Open Access

Check for updates

Research Article

Journal of Veterinary and Animal Sciences
ISSN (Print): 0971-0701, (Online): 2582-0605
https://doi.org/10.51966/jvas.2025.56.4.566-571

Field evaluation of FAMACHA© in detecting haemonchosis in indigenous sheep of Tamil Nadu: Correlation with volume of packed red cell and faecal egg count

Manikkavasagan[1], P. M. Raman[2*], Azahahianambi[3], S. T. Bino Sundar[4] and A. Serma Saravana Pandian[5]

[1]Department of Food Safety and Quality Assurance, College of Food and Dairy Technology, Tamil Nadu Veterinary and Animal Sciences University, Chennai-600052, India, [2]School of Public Health Sciences and Technology, Malla Reddy Vishwavidyapeeth, Hyderabad, India., [3]Department of Veterinary Parasitology, Veterinary College and Research Institute, Tirunelveli, Tamil Nadu Veterinary and Animal Sciences University, Chennai-6000007, India, [4]Department of Veterinary Parasitology, Veterinary College and Research Institute, Theni, Tamil Nadu Veterinary and Animal Sciences University, Chennai-6000007, India, [5]Department of Animal Husbandry Economics, Madras Veterinary College, Chennai.

Citation: Manikkavasagan, I., Raman, M., Azahahianambi, P., Bino Sundar, S. T., and Pandian, A.S.S. 2025. Field evaluation of FAMACHA© and its correlation with Packed cell volume and Faecal egg count in detection of haemonchosis in indigenous sheep breeds of Tamil Nadu, South India. *J. Vet. Anim. Sci.* **56** (4): 566-571

Received: 10.09.2025 Accepted: 16.10.2025 Published: 31.12.2025

Abstract

The *FAMACHA©* system was developed in South Africa and has been tested in various geographical regions on sheep for targeted selective treatment with anthelmintics against gastrointestinal parasitism, particularly *Haemonchus contortus.* This study was undertaken to evaluate the effectiveness of the FAMACHA© chart in different indigenous sheep breeds of Tamil Nadu, Southern India. The investigation involved 160 animals representing the Madras Red, Mecheri, Vembur and Nilagiri breeds. Faecal egg counts, haematological parameters, ocular mucous membrane photographs and FAMACHA© scores were recorded monthly from 40 animals of each breed. In Madras Red sheep, higher FAMACHA© scores were consistently associated with lower Volume of Packed Red Cell (VPRC) values and higher Egg per gram of faeces (EPG) counts, demonstrating a positive correlation. In Mecheri and Nilagiri breeds, FAMACHA© scores showed a stronger correlation with VPRC, while in the Vembur breed, over 50% of the animals exhibited a positive relationship between eye scores, VPRC, and EPG values. Overall, a significant negative correlation was observed between FAMACHA© scores and VPRC. The study concluded that a negative correlation was observed between FAMACHA© scores and VPRC values, indicating that higher FAMACHA© scores were associated with lower packed cell volumes (anaemia).

Keywords: *FAMACHA©, Sheep, H. contortus, ocular mucosa, VPRC, haemoglobin, EPG*

India ranks among the leading countries in livestock population, accounting for 27.8% of the global goat population and 13.8% of the sheep population. In South India, sheep and goat farming constitute an important livelihood strategy for small and marginal farmers and landless labourers, representing a crucial component of the rural economy. In India, sheep and goats are predominantly reared on small to medium-sized farms under intensive or semi-intensive

**Corresponding author: raman.tanuvas@gmail.com*

systems with high stocking densities, where the production of healthy lambs and kids is a key contributor to farm income.

Gastrointestinal parasitism poses a major constraint to the economic efficiency and sustainability of sheep and goat production systems. *Haemonchus contortus* is the major blood-feeding nematode that causes significant mortality and morbidity in sheep and goats, despite the regular use of potent anthelmintics. Anthelmintic resistance has increased dramatically in three groups of broad-spectrum anthelmintics among nematodes of sheep and goats in many parts of the world (Wolstenholme *et al.,* 2004). Development of resistant worm populations is one of the major concerns and most of the unorganized goat flocks in Tamil Nadu show resistance to most of the commonly used anthelmintics viz., albendazole, levamisole and ivermectin (Manikkavasagan *et al.,* 2013a, 2013b). Therefore, nematode control programs should be designed to maintain the maximum amount of refugia (the portion of the worm population that is not exposed to the drug) that is commensurate with sustainable parasite management and animal production (Van Wyk, 2001).

