Communication

Zoometric Characterization of Creole cows from the Southern Amazon Region of Peru

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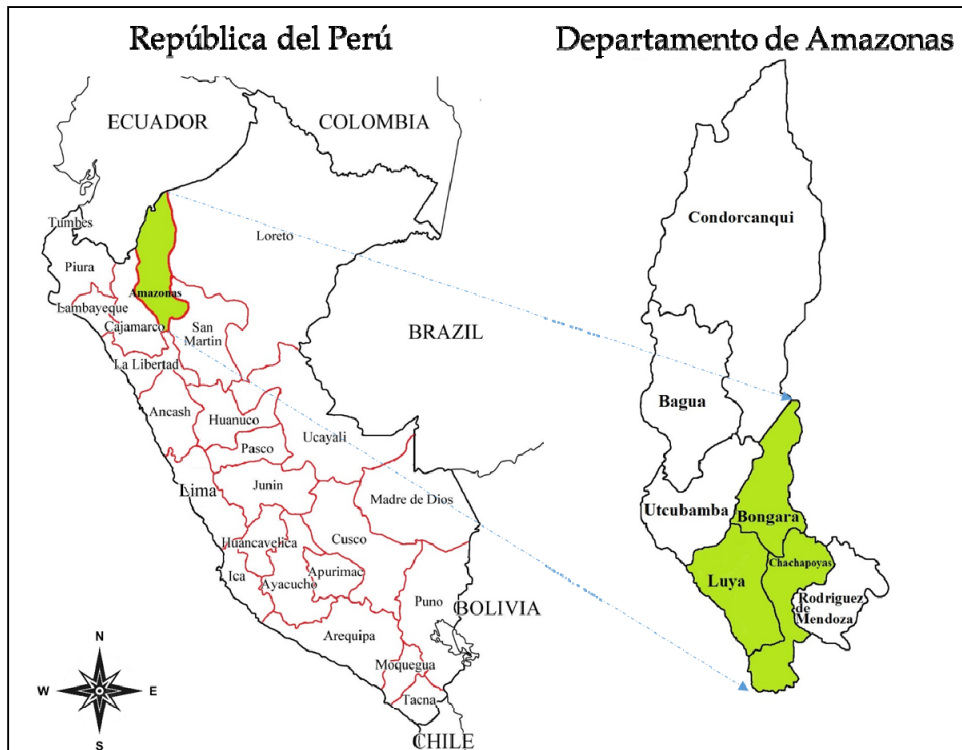
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Table S1. Creole bovine location.

Province	District	South Latitude	West Longitude	Life Zone	Average Temperature	masl
Chachapoyas	Soloco	6°17'21"	77°41'03"	TM-mf	16 °C	2188
	San Francisco de Daguas	6°13'53"	77°43'51"	TM-rf	15.5 °C	1999
	Molinopampa	6°12'46"	77°40'02"	LTM-mf	14.5 °C	2389
	Olleros	6°03'12"	77°38'33"	TM-mf	10.5 °C	3098
	Quinjalca	6°05'18"	77°40'36"	LTM-mf	10.6 °C	3050
	Huancas	6°09'56"	77°51'50"	TM-df	16 °C	2619
Luya	Colcamar	6°18'07"	77°58'46"	TM-vmm	16 °C	2384
	Conila	6°07'23"	78°12'29"	LMT-df	12 °C	2533
	Inguilpata	6°10'00"	78°04'38"	TM-vmf	17 °C	2818
Bongará	Cuispes	5°55'29"	77°56'40"	LMT-df	19 °C	1888
	San Carlos	5°58'15"	77°53'07"	TM-df	15 °C	2821

These locations refer to where female Creole bovine data was taken. TM-mf: Tropical Montane moist forest. TM-rf: Tropical Montane rain forest, LTM-mf: Low Tropical Montane moist forest, TM-mf: Tropical Montane moist forest, TLM-mf: Tropical Low Montane moist forest, TM-df: Tropical Montane dry forest, TM-vmm: Tropical Montane very moist forest, LMT-df: Low Tropical Montane dry forest, masl: meters above sea level.

Figure S1. Geographical location of Chachapoyas, Luya and Bongará province in Amazonas.

