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Effect of vanadium supplementation on Hemeto-biochemical status of Barbari goat kids

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Abstract
Different levels of Vanadium were used to assess the effect on antioxidant status of Barbari goat kids. A total of 21 barbari goat kids were selected after blocking by body weight (16.27 ±0.89 kg) and age (6.0±0.15 month). Kids were randomly allocated into 3 treatments. The treatments were as follows: 1) Control comprised of total mixed ration (TMR) without any supplementation of vanadium; 2) T1 group was provided TMR basal diet with vanadium @ 1.5 mg/kg DM/kids/day). 3) T2 group was offered TMR basal diet with vanadium @3.0 mg/kg DM/kids/day. Hemoglobin was observed significantly (p<0.05) higher in all three groups. The vanadium supplementation was unaffected in packed cell volume (PCV). Total leukocyte count was elevated with the supplementation of vanadium and was observed significantly higher in all the groups. Neutrophil and Lymphocyte was not affected with vanadium supplementation and shows no significant among groups. Total immunoglobulin was statistically (p<0.05) higher in T1 and T2 than control group. Total cholesterol, HDL cholesterol, ALT, AST and ALP were not affected with the supplementation of vanadium and found statistically similar in the all three groups. Triglyceride was recorded higher significant in T2 groups as compared to control and T1 groups. The study accomplished that the dietary fed of vanadium elevated the hemato-biochemical status of Barbari kids.

Keywords: Vanadium, Barbari kids, TMR, Hemeto-biochemical, packed cell volume (PCV)

Introduction
Vanadium is a rare, hard, ductile gray-white element found combined in certain minerals. Vanadium can be found in the environment in algae, plants, invertebrates, fishes and many other species. In mussels and crabs vanadium strongly bio-accumulates, which can lead to concentrations of about 105 to 106 times greater than the concentrations that are found in seawater. Vanadium is a trace mineral found in many foods. Scientists think your body may need vanadium in very small amounts for normal bone growth. Scientists aren't sure exactly what effects vanadium may have, or what amount might be helpful. Several animal studies and a few small human studies suggest that vanadium may lower blood sugar levels and improve sensitivity to insulin in people with type 2 diabetes. In one study of people with type 2 diabetes, vanadium also lowered total and LDL ("bad") cholesterol. Vanadium (V) has not been reported as an essential mineral in ruminants, although it's well-known role as an insulin-a mimic agent for catalysis enzymatic activities in lower organisms and rat models. Biologists and biomedical specialists have yet to decide on the importance of this element as a micronutrient. Despite its toxicity, it remains essential to investigate the element's many biological functions. Vanadium compounds have been linked to various effects in the development of human illnesses as well as the maintenance of healthy bodily functioning. Vanadium salts interrupt a wide range of enzyme systems, including ATPases, protein kinases, ribonucleases and phosphatases. Several genes are regulated by this element or its compounds, including genes for tumor necrosis factor-alpha (TNF-), Interleukin-8 (IL-8), activator protein-1 (AP-1), c-raf-1, mitogen-activated protein kinase (MAPK), p53, nuclear factors-KB and others, while vanadium deficiency accounts for several physiological malfunctions such as thyroid, glucose and lipid metabolism etc.

Materials and Methods

All the procedures followed in this study were sanctioned by the Institutional Animal Ethics committee, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut. Twenty-one Barbari kids (6-12 months old) will be sorted out from LRC-2, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut and arbitrarily distributed into three groups (n=7) after blocking by body weight (16.27 ±0.89 kg) and age (6.0±0.15 month). The diet was provided to the experimental kids in the form of a total mixed ration (TMR). Total mixed ration prepared as per feeding standard and offered daily in the morning (07.00 h), noon (13.00 h) and evening (17.30 h).Supplementation of vanadium doses will be given to the animals as followings.

Number of animals	Group	Diet	Supplementation of vanadium
21 Barbari kids	Control, 7 kids	TMR	No supplementation
	T1, 7 kids	TMR	1.5 mg/kg DM/calf/day for 90 days
	T2, 7 kids	TMR	3.0 mg/kg DM/calf/day for 90 days

Clean and fresh tap water were offered ad-libitum. Experimental animals were kept under a conventional housing system. The shed were washed and cleaned daily to prevent the chances of any infections. During the entire period of study, various management practices *viz*., deworming, washing, grooming and treatment, etc. were followed as per the standard procedure of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut. Blood samples were collected from the jugular vein of calves at the fortnightly interval in the EDTA coated Vacutainer tube at 07.00 a.m. before feeding and watering. Fraction of blood was used in the estimation of hemoglobin, total leukocyte counts, lymphocyte and neutrophil. The rest of the blood samples then were centrifuged at 3000 rpm for 30 min. The plasma was kept in Eppendorf tubes and stored at -20 ^{o}C till further analysis of antioxidant, immune status, energy and lipid metabolites. After centrifugation hematocrit was washed and centrifuged thrice with normal saline (0.9%NaCl) solution. Then distilled water was added to the erythrocyte pellet slowly and with constant stirring up to the marked level to prepare hemolysate and the rest of hemolysate was quickly stored at –200C till activities of superoxide dismutase and catalase were estimated.