Several practical field applicable methods have been developed by researchers to reduce the use of anthelmintics and to develop practical methods of integrated parasite management (IPM) with less usage of anthelmintics (Bath, 2011). Recently, targeted selective treatment (TST) has been suggested as a strategy to decrease the use of anthelmintics and support the preservation of refugia populations in livestock. This approach is expected to aid in maintaining the genes responsible for susceptibility in parasite communities (Van Wyk and Bath, 2002). The best-known TST indicator is FAMACHA, derived from Dr. Faffa Malan (FAffa MAlan CHArt), a system developed in South Africa that uses anaemia, based on lower eyelid mucous membrane colour in small ruminants, as a marker for haemonchosis (Malan *et al*., 2001, Vatta *et al*., 2001 and Van Wyk and Bath, 2002). Through clinical identification and selective treatment of needy animals, use of anthelmintic drugs can considerably be reduced (Malan *et al*., 2001, Mahieu *et al*., 2007, Molento *et al*., 2009). Since its induction the FAMACHA© system had been studied in a variety of different countries and production systems to optimize its use (Kaplan *et al*., 2004; Ejlertsen *et al*., 2006; Burke and Miller 2008., Molento *et al*., 2009; Riley and Van Wyk, 2009; Scheuerle *et al*., 2010, Sotomaior *et al*., 2012, Vilella *et al* 2012). The FAMACHA© system assesses the worm infection status by grading the conjunctivae colour of sheep, which changes from deep red in healthy sheep, through shades of pink to practically white, as a result of anaemia caused by fatal haemonchosis. The extent to which these changes relate to a range of haematocrit values chosen as the "gold standard" of anaemia. Identifying needy sheep using FAMACHA© system and selectively deworming them would help to minimize the development of anthelmintic resistance to currently available anthelmintics. The present study was aimed at field evaluation of FAMACHA© system in indigenous sheep breeds maintained at organized sheep farms in Tamil Nadu, South India and to study the correlation between Volume of Packed Red Cell (VPRC), Egg per gram of faeces (EPG) and FAMACHA© scores in sheep infected with *Haemonchus contortus*.

Materials and methods

Animals

FAMACHA© evaluation was conducted in four organised sheep farms in Tamil Nadu, with the selected animals identified using ear tags. The study included both male and female sheep, encompassing young and adult animals. Among ewes, only late-lactating and non-lactating individuals were evaluated, while pregnant ewes were excluded. The breeds selected for the study were Madras Red, Nilagiri, Mecheri and Vembur.

Two farms of the Tamil Nadu Veterinary and Animal Sciences University viz. Post Graduate Research


Madras Red


Nilagiri


Mecheri


Vembur

Table.1. FAMACHA© Farm Visit and Sampling Details

	PGRIAS, Kattupakkam	SBRS, Ooty	DLF, Hosur	Government Sheep Farm, Sattur
No. of visits	21	4	4	2
Sheep breeds selected	Madras Red	Nilagiri	Mecheri	Vembur
No. of animals	40	40	40	40

Institute for Animal Sciences (PGRIAS), Kattupakkam, Chengalpattu District and Sheep Breeding Research Station (SBRS), Sandynallah, Ooty, The Nilagiri alongwith two state government farms viz. District Livestock Farm (DLF), Hosur and Government Sheep Farm, Sattur. A total of 21 visits were made to PGRIAS, Kattupakkam; 2 visits to Government Sheep Farm, Sattur; and 4 visits each to DLF, Hosur and SBRS, Ooty. (Table 1).

Collection of blood and faecal samples

The animals underwent monthly blood and faecal examinations, and the colour of the ocular mucous membrane was recorded. Blood samples were collected from the jugular vein into an ethylene diamine tetra acetic acid-containing tube for haematological analysis and faecal samples were collected directly from the rectum into a plastic container for faecal egg count and for identification of the larval composition.

