

恆春黑山羊與波爾山羊泌乳性狀及其仔羊離乳前生長性狀之比較⁽¹⁾

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摘 要

本研究選用剛分娩之恆春黑山羊與波爾山羊各 8 頭，進行為期 154 天之泌乳性狀調查；另在兩品種再各選取 3 頭母羊分別哺育 6 頭仔羊，並與以人工哺育之兩品種仔羊各 7 頭，比較為期 90 天之不同哺育方式對哺育期仔羊生長性狀之影響，以評估母羊之泌乳能力及其仔羊離乳前之生長性狀。試驗結果顯示，兩組母羊之平均乾物質採食量與乾物質採食量佔體重百分比均無顯著差異，且兩組母羊之結束體重均緩降，惟無差異存在。在泌乳性狀及乳成分分析方面，兩組母羊之平均日泌乳量分別為 0.547 vs. 0.536 kg，且其乳脂肪、乳蛋白質、乳糖、無脂固形物及總固形物等均無顯著差異存在。不同哺育方式對仔羊離乳前之生長性狀影響，在品種間無統計差異，惟自然哺育之仔羊，其平均日增重顯著 ($P < 0.05$) 優於人工哺育者。結果顯示，恆春黑山羊之泌乳能力與波爾山羊相似，且均有良好照顧仔羊之母性特質。

關鍵詞：恆春黑山羊、波爾山羊、泌乳能力、生長性狀。

緒 言

世界上肉用山羊的品種改良，均以體型大且增重快速的羊隻品種，級進改良地區性矮小且增重緩慢的山羊品種 (Prieto *et al.*, 2000; Urge *et al.*, 2004)。波爾山羊體型較大 (Campbell *et al.*, 1984; Smith *et al.*, 1986)、增重快 (Sheridan *et al.*, 2003)、精肉率高 (Owen and Norman, 1977)、繁殖效率高 (Norman, 1987)、耐粗放、抗病力強且具良好母性 (Casey, 1982)，其羊肉富含具健康飲食概念之不飽和脂肪酸 (Pratiwi *et al.*, 2006)，被譽為當今世上最佳的肉羊品種 (Malan, 2000; Sheridan *et al.*, 2003)。

臺灣原無山羊品種，最早係隨先民自中國大陸沿海地區引進體型矮小且為黑色皮毛的山羊品種 (施等, 1996; 謝等, 1997)，並以臺灣黑山羊 (Taiwan black goat) 稱之。臺灣黑山羊經過數百年來的演化及適應，儼然成為本地重要的羊種之一。臺灣黑山羊適應力強且肉質鮮美，在冬季以其羊肉所烹飪之傳統羊肉爐廣為國人所喜愛。惟因屬小體型羊隻，屠體較輕且精肉率相對偏低，已不被肉商及飼養者所接受。在經濟因素考量下，臺灣養羊業者於 1980 年代間自國外引進努比亞山羊 (Nubian goat) 進行品種改良，隨後溫等 (1997) 又建議引進波爾山羊 (Boer goat) 為種公羊，級進配種努比亞及臺灣黑山羊之雜交一代母羊，並由蘇等 (2010) 以含 87.5% 波爾山羊、6.25% 努比亞山羊及 6.25% 臺灣黑山羊血源之後裔，自交選育而得體型大、增重快速、肉質佳且毛色全黑之「恆春黑山羊 (Hengchun black goat)」新品種 (蘇及楊, 2009; 楊等, 2011; Su *et al.*, 2012)。

肉羊以產肉為主，母羊的多產性及其泌乳性能為評估該品種羊隻是否具備良好母性的重要指標之一。Al-Shorepy (1995) 調查阿拉伯聯合大公國 Emirati 之仔羊離乳前體重及增重時發現，母羊的泌乳能力不但會影響仔羊出生體重，且會影響仔羊一月齡體重及至一月齡前之日增重，此可能與來自母羊的泌乳能力

