

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; 9(11): 779-781
www.biochemjournal.com
Received: 04-09-2025
Accepted: 07-10-2025

Kalyani P
Department of Veterinary
Biochemistry, College of
Veterinary Science, Proddatur,
Andhra Pradesh, India

Muralidhar M
Department of Animal
Genetics & Breeding, College of
Veterinary Science, Garividi,
Andhra Pradesh, India

Comparative serum chemistry profile of different age group buffaloes of Guntur district

Kalyani P and Muralidhar M

DOI: <https://www.doi.org/10.33545/26174693.2025.v9.i11j.6814>

Abstract

Serum chemistry profile plays a very important role in monitoring the nutritional and health status of animals and it varies with age. The present study was conducted to elucidate the health status and age specific variations in serum chemistry profile of buffaloes of Guntur District. The apparently healthy buffaloes were selected and divided into three groups based on age as 0-3 years, 4-6 years and 7-9 years. Ten basic biochemical parameters of significant importance in herbivores like total protein, albumin, globulins, blood urea nitrogen, creatinine, total bilirubin, direct bilirubin, calcium and phosphorus were analyzed in the serum samples using commercially available kits from Erba Mannheim. Total protein, globulins, urea and calcium were lower than the lower reference limit whereas albumin, creatinine, bilirubin (total and direct) and phosphorus were within the normal limits. There was no significant difference in these parameters except creatinine among different age groups. The values were relatively higher in 4-6 years age group, which is generally considered as the most productive period in buffaloes.

The results elucidated the prevalence of subclinical hypocalcemia and immunodeficiency in all age group buffaloes of Varagani village in Guntur district. It is likely to have a profound impact on the productive performance of the animals.

Keywords: Serum chemistry profile, creatinine, hypoglobulinemia, hypocalcemia, productive performance

Introduction

Andhra Pradesh is the second largest state in buffalo population next to Uttar Pradesh. Buffaloes are mainly reared for milk production. Most of the animals belong to non-descript breed whose average milk yield is 1.8 kg/day as per 2003 census whereas some of them are graded Murrah with average milk yield of 4.26 kg/day (Garcia *et al.*, 2006) ^[12]. Health status has significant impact on the milk yield. Serum chemistry profile plays an important role in monitoring the health status such as body's internal condition, function of different organs and metabolic changes in the body (Lee *et al.*, 1978 and Scamell, 2006) ^[16, 21]. The estimation of basic biochemical constituents helps in the further diagnosis of various pathophysiological and metabolic diseases. The blood biochemical parameters are classified into three groups based on variability in the values and diagnostic value as low variability with high diagnostic value, moderate variability with diagnostic value and high variability with low diagnostic value by Suan (2006) ^[22].

Serum biochemical constituents of low variability with high diagnostic value like total protein, albumin, globulin, calcium and phosphorus can be used to screen animals for subclinical infections that are responsible for lowering the productivity of animals. Hence a small trial was conducted to monitor the health status of three age group buffaloes namely 0-3 years, 4-6 years and 7-9 years of Varagani village in Guntur district using serum chemistry parameters of low variability and high diagnostic value.

Materials and Methods

Thirty animals of different ages were selected at random from Varagani village of Guntur district. The blood samples were collected in vacutainer tubes by jugular vein puncture. After clot formation, the vacutainer tubes were centrifuged, clear serum samples were collected in clean vials and stored at -20°C until further analysis. The blood biochemical constituents like total protein, albumin, urea, creatinine, total bilirubin, direct bilirubin, calcium and

Corresponding Author:
Kalyani P
Department of Veterinary
Biochemistry, College of
Veterinary Science, Proddatur,
Andhra Pradesh, India

phosphorus were estimated using diagnostic kits from Erba Mannheim and 'Multiscan Go' spectrophotometer. The tests were repeated twice and checked for repeatability.

