



Short Communication

Hematological Profile of Achai Cows during Different Stages of Pregnancy in Kohistan Hindukush Mountainous Range

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ABSTRACT

Pregnancy is a common situation and concurrently the most altered physiologic state consisting of variety of physiological and hormonal changes. These changes begin after conception which alters the normal physiological status of blood. The present study was conducted to evaluate changes in hematological biomarkers of Achi cows at different stages of pregnancy. Forty multiparous cows with 4 ± 1 years of age and live weight of 188.23 ± 2.6 to 207.13 ± 2.59 kg of different stages of pregnancy were divided into four groups (Group 1=1st trimester Group 2= 2nd trimester and Group 3= 3rd trimester, Group 4= non-pregnant). Blood samples were collected from all the animals and assayed for hematological biomarkers like erythrogram, leukogram and erythrocyte sedimentation rate (ESR) were determined during three stages of pregnancy. The highest RBC count was recorded in group 4, The highest Hb, MCH and MCV was recorded in group 3. The lymphocytes and neutrophils were high in group 2 and group 3 respectively as compare to other groups, the leukocytes was low in group 4 and high in other groups, the eosinophil was high in group 3 where the monocytes was high in group 1 and group 3 as compared to other groups. The ESR was high in group 2 and low in group 4 as compare to other groups.

Achai cattle yet undocumented but well adopted and native breed of Hindu Kash Mountain in north Pakistan. Its habitat is Khyber Pakhtunkhwa province of Pakistan, which extends on the west to adjoining part of

Afghanistan and on the east to hilly tract of north-western Punjab (Saleem *et al.*, 2013). The Achai cattle is more resistant to disease, graze in free environment, is adapted to high altitude area and the efficiency index is better than other breeds of Pakistan (Kenyanjui and Sheikh, 2009). Achai cattle produce 2.5 to 3.5 L milk per day, for 8 to 9 months and then go dry. Achai breed can be milked several times a day (Hayaz *et al.*, 2014). The reproductive performance of Achi is also better than all the cattle breeds of Pakistan (Saleem *et al.*, 2013).

Pregnancy is a normal condition and simultaneously the most altered physiologic state characterized by complex physiological and hormonal changes. The series of changes begin after conception which capacitate the

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Authors' Contribution

JA, AU, AY, SU, ZA performed the experiments. HS, TH, OU, AH, AG designed the experiments and also wrote the manuscript. IA, HY, NZF, YF, ZL performed the analysis and reviewed the manuscript.

Key words

Achai cow, Gestation, Erythrogram, Leukogram

female to adapt to the pregnant state and to aid fetal growth (Shagana and Pradeep, 2018).

Blood is an important biological fluid the hematologic and biochemical profile of which can be altered with specific physiologic and pathologic conditions (Abdul-Rahaman *et al.*, 2018). Studies of blood components can be used for monitoring physiological changes occurring in animals. Several studies have described the effect of pregnancy on hematological profile of farm animals (Marcos *et al.*, 2019; Gravena, 2010). The present study was aimed to examine the alterations in hematological parameters in healthy females of Achai cattle breed during the first, second and third period of pregnancy.

Materials and methods

For the present study, 40 Achai cows comprising of 10 non-pregnant and 30 pregnant cows were selected for a period of 30 days from Achai Cattle Conservation Farm Munda (Lower Dir), Khyber Pakhtunkhwa. The 30 pregnant cows were again divided into three groups, each of 10, based on their stages of gestation *viz* early pregnancy (1-3 months), mid pregnancy (4-6 months) and late pregnancy (7 months). They were given good quality seasonal green fodder and concentrate (10% and 1.5%) every day. A supply of clean water was also ensured to the cattle.

A total of 5 ml blood was collected from each cow in vacutainer anticoagulant containing tube (455036 greiner bio-one) by inserting 22-gauge needle coupled with 10 ml syringe (Lot No 20200622 Shifa disposable syringes) at 30° into the jugular vein and analyzed by Sysmex XP-100 hematology analyzer (SCS-1000 Pelican Medical systems, Kochi) for RBC, Hb, MCV, MCH, HCT, MCHC, leukocytes, lymphocytes, neutrophils, eosinophil, monocytes and ESR. Data was analyzed statistically by one way ANOVA.

