The Season Influence on Blood Parameters in Lactating Buffalo Females

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Abstract
Metabolic profile is used to detect possible nutritional errors with negative effects on animal's production. The aim of this study was to establish some reference values of blood constituents for lactating buffaloes related to the season. Thus, 15 buffalo females, clinically healthy, from the S.C.D.C.B. Sercaia-Brasov were screened for hematological and biochemical blood profile during the summer and the winter period. Feeding system was differentiated by season (conserved forage and corn fodder in the winter season and green mass in the summer season). The results for hematological parameters revealed no significantly statistical differences ($p>0.05$) between seasons. The average values of the determined biochemical parameters (total cholesterol, serum levels of Mg) had values within the normal range, with no statistically differences between seasons. Total protein level varied significantly distinct ($p<0.01$) between the winter season 7.02±1.13 mg/dL and the summer season 8.20±0.92 mg/dL. The values obtained for the mineral profile (serum Ca and inorganic P) varied significantly ($p<0.05$) between seasons. The level of PAL and GOT enzymes registered values above normal physiological limits, the activity of these enzymes being considered as an indicator for acute liver necrosis. The obtained values in this study could be useful for interpretation of biochemical and hematological parameters in lactating buffaloes.

Keywords: biochemical parameters, buffaloes, haematological parameters, season.

1. Introduction

A rational nutrition leads to obtain animal products with high biological value. On the contrary, the unbalanced nutrition has negative effects on animal health as well as on the production and reproduction performances [1]. For these reasons nutrition must be under control, being the most important factor of the external environment that influence the animal organism. Metabolic profile is used to detect the possible nutritional errors with negative effects on animal's production and reproduction [2].

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2. Materials and methods

Fifteen buffalo females (10-12 years old) clinically healthy, from the S.C.D.C.B. Sercaia-Brasov were screened for hematological and biochemical blood profile during the summer and the winter period. Feeding system was differentiated by season as following: conserved forage - sedge, marsh hay, corn silage, triticale straw, fodder maize - in the winter season and green mass in the summer season. The animals received salt and water ad libitum. The analyses were carried out in the Animal Physiology and Biochemistry Laboratory of the I.C.D.C.B. Balotesti. Blood samples were collected aseptically from the jugular vein of each animal, in vacutainer tubes with and without anticoagulant using disodium ethylene diamine tetra acetic acid

(EDTA). Hematological parameters - red blood cells, haemoglobin, hematocrit, total white blood cells, lymphocytes, monocytes, neutrophil, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, red blood cells distribution width, platelets count, platelet percentage, mean platelets volume, platelets distribution width - were determined using automated hematology analyzer Abacus Junior Vet (Diatron, Hungary). The blood biochemical parameters - total proteins, total cholesterol, alkaline phosphatase, asparagine aminotransferase, alanine aminotransferase, total calcium, inorganic phosphorus, magnesium - were estimated using a semiautomated biochemical analyzer StarDust MC 15 (DiaSys Diagnostics Systems Gmbh, Germany) and DiaSys reagents in dedicated kits. Results were expressed as a mean ±standard error. The Student's t-test was applied to obtain the significance of difference. To establish the statistical relationship between quantitative variables used in this study, the correlation coefficient (r) was calculated.

3. Results and discussion

In the present study, all the mean values for haematological parameters were situated in the normal physiological limits without statistical significant difference ($p>0.05$) between seasons. The results of screened hematological parameters are presented in Table 1.

Table 1. Results of hematological parameters in lactating buffaloes by season (n=15)

