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The hematological profile changes in Saanen goat kids from birth to 3 months of age

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Keywords

age, blood, goat kids, neonatal period, Sannen goat, small ruminants

Abstract

This study performed to determine hematological parameters in Saanen goats' kids from birth until 3 months of age. The whole blood specimens were collected from 20 clinically healthy goat kids (15 females and 5 males). The blood specimens were obtained at 24-48h after birth and 10 ± 2, 28 ± 2, 56 ± 2 and 84 ± 2 days. Hematological variables were determined based on reference laboratory methods. Results showed significant age related changes for most factors ($p < 0.05$) except for MCHC and the number of monocytes, eosinophils, and band neutrophils. There were significant differences with first sampling time for all parameters ($p < 0.01$) except for the number of monocytes, eosinophils and band neutrophils. The results of the present study ould be used as reference values for proper interpretation of laboratory results.

Abbreviations

ARI: adult reference interval
EDTA: ethylene diamine tetra acetic acid
Hgb: hemoglobin
MCH: mean cell hemoglobin
MCHC: mean cell hemoglobin concentration
MCV: mean cell volume
N: L: neutrophil to lymphocyte
PCV: packed cell volume
RBC: red blood cells
WBC: total white blood cells

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Introduction

Saanens are the largest of the goat dairy breeds. They are white or light cream in color. Their coats are usually short and fine; although a fringe over the spine and thighs is often present [1]. The name of this species originated in the Saanen valley in Switzerland. It is now the most popular dairy goat breed in many countries because of their heavy milk production, high reproductive yield, multi parturition, high growth and puberty rates [2-4]. The Saanen temperament is as a rule, calm and Saanen does are known for their ease of management in herds, and easily adaptation to different places [5-6].

Diseases of the newborn and neonatal mortality are major causes of economic loss in livestock production. Specific hematological reference ranges could help realistic evaluation of management practices, nutritional status and health conditions. Although there are reports concerning the values of serum hematological variables in other breeds of goats kids [7-11], but so far, the age related changes of hematological variables have not been studied in Saanen kids. Albeit these variables in Saanen goat kids, just has been com-