FAMACHA© scoring

The colour of the lower eyelid mucous membrane was examined for each animal, and a score from 1 to 5 was assigned according to the colour intensity. Using the FAMACHA© eye colour chart, all animals in each flock were classified as follows: '1'= red, non-anaemic; '2'= red-pink, non-anaemic; '3'= pink, mildly anaemic; '4'= pink-white, anaemic; and '5'= white, severely anaemic. Animals with bright red ocular mucosa received a score of '1' or '2', while those with pale pink-white or white mucosa were scored '4' or '5'. Intermediate colouration was scored as '3'.

Statistical analysis

A one-way ANOVA was performed to compare VPRC, Hb and EPG values across visits. Correlation analyses were conducted for overall VPRC, Hb and EPG values, as well as between these parameters for each visit. All the statistical analyses were performed using SPSS software.

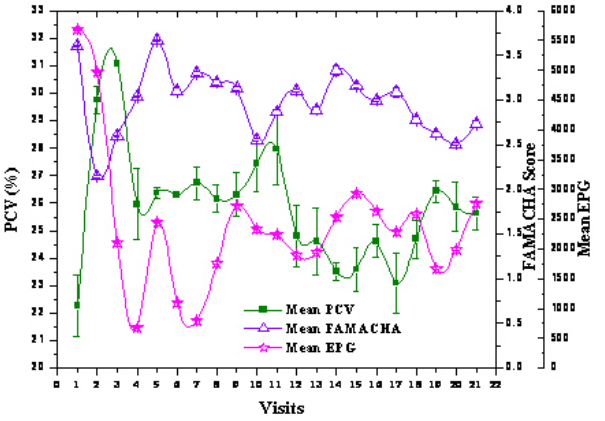

Fig 1: FAMACHA©, VPRC and EPG trends in Madras red sheep of PGRIAS Kattupakkam

Results and discussion

The majority of visits for evaluating the FAMACHA© system were conducted at PGRIAS, Kattupakkam, where the Madras Red breed was studied. The correlation between mean FAMACHA© scores and their corresponding VPRC and EPG values across different visits is presented in Fig. 1. In most instances, higher FAMACHA© scores corresponded with lower VPRC and higher EPG values in the flocks. However, occasional discrepancies were noted, where animals with high VPRC values were assigned low FAMACHA© scores. The results varied across farms as well as between visits, though the general trend in PGRIAS indicated a strong association of higher FAMACHA© scores with lower VPRC and higher EPG values.

The FAMACHA© system has been applied exclusively in sheep (Reynecke *et al*., 2011; Wagener *et al.,* 2021*;* Cunha *et al.,* 2024), exclusively in goats (Vatta *et al*., 2001; Mahieu *et al*., 2007; Scheuerle *et al*., 2010). A significant relationship was found between the FAMACHA© scoring method, body condition, and the Strongylida parasite load (Tachack *et al*., 2022). In all