Results and discussion

Figure 1 shows erythrogram during different stages of pregnancy. High RBC count was observed in the non pregnant compared to the other stages. The Hb, MCV and MCH was high in third trimester as compared to other groups. There is no significant difference in the value of HCT and MCHC among the groups. From the result presented above it was discovered that the mean value of RBC in non- pregnant animal was highest than pregnant animals. During the course of gestation, no significant change was observed in the mean value of RBC from first, second and 3rd trimester. Moreover, the mean value of RBC in non pregnant group was high as compared to the others groups. In our study the variations in mean value of RBC correspond with the findings of Roy *et al.*

(2010) where the same trend of variations over the course of gestation has been reported in Sahiwal cow. From the above discussion, it is clear that pregnancy is dynamic process influencing the number of circulating erythrocytes. The decrease in the number of RBC during gestation as compared to non-pregnant animals is due to mobilization of circulating erythrocytes to fetal circulation and plasma volume expansion (Al-Eissa and Saad, 2012). The mean values of Hb in 3rd trimester were found to be significantly higher than the 1st and 2nd trimester. From the Figure 1, it can be seen that the mean value of Hb increases as pregnancy advances. The phenomenon can be correlated with physiologic compensatory response of pregnant dam to fulfill the oxygen demand of advancing pregnancy. As shown in Figure 1, the pattern of parallel increase of Hb was recorded as pregnancy advances. The value of MCV and MCH was high in last stage of pregnancy and low in early stage and non pregnant animals. Non-significant variations in HCT and MCHC values were observed among all study groups.

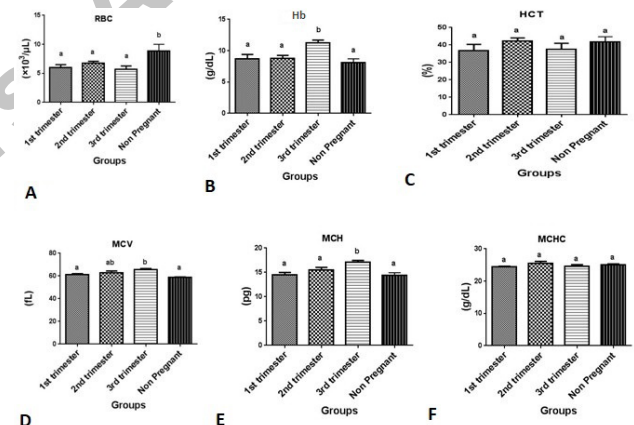


Fig. 1. Influence of the reproductive stage on the Erythrogram of Achai cows.

Figure 2 shows the leukocyte profile with variation in the total leukocyte count and in the absolute values of lymphocytes, neutrophils, eosinophil, and monocytes. The leukocytes were low in non pregnant group where the lymphocytes were high in the 2nd trimester and the neutrophils were high in 2nd and 3rd trimesters compared to other groups. The eosinophil was high in 3rd trimester where the monocytes were high in 1st and 3rd trimester as compared to other groups. The number of lymphocytes was significantly higher in all stages of pregnancy as compared to non-pregnant animals. The mean values of lymphocytes were found to be significantly increasing from first to second trimester. However, there was a sharp decrease in the mean values of lymphocytes at the

end of 3rd trimester. In this study, variations in the mean values of lymphocytes over the length of gestation are in agreement with findings of Marcos and its colleagues that decrease in the mean value of lymphocytes in advanced pregnancy can be correlated to elevated stress due to high concentration of adrenocorticoids produced by pregnant cow and growing fetus (Marcos *et al.*, 2019). The number of circulating neutrophils was found to be significantly increasing with advancing pregnancy. The highest mean value of neutrophils was found in the 3rd trimester of pregnancy. The neutrophils are the first line of defense in all inflammatory immune responses of animals and hence the increase in the number of neutrophils over the length of gestation can be correlated to the maternal immune response. The immune response of pregnant cows is triggered due to cytokine production by conceptus during implantation and placentation (Muller, 2019; Saut and Paulo, 2009).

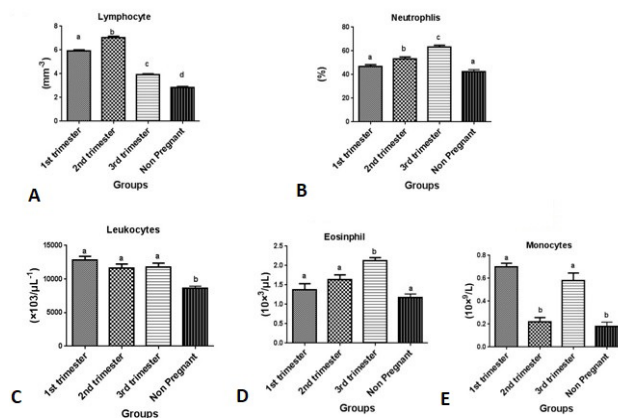


Fig. 2. Influence of the reproductive stage on the leukogram and erythrogram of Achai cows.

The mean values of monocytes were found to be highest in 1st trimester followed by 3rd trimester with the lowest being observed in 2nd trimester and non pregnant animal. The phenomenon can be correlated to normal physiological response of monocytes to inflammatory condition triggered by synthesis of chemical substance cytokine during implantation and placentation (Muller, 2019; Faas *et al.*, 2014; Saut and Paulo, 2009).

A steady increase in the mean value of eosinophil from first to last trimester was observed. Similarly, the concentration of leukocytes was higher in pregnant animals as compared to non pregnant. There was a marked rise in the concentration of leukocytes in first trimester followed by a slight decrease and increase in 2nd and 3rd trimester, respectively. Leukocytosis is a physiologic response to inflammatory condition in normal pregnancy

(Canzoneri *et al.*, 2009). This upsurge is due to rise in the concentration of differential leukocytes count.

