Genetics and Molecular Research

Effects of muscle fiber type on glycolytic potential and meat quality traits in different Tibetan pig muscles and their association with glycolysis-related gene expression

L.Y. Shen[1], J. Luo[1], H.G. Lei[1], Y.Z. Jiang[2], L. Bai[1], M.Z. Li[1], G.Q. Tang[1], X.W. Li[1], S.H. Zhang[1] and L. Zhu[1]

[1]College of Animal Science and Technology, Sichuan Agricultural University, Chengdu, China
[2]College of Life Science, Sichuan Agricultural University, Chengdu, China

Corresponding author: S.H. Zhang
E-mail: zhangsh1919@163.com

Genet. Mol. Res. 14 (4): 14366-14378 (2015)
Received May 18, 2015
Accepted August 19, 2015
Published November 13, 2015
DOI http://dx.doi.org/10.4238/2015.November.13.22

ABSTRACT. The myosin heavy chain (MyHC) composition, glycolytic potential, mitochondrial content, and gene expression related to energy metabolism were analyzed in eight muscles from Tibetan pigs, to study how meat quality develops in different muscle tissues. The muscles were classified into three clusters, based on MyHC composition: *masseter*, *trapezius*, and *latissimus dorsi* as 'slow-oxidative-type'; psoas major and semimembranosus as 'intermediate-type'; and longissimus dorsi, obliquus externus abdominis, and semitendinosus as 'fast-glycolytic-type'. The 'slow-oxidative-type' muscles had the highest MyHC I and MyHC IIA content ($P < 0.01$); 'intermediate-type' muscles, the highest MyHC IIx content ($P < 0.01$); and 'fast-glycolytic-type' muscles, the highest MyHC IIb content ($P < 0.01$). The pH values measured in 'slow-oxidative-type' muscles were higher than those in the other clusters were; however, the color of 'fast-glycolytic-type' muscles was palest ($P < 0.01$). Mitochondrial content increased in

the order: fast-glycolytic-type < intermediate-type < slow-oxidative-type. In the ‘slow-oxidative-type’ muscles, the expression levels of genes related to ATP synthesis were higher, but were lower for those related to glycogen synthesis and glycolysis. Mitochondrial content was significantly positively correlated with MyHC I content, but negatively correlated with MyHC IIb content. MyHC I and mitochondrial content were both negatively correlated with glycolytic potential. Overall, muscles used frequently in exercise had a higher proportion of type I fibers. ‘Slow-oxidative-type’ muscles, rich in type I fibers with higher mitochondrial and lower glycogen and glucose contents, had a higher ATP synthesis efficiency and lower glycolytic capacity, which contributed to their superior meat quality.

Key words: Glycolytic potential; Mitochondria; Muscle fiber type; Meat quality; Tibetan pigs