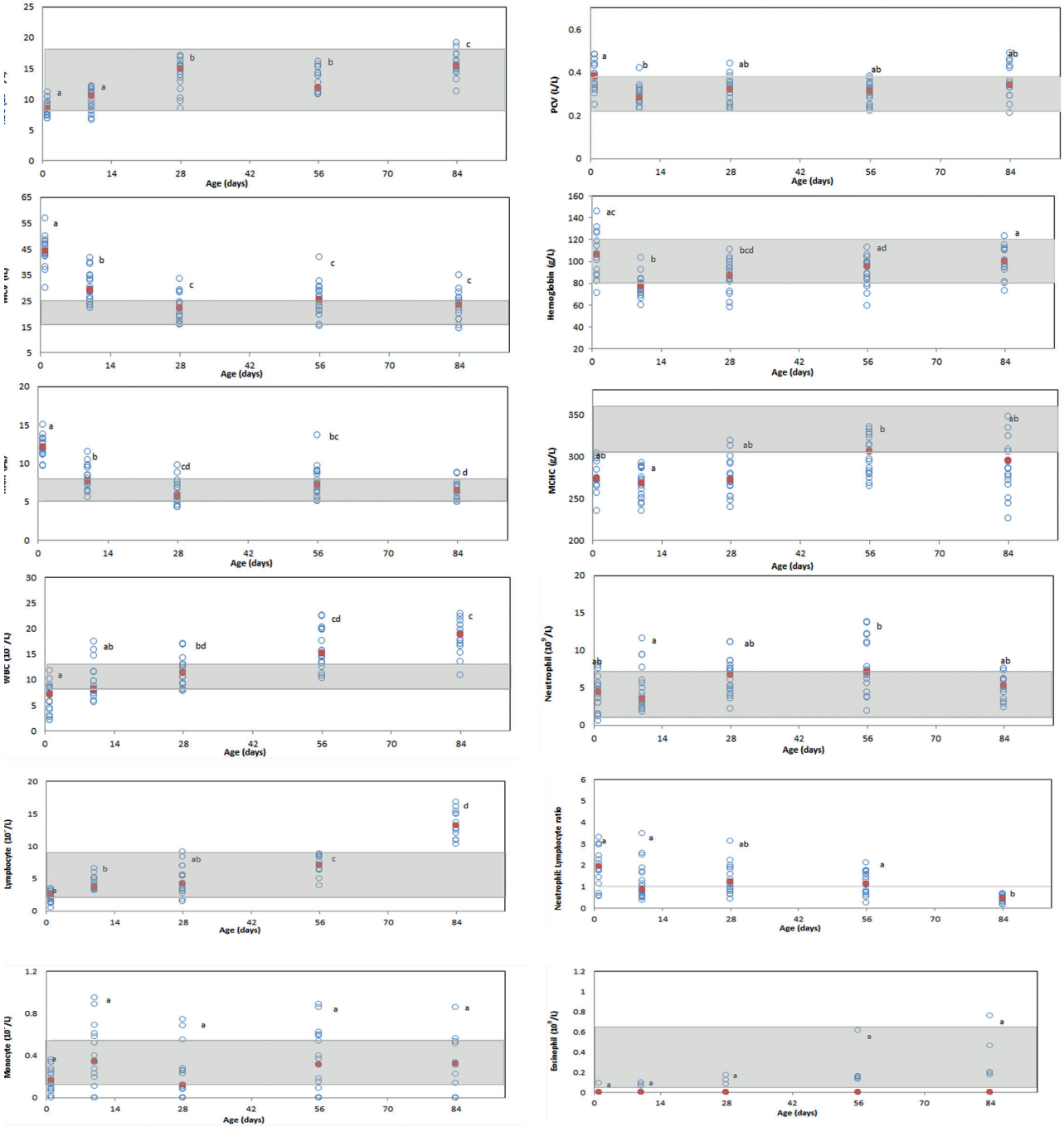

Figure 1.
Dot plots of hematological variables (○) and their medians (●) in kids from 1 to 84 days of age (Gray shading indicates adult reference intervals; Non-similar letters indicate significant difference ($p < 0.01$).

pared with adults and were not investigated in growing animals [1].

Since age has profound effect on the amounts of many hematological factors [12,13], the aim of the present study was to investigate the physiological pattern of hematological variables by sequential measurement in growing goat kids in order to evaluate the need for defining reference values for different age-groups. The obtained data should help in interpretation of laboratory results.

Results

Sampling time (age) had a significant ($p < 0.05$) effect on most measured variables except eosinophil, band neutrophil and monocyte counts. The significant differences ($p < 0.01$) between all times are presented in Figure 1.

PCV and Hgb showed a declining trend from 24 -48 h to day 10 and thereafter increased up to day 84. MCV and MCH showed a decreasing trend throughout the study, while RBC, WBC and lymphocyte counts had an increasing trend. Neutrophil counts, N: L ratio and MCHC fluctuated in similar pattern. These variables decreased slightly from birth to day 10, thereafter increased up to day 56, and then showed a slight decreasing trend up to 3 months of age.

Discussion

Considering the significant impacts of environmental conditions on blood variables, investigation of hematological profile appears to be essential in growing goat kids during the first 3 months of life. In this study, the PCV and RBC were within adult reference range (ARI). Hgb concentration also was in ARI throughout this study except in day 10 that was in lower limit of ARI. Similar findings have been reported in lambs during the 70 days of age [14]. Hematological profile in neonatal calves is controversial. Knowles et al. 2000 showed that all these variables were within ARI in calves during the first three months of age [13], while in another study Hgb concentration was less than ARI until 2 months of age [12]. The environmental and breeds differences likely create this discrepancy.

Our results showed an increasing trend in RBC up to day 84. After declining of PCV and Hgb from 24-48 h to day 10, an increasing trend was also observed in these variables up to day 84. This pattern that is similar to hematological findings in dwarf and landrace kids [7] is likely related to elevated plasma volume due to colostral protein intake and rapid expansion of vascular space [15]. The failure of neonatal bone marrow in erythropoiesis also leads to this hemogram, because erythropoietin in neonatal period is not adequately produced by the underdeveloped neonatal kidneys [11].

MCV and MCH indices of kids were higher than that of adults from birth to day 10 and MCHC was lower than ARI during the first three months of age. Erythrocyte indices in newborn calves were below the ARI and decreasing the erythrocyte size has been observed until first 3 months of life [12]. In the blood specimens of the 70 days old lambs, the higher MCV and lower content of MCH and MCHC were observed in comparison with the 30 days old lambs [14].

In contrast to decreasing trend in MCV and MCH indices, MCHC showed little fluctuatation throughout this study. The decreasing trends in MCV and MCH with advancing age have been reported by previous studies [7-10, 16]. The erythrocyte indices changes may be attributed to iron content or availability of diet and/or physiologic status during interpretation of erythrogram of neonates [12].The amount of serum iron can differentiate these conditions from each other. Although serum concentration of iron in kids showed decreasing trend after day 28, it was within ARI during this study [17].

The presence of immature erythrocyte may be is a cause of higher MCV in kids during first month of age. Neonatal erythrocyte size varies with the type of Hgb they contain. At birth, high percentage of the neonatal Hgb is Hgb F and there are higher numbers of reticulocytes in blood specimens which have larger size than mature RBCs [18]. Furthermore, the reduction of PCV, RBC, Hgb and MCH during the first days of life is probably due to replacing of reticulocytes and diffusely basophilic polychromatophilic erythrocytes by mature RBCs containing Hgb A [7].