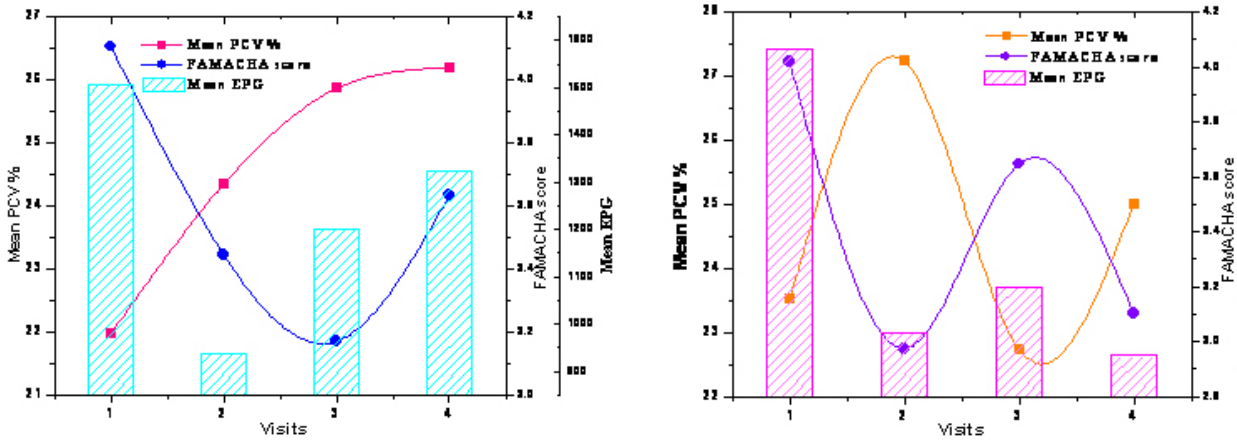

Fig 2: FAMACHA©, VPRC and EPG Assessment in Mecheri (at Hosur) and Nilgiri Sheep (at Ooty)

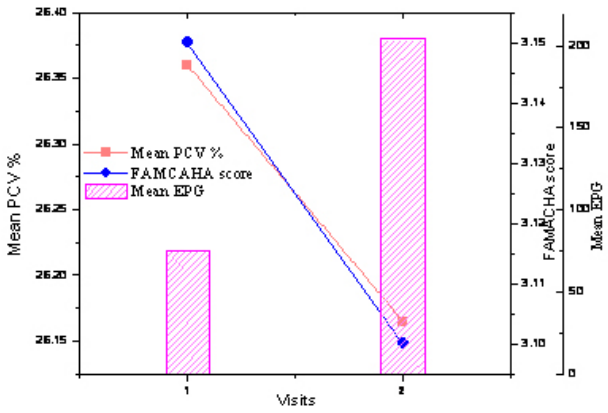

Fig 3: FAMACHA©, VPRC and EPG evaluation in Vembur sheep at government sheep farm, Sattur

cases, it has proven to be a highly effective field tool for targeted selective treatment of animals infected with haemonchosis.

From the four visits to Hosur and Ooty it was evident that the FAMACHA© scoring was good for both the sheep breeds, Mecheri and Nilagiri respectively. An increased FAMACHA© score gave a low VPRC value in the sheep flocks in both the farms from different regions. But the correlation between the mean EPG and the other two parameters was not good at all times (Fig 2). Loria *et al*. (2009) also reported a negative correlation between FAMACHA© scores, Hb, and haematocrit ($p < 0.001$).

Two visits were conducted to the Government Sheep Farm, Sattur, for evaluating the FAMACHA© system in 40 animals. During both visits, the EPG values of the flocks remained low. Analysis of the data revealed that in more than 50% of the animals, FAMACHA© eye scores showed a good correlation with the respective VPRC and EPG values (Fig. 3). In most cases, a decrease in VPRC was accompanied by an increase in EPG and a low FAMACHA© score, indicating a clear and consistent relationship among these three parameters. Similar findings were reported by Sotomaior *et al*. (2012), who observed a strong correlation between FAMACHA© scores and VPRC. The present study also demonstrated that higher FAMACHA© scores were significantly associated with lower VPRC values.

Statistical analysis revealed a highly significant difference ($p < 0.01$) between successive visits with respect to FAMACHA© scores, VPRC, Hb, and EPG values

Table 2. One-way ANOVA results for FAMACHA© score, EPG, VPRC and Hb across visits

Parameters	F	P value
FAMACHA© score	**17.543****	0.000
EPG	**5.834****	0.000
VPRC	**32.197****	0.000
Hb	**20.539****	0.000

** Statistically significant (P<0.01)

Table 3. Mean VPRC, Hb and EPG across successive visits

Visits	VPRC	Hb	EPG
1	25.64±0.55	8.23±0.18	899.20±238.14
2	22.27±0.30	7.98±0.10	1520.00±357.14
3	29.75±0.65	9.74±0.21	678.57±236.96
4	31.10±0.43	10.25±0.12	2512.38±762.26
5	26.53±0.39	8.84±0.14	1103.23±192.91
6	26.31±0.28	8.88±0.10	531.89±161.52
7	26.76±0.30	9.09±0.10	531.89±161.52
8	26.29±0.37	8.72±0.14	531.89±161.52
9	26.31±0.37	8.69±0.12	421.95±105.31
10	27.43±0.22	9.10±0.09	90.37±24.31
11	27.96±0.28	9.31±0.09	508.65±143.95