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及其乳汁的組成分有關。Thomas and Rook (1983) 認為乳羊泌乳量及其泌乳性狀受到日糧所含粗蛋白質 (crude protein, CP) 及總可消化營養分 (total digestible nutrients, TDN) 濃度所影響, Morand-Fehr *et al.* (2007) 及 Osmari *et al.* (2011) 均認為飼養模式及其餵飼方式, 亦會影響綿羊或山羊的泌乳量。Sampelayo *et al.* (2007) 指出, 飼料種類與日糧精粗料比均會影響山羊的泌乳量。Tovar-Luna *et al.* (2011) 及 Goetsch *et al.* (2011) 認為夜間圈養及不同之泌乳階段, 會影響山羊的泌乳量及其乳脂百分比。因此本試驗選擇圈飼於高床羊欄, 體重相近且具相同窩仔數之經產母羊, 在相同的給飼條件下進行泌乳能力之調查。鑑於恆春黑山羊有 87.5% 血源來自波爾山羊, 故擬比較恆春黑山羊與波爾山羊的泌乳能力, 以及兩品種仔羊離乳前之生長性狀表現, 以供養羊業者參考。

材料與方法

I. 試驗材料：

恆春黑山羊與波爾山羊之母羊各 11 頭、恆春黑山羊與波爾山羊之仔羊各 13 頭。

II. 試驗方法：

(i) 恆春黑山羊與波爾山羊之泌乳性狀

選擇第 2 至 3 產且每胎產仔數為 2 頭之恆春黑山羊與波爾山羊母羊各 8 頭, 於分娩後立即與仔羊隔離。母羊被移至已消毒之 3 × 4 m 鋁鋅網高床上依品種分欄飼養, 在 154 天試驗期間餵飼 11.3% CP 及 72.4% TDN 之日糧, 而礦鹽任食及飲水任飲方式供應。每日一次於早上 9 時以手提式擠乳機進行擠乳, 每日記錄精粗料採食量及泌乳量, 泌乳量曲線採計每週平均值繪之, 而羊乳組成分分析則每月採樣一次送檢, 檢測項目為乳脂肪、乳蛋白質、乳糖、無脂固形物及總固形物等, 檢測儀器為乳成分與體細胞合併測定儀 Milk Scan 4000 及 Fossomatic 5000 (Foss Analytical A/S 公司, 丹麥製)。

(ii) 恆春黑山羊與波爾山羊仔羊之生長性狀

母羊分娩時間為下午 17 時至翌日上午 8 時者, 所生仔羊採自然哺育方式為之; 而母羊分娩時間為上午 8 時至下午 17 時者, 其仔羊則採人工哺育。分娩所得仔羊以自然哺育者各品種有 6 頭, 其公母比為 3:3, 以人工哺育者各品種均為 7 頭, 其公母比為 4:3。剛出生仔羊立即剪耳號、臍帶消毒、進行秤重, 同時以布尺丈量其羊隻肩胛前端至坐骨尾端為其體長、肩胛上端至地面之高度為其體高及於肩胛後方軀體周長為其胸圍等 3 項體測。採自然哺乳之仔羊隨母羊群圈養於 3 × 4 m 之鋁鋅網高床上; 而採人工哺育之仔羊則在出生後立即與母羊隔離後移至已消毒之高床上由專人進行人工餵飼。人工哺育仔羊於 2 日齡內均以商用人乳初乳粉沖泡飼養, 自 3 日齡起改用全脂牛奶粉以 1:7 之比例調製為還原乳飼養, 每頭每餐給予 600 mL 之乳汁, 每日分上、下午 2 次餵飼。兩群仔羊滿 2 週齡後另供應教槽料至 3 月齡離乳, 期間進行採食量、日增重及相關體測資料之收集。

III. 統計方法：

試驗所得數據利用 SAS 套裝軟體 (Statistical Analysis System; SAS, 2002) 以一般線性模式 (General linear model procedure) 進行變方分析, 再以鄧肯氏新多變域測定法 (Duncan's new multiple range test) 比較平均值之差異顯著性。

結果與討論

I. 恆春黑山羊與波爾山羊母羊之泌乳性狀

恆春黑山羊與波爾山羊之母羊於 154 天試驗期間所採食之飼料配方均相同, 配方組成如表 1 所示。日糧 CP 與 TDN 分別為 11.3% 及 72.4%, 日糧精粗料比為 6:4, 精料由玉米及大豆粕等原料所組成, 粗料則為百慕達乾草。兩品種母羊之每日乾物質採食量如表 2 所示, 其分別為 1.304 kg/頭 vs. 1.321 kg/頭, 統計上無組間差異存在。而其母羊乾物質採食量佔體重百分比分別為 2.18% vs. 2.18%, 統計上亦無組間差異存在, 顯示在試驗期間兩組母羊採食量相近。

