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FAMACHA© Scores, Hematocrit, and Fecal Egg Counts in Canindé Goats: Seasonal Effects and Classification Agreement in a Predominantly Non-Anemic Herd

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Abstract

This study evaluated seasonal and FAMACHA©-group effects on hematocrit (HCT) and fecal egg counts (EPG) and, separately, quantified agreement between observed FAMACHA© scores and HCT-derived categories in Canindé goats raised under semiarid conditions. Analyses were restricted to 162 adult goats, assessed in both the rainy and dry seasons, yielding a balanced dataset of 324 observations (162 per season). Mean EPG was 327.16 ± 317.18 in the rainy season and 206.91 ± 323.32 in the dry season; corresponding log10(EPG + 1) means were 2.216 ± 0.742 and 1.516 ± 1.127. Random-intercept linear mixed models detected a season-by-FAMACHA©-group interaction for log-transformed EPG ($p = 0.0105$). For HCT, the interaction was not significant ($p = 0.5186$); the reduced additive model indicated an overall FAMACHA©-group effect ($p = 0.0372$), whereas the season effect was not significant ($p = 0.0726$). Exact category agreement was 2/324 (0.6%). Linearly weighted Cohen's κ was 0.0001 (animal-cluster bootstrap 95% CI: 0.0000–0.0004), and unweighted κ was −0.0003 (95% CI: −0.0051–0.0067). No observation had HCT ≤22%; therefore, the absence of clinically anemic observations precluded estimation of sensitivity and a meaningful assessment of diagnostic accuracy across disease states. The near-zero agreement applies only to this predominantly non-anemic sample and may reflect restricted disease severity, breed-related mucosal-color variation, use of analyzer-derived HCT rather than spun packed cell volume, or a combination of these factors.

Keywords: fecal egg count; gastrointestinal nematodes; hematocrit; selective treatment; semiarid region

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1. Introduction

Gastrointestinal nematodes are among the main health constraints affecting small ruminant production worldwide, causing economic losses through reduced productivity, impaired animal performance, and increased mortality [1,2]. Among these parasites, Haemonchus contortus is considered one of the most pathogenic species due to its hematophagous behavior and its ability to induce anemia, particularly under favorable environmental conditions [3].

The increasing occurrence of anthelmintic resistance has stimulated sustainable parasite-control strategies, including targeted selective treatment. The FAMACHA© system is widely used to identify animals that may require treatment based on ocular mucous membrane color as a field indicator of anemia [4]. Validation studies have shown that its performance varies with host species, population, observer training, infection spectrum, and intended purpose [5–8].

The relationship between FAMACHA© score and hematological or parasitological measurements may vary with breed, environmental conditions, physiological status, and the distribution of disease severity in the sampled population. Locally adapted breeds may also differ in resilience to parasitic challenge, reinforcing the need to interpret ocular mucosal color together with hematological and parasitological information rather than as a stand-alone indicator [1,3].

The Canindé goat is a locally adapted Brazilian breed recognized for its adaptation and resilience to semiarid environments [9]. However, physiological and phenotypic characteristics associated with this adaptation may influence the relationship between ocular mucosal color, hematological measurements, and parasite burden [10,11]. We hypothesized that five-score FAMACHA© scores and HCT-derived categories would show limited agreement in Canindé goats and that seasonal conditions would affect EPG and HCT differently across FAMACHA© groups. Therefore, this study aimed to evaluate the effects of season and pooled FAMACHA© group on HCT and EPG and to quantify the agreement between observed FAMACHA© scores and HCT-derived categories in locally adapted Canindé goats.

2. Materials and Methods

2.1. Ethical Approval and Study Area

All experimental procedures were approved by the Ethics Committee on Animal Use of the Federal Rural University of the Semi-Arid Region (UFERSA; protocol n°. 23091003895/2014-71, 3 September 2013).

The study was conducted on a commercial farm located in Pedro Avelino, Rio Grande do Norte, Brazil (5°23′ S, 36°23′ W; 95 m altitude), within the Brazilian semiarid region. The animals were raised under an extensive production system on native Caatinga vegetation, with free access to water and nighttime shelter in dirt-floor corrals.

