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RESEARCH ARTICLE

Supplementation of haematinics and UMMB on some haematological values in local goats

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Abstract

The effect of supplementation of haematinics and UMMB on some haematological values in local apparently healthy goats was investigated. Twelve male goats were randomly divided into 4 groups (n = 3). The goats were allowed to graze regularly on the naturally grown weeds, bush, and grasses within the University campus. All the groups were housed in separate pens and water was supplied *ad libitum* throughout the experimental period. Goats from group A were treated orally with the combination of haematinics ($CuSO_4$, $FeSO_4$ and $CoSO_4$) at the dose of 5 mg/kg, 20 mg/kg, and 0.1 mg/kg body weight, respectively. The goats of group B were treated orally with the same combination of haematinics in group A and additional intramuscular injections of vitamin B_{12} at the dose of 100µg/kg body weight every 15 days interval (at day 0, 15, 30 and 45). Goats from group C received orally UMMB at the dose of 1g/kg body weight daily for 60 days. Group D was kept as untreated control. At day 0, 15, 30, 45, and 60, blood samples (about 3 ml) were collected and TEC, Hb concentration, PCV, TLC, MCV, MCH and MCHC were examined. A strong positive correlation among TEC, PCV, and Hb concentration was observed ($r = 0.79$ to 0.83). Hb concentration, MCV and MCH were significantly increased in haematinics treated groups ($P < 0.05$). Additional intramuscular injection of vitamin B_{12} has no particular added effect on these values ($P > 0.05$). Slight anaemia is corrected by supplementation of haematinics but supplementation of UMMB has no persistent efficacy on haematological values of goats at the end of 60 days trial.

Keywords:

goats, haematinics, UMMB, haematological values

1. Introduction

Goats are one of the most popular, extremely important and easily reared animals in many countries of the world. These animals can survive better than other ruminants on low level of nutrition and their browsing habit help them for satisfying their nutrient requirements (Islam *et al.,* 2005). Goats are reared traditionally on a forage-based diet in the villages and the practice of supplementation is not common. The conventional feeding system is insufficient to satisfy the nutritional requirements of the goats, especially during high production periods like late pregnancy, lactation and growth (Saddul and Boodoo, 2001).

Ruminant diets in most developing countries are based on fibrous feeds: mainly mature pastures (particularly at the end of the dry season) and crop residues (e.g. wheat and rice straw, maize and sorghum stovers). These feeds are imbalanced and particularly deficient in protein, minerals and vitamins; they are highly lignified and their digestibility is low (Sansoucy, 1995). The deficiency of microelements such as copper, cobalt and iron contribute to the condition by reduced number of circulating erythrocytes and deficient haemoglobin synthesis (Fraser *et al.,* 1991). These micronutrients are necessary for blood constituents, growth, health, fertility and productivity of animals (Chaudhary *et al.*, 2008).

Majority of goats are grazing and are kept under imbalanced diet, they often suffer from anaemia due to malnutrition. The haematological parameters are major indicator of animal health and nutritional status. The health status of ruminants under supplementation, evaluations of blood level parameters give accurate measurements as blood profile reflects actual health status and any subclinical disorders (Gwaze *et al.*, 2012). Factors such as physiological state, environmental condition, disease and stress are also known to influence haematological parameters (Etim *et al.,* 2014).

Urea-molasses multinutrients block (UMMB) licks can improve the utilization of low quality roughages by satisfying the requirement of the rumen microorganisms, creating a better environment for the fermentation of fibrous material and increasing production of microbial protein and volatile fatty acids. Urea, after hydrolyzing into ammonia in the rumen, provides a nitrogen source for the rumen microflora. Molasses is a source of readily fermentable energy (Bach, 2005). UMMB supplementation in goat accelerates body weight gain and alterations in haematological values (Hossain *et al.*, 2011; Gabriel *et al.*, 2018).