(Table 2). Examination of the mean values indicated a gradual increase in VPRC and Hb, accompanied by a progressive decline in mean EPG across visits (Table 3). The FAMACHA© system was efficient in detecting anaemic sheep, and it remains a useful diagnostic tool when integrated with clinical examinations. Medrado *et al.* (2021) conducted a meta-analysis and reported a correlation of 0.70 between faecal egg count (FEC) and FAMACHA© scores, and a negative correlation of –0.48 between FEC and hematocrit (HCT).

The analysis of the correlation between FAMACHA© score, VPRC, Hb and EPG values (Table 4) showed a statistically significant correlation between VPRC and EPG values (correlation coefficient r = -0.53, p<0.01). Similarly, a statistically significant correlation was noted between Hb and EPG values (correlation coefficient r = -0.372, p<0.05). Correlation analysis between FAMACHA score and other parameters revealed that there was a statistically significant and positive correlation between FAMACHA© score and EPG (r = 0.394, P<0.01), and negative correlations were noted between FAMACHA© score and VPRC (r = -0.48, p<0.01) and FAMACHA score and Hb (r = -0.298, p<0.05). The correlation between FAMACHA scores and VPRC or FEC was high for both sheep and goats (P<0.001), as observed by Burke *et al*. (2007). In the present study, there was a good correlation between FAMACHA scores, VPRC, and Hb levels in Vembur sheep breeds in Sattur farm. Kaplan *et al*. (2004) revealed that correlations between VPRC and eye scores, VPRC and FEC, and FEC and eye scores were all highly significant for both sheep and goats ($P < 0.001$). Compared to conventional dosing practices, where all animals are treated, a large proportion of animals would remain untreated when FAMACHA scoring was adopted as a marker for deworming. Similar findings were observed in the present study. Sahin *et al.* (2022) reported that 101 animals in the sheep population had scores between 3 and 4. They found that differences in haematocrit (Hct) and haemoglobin (Hb) levels among these score groups

Table 4. Correlation Matrix of VPRC, Hb, EPG and FAMACHA© Scores

Correlations Matrix					
		VPRC	EPG	HB	FAMACHA score
VPRC	Pearson Correlation	1	-0.53**	0.843**	-0.48**
EPG	Pearson Correlation	-0.53**	1	-0.372*	0.394**
Hb	Pearson Correlation	0.843**	-0.372*	1	-0.298*
FAMACHA score	Pearson Correlation	-0.48**	0.394**	-0.298*	1

*Statistically significant (P<0.05) ,** Statistically significant (P<0.01)

were statistically significant ($p < 0.05$), confirming the occurrence of anaemia.

Papadopoulos *et al*. (2013) evaluated the FAMACHA© system in small ruminants, including sheep and goats, for targeted selective anthelmintic treatments and found no significant association between haematocrit values and faecal egg counts.

Marcelo *et al*. (2004) evaluated the efficacy of FAMACHA© in small ruminants, alongside clinical examination, haematocrit levels and EPG were measured and the study revealed that, sheep showed a 75.6% reduction in antiparasitic drug use compared to the previous prophylactic control strategy, which involved treating the entire flock at 30-day intervals. It was concluded that using the FAMACHA© guide can substantially reduce anthelmintic use and serves as a practical field method for identifying animals infected with haemonchosis

Conclusion

The present study found a negative correlation between FAMACHA© scores and VPRC, and a positive correlation between FAMACHA© scores and EPG. However, there was differences in this pattern in different indigenous breeds studied in different farms, which could be due to variations in sheep breed, geographical location, climatic conditions, and management practices. These results emphasize the importance of modifying the FAMACHA© chart to better represent the clinical signs of haemonchosis in indigenous sheep breeds.