2.2. Animals and Experimental Design

The study included 162 adult Canindé goats aged 1.5–3.5 years. Each animal was evaluated once during the rainy season and once during the dry season, resulting in a balanced longitudinal dataset of 324 observations, with 162 observations per season. Animals were individually identified and clinically evaluated for evident disorders unrelated to gastrointestinal parasitism.

Blood and fecal samples and the FAMACHA© score were obtained at each recorded visit. Each included animal contributed one complete record per season, and animal identity was retained as the random effect to account for the paired repeated measurements.

2.3. FAMACHA© Evaluation

The FAMACHA© system was applied individually by a single trained evaluator using the standard five-score FAMACHA© [7]. Observed FAMACHA© scores ranged from 1 to 5. For the agreement analysis, each HCT value was assigned to an HCT-derived category according to the historical PCV-based intervals reported by Van Wyk and Bath [6]: ≥28%, 23–<28%, 18–<23%, 13–<18%, and <13% for categories 1–5, respectively. These

HCT-derived categories were used solely as operational reference categories and were not Canindé-specific diagnostic thresholds.

2.4. Hematological Analyses

Blood samples were collected by jugular venipuncture into tubes containing ethylenediaminetetraacetic acid (EDTA). Samples were maintained under refrigeration and transported to the laboratory for analysis.

A complete blood count, including red blood cell count, hemoglobin, HCT, and erythrocyte indices, was performed using an automated hematology analyzer (SDH-3, SDH Laboratory Diagnostics) based on electrical impedance. HCT was selected a priori because the historical PCV-based intervals were originally linked to spun packed cell volume (PCV). Automated HCT is related to, but not analytically identical to, PCV measured by microhematocrit; consequently, the present analysis evaluated agreement with operational HCT-derived categories rather than directly replicating the original PCV-based validation. The remaining hematological variables were outside the study objective.

2.5. Parasitological Analyses

Fecal samples were collected directly from the rectum, identified individually, and transported under refrigerated conditions to the laboratory.

Fecal egg counts were determined using the McMaster technique [12,13]. Briefly, 4 g of feces was homogenized in 26 mL of saturated sodium chloride solution, and the resulting suspension was used for egg counting. Results were expressed as eggs per gram of feces (EPG). No coproculture was performed. Therefore, species-level identification was not performed, and the EPG data could not be used to determine species composition.

2.6. Statistical Analysis

Data were screened for outliers and evaluated for normality using the Shapiro–Wilk test and for homogeneity of variances using Levene's test. Egg count data were log-transformed [log10(x + 1)] before analysis to improve normality.

HCT and log10(EPG + 1) were analyzed using random-intercept linear mixed models based on 324 observations from 162 goats evaluated in both seasons. Season, pooled FAMACHA© group (scores 1–2, score 3, and scores 4–5), and their interaction were included as fixed effects, whereas animal identity was included as a random effect to account for repeated measurements. Adjacent FAMACHA© scores were pooled because scores 1 and 5 had small sample sizes. The season-by-group interaction was evaluated by comparing nested models fitted by maximum likelihood using a likelihood-ratio test. When the interaction was not significant, it was removed, and an additive model was fitted. Main effects in the selected additive model were evaluated using maximum-likelihood likelihood-ratio tests. The selected models were subsequently refitted using restricted maximum likelihood to estimate variance components, least-squares means, and standard errors. Simple effects and pairwise contrasts were evaluated using model-based Wald statistics, and pairwise p values were adjusted using the Holm method within each family of comparisons. Models were implemented in Python 3.12 using NumPy 2.3.5 and SciPy 1.17.0.

Agreement between observed FAMACHA© scores and HCT-derived categories was evaluated separately using the same 324 observations. Each HCT measurement was assigned to one of five operational HCT-derived categories based on the historical PCV intervals reported by Van Wyk and Bath [6] and compared with the corresponding observed FAMACHA© score. Exact agreement, linearly weighted Cohen's κ, and unweighted Cohen's κ were calculated. Because the categories are ordinal, linearly weighted κ was defined as the primary agreement coefficient, whereas unweighted κ quantified exact-category agreement beyond chance. Percentile 95% confidence intervals were obtained from

10,000 cluster-bootstrap samples generated by resampling the 162 animals with replacement while retaining both seasonal observations from each selected animal. Diagnostic sensitivity and specificity were not estimated because no observations were classified as clinically anemic according to the adopted HCT criterion. Statistical significance was established at $p < 0.05$.