Results

The results were presented in Table 1. There was no statistically significant difference in the values of different parameters among different age groups except creatinine, which was significantly higher in 4-6 years age group when compared to other age groups. The total protein, globulin, BUN and calcium values were lower than the reported lower reference limit with values of 5.31 ± 0.19 , 5.53 ± 0.48 , 5.39 ± 0.14 and 6.7 g/dl for total protein; 2.11 ± 0.2 , 2.14 ± 0.16 , 2.22 ± 0.14 and 3.0 g/dl for globulins; 14.02 ± 2.1 , 12.37 ± 1.5 , 8.55 ± 1.32 and 20 mg/dl for BUN and 7.50 ± 0.25 , 8.58 ± 0.81 , 7.01 ± 0.25 and 9.7 mg/dl for calcium in all the age groups and LRL respectively.

The albumin, creatinine, total bilirubin, direct bilirubin and phosphorus values were within the normal range. There was statistically significant difference in creatinine values among the different age groups whereas for all other parameters, there was no statistically significant difference in values among various age groups.

Discussion

From the results, it is evident that there is hypoproteinemia due to hypoglobulinemia. Chorfe *et al.* reported that variation in serum globulin level in buffaloes is mainly due to γ globulin fraction and both of them have positive correlation with r^2 value of 0.87 for γ globulins and 0.91 for IgG (Ingvarsten and Moyes, 2013) [15]. Based on this report, it can be presumed that the buffaloes in the present study had poor humoral immune response.

Nutritional status has a key role in immune function of dairy cows. The major energetic fuels used by immune cells are glucose, non-esterified fatty acids (NEFA), beta hydroxyl butyric acid (BHBA) and glutamine (Gln) (Ingvarsten and Moyes, 2013) [15]. Poor nutritional status leads to decreased γ globulin production by immune cells. Deficiency of vitamin B₁₂ was found to affect production of immunoglobulins and complement components in mice (Funanda *et al.*, 2001) [11]. Malnutrition also leads to increase in the levels of glucocorticosteroids, which are known to cause immunodeficiency (Cunningham, 1982) [9]. Mineral metabolism is altered in malnutrition syndrome leading to deficiency of iron and zinc, which have an important role to play in immune function. Iron and zinc deficiencies have been reported to cause immunodeficiency (Gross *et al.*, 1975; de Sousa *et al.*, 1978; Brummerstedt, 1971) [13, 10, 3]. Congenital immune deficiency or nephrotic syndrome can also cause hypoglobulinemia (Busher, 1980) [4].

The results of the present study delineate the fact that the animals are undernourished and that might have resulted in low protein and globulin levels. This assumption can be strengthened by the BUN levels, which are lower than the normal range of 20-30 mg/dl in all the three age groups with values, 14.02 ± 2.1 , 12.37 ± 1.5 and 8.55 ± 1.32 respectively (Table 1). Lower BUN values are good indicators of less protein turnover in the body. Blood or milk urea nitrogen forms a useful tool for monitoring protein-energy status of cattle. Preston *et al.*, (1978) [19] reported that BUN value of

<7 mg/dl in finishing steers and < 15 mg/dl in rapidly growing cattle indicates dietary protein deficiency. The BUN values in the present study are less than 15 mg/dl indicating protein deficiencies in the animals.

Creatinine levels showed significant variation between different age groups with higher level of 1.39 ± 0.09 in 4-6 years age group (Table 1). This period is considered to be the most productive period in buffaloes. The results are in agreement with those of Patel *et al.*, 2016 [18] who observed higher creatinine levels in bulls when compared to male calves whereas Saraiva *et al.*, 2014 [20] reported contradictory results stating that creatinine levels decreased with advancing age from 1.85 ± 0.41 mg/dl at 12 months to 1.71 ± 0.42 mg/dl at 24 months. Creatinine is a marker of muscular and kidney function. The animals are apparently healthy and no evidence of kidney disorders was observed based on animal behavior and other markers of kidney function like albumin and BUN. So the variation in creatinine levels in the present study could most probably be due to physiological variation in muscular function at different ages. The higher creatinine levels during 4-6 years age in the present study can be corroborated to higher muscular activity during this productively active period. This is in agreement with the findings of Baxmann *et al.*, 2008 [2], who identified a significantly higher mean serum creatinine levels in humans with moderate/intense physical activity compared to the those with mild activity or the sedentary individuals.