After birth, WBC and lymph counts increased which is in agreement with other studies [8, 11, 19] and indicate maturation of immune system and exposure to pathogens that lead to cellular immune responses [19].

WBC count was higher than ARI after day 28. This is in contrast to previous finding that reported age related decrease of leukocyte count in Saanen goats [1]. This must be noticed that in the mentioned study, hemogram was compared between kids and adults not in growing kids. Furthermore, the environmental differences likely create this discrepancy. It was reported that WBC number of calves at birth tended to be above the upper limit of ARI but will drop to levels within ARI after that [13, 20]. The high levels in the WBC count would typically be attributed to physi-

ological phenomenon i.e. excitement during sampling or some disease challenge. However, there were no obvious clinical signs of disease in the kids when they were sampled. The higher values of leukocytes in newborns can be related to the delivered immunoglobulin from the colostrum [21, 22] or high concentration of cortisol that increases during the last days of fetal life and decreases progressively after the birth [12].

In goat kids, leukocyte counts increase from birth to 3 months of age that indicates both marked increase in lymphocyte numbers and a smaller increase in neutrophil numbers that peak at 1 month of age [18]. Neutrophil counts were within the ARI during study but lymphocyte counts were higher than ARI after day 56. Other studies reported lymphocytopenia and neutrophilia at birth in response to endogenous corticosteroids [8]. In this study the N: L ratio fluctuated and its value is certainly dependent upon neutrophil and lymphocyte counts. This ratio was 1.9 at the time of birth then reached to 0.43 in 3 month–old kids. These alterations are similar to those reported by Smith and Sherman [4] and the N: L ratio should be increased again to about 1.0 in adults.

Eosinophil counts were below the ARI and increased insignificantly during this study. In neonates, eosinophil count is relatively low due to the stress of birth and release of endogenous corticosteroids and gradually increases and reaches ARI by 2 years of age [23].

Some studies showed a gradual increase in eosinophil counts from young kids to adult goats [4, 7]. The higher number of eosinophil may be related to allergic response to ecto- or endoparasites [24]. Similar to previous findings [8], monocyte counts were within the ARI and insignificantly fluctuated throughout this study.

Conclusion

The results of this study report the age related hematological changes in Saanen goat kids during their 3 months of age. These data could be used by veterinarians to interpret the laboratory data appropriately. The results of the present study indicated that age significantly influenced most hematological variables. MCHC and eosinophil at the first three months of life, MCV and MCH at the first 10 days of age, Hgb at day 10, and WBC and lymphocyte count after 2 months of age, provide specific reference values and are essential for proper interpretation of laboratory results.

Materials and methods

Twenty goat kids (15 females and 5 males) were blood sampled from birth to 84 days of age. A blood specimen was taken within 24 – 48 (± 2) hours, and at 10 ± 2, 28 ± 2, 56 ± 2, and 84 ± 2 days of age. The farm was monitored by the Veterinary School of Ferdowsi University of Mashhad and kid's health status was evaluated before each sampling, based on rectal temperature, heart and respiratory rate, and other routine factors. Kids that showed abnormal signs in coughing, nasal discharge, ocular discharge, appetite status, and fecal consistency were excluded from the study.

Blood sampling was performed through jugular vein between 6.00 and 10.00 AM. Specimens were collected in K3-EDTA tubes (FL medical, Italy) and were placed immediately on ice for transferring them to the laboratory. Hematological variables such as RBC, Hgb, PCV, MCV, MCH, MCHC, total WBC, differential cell count (neutrophil, lymphocyte, eosinophil, monocyte and neutrophil to lymphocyte (N: L) ratio) were measured. All CBC related determinations were performed manually based on routine laboratory methods [25] except of total WBC count and Hgb concentration that was determined by a hematology analyzer (Nihon Kohden, Cell Tac a, MEK 6108, Tokyo, Japan).

Statistical analysis

Statistical analysis was conducted using SPSS for Windows (release 20, IBM, USA). Age effect was examined using non-parametric Friedman test. In addition, a non-parametric paired *t* test was used for the comparison of each sampling stage with first sampling time. Because of using multiple comparison test, the corrected *p* value was calculated and adjusted at 0.01. For each variable, age related changes were showed by a graph with upper and lower limits of adult reference intervals [18].

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Author contributions

Conceived and designed the experiments: MZ, MM. Performed the experiments: MZ, SA. Scientific counseling: AAN. Wrote the paper: MZ, SA.

Conflict of interest

None of the authors have any conflict of interest to declare.

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