Statistical analysis

Analysis of variance techniques was used to analyze the data using the GLM procedure of SPSS (V20: SPSS Inc., Chicago, IL, USA). Duncan's Multiple Range Test was conducted to compare the means.

Results and Discussion

Variable	Control	T1	T2	SEM	P- Value
Hemoglobin	10.84	11.09	11.31	0.77	**
Packed cell volume	33.35	33.65	33.50	1.57	NS
Total leukocyte count (TLC)	8.53	9.03	9.20	0.61	NS
Nutrophil	37.12	37.38	37.56	4.06	NS
Lymphocyte	52.72	53.07	53.31	1.18	NS
Total Cholesterol	2.14	2.16	2.13	0.40	NS
HDL- Cholesterol	1.29	1.34	1.32	0.06	NS
Total Immunoglobulin	31.12^{a}	33.34^{ab}	33.96^{b}	5.52	**
Alanine aminotransferase (ALT)	33.73	33.98	33.27	1.39	NS
Aspartate transaminase (AST)	85.67	85.70	86.24	4.57	NS
Alkaline phosphatase (ALP)	23.76	23.93	24.55	1.14	NS
Triglycerides	0.34^{a}	0.37^{a}	0.40^{b}	0.05	**

Hemoglobin

The hemoglobin concentration was observed linear increase (p<0.05) significant in 2nd and 4th fortnight of the investigational period of all three groups. Although, the overall mean did not observe differ significant among groups. The results are in agreement with Abdelhamid *et al*. (2013) [1] who had reported an increase in the concentration of hemoglobin.

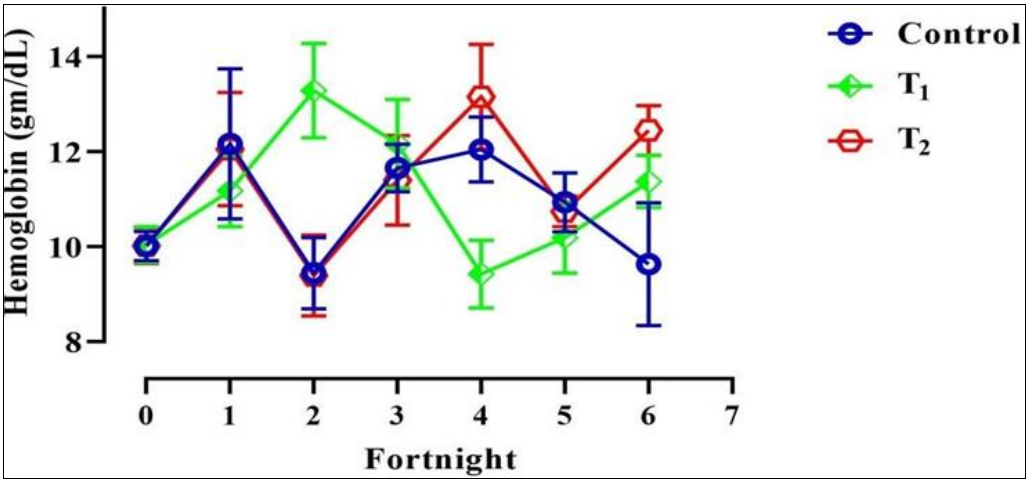

Fig 1: Fortnight changes of hemoglobin supplemented with vanadium

Packed cell volume

At the start of the research, the PCV was 32.04, 32.02 and 32.06% in the control, T1 and T2 groups, respectively, while the overall mean concentration was 33.35, 33.65 and 33.50%. Although there was recorded no significant (p>0.05) difference in the overall mean and fortnightly interval of packed cell volume concentration among groups. That is according to the previously reported by Zaki *et al.* (2010) [16] in fish and Rezk *et al.* (2020) [11] in rats.