Table S2. Qualitative and quantitative traits[1] of creole bovine.

Quantitative traits						
Structure	Raised to sacrum	Body depth	Hip width	Back length	Rump length	Pelvic tilt
Udder	Teats length	Teats thickness	Fore udder length	Udder depth	Central ligament	

Qualitative traits					
Muscularity	Concave	Slightly concave	Straight	Slightly convex/normal	Convex / thin
Udder	Fore udder attachment	Front teat placement	Rear udder length	Rear teat orientation	Rear teat placement
Coloring pattern	Simple	Compound		Mixed	
Coat color	See figure 2				
Hoof color	Dark		Clear		
Horn tip color	Black	Dark		Amber	

[1]Classification according to https://www.fleckscore.com/; and [21, 22]

Table S3. Defects of female Creole cows.

Udder	Body	Feet and Leg
Presence or absence of edema	Backline impressed	Loosely shoulder
Staged udder	Kidney impressed	Front legs distorted
Teats distance close	Chest narrow	Hindfoot outwards
Teats crumbly	Rump narrow	Rolled hoof
Front teats spread out	Rump arched	Splayed hoof
Front teats spread forward		

[1]Defects according to the FleckScore classification.

Table S4. Body Condition [24]

Score	1	2	3	4	5
Backbone	Animal with a spine easily palpable	Animal with some fatty tissue on the spine.	There is no visible spine.	They had no visible spinal column, visible only when pressured.	They are characterised by a well-rounded spinal column covered with fatty tissue.
Hip bone	Very prominent hip bone.	More rounded hip bone.	Barely perceptible and well covered with fatty tissue.	Only visible when pressured.	No visible
Tailhead	Deep cavity around the tailhead.	Shallow cavity around the tailhead.	No visible cavity around the tailhead, which is slightly rounded and covered with fatty tissue.	Folds of fatty tissue are observed around the tailhead.	The tailhead is buried in a thick layer of fatty tissue.
Ribs	Palpable and prominent.	Palpable and slightly prominent.	Visible and covered by fatty tissue	Hardly visible.	No visible and palpable.
Overall state	Emaciated bovine	Slender and healthy-looking animal.	Firm and not obese.	Obese with full hindquarters.	Extremely obese, with excessively full hindquarters.

Table S5. Validation of the clusters or cow biotypes by ANOVA, KMO and Bartlett test

ANOVA

	Sum of squares	Degrees of freedom	Quadratic mean	F	Significance
Between groups	1640,153	2	820,077	16,386	**,000**
Within groups	4604,268	92	50,046		
Total	6244,421	94			

KMO and Bartlett test

Kaiser-Meyer-Olkin measure of sampling adequacy		**,389**
Bartlett's test of sphericity	Aprox. Chi-cuadrado	2175,904
	Degrees of freedom	946
	Significance	**,000**

Table S6. Qualitative traits of creole cows (N = 95) according to age and lactation (%)[1].

Age	Six-teeth	Eight-teeth	Full-mouth		P-value
Muscularity					
Concave	4.8	12.9	4.7		
Slightly concave	28.6	16.1	27.9		0.032**
Straight	61.9	67.7	41.9		
Slightly convex/normal	4.8	3.2	25.6		
Fore udder attachment (°)					
10 to 20	4.8	19.4	7.0		
20 to 30	4.8	9.7	0.0		
30 to 40	66.7	51.6	32.6		0.007**
40 to 50	23.8	6.5	44.2		
50 to 60	0.0	9.7	14.0		
60 to 70	0.0	3.2	2.3		
Front teat placement					
Very protruding	42.9	25.8	11.6		
Centered	23.8	38.7	48.8		
Slightly inward	0.0	9.7	27.9		0.006**
Inward	33.3	22.6	9.3		
Very inward	0.0	3.2	2.3		
Hock angularity (°)					
Slightly angled	0.0	50.0	50.0		
Slightly angled	0.0	57.1	42.9		
Normal angulation	22.6	25.8	51.6		0.756
Slightly more angled	27.5	32.5	40.0		
Very angled	20.0	33.3	46.7		
Hock development					
Undefined	9.5	6.5	16.3		
Slightly undefined	52.4	58.1	34.9		0.565
Clear	33.3	32.3	44.2		
Very defined	4.8	3.2	4.7		
Pasterns					
Flexible	23.8	22.6	18.6		
Slightly flexible	61.9	54.8	58.1		0.92
Tight	14.3	22.6	23.3		
Lactation	**1st Lact**	**2nd Lact**	**3rd Lact**	**≥ 4th Lact**	**P-value**
Muscularity					
Concave	0.0	71.4	28.6	0.0	
Slightly concave	13.0	47.8	30.4	8.7	0.068
Straight	21.2	59.6	17.3	1.9	
Slightly concave/normal	7.7	23.1	53.8	15.4	

