GENETIC IMPROVEMENT OF FILLET TRAITS AND FLESH QUALITY IN AQUACULTURE SPECIES

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Abstract

Flesh quality has gained importance among consumers and in the aquaculture industry because it is related to consumer preference as well as human health and nutrition. We studied four groups of flesh quality traits in the Genetically Improved Farmed Tilapia (GIFT) strain: i) Carcass (fillet) traits, ii) Flesh composition (protein, fat, moisture and ash content), iii) Flesh quality attributes (pH, color), and iv) Fatty acid composition.

The data were collected over three generations from the long term selection program in the GIFT strain of Nile tilapia. During 2006, 2007 and 2008 data on fillet weight and yield were recorded in 5332 fish from 174 sires and 280 dams. Fillets were weighed and frozen for later use in the assessment of flesh quality attributes. Approximately 2000 fillets were randomly sampled across families, selection lines, sex, batch of filleting within generations, and were sent to a specialized laboratory for the analysis of flesh quality attributes, such as protein %, moisture %, fat %, pH and colour. A sub-set of the samples (514 samples) were also analyzed for fatty acid composition. We assembled a full data set including body measurements, carcass traits, chemical composition, flesh quality attributes and fatty acids for genetic analysis of population parameters and selection responses.

Our results in GIFT tilapia indicated that there was genetic variation in flesh quality traits which provides scope for genetic improvement. The estimates of heritability for body

and carcass traits were of moderate magnitude (0.20 to 0.33). For proximate composition and flesh quality attributes, the heritability estimate for protein content was low, whereas the heritabilities for fat and moisture contents, pH and colour were generally moderate. The estimates of heritability for fatty acids of GIFT fillet varied from zero to medium (0.00 to 0.48). The genetic correlations between fillet weight and body measurements were very high (0.78 to 0.96), indicating that both growth and carcass performance can be simultaneously improved. Regarding the genetic correlations between body traits and flesh composition, the estimate between protein content and body weight was low. The genetic correlations between fat and body weight were moderate to high and mostly positive. Among fatty acids (FA), the genetic associations between FA groups (saturated vs. unsaturated FA) were generally antagonistic. By contrast, the genetic correlations of FA within the same group were mostly positive. The genetic correlations between important high chain poly-unsaturated fatty acids and performance, fillet and flesh quality traits were variable, namely, with estimates both favourable and unfavourable.

We also examined the effects of selection for increased performance on flesh quality of GIFT tilapia. The selection program for high growth rate in GIFT has resulted in a significant increase in fillet weight. The accumulated response in fillet weight up to the latest generation of selection included in this study (corresponding to the spawning season in 2008) was 23%. In contrast to fillet weight, change in fillet yield was non-significant. There was very limited impact of selection for increased growth rate on flesh quality traits and fatty acid composition.

It is concluded that there was a potential for genetic improvement for flesh quality traits. Selection for increased growth rate had no detrimental effects on flesh quality traits. However, a close monitor of their correlated changes as a result of selection for high productivity is recommended in breeding programs. Strategies for genetic improvement of flesh quality traits should be further studied.