 35 day			
Cobb 500-smjesa I, mixture I	238,67	36,61	ab
Cobb 500-smjesa II, mixture II	250,14	40,46	a
Hubbard-smjesa I, mixture I	214,86	32,37	b
Hubbard-smjesa II, mixture II	236,86	51,57	ab
Interakcije genotip x smjesa Genotype x diet interactions	*		
42. dan			
Cobb 500-smjesa I, mixture I	340,36	36,32	a
Cobb 500-smjesa II, mixture II	313,17	28,18	b
Hubbard-smjesa I, mixture I	312,97	48,48	b
Hubbard-smjesa II, mixture II	315,37	39,72	b
Interakcije genotip x smjesa Genotype x diet interactions	*		
49. dan, 49 day			
Cobb 500-smjesa , mixture I	459,04	50,94	a
Cobb 500-smjesa II, mixture II	411,38	60,03	b
Hubbard-smjesa I, mixture I	397,56	44,35	b
Hubbard-smjesa II, mixture II	390,43	52,00	b
Interakcije genotip x smjesa Genotype x diet interactions	*		

Cobb 500 chickens fed energy stronger meal had significantly more breast meat than the other tested group of chickens.

The weight of chicken drumstick meat with different genotypes and different system of feeding is shown in Table 3.

In chickens slaughtered on 35th day of fattening, the largest mass of meat from drumstick was obtained in the Cobb 500 chickens fed mixture II (97.87 g), and the lowest in Hubbard chickens fed mixture I (82.76 g). Cobb 500 chickens fed protein stronger meals had significantly more meat on the drumstick than the Cobb 500 and Hubbard chickens fed with mixture I. Hubbard chickens fed with mixture II (96.45 g) had significantly more drumstick meat then the Hubbard chicken fed mixture I.

Differences in meat mass of chicken drumstick of various genotypes and feeding systems were not statistically significant on 42nd and 49th days of fattening.

The weight of chicken meat of thigh in different genotypes and different systems of feeding is shown in Table 4.

Tablica 3. Interakcije genotip x sustava hranidbe kod mase mesa bataka
Table 3. Genotype x diet interactions in the mass of drumstick meat

Dob/Učinak - Age/Effect	X	S.D.	Interakcija Interaction
35. dan, 35 day			
Cobb 500-smjesa I, mixture I	86,58	10,91	b
Cobb 500-smjesa II, mixture II	97,87	24,37	a
Hubbard-smjesa I, mixture I	82,76	11,56	bc
Hubbard-smjesa II, mixture II	96,45	18,54	ab
Interakcija genotip x smjesa Genotype x diet interactions	*		
42. dan, 42 day			
Cobb 500-smjesa I, mixture I	121,10	15,97	N.S.
Cobb 500-smjesa II, mixture II	115,45	14,81	N.S.
Hubbard-smjesa I, mixture I	118,20	14,58	N.S.
Hubbard-smjesa II, mixture II	130,23	22,81	N.S.
Interakcije genotip x smjesa Genotype x diet interactions	N.S.		
49. dan, 49 day			
Cobb 500-smjesa I, mixture I	155,74	23,15	N.S.
Cobb 500-smjesa II, mixture II	151,30	24,16	N.S.
Hubbard-smjesa I, mixture I	150,83	21,40	N.S.
Hubbard-smjesa II, mixture II	144,55	15,57	N.S.
Interakcije genotip x smjesa Genotype x diet interactions	N.S.		

Tablica 4. Interakcije genotip x sustava hranidbe kod mase mesa zabataka
Table 4. Genotype x diet interactions in the mass of thigh meat

Dob/Učinak - Age/Effect	X	S.D.	Interakcija, Interaction
35. dan, 35 day			
Cobb 500-smjesa I, mixture I	114,03	16,88	N.S.
Cobb 500-smjesa II, mixture II	118,46	23,43	N.S.
Hubbard-smjesa I, mixture I	105,55	15,55	N.S.
Hubbard-smjesa II, mixture II	118,38	24,60	N.S.
Interakcije genotip x smjesa Genotype x diet interactions	N.S.		
42. dan, 42 day			
Cobb 500-smjesa I, mixture I	156,30	18,63	N.S.
Cobb 500-smjesa II, mixture II	146,31	15,90	N.S.
Hubbard-smjesa I, mixture I	147,89	17,45	N.S.
Hubbard-smjesa II, mixture II	149,88	18,38	N.S.
Interakcije genotip x smjesa Genotype x diet interactions	N.S.		
49. dan, 49 day			
Cobb 500-smjesa I, mixture I	207,36	27,89	a
Cobb 500-smjesa II, mixture II	186,66	20,88	b
Hubbard-smjesa I, mixture I	185,28	21,47	b
Hubbard-smjesa II, mixture II	177,16	21,29	b
Interakcije genotip x smjesa Genotype x diet interactions	*		

Between chickens slaughtered on 35th and 42nd days of age there were differences in the mass of thigh that were not at the level of statistical significance. Cobb 500 and Hubbard chickens fed mixture I had insignificantly more thigh meat. Chickens slaughtered on 49th day had the largest mass meat of thigh and was obtained from Cobb 500 chickens fed mixture I (207.36 g), and the lowest in Hubbard chickens with mixture II (177.16 g). Cobb 500 chickens fed energy stronger meal and greater E:P ratio had a significantly higher thigh meat mass than the other examined groups of chickens.

