SIMULATING ALLELE FREQUENCY CHANGES IN INDONESIAN GOAT CROSSBREEDING SCENARIOS

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Introduction

A strategy to improve local goat performance is by crossbreeding, which main benefit comes from the effect of heterosis. The occurrence of heterosis is determined by the combination of parental alleles and change allele frequency by improving heterozygosity and lowering homozygosity.

Objective

To estimate heterozygosity (**H**) related to body weight (BW) trait by using simulation of allele frequency changes in different crossbreeding scenarios of Indonesian goat breed.

Methods

Five goat crossbreeding scenarios

1. Jawarandu (Etawah grade ♂ >< Kacang ♀)
2. Boer (Boer ♂ >< Boer ♀)
3. Boerja F1 (Boer ♂ >< Jawarandu ♀)
4. Boerja F2 (Boer ♂ >< Boerja F1 ♀)
5. Boerja F3 (Boer ♂ >< Boerja F2 ♀)

Data assumption

- Allele "**B**" for high and "**b**" for low BW.
- The initial allele frequencies of Jawarandu were **B**=0.45; **b**=0.55, and Boer were **B**=0.7; **b**=0.3.

♂ \ ♀	B	b
B	BB	Bb
b	Bb	bb

Figure 1. Punnet square simulation in goat crossbreeding scenario. (**BB**, **Bb,** and **bb** are the genotypes of Body Weight trait)

Allele frequency and heterozygosity calculation

B = p or f(B) = p	p = P + ½ H	P = f(BB)
b = q or f(b) = q,	q = Q + ½ H	Q = f(bb),
p + q = 1	p = f(B)	H = f(Bb) + f(Bb)
$p^2 + 2pq + q^2 = 1$	q = f(b),	

- The associations to the observed BW measured from the corresponding goat samples.
- BW (kg) data was retrieved from 1.5-year-old goats from the studied samples.

Results

Table 1. Allele frequency of different goat crossbreed

Crossbreed	p = f(B)	q = f(b)	P = f(BB)	Q = f(bb)
Jawarandu	0.45	0.55	0.18	0.28
Boer	0.70	0.30	0.49	0.09
Boerja F1	0.57	0.43	0.31	0.17
Boerja F2	0.64	0.36	0.40	0.13
Boerja F3	0.67	0.33	0.45	0.11

Table 2. Crossbreed heterozygosity (H) and goat body weight (BW)

Crossbreed	H	n (head)	BW mean ± SD (kg)
Jawarandu	0.54	8	30.50 ± 4.50
Boer	0.42	26	49.50 ± 5.90
Boerja F1	0.52	297	41.80 ± 4.10
Boerja F2	0.47	168	41.60 ± 3.60
Boerja F2	0.44	32	39.80 ± 3.20

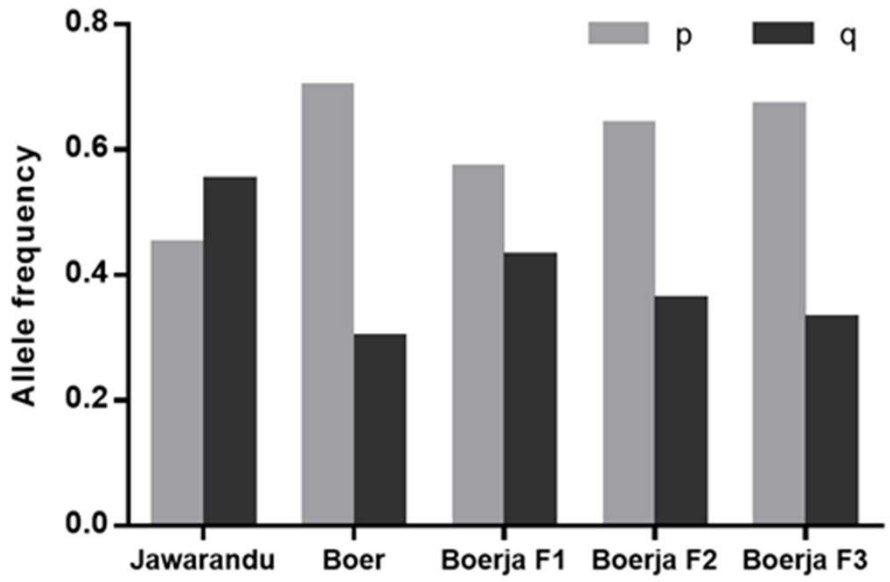

Figure 2. Plot of allele frequency in different goat crossbreed

- Jawarandu, has lowest frequency of **B** allele (**p**) (Tabel 1)
- Jawarandu has highest H estimation, while Boer the lowest one (Tabel 2)
- The frequency of allele **B** (**p** and **P**) from Boerja F1 to F2 and F3 were showing increasing pattern (Figure 2), however **H** and BW means were decreasing (Tabel 2).
- The effect of heterozygosity in the crossbreeding simulation didn't give improvement in BW.

Conclusions

- Crossbreeding changes heterozygosity in our simulation study
- Allele frequency changes with BW trait in Indonesian crossbred goats yields in positive association results.