恆春黑山羊與波爾山羊之泌乳性狀如表 2 所示, 依母羊在試驗前與試驗結束之體重變化、平均日採食量、日糧營養組成及山羊營養需求 (NRC, 1984) 等資料, 計算其每日營養供應與需求 (表 2), 發現

恆春黑山羊與波爾山羊母羊每日所攝食之 TDN 均僅較 NRC (1984) 需求建議量多約 1.6 – 2.2%。惟兩品種山羊每日攝食之 CP 卻較 NRC (1984) 需求建議量減少約 9.4 – 10.4%。本試驗調查兩品種母羊每日採食之 TDN 與 NRC (1984) 需求建議量相近，但獲取之 CP 則較少，試驗期間之體重降低 1.8 – 4.5%，顯示恆春黑山羊與波爾山羊之母羊均具有利用含低營養濃度日糧之耐粗特性 (Sheridan *et al.*, 2003)。Boulanouar *et al.* (1995) 調查女綿羊發身體重時發現，日糧中缺乏或限制能量濃度遠比缺乏或限制蛋白質來的嚴重。Sahlu *et al.* (1995) 與 Goetsch *et al.* (2011) 分別指出泌乳羊泌乳能力的第一限制是日糧能量濃度，本試驗所得結果與前述研究相近似。

Greyling *et al.* (2004) 調查不同飼養模式對波爾山羊及南非本地山羊之泌乳潛能時發現，在非集約飼養與低營養供應下，波爾山羊之日平均泌乳量約為 0.8 kg。本試驗採用每日擠乳一次的方式，雖然每日擠乳一次之模式會影響泌乳量高之乳羊 (Salama *et al.*, 2004; Komara *et al.*, 2009)，惟在泌乳後期的乳羊、年歲較大或是低乳量的肉羊 (Prasad and Sengar, 2002) 採用每日擠乳一次之模式，並不會影響其收益 (Salama *et al.*, 2003)。在 154 天試驗期間，兩品種山羊每日之平均泌乳量分別為 0.547 vs. 0.536 kg，並無組間差異存在 (表 2)。乳成分之分析結果顯示，恆春黑山羊與波爾山羊之乳脂率、乳蛋白率、乳糖率、非脂固形物百分比及總固形物百分比分別為 4.7 vs. 4.6 %、4.9 vs. 4.6 %、4.7 vs. 4.9 %、10.3 vs. 10.2 %、14.9 vs. 14.8 %，組間亦無顯著差異存在 (表 3)。恆春黑山羊與波爾山羊之泌乳量雖較一般乳用山羊低，惟前兩者之乳脂率、乳蛋白率、乳糖率及總固形物百分比均明顯高於乳羊品種 (蘇等，2008)，此與 Torres-Vazquez *et al.* (2009)、Barron-Bravo *et al.* (2013) 等研究指出乳量與乳組成分呈負相關之結論相似。

在泌乳曲線方面，恆春黑山羊與波爾山羊等肉羊不若乳用山羊者，約於分娩後 2 至 3 個月達最高峰後即緩步下降。圖 1 顯示，泌乳初期之波爾山羊，其平均每日乳量高於恆春黑山羊，而於第 5 至 12 週兩品種漸趨相近，其後以恆春黑山羊漸高於波爾山羊，至第 20 週則顯著高於波爾山羊。泌乳末期之波爾山羊，不但平均每日乳量低於恆春黑山羊，且其羊乳中之乳脂率、乳蛋白率及無脂固形物百分比亦較恆春黑山羊為差，僅乳糖率略高於恆春黑山羊。Mmbengwa *et al.* (2008) 調查波爾山羊和南非 Nguni 土山羊在不同圈養模式下的乳成分曲線圖發現，圈養之波爾山羊，其乳脂率、乳蛋白質率、乳糖率及非脂固形物百分比於產後第 5 至 6 週降至最低，其後緩升至第 12 週，且其羊乳所含之乳脂率、乳蛋白率、乳糖率、非脂固形物百分比及總固形物均百分比均無法超過泌乳初期者，此與本試驗波爾山羊泌乳曲線及其乳組成分相似 (圖 1)。