3. Results and Discussion

Mean EPG was higher descriptively in the rainy season (327.16 ± 317.18) than in the dry season (206.91 ± 323.32), and the corresponding mean log10(EPG + 1) values were 2.216 ± 0.742 and 1.516 ± 1.127 (Table 1).

Table 1. Descriptive hematocrit (HCT), fecal egg count (EPG), and log10(EPG + 1) by season.

Season	n	HCT (%)	EPG	log10(EPG + 1)
Rainy	162	36.32 ± 3.80	327.16 ± 317.18	2.216 ± 0.742
Dry	162	36.79 ± 5.17	206.91 ± 323.32	1.516 ± 1.127

Values are mean ± SD; n denotes the number of observations. Inferential results are reported from the mixed models; all 162 animals contributed one observation in each season.

Mean HCT was similar descriptively between seasons (36.32 ± 3.80% and 36.79 ± 5.17%, respectively). Because the mixed model detected a season-by-score-group interaction for log-transformed EPG, seasonal differences were interpreted within pooled FAMACHA© groups rather than as a single marginal season effect.

FAMACHA© scores of 3 and 4 were predominant (Figure 1). During the rainy season, the counts for scores 1–5 were 0, 10, 88, 62, and 2; during the dry season they were 1, 21, 55, 76, and 9. For mixed-model analyses, these were pooled into groups 1–2, 3, and 4–5, yielding group sizes of 10, 88, and 64 in the rainy season and 22, 55, and 85 in the dry season.

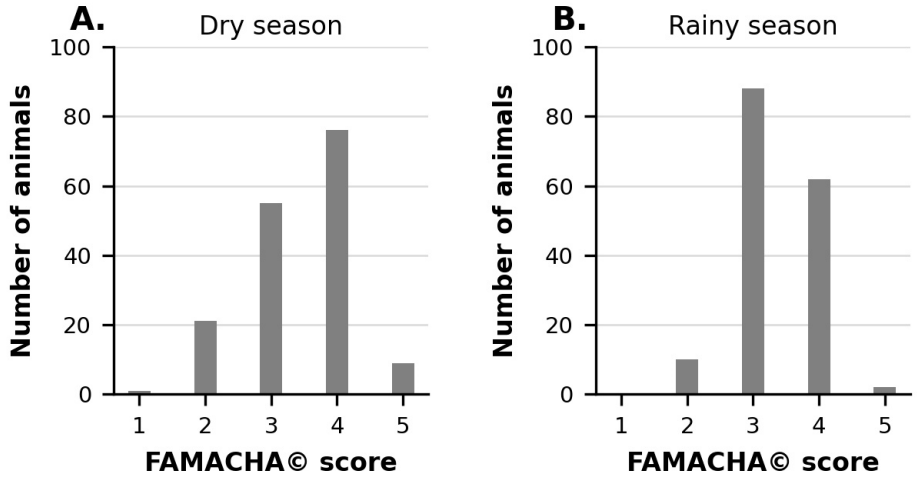


Figure 1. Distribution of observed FAMACHA© scores in the balanced paired cohort of Canindé goats by season: (**A**) dry season (n = 162); (**B**) rainy season (n = 162).

For HCT, the season-by-group interaction was not significant (likelihood-ratio $\chi^2 = 1.3132$, $p = 0.5186$) and was removed. In the additive model, there was an overall pooled-group effect (likelihood-ratio $\chi^2 = 6.5853$, $p = 0.0372$), whereas the season effect was not significant ($\chi^2 = 3.2225$, 1 df, $p = 0.0726$). Marginal HCT least-squares means were 36.78 ± 0.72%, 37.14 ± 0.40%, and 35.94 ± 0.39% for groups 1–2, 3, and 4–5, respectively; group 3 differed from group 4–5 (Holm-adjusted $p = 0.0322$; Table 2). For log10(EPG + 1), the season-by-group interaction was significant (likelihood-ratio $\chi^2 = 9.1132$, $p = 0.0105$).