The diversity of goats in Myanmar is represented by three indigenous breeds, Jade Ni, Nyaung Oo and Waithar Li (Phyu *et al*, 2017). The findings of previous research data supported that sheep and goat production in tropical area of Myanmar encounter problem with gastrointestinal nematodes and cestodes, which may lead to anaemia in such animals (Lin, 2008; Than, 2008). Several reports indicated that supplementation of haematinics improve haematological values and body weight gain of small ruminants (Sharmin *et al.*, 2004; Goklaney *et al.*, 2012). However, Myanmar's goat farmers were not familiar with supplementation of haematinics and UMMB to goats. Therefore, the objective of this study was to investigate supplementation of haematinics and UMMB on haematological values of apparently healthy goats in a local area of Myanmar.

2. Materials and methods

2.1Preliminary survey

During September 2008, blood samples were collected from 20 goats in Takkon Livestock Farming Zone, Takkon Township, Mandalay Region. Blood samples were examined for identification of anaemic goats.

2.2 Experimental animals

Twelve apparently healthy goats (age between 12-14 months and mean body weight 23.58 ± 3.92 kg) were used for this experiment. The goats were randomly divided into 4 groups (n=3) and allowed to graze regularly on the naturally grown weeds, bush, and grasses within the University campus. Before starting the experiment, the goats were dewormed by using Fenbendazole bolus at the dose of 5 mg/kg body weight (Fenbenzol, The Alps Laboratory Ltd, Ahmedabad, Gujarat, India). Goats from group A were treated orally with the combination haematinics such as $CuSO_4$ (copper (II) sulfate), $FeSO_4$ (iron (II) sulfate), and $CoSO_4$ (cobalt (II) sulfate), at the dose of 5 mg/kg, 20 mg/kg, and 0.1 mg/kg body weight, respectively. The goats of group B were treated orally with the same combination of haematinics at the same dose and additional intramuscular injection of vitamin B_{12} {α-(5,6-Dimethylbenzimidazolyl) cobamidcyanide}, at the dose of 100 µg/kg B.W every 15 days interval (at day 0, 15, 30, and 45). The goats from group C were fed UMMB (commercially available 10% urea basis) at the dose of 1g/kg body weight daily for 60 days. Group D was kept as untreated control. All the groups were housed in separate pens and the goats of both control and treated groups had free access to clean and fresh water. All the experimental animals were allowed to browse in the morning (between 8:00 am to 12:00 noon) and in the afternoon (2:00 to 5:00 pm).

2.3 Examination of blood samples

About 3 ml blood samples were collected from jugular vein of experimental goats by using sterile hypodermic syringe and 18 gauge needle at day 0, 15, 30, 45, and 60. Blood samples were collected and total erythrocyte counts (TEC), Haemoglobin concentration (Hb), packed cell volume (PCV), total leukocyte counts (TLC) were detected according to standard methods (Shrivastava *et al.,* 1962; Boddie, 1964; Chakrabarti, 2002). Mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were calculated base on detected haematological values. Haematological examination was carried out within 24 hours after collection of blood samples at the laboratory of Physiology and Biochemistry Department, University of Veterinary Science, Yezin, Nay Pyi Taw.

3. Statistical analysis

The data obtained were analyzed by one-way analysis of variance and the differences among means were compared by Tukey's Test using (SPSS) version 11.5 Relationship among PCV, TEC and Hb concentration were also analyzed by correlation regression analysis (Coakes and Steel, 2003).

4. Results and discussions

According to the preliminary survey on 3 flocks by assessment of 20 blood samples, goats from these flocks were suffered from normocytic hypochromic anaemia, which is characterized by normal TEC and PCVwith lower Hb concentration (data not shown). In this experimental trial, 12 of 20 goats from the preliminary survey were used and those were already determined suffering from normocytic hypochromic anaemia.