Hematological parameters[1]	Units	Season				t-test
		Winter $\ddot{X}\pm s_x$	Limits of variation	Summer $\ddot{X}\pm s_x$	Limits of variation	
RBC	mil/mm3	6.41±0.79	5.26-7.90	6.61±0.67	5.47-7.64	ns
HGB	g/dL	12.47±0.97	10.80-14.23	11.94±0.99	10.00-13.30	ns
HCT	%	39.94±3.56	32.00-39.12	39.85±4.13	31.67-46.01	ns
WBC	mii/mm3	8.90±1.35	6.20-11.00	9.85±2.09	5.94-14.21	ns
LY	%	40.99±7.03	32.90-53.00	37.60±5.05	31.70-49.40	ns
MO	%	3.52±1.19	0.90-5.10	3.80±1.39	1.10-5.20	ns
NE	%	52.45±11.72	31.00-64.10	57.60±5.76	46.00-64.20	ns
MCV	fl	57.86±1.24	55.00-68.00	60.20±0.80	51.00-68.00	ns
MCH	pg	17.40±0.41	16.80-19.90	18.12±0.27	32.80-29.00	ns
MCHC	g/dl	29.62±0.55	31.70-27.30	30.10±0.42	32.50-26.90	ns
RDWc	%	19.50±0.21	17.90-19.50	19.50±0.21	18.00-20.60	ns
PLT	mii/mm3	210.00±3.06	142.00-446.00	206.00±5.12	138.00-459.00	ns
PCT	%	0.23±1.02	0,14-0,30	0.21±1.02	0.15-0.27	ns
MPV	fl	9.10±0.41	8,30-10,10	9.30±0.34	8.60-10.50	ns
PDWc	%	39.20±2.09	35,20-42,80	39.82±2.09	37.90-40.90	ns

[1]RBC=red blood cells count, HGB=hemoglobin concentration, HCT=hematocrit percentage, WBC=total white blood cells count, LY=lymphocytes percentage, MO=monocytes percentage, NE=neutrophil percentage, MCV=mean corpuscular volume, MCH=mean corpuscular hemoglobin, MCHC=mean corpuscular hemoglobin concentration, RDWc=red blood cells distribution width, PLT=platelets count, PCT=platelet percentage, MPV=mean platelets volume, PDWc=platelets distribution width.
[2]ns = non significant ($p>0.05$).

The mean values for red blood cell, was similar in both seasons, 6.41±0.79 mil/mm3 in the winter season and 6.61±0.67mil/mm3 in the summer season. Similar values were reported by Durrani et al. [3] and Hagawane et al. [4]. For an accurate assessment the red blood cell mass was correlated with hematocrit. A positive correlation, between the number of the erythrocytes and the HTC was observed ($r=0.570$, $r^2= 0.324$, $p<0.027$) in the winter season compared to the summer season where we had a strong positive correlation, ($r=0.899$, $r^2=0.808$, $p<0.0001$). The average values for hemoglobin varied insignificantly in both seasons (winter -11.94±0.99 g/dL versus summer - 12.47±0.97 g/dL), the level of the hemoglobin being influenced by the season, so that in winter - spring period, the values of this parameter were lower, comparative with the summer period. Our

results are in agreement with results by Fagiolo et al. [5] who reported higher HGB values in lactating buffaloes, during the summer season (13.62 g/dL) than in the winter season (11.37 g/dL). The average percentage for the hematocrit was 39.94±3.56 % in the winter season with limits between 32% to 39.12% and 39.85±4.13 % in the summer season with limits between 31.67% and 46.01%. In lactating buffaloes, HCT was higher in the summer period (40.75%) than in the winter period (32.63%) [5]. The mean values for MCV, MCH, MCHC (Figure 1), were situated within normal physiological limits in different seasons. Total WBC count from the current study was lower than total WBC count reported by Garkal et al. [6]. The values recorded for diferential count of WBC, RDWc, PLT, PCT, MPV, PDWc were differed from values reported by Ciaramella et al. [7] and Fagiolo et al. [5]. Differences may be attributed to breed, age, lactations rank, climatic and physiological status of the animals.

