Istituto Zooprofilattico Sperimentale del Mezzogiorno

Environment and innate immunity in water buffaloes

[1]De Carlo E., [1]Martucciello A., [1]Schiavo L., [1]Vecchio R., [2]Palermo P., [3]Amadori M.

[1]Istituto Zooprofilattico Sperimentale del Mezzogiorno, Centro di Referenza Nazionale sull'Igiene e le Tecnologie dell'Allevamento e delle Produzioni Bufaline, Salerno

[2]Istituto Zooprofilattico Sperimentale del Mezzogiorno, Portici

[3]Istituto Zooprofilattico Sperimentale Lombardia ed Emilia Romagna, Brescia

INTRODUCTION

Any attempt to up-regulate the animal's physiological performance causes stress, as does any environmental stimulus that affects the systems of control and regulation. In order to provide a detailed and timely assessment of the well-being of livestock, a combined multidisciplinary approach based on clinical, zootechnic, ethological and immuno-biochemical skills needs to be adopted. This not only allows the state of well-being to be assessed and controlled, but also enables stress to be prevented and the immune competence of the animal to be fully maintained. In this regard, a fundamental role is played by laboratory tests that can reveal the immune status of the individuals, thereby indicating their predisposition to developing diseases that are conditioned by stressful events of whatever kind.

MATERIALS AND METHODS

In two buffalo herds – one intensively farmed and one free-range – blood samples were taken from the jugular veins of cows at the beginning and end of lactation, dry cows, heifers and calves, in the summer and autumn/winter periods. In addition, samples were taken from sick individuals, such as calves with diarrhea and cows that had miscarried, and from healthy individuals living in groups with a high environmental microbial load (*Salmonella spp.* and *E. coli*).

The following parameters of clinical immunology were evaluated: hemolytic complement, lysozyme and bactericidal capacity according to Amadori et al.(1997), and haptoglobin. The method of **haptoglobin** assay is based on the difference between the peroxidase activity, in an acidic environment, of free hemoglobin and that of haptoglobin-bound hemoglobin. The peroxidase activity of the bound hemoglobin is directly proportional to the amount of haptoglobin present in the sample. Sera were analyzed by means of the Phase Haptoglobin Colorimetric Assay kit (Tridelta Development LTD, Maynooth, Co. Kildare, Ireland).

Immunological Parameters	Healthy		Sick
	Mean	Min-Max (CI 95%)	Mean
Lysozyme	5.09	4.69-5.48	4.42
Complement	37.68	35.94-39.43	18.75
Bactericidal Capacity	86.63	85.86-87.40	74.19
Haptoglobin	1.25	1.10-1.39	3.15

Figure 1. Mean values of the immunological parameters in healthy and sick individuals.

RESULTS AND CONCLUSIONS

All the parameters investigated with Multivariate Analysis of Variance (MANOVA) can be successfully applied to buffalo in order to assess their status of innate immunity; this conclusion is also supported by the data on sick individuals, in which the values are significantly modified (fig.1).

The levels of **hemolytic complement** (fig.2) (alternative pathway) proved to be fairly uniform in the various categories. Differences emerged between free-range and intensively-reared herds, with much higher mean values of complement being recorded in free-range animals, especially calves.

With regard to **lysozyme**, it emerges from evaluation of the mean values that the levels of this enzyme in the buffalo species fall between those observed in beef cattle and dairy cattle (Amadori et al., 2002). Moreover, in all the zootechnic categories, lysozyme displays lower values both among free-range animals and in the winter season (fig.3).

Unlike what has been observed in cattle (Chan J.P. et al. 2003), in buffaloes the mean values of **haptoglobin** (fig.4) are influenced by the season in dry cows [sig. 95%, IC -0,57;0,72], in heifers and in cows at the beginning of lactation [sig. 95%, IC -1,2 ; 0,4], with higher values being recorded in the winter.

