*Int.J.Curr.Microbiol.App.Sci* (2020) *9*(8): 190-195

*International Journal of Current Microbiology and Applied Sciences*
***ISSN: 2319-7706* Volume 9 Number 8 (2020)**
Journal homepage: http://www.ijcmas.com

**Original Research Article** https://doi.org/10.20546/ijcmas.2020.908.021

# Effect of Watering Frequencies and Rehydration on Blood Parameters of Indigenous Sheep

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**Keywords**

Watering frequencies, Rehydration, Blood parameters, Sheep

**Article Info**

***Accepted:***
10 July 2020
***Available Online:***
10 August 2020

**A B S T R A C T**

Present experiment was conducted with the objective to study the effect of watering frequencies and rehydration on blood parameters of indigenous sheep under intensive production system during hot humid season. Eighteen adult dry non pregnant farm born Patanwadi and Marwari female (25-35 kg) sheep were divided randomly on body weight basis in three treatment groups *viz.*, $T_1$: Control (watering thrice in a day), $T_2$: (watering twice in a day), $T_3$: (watering once in a day). The duration of experiment was 44 days (42 days of different watering frequencies and 2 days of rehydration phase). The experimental animals were maintained on conventional feed as per the recommendations of ICAR feeding standard (2013). Once a day *ad lib.* watering ($T_3$) significantly ($P<0.05$) increased Haemoglobin (g/dL), PCV (%), urea (mg/dL), uric acid (mg/dL), creatinine (mg/dL) and Na (mmol/L) due to haemoconcentration as compared to animals watered twice ($T_2$) or thrice a day($T_1$). Moreover, rehydration significantly ($P<0.05$) influenced urea (mg/dL), uric acid (mg/dL) and Na (mmol/L) levels in the blood.It may be concluded from present study that the adult sheep should be given *ad lib.* water at least thrice a day at the interval of less than12 hrs. in middle Gujarat agroclimatic condition during hot humid season.

## Introduction

Small ruminants are an integral part of farming systems in the arid and semi-arid regions of the world. These areas are characterized by fluctuating precipitation, water scarcity and unpredictable weather. Irregular rainfall of these areas leads to limited availability of water (Iniguez, 2005). Under water stress conditions, the transfer function of the kidney is altered (Kataria *et al.,* 2007) which consequently increases the levels of urea and creatinine in blood (Igbokwe, 1993 and Jaber *et al.*, 2004).

Water restriction in warm environment leads to increased haemoglobin level due to haemoconcentration (Li *et al.,* 2000). The study (Casamassima *et al.*, 2008) carried out on water-restricted Comisana sheep revealed a significant increase of some blood metabolites like sodium, creatinine, urea and potassium. In this attempt, the present work was undertaken to investigate the selected

blood parameters of indigenous sheep under intensive production system during hot humid season in response to different watering frequencies and rehydration.

## Materials and Methods

The present experiment was conducted at Livestock Farm Complex, College of Veterinary Science and Animal Husbandry, Anand Agricultural University, Anand. Eighteen adult farm born dry non pregnant female Patanwadi and Marwari sheep (25-35 kg) were selected as experimental animals and divided in to three treatment groups on the basis of body weight comprising six animals in each treatment *viz*., $T_1$: Control (watering thrice a day), $T_2$: (watering twice a day), $T_3$: (watering once a day). The duration of experiment was 44 days (42 days of different watering frequencies and 2 days of rehydration phase) under intensive production system in hot humid season (1$^{st}$ September to 15$^{th}$ October). Animals of $T_1$group was offered water at 8.30 a.m., 2.30 p.m., and 8.30 p.m. whereas Group $T_2$ at 8.30 a.m. and 8.30 p.m. and Group $T_3$ at 8.30 a.m. only. The experimental animals were maintained on conventional feed as per the recommendations of ICAR feeding standard (2013). The blood samples were collected weekly once during different watering frequencies and daily in rehydration phase from the jugular vein under aseptic precaution in vacutainer with anticoagulant. The fresh whole blood was used to estimate hematological parameters like Hb and PCV using blood auto analyser (BC-2800 Vet, Mindray). The remaining blood was centrifuged for 30 minutes at 3000 rpm to separate plasma which was stored at -20 ºC till further analysis. Various biochemical parameters like urea, uric acid, creatinine, sodium and potassium were estimated from plasma. Urea, uric acid and creatinine were analysed using chemistry analyser (BS-120, Mindray) while sodium and potassium were analysed using flame photometer 128.

