Rapid Communication: Mapping and Genetic Analysis of Porcine FOSB

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Abstract
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Source and Description of Primers. Primers were designed from a human and mouse FOSB consensus sequence and used for PCR amplification of the genomic region from Exons 2 to 3 of the porcine FOSB gene.

Keywords
Genes, Maternal Behavior, Pigs, Gene Mapping

Disciplines
Agriculture | Animal Sciences | Genetics and Genomics

Comments
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Rapid Communication: Mapping and Genetic Analysis of Porcine FOSB

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Locus. FBJ murine osteosarcoma viral oncogene homolog B (FOSB) gene.

Source and Description of Primers. Primers were designed from a human and mouse FOSB consensus sequence and used for PCR amplification of the genomic region from Exons 2 to 3 of the porcine FOSB gene.

Primer Sequences. The forward primer was 5’ GCA ACC CCT CAT CTC T 3’, and the reverse primer 5’ GTC AGC TCC CTC CGC CGG TTC 3’.

Method of Detection. A 567-bp fragment was amplified from genomic porcine DNA. Amplification products were obtained under the following conditions. A 25-μL reaction containing 1× PCR buffer (Promega; Madison, WI), 1.5 mM MgCl2, 200 μM dNTP, 10 pmol of each primer, .2 U of Taq DNA polymerase (Promega), and 12.5 ng of porcine genomic DNA was placed in a Robocycler (Stratagene; La Jolla, CA) for a thermal cycling regimen of initial denaturation for 3 min at 93°C, 35 cycles of 45 s at 93°C, 45 s at 60°C, and 45 s at 72°C, and a final extension of 5 min at 72°C. The PCR products were detected on a 1% agarose gel.

Sequence Homology. The 567-bp amplified product was confirmed as the porcine FOSB gene through sequence comparison (primer sequences excluded) to mouse and human FOSB sequence. Exonic sequences had a 91 and 84% nucleotide identity to human and mouse FOSB, respectively. This porcine FOSB sequence has been submitted to GenBank (accession number AF120155).

Description of Polymorphism. A single nucleotide substitution was detected by sequence analysis in intron 2, and a NlaIII PCR-RFLP assay was developed. Upon NlaIII digestion, polymorphic allelic fragments, 355 bp (allele 1) or 340 and 15 bp (allele 2), and monomorphic fragments, 110, 72, and 30 bp, were seen (Figure 1). Fragments were resolved with electrophoresis using a 3.5% MetaPhor agarose gel (FMC BioProducts; Rochland, ME) for 550 Vh.

Pattern of Inheritance. The PCR-RFLP (NlaIII) for the porcine FOSB gene showed autosomal Mendelian segregation in 3 three-generation Iowa State University (ISU) and 2 three-generation European PiGMaP swine reference families.

Allelic Frequencies. Analysis of allelic frequencies (Table 1) in eight swine breeds, 71 pigs in total, showed allele 2 to have a marginally, but not significantly, higher frequency in breeds traditionally associated with good maternal behavior (i.e., number

Figure 1. FOSB NlaIII PCR-RFLP allelic fragments, 355 bp for Allele 1 and 340 bp for Allele 2, are illustrated. Not shown are a second band, 15 bp, for Allele 2 and three monomorphic bands.
Table 1. Allelic frequencies for the porcine FOSB NlaIII
PCR-RFLP in eight swine breeds

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<th>D</th>
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<th>L</th>
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</table>


Chromosomal Location. The FOSB was physically mapped to the distal part of SSC6q21 using a Swine-Rodent Somatic Cell Hybrid Panel (Yerle et al., 1996). Linkage mapping analysis (CRIMAP, v. 2.4; Green et al., 1990) using FOSB NlaIII genotypes from a three-generation European PiGMaP family (Archibald et al., 1995) confirmed the placement of FOSB on chromosome 6. Two-point linkage analysis showed significant linkage (LOD = 4.82) between FOSB and GPI (glucose phosphate isomerase), which was previously mapped on swine chromosome 6. Multipoint linkage analysis indicated that FOSB is in close proximity to swine GPI, CRC (calcium release channel for skeletal muscle), and EAH (erythrocyte antigen H). Synteny between FOSB, GPI, CRC, and EAH has also been detected on human chromosome 19 (q13.3) and mouse chromosome 7.

Comments. The genetic components to behavioral traits have rarely been elucidated. However, the FOSB gene has been shown to directly control one specific behavior, maternal nurturing in mice (Brown et al., 1996). Recently other genes have also been linked to specific maternal behaviors (Bridges, 1998; Lefebvre et al., 1998). In swine, differences among breeds in sow behaviors related to the care of pigs, have long been noted by pork producers. We have made a preliminary investigation of the association between genetic differences with the FOSB gene by examining those swine breeds predominantly differentiated as sire and maternal breeds. No allelic association with breeds traditionally assigned as sire vs maternal breeds was noted. Further breed analysis is necessary to determine whether there is an obvious association between FOSB and differences in breed maternal performance.

Literature Cited


Green, P., K. Falls, and S. Crooks. 1990. Documentation for CRIMAP, version 2.4. Washington Univ. School of Medicine, St. Louis, MO.


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