Mass of breast meat, mass of thigh meat and mass of drumstick meat are characteristics of medium variability.

In this paper, the impact of genotype x diet interactions on breast meat mass on 35th, 42nd and 49th days of age was determined. These results are in accordance with the comparison results of Corso et al. (2005) who say that at 42 days of age chickens line x food interactions occurred in the fillets and share of breast meat. Lines that were fed with high protein meals had a better share of meat in contrast to other lines. That can be concluded in this investigation into Hubbard chickens on 42nd day of age that used mixture II.

In the mass of drumstick meat, the genotypes x nutrition system interactions were exhibited only on 35th, while in the mass of thigh meat on 49th day of fattening. In other age groups no significant differences of interactions were founded.

Shanin and Elazeem (2005) have not found significant genotype x diet interactions in the proportions of main parts of broiler carcass and the proportion of total meat, muscle and fat in different main parts of carcass. The significant differences were determined by the proportion of total bones in the main parts of carcass, which points to the fact that influence of diet was based on the genetic line of chickens.

CONCLUSIONS

Based on the conducted research on genotype x diet interactions on meat mass of basic carcass parts in Cobb 500 and Hubbard Classic lines of broiler chickens, one might conclude the following:

• Genotype x diet interaction was expressed in all ages (35^{th}, 42^{nd} and 49^{th} days) only in mass of breast meat of the broiler carcass. Cobb chickens fed mixture I (energy stronger with higher E:P ratio) on 42^{nd} and 49^{th} days, and mixture II (protein stronger with lower E:P ratio) on 35^{th} day of fattening had significantly more breast meat than Hubbard chickens.

• Significant interaction in mass of drumstick meat was proven on 35^{th} day of age, while in mass of thigh meat it was demonstrated in the last week of fattening. Cobb chickens fed protein stronger meal had significantly more meat on drumstick, while chickens fed energy stronger mixture appeared to have more mass of meat on thigh. Hubbard chickens that used mixture II had insignificantly greater mass of meat in most important parts of carcass during the 35^{th} and 42^{nd} days of fattening.

Genotypes x diet interactions, however, are responsible for no more than 2% of the total variation. This illustrates that the absolute impact of genotype x diet interaction is rather weak, however, in different considerations should be taken. In view of the fact that broiler production consists of various lines raised in different systems of nutrition, in order to better understand this issue, it is considered necessary and reasonable to undertake new research into genotype x diet interactions.

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SAŽETAK

U ovom se radu razmatra interakcija genotip x sustava hranidbe kod mase mesa važnijih dijelova trupa (prsa, bataka i zabataka) kod brojlerskih pilića. Ispitivanje je provedeno kod pilića provenijencije Cobb 500 i Hubbard Classic koji su hranjeni različitim energetsko - proteinskim krmnim smjesama (smjesa I - energetski jača i s većim odnosom E:P i smjesa II - proteinski jača i s manjim odnosom E:P). Pilići su tovljeni 7 tjedana i krajem 5, 6 i 7 tjedna slučajno odabrani pilići su žrtvovani i obrađeni randmanom "pripremljeno za roštilj". Svakom trupu izdvojeni su najvažniji jestivi dijelovi, utvrđeni su njihovi prinosi i udjel, stavljeni u odnosu na živu masu pilića prije klanja. Postojanje interakcija je provjereno kod pilića istog uzrasta, analizom varijance u komjutorskom programu Statistica, podprogram Anova, dok se definiranje tretmana kod kojih se pojavila interakcija dokazivalo LSD testom na razini 0,01% točnosti. Interakcije genotip x hranidba ispoljile su se u svim uzrastima jedino kod analize mase prsnog mesa. Pilići genotipa Cobb hranjeni smjesom u sustavu I 42 i 49 dana i smjesom u sustavu II 35 dana tova imali su značajno više prsnog mesa u odnosu na piliće Hubbard. Kod mase mesa bataka interakcije su dokazane u dobi od 35 dana, dok su se kod mase mesa zabataka ispoljile u zadnjem tjednu tova. Pilići Cobb, koji su uzimali krmnu smjesu u sustavu II imali su značajno više mesa na batacima, dok su se kod pilića hranjenih krmnom smjesom u sustavu I pojavile veće količine mesa na zabatcima. Hubbard pilići koji su uzimali proteinski jaču smjesu imali su neznačajno veću masu mesa važnijih dijelova trupa u 35 i 42 danu tova. Interakcije genotip x hranidba, odgovorne su za ne više od 2% ukupnih varijacija, ali iako je učinak prilično slab, njega treba primjenjivati u većini analiza.

Ključne riječi: interakcije genotip x sustava hranidbe, osnovni dijelovi trupa, masa mesa, brojlerski pilići.