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## UTJECAJ KALPASTATIN (*CAST*) GENOTIPA NA KVALITATIVNA SVOJSTVA HIBRIDNIH SVINJA

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Disertacija <sup>(2)</sup>

Istraživanje je provedeno na 90 tovljenika (45 nazimica i 45 kastrata) križanaca PIC337xC23. Svinje su uzgojene u testnoj stanici „Kozarac“ i hranjene smjesama koje su sadržavale 13,58 MJ/ME i 17,36 % sirovih proteina u razdoblju do 30 kg žive mase; 13,26 MJ/ME i 16,05 % sirovih proteina u razdoblju od 30 do 70 kg žive mase te 12,95 MJ/ME i 14,06 % sirovih proteina od 70 kg žive mase do kraja tova. Hranidba je bila *ad libitum*. Tijekom tova jedna je svinja uginula. U dobi od 169 dana (prosječno 110 kg žive mase), 183 dana (prosječno 130 kg žive mase) i 197 dana (prosječno 150 kg žive mase) svinje su žrtvovane. Na liniji klanja i u laboratoriju utvrđena su sljedeća svojstva polovica i kvalitete mesa: duljine polovica „a“ i „b“, duljina i opseg buta, indeks buta, debljina mišića i ledne slanine prema „DT“ metodi, površina lednoga mišića i pripadajuće mu slanine, pH<sub>45</sub> i pH<sub>24</sub> u *m. longissimus dorsi* i *m. semimembranosus*, EC<sub>45</sub> i EC<sub>24</sub> na istim mjestima i u isto vrijeme kao i pH vrijednosti, boja mesa (CIE L\* a\* b\*), otpuštanje mesnoga soka, kalo kuhanja, instrumentalna nježnost (WBSF) i aktivnost ukupnoga kalpaina. Kemijski sastav lednoga mišića utvrđen je NIR spektrofotometrijom. Polimorfizmi na *CAST* genu utvrđeni su PCR-RFLP metodom uporabom *HinfI*, *MspI* i *RsaI* restrikcijskih endonukleaza. Za svaki od navedenih lokusa utvrđena su po tri genotipa te su imenovani na sljedeći način: AA, AB i BB za *CAST/HinfI* lokus; CC, CD i DD za *CAST/MspI* lokus te EE, EF i FF za *CAST/RsaI* lokus. Statistička je analiza pokazala da je klaonička masa visoko signifikantno ( $p < 0,001$ ) utjecala na sva svojstva polovica, gdje su se skupine svinja međusobno razlikovale u svim mjeranim svojstvima. Povećanje dobi/klaoničke mase poželjno je utjecalo na pH<sub>24</sub> u *m. longissimus dorsi* i *m. semimembranosus*, CIE L\* i CIE a\* te otpuštanje mesnog soka i kalo kuhanja. Skupine srednje teških i teških svinja imale su veće vrijednosti WBSF u odnosu na skupinu lakih svinja. Zabilježen je, također, i značajan utjecaj završne mase na kemijski sastav mesa istraživanih svinja. Ispitivanjem utjecaja mase tople polovice na svojstva polovica i mesa istraživanih svinja utvrđeno je da je masa tople polovice visoko značajno ( $p < 0,001$ ) utjecala na sva mjerena svojstva polovica, kao i na pH<sub>24</sub> u lednome mišiću te CIE L\* i CIE a\* vrijednosti i otpuštanje mesnoga soka, dok je značajan utjecaj ( $p < 0,05$ ) zabilježen za EC<sub>45</sub> u butu i lednome mišiću, pH<sub>24</sub> u butu, CIE b\* i kalo kuhanja. Masa

