民間場黑豬之高肉質基因型頻率

遺傳育種組
陳佳萱

高肉質基因

- 心臟脂肪酸結合蛋白（Heart fatty acid binding protein, H-FABP），主要表現於心臟組織中，負責細胞內脂肪酸運輸以進行β- 氧化作用及三酸甘油酯或磷脂質之合成，並具有調節脂肪酸利用之功能。

高肉質基因

- 豬心臟型脂肪酸結合蛋白基因(簡稱高肉質基因)可調節脂肪酸的合成與代謝，推測此基因會影響豬隻肌肉內脂肪的沉積。
- 肌肉內脂肪(intramuscular fat, IMF) 具有高遺傳性。
- 可藉由屠體性狀之測定與高肉質基因分析進行遺傳評估，找出最佳遺傳組合，提供養豬業者選拔之參考。

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民間黑豬場服務區域共7家

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Figure 1 Pork marbling standards.

(Source: National Pork Producers Council, 2000)

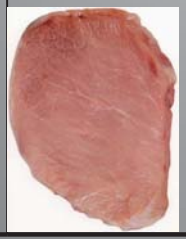
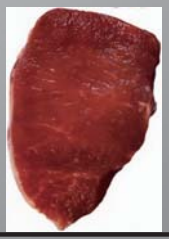
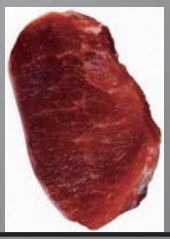
級數	1.0	2.0	3.0	4.0	5.0	6.0
L值	61	55	49	43	37	31
顏色	蒼白	淡粉紅	粉紅	鮮紅	棗紅	暗棗紅
圖例						

Figure 2 Pork color scores.

(Source: National Pork Producers Council, 2000)

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高肉質基因

心臟脂肪酸結合蛋白基因
(Heart fatty acid-binding protein, H-FABP)

基因組DNA抽取

↓

PCR擴增

↓

HaeIII、
MspI
及*HinfI*切割

↓

基因型判定

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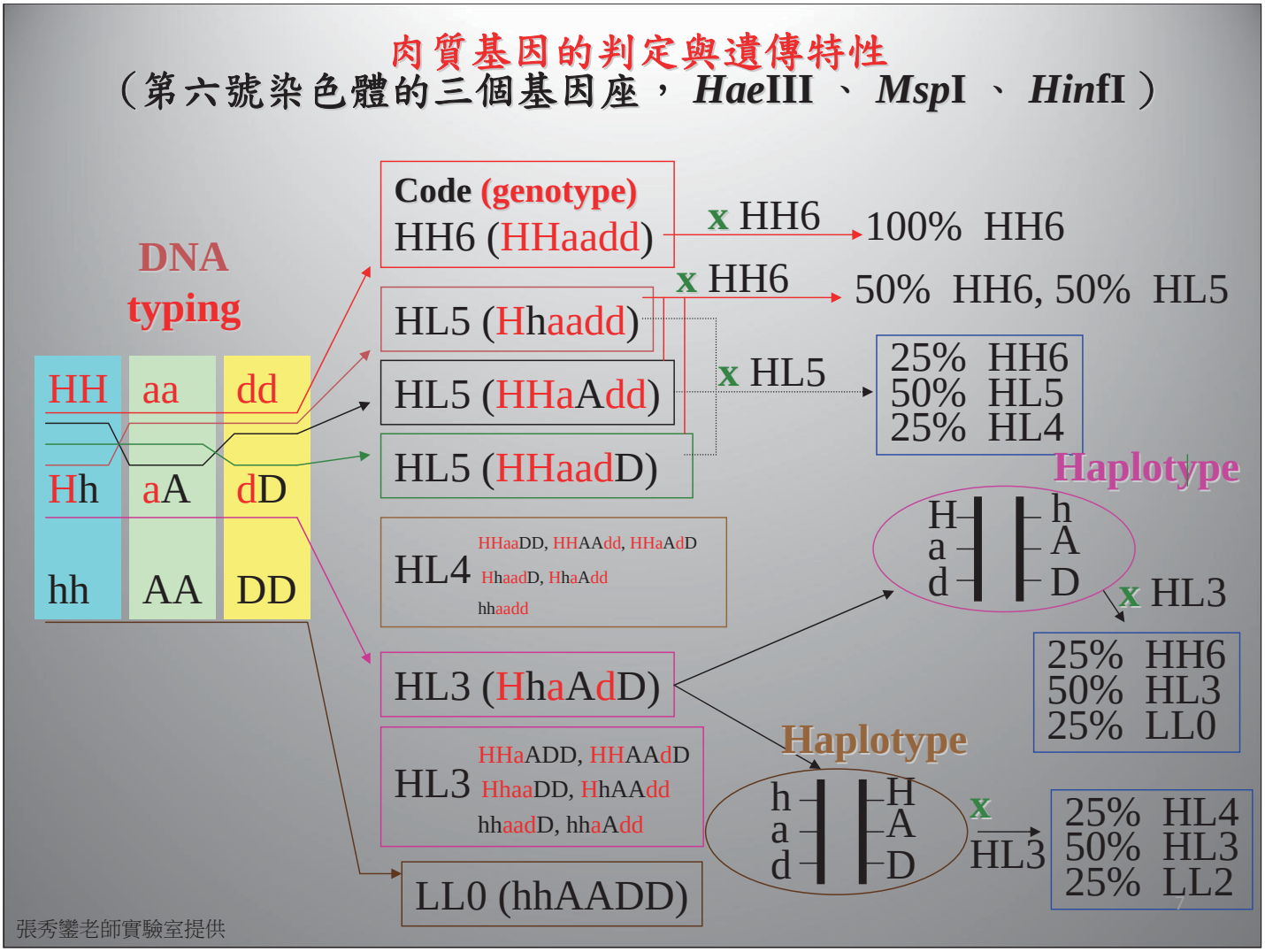
張秀鑾老師實驗室提供