II. 恆春黑山羊與波爾山羊仔羊之離乳前生長性狀

恆春黑山羊與波爾山羊之仔羊生長性狀如表 4 所示，試驗顯示離乳時之體重並無品種間之差異，兩品種自然與人工哺育之仔羊離乳時之公、母仔羊體重分別為 19.9、15.9 vs. 15.0、14.6；20.2、15.7 vs. 15.7、12.9 kg，自然哺育之仔羊較人工哺育之仔羊有顯著較重之離乳體重 ($P < 0.05$)。離乳時兩品種之公、母仔羊平均日增重分別為 0.181、0.147 vs. 0.129、0.128；0.184、0.147 vs. 0.137、0.113 kg，品種間亦無顯著差異。Stehulova *et al.* (2013) 調查母牛照顧仔牛之能力時發現，母牛會因其身體狀況而調整其照顧仔牛的能力，而仔牛生長良好與否則取決於仔牛吸吮母牛乳汁之頻度。推測本試驗採自然哺育之仔羊因隨時可吸吮母羊乳，故較人工哺育之仔羊有較重的離乳體重及平均日增重。Delgado-Pertinez *et al.* (2009 a) 在半圈飼半放牧的牧區中，比較自然哺育或人工哺育方式對 Payoya 乳山羊之仔羊生長性狀，結果顯示自然哺育者有較重之趨勢，惟哺育方式及性別對 5 週齡仔羊之體重與日增重無顯著差異。本試驗之結果與之相異，推測原因可能為半圈飼半放牧之牧區內鮮草較能吸引 Payoya 乳山羊之仔羊飽食所致。Delgado-Pertinez *et al.* (2009 b) 另調查以自然哺育或人工哺育方式飼養佛羅里達乳羊之仔羊時發現，哺育方式亦不影響 5 週齡仔羊之體重與日增重，惟人工哺育仔羊有較重之趨勢，本試驗之結果亦與之相異，推測原因可能為該試驗之人工哺育仔羊係採可 24 小時供應人工乳之系統所致。此外，圖 2 顯示兩品種仔羊出生至離乳之體測資料，無論在體長、體高及胸圍周長，均以自然哺育仔羊較人工哺育仔羊體長較長、體高較高及胸圍周長亦較長之趨勢。推測可能原因為自然哺育之仔羊可隨時吸吮其母畜乳汁，而人工哺育者每頭僅於每日上午 8 時與下午 17 時分別接受 600 mL 之還原乳汁。由此觀之，仔羊於出生一個月內，乳汁或營養分之供給儘可能 24 小時穩定且持續的供應，應有助其在此階段之生長。

表 1. 試驗日糧組成

Table 1. The composition of experimental ration

Ingredients	%
As fed	
Bermuda hay	40.0
Corn	44.4
Soybean meal	12.3
Premix ¹	0.06
Salt	0.3
Vegetable oil	1.8
Limestone	1.14
Total	100.0
Analyzed value, DM basis	
Dry matter	88.8
Crude protein	11.3
TDN	72.4
Feed cost/ kg ² (NT\$/kg)	12.62

¹ Each kg of mineral premix contained: Cu, 10 g; Co, 100 mg; Zn, 60 g; Mn, 60 g; Fe, 30 g; Se, 100 mg; Vitamin A, 6,000,000 I.U.; Vitamin D, 100,000 I.U.; Vitamin E, 4,000 I.U.

² Concentrate: 13.7 NT\$/kg; Bermuda hay: 11.0 NT\$/kg.

³ NT\$: New Taiwan dollars.

