

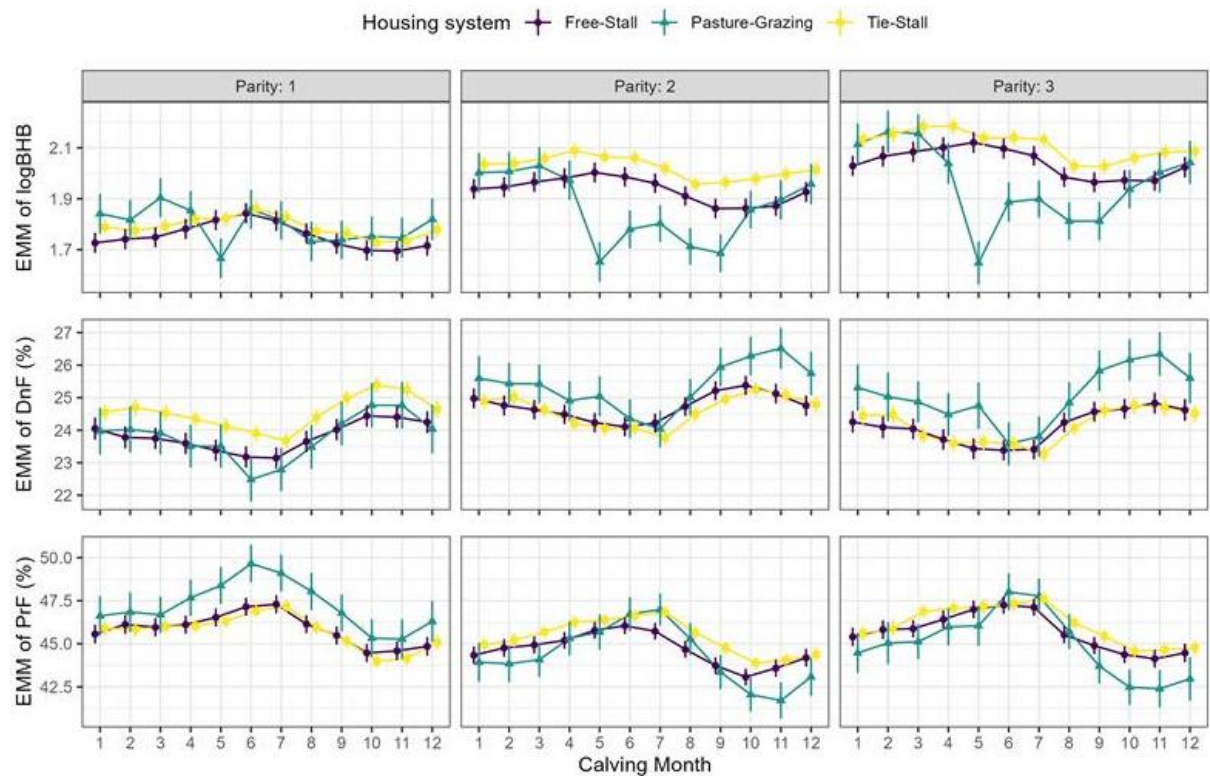


Figure 1. Effect of calving month (Estimated marginal mean [EMM] $\pm 1.96SE$) on metabolic traits in early lactation across housing systems and parities (logBHB: log-transformed beta-hydroxybutyrate; DnF: *de novo* fatty acid proportion; PrF: preformed fatty acid proportion).

Table 1. Record number of the beta-hydroxybutyrate dataset and the fatty acid proportion dataset (values in parentheses) by housing system and parity.

Housing System	Farm Number	Record Number in each Parity		
		1	2	3
Free-Stall	283 (278)	77,338 (33,530)	60,961 (27,973)	40,763 (19,582)
Pasture -Grazing	113 (111)	8,239 (3,778)	7,209 (3,304)	5,824 (2,753)
Tie-Stall	750 (732)	66,520 (30,506)	56,646 (27,105)	41,889 (20,370)

Table 2. Within-herd heritability estimates (median; 95% highest density interval) of metabolic traits during early lactation across housing systems and first three parities.