tople polovice također je utjecala ( $p < 0,1$ ) na aktivnost kalpaina i udio IMM u istraživanih svinja. *CAST/HinfI* lokus visoko je signifikantno ( $p < 0,001$ ) utjecao na sva mjerena svojstva polovica, pri čemu je genotip AB imao najveću duljinu polovica („a“ i „b“), najdulji but, najveći opseg buta, najveću površinu i debljinu mišića te najmanju debljinu slanine. Visoko signifikantan ( $p < 0,001$ ) utjecaj toga lokusa utvrđen je i za pH<sub>24</sub> u *m. longissimus dorsi*, CIE L\* i CIE a\* vrijednosti, dok je značajan ( $p < 0,05$ ) utjecaj utvrđen za EC<sub>45</sub> u lednome mišiću, pH<sub>24</sub> u butu, CIE b\*, otpuštanje mesnoga soka i kalo kuhanja. Razlike ( $p < 0,1$ ) između genotipova utvrđene su za pH<sub>24</sub> mjerene u *m. longissimus dorsi*. Mutacija utvrđena *HinfI* restrikcijskom endonukleazom utjecala je ( $p < 0,1$ ) na IMM u mesu istraživanih svinja. *CAST/MspI* lokus visoko je signifikantno ( $p < 0,001$ ) utjecao na svojstva polovica istraživanih svinja, a statistički značajne razlike ( $p < 0,05$ ) između genotipova utvrđene su za debljinu ledne slanine i njezinu površinu. Statistička je analiza pokazala visoko značajan utjecaj ( $p < 0,001$ ) *MspI* lokusa na pH<sub>24</sub> u lednome mišiću te CIE L\* i CIE a\* vrijednosti te značajan utjecaj ( $p < 0,05$ ) na pH<sub>24</sub> u butu, CIE b\*, otpuštanje mesnoga soka i kalo kuhanja. *MspI* mutacija je utjecala ( $p < 0,1$ ) i na EC<sub>45</sub> u butu i lednome mišiću te EC<sub>24</sub> u lednome mišiću. Usporedbom genotipova utvrđene su statistički značajne razlike ( $p < 0,05$ ) za CIE b\* vrijednosti. *CAST/MspI* lokus nije utjecao na kemijski sastav istraživanih polovica. *CAST/RsaI* lokus je visoko signifikantno ( $p < 0,001$ ) utjecao na svojstva polovica istraživanih svinja, pri čemu su statistički značajne razlike između pojedinih genotipova utvrđene za opseg buta, indeks buta, površinu i debljinu ledne slanine. Analiza svojstava kvalitete mesa pokazala je da je *RsaI* lokus visoko statistički značajno ( $p < 0,001$ ) utjecao na pH<sub>24</sub> u *m. longissimus dorsi* te CIE L\* i CIE a\*. Značajan utjecaj ( $p < 0,05$ ) toga lokusa utvrđen je za pH<sub>45</sub> i pH<sub>24</sub> u butu, EC<sub>45</sub> u butu, otpuštanje mesnoga soka, kalo kuhanja te aktivnost kalpaina. Isti je lokus utjecao na WBSF vrijednosti na razini  $p < 0,1$ . Genotipovi na *RsaI* lokusu međusobno su se značajno ( $p < 0,05$ ) razlikovali u pH<sub>45</sub> i pH<sub>24</sub> vrijednostima mjeranim u butu aktivnostima kalpaina, a postojanje razlika ( $p < 0,1$ ) između genotipova utvrđeno je i za EC<sub>45</sub> u butu te instrumentalnu nježnost. *RsaI* lokus je utjecao ( $p < 0,1$ ) na relativni udio intramuskularne masti u *m. longissimus dorsi* istraživanih svinja, a usporedbom *CAST/RsaI* genotipova utvrđene su razlike ( $p < 0,1$ ) u relativnim udjelima masti i kolagena.

Ključne riječi: svinje, sastav trupa, kvaliteta mesa, *CAST* genotip

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## INFLUENCE OF CALPASTATIN (CAST) GENOTYPE ON HYBRID PIGS QUALITY TRAITS

