The effect of water intake prior to blood sampling on packed cell volume in sheep

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ABSTRACT

The effect of water intake prior to blood sampling on subsequent packed cell volume (PCV) was investigated in ewe lambs (8 months of age) of the Dohne Merino, Merino and Letelle flocks at Grootfontein Agricultural Development Institute. On the afternoon of the day before the experiment was conducted, a blood sample for a baseline PCV value (R) was taken from each animal. The following day, 15 ewes of each breed ($n = 45$) were dosed with 1 litre of water and another 15 of each ($n = 45$) were used as a control. Blood samples for PCV were taken concurrently for both the control and water treatment groups before the dose (0), and at 15, 30 and 60 minutes after dosing . PCV were subsequently determined with the microcapillary centrifuge technique. Baseline PCV of Letelle ewes was higher (32.4 ± 0.6) than that of the Dohne Merino (29.7 ± 0.6) and Merino (28.7 ± 0.6) ewes. Furthermore, recovery rate at 30 minutes after treatment also differed among breeds. Although there were significant differences between the control and water treatment groups at R and 0 minutes, which were probably due to inherent animal differences, there were no significant differences between PCV of the 2 groups during the remainder of the experimental period. Overall it can be concluded that water intake before blood sampling for the determination of PCV has no significant effect on haematocrit. Differences among breeds were more pronounced than those between treatment groups.

Key words: blood parameters, haematocrit.

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INTRODUCTION

Various factors have been reported to affect packed cell volume (PCV) in sheep[3,4,5,14]. Different infective agents or illnesses may also cause an anaemic status in animals. Infections of ruminants with various internal parasite species, predominantly *Haemonchus* but also *Bunostomum, Trichuris* and *Fasciola,* can cause anaemia. In acute haemonchosis and fascioliasis, the pathogenic effect of the parasite is often present before eggs appear in the faeces[6]. An early estimation of the degree of anaemia is possible by measuring PCV of a blood sample[6,13].

The use of routine parasitological techniques and blood parameters for the identification of lambs resistant to *Haemonchus contortus* has been reported[7]. Results in that study confirmed that PCV, indicating the degree of anaemia, is related to faecal egg counts, suggesting that this can be used as an indicator to determine resistance or susceptibility of animals to *Haemonchus contortus*. Furthermore, PCV can be used in breeding programmes for increased resistance to *Haemonchus contortus,* as it was found that PCV had a heritability equal to that reflected by faecal egg counts[13,15].

For the determination of PCV of sheep in practice, it would not always be possible to take the blood samples at a specific time. For instance, some of the animals might have drunk water before blood sampling , and others not. Although work has been done to investigate the effect of water deprivation on PCV in sheep[1,2,8,9,10,12], no evidence could be found in literature regarding the effect of water intake prior to blood sampling on the accuracy of PCV in sheep.

Studies, using Tswana goats, on the effects of short-term water deprivation in summer and winter (6000 mℓ water offered either once every 72 h, 48 h, 24 h or *ad libitum*), indicated that haematocrit concentration was highest with the 72-h-watering interval[1]. Effect of water restriction was also studied in Awassi ewes subjected to 3 watering regimes[9]. One group received water once every 4 days, another group once every 2 days and a third group, the control, received water every day. Haematocrit values did not differ significantly within or among the treatments. Similar results were obtained in Yankasa sheep deprived of water for up to 5 days[2,8]. Other studies with Merino and Awassi sheep, however, indicated an increased haematocrit following water deprivation[10,12].

The objective of this study was, therefore, to quantify the effect of water intake prior to blood sampling on PCV in sheep.

MATERIALS AND METHODS

Experimental animals

Ewe lambs (8 months of age) from the Dohne Merino, Merino and Letelle flocks of the Grootfontein Agricultural Development Institute were used to determine the effect of water intake prior to blood sampling on PCV.

Experimental layout

Thirty ewe lambs of each breed were used, as indicated in Table 1.

On the afternoon of the day before the experiment was conducted, the sheep were kept in enclosures in groups of 15, as indicated in Table 1, and a blood sample for a baseline packed cell volume PCV value (R) was taken from each animal.