Acknowledgements

The authors thank the authorities of Tamil Nadu Veterinary and Animal Sciences University, Sheep Breeding Research Station, Sandynallah and Post Graduate Research Institute of Animal Sciences and the authorities of the Department of Animal Husbandry, Government of Tamil Nadu for their cooperation throughout the study period. The authors also thank Biotechnology and Biological Sciences Research Council (BBSRC), United Kingdom for funding this study under CIDLID grant.

Conflict of interest

The authors declare no conflict of interest.

References

Bath, G.F. 2011. Non-pharmaceutical control of endoparasitic infections in sheep. *Vet. Clin. North Am. Food Anim. Pract.* **27:** 157–162.

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. and Vatta, A.F. 2007. Accuracy of the FAMACHA system for on-farm use by sheep and goat producers in the southeastern United States. *Vet. Parasitol.* **147:** 89-95.

Burke, J.M. and Miller, J.E. 2008. Use of FAMACHA system to evaluate gastrointestinal nematode resistance/ resilience in offspring of stud rams. *Vet. Parasitol.* **153:**85-92.

Cunha, S.M.F., Willoughby, O., Schenkel, F. and Cánovas. 2024. Á. Genetic Parameter Estimation and Selection for Resistance to Gastrointestinal Nematode Parasites in Sheep—A Review. *Animals*, **14***:* 613. https://doi.org/10.3390/ani14040613

Ejlertsen, M., Githigia, S.M., Otieno, R.O. and Thamsborg, S.M. 2006. Accuracy of an anaemia scoring chart applied on goats in sub-humid Kenya and its potential for control of *Haemonchus contortus* infections. *Vet. Parasitol.* **141**: 291-301.

Kaplan, R.M., Burke, J.M., Terrill, T.H., Miller, J.E., Getz, W.R., Mobini, S., Valencia, E., Williams, M.J., Williamson, L.H., Larsen, M. and Vatta, A.F. 2004. Validation of the FAMACHA eye color chart for detecting clinical anemia in sheep and goats on farms in the southern United States. *Vet. Parasitol.* **123**: 105-120.

Loria, D. A., Veneziano, V., Piantedosi, D., Rinaldi, L., Cortese, L., Mezzino, L., Cringoli, G. and Ciaramella, P. 2009. Evaluation of the FAMACHA system for detecting the severity of anaemia in sheep from southern Italy. *Vet. Parasitol.* **161:** 53–59

Mahieu, M., Arquet, R., Kandassamy, T., Mandonnet, N. and Hoste, H. 2007. Evaluation of targeted drenching using Famacha method in Creole goat: reduction of anthelmintic use, and effects on kid production and pasture contamination. *Vet. Parasitol*. **146:** 135-147.

Malan, F.S., Van Wyk, J.A. and Wessels, C.D. 2001. Clinical evaluation of anaemia in sheep: early trials. *Onderstepoort J. Vet. Res.* **68:** 165–174.

Manikkavasagan, I., Bino Sundar, S.T., Raman, M., Susithra, S., Dexilin, M. and Abdul Basith, S. 2013. Detection of Ivermectin Resistance in Unorganized Goat Farms of Tamil Nadu; *Indian Vet. J..* **90:** 138-139.

Manikkavasagan, I., Binosundar, S.T. and Raman, M. 2013. Survey on anthelmintic resistance to gastrointestinal nematodes in unorganized goat farms of Tamil Nadu, *J. Parasitic Dis.* DOI 10.1007/s12639-013-0335-0

Marcelo, M., Cláudio, T., Alencar, G., Márcio, F., Ronaldo, B. and Evandro, S. 2004. FAMACHA guide as an individual clinic parameter for *Haemonchus contortus* infection in small ruminants. *Ciência Rural*. 34. 1139-1145. 10.1590/S0103-84782004000400027.

Medrado, B.D., Pedrosa, V.B. and Pinto, L.F.B. 2021**.** Meta-Analysis of Genetic Parameters for Economic Traits in Sheep. *Livestock. Sci..* **247***:* 104477.

Molento, M.B., Gaviao, A.A., Depner, R.A., and Pires, C.C. 2009. Frequency of treatment and production performance using the FAMACHA method compared with preventive control in ewes. *Vet. Parasitol.* **162:** 314-319.