Total leukocyte count (TLC)

TLC concentrations in the control, T1 and T2 groups were 8.06, 8.08 and 8.11× 103/µl before vanadium supplementation began. It demonstrates increased significance (p<0.05) in both the treatment and control groups at the 3rd and 5th fortnights. Although the total means TLC concentration was 8.53, 9.03 and 9.20× 103/µl in the control, T1 and T2 groups, there was no significant difference between the three groups. Dietary fed of vanadium did not affect total leukocyte count as reported in the current study. Dissimilar findings earlier came from Scibor (2005) [12] in rats and Omayone *et al.* (2020) [9] in rats.

Neutrophils

The concentrations of neutrophils in the control, T1 and T2 groups were 37.00, 37.40 and 38.49%, respectively, before starting dietary feeding vanadium in the trial. The corresponding data of neutrophil concentration of overall mean was recorded as 37.12, 37.38 and 37.56% in all three groups. During the research period, however, data from neutrophils of all intervals and overall mean showed no significant differences. The results of the present study are in not accordance with Adebiyi *et al.* (2015) [2] was reveal that it decreases the neutrophils in mice.

Lymphocyte

The lymphocyte concentration in the control, T1 and T2 groups was recorded at 52.60, 53.00 and 54.63%, respectively, before beginning vanadium supplementation in the study period. The overall mean of the research period, the corresponding lymphocyte percentages were 52.72, 53.07 and 53.31%. The lymphocyte concentrations fortnightly did not differ statistically (p>0.05) across groups. The total mean lymphocyte percentage was not statistically (p>0.05) different among groups. It is not confirmed with the results of the earlier works; Wang *et al.* (2008) [15] reported a decrease in the percentage of lymphocytes with vanadium supplementation in chickens.

Total Cholesterol

The overall mean total cholesterol levels in the control, T1 and T2 groups were 2.14, 2.16 and 2.13 mmol/L, respectively, during the whole study period. The mean total cholesterol and cholesterol concentration in all three groups of Barbari kids were significant (p>0.05) equivalent. The result of the present study is in accordance with the Moumtain *et al.* (1956) [8] in rabbits. Hafez and Kratzer (1976) [6] also reported that no significant influence of supplemented vanadium @ 100 mg/kg DM on the total cholesterol concentration in white leghorn

HDL-Cholesterol

The vanadium supplementation did not affect HDL cholesterol levels, which were shown to be substantially (p>0.05) comparable in all three groups over the research period. Furthermore, the total mean value of HDL cholesterol in control, T1 and T2 was found to be 1.29, 1.34 and 1.32 mmol/L, respectively, indicating that HDL cholesterol concentrations were shows no significant (p>0.05) among groups. A Similar reported has come from Subrahmanyam *et al.* (2013) [13] who had reported the effect of vanadium supplementation @ 0.5 mg/kg DM in rabbits.

Total immunoglobulin

The overall mean plasma concentration of total immunoglobulin was statistically higher (p<0.05) in T2 than control and T1 and also in the 6th fortnight. Furthermore, 1st, 2nd, 3rd, 4th and 5th fortnight of the research period revealed no significant differences in the circulating concentrations of total immunoglobulin in all three groups. Similar findings on total immunoglobulin were reported by Pal *et al.* (2018) [10] reported that the concentration was increased with the vanadium dietary in crossbred calves and Gupta *et al.* (2020) [5] was also reported in Hariana heifers. The improvement in the immunoglobulin concentration in the blood might be vanadium supplementation improves the circulating concentration of lymphocytes, which is responsible for the production of immunoglobulin.