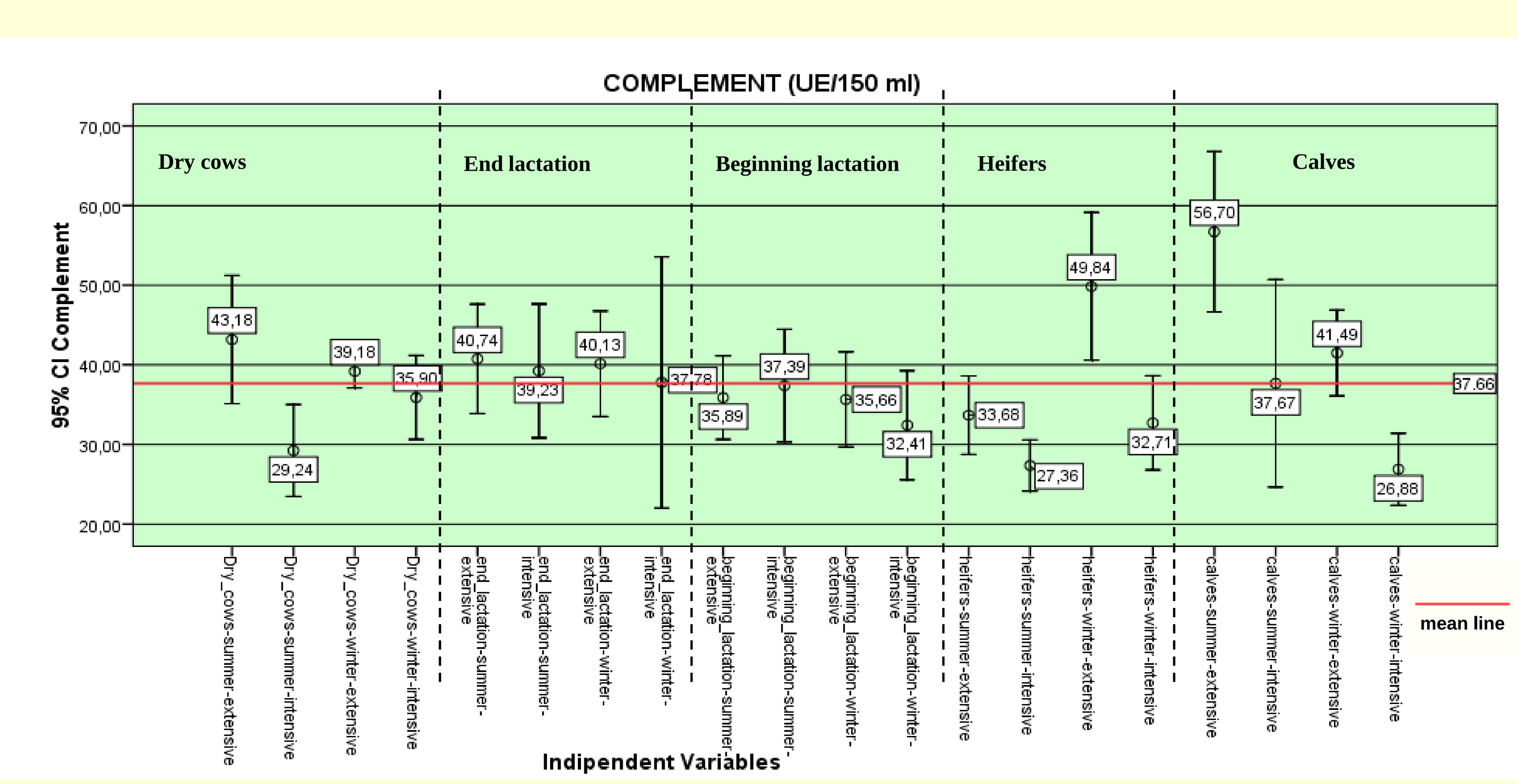

Figure 2. Hemolytic complement levels.

