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## Effect of dietary inclusion of *Moringa oleifera* leaf meal and herbal galactogogues on haematological attributes of Sahiwal cows

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### Abstract

The present study was conducted to evaluate the effect of inclusion of *Moringa oleifera* leaf meal and herbal galactogogues on blood haematological profile of Sahiwal cows. Twenty four lactating cows were selected and divided into four groups as control (T<sub>C</sub>), T<sub>M</sub>, T<sub>HG</sub> and T<sub>MIX</sub> on the basis of previous lactation yield. Control group was fed basal ration alone, T<sub>M</sub> group supplemented *Moringa oleifera* leaf meal (MOLM) @ 12% of concentrate, T<sub>HG</sub> supplemented with mixture of herbal galactogogues containing shatavari, fenugreek and jivanti in the ratio of 1:1:1 and fed @ 60 g/day/cow. T<sub>MIX</sub> supplemented combination of herbal galactogogues @ 60 g/day/cow and *Moringa oleifera* leaf meal @ 12% of concentrate. The feeding was practiced for 150 days. Results indicated that mean haematological parameters; neutrophil count, mix cells and TLC was not affected, whereas; haemoglobin concentration, PCV and total erythrocyte count was significantly increased in animals supplemented with MOLM and herbal galactogogues.

**Keywords:** Haematology, moringa leaf meal, herbal galactogogues, Sahiwal

### Introduction

*Moringa oleifera* has gained wide range of applications both as nutritional and therapeutic agent globally. It has been increasingly considered as an alternative ingredient for animal feed because of its high content of protein, vitamins and minerals. These nutrients maintain osmotic balance and helps in activation of enzymes which are beneficial for physiological functions (Anjorin *et al.*, 2010) [4]. *Moringa* is available across the country and its leaves do not contain any anti-nutritional factor apart from negligible amount of tannin and saponins (Moyo *et al.*, 2011 and Kar S, 2013) [13, 10]. The relative lack of anti-nutritional components and the high protein, lipid and sulfur containing amino acid contents encourage use of *Moringa oleifera* as animal feed supplement. Iron content is 25 times higher than spinach and 3 times greater than almonds. Furthermore, *Moringa* leaves contain lots of vitamin C which is a potent iron absorption stimulant. *Moringa* leaves contain vitamin C of 220 mg per 100 grams of fresh leaves. It is seven times larger than orange and ten times larger than grape (Susilowati *et al.*, 2022) [20]. It functions as a reducing agent, converts ferric into ferrous oxide, maintains intestinal pH, and preventing iron precipitation. Besides, it may act as a chelator to forms iron-ascorbate which facilitates easy absorption (Tirtawati *et al.*, 2021) [21]. Moreover, herbal galactogogues mixture like shatavari, fenugreek and jivanti (*Letptadenia*) has similar property which is available in herbal shops.

Blood indices play a vital role in judging the quality of feedstuffs, and their suitability in inclusion in the diets of farm animals (Maxwell *et al.*, 1990) [11]. This may give an outlook of the potential of feedstuffs to meet the metabolic requirements of the animal. Animashahun *et al.* (2006) [3] affirmed that the comparison of blood chemistry profile with nutrient composition might indicate the need for adjustment of certain nutrients upward or downward for different group. The component of bloods are also important for maintaining normal physiological equilibrium in the body however this equilibrium may alter in certain physiological conditions. Haematological attributes can be considered to assess animal health conditions proficiently (Coroian *et al.*, 2017) [5] thus, determining the basal parameters of blood is important in order to monitor the health status of animals. Hence, the present work was conducted to assess the effect of dietary inclusion of *Moringa oleifera* leaf meal and herbal galactogogues on haematological attributes of Sahiwal cows.