## Statistical Analysis

The experimental data were analysed using completely randomized design (Snedecor and Cochran, 1991).

## Results and Discussion

Results of blood parameters of sheep under different watering frequencies and rehydration are presented in Table 1 and 2, respectively. The present study revealed a significant ($P<0.05$) increase in Hb level when animals maintained under watering once in a day as compared to twice (4.14%) and thrice (4.39%) a day groups, whereas animals of twice a day watering frequency was at par with thrice a day watering group. The Hb showed a non-significant reduction to the tune of 2.93 and 3.74% in $T_2$ and $T_3$, respectively after 48 hrs. of rehydration as compared to last week of different watering frequencies. The 72 hrs watering interval (Adogla and Aganga, 2000) in goats and watering once in every three days in Awassi ewes (Hamadeh *et al.*, 2006) elevated the Hb concentration are in accordance with present findings.

The experimental animals maintained on once a day watering showed significantly ($P<0.05$) higher PCV as compared to control group, whereas PCV of animals kept on twice a day watering was at par with thrice and once a day watering groups. The PCV of experimental animals increased by 1.28 and 4.53% in $T_2$ and $T_3$ groups, respectively as compared to control group. The elevation in Hb and PCV might be due to the development of haemoconcentration by consuming less water. The PCV decreased non-significantly to the tune of 3.33 and 4.97% in $T_2$ and $T_3$, respectively after 48 hrs. of rehydration as

compared to last week of different watering frequencies. The PCV was significantly (P<0.05) higher in the experimental animals which maintained on 40% water restriction (Neelam, 2013 and Patel, 2015) supports the present findings. Abdelatif *et al.,* (2010) also reported significant rise in PCV in dehydrated animals which returned to normal level after rehydration. The PCV values recovered non-significantly due to rehydration (Neelam, 2013) supports the current findings.

**Table.1** Blood Parameters of sheep under different watering frequencies

| Blood Parameters | Treatments | | |
|---|---|---|---|
| | $T_1$ | $T_2$ | $T_3$ |
| **Haemoglobin (g/dL)** | $8.78^{b} \pm 0.07$ | $8.80^{b} \pm 0.10$ | $9.16^{a} \pm 0.12$ |
| **PCV (%)** | $31.56^{b} \pm 0.33$ | $31.97^{ab} \pm 0.45$ | $32.99^{a} \pm 0.30$ |
| **Urea (mg/dL)** | $22.33^{b} \pm 1.25$ | $23.64^{b} \pm 1.60$ | $30.38^{a} \pm 2.25$ |
| **Uric acid (mg/dL)** | $0.38^{c} \pm 0.01$ | $0.45^{b} \pm 0.01$ | $0.51^{a} \pm 0.02$ |
| **Creatinine (mg/dL)** | $1.62^{b} \pm 0.04$ | $1.67^{ab} \pm 0.03$ | $1.70^{a} \pm 0.03$ |
| **Sodium (mmol/L)** | $141.86^{c} \pm 0.34$ | $145.54^{b} \pm 0.62$ | $150.56^{a} \pm 0.93$ |
| **Potassium (mmol/L)** | 4.82 ± 0.07 | 4.89 ± 0.08 | 5.00 ± 0.11 |

Means with dissimilar superscripts (a, b, c) in a row differ significantly (P<0.05)