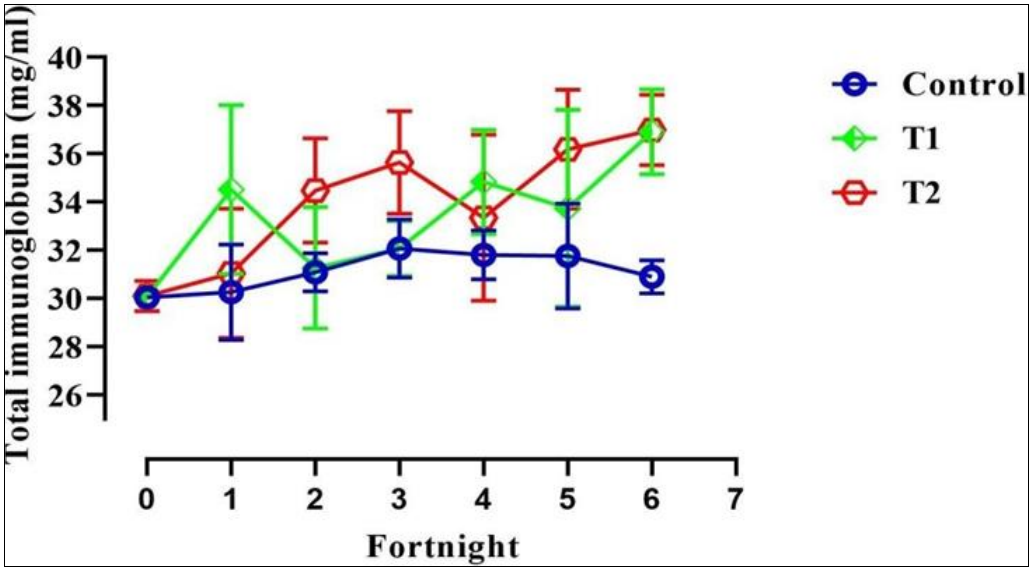

Fig 2: Fortnight changes of total immunoglobulin supplemented with vanadium

Alanine aminotransferase (ALT)

ALT activity in Barbari kids was 31.97, 32.07 and 31.13 IU/L before starting vanadium supplementation. However, the average mean of ALT (IU/L) content was detected to be 33.73, 33.98 and 33.27 IU/L, indicating that there was no statistical difference in ALT activity between the three groups (p>0.05). Vanadium supplementation did not affect the ALT and accordance with the previously reported by Dai *et al.* (1994) [3] in rats. Although, Zaki *et al.* (2010) [16] reported that the ALT activity was increased with vanadium supplementation in fish.

Aspartate transaminase (AST)

During the whole study period, there was no statistically significant difference in AST between the groups (p>0.05). In the control, T1 and T2 groups, the average ASTactivity was 85.67, 85.70 and 86.24 IU/L, respectively. The overall mean of AST in the three groups did not differ significantly (p>0.05). No significant effect of vanadium supplementation on AST activities was found by Singh *et al.* (2020) who had reported that vanadium dietary with a dose of 2, 4, or 8 were unaffected by the AST in Sahiwal calves.

Alkaline phosphatase (ALP)

Before commencing vanadium supplementation, ALP levels in the control, T1 and T2 groups were 22.18, 22.27 and 22.37 IU/L, respectively. The overall mean ALP value in the control, T1 and T2 groups were 23.76, 23.93 and 24.55 IU/L, respectively. No statistical (p>0.05) difference was observed in the alkaline phosphatase activity of experimental animals. The results of the present study are not in accordance with Li *et al.* (2009) [7] in rats.

Triglycerides

On the starting period of the experiment, the circulating triglyceride concentrations in the control, T1 and T2 groups were 0.32, 0.33 and 0.34 mg/ml, respectively. Triglyceride concentrations in the control and T2 groups were significantly higher than in the T1 group on the 5thfortnight of the study. The 6th fortnight of the experimental period was also showing a higher significance (p<0.05) among groups. Furthermore, the overall mean triglyceride concentration revealed a significant (p<0.05) difference between groups. In the present the impact of vanadium supplementation was improved the Triglycerides concentration in Barbari kids. Dissimilar report has come from Ding *et al.* (2001) [4] in mice.

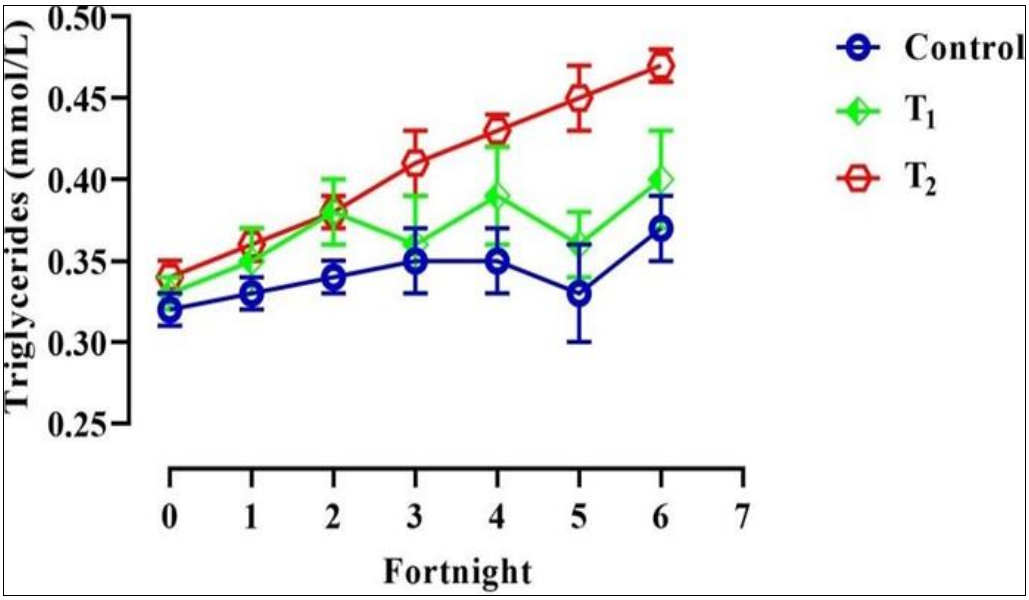

Fig 3: Fortnight changes of triglycerides supplemented with vanadium

Conclusions

The dietary of vanadium supplementation increased total immunoglobulin, hemoglobin, total leukocyte counts. The results indicate that vanadium supplementation might improve the hemato-biochemical status of Barbari kids.