表 2. 恆春黑山羊與波爾山羊母羊之乾物質採食量及其泌乳量

Table 2. The dry matter intake and milk yield of Hengchun black does and Boer does

Items	Hengchun black does	Boer does	SE
Number of animals	8	8	
Days on trial	150	150	
Initial BW, kg	62.5	61.8	9.9
End BW, kg	59.7	60.7	10.2
Average daily gain, kg	-0.019	-0.007	0.020
DM Feed intake, kg/head/day	1.304	1.321	0.014
DM intake on body weight, %	2.18	2.18	0.064
Daily milk production, kg	0.547	0.536	0.055
TDN ¹ requirement per day, kg	0.929	0.936	-
CP ¹ requirement per day, kg	0.164	0.165	-
Ration supply TDN ² per day, kg	0.944	0.957	-
Ration supply CP ² per day, kg	0.147	0.149	-
Estimate TDN balance, %	+1.6	+2.2	-
Estimate CP balance, %	-10.4	-9.4	-

¹ Daily TDN and CP requirement recommended by Nutrient Requirements of Goat at maintenance plus low activity condition and additional requirements for milk production per day at different fat percentage calculated by linear interpolation method (NRC, 1984).

² Daily TDN and CP supplied in whole stage by the ration from table 1.

表 3. 恆春黑山羊與波爾山羊乳成分分析

Table 3. The milk components of Hengchun black goats and Boer goats

Items	Hengchun black goat	Boer goat	SE
Milk fat, %	4.7	4.6	0.45
Milk protein, %	4.9	4.6	0.23
Milk Lactose, %	4.7	4.9	0.13
Non-fat solid, %	10.3	10.2	0.20
Total solid, %	14.9	14.8	0.45

表 4. 哺乳方式對恆春黑山羊與波爾山羊仔羊之生長性狀影響

Table 4. The effect of nursing methods on growth performances of Hengchun black kids and Boer kids

Nursing method	Hengchun black goat		Boer goat		SE
	Does	Labor*	Does	Labor*	
Numbers (Sex ratio : ♂ : ♀)	6 (3:3)	7 (4:3)	6 (3:3)	7 (4:3)	
Days on trial	90	90	90	90	
Birth Weight, kg (♂)	3.6	3.4	3.6	3.4	0.53
Birth Weight, kg (♀)	2.7	3.1	2.5	2.7	0.37
Weaning Weight, kg (♂)	19.9 ^a	15.0 ^b	20.2 ^a	15.7 ^b	2.33
Weaning Weight, kg (♀)	15.9 ^a	14.6 ^b	15.7 ^a	12.9 ^b	0.98
ADG, kg (♂)	0.181 ^a	0.129 ^b	0.184 ^a	0.137 ^b	0.02
ADG, kg (♀)	0.147 ^a	0.128 ^b	0.147 ^a	0.113 ^c	0.01

^{a, b, c} Means within the same row with the different superscripts differ significantly ($P < 0.05$).

*Labor: nursing by baby bottles.