A pooled-group effect occurred in the dry season (Wald $\chi^2 = 20.3448$, $p < 0.0001$), where group 4–5 exceeded groups 1–2 and 3 (Holm-adjusted $p = 0.0022$ and 0.0003, respectively); no group effect occurred in the rainy season ($p = 0.6135$; Table 3). Rainy-season values exceeded dry-season values in every pooled group (Holm-adjusted $p \leq 0.0042$).

Table 2. Marginal HCT least-squares means from the selected additive mixed model.

Outcome	Pooled FAMACHA© Group	n	LS Mean	SE
HCT (%)	1–2	32	36.78	0.72
HCT (%)	3	143	37.14	0.40
HCT (%)	4–5	149	35.94	0.39

n denotes observations; LS mean = least-squares mean; SE = standard error. Overall pooled-group effect: likelihood-ratio $\chi^2 = 6.5853$, 2 df, $p = 0.0372$. Pairwise Holm-adjusted p: 1–2 vs. 3 = 0.6280; 1–2 vs. 4–5 = 0.5414; 3 vs. 4–5 = 0.0322.

Table 3. Least-squares means for log10(EPG + 1) from the mixed model containing the season-by-group interaction.

Season	Pooled FAMACHA© Group	n	LS Mean	SE
Dry	1–2	22	1.106	0.197
Dry	3	55	1.200	0.125
Dry	4–5	85	1.827	0.101
Rainy	1–2	10	2.440	0.292
Rainy	3	88	2.164	0.099
Rainy	4–5	64	2.254	0.116

n denotes observations; LS mean = least-squares mean; SE = standard error. Pooled-group simple effects: dry, Wald $\chi^2 = 20.3448$, 2 df, $p < 0.0001$; rainy, Wald $\chi^2 = 0.9772$, 2 df, $p = 0.6135$.

The HCT-derived classification was extremely imbalanced: 312 observations were assigned to category 1, 12 to category 2, and none to categories 3–5. Cross-classification with the observed FAMACHA© score is presented in Table 4. This restricted HCT spectrum is central to interpreting both the agreement estimate and the inability to assess diagnostic accuracy.

Table 4. Cross-classification of HCT-derived categories and observed FAMACHA© scores across 324 paired-cohort observations.

HCT-Derived Category	FAMACHA© Score 1	FAMACHA© Score 2	FAMACHA© Score 3	FAMACHA© Score 4	FAMACHA© Score 5	Total
1 (≥28%)	1	30	139	131	11	312
2 (23–<28%)	0	1	4	7	0	12
3–5 (≤22%)	0	0	0	0	0	0
Total	1	31	143	138	11	324

HCT-derived categories used the historical PCV-based intervals reported by Van Wyk and Bath [6]. Exact agreement = 2/324 (0.6%); linearly weighted Cohen's $\kappa = 0.0001$ (animal-cluster bootstrap 95% CI: 0.0000–0.0004); unweighted $\kappa = -0.0003$ (95% CI: −0.0051–0.0067).

The absence of clinical anemia may reflect the low-to-moderate disease severity represented in this herd, breed-related resilience, management, or a combination of these factors. Normal breed-related variation in ocular mucosal pigmentation or color perception is also a plausible explanation for high FAMACHA© scores in animals with preserved HCT. Although locally adapted goats show physiological stability under semi-arid conditions [9,14,15], the present design cannot separate breed adaptation from infection severity, evaluator-related classification, or other causes of mucosal color variation.

Complete-case restriction may introduce selection bias if missing seasonal assessments were informative, although the sensitivity analysis using all 324 records produced the same qualitative conclusions.