Bilirubin levels (total and direct) are within the normal range indicating no influence of age on bilirubin metabolism in the body (Fig. 4).

Among the two minerals calcium and phosphorus studied, calcium values are 7.50 ± 0.25 , 8.58 ± 0.81 and 6.96 ± 0.39 respectively in all the three age groups and are less than the normal range of 9.7-12.4 mg/dl. Phosphorus values were within the normal range in the first two age groups where as in the third age group i.e., 6-9 years, it is 4.55 ± 0.48 mg/dl, which is less than the normal range of 5.6-6.5 mg/dl (Fig. 5). It indicates hypophosphatemia although the difference is not significant when compared to the other age groups. Based on these results, subclinical hypocalcemia is evident in all the buffaloes of Varagani village as the traditional cut-off value of total calcium for subclinical hypocalcemia is reported as < 8 mg/dl (Gutarra SM *et al.*, 2025) [14]. Incidence of subclinical hypocalcemia was reported to be 22.64% in cross-bred cattle of Andhra Pradesh by Ambica and Rao (2012) [1]. The Ca²⁺ levels in water buffaloes of Ludhiana are 8.92 ± 0.26 mg/dl during summer and 9.74 ± 0.30 mg/dl in winter. Hypocalcemic HF cows were found to have significantly more lipid infiltration in hepatocytes on day 7 and day 35 post-partum. Milk protein percentage was decreased by day 21 and day 35 post-partum (Chamberlin *et al.*, 2013) [6]. These reports emphasize the fact that subclinical hypocalcemia in the buffaloes of Varagani village may lead to future complications such as adverse effect on liver function and milk production performance of the animals.

Hence there is an urgent need to include protein and mineral supplements in the ration of Varagani village buffaloes to prevent further damage to the health and production performance.

Table 1: Biochemical profile of buffaloes of Varagani village of Guntur district

S. No.	Parameter	Age groups			Total	Normal range	P value
		0-3 yrs	4-6 yrs	7-9 yrs			
1	Total protein	5.31±0.19	5.53±0.48	5.39±0.14	5.42±0.09	6.7-7.5	> 0.05
2	Albumin	3.32±0.16	3.39±0.13	3.17±0.04	3.27±0.07	3.0-3.6	> 0.05
3	Globulins	2.11±0.20	2.14±0.16	2.22±0.14	2.15±0.09	3.0-3.5	> 0.05
4	Urea	30.00±4.5	26.48±3.20	18.29±2.82	25.14±2.20	43-65	> 0.05
5	BUN	14.02±2.1	12.37±1.50	8.55±1.32	11.70±1.03	20-30	> 0.05
6	Creatinine	0.96±0.14	1.39±0.09	1.15±0.11	1.20±0.07	1.0-2.0	< 0.05
7	Total bilirubin	0.11±0.02	0.12±0.03	0.19±0.07	0.14±0.03	0.1-0.5	> 0.05
8	Direct bilirubin	0.08±0.01	0.06±0.01	0.07±0.01	0.07±0.01	0.04-0.14	> 0.05
9	Calcium	7.50±0.25	8.58±0.81	7.01±0.25	7.82±0.38	9.7-12.4	> 0.05
10	Phosphorus	6.02±0.60	6.60±0.71	4.55±0.48	5.85±0.41	5.6-6.5	> 0.05

Acknowledgements

We thank Sri Venkateswara Veterinary University, Tirupati for supporting us in executing this work. We also thank Mr. Rambabu, Regional sales manager, Mineral mixture supplier of Guntur District who has contributed in sample collection from Varagani village.