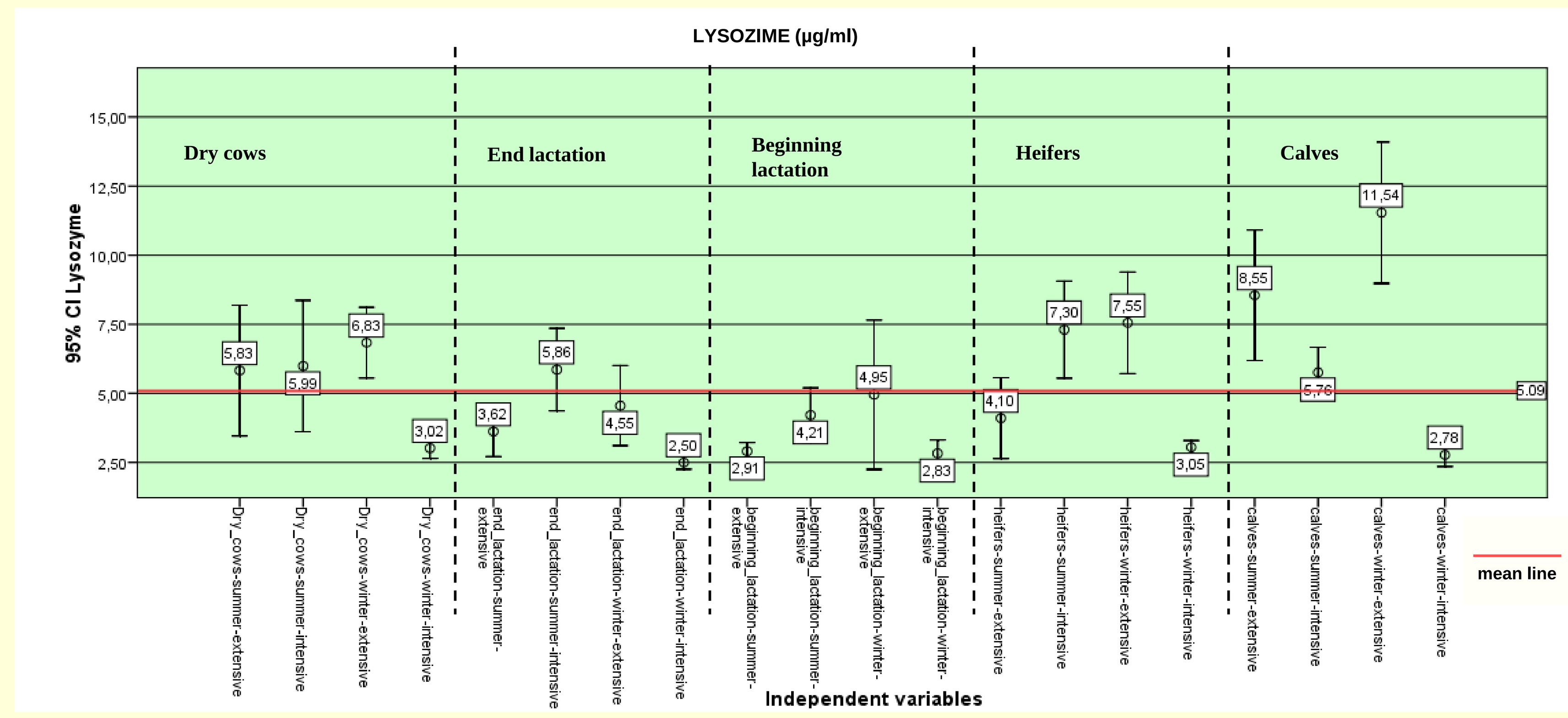

Figure 3. Lysozime levels.

The parameters assessed proved to be influenced by the season in which blood samples were taken. From the clinical standpoint, the condition of the buffalo is usually better in the summer, and deteriorates during the cold season. Consequently, the parameters of clinical immunology display different patterns, and must be evaluated with attention. In particular, haptoglobin values undergo considerable seasonal variation, while bactericidal capacity seems to be less affected.

Haptoglobin displays two distinct peculiarities in buffaloes in comparison with cattle: much higher mean values between lactations than in the phase following calving. This latter feature substantially resembles what happens in the goat, in which the acute-phase positive response (haptoglobin) is associated to inflammation and ketosis during pregnancy and decreases after delivery (Trevisi et al., 2005).

The pattern of the parameters of clinical immunology in calves deserves further reflection. Most noteworthy is the combined upward co-variation of the values of haptoglobin and complement, which display their highest levels in summer and in free-range herds. Thus, the well-known difficulty that these animals have in adapting to a winter environment when shelter is inadequate (a condition more frequently faced by free-range herds) could be related to reduced expression of the parameters of clinical immunology under investigation. It therefore seems that some functions of the innate immune system of the buffalo are expressed in favorable environmental conditions to a far greater degree than they are in cattle. This may indicate a greater reactive state of the monocyte-macrophage compartment.

The fact that far greater difficulty is encountered in winter than in summer (substantially the opposite of what is observed in dairy cattle) is in complete agreement with the productive and healthcare standards of the buffalo species.