### Doctoral thesis

The investigation was carried out on 90 (45 gilts and 45 barrows) PIC337xC23 crossbred pigs raised at the "Kozarac" test farm. The pigs were fed *ad libitum* with three different diets consisting 13.58 MJ/ME and 17.36 % CP up to 30 kg LW; 13.26 MJ/ME and 16.05 % CP from 30 kg to 70 kg LW and 12.95 MJ/ME and 14.06 % CP from 70 kg LW to final slaughter weight. During the fattening period one animal died. At the age of 169 days (approximately 110 kg LW), 183 days (approximately 130 kg LW) and 197 days (approximately 150 kg LW) pigs were slaughtered. Measures of carcass and meat quality traits taken at the slaughter line and in laboratory were as follows: carcass lengths "a" and "b", ham length and its circumference, muscle and fat thickness according to "Two points" method, LD muscle area and area of belonging fat, pH<sub>45</sub> and pH<sub>24</sub> in ham and LD muscle, EC<sub>45</sub> and EC<sub>24</sub> at the same time and in the same places as pH measures, meat colour (CIE L\* a\* b\*), drip loss, cooking loss, instrumental tenderness (WBSF) and total calpain activity. Chemical composition of *m. longissimus dorsi* was determined by NIR spectrophotometer. Polymorphisms at CAST gene were determined by PCR-RFLP method using *HinfI*, *MspI* and *RsaI* restriction endonuclease. Three genotypes were determined for each of the loci. The genotypes were named AA, AB and BB for CAST/*HinfI* locus; CC, CD and DD for CAST/*MspI* locus and EE, EF and FF for CAST/*RsaI* locus. Statistical analysis showed that slaughter weight had highly significant influence ( $p < 0.001$ ) on all carcass and meat quality traits of investigated pigs. Increasing of age/slaughter weight had desirable influence on pH<sub>24</sub> of ham and LD muscle, CIE L\*, CIE a\*, drip loss and cooking loss. "Medium" and "Heavy" weight groups had higher WBSF values than "Light" weight group of pigs. Slaughter weight influenced significantly chemical composition of the investigated pigs. Hot carcass weight had highly significant influence ( $p < 0.001$ ) on all carcass traits, as well as pH<sub>24</sub> in LD muscle, CIE L\*, CIE a\* and drip loss. Significant ( $p < 0.05$ ) influence of hot carcass weight was found for EC<sub>45</sub> in ham and LD muscle, pH<sub>24</sub> in ham, CIE b\* and cooking loss. Hot carcass weight also influenced ( $p < 0.1$ ) intramuscular fat content of the investigated pigs. Highly significant influence ( $p < 0.001$ ) on all carcass traits was found for CAST/*HinfI* locus where AB genotype had the longest carcasses ("a" and "b" lengths), longest ham, biggest ham circumference, largest LD muscle area and muscle thickness as well as the thinnest back fat. Highly significant ( $p < 0.001$ ) influence of this locus on pH<sub>24</sub> in LD muscle, CIE L\* and CIE a\* was found while on EC<sub>45</sub> in LD muscle, pH<sub>24</sub> in ham, CIE b\*, drip loss and cooking loss the influence was significant ( $p < 0.05$ ). Genotypes diffe-

red ( $p < 0.1$ ) only in pH<sub>24</sub> values measured in *longissimus* muscle. *HinfI* mutation influenced ( $p < 0.1$ ) intramuscular fat content of the investigated pigs.

CAST/*MspI* locus had highly significant influence ( $p < 0.001$ ) on all carcass traits; genotypes significantly ( $p < 0.05$ ) differed in backfat thickness and fat surface above LD muscle. Statistical analysis showed highly significant ( $p < 0.001$ ) influence of *MspI* locus on pH<sub>24</sub> in LD muscle, CIE L\* and CIE a\*, as well as significant ( $p < 0.05$ ) influence on pH<sub>24</sub> in ham, CIE b\*, drip loss and cooking loss. *MspI* mutation also influenced ( $p < 0.1$ ) EC<sub>45</sub> in ham and LD muscle as well as EC<sub>24</sub> in LD muscle. Comparison of the genotypes on this locus showed that they significantly ( $p < 0.05$ ) differed in CIE b\* values. CAST/*MspI* locus did not influence chemical composition of the investigated pigs. All of the investigated carcass traits and genotypes were influenced by CAST/*RsaI* locus. The genotypes differed significantly in ham circumference, ham index, backfat thickness and fat surface above LD muscle. Analysis of meat quality traits showed highly significant ( $p < 0.001$ ) influence of this locus on pH<sub>24</sub> in LD muscle, CIE L\* and CIE a\*. It also significantly ( $p < 0.05$ ) influenced pH<sub>45</sub> and pH<sub>24</sub> in ham, EC<sub>45</sub> in ham, drip loss, cooking loss and calpain activity. This locus also influenced ( $p < 0.1$ ) WBSF. Genotypes at *RsaI* locus differed significantly ( $p < 0.05$ ) in pH<sub>45</sub> and pH<sub>24</sub> in ham, as well as in calpain activity, whereas existence of differences ( $p < 0.1$ ) was determined for EC<sub>45</sub> in ham and WBSF values. This locus influenced ( $p < 0.1$ ) intramuscular fat content of the investigated pigs; genotypes differed ( $p < 0.1$ ) in intramuscular fat and collagen content.

Key-words: pigs, carcass traits, meat quality traits, CAST genotype