Influence of selection on frequency of \textit{cGH} and \textit{IGF-1} in Chee KKU12 populations

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\textbf{ABSTRACT:} The study aimed to determine genetic variation and frequency of chicken growth hormone gene (\textit{cGH}) and insulin-like growth factor I gene (\textit{IGF-I}) in Chee KKU12. Three populations of Chee KKU12 were studied, including GP population (G6), Chee developing line of meat (G5) and egg line (G5). PCR-RFLP was used to detect genetic variation of \textit{cGH} and \textit{IGF-1}. The result revealed the highest frequency of GG genotype of \textit{cGH} in GP (0.92) and developing of meat line (0.97) compared to egg line (0.48). Variation in \textit{IGF-1} showed a predominant genotype of CC (0.78) in Chee egg line, whereas it was lower than 0.5 in GP and Chee meat line. The finding suggested that a selection for growth traits could affect variation in \textit{cGH} and \textit{IGF-I}, and hence variation in both \textit{cGH} and \textit{IGF-I} might be benefit for selection of growth traits in native chicken.

\textbf{Keywords:} Chee KKU12, chicken growth hormone (cGH), insulin-like growth factor 1(IGF-1)

\section{Introduction}

Research and development network center for animal breeding (Native Chicken) has been developing a Chee KKU12 chicken for purposes of meat and egg production. Since, Thai native chicken is favored for healthy meat (Jaturasitha et al., 2008), Chee KKU12 has been selected to produce more meat yield and also provide an appropriation of egg production. To improve meat production with a balancing of growth and egg production, multi-trait selection is required. The use of traditional genetic selection and molecular methods may, therefore, be useful for breeding chickens in the future (Hui et al., 2003). Correspondingly, two developing lines of Chee KKU12 have been developed for developing of meat line and egg line.

Growth hormone (GH), a polypeptide hormone, is very important in animals. It plays important roles in promoting-growth, protein and muscle accretion, and fat catabolism together with other hormones of the somatotropic axis. Therefore, GH gene may be a potential candidate gene for MAS schemes. Compared with other animals, the intron regions of the chicken GH gene (\textit{cGH}) is highly polymorphic, and the studies using RFLP revealed that these variations are associated with meat yield traits (Yan et al., 2003).

Insulin-like growth factors (IGF) consist of a family of polypeptide hormones associated with insulin with multiple metabolic and anabolic functions. The IGF-I and IGF-II stimulate the proliferation, differentiation, and metabolism of myogenic cell lines from different species. In chickens divergently selected for high or low growth rates, there were significantly higher \textit{IGF1} mRNA levels in the high growth rate line than in the low growth rate line (Beccavin et al., 2001).

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The objective of this work was to determine genetic variation and frequency of \( cGH \) and \( IGF-1 \) in Chee KKU12, which it would be affected by selection of growth traits in Chee GP in generation 6 and Chee developing meat line and egg line in generation 5.

**Materials and Methods**

A total of 220 blood samples were collected from Chee KKU12 that comprised of 72 samples of Chee grandparents, 79 samples of Chee developing meat line and 69 samples of developing egg line. DNA purification was performed using Guanidine-HCL methods. DNA qualification and concentration were evaluated by spectrophotometer (Nano-Drop2000, Delaware USA). Phenotypic data were recorded for animal ID, gender and generation. PCR-restriction fragment length polymorphism (RFLP) was used to identify DNA patterns of \( cGH \) and \( IGF-1 \). Two restriction fragment length polymorphism (RFLP) were typed on the cGH (\( EcoRV/cGH \)) and IGF-1 (\( HinfI /IGF-1 \)), which was described in Nie et al. (2005) and Zhou et al. (2005).

**Results and discussion**

**Frequency of genotypes**

Three genotypes of \( cGH \) (AA, AG, GG) was observed in Chee developing egg line, but only two detected in Chee grandparents (GP) and Chee developing meat line. This was consistency with Promwatee and Duangjinda (2010), report that there was no variation AA genotypes in Chee GP. However, variation of AA was lower than 0.04 in developing egg line.

In variation of \( IGF-1 \), there were three genotypes (AA, AC and CC) observed in GP and meat line, but only two genotypes were detected in Chee egg line. Moreover, genotype CC was predominantly found in Chee egg line. (Table 1)

The finding found that genetic pattern and frequency of \( cGH \) and \( IGF-1 \) was similar in GP and Chee meat line compared to Chee egg line.

**Table 1** Frequency of \( cGH \) and \( IGF-1 \) in Chee KKU12

<table>
<thead>
<tr>
<th>Gene</th>
<th>Population</th>
<th>Grandparents (N)</th>
<th>Developing meat line at G5 (N)</th>
<th>Developing Egg line at G5 (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.00(0)</td>
<td>0.00(0)</td>
<td>0.04(3)</td>
</tr>
<tr>
<td>cGH</td>
<td>AA</td>
<td>0.08(6)</td>
<td>0.03(2)</td>
<td>0.48(32)</td>
</tr>
<tr>
<td></td>
<td>AG</td>
<td>0.92(66)</td>
<td>0.97(76)</td>
<td>0.48(32)</td>
</tr>
<tr>
<td></td>
<td>GG</td>
<td>0.08(6)</td>
<td>0.12(9)</td>
<td>0.00(0)</td>
</tr>
<tr>
<td></td>
<td>AA</td>
<td>0.08(6)</td>
<td>0.48(37)</td>
<td>0.22(15)</td>
</tr>
<tr>
<td>IGF-1</td>
<td>AC</td>
<td>0.52(37)</td>
<td>0.40(31)</td>
<td>0.78(53)</td>
</tr>
<tr>
<td></td>
<td>CC</td>
<td>0.40(28)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Conclusion

The present study provides evidence that there are different patterns of cGH and IGF-1 in Chee KKU12. The genetic variation is promising candidate gene to study for improving growth trait in the Chee KKU12 population. The cGH and IGF-1 variants would be benefit of body weight. Further study need to be confirmed prior to use as genetic marker in selection program.

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References