Exact agreement occurred in 2 of 324 observations (0.6%). The primary linearly weighted Cohen's κ was 0.0001 (animal-cluster bootstrap 95% CI: 0.0000–0.0004); complementary unweighted κ was −0.0003 (95% CI: −0.0051–0.0067). These estimates are consistent with no agreement beyond chance in this sample. However, both coefficients are constrained by the extreme marginal imbalance and absence of HCT-derived categories 3–5 and should not be interpreted as definitive validation results for Canindé goats.

The historical PCV-based intervals were retained solely as operational reference categories and have not been validated as Canindé-specific diagnostic thresholds. In clinically healthy Canindé goats, Oliveira et al. [11] reported mean HCT values of 34.28 ± 8.82% in adult males, 33.95 ± 5.93% in pregnant females, 30.63 ± 6.93% in kids, and 32.15 ± 5.16% in non-pregnant adult females. Nunes et al. [16] further emphasized that caprine hematological estimates can depend on the analytical method and analyzer calibration. Thus, the near-zero agreement may reflect restricted anemia severity, breed-related ocular mucosal characteristics, evaluator-related classification, differences between automated HCT and microhematocrit PCV, the operational cutoffs, or a combination of these factors. Future studies should use a prespecified clinically justified reference standard, document analytical comparability, and recruit sufficient animals across all relevant anemia states.

Although the animals were clinically screened for evident health disorders, no comprehensive diagnostic investigation was performed to systematically exclude other potential causes of anaemia. Therefore, the findings should be interpreted as associations among FAMACHA© scores, HCT, and EPG rather than as an etiological assessment of anaemia.

No coproculture was performed; therefore, the presence and dominance of Haemonchus contortus, as well as possible seasonal changes in nematode species composition, could not be determined. Accordingly, the EPG findings should not be interpreted as *Haemonchus contortus*-specific evidence.

4. Conclusions

In conclusion, the five-score FAMACHA© classification showed limited correspondence with HCT-derived categories in this predominantly non-anemic cohort of Canindé goats. The effects of season and pooled FAMACHA© group on EPG and HCT indicate that the relationships among ocular mucosal color, parasite burden, and hematological status are influenced by environmental and biological factors. Therefore, under conditions similar to those evaluated here, FAMACHA© should not be interpreted as a stand-alone indicator of anemia or used to establish breed-specific treatment thresholds. Its application in targeted selective treatment programs for Canindé goats should be complemented, whenever possible, by hematological, parasitological, and clinical assessment. Because clinically anemic animals were not represented, these findings neither establish the diagnostic accuracy of FAMACHA© nor invalidate its use in this breed. Prospective studies encompassing the full spectrum of anemia are required to determine its diagnostic performance and to develop evidence-based decision thresholds for locally adapted goats raised in semiarid environments.