Trait¹	Parity	Free-Stall	Pasture-Grazing	Tie-Stall
logBHB	1	0.21 (0.19 - 0.23)	0.20 (0.16 - 0.24)	0.23 (0.21 - 0.24)
	2	0.20 (0.19 - 0.22)	0.24 (0.21 - 0.28)	0.18 (0.16 - 0.19)
	3	0.18 (0.16 - 0.20)	0.25 (0.20 - 0.30)	0.18 (0.16 - 0.20)
DnF	1	0.18 (0.16 - 0.21)	0.21 (0.15 - 0.28)	0.20 (0.17 - 0.22)
	2	0.11 (0.09 - 0.13)	0.21 (0.16 - 0.28)	0.13 (0.11 - 0.15)
	3	0.13 (0.11 - 0.16)	0.22 (0.16 - 0.31)	0.13 (0.11 - 0.16)
PrF	1	0.21 (0.18 - 0.23)	0.26 (0.17 - 0.36)	0.25 (0.22 - 0.28)
	2	0.15 (0.13 - 0.18)	0.27 (0.21 - 0.33)	0.19 (0.16 - 0.21)
	3	0.18 (0.15 - 0.22)	0.27 (0.20 - 0.35)	0.18 (0.16 - 0.21)

¹ logBHB: log-transformed beta-hydroxybutyrate; DnF: *de novo* fatty acid proportion in total fatty acid;
PrF: preformed fatty acid proportion in total fatty acid

Table 3. Genetic correlations (median; 95% highest density interval) of metabolic traits during early lactation among first three parities for cows managed under free-stall (FS), pasture-grazing (GZ), and tie-stall (TS) systems.

Trait ¹	Housing	Parity		
		1 st -2 nd	1 st -3 rd	2 nd -3 rd
logBHB	FS	0.82 (0.78 - 0.86)	0.80 (0.75 - 0.84)	0.95 (0.93 - 0.98)
	GZ	0.75 (0.65 - 0.84)	0.63 (0.51 - 0.73)	0.85 (0.72 - 0.92)
	TS	0.82 (0.78 - 0.86)	0.78 (0.72 - 0.84)	0.94 (0.91 - 0.97)
DnF	FS	0.62 (0.52 - 0.70)	0.62 (0.51 - 0.70)	0.84 (0.74 - 0.90)
	GZ	0.33 (0.15 - 0.54)	0.35 (0.07 - 0.60)	0.72 (0.51 - 0.85)
	TS	0.64 (0.54 - 0.73)	0.63 (0.53 - 0.72)	0.85 (0.78 - 0.90)
PrF	FS	0.64 (0.56 - 0.71)	0.61 (0.52 - 0.68)	0.85 (0.80 - 0.91)
	GZ	0.41 (0.18 - 0.58)	0.45 (0.25 - 0.64)	0.74 (0.55 - 0.87)
	TS	0.66 (0.56 - 0.73)	0.66 (0.58 - 0.74)	0.92 (0.86 - 0.96)

¹ logBHB: log-transformed beta-hydroxybutyrate; DnF: *de novo* fatty acid proportion in total fatty acid; PrF: preformed fatty acid proportion in total fatty acid

Table 4. Genetic correlations (median; 95% highest density interval) of metabolic traits during early lactation among cows managed under free-stall (FS), pasture-grazing (GZ), and tie-stall (TS) systems for the first three parities.

Trait ¹	Parity	Housing		
		FS-GZ	FS-TS	GZ-TS
logBHB	1	0.81 (0.75 - 0.89)	0.97 (0.95 - 0.98)	0.87 (0.82 - 0.93)
	2	0.89 (0.83 - 0.94)	0.96 (0.94 - 0.99)	0.94 (0.88 - 0.97)
	3	0.81 (0.74 - 0.87)	0.96 (0.95 - 0.97)	0.77 (0.69 - 0.86)
DnF	1	0.71 (0.54 - 0.84)	0.97 (0.95 - 0.99)	0.78 (0.69 - 0.87)
	2	0.82 (0.70 - 0.93)	0.91 (0.85 - 0.97)	0.74 (0.61 - 0.85)
	3	0.59 (0.38 - 0.75)	0.91 (0.85 - 0.96)	0.54 (0.36 - 0.68)
PrF	1	0.79 (0.60 - 0.88)	0.97 (0.92 - 0.99)	0.78 (0.60 - 0.91)
	2	0.87 (0.78 - 0.92)	0.96 (0.90 - 0.99)	0.83 (0.74 - 0.89)
	3	0.70 (0.57 - 0.80)	0.94 (0.90 - 0.97)	0.65 (0.51 - 0.80)

¹ logBHB: log-transformed beta-hydroxybutyrate; DnF: *de novo* fatty acid proportion in total fatty acid; PrF: preformed fatty acid proportion in total fatty acid