In comparison among TEC of goats from 4 groups, group A was significantly different ($P < 0.05$) at day 60 but there was no significant difference ($P > 0.05$) in other groups in comparison between before and after supplementation (Table 1). This finding did not agree with the reports of (Baustad and Tollersrud, 1996; Rahman *et al.*, 2005) who found that TEC of ruminant animals were significantly improved after supplementation of haematinics. Our result was consistent with Solaiman *et al*. (2007) who reported that TEC of goats did not improve by supplementation of haematinics. In our study, TEC of goats from group A at day 60 was significantly lower (P < 0.05) than that of the same goats at day 0. The amount of the TEC fall within the normal range compared with haematology of goat reference values (Pugh, 2001; Mathrew, 2006). Normal TEC values elucidated the absence of haemolytic anaemia and depression of erythrogenesis reported for clinically healthy goats (Sirois, 1995; Goklaney *et al.*, 2012). Blood constituents change in relation to the physiological conditions of health (Togun *et al.,* 2007). These changes are of value in assessing response of animals to various physiological responses (Khan and Zafar, 2005). Changes in haematological parameters are often used to determine various status of the body and to determine stresses due to environmental, nutritional and/or pathological factors (Afolabi *et al.*, 2010). Thus, the TEC values detected in our study indicated that the goats were apparently healthy.

Goats from group C fed 10% urea containing UMMB showed normal range of TEC and was not significantly differed with other treatment groups. This result was inconsistent to that of (Hossain *et al.*, 2011; Gabriel *et al.*, 2018), who observed an increase in the TEC following supplemented with UMMB blocks to goats. The differences were due to many factors, such as breed of goats, UMMB composition, environment, and climatic conditions, which may also influence on haematological results.

Table 1. Total erythrocyte counts (TEC) of goats from four experimental groups

Treatment groups	Mean ± SD at experimental period (n x 10^6/µl)				
	Day 0	Day 15	Day 30	Day 45	Day 60
A	15.00 ± 1.00^{A}	15.00 ± 1.00^{A}	16.33 ± 1.15^{A}	15.00 ± 1.00^{A}	13.00 ± 1.00^{B}
B	14.00 ± 1.00^{A}	13.66 ± 1.15^{A}	14.33 ± 1.52^{A}	14.33 ± 2.08^{A}	13.66 ± 0.57^{A}
C	13.66 ± 1.52^{A}	13.33 ± 1.15^{A}	14.00 ± 1.00^{A}	14.00 ± 1.73^{A}	13.66 ± 0.57^{A}
D	14.00 ± 1.00^{A}	14.33 ± 0.57^{A}	14.33 ± 0.57^{A}	11.66 ± 1.52^{A}	12.33 ± 0.57^{A}

$^{A, B}$ = The mean with the superscript within the same row are significantly different at (P < 0.05) level.
Group A = Cu+Fe+Co treatment ; Group B = Cu+Fe+Co+B_{12} treatment
Group C = UMMB treatment ; Group D = Control

Table 2. Haemoglobin (Hb) concentration of goats from four experimental groups

Treatment groups	Mean ± SD at experimental period (g/dl)				
	Day 0	Day 15	Day 30	Day 45	Day 60
A	7.00 ± 0.50^{aA}	8.26 ± 0.64^{aA}	9.50 ± 0.50^{cB}	10.76 ± 0.25^{bB}	9.66 ± 0.28^{bB}
B	7.33 ± 0.76^{aA}	8.60 ± 1.01^{aA}	8.83 ± 0.28^{bcB}	10.93 ± 1.00^{bB}	9.83 ± 0.57^{bB}
C	7.16 ± 1.04^{aA}	8.26 ± 1.16^{aA}	8.16 ± 0.28^{abA}	10.83 ± 1.04^{bB}	9.00 ± 0.50^{aA}
D	7.33 ± 1.04^{aA}	7.53 ± 0.92^{aA}	7.66 ± 0.28^{aA}	7.83 ± 0.57^{aA}	8.16 ± 0.28^{aA}