**Table.2** Blood Parameters of sheep under rehydration phase

| Blood Parameters | Treatments | Last week of different watering frequencies | Rehydration phase | |
|---|---|---|---|---|
| | | | 1st day | 2nd day |
| **Haemoglobin (g/dL)** | $T_1$ | 8.95 ± 0.16 | 8.87 ± 0.15 | 8.90 ± 0.17 |
| | $T_2$ | 9.20 ± 0.23 | 9.05 ± 0.22 | 8.93 ± 0.25 |
| | $T_3$ | 9.63 ± 0.39 | 9.45 ± 0.35 | 9.27 ± 0.35 |
| **PCV (%)** | $T_1$ | 32.35 ± 0.58 | 32.08 ± 0.65 | 32.38 ± 0.62 |
| | $T_2$ | 33.00 ± 1.14 | 32.10 ± 1.10 | 31.90 ± 1.02 |
| | $T_3$ | 34.02 ± 0.81 | 32.80 ± 0.89 | 32.33 ± 0.83 |
| **Urea (mg/dL)** | $T_1$ | 19.87 ± 1.92 | 17.20 ± 1.15 | 18.71 ± 1.28 |
| | $T_2$ | $20.52^{a} \pm 1.95$ | $12.15^{b} \pm 0.54$ | $13.12^{b} \pm 0.56$ |
| | $T_3$ | $23.62^{a} \pm 2.00$ | $15.48^{b} \pm 1.44$ | $14.26^{b} \pm 1.32$ |
| **Uric acid (mg/dL)** | $T_1$ | 0.42 ± 0.04 | 0.40 ± 0.03 | 0.41 ± 0.04 |
| | $T_2$ | $0.49^{a} \pm 0.01$ | $0.37^{b} \pm 0.02$ | $0.38^{b} \pm 0.01$ |
| | $T_3$ | $0.55^{a} \pm 0.02$ | $0.40^{b} \pm 0.02$ | $0.41^{b} \pm 0.02$ |
| **Creatinine (mg/dL)** | $T_1$ | 1.78 ± 0.01 | 1.78 ± 0.01 | 1.79 ± 0.02 |
| | $T_2$ | 1.79 ± 0.01 | 1.76 ± 0.01 | 1.76 ± 0.01 |
| | $T_3$ | 1.81 ± 0.01 | 1.79 ± 0.01 | 1.78 ± 0.02 |
| **Sodium (mmol/L)** | $T_1$ | 142.69 ± 0.78 | 142.05 ± 0.98 | 141.34 ± 0.94 |
| | $T_2$ | 148.36 ± 1.68 | 146.31 ± 1.71 | 144.79 ±1.80 |
| | $T_3$ | $155.48^{a} \pm 0.75$ | $152.84^{b} \pm 0.71$ | $149.30^{c} \pm 0.89$ |
| **Potassium (mmol/L)** | $T_1$ | 5.02 ± 0.16 | 4.99 ± 0.14 | 4.86 ± 0.14 |
| | $T_2$ | 5.16 ± 0.19 | 5.08 ± 0.17 | 4.71 ± 0.09 |
| | $T_3$ | 5.80 ± 0.12 | 5.72 ± 0.12 | 5.58 ± 0.16 |

Means with dissimilar superscripts (a, b, c) in a row within same treatment differ significantly (P<0.05)

The urea concentration of sheep significantly (P<0.05) increased to the tune of 36.05 and 5.87% in $T_3$ as compared to $T_1$ and $T_2$, respectively indicated adaptation of experimental animals to water restriction. The urea concentration of sheep in $T_2$ group was at par with control group. The plasma urea concentration of experimental animals dropped down significantly (P<0.05) due to rehydration to the tune of 34.46 and 39.63% in the first and second day of rehydration, respectively as compared to last week of different watering frequencies. The water deprivation was associated with significant increase in urea (mg/dl) concentration (Alamer, 2006, Hamadeh *et al.,* 2006, Kheir and Ahmed, 2008, Abdelatif *et al.,* 2010, Neelam, 2013, Khanvilkar, 2014, Patel, 2015, Casamassima *et al.,* 2016 and Patel, 2018) supports the present findings.