7家黑豬場 緊迫基因檢測結果

緊迫基因型	AA	AB	BB
頭數	180	6	0
百分比	96.8%	3.2%	0%

7家黑豬場 多產質基因檢測結果

多產基因型	MM	MN	NN
頭數	112	35	39
百分比	60.2%	18.8%	21.0%

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7家黑豬場 高肉質基因檢測結果

高肉質基因型	HH6 	HL5	HL4	HL3	LL2	LL1	LL0
頭數	7	4	11	34	59	36	35
百分比	3.8%	2.2%	5.9%	18.3%	31.7%	19.3%	18.8%

中肉質基因26.4%

低肉質基因69.8%

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各品種乳豬於6公斤或12公斤之屠宰率與製成率之比較

Items	6 kg			12 kg		
	Taoyuan	Meishan	Crossbred	Taoyuan	Meishan	Crossbred
Dressing percentage, %*	74.1[b]	75.6[b]	80.9[a]	75.3[b]	76.7[b]	81.2[a]
Yield, %**	71.3[a]	64.1[b]	62.5[b]	64.5[b]	66.6[ab]	62.1[b]

* (Carcass wt./body wt.)×100.
** (Roast wt./carcass wt.)×100.
[a,b] Values at the same row with different superscripts differ significantly (P<0.05).

(陳等，2001)

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Table 2. Comparison of sensory evaluation within roast suckling pig from different breeds at body weight 6 kg or 12 kg*

Items	6 kg			12 kg		
	Taoyuan	Meishan	Crossbred	Taoyuan	Meishan	Crossbred
Roast color	5.53[a]	5.24[ab]	4.71[c]	4.95[c]	5.01[bc]	4.16[d]
Crispness	5.02[a]	4.88[ab]	4.41[bc]	5.02[a]	5.09[a]	4.20[c]
Juiciness	5.02	4.84	4.76	5.06	4.91	4.75
Flavor	4.50[b]	5.08[a]	4.64[ab]	4.57[b]	4.94[ab]	4.93[ab]

(陳等，2001)

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Table 3. Carcass traits and cutability from different breeds

Traits	Taoyuan	Meishan	Crossbred
Carcass wt, kg	49.2[b]	48.5[b]	88.2[a]
Carcass length, cm	69.2[b]	68.9[b]	83.8[a]
Backfat thickness, cm	2.15	2.28	2.12
Lean percentage, %	37.4[b]	35.6[b]	55.7[a]
Fat percentage, %	15.4[b]	19.8[a]	9.4[c]
Bone percentage, %	12.40[a]	8.80[b]	11.70[a]

(陳等，2001)

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Table 5. Color, firmness and marbling scores from different breeds

Parameters	Taoyuan	Meishan	Crossbred
Color score*	2.67[ab]	2.57[b]	2.87[a]
Firmness score**	2.49[b]	2.41[b]	2.86[a]
Marbling score***	1.41[c]	2.03[b]	2.50[a]

* 1, very light; 5, very dark.
** 1, very soft; 5, very firm.
*** 1, trace; 5, abundant.
[a,b,c] Same as Table 1.