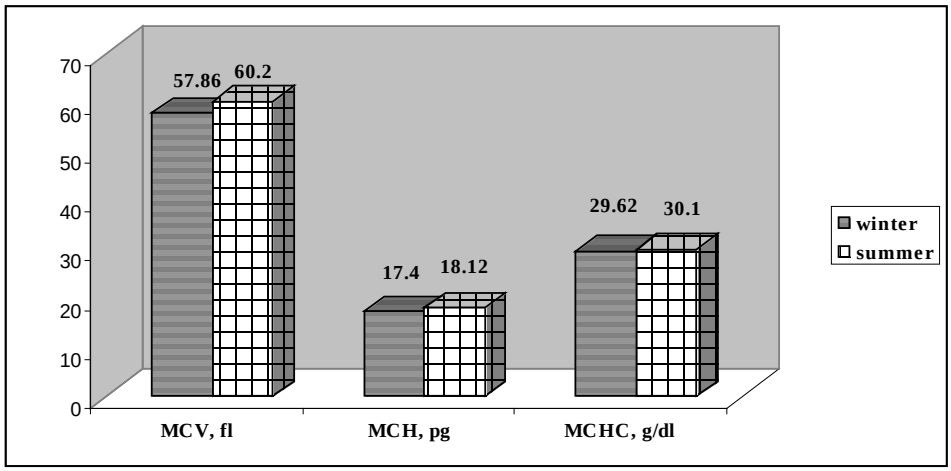

Figure 1. Graphical representation of MCV, MCH, MCHC parameters in lactating buffaloes by season

The results of serum biochemical parameters examination are presented in Table 2. The mean values, reported in this study, for the total proteins (Figure 2) was distinct significantly ($p<0.01$) between seasons (winter - 7.02±1.03 mg/dL and summer - 8.20±0.92 mg/dL).

The same mean values have been obtained by others authors [4, 8-11].

Table 2. Results of serum biochemical parameters in lactating buffaloes by season (n=15)

Biochemical parameters[1]	Units	Season				t-test
		Winter $\bar{X}\pm s_x$	Limits of variation	Summer $\bar{X}\pm s_x$	Limits of variation	
Proteins	mg/dL	7.02±1.03	5.30-9.00	8.20±0.92	6.90-10.50	**
Cholesterol	mg/dL	106.86±29.78	56.00-149.00	118.46±30.70	74.00-186.00	ns
PAL	U/L	79.20±21.52	61.00-149.00	73.53±18.72	51.00-130.00	ns
GOT	U/L	71.86±17.65	52.00-122.00	72.26±18.61	53.00-127.00	ns
GPT	U/L	231.06±108.58	120.00-480.00	262.26±146.47	113.00-569.00	ns
Ca	mg/dL	9.58±0.88	8.90-11.80	9.03±0.41	8.40-9.90	*
P	mg/dL	6.10±0.80	4.60-7.50	5.33±1.15	3.60-7.50	*
Mg	mg/dL	3.60±0.43	2.97-4.67	3.01±0.26	2.97-4.01	ns

[1]PAL=alkaline phosphatase, GOT=asparagine aminotransferase, GPT=alanine aminotransferase, Ca=total calcium, P=inorganic phosphorus, Mg=magnesium.

[2]* $p<0.05$, ** $p<0.01$.

[3]ns = non significant ($p>0.05$).

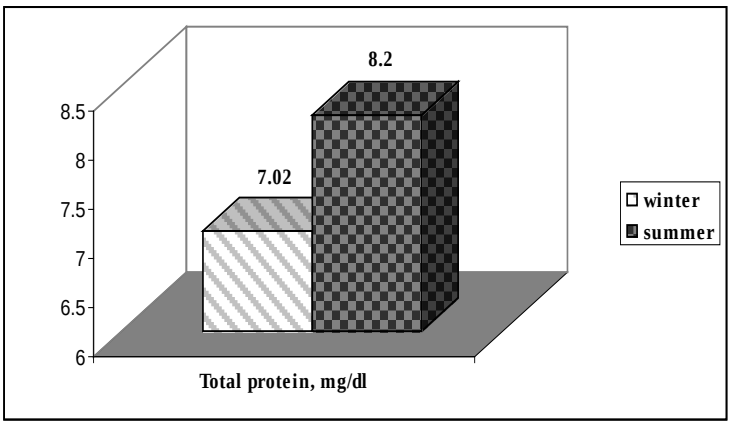

Figure 2. Graphical representation of total proteins in lactating buffaloes by season