Table 1: **Experimental layout.**

Breed	Number of animals	
	G1 (control – no water)	G2 (dosed 1000 mℓ water)
Dohne Merino	15	15
Merino	15	15
Letelle	15	15

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Table 2: **Mean** (%) **and coefficient of variation** (%) **for PCV over the experimental period.**

Time after treatment	Mean	C.V.
R	30.2	10.6
0	36.8	6.8
15	34.9	8.1
30	33.3	7.6
60	31.8	7.6
R-0	–6.5	–56.3
R-30	–3.1	–82.5
R-60	–1.6	–152.3

The following day, animals in G2 were dosed *via* a stomach tube with 1 litre of water and the other 45 ewes (G1) were used as a control (received no water). Blood samples for PCV were taken concurrently for both the control and water treatment groups before the dosing (0), and at 15, 30 and 60 minutes after dosing. The PCV was subsequently determined with the microcapillary centrifuge technique.

Statistical analysis

Change in PCV from the baseline value established the previous afternoon, to PCV at 0 minutes (R-0), was calculated by subtracting PCV determined at 0 minutes from the baseline PCV (R). Recovery rate of PCV was determined at 30 (R-30) and 60 (R-60) minutes after treatment by subtracting values recorded at these times, from the baseline PCV value. This was done to determine how soon the PCV would return to normal.

Statistical analyses were performed using the GLM procedures of SAS[11] to determine the effect of water intake on PCV between treatment groups, breeds and treatment groups within the same breed for the different PCV measurements. As reference PCV differed between treatment groups, this effect was included as a covariate for analysis of the subsequent PCV measurements.

The following model was used:

$$Y_{ijk} = \mu + b_i + t_j + (bt)_{ij} + e_{ijk},$$

where Y_{ijk} = trait of the k'th animal of the j'th treatment group of the i'th breed, μ = overall mean, b_i = fixed effect of the i'th breed (Dohne Merino, Merino, Letelle), t_j = fixed effect of the j'th treatment group (control, water), $(bt)_{ij}$ = effect of the interaction between the i'th breed and the j'th treatment group, e_{ijk} = random error with zero mean and variance $I\sigma^2_e$.

RESULTS AND DISCUSSION

Mean and coefficient of variation for the different PCV measurements are presented in Table 2.

Table 3: **Effect of breed on PCV** (%) **over the experimental period.**

Time after treatment	Dohne[d]	Letelle[l]	Merino[m]
R	29.7 ± 0.6[l]	32.4 ± 0.6[dm]	28.7 ± 0.6[l]
0	37.2 ± 0.5	37.0 ± 0.5	36.1 ± 0.5
15	35.4 ± 0.5	34.9 ± 0.5	34.2 ± 0.5
30	34.3 ± 0.5[lm]	32.8 ± 0.5[d]	32.7 ± 0.5[d]
60	31.2 ± 0.4	32.1 ± 0.4	32.1 ± 0.4
R-0	–7.4 ± 0.7[l]	–4.9 ± 0.7[dm]	–7.2 ± 0.7[dl]
R-30	–4.1 ± 0.5[lm]	–2.9 ± 0.5[d]	–2.5 ± 0.5[d]
R-60	–1.0 ± 0.4	–1.9 ± 0.5	–1.9 ± 0.6

[m,d,l]Breed values differed significantly ($P < 0.05$) from those in the superscripts.

The effect of breed on PCV is summarized in Table 3. Baseline PCV of Letelle ewes was higher (32.4 ± 0.6) than that of the Dohne Merino (29.7 ± 0.6) and Merino (28.7 ± 0.6) ewes. PCV increased in all breeds and groups from the baseline value to the 0 minute value the following morning (Tables 2, 3). PCV of Letelle ewes increased less from the baseline to the 0 minute values than those of the other breeds. The reason for this increase could be dehydration-induced, as the animals were without water for at least an 18-hour period from the baseline till the 0 minute PCV values. Unfortunately there is no record of the water intake of the animals prior to taking the baseline values.

Recovery rate at 30 minutes after treatment also differed among breeds.

The effect of treatment group on PCV over the experimental period is presented in Table 4. There were significant differences between the control and water treatment groups at R and 0 minutes after treatment. These differences could probably be explained by inherent animal differences, as the PCV values of individual animals were not taken into account when the animals were randomly allocated to the different treatment groups. There were no significant differences between the PCV of the 2 groups during the remainder of the experimental period.