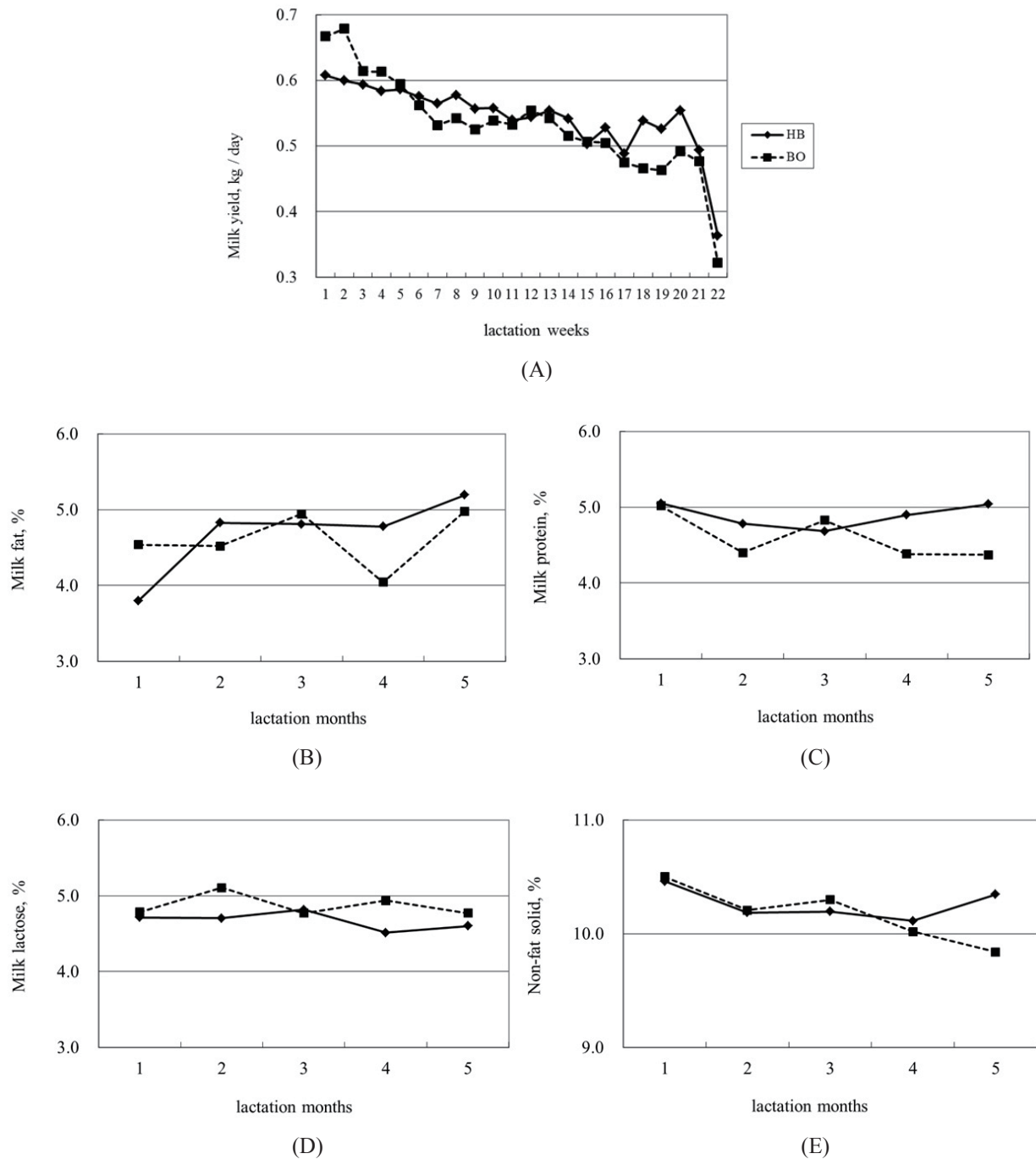


圖 1. 恆春黑山羊 (HB) 與波爾山羊 (BO) 之泌乳量 (A) 及其乳成分曲線 (B, C, D, E)。

Fig. 1. The milk production (A) and the percentage of milk components (B, C, D, E) on Hengchun black does and Boer does.