(陳等，2001)

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表 6. 梅山豬屠體性狀之平均值與標準偏差

Table6. Mean and standard deviation of carcass traits of Meishan pigs

Traits	Meishan Pig	YLD three way crossbreed pig [a]
Head	11	10
Live weight, kg	122.6 ± 14.9	102.5 ± 4.9
Carcass weight, kg	106.9 ± 13.4	88.0 ± 4.9
Dressing percentage, %	87.2 ± 1.4	85.8 ± 1.0
Carcass length, cm	81.0 ± 4.7	86.3 ± 2.9
Backfat thickness, cm	3.7 ± 0.5	1.5 ± 0.1
Loin eye area at 10-11 ribs, cm^2	20.4 ± 1.6	40.6 ± 3.7
Lean percentage, %	34.1 ± 2.0	56.5 ± 1.3
Fat percentage, %	23.0 ± 3.4	11.5 ± 1.9
Bone percentage, %	9.2 ± 1.2	12.4 ± 0.8

[a]陳等, 1991。

(顏等，2003)

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Table 7. Mean and standard deviation of chemical content and pork quality of *longissimus dorsi* muscle from Meishan pigs

Traits	Meishan pig	YLD three way crossbreed pig[2]
No of sample	11	2
Moisture, %	73.7 ± 1.0	74.4 ± 0.3
Crude fat, %	3.1 ± 0.9	1.6 ± 0.0
Crude protein, %	21.9 ± 0.3	22.8 ± 0.1
Ash, %	1.18 ± 0.07	1.16 ± 0.02
L value	39.0 ± 2.1	45.9 ± 7.5
a value	9.9 ± 0.8	8.5 ± 1.3
b value	6.6 ± 0.7	7.7 ± 2.4
Sensory evaluation[3]		
Tenderness	5.8 ± 1.2	4.2 ± 1.3
Juiciness	5.3 ± 1.0	4.4 ± 1.0
Flavor	5.0 ± 1.1	4.7 ± 1.2
Over-all acceptance	5.4 ± 1.2	4.4 ± 1.3

1：*Longissimus dorsi* at 10-11th rib.

2：陳等，1991。

3：Mean values from 1-9 tests of sensory evaluation.

(顏等，2003)

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高畜黑豬(K5)在不同屠宰體重之屠體性狀

Trait	90-100 kg	100-110 kg	110-120 kg
頭數	8	6	7
平均日齡	282	290	299
平均上市體重, kg	93.0 ± 4.8[c]	104.4 ± 3.5[b]	115.1 ± 2.5[a]
屠體重, kg	77.3 ± 5.9[c]	85.8 ± 5.6[b]	95.7 ± 3.3[a]
屠體長, cm	76.6 ± 2.7[b]	81.2 ± 3[a]	83.6 ± 4.3 [a]
背脂厚度, cm			
第一肋	3.5 ± 0.6	3.1 ± 0.8	3.0 ± 0.4
最後肋	2.7 ± 0.6	2.5 ± 0.7	2.7 ± 0.8
最後腰椎	1.9 ± 0.5	2.0 ± 0.8	2.2 ± 0.9
平均厚度	2.7 ± 0.5	2.5 ± 0.7	2.6 ± 0.7
腰眼面積, cm^2	29.6 ± 5.6	31.3 ± 5.0	34.4 ± 11.5
屠宰率, %[1]	83.1 ± 2.6	82.2 ± 3.2	83.1 ± 2.4
瘦肉率, %[2]	42.9 ± 3.5	42.9 ± 3.7	43.1 ± 3.5
脂肪率, %[2]	18.7 ± 4.6	17.9 ± 8.5	17.8 ± 5.0
骨頭率, %, %[2]	14.7 ± 0.7	14.9 ± 2.0	15.1 ± 1.6