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## Materials and Methods

### Animals and experimental diets

Twenty four early lactating cows were selected from Livestock Research Center, NDRI, Karnal and randomly divided in four groups as T<sub>C</sub>, T<sub>M</sub>, T<sub>HG</sub> and T<sub>MIX</sub>. T<sub>C</sub> considered as control, without any supplementation and the animals in T<sub>M</sub> group supplemented *Moringa oleifera* leaf meal (MOLM) @ 12% of the concentrate, T<sub>HG</sub> with herbal galactogogues mixture @ 60 g/day/head containing Shatavari, Fenugreek and Jivanti in the ratio of 1:1:1 and T<sub>MIX</sub> with combination of herbal galactogogues and MOLM @ 60 g/day/head and @ 12% of the concentrate, respectively. Supplementation was started 7 days after parturition and continued up to 150 days. The complete feed fed to the animals contained roughage and concentrate in ratio of 60:40. The composition of concentrate is presented in Table 1.

**Table 1:** Composition of concentrate mixture

Ingredients	T <sub>C</sub>	T <sub>M</sub>	T <sub>HG</sub>	T <sub>MIX</sub>
Cotton seed cake (undecorticated)	10	-	10	-
Ground nut cake	22	22	22	22
<i>Moringa oleifera</i> leaf meal	-	12	-	12
Maize	35	33	35	33
Wheat bran	20	20	20	20
Molasses	10	10	10	10
Mineral mixture	2	2	2	2
Salt	1	1	1	1
Total	100	100	100	100

### Collection of blood sample and estimation

The blood samples were taken from all experimental animals during morning hours prior to feeding. Blood samples were collected from jugular vein into EDTA vacutainer tubes at monthly interval started from the beginning of experiment to the end of experimental trial. Experiment was approved and conducted under the established standards of the Institutional Animal Ethics Committee (IAEC). Blood haematology includes haemoglobin (Hb), packed cell volume (PCV), total erythrocyte count (TEC), total leukocyte count (TLC), neutrophils, lymphocytes and mix cells (eosinophil, basophils and monocytes) was estimated using automatic blood analyser. The MCV, MCH and MCHC were calculated from PCV, Hb and TEC using the formula (Nedea, 2017) [15] below:

$$\text{MCV (\%)} = \frac{\text{PCV (\%)}}{\text{TEC}} \times 10$$

$$\text{MCH (pg)} = \frac{\text{Hb (g/dl)}}{\text{TEC}} \times 10$$

$$\text{MCHC (g/dl)} = \frac{\text{Hb (g/dl)}}{\text{PCV (\%)}} \times 100$$

### Statistical analysis

The results were statistically analyzed using a one-way analysis of variance (ANOVA) by the SPSS program (version 21.0). Means were established for significant differences using Duncan's multiple range test at a level of  $p = 0.05$ .

### Results and Discussion

The effect of the dietary inclusion of *Moringa oleifera* leaf

meal and herbal galactogogues on haematological attributes of Sahiwal cows are presented in Table 2. The overall Hb (g%) was significantly ( $p \leq 0.05$ ) higher in T<sub>M</sub>, T<sub>HG</sub> and T<sub>MIX</sub> by 9.74, 7.23 and 5.68%, respectively as compared to T<sub>C</sub>. The increase in Hb count may be an indication that moringa leaf meal and herbal galactogogues could boost blood production. Formation of haemoglobin and myoglobin requires iron (Elbasher and Ahmed, 2016) [6] which is abundance in moringa leaves (Akangbe and Abu, 2022) [2]. The PCV was found to be significantly ( $p \leq 0.05$ ) higher in T<sub>M</sub> by 18.34% followed by T<sub>HG</sub> and T<sub>MIX</sub> by 17.29 and 8.81%, respectively as compared to T<sub>C</sub>. The TEC was found to be significantly ( $p \leq 0.05$ ) high in T<sub>M</sub>, T<sub>HG</sub> and T<sub>MIX</sub> by 9.21, 10.15 and 10.15%, respectively in comparison to T<sub>C</sub>, however, no such differences were noted among T<sub>M</sub>, T<sub>HG</sub> and T<sub>MIX</sub>. Increased TEC in moringa leaf supplemented animals might be due to presence of  $\beta$ -carotene and vitamin B<sub>12</sub> in *Moringa oleifera* leaves which requires for formation and maturation of red blood cells in bone marrow (Samuel *et al.*, 2015) [17]. Correspondingly, fenugreek has antioxidant property that reduces damage of RBC membranes (Nagamma *et al.*, 2019) [14]. This may be the possible reason of improved TEC count in T<sub>HG</sub> group.