The effect of breed by treatment group for the PCV determined over the experimental period is summarised in Table 5. The results show that there were no significant differences between the control and water treatment groups in any of the breeds, with the exception of the 0 minutes value in the Dohne Merino's and the R-value in the Merino's (Table 5). As already mentioned above, these differences at R and 0 minutes are probably due to inherent differences between animals.

Table 4: **Effect of treatment group on PCV** (%) **over the experimental period.**

Time after treatment	Control[c]	Water[w]
R	31.1 ± 0.5[w]	29.4 ± 0.5[c]
0	37.5 ± 0.4[w]	36.1 ± 0.4[c]
15	35.3 ± 0.4	34.4 ± 0.4
30	33.7 ± 0.4	32.9 ± 0.4
60	32.1 ± 0.4	31.5 ± 0.4
R-0	–6.5 ± 0.5	–6.5 ± 0.5
R-30	–3.5 ± 0.4	–2.7 ± 0.4
R-60	–1.9 ± 0.4	–1.3 ± 0.4

[c,w]Treatment values differed significantly ($P < 0.05$) from those in the superscripts.

Change in PCV over the experimental period is presented for the 2 treatment groups in Fig. 1, using the pooled data from the 3 breeds. From this it is evident that water intake prior to blood sampling did not influence subsequent PCV measurements significantly.

CONCLUSIONS

Overall it can be concluded that water intake before blood sampling for the determination of PCV did not influence PCV to any practical extent. Differences

Table 5: **Effect of breed by treatment group for PCV** (%) **over the experimental period.**

Time after treatment	Dohne Merino		Letelle		Merino	
	Control	Water	Control	Water	Control	Water
R	30.7 ± 0.8	28.7 ± 0.8	32.5 ± 0.8	32.3 ± 0.8	30.1 ± 0.8[w]	27.3 ± 0.8[c]
0	38.3 ± 0.6[w]	36.0 ± 0.6[c]	37.7 ± 0.6	36.2 ± 0.6	36.3 ± 0.6	36.0 ± 0.6
15	36.0 ± 0.7	34.8 ± 0.7	35.4 ± 0.7	34.5 ± 0.7	34.5 ± 0.7	33.9 ± 0.7
30	34.3 ± 0.7	34.3 ± 0.7	33.8 ± 0.7	31.9 ± 0.7	33.0 ± 0.7	32.4 ± 0.7
60	31.6 ± 0.6	30.8 ± 0.6	32.7 ± 0.6	31.5 ± 0.6	32.1 ± 0.6	32.2 ± 0.6
R-0	–7.7 ± 0.9	–7.1 ± 0.9	–5.6 ± 0.9	–4.2 ± 0.9	–6.2 ± 0.9	–8.3 ± 0.9
R-30	–4.1 ± 0.7	–4.1 ± 0.7	–3.5 ± 0.7	–1.7 ± 0.7	–2.8 ± 0.7	–2.2 ± 0.7
R-60	–1.4 ± 0.6	–0.6 ± 0.6	–2.5 ± 0.6	–1.3 ± 0.6	–1.8 ± 0.6	–1.9 ± 0.6

[c,w]Values with superscripts differ between groups within the same breed ($P < 0.05$).

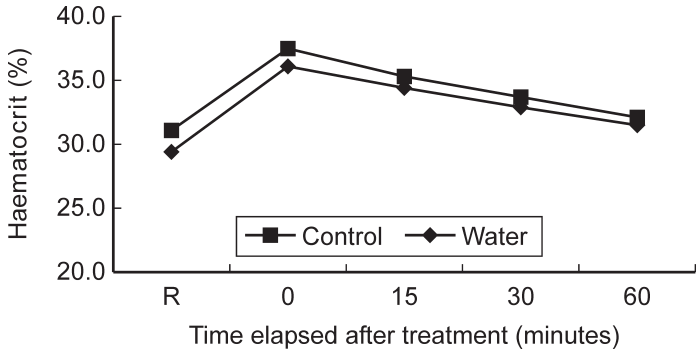

Fig. 1: **Effect of water intake on PCV of ewes.**

between breeds were more pronounced than those between treatment groups. Therefore, it would not be necessary to take blood samples for determination of PCV at any specific time under field conditions.

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