# Measuring welfare indicators in dairy goats through salivary cortisol and somatic cell counts (scc)

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## Introduction

Somatic cell count (SCC) is used to monitor udder health and milk quality in the dairy industry. SCC in goats showed marked inter and intra-individual variability and some of the factors that cause variability have been previously investigated in several studies.

Studies have demonstrated that some factors other than infection may influence SCC in goats. Some external factors such as age [3], and breed [4], which are not associated with inflammation, can cause variation on milk SCC. High somatic cell count can compromise the milk quality, milk yield, milk composition and cheese-making aptitude [2].

The relationship between the hypothalamic-pituitary adrenal axis activity and somatic cell counts have not been investigated in dairy goats. Some animal management practices such as social mixing, transportation and handling may cause activation of the hypothalamic- pituitary adrenal axis. A high proportion of all farmed animals are transported at some stage in their lives. Transportation is carried out to move animals to places where food is more readily available, or to a different owner or to a different place of keeping, and sometimes to slaughter [1].

The aims of this study were to evaluate the effects of transportation stress on dairy goats somatic cell counts. We hypothesized that stress and consequent activation of HPA-axis increase SCC in goats. We characterized the activity of the HPA-axis, measuring salivary cortisol, and SCC profile in milk samples.

## Material and Methods

Twenty lactating dairy goats of Norwegian Milking breed were studied seven days before, during and seven days after transportation. The animals were selected to cover a wide age range (1 to 6 years old) and were at similar stage of lactation (range between 167 and 194 days). The experimental animals were kept together with the remaining herd during the experimental period, just being separated during the sample collection and transportation. No symptoms of mastitis were observed during the study.

Saliva and milk samples were harvested from all the experimental animals in the morning and afternoon during 7 days in location 1 - summer farm, and 7 days in location 2 -winter housing.
During the 380 km transfer from location 1 to location 2 we monitored cortisol levels before, during and 2 hours after transportation. Saliva samples were collected before (08:10h) and after (10:40h) loading, half-way through the journey (15:40 h), at arrival on location 2 (18:15h) and two hours post-arrival (20:15h). Milk samples were collected before and after transportation. Saliva was collected using cotton buds.
Samples were assayed using an ELISA technique. SCC was assayed by means of the Fossomatic principle. Area under the curve for cortisol was calculated using the trapezoidal method. Repeated measures ANOVA was used to test for changes within the group and between periods.

## Results and Discussion

Before and after transportation cortisol levels were significantly higher ($p<0.05$) in the morning comparing to the afternoon. During transportation cortisol levels increased significantly in all collection intervals, from 8:10 to 10:40 ($p<0.01$), from 10:40 to 15:40 ($p<0.01$) and from 15:40 to 18:15 ($p<0.05$). Salivary cortisol was significantly reduced two hours after unloading, from 18:15 to 20:05 ($p<0.01$). Our hypothesis is not supported by the present experiment; higher SCC was associated with periods with the lowest cortisol levels, such as afternoon samples ($t=7.9$, $p<0.0001$). Post-transportation SCC levels were lower than pre-transportation levels ($t=-6.5$, $p<0.0001$).

## Conclusion

The present experiment did not support our hypothesis as SCC was not increased in association with the activation of HPA-axis.
The stress free nature of saliva collection allowed us to demonstrate differences between morning and afternoon cortisol levels. We also demonstrated that transportation is a powerful activator of the HPA-axis in goats. We are studying behavioural measures, salivary cortisol and SCC on individual animals in order to understand the contribution of stress and poor welfare on SCC variability in goats.
Further studies are necessary to elucidate the factors which contribute to the variation on SCC in goats.

## References

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