The values recorded for all the above parameters constitute the basis both for establishing reference values that are proper to the species and which can be differentiated according to the zootechnical category, and for determining, for each parameter analyzed, cut-off values indicating situations at risk for the onset of stress-related diseases.

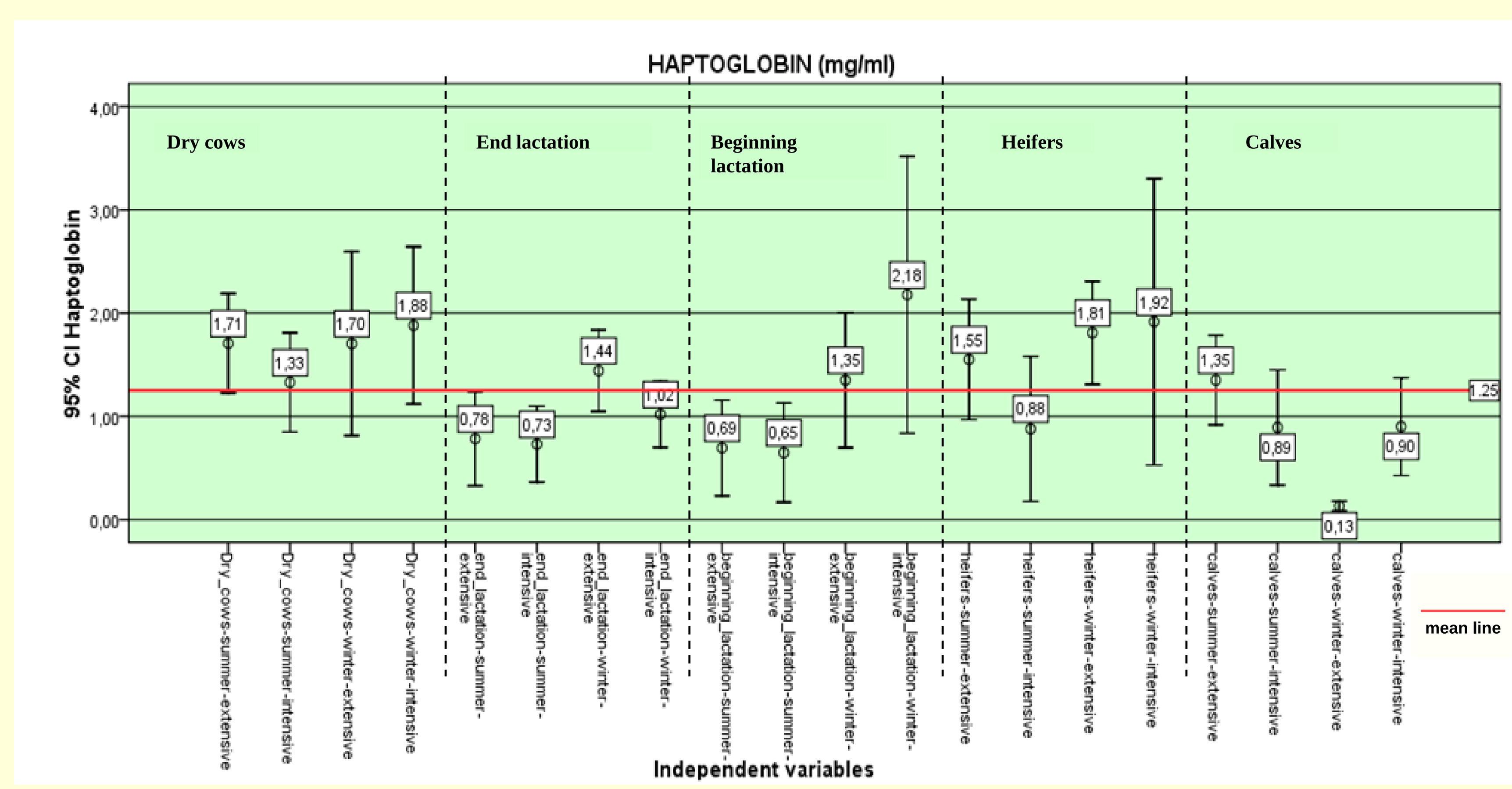

Figure 4. Haptoglobin levels.

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