The serum cholesterol level was 106.86±29.78 mg/dL in the winter season and 118.46±30.70 mg/dL in the summer season (p>0.05).This higher values during the summer were generated by the consumption of green fodder. Our results are similar with the values obtained by Abdulkareem [12]. Akhtar et al. [13] has obtained a value of 202.73±27.85 mg/dL total cholesterol. It is important to know the variation of cholesterol, because the cholesterol participates in the mobilization of fatty acids needed for the synthesis of lipids in milk [14]. The level of PAL and GOT enzymes registered values above normal physiological limits. The higher values of the activity GPT correlated with higher values of the activity GOT and PAL, represents the indicators of liver disorders such as hepatitis infectious and intoxications. The activity of these enzymes being considered as an indicator for acute liver necrosis [15]. In bovine, alkaline phosphatase are often associated with bone diseases. There was a positive correlation between the activity of PAL, and the serum Ca in the winter season (r=0.250, r^2=0.058, p=0.388) and a negative correlation in the summer season (r=0.088, r^2=0.008, p=0.755). The values obtained for the mineral profile (serum Ca and inorganic P) varied significantly (p<0.05) between seasons (Figure 3). The results are in agreement with those presented by others authors [4, 9, 11, 16-18]. If the diet is deficient in Ca and P, the lactating animals have to bring these minerals from the skeletal reserves for maintaining the production and milk composition. The phosphorus and calcium deficiency could generate reproductive and production disorders [19], in adult bovine animals the phosphorus being considered a limiting factor of reproduction.

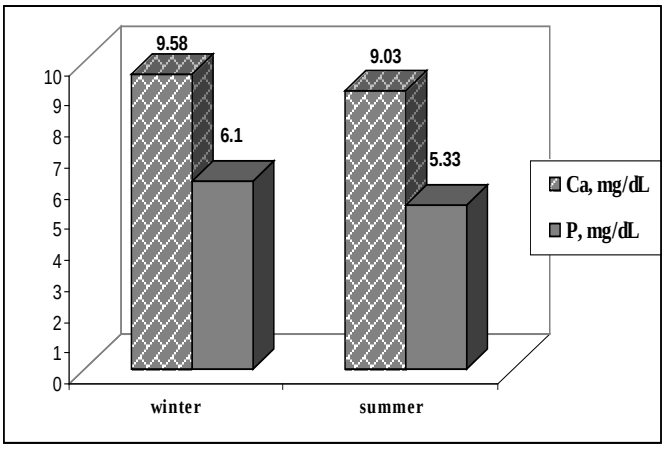

Figure 3. Graphical representation of total calcium and phosphorus in lactating buffaloes by season

The levels of Mg in the summer season is lower compared with the value obtained in the winter season, because ruminants have a limited reserve of Mg, depending on the daily supply.

Thus, the transition from the winter to summer season feeding, the mobilization of magnesium in the body is also slow and insufficient to cover the deficit, which is the main cause of grass tetany disorder.

4. Conclusions

The feeding is the most important external factor which influences the physiological status in lactating buffaloes, this fact being reflected by the metabolic profile.

The values obtained for hematological parameters in different seasons were within normal physiological limits, without significant differences ($p>0.05$). The mean values for total proteins showed seasonal variations from 7.02±1.03 mg/dL in winter to 8.20±0.92 mg/dL in summer ($p<0.01$). The concentration of cholesterol, the serum level for PAL, GOT and GPT enzymes, was not affected by the feeding system ($p>0.05$) compared with the values recorded for the serum Ca and inorganic P ($p<0.05$). The obtained values in this study could be useful for interpretation of biochemical and hematological parameters in lactating buffaloes. Research will continue on a larger number of animals with different gender, age, physiological condition and health status.