Fore udder attachment (°)

10 to 20	30.0	60.0	10.0	0.0	
20 to 30	25.0	75.0	0.0	0.0	
30 to 40	20.5)	56.8	18.2	4.5	0.437
40 to 50	7.7	42.3	42.3	7.7	
50 to 60	0.0	44.4	44.4	11.1	
60 to 70	0.0	50.0	50.0	0.0	

Front teat placement

Very protruding	13.6	72.7	9.1	4.5	
Centered	18.4	42.1	28.9	10.5	
Slightly inward	13.3	20.0	66.7	0.0	0.007**
Inward	16.7	77.8	5.6	0.0	
Very inward	0.0	50.0	50.0	0.0	

Hock angularity (°)

Slightly angled	50.0	50.0	0.0	0.0	
Slightly angled	28.6	28.6	42.9	0.0	
Normal angulation	19.4	45.2	29.0	6.5	0.689
Slightly more angled	10.0	62.5	20.0	7.5	
Very angled	13.3	53.3	33.3	0.0	

Hock development

Undefined	27.3	45.5	18.2	9.1	
Slightly undefined	11.4	59.1	25.0	4.5	0.873
Clear	16.7	50.0	27.8	5.6	
Very defined	25.0	25.0	50.0	0.0	

Pasterns

Flexible	15.0	50.0	25.0	10.0	
Slightly flexible	16.4	52.7	27.3	3.6	0.974
Tight	15.0	55.0	25.0	5.0	

[1] Asymptotic (two-sided) significance using Pearson's chi-square in SPSS v. 15; * Significant ($p < 0.05$), ** Highly significant ($p < 0.01$).

Table S7. Presence of defect in structure traits of Creole cow (N = 95) according to age and lactation (%)[1]

Age	Six- teeth	Eight- teeth	Full-mouth	P-value
Backline impressed	14.3	32.3	32.6	0.266
Kidney impressed	14.3	32.3	30.2	0.308
Chest narrow	42.9	25.8	14	0.039*
Rump narrow	19.1	6.5	23.3	0.155
Rump roof shaped	14.3	22.6	30.2	0.364
Loosely shoulder	38.1	12.9	39.5	0.034*
Hindfoot outwards	61.9	74.2	67.4	0.634
Rolled hoof	0.0	6.5	4.7	0.514
Splayed hoof	0.0	6.5	7.0	0.471
Udder edema	0.0	3.2	0.0	0.352
Staged Udder	33.3	22.6	48.8	0.065
Teats distance close	61.9	74.2	60.5	0.442
Teats crumbly	0.0	0.0	2.3	0.543
Front teats spread out	0.0	6.5	2.3	0.39
Teats spread forward	0.0	0.0	2.3	0.543
Front legs distroted	9.5	0.0	0.0	0.027*

Lactation	1st Lact	2nd Lact	3rd Lact	≥ 4th Lact	P-value
Backline impressed	14.8	40.7	40.7	3.7	0.241
Kidney impressed	15.4	42.3	38.5	3.8	0.412
Chest narrow	17.4	60.9	13.0	8.7	0.369
Rump narrow	25.0	43.8	25.0	6.3	0.712
Rump roof shaped	21.7	30.4	39.1	8.7	0.107
Loosely shoulder	20.7	44.8	34.5	0.0	0.224
Front legs distroted	0.0	100.0	0.0	0.0	0.607
Hindfoot outwards	10.8	56.9	27.7	4.6	0.229
Rolled hoof	50.0	25.0	25.0	0.0	0.27
Splayed hoof	0.0	40.0	40.0	20.0	0.315
Udder edema	0.0	100.0	0.0	0.0	0.823
Staged udder	20.0	40.0	31.3	8.6	0.261
Teats distance closes	14.5	59.7	22.6	3.2	0.239
Teats crumbly	0.0	100.0	0.0	0.0	0.823
Front teats spread out	0.0	66.7	33.3	0.0	0.843
Teats spread forward	0.0	100.0	0.0	0.0	0.823