The uric acid concentration significantly (P<0.05) increased to the tune of 18.42 and 34.21% when experimental animals were subjected to 12 and 24 hrs. watering interval, respectively as compared to animals of control group, whereas uric acid concentration significantly (P<0.05) increased by 13.33% in $T_3$ as compared to $T_2$. The uric acid concentration dropped down significantly (P<0.05) in $T_2$ (24.49 and 22.45 %) and $T_3$ (27.27 and 25.45%) after 24 and 48 hrs. of rehydration as compared to last week of different watering frequencies. Khanvilkar (2014) and Patel (2018) reported significant (P<0.05) rise in uric acid concentration due to water deprivation supported the present findings.

The creatinine concentration increased significantly (P<0.05) to the tune of 3.09 and 4.94% when animals were offered water at 12 and 24 hrs interval, respectively as compared to animals of control group. The effect of rehydration was non-significant. However, the creatinine concentration dropped down non-significantly by 1.66% in $T_2$ and $T_3$ groups after 48 hrs. of rehydration as compared to last week of different watering frequencies. According to Alamer (2006), Hamadeh *et al.,* (2006), Abdelatif *et al.,* (2010), Khanvilkar (2014), Casamassima *et al.,* (2016) and Patel (2018) creatinine level increased significantly (P<0.05) on water restriction, which supports the present findings.

The plasma sodium level significantly (P<0.05) increased by 2.59 and 6.13% in $T_2$ and $T_3$, respectively as compared to the animals kept on thrice in a day watering frequency ($T_1$), whereas it increased significantly (P<0.05) by 3.45% in $T_3$ in comparison to $T_2$. The plasma sodium level of sheep maintained on 12 hrs. watering interval declined non-significantly to the tune of 1.38 and 2.41 % on 1st and 2nd day of rehydration, respectively as compared to last week of different watering frequencies. The animals maintained on 24 hrs. watering interval showed significant (P<0.05) reduction in sodium level to the tune of 1.70 and 3.97% on 1st and 2nd day of rehydration, respectively as compared to last week of different watering frequencies, whereas the sodium level decreased significantly (P<0.05) by 2.28% in $T_3$ group as compared to $T_2$ group. The water restriction regimen resulted in a significant (P<0.05*)* increase in sodium level (Casamassima *et al.,* 2008, Casamassima *et al.,* 2016 and Patel, 2018) is in accordance with the present study.

The plasma potassium concentration (mmol/L) was not influenced by different watering frequencies. Potassium concentration decreased to the tune of 8.72 and 3.79 % in $T_2$ and $T_3$ groups, respectively after 48 hrs. of rehydration as compared to last week of different watering frequencies. The non-significant effect of water deprivation (Igbokwe, 1993) and different

watering frequencies (Patel, 2018) are in accordance with the present findings.

The study can be concluded that the adult sheep should be given *ad libitum* water at least thrice a day at the interval of less than12 hrs. in middle Gujarat agroclimatic condition during hot humid season to sustain Uric acid (mg/dL) and Sodium (mmol/L) levels in blood. Water should not be withheld for more than 12 hrs. to sustain Haemoglobin (g/dL), PCV (%), Urea (mg/dL) and Creatinine (mg/dL).

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**How to cite this article:**

Sahana, M., R. J. Modi, M. M. Trivedi, M. M. Islam and Wadhwani, K. N. 2020. Effect of Watering Frequencies and Rehydration on Blood Parameters of Indigenous Sheep. *Int.J.Curr.Microbiol.App.Sci.* 9(08): 190-195. doi: https://doi.org/10.20546/ijcmas.2020.908.021