References

1. Stoica, I, Liliana Stoica, Bazele nutriţiei şi alimentaţiei animalelor, Editura Coral Sanivet, Bucureşti, 2001, pp. 8-9.
2. Părvu, Gh., Costea, M., Pirvu, M., Nicolae, B., Tratat de Nutritia Animalelor, Editura Coral Sanivet, Bucureşti, 2003, pp. 834-838.
3. Durrani, K., Shakoori, R., Younus, R. M., Prevalence of post parturient haemoglobinuria in buffalo and therapeutic trials with toldimfos sodium and tea leaves in Pakistan, Turk. J. Vet. Anim. Sci, 2010, 34(1), 45-51.
4. Hagawane, S. D., Shinde, S. B., Rajguru, D. N., Haematological and Blood Biochemical Profile in Lactating Buffaloes in and around Parbhani city, Veterinary World, 2009,.2(12).
5. Fagiolo, A., Lai, O., Alfieri, L., Nardon, A. Cavallina, R., Environmental factors and different managements that influence metabolic, endocrine and immuno responses in water buffalo during lactation, Proc. Seventh World Buffalo Congress, Manila, Philippines, 2004, 24-26.
6.Garkal, R. A., Keken, P. M., Kharde, P. M., Munde, V. K., Narladkar, B. W., Vaidya, M. S., Effect of different housing systems on haematological parameters of buffaloes, Buffalo Bulletin, 2016, 35(2).
7. Ciaramella, P. Corona, M., Ambrosio, R., Consalvo, F., Persechino, A., Haematological profile on non-lactating Mediterranean buffaloes (*Bubalus bubalis*) ranging in age from 24 months to 14 years. Research in Veterinary Science., 2005, 79(1), 77-80.
8. Neamat-Allah, A. N. F., Alterations in some hematological and biochemical parameters in Egyptian buffaloes suffering from traumatic reticuloperitonitis and its sequelae, Bulletin UASVM Veterinary Medicne, 2015, 72(1).
9. Sălăgeanu, Gh., Bota, A., Ghelţu, L., Nica, O., Matei, R., Influenţa leticinei administrată în raţie asupra proceselor secretei lactate la bivoliţă, Lucrări şt. ICPCB, 1995, 285-290.
10. Chaves de Oliveira C. M., Barbosa, J. D., Pfeifere, I. B., Cardoso, D. P., Parâmetros sangüíneos e urinários, no pré e pós parto, de búfalas criadas em sistema exclusivo de pastejo, Pesq. Vet. Bras., 2003, 23(2), 87-92.
11. Pucheanu, C., Cercetări privind cunoaşterea unor parametrii morfologici, fiziologici şi productivi la bivoliţe, în relaţie cu diferiţi factori de influenţă, Teză de doctorat, 2000, Bucureşti.
12. Abdulkareem, T. A., Some hematological and blood biochemical attributes of Iraqi riverine buffaloes (*Bubalus Bubalis*) around calving and postpartum periods, Al-Anbar J. Vet. Sci., 2013, 6(1).
13. Akhtar, M. Z, Ahrar, K., Zargham, M., Biochemical changes in buffaloes (Bubalus Bubalis) suffering from parturient haemoglobinuriapakistan,Vet. J., 2008, 28,(3), 139-14.
14. Popovici, D., Răitaru M., Jurenkova G., Implicaţiile funcţionale şi productive ale mobilizării rezervelor la vacile cu producţii mari de lapte în primele luni de lactaţie, Lucrări Ştiinţifice, ICCT, 1972, 4.
15. Kaplan M. M., Laboratory Tests. In: Diseases of the Liver. Eds. Schiff, L. & Schiff, E.R., J. B. Lippincott, Philadelphia, USA, 1987, pp. 219.
16. Terzano, G. M., Tripaldi, C., Allegrini, S., Pasqui, E., Roncoroni, C., Satà, M .C. E. Terramoccia, S., Benessere e riproduzione: approccio sperimentale sulla specie bufalina. Proc. Workshop Stato di benessere ed efficienza riproduttiva negli animali di interesse zootecnico,Viterbo, Italia, 2000, 147-153.
17. Campanile, G., Di Palo, R., D'Angelo, A., Profilo metabolico nel bufalo, Bubalus Bubalis, 1997, Suppl. 4, 236-249.
18. Montemurro, N., Pacelli, C., Borghese, A., Blood metabolites change in milking buffalo cows. Bubalus Bubalis, 1997, 3, 69-78.
19. Abd Ellah, M. R., Hamed, M. I., Derar, R. I., Rateb, H. Z., Comparative studyon reference values for blood constituents during pregnancy in buffaloes (*Bubalus bubalis*), Journal advanced veterinary research, 2013, 3, 36-46.