References

1. Abdelhamid G, Amara IE, Anwar-Mohamed A, El-Kadi AO. Modulation of cytochrome P450 1 (Cyp1) by vanadium in hepatic tissue and isolated hepatocyte of C57BL/6 mice. Archives of Toxicology. 2013;87(8):1531- 1543.
2. Adebiyi OE, Obisesan AD, Olayemi FO, Olopade JO. Protective effect of ethanolic extract of Grewia carpinifolia leaves on vanadium-induced toxicity. Alexandria Journal for Veterinary Sciences. 2015;47(1):24-31.
3. Dai S, Thompson KH, Vera E, McNeill JH. Toxicity studies on the one-year treatment of non-diabetic and streptozotocin-diabetic rats with vanadyl sulphate. Pharmacology and Toxicology. 1994;75(3-4):265-273.
4. Ding W, Hasegawa T, Hosaka H, Peng D, Takahashi K, Seko Y. Effect of long-term treatment with vanadate in drinking water on KK mice with genetic non-insulin-dependent diabetes mellitus. Biological Trace Element Research. 2001;80(2):159-174.
5. Gupta PK, Vaswani S, Kumar V, Roy D, Kumar M, Kushwaha R, *et al*. Investigations on modulating effect of vanadium supplementation on growth and metabolism through improved immune response, antioxidative profile and endocrine variables in Hariana heifers. Biological Trace Element Research. 2020;194(2):379-389.
6. Hafez YS, Kratzer FH. The effect of pharmacological levels of dietary vanadium on the egg production, shell thickness and egg yolk cholesterol in laying hens and Coturnix. Poultry Science. 1976;55(3):923-926.
7. Li M, Ding W, Smee JJ, Baruah B, Willsky GR, Crans DC. Anti-diabetic effects of vanadium (III, IV, V)–

chlorodipicolinate complexes in streptozotocin-induced diabetic rats. Bio metals. 2009;22(6):895-905.
8. Mountain JT, Stockell Jr. FR, Stokinger HE. Effect of ingested vanadium on cholesterol and phospholipid metabolism in the rabbit. Proceedings of the Society for Experimental Biology and Medicine. 1956;92(3):582-587.
9. Omayone T, Salami AT, Odukanmi AO, Olaleye SB. Dose- dependent changes in hematological and serum biochemical variables in rats exposed to sodium metavanadate in male Wistar Rats. Nigerian Journal of Physiological Sciences. 2020;35(2):147-153.
10. Pal RP, Mani V, Tripathi D, Datt C. Inorganic vanadium supplementation in crossbred calves: effects on antioxidant status, immune response and haemato-biochemical attributes. Biological Trace Element Research. 2018;186(1):154-161.
11. Rezk MM, Dhmees AS, Abd El-Magied MO, Manaa ESA, El-Gendy HS. The influence of cobalt manganese ferrite nanoparticles (Co0.5Mn0. 5Fe2O4) on reduction of hazardous effects of vanadate in adult rats. Toxicology Research. 2020;9(2):81-90.
12. Scibor A. Some selected blood parameters in rats exposed to vanadium and chromium via drinking water. Trace Elements and Electrolytes. 2005;22(1):40-46.
13. Subrahmanyam G, Sankar KD, Ramalingam K, Bhanu PS. Hypolipidemic and anti-atherogenic effects of vanadium in high-fat diet rabbits. Trace Elements and Electrolytes. 2013;30(3):114-121.
14. Singh D, Datt C, Mishra A, Shivani S, Gupta R, Mani V. Influence of dietary vanadium supplementation on nutrient utilization, growth performance and blood biochemical parameters in Sahiwal calves. Indian Journal of Animal Research. 2020;54(8):973-980.
15. Wang J, Li SH, Liu B, Gu YF. Effect of vanadium supplemented in the diet on blood cells of Minzhong chicken. China Veterinary Science. 2008;38(6):521-524.
16. Zaki MS, Sharaf NE, Osfor MH. Effect of vanadium toxicity in Clarias lazera. Journal of American Science. 2010;6(12):291-296.