INSULIN-LIKE GROWTH FACTOR 2 GENE STATUS IN THE SOUTH AFRICAN PIG POPULATION

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Abstract – The Insulin-like growth factor 2 gene is located on porcine chromosome 2 and a single nucleotide polymorphism (SNP) at intron 3 of this gene has been reported to have large effects on certain carcass quality traits such as lean meat. Several studies have indicated the use of this paternally expressed gene to produce leaner boars from fatter sows. The aim of this study was to determine the IGF2-gene status of the breeding boars of the South African pig population (Phase 1) and then to correlate the specific genotypes (A/A, A/G and G/G) with meat quality characteristics. In Phase 1 of this study, the SA Landrace has shown a higher percentage of G/G (wild type) genotype.

Key Words – Lean meat, Genotypes, Porcine

- INTRODUCTION

South African pig breeders are faced with the challenge of breeding leaner pigs. There are approximately 350 commercial pork producers in South Africa. About 50% of the production is used for processing products such as sausages, bacon and other products. The consumption of pork has overtaken that of lamb/mutton, South Africa's agricultural statistics show [7]. There is great scope in South Africa to increase pork production and consumption. The genetics of pig breeding is studied intensively in order to produce pork for human consumption that is mainly free of fat. IGF2-gene plays an important role in muscle growth in pigs. The IGF2 gene is located on porcine chromosome 2 and a single nucleotide polymorphism (SNP) in intron 3 of this gene has been reported to have large effects on certain carcass quality traits such as lean meat content [2, 3]. Several studies have also described the use of this paternally expressed gene to produce leaner boars from fatter sows [1, 5, 6]. The test for IGF2 gene allows for knowing if the pig has the gene for leanness or fatness and accurately detects the genetic mutation associated with meat quality. Both genotypes can be useful to breeders allowing them to make informed decisions for selection of breeding stock. Future success for the pig industry will require efficient growth with good quality meat or perhaps optimizing meat quality at the lowest production costs. The initiation of IGF2 testing in South Africa thus becomes imperative for South African commercial pork producers and the industry at large. The aim of this study is to evaluate the frequency of the IGF2 gene in the stud and commercial population in SA (Phase 1) and then to study the effect of the different genotypes on carcass quality traits such as pH, back fat thickness, intra muscular fat and water-holding capacity (Phase 2). Only phase 1 results are presented in this paper

- MATERIALS AND METHODS

For phase one of the genetic screening for the IGF2 gene, 412 hair samples representing the SA Landrace, Large White, Duroc, Pietrain, Chester White and Kolbroek were analysed (Table 1). These samples were representative of the different breeders in all regions across South Africa. The laboratory assay consisted of the DNA extraction from hair roots, followed by Real-Time PCR using the Applied Biosystems 7500 instrument, analysis and interpretation. DNA was extracted from the hair roots using the phenol/chloroform/isoamylalcohol procedure [4]. The DNA was quantified using the Qubit 2.0 fluorometer instrument from Invitrogen. Primer

Express software version 3.0. for primer and probe design was used. The specific primers for IGF2-gene were 5'- CAAGTCCGAGAGGGACGTGT -3' (IGF2-F) and 5'-CCAGGTGTCATAGCGGAAGAA 3' (IGF2-R). The IGF2 probe sequence was 5'-CCGACCGTGCTTCCGGACAACTT-3'. The PCR program used included a Pre-PCR read step at 60 ºC for 30 sec, followed by a holding stage at 95 ºC for 10 min, a cycling stage at 95 ºC for 15 min with an extension step at 60 ºC for 1 min. Forty five cycles of this 3-step procedure was performed. Controls with known genotypes (AA, GG and A/G) as well as no template controls were included in each run.

Table 1 Breed and sample numbers

Breed	Number of samples
Large White	145
SA Landrace	91
Duroc	38
Pietrain	24
Chester	3
Composite	100
Kolbroek	11
Total	412

- RESULTS AND DISCUSSION

The results of Phase 1 are presented in Table 2.

Table 2 Breeds, number of animals tested, IGF2-gene status

Breed	No. of Boars	MH Test Results					
		A/A	**%**	**G/G**	**%**	**A/G**	**%**
SA Landrace	91	21	23	32	35	38	42
Large White	145	13	9	100	69	32	22
Duroc	38	-	-	36	95	2	5
Pietrain	24		-	24	100*	-	-
Chester	3	-	-	2	67*	1	33
Kolbroek	11	9	82*	2	18*	-	
Synthetic lines/Composite	100	4	4	75	75	21	21
Total	412	47		271		94	

*Percentage based on low sample size

Only 11.4% of the animals tested had the A/A genotype (mutant). About 65% of the animals tested carried the G/G genotype (wildtype). The G allele frequency was found to be higher in the Large White population as compared to the SA Landrace.

These two breeds have potential to display a higher lean meat percentage. They also showed a larger number that inherited the A/G genotype. The Kolbroek which is an indigenous breed to South Africa showed a higher A/A genotype. This was also due to a smaller sample size. The Pietrain breed showed 100% G/G genotype and the Duroc 95% of the same genotype. Although genetic differences among breeds and lines can be important, there is also a large amount of genetic variability among individuals within a breed or line. Differences among individual sires within a breed, for example, can often be much larger than differences between breeds.

- CONCLUSION

Molecular biology and molecular genetic provides excellent opportunities to improve meat quality in selection schemes and lines. The results presented here will be used in a trial to determine the effect of the specific genotype with meat quality characteristics.

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