Basophils, monocytes and eosinophils are very less in number in normal physiological conditions. Increase in the no. of eosinophils indicates specific conditions such as parasitic infestations and allergy (Fulkerson and Rothenberg, 2013) [8]. In addition, the monocyte/macrophages and basophils are responsible for maintaining natural immunity and their numbers are increases in inflammatory conditions. In the present study, the mix cells was within the normal range (1 to 5%) in all experimental groups which indicates no such conditions in the experimental animals. Lowered MCV in T<sub>MIX</sub> was might be due to lower PCV and TEC ratio. The MCHC was found to be significantly ( $p \leq 0.05$ ) high in T<sub>MIX</sub> by 3.68% as compared to T<sub>C</sub>, however; other TLC and MCH were not statistically different ( $p \geq 0.05$ ) among the various groups.

Present finding supports previous study by Umar *et al.* (2017) [22] who also reported higher Hb and TEC in sheep received *Moringa oleifera* leaf meal. Zaher *et al.* (2020) [23] also observed higher Hb level in goats supplemented with 25% moringa foliage. Fadiyimu *et al.* (2010) [7] and Jiwuba *et al.* (2016) [9] found higher PCV in goats supplemented with moringa leaves. Pathak (2017) [16] reported higher PCV in buffaloes after *Leptadina reticulata* feeding. Increased PCV is associated with increased TEC and Hb, whereas; Aharwal *et al.* (2018) [1] and Sonkar *et al.* (2020) [19] reported non-significant variation in Hb concentration and PCV in animals received moringa leaf meal. Mishra (2008) [12] observed non-significant variation in PCV and TLC when animals were supplemented moringa and shatavari. Singh (2011) [18] found non-significant variation on Hb and PCV in animals when they were fed goats with herbal galactogogues containing ashwagandha and Jivanti.

Concerning the present findings, all the values were found to be within normal range and none of the groups were negatively affected the haematological attributes by supplementation of moringa leaf meal and herbal galactogogues.

**Table 2:** Blood haematology in lactating Sahiwal cows fed diets with *Moringa oleifera* leaf meal and herbal galactogogues

Attributes	Tc	Tm	THG	TmIX	SEM	P value
Hb (g%)	9.96 <sup>a</sup>	10.93 <sup>b</sup>	10.68 <sup>b</sup>	10.56 <sup>b</sup>	0.15	0.00
PCV (%)	26.55 <sup>a</sup>	31.42 <sup>c</sup>	31.14 <sup>c</sup>	28.89 <sup>b</sup>	0.68	0.00
TEC (x106/mm <sup>3</sup> )	6.11 <sup>a</sup>	6.73 <sup>b</sup>	6.80 <sup>b</sup>	6.80 <sup>b</sup>	0.09	0.00
TLC (x106/mm <sup>3</sup> )	9.13	8.79	8.54	7.88	0.36	0.11
Neutrophil (%)	30.03	28.53	28.44	29.11	0.51	0.12
Lymphocytes (%)	64.11	66.03	65.33	65.17	0.65	0.24
Mix cell (%) (eosinophils, monocytes, basophils)	1.63	1.74	1.65	1.75	0.10	0.75
MCV (%)	46.43 <sup>b</sup>	46.96 <sup>b</sup>	46.61 <sup>b</sup>	42.55 <sup>a</sup>	0.87	0.00
MCH (pg)	16.36	16.31	15.99	15.54	0.24	0.06
MCHC (g/dl)	35.37 <sup>a</sup>	35.02 <sup>a</sup>	34.52 <sup>a</sup>	36.72 <sup>b</sup>	0.50	0.01

<sup>abc</sup> Means with different superscripts in a row differ significantly among groups ( $P < 0.05$ )

## Conclusion

It could be concluded that supplementation of dietary inclusion of *Moringa oleifera* leaf meal and herbal galactogogues in the diet of lactating Sahiwal cows has no deleterious effect on haematological parameters. *Moringa oleifera* leaf meal and herbal galactogogues has tendency to increase Hb concentration, PCV and TEC in cows during early lactation when it is most needed.

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