^{a,b,c} = The mean with the superscript within the same column are significantly different at (P < 0.05) level.
$^{A, B}$ = The mean with the superscript within the same row are significantly different at (P < 0.05) level.
Group A = Cu+Fe+Co treatment ; Group B = Cu+Fe+Co+B_{12} treatment
Group C = UMMB treatment ; Group D = Control

Table 3. Packed cell volume (PCV) of goats from four experimental groups

Treatment groups	Mean ± SD at experimental period (%)				
	Day 0	Day 15	Day 30	Day 45	Day 60
A	37.33±2.52	35.00±2.00	36.66±5.77	35.33±0.57	31.66±2.88
B	31.33±2.52	30.33±2.30	36.66±2.88	35.00±5.00	33.33±2.88
C	30.67±3.51	29.33±2.88	33.33±5.77	35.33±5.03	33.33±2.88
D	31.33±2.51	31.66±1.15	32.00±1.73	26.33±3.05	27.66±1.15

Group A = Cu+Fe+Co treatment ; Group B = Cu+Fe+Co+B_{12} treatment
Group C = UMMB treatment ; Group D = Control

Table 4. Mean corpuscular volume (MCV) of goats from four experimental groups

Treatment groups	Mean ± SD at experimental period (fl)				
	Day 0	Day 15	Day 30	Day 45	Day 60
A	21.95±0.24^{A}	21.87±0.12^{A}	22.34±2.03^{A}	23.63±1.93^{A}	24.35±1.11^{B}
B	22.36±0.26^{A}	22.20±0.17^{A}	25.68±1.07^{B}	24.51±2.43^{A}	24.35±1.11^{B}
C	22.43±0.26^{A}	21.98±0.27^{A}	24.06±5.84^{A}	25.22±1.34^{B}	24.44±2.79^{A}
D	22.36±0.26^{A}	22.09±0.08^{A}	22.31±0.30^{A}	22.60±0.36^{A}	22.43±0.11^{A}

$^{A, B}$ = The mean with the superscript within the same row are significantly different at (P < 0.05) level.
Group A = Cu+Fe+Co treatment ; Group B = Cu+Fe+Co+B_{12} treatment
Group C = UMMB treatment ; Group D = Control

Table 5. Mean corpuscular haemoglobin (MCH) of goats from four experimental groups

Treatment groups	Mean ± SD at experimental period (pg)				
	Day 0	Day 15	Day 30	Day 45	Day 60
A	4.11±0.27^{A}	5.15±0.24^{B}	5.84±0.72^{B}	7.19±0.39^{B}	7.46±0.59^{B}
B	5.27±0.91^{A}	6.35±1.20^{A}	6.19±0.49^{A}	7.68±0.82^{B}	7.21±0.74^{B}
C	5.31±1.22^{A}	6.27±1.38^{A}	5.85±0.45^{A}	7.76±0.68^{B}	6.57±0.18^{A}
D	5.27±1.08^{A}	5.24±0.42^{A}	5.34±0.01^{A}	6.76±0.65^{A}	6.63±0.45^{A}

$^{A, B}$ = The mean with the superscript within the same row are significantly different at (P < *0.05*) level.
Group A = Cu+Fe+Co treatment ; Group B = Cu+Fe+Co+B_{12} treatment
Group C = UMMB treatment ; Group D = Control

Table 6. Mean corpuscular haemoglobin concentration (MCHC) of goats from four experimental groups

Treatment groups	Mean ± SD at experimental period (g/dl)				
	Day 0	Day 15	Day 30	Day 45	Day 60
A	18.77±1.22^{A}	23.61±1.15^{B}	26.52±5.92^{A}	30.47±1.17^{B}	27.14±3.20^{B}
B	23.62±4.26^{A}	28.60±5.23^{A}	24.16±1.60^{A}	31.39±1.73^{B}	29.76±4.53^{A}
C	23.67±5.32^{A}	28.58±6.66^{A}	24.99±4.40^{A}	30.83±2.20^{A}	27.14±2.86^{A}
D	23.61±4.93^{A}	23.74±2.00^{A}	23.96±0.38^{A}	29.89±2.46^{A}	27.18±4.50^{A}