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References

1. Ferreira, J.B.; Bezerra, A.C.D.S.; Guilhermino, M.M.; Leite, J.H.G.M.; da Silva, W.E.; Paiva, R.D.M.; Barbosa, T.N.; de Sousa, J.E.R.; Façanha, D.A.E. Performance, endoparasitary control and blood values of ewes locally adapted in semiarid region. *Comp. Immunol. Microbiol. Infect. Dis.* **2017**, *52*, 23–29. [CrossRef] [PubMed]
2. Ferreira, J.B.; Paiva, R.D.M.; Bezerra, A.C.D.S.; de Sousa, J.E.R.; Façanha, D.A.E. A multivariate approach to the diagnosis of gastrointestinal infection in ewes. *Vet. Parasitol.* **2018**, *252*, 95–97. [CrossRef] [PubMed]
3. Vieira, L.S. Métodos alternativos de controle de nematoides gastrintestinais em caprinos e ovinos. *Tecnol. Ciênc. Agropecuária* **2008**, *2*, 49–56.
4. Ferreira, J.B.; Sotomaior, C.S.; Bezerra, A.C.D.S.; da Silva, W.E.; Leite, J.H.G.M.; de Sousa, J.E.R.; de Fátima França Biz, J.; Façanha, D.A.E. Sensitivity and specificity of the FAMACHA© system in tropical hair sheep. *Trop. Anim. Health Prod.* **2019**, *51*, 1767–1771. [CrossRef] [PubMed]
5. Vatta, A.F.; Letty, B.A.; van der Linde, M.J.; van Wijk, E.F.; Hansen, J.W.; Krecek, R.C. Testing for clinical anaemia caused by *Haemonchus* spp. in goats farmed under resource-poor conditions in South Africa using an eye colour chart developed for sheep. *Vet. Parasitol.* **2001**, *99*, 1–14. [CrossRef] [PubMed]
6. Vanwyk, J.A.; Bath, G.F. The FAMACHA© system for managing haemonchosis in sheep and goats by clinically identifying individual animals for treatment. *Vet. Res.* **2002**, *33*, 509–529. [CrossRef] [PubMed]
7. Molento, M.B.; Tasca, C.; Gallo, A.; Ferreira, M.; Bononi, R.; Stecca, E. Método Famacha como parâmetro clínico individual de infecções por Haemonchus contortus em pequenos ruminantes. *Ciênc. Rural* **2004**, *34*, 1139–1145. [CrossRef]
8. Burke, J.M.; Kaplan, R.M.; Miller, J.E.; Terrill, T.H.; Getz, W.R.; Mobini, S.; Valencia, E.; Williams, M.J.; Williamson, L.H.; Vatta, A.F. Accuracy of the FAMACHA© system for on-farm use by sheep and goat producers in the southeastern United States. *Vet. Parasitol.* **2007**, *147*, 89–95. [CrossRef] [PubMed]
9. da Silva, W.S.T.; Freitas Silveira, R.M.; Leite, J.H.G.M.; McManus, C.; Façanha, D.A.E. Coat characteristics, physiological traits, serum metabolites, and thyroid hormones of Canindé and Moxotó goats in a semiarid environment. *Trop. Anim. Health Prod.* **2026**, *58*, 378. [CrossRef] [PubMed]
10. Moors, E.; Gauly, M. Is the FAMACHA© chart suitable for every breed? Correlations between FAMACHA© scores and different traits of mucosa colour in naturally parasite-infected sheep breeds. *Vet. Parasitol.* **2009**, *166*, 108–111. [CrossRef] [PubMed]
11. Oliveira, M.G.C.; Nunes, T.L.; Paiva, A.L.C.; Bezerra, T.C.G.; Fernandes, N.S.; Vale, A.M.; Barrêto Júnior, R.A.; Paula, V.V. Hematological aspects of Canindé goats (*Capra hircus*) raised in Rio Grande do Norte. *Pesqui. Veterinária Bras.* **2012**, *32*, 4–8. [CrossRef]
12. Chagas, C.A.C.S.; Niciura, S.C.M.; Molento, M.B. *Manual Prático: Metodologia de Diagnóstico da Resistência e de Detecção de Substâncias Ativas em Parasitos de Ruminantes*; EMBRAPA: Brasília, Brazil, 2011.
13. Gordon, H.M.; Whitlock, H.V. A new technique for counting nematode eggs in sheep faeces. *J. Sci. Ind. Res.* **1939**, *12*, 50–52.
14. Ferreira, J.; Silveira, R.M.F.; de Sousa, J.E.R.; Façanha, D.A.E. Locally adapted goats efficiently gain and lose heat in an equatorial semi-arid environment. *Int. J. Biometeorol.* **2020**, *64*, 1777–1782. [CrossRef] [PubMed]

15. Ferreira, J.; Silveira, R.M.F.; de Sousa, J.E.R.; de Vasconcelos, A.M.; Guilhermino, M.M.; Façanha, D.A.E. Evaluation of homeothermy, acid-base and electrolytic balance of black goats and ewes in an equatorial semi-arid environment. *J. Therm. Biol.* **2021**, *100*, 103027. [CrossRef] [PubMed]
16. Nunes, T.L.; Oliveira, M.G.C.; Paiva, A.L.C.; Bezerra, T.C.G.; Barrêto Júnior, R.A.; Paula, V.V. Valores hemogasométricos e eletrolíticos de caprinos (*Capra Hircus*) da raça Canindé criados no semiárido nordestino. *Rev. Bras. DE Med. Veterinária* **2014**, *36*, 255–260.

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