Figure 3 shows ESR in different stages of pregnancy as compared to the control. The high value was recorded in 2nd trimester followed by 1st and 3rd trimester, where the low ESR value was recorded in non pregnant group. Elevated erythrocyte sedimentation rate (ESR) was observed in pregnancy as compared to non pregnant. The highest values were observed in 2nd trimester followed by 3rd trimester. These findings are in agreement with Mir *et al.* (2008), where highest values of ESR were reported in 2nd trimester of gestation. The increase in ESR is directly related to the levels of fibrinogen in the blood of pregnant dam. During pregnancy the levels of fibrinogen and fibrinolytic activity increases and decreases, respectively. Moreover, plasma volume expansion is a physiologic response in the course of normal gestation. All these factors favor rouleaux formation and hence result in increased ESR (Priya *et al.*, 2016).

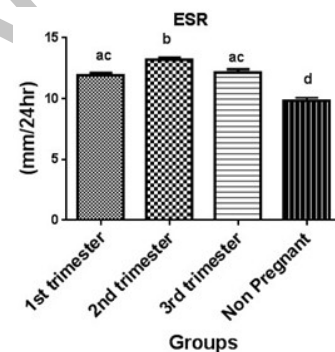


Fig. 3. The mean value ESR at different stages of pregnancy in Achi cattle breed.

Conclusion

The present study shows that the RBC count is high in non pregnant animal, while the Hb, MCV, MCH, neutrophils, monocytes and eosinophil increase with advancing pregnancy. There is no significant difference in MCHC and leukocytes among the groups.

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Statement of conflict of interest

The authors have declared no conflict of interest.

References

- Abdul-Rahaman, Y.T., Mnati, A.A and Mohammed, W.M., 2018. *Iraqi J. agric. Sci.*, **49**: 694-699.
- AL-Eissa, M.S. and Saad, A., 2012. *Res. Zool.*, **1**: 5-7. <https://doi.org/10.1016/j.scs.2012.11.001>
- Canzoneri, B.J., David, F.L.M.D., Lynn, G.M.D. and Yuping, W.M.D., 2009. *Am. J. Perinatol.*, **10**: 729-741. <https://doi.org/10.1055/s-0029-1223285>
- Faas, M.M., Floor, S. and Paul, D.V., 2014. *Front. Int. Immun.*, **5**: 298-306.
- Gravena, K., 2010. *Arq. Bras. Med. Vet. Zootec.*, **62**: 1514-1516. <https://doi.org/10.1590/S0102-09352010000600034>
- Hayaz, U., Hamid, U.K., Muhammad, I.K., Rajwali, K. and Ahmad, N., 2014. *J. Anim. Hlth. Prod.*, **22**: 13-19.
- Joao, P.E.S., Regiane, M.S., Daniela, B.B., Fabio, C.P., Carolina, Z.C., Samantha, I.M., José, J.F. and Eduardo, H.B.J., 2009. *Semin. Cienc. Agrar.*, **30**: 661-670.
- Kenyanjui, M.B. and Sheikh, A.M., 2009. *J. Agric. Environ. Int. Dev.*, **103**: 155-172. <https://doi.org/10.34225/jidc.2009.3.155>
- Mir, S.H., Darzi, M.M., Ahmad, F., Chisti, M.Z. and Mir, M.S., 2008. *Pak. J. Nutr.*, **7**: 404-407. <https://doi.org/10.3923/pjn.2008.404.407>
- Marcos, J.A., Ricardo, L.E., Ronaldo, L.O and Leilson, R.B., 2019. *Anim. Sci.*, **41**: 45725-45737. <https://doi.org/10.4025/actascianimsci.v41i1.45725>
- Müller, U., 2019. *Livest. Sci.*, **221**: 6-14.
- Priya, S.P., Nelson-Piercy, C., Heli, T., Alexandre, M. and Heli, T., 2016. *Cardiol. J. Afr.*, **27**: 89-94.
- Roy, S., Roy, M. and Mishra, S., 2010. *Vet. World*, **1**: 26-28.
- Sajad, H.M., Darzi, M.M., Fayaz, A., Chishti, M.Z. and Mir, M.S., 2008. *Pak. J. Nutr.*, **7**: 404-407. <https://doi.org/10.3923/pjn.2008.404.407>
- Saleem, M., Rahim, I., Jalali, S., Rueff, H., Khan, M., Maselli, D., Wiesmann, U. and Muhammad, S., 2013. *Anim. Genet. Resou.*, **52**: 83-90. <https://doi.org/10.1017/S207863361200080X>
- Saut, J. and Paulo, E.S., 2009. *Ciênc. Agrár.*, **30**: 661-670. <https://doi.org/10.5433/1679-0359.2009v30n3p661>
- Shagana, J.A. and Pradeep, K., 2018. *J. Phar. Res.*, **5**: 684-688.