Papadopoulos, E., Gallidis, E., Ptochos, S. and Fthenakis, G.C. 2013. Evaluation of the FAMACHA-® system for targeted selective anthelmintic treatments for potential use in small ruminants in Greece. *Small Rumin. Res.* **110**: 124-127. 10.1016/j.smallrumres.2012.11.019.

Reynecke, D.P., Van Wyk, J.A., Gummow, B., Dorny, P. and Boomker, J. 2011. A stochastic model accommodating the FAMACHA(c) system for estimating worm burdens and associated risk factors in sheep naturally infected with *Haemonchus* contortus. *Vet. Parasitol.* **177:** 231-241.

Riley, D.G. and Van Wyk, J.A. 2009. Genetic parameters for FAMACHA score and related traits for host resistance/resilience and production at differing severities of worm challenge in a Merino flock in South Africa. *Vet. Parasitol.* **164:** 44-52.

Scheuerle, M., Mahling, M., Muntwyler, J. and Pfister, K. 2010. The accuracy of the FAMACHA- method in detecting anaemia and haemonchosis in goat flocks in Switzerland under field conditions. *Vet. Parasitol.* **170:** 71-77.

Şahin, Ö., Aytekin, İ., Boztepe, S., Keskin, İ., Karabacak, A., Altay, Y. and Bayraktar, M. 2022. Relationships between Famacha scores and some blood values in sheep and goats. *Turkish J. Vet. Anim. Sci.* **46** (2): 314- 321. https://doi.org/10.55730/1300-0128.4179

Sotomaior, C.S., Rosalinski-Moraes, F., da Costa, A.R., Maia, D., Monteiro, A.L., and Van Wyk, J.A., 2012. Sensitivity and specificity of the FAMACHA(c)) system in Suffolk sheep and crossbred Boer goats. *Vet. Parasitol.* **190:** 114-119.

Tachack, E.B., Oviedo-Socarrás, T., Pastrana, M.O., Pérez-Cogollo, L.C., Benavides, Y.H., Pinto, C.R. and Garay O.V. 2022. Status of gastrointestinal nematode infections and associated epidemiological factors in sheep from Córdoba, Colombia. *Trop.Anim. Hlth Prod..* **54:** 171. https://doi.org/10.1007/s11250-022-03170-2

Van Wyk J.A., Bath G.F., Groeneveld H.T., Stenson M.O. and Malan F.S. 2001. Wide testing of the FAMACHA system for accuracy of clinical evaluation of anaemia caused by *Haemonchus* spp. infection in sheep in South Africa, Proceedings of the 5th International Sheep Veterinary Congress, 22–25 January 2001, Stellenbosch, South Africa.

Van Wyk, J.A. and Bath, G.F. 2002. The FAMACHA system for managing haemonchosis in sheep and goats by clinically identifying individual animals for treatment. *Vet. Res.* **33:** 509-529.

Vatta, A.F., Letty, B.A., van der Linde, M.J., van Wijk, E.F., Hansen, J.W. and Krecek, R.C. 2001. 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*. **99:** 1-14.

Vilela, V.L., Feitosa, T.F., Linhares, E.F., Athayde, A.C., Molento, M.B. and Azevedo, S.S. 2012. FAMACHA(c) method as an auxiliary strategy in the control of gastrointestinal helminthiasis of dairy goats under semiarid conditions of Northeastern Brazil. *Vet. Parasitol.* **190:** 281-284.

Wagener, M. G., Neubert, S., Punsmann, T. M., Wiegand, S. B. and Ganter, M. 2021. Relationships between Body Condition Score (BCS), FAMACHA© Score and Haematological Parameters in Alpacas *(Vicugna pacos),* and Llamas *(Lama glama)* Presented at the Veterinary Clinic. *Animals*. **11**: 2517. https://doi.org/10.3390/ani11092517

Wolstenholme, A. J., Fairweather, I., Prichard, R., von Samson-Himmelstjerna, G. and Sangster, N. C. 2004. Drug resistance in veterinary helminths. *Trends Parasitol.* **20:** 469–476. ■