References

- Ambica G, Rao TS. Haematobiochemical and therapeutic studies on subclinical hypocalcemia in crossbred cows. *Int J Pharma Bio Sci.* 2012;3(4):225-231.
- Baxmann AC, Ahmed MS, Marques NC, Menon UB, Pereira AB, Kirsztajn GM, Heilberg IP. Influence of muscle mass and physical activity on serum and urinary creatinine and serum cystatin C. *Clin J Am Soc Nephrol.* 2008;3(2):348-354.
- Brummerstedt E, Glagstad T, Andresen E. The effect of zinc on calves with hereditary thymus hypoplasia. *Acta Pathol Microbiol Scand A.* 1971;79:686-687.
- Busher JT. Clinical methods: the history, physical, and laboratory examinations. 3rd ed. Boston: Butterworth Publishers; 1980. Chapter 101, p. 1-25.
- Chaffe RRJ. Progress in biometeorology. Vol. 1. Amsterdam: Swets and Zeitlinger BV; 1976. p. 5-15.
- Chamberlin WG, Middleton JR, Spain JN, Johnson GC, Eilersieck MR, Pithua P. Subclinical hypocalcemia, plasma biochemical parameters, lipid metabolism, postpartum disease, and fertility in postpartum dairy cows. *J Dairy Sci.* 2013;96(11):7001-7013.
- Chhabra S, Randhawa SNS, Bharadwaj SD. Macro and micro mineral profile in forage and blood plasma of water buffaloes with respect to seasonal variation. *Buffalo Bull.* 2015;34(1):45-50.
- Chofi Y, Pietersma AL, Girard V, Tremblay A. Evaluation of variation in serum globulin concentrations in dairy cattle. *Vet Clin Pathol.* 2004;33(3):122-127.
- Cunningham S. Effect of nutritional status on immunological function. *Am J Clin Nutr.* 1982;35:1202-1210.
- De Sousa M, Smythman A, Tan C. Suggested models of ecotaxopathy in lymphoreticular malignancy. *Am J Pathol.* 1978;90:497-520.
- Funanda U, Wada M, Kawata T, Mori K, Tamai H, Ishiki T, et al. Vitamin B12 deficiency affects immunoglobulin production and cytokine levels in mice. *Int J Vitam Nutr Res.* 2001;71:60-65.
- Garcia O, Saha A, Mahmood K, Ndambi A, Hemme T. Dairy development programs in Andhra Pradesh, India: impacts and risks for small-scale dairy farms. *Int Farm Comparison Network Rep.* 2006:1-45.
- Gross RL, Reid JVO, Newberne PM, Burgess B, Marston R, Hift W. Depressed cell-mediated immunity in megaloblastic anemia due to folic acid deficiency. *Am J Clin Nutr.* 1975;28:225-232.
- Gutarra SM, Sandoval-Monzon R, Montenegro M, Ruiz-Garcia L. Determination of the impact of subclinical hypocalcemia on milk production in the first third of lactation in intensively farmed cows in Lima, Peru. *Open Vet J.* 2025;15(7):3006-3011.
- Ingvarsen KL, Moyes K. Nutrition, immune function and health of dairy cattle. *Animal.* 2013;7(1):112-122.
- Lee AJ, Twardock AR, Bubar RH, Hall JE, Davis CL. Blood metabolic profile: their use and relation to nutritional status of dairy cows. *J Dairy Sci.* 1978;61:1652-1670.
- McDowell LR. Minerals in animal and human nutrition. San Diego (CA): Academic Press; 1992. p. 1-524.
- Patel MD, Lateef A, Das H, Prajapati MV, Kakati P, Savani HR. Estimation of blood biochemical parameters of Banni buffalo (*Bubalus bubalus*) at different age, sex and physiological states. *Livest Sci.* 2016;7:250-255.
- Preston RL, Byers F, Stevens KR. Estrogenic activity and growth stimulation in steers fed varying protein levels. *J Anim Sci.* 1978;46:541-547.
- Saraiva LA, da Silva TP, Paraguaio PE, Araujo MS, de Sousa SV, Machado LP. Serum urea, creatinine and alkaline phosphatase activity in Nellore cattle raised in the micro Upper Middle Gurgueia. *Anim Vet Sci.* 2014;2(4):105-108.
- Scamell JM. Healthy land for healthy cattle. *Cattle Pract.* 2006;14:143-152.
- Suan RV. Metabolic profiling to assess health status of transition dairy cows [dissertation]. University Park (PA): Pennsylvania State University; 2006. p. 1-210. DOI:10.3920/9789086865710_005.