$^{A, B}$ = The mean with the superscript within the same row are significantly different at (P < *0.05*) level.
Group A = Cu+Fe+Co treatment ; Group B = Cu+Fe+Co+B_{12} treatment
Group C = UMMB treatment ; Group D = Control

Table 7. Total leucocyte counts (TLC) of goats from four experimental groups

Treatment groups	Mean ± SD at experimental period (n x 10^3/µl)				
	Day 0	Day 15	Day 30	Day 45	Day 60
A	9.40± 0.52	9.56±0.20	9.40±0.10	8.33±0.43	8.70±0.43
B	8.76±0.37	9.06±0.30	9.30±0.60	8.16±0.76	8.86±0.70
C	9.50±0.50	9.20±0.52	8.96±0.25	9.33±0.76	9.08±0.29
D	9.16±0.76	8.96±0.40	9.16±0.70	9.2±0.62	9.16±0.28

Group A = Cu+Fe+Co treatment ; Group B = Cu+Fe+Co+B_{12} treatment
Group C = UMMB treatment ; Group D = Control

There was no significant difference among mean Hb concentration of goats from 4 treatment groups at day 0 and 15 (Table. 2). At day 30, mean Hb concentration of goats from groups A and B were significantly higher ($P < 0.05$) than that of goats from control group D. In addition, Hb concentration of goats from groups A was significantly higher ($P < 0.05$) than that of goats from group C. At day 45, Hb concentration goats from all treated groups were significantly higher ($P < 0.05$) than that of goats from control group D. However, the significant difference in Hb concentration ($P < 0.05$) was observed among goats from group A and B with other groups at day 60. After supplementation of haematinics, improved level of Hb content can be regarded as having high level of oxygen capacity and withstand respiratory stress as reported by (Oni *et al.*, 2012). There was no significant difference between goats from group C and D at day 60.

These data indicated that addition of haematinics have positive effect on Hb concentration of goats, although UMMB have no persistent efficacy. As haematological values of group A and B were not significant different ($P > 0.05$), additional intramuscular injection of vitamin B_{12} has no particular added effect on these values. The present study was consistent with previous reports of Wenzlaf and Erhardt (1991) and Mburu *et al.* (1993), who reported that increase of Hb concentrations after treated with haematinics in lambs and east African goats respectively. Ismail (1983) showed that there was improvement of Hb values in calves treated with copper and cobalt. In contrast, our finding did not agree with the finding of Solaiman *et al*. (2007), who reported that copper supplementation had no effect on haemoglobin values of goats. This result was inconsistent with Jahan *et al*. (2009), who reported that vitamin B_{12} treated guinea pigs showed improved TEC and Hb concentration. The experimental animals from group A and B showed relatively high Hb concentration values, and this is an advantage in oxygen carrying capacity of the blood.

Based on the data of UMMB supplemented group C, the experimental goats have no persistence efficacy of Hb concentration throughout 60 days trials except at day 45. Significantly higher Hb level in goats at day 45 indicates that UMMB may have certain amount of nutrients received by the goats and potentiate Hb formation. In our study, UMMB treated group C showed no stable effects throughout the experimental period. It is possible that the daily amount of UMMB supplements were inadequate to meet the demand of energy, protein and other nutrients for blood formation for the goats those are naturally grazing. This finding was inconsistent with the report of (Zhang, 1998; Zhang *et al*., 2000; Haili *et al.,* 2014; Kerketta *et al.*, 2017) who stated that Hb values were significantly higher in ruminants supplemented with UMMB than in ruminants without blocks throughout the experimental period. This may be accounted by species of animal, UMMB composition, breed, UMMB production methods, and testing methodology. Further studies are required in order to substantiate the present findings.