資料來源：高畜黑豬品種命名資料

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高畜黑豬(K6)之屠體性能

屠體性狀	上市活重範圍	
頭數	11	9
平均上市體重, kg	101.2 ± 4.2	117.4 ± 8.0
屠體重, kg	87.0 ± 4.5	100.1 ± 7.7
屠宰率, %	85.9 ± 1.8	85.2 ± 1.8
屠體長, cm	80.0 ± 2.8	81.9 ± 4.6
平均肋骨數, 根	14.7 ± 0.5	14.8 ± 0.4
平均背脂厚度, cm	3.0 ± 0.8	3.6 ± 0.7
感官肉色(1～5)	2.9 ± 0.7	3.0 ± 0.5
大理石紋(1～5)	2.0 ± 0.9	1.7 ± 0.4

資料來源：高畜黑豬品種命名資料

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Table 3. Number of ribs in left side of pigs

No. of ribs in left side	Breed								Total	
	Landrace		Yorkshire		Duroc		Berkshire			
	Head（%）									
14	1	(3.7)	3	(10.0)	1	(7.1)	31	(25.2)	36	(18.6)
15	12	(44.4)	22	(73.3)	11	(78.6)	73	(59.3)	118	(60.8)
16	13	(48.1)	5	(16.7)	2	(14.3)	19	(15.4)	39	(20.1)
17	1	(3.7)	0	(0.0)	0	(0.0)	0	(0.0)	1	(0.5)
Total	27	(13.9)	30	(15.5)	14	(7.2)	123	(63.4)	194	(100.0)

(廖等，2006)

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不同品種肉豬屠體性能品種差異

Trait	Landrace[1]	Yorkshire[1]	Duroc[1]	Landrace[1]	Yorkshire[1]	Duroc[1]
Gender	Barrow	Barrow	Barrow	Gilt	Gilt	Gilt
No. of pigs tested	42	36	29	81	72	62
Carcass weight, kg	100.6 ±1.5[2]	102.4 ± 1.6	96.0 ± 1.6	88.5 ± 1.1	87.3 ± 1.1	89.3 ± 1.2
Lean percentage, %	58.4 ± 0.4	57.2 ± 0.5	57.7 ± 0.5	58.7 ± 0.3	57.9 ± 0.3	58.1 ± 0.3
Backfat thickness, cm	2.0 ± 0.1	2.3 ± 0.1	2.1 ± 0.1	1.9 ± 0.1	2.2 ± 0.1	2.2 ± 0.1
Abdominal fat thickness, cm	3.7 ± 0.1	3.5 ± 0.5	3.5 ± 0.1	3.6 ± 0.1	3.7 ± 0.1	3.6 ± 0.1
Loin muscle area, cm^2	46.0 ± 0.9	45.9 ± 1.0	43.0 ± 1.0	42.7 ± 0.7	41.0 ± 0.7	44.6 ± 0.8
Carcass length, cm	91.6 ± 0.8	87.8 ± 0.8	86.2 ± 0.9	88.5 ± 0.6	84.6 ± 0.6	83.6 ± 0.6

[1] 資料來源參考畜產研究36: 149~156 (2003年)
[2] Means ± SE

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資料來源：101年台灣杜洛克豬新品種選育計畫期末報告

結論

- 利用中國地方豬種與洋品種豬雜交可改善肉質性狀。
- 不同來源之黑豬品種、日齡、飼料配方與飼養方式均會影響豬隻屠體與肉質性狀，生產者應利用基因選種加速性能遺傳改進，以生產屠體與肉質性能兼具的高品質黑豬肉。

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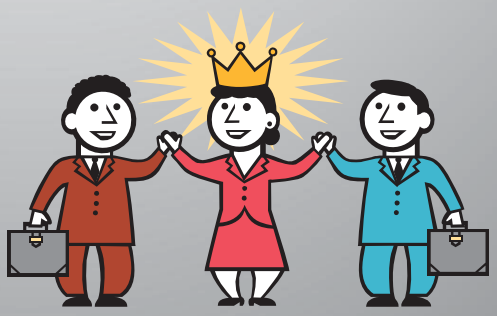
感謝屏科大張秀鑾老師實驗室協助高肉質基因檢測
帶動產業發展 加速遺傳改進



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敬請指教