

COMPARISON OF BLOOD ACID BASE GAS PARAMETERS IN VENOUS AND ARTERIAL BLOOD OF HEALTHY BUFFALOES

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ABSTRACT

The present study was carried out on ten clinically healthy adult buffaloes of 4 to 6 years of age. The parameters of acid-base balance (pH, pCO₂, pO₂, HCO₃, SBC, ABE, SBE, SAT and O₂ct) were measured simultaneously in venous and arterial blood. The results from this study revealed that the mean, minimum and maximum values of pH, pO₂, ABE, SAT and O₂ct were lower in the venous blood than in the arterial blood while the values of pCO₂ and HCO₃ were higher in venous blood than in the arterial blood. Wider differences were observed in the values of the respiratory parameters of venous and arterial blood. The differences found in the parameters of acid-base balance between both the kinds of blood revealed the restricted informative significance of the venous blood. This calls for the use of arterial blood when it is necessary to assess the acid-base balance.

Keywords: acid-base balance, arterial blood, buffalo, venous blood

INTRODUCTION

The changes in blood acid-base gas status are the early manifestation of many diseases in humans as well as animals. So, they are source

of information for early phase of the disease and they influence the development of clinical signs and therapeutic effectiveness (Brobst 1975). Some authors (Brobst, 1975; Singh *et al.*, 1981; Naito and Murakami, 1982) think that with the exception of the respiratory components (pCO₂ and pO₂) and the SAT, other components are not different in venous and arterial blood. Others think that the venous blood is unsuitable for acid base gas analysis (Bergman and Coleman, 1983; Gemelli, 1981). The reference values for every parameter help in correct interpretation of the results. The reference values in calves are available in the literature. The limited overall research of acid-base balance in buffaloes prompted us for this research, whose purpose was to describe the blood acid-base gas information for the venous and arterial blood in buffaloes.

MATERIALS AND METHODS

The study was carried out on ten clinical healthy buffaloes of age between 4 to 6 years. The selected buffaloes had no history of disease for the current lactation and were clinically healthy at the time of sampling. Blood samples were collected in heparinised (1:1000) disposable syringes and were examined by apparatus ABL- 77 v1.41, produced by Radiometer- Denmark. Venous blood samples were collected from the jugular vein and

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arterial blood samples from auricular artery. The blood acid-base parameters determined were pH, partial pressure of carbon dioxide ($p\text{CO}_2$), partial pressure of oxygen ($p\text{O}_2$), actual bicarbonate (HCO_3), standard bicarbonate (SBC), actual base excess (ABE), standard base excess (SBE), oxygen saturation (SAT) and oxygen capacity (O_2ct). The student's t-test was used to analyze the significance of difference between parameters of venous and arterial blood. The significance level was kept at $p \leq 0.05$ and $p \leq 0.01$.

RESULTS AND DISCUSSION

The mean, minimum and maximum values of acid base balance are shown in Table 1. The average (7.386 ± 0.023) and the maximal (7.43) indexes of pH in the venous blood were over taken with the average (7.463 ± 0.015) and maximal (7.52) pH in the arterial blood. The mean pH value in the venous blood was 0.077 lower than that of the arterial blood. The difference between the minimal pH indexes of the two kinds of blood was 0.07 and between the maximal pH indexes it was 0.09.

The $p\text{CO}_2$ in the venous blood was 7.33 mmHg higher than that in the arterial blood. The biggest differences were found between the maximal indexes of the venous and arterial blood (11 mmHg), the lowest were between their minimal indexes (4 mmHg). In comparison to $p\text{CO}_2$, $p\text{O}_2$ in the venous was 53.6% to 72.6% lower as compared to that in the arterial blood. Similar substantial differential rate was found for SAT and O_2ct . The average, minimal and maximal indexes for SAT and O_2ct in the venous blood were lower than those of the arterial blood.

The average values of HCO_3 and SBC in the venous blood were respectively 2.17 mmol/L and

0.66 mmol/L higher than those in arterial blood. A difference was also found for the ABE, whose average value in the venous blood was 1.03 mmol/L lower than that in the arterial blood.

The analysis of the results for the average, minimal and maximal values of the acid-base balance of the venous and arterialized capillary blood revealed that these values of the pH, $p\text{O}_2$, ABE, SAT and O_2ct in the venous blood were lower, and for $p\text{CO}_2$ and HCO_3 were higher than those of the arterial blood. Also the acquired results between the maximal and minimal values of pH, HCO_3 and ABE of the venous and arterial blood were narrower, and the ones for $p\text{CO}_2$, $p\text{O}_2$, and SAT are substantially wider. Van Sluijs *et al.* (1983) and Waizenhofer and Mulling (1978) discussed similar differences between the indexes of the venous and arterialized capillary blood of dogs and calves. According to these authors the values of the indexes of acid-base balance in the arterial blood are closer to the arterialized capillary blood rather than the venous blood.

The results of the present study for the venous blood of buffaloes were different that the ones of Nangia and Sukhija (1981) and Sobti *et al.* (1995) who found higher indexes for pH and lower for $p\text{CO}_2$ and HCO_3 . The values of pH, $p\text{O}_2$ and HCO_3 of the arterial capillary blood found in this study were closer to those of Singh *et al.* (1981) who used arterial blood, rather than Nangia and Sukhija (1981) and Sobti *et al.* (1995) who used venous blood. Apart from the bigger differences of the established values for the respiratory indexes ($p\text{CO}_2$ and $p\text{O}_2$) and SAT between arterial and venous blood, the values of the metabolic component (HCO_3 and ABE) of the acid-base balance and the blood pH of both the blood types overlapped to a certain degree. For example, the average and minimal values of HCO_3 in the venous

Table 1. Mean, minimum and maximum values of acid base gas parameters in venous and arterial blood of healthy buffaloes.

	Venous blood			Arterial blood		
	Mean±S.E	Minimum	Maximum	Mean±S.E	Minimum	Maximum
pH	7.386±0.023	7.35	7.43	7.463±0.015	7.42	7.52
pCO ₂ (mmHg)	41.33±2.27	35	46	34.0±1.52	31	35
pO ₂ (mmHg)	49.00±3.26	37	69	86.67±2.64	79	95
HCO ₃ (mmol/L)	26.20±1.43	23.1	30	24.03±0.66	22.9	25.2
SBC (mmol/L)	26.03±1.89	22.4	28.8	25.37±1.06	23.8	27.4
ABE (mmol/L)	1.10±0.52*	-1.9	3.4	2.13±0.54	-0.7	5.4
SBE (mmol/L)	2.13±0.52*	-1.7	5.7	0.63±0.48	-0.9	2.4
SAT (%)	80.17±4.23**	71.7	95.2	97.13±3.83	96.2	97.6
O ₂ ct (%)	12.37±1.23**	10.2	14.8	15.50±1.32	10.8	21.6

*Difference significant at $p \leq 0.05$; **Difference significant at $p \leq 0.01$.

blood overlapped with the maximum and minimum values of the arterial blood and the found borders for ABE of the venous blood covered most of the values of arterial blood. Thus, it was inferred that the venous blood of buffaloes could be used for assessing pH and HCO₃ only. For the respiratory components (pCO₂ and pO₂) and SAT the venous blood did not give a clear idea.

The overall assessment of the venous blood parameters showed that it was not suitable for the evaluation of acid base balance. Because of this, arterial blood is recommended for assessment of acid base balance.

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