[1] Asymptotic (two-sided) significance using Pearson's chi-square in SPSS v. 15.

Table S8. Quantitative traits of Creole cows (N = 95) according to age and lactation

Age	6 teeth	8 teeth	Full-mouth	Total	P-value
N	21	31	43	95	
Height at cross	125.8±8.5	125.5±7.4	124.4±8.6	124.6±8.2	0.42
Body depth	68.3±4.5	69.0±7.6	72.1±8.2	70.3±7.5	0.08
Hip width	45.4±5.0	46.4±4.1	45.1±4.4	45.6±4.4	0.5
Back length	84.5±7.2	87.9±9.2	92.2±12.8	89.1±11.0	0.21
Rump length	45.5±3.0	46.0±3.4	44.9±3.1	45.4±3.2	0.3
Teats length	5.1±0.9	6.0±1.6	5.8±1.4	5.7±1.4	0.07
Teats thickness	2.6±0.4	2.6±0.5	2.9±0.4	2.7±0.5	0.07
Fore udder length	15.1±3.6	13.9±3.3	13.7±2.6	14.1±3.1	0.23
Rear udder length	13.2±0.4[a]	13.0±0.2[b]	13.0±0.2[b]	13.1±0.3	0.020*
Udder depth	19.2±5.6	17.4±5.0	18.8±5.1	18.4±4.8	0.3
Central ligament	1.8±1.1	2.2±1.1	2.4±0.8	2.2±1.0	0.07
Hoof height	2.6±1.2	2.8±1.1	2.6±1.1	2.7±1.1	0.8
Rump angle	4.5±1.9	4.9±2.0	4.5±2.2	4.6±2.0	0.6
Body condition	2.6±0.3	2.7±0.3	2.8±0.3	2.7±0.3	0.27
Lactation	**1st Lact**	**2nd Lact**	**≥ 3rd Lact**	**Total**	**P-value**
N	15	50	30	95	
Height at cross (cm)	122.7±9.6	126.4±7.3	122.6±8.5	124.6±8.2	0.084
Depth (cm)	72.9±8.2	68.6±6.0	71.7±8.7	70.3±7.5	0.06
Hip width (cm)	42.9±4.4[b]	46.5±4.6[a]	45.4±3.8[a]	45.6±4.4	0.022*
Back length (cm)	91.2±12.9	87.6±9.5	90.4±12.2	89.1±11.0	0.397
Rump length (cm)	43.8±3.2[b]	46.1±3.2[a]	45.0±2.8[ab]	45.4±3.2	0.034*
Teats length (cm)	5.6±1.5	5.7±1.4	5.7±1.3	5.7±1.4	0.983
Teats thickness (cm)	2.7±0.5	2.7±0.5	2.8±0.4	2.7±0.5	0.4
Fore udder length (cm)	13.4±3.2	14.5±3.4	13.8±2.4	14.1±3.1	0.428
Rear udder length (cm)	13.1±0.4	13.1±0.3	13.0±0.2	13.1±0.3	0.449
Udder depth (cm)	19.1±4.5	18.7±5.2	17.6±4.0	18.4±4.8	0.517
Central ligament (cm)	2.1±1.0	2.1±1.1	2.3±0.8	2.2±1.0	0.58
Hoofs height (cm)	2.4±1.2	2.7±1.0	2.8±1.3	2.7±1.1	0.677
Body condition	2.7±0.2	2.7±0.3	2.8±0.3	2.7±0.3	0.204

[1]Duncan's multiple comparisons with an alpha level of 0.05 in SPSS v. 15. * Significant (p <0.05).