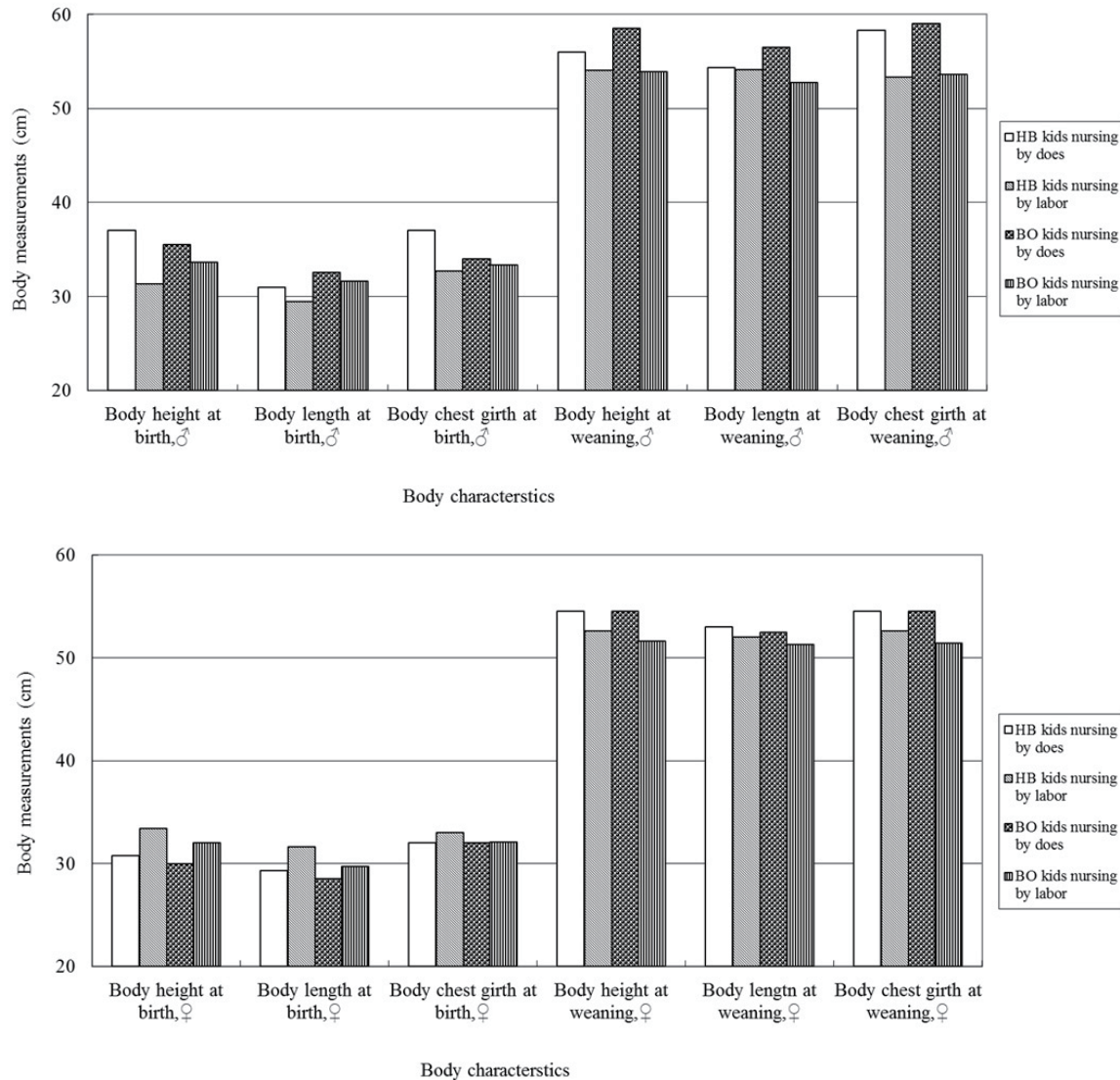


圖 2. 恆春黑山羊 (HB) 與波爾山羊 (BO) 公母仔羊出生及離乳階段之體測值。

Fig. 2. The body characteristics of male and female kids from Hengchun black goats and Boer goats at birth and weaning stage.

結論與建議

恆春黑山羊與波爾山羊均有照顧仔羊之良好母性特質，且恆春黑山羊母羊之泌乳性狀、仔羊之增重效率與體測值資料均與波爾山羊相近。恆春黑山羊因含有部分臺灣黑山羊之血統，對本土環境之適應力亦具有優勢，相信是我國羊農飼養肉用山羊時的另一個新選擇。此外，建議應針對仔羊離乳前之全日營養供應體系進行研究，期能激發仔羊生長潛能，並提高其育成率。

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Comparison of the milking ability of does and the growth performances of kids before weaning for Hengchun black goats and Boer goats⁽¹⁾

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Abstract

Eight heads of does, from Hengchun black goat and Boer goat respectively, were chosen for milking ability investigation during the 154 days lactation period. Meanwhile, another three does and their six kids in each breed were chosen to compare with seven heads of kids in same breeds on the growth performance of kids nursing by their does or bottles. The result showed that there were no differences on the average daily dry matter intake, the percentage of dry matter intake/body weight and the body weight change of does between two breeds during 154 days lactation period. On the milk production and their components, no differences have been found between these two breeds (0.547 vs. 0.536 kg/day). There was no difference between breeds on the growth performance of kids. Kids nursed by their does had heavier ($P < 0.05$) weaning weight and average daily gain before weaning than those kids nursed by baby bottles. Resulted showed that Hengchun black does have the same milking ability with the Boer does. Both breeds have good maternal abilities.

Key words: Hengchun black goat, Boer goat, Milking ability, Growth performances.

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