After supplementation of haematinics or UMMB, PCV of goats from four groups were not significantly different (P > 0.05) (Table 3). In addition, there was no significant difference in PCV of goats when compared between before and after medication with haematinics or UMMB in each group. This indicates that addition of haematinics or UMMB in goats have no effect on PCV of goats. This finding did not agree with the reports of Sarkar *et al.* (1995) and Goklaney *et al.* (2012) who reported that an increase in PCV values after haematinics therapy in goats suffering from nutritional anaemia. In contrast, Solaiman *et al.* (2007) reported that PCV of goats did not improve by supplementation of haematinics. The PCV is the measure of the ratio of the volume occupied by the TEC to the volume of the whole blood in a sample of capillary or arterial blood. PCV is involved in transport of oxygen and absorbed nutrients at different physiological states (Isaac *et al.,* 2013).

It was observed that, the PCV values were within the normal range in UMMB treated group C as reported by (Sirois, 1995; Tibbo *et al.,* 2004). PCV is blood toxicity reduction index and its abnormal level point to the presence of a toxic factor which has a drastic effect in blood formation (Oyawoye and Ogunkunle, 1998). This indicates that detoxification of UMMB was good enough as demonstrated in the normal PCV values detected in goats (Ruknuzzaman *et al.*, 2018). This finding was inconsistent with Kioumarsi *et al.* (2012) who reported that the PCV was significantly increased in UMMB treated goats. Similarly, PCV in the UMMB treated heifer group was improved at 60 days but PCV was not significantly different at 30, 90 and 120 days after UMMB supplementation (Wongnen, 2007). This difference in PCV values may be due to breeds of goats, type of UMMB supplied, and environmental factors among different experiments.

A strong correlation (r=0.79 to 0.83) was observed within three parameters such as TEC, Hb concentration and PCV of the experimental goats. This means that TEC counts were correlated with major blood index such as Hb concentration and PCV. This is in agreement with the reports by Etim *et al.* (2014), who expressed that high PCV values indicated either an increase in number of TEC or reduction in circulating plasma volume. As reported by Adejumo (2004), haematological traits, especially, PCV and Hb were correlated with the nutritional status of the animal. Adamu *et al.* (2006) observed that nutrition had significant effect on haematological values like PCV, Hb and RBC. In contrast, no significant positive correlation was reported with TEC and MCHC (Bhatane *et al.*, 2018). The TEC, PCV, Hb concentration, MCV, MCH and MCHC values help to determine and classify anaemia (Jain, 1986).

In comparison among MCV, MCH, and MCHC of goats from 4 groups, there was no significant difference throughout the experimental period (Table 4, 5, 6). However, MCV and MCH of goats from haematinics treated groups significantly increased (P < 0.05) at day 60 in comparison to day 0 values of each group. This indicates haematinics has some effect on MCV and MCH of goats. The present study showed that mean MCV was singnificantly increased in group B at day 30. This finding is consistent with the results of Goklaney *et al.* (2012) who observed increased MCV and MCH values in anaemic goats after treated with haematinic for 30 days trial. Tufani and Haque (2007) also reported similar findings with the results of our investigation.

For UMMB treated group, MCV and MCH did not increase significantly at day 60 in comparison to day 0, although there was a significant increase at day 45. This data leads to draw a conclusion that UMMB has no effect on MCV and MCH of goats in our study (Table 4, 5). At day 60, MCHC of group A was significantly increased in comparison to day 0. But there was no significant increase in MCHC of group B, the other haematinics treated group. The MCV, MCH and MCHC were indicated blood level conditions for anaemia or not. MCV classifies the anaemia as normocytic, microcytic and macrocytic based on TEC volume. MCH expresses the weight of Hb in single red blood cell whereas MCHC dictates concentration of Hb in PCV. Both MCH and MCHC values help to designate anemia as hypochoromic, normochromic, or hyperchromic type (Aster, 2004).

In our preliminary survey on 3 flocks, before the implementation of the current research, the blood profiles of the 20 goats indicated normocytic hypochromic anaemia, which with supplementation of haematinics had improved to normocytic normochromic type in treated animals. Copper is an essential element for a number of biochemical functions, such as iron utilization and haemoglobin formation (Davis and Mertz, 1987). Iron is an essential mineral in hemoglobin molecule, a small quantity into myoglobin and very less amount exists in muscle as tissue iron (Radostits *et al*, 1994). Cobalt is a constituent of vitamin B_{12}, which is necessary for the maturation of erythrocyte (McDonald *et al.*, 1987). The present finding pointed out that supplementation of haematinics has corrected this condition. On the other hand, the goats from this experiment were allowed to free range grazing in common pasture during day time. The blood indices' values and their differences between groups may reflect the differences in nutritional status and/or possible parasitic infestations as reported by (Yacob *et al.*, 2008).

In comparison among total leucocyte counts **(**TLC) of goats from 4 groups were not significantly different throughout the experimental period (Table 7). The observed values for white blood cells in our study fell within the normal range as previous reports (Mbassa and Poulsen, 1993; Daramola *et al.*, 2005). This showed that the animals were healthy because its normal range was indication of non-allergic conditions or absence of foreign body in circulating system (Lehninger *et al.*, 1993). Similar results were obtained by Jahan *et al.* (2007) who observed similar finding in haematinics treated laboratory mice. However, current findings were contradictory to the findings of Hossain *et al.* (2011) and Kioumarsi *et al.* (2012) who demonstrated that UMMB supplementation in goats and found the levels of white cells were increased significantly in treated goats than in goats without blocks. The results might be due to the difference of the basal feed given, difference of goat breeds, period of experimental and difference of UMMB composition etc.

The goats used in this study did not show any clinical signs throughout the experimental period in all treatment groups. This finding is consistent with Bach et *al.* (2005) who showed that ad *lib* feeding of UMMB does not have any adverse effect on haematological and biochemical parameters in buffaloes. To our knowledge, there is no information on normal haematological values of different breeds of goats from Myanmar. So, it is difficult to say the goats used in the present study were suffering anaemia or not. Although they are apparently healthy, the goats used in this study may have normocytic hypochromic anaemia based on the normal haematological values of goats from some tropical countries (Oduye, 1976, Somvanshi *et al.*, 1987, Pospisil *et al.*, 1987, Mbassa and Poulsen, 1993, and Daramola *et al.*, 2005). In our study, additional vitamin B_{12} injection did not elicit haematological parameters in goats. Similarly, additional vitamin B_{12} is not necessary to ruminants because it is produced by rumen microbes for their use and used by the host animal (McDowell, 2000). However our findings was contradictory to the findings of Islam *et al.* (2005) and Jahan *et al.* (2007; 2009) who reported that supplementation of vitamin B_{12} improved blood profiles in treated animals.

After 60 days of treatment by supplementation with haematinics, some haematological values of goats, such as Hb concentration, MCV, and MCH, were significantly increased ($P < 0.05$) in comparison to untreated control. Since haematological values of treated goats are improved, this in term probably define that the slight anaemia is corrected by supplementation of haematinics. Improvement in haematological parameters reflects the quantitative regeneration of the erythropoiesis which in turn could be due to copper, cobalt and iron supplementations from the therapy. Further studies are needed to support these findings and to clarify proper supplements ratio and duration to improve the blood profiles and health status of local goats in Myanmar.

Conclusions

Slight anaemia is corrected by supplementation of haematinics but supplementation of UMMB has no persistent efficacy on haematological values of goats at the end of 60 days trial.

Conflict of interest

All authors have approved the submission of this manuscript and do declare that there is no conflict of interest. The manuscript has not been published previously and is not under consideration for publication elsewhere.

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