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EFFECTS OF CULL POTATO (*SOLANUM* TUBEROSUM) FEEDING ON HEMATOLOGICAL AND BIO-CHEMICAL PARAMETERS IN MALE THARI GOAT KIDS UNDER AN INTENSIVE MANAGEMENT SYSTEM

Jeevan Kumar Bheel[*1], Jabir Gadani1[2], Professor Huma Rizwana[3], Dr. Saeed Ahmad Soomro[4], Dr. Shakeel Ahmed Tunio[5]

[*1,2,3,5]*Department of Livestock Management, Faculty of Animal Husbandry and Veterinary Science, Sindh Agriculture University Tandojam, Pakistan*
[4]*Department of Veterinary Physiology and Biochemistry, Faculty of Animal Husbandry and Veterinary Science, Sindh Agriculture University Tandojam, Pakistan*

[*1]drjkshav@gmail.com

Corresponding Author: *
Jeevan Kumar Bheel
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ABSTRACT

A study was conducted at the Livestock Experimental Station, Department of Livestock Management, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University, Tandojam, on the effect of potato feeding on hematological and biochemical parameters in male goat kids. For this purpose twelve male goat kids, aged approximately six months, with an average body weight of 10±0.31 kg, were selected and divided into three equal groups and randomly assigned to the control and two treatment rations containing cull potatoes: group A, which was kept as the control ration; group B, the treatment ration with 5% cull potato; and group C, the treatment ration with 10% cull potato, respectively. In this study, the overall parameters were hematological and biochemical parameters. The hematological parameters white blood cells, red blood cells, hemoglobin concentration, hematocrit count, mean corpuscular volume and platelets counts of group A, B and C values analysis showed significant difference (P<0.05) in all three groups. The average of total protein and glucose of groups A (6.65 g/dl and 62 mg/dl), B (6.40 g/dl and 66 mg/dl), and C (6.45 g/dl and 70 mg/dl) was found to be significant (P<0.05) in all three groups. However, the average triglyceride in group A (175 mg/dl) was significantly (P<0.05) higher than kids in groups B (161 mg/dl) and C (150 mg/dl). Moreover, the average cholesterol in group A (220.5 mg/dl) was significantly (P<0.05) higher than kids in groups B (209.5 mg/dl) and C (194 mg/dl).

Keywords: *Hematological parameter, Biochemical parameter, Thari goat kids, Intensive management, Cull potato feeding.*

1. INTRODUCTION

The goat breeds of Pakistan have great potential to dominate international meat production, e.g., Kamori, Pateri, Tapri, Teddy, Beetal, and Dera Din Panah are popular goat breeds. Kagan, Khurrasani, Nichi, Kachhan, etc., are also reared in different areas of the country. Goat meat, milk, and dairy products have been transformed because these products are important for financial reasons and the skin has less significance (Sen et al., 2004). Because of their

outstanding adaptability in harsh environments and ability to yield quality meat and milk, goats are recognized as the best animals to raise. (Silanikove, 2000). In Pakistan, small ruminants are the primary source of profits for rural farmers. In particular, due to excellent export potential and foreign exchange. There are a number of factors that influence goat production and breeding, including weather, feeding, management, and so on, that should be carefully managed for the purpose of enhancing genetic values and accurately assessing genetic parameters (Getachew et al., 2018; Mustefa et al., 2019).

Although there is an extensive amount of information available regarding common blood parameters of domestic animal species, the values have the potential to alter according to the breed, various environmental circumstances, and management practices. (Sharma & Kataria, 2012), and goats have been used to study changes in all of these parameters (Tibbo et al., 2008; Avcı et al., 2013). Analyzing blood components has been a common way to assess the effectiveness of feed supplements and nutrient content (Belewu and Ogunsola, 2010; Belewu et al., 2009; Akingbade et al., 2002) but also a measure of stress related to transportation (Ambore et al., 2009). In the end, it is well recognized that the hematological and biochemical profiles of small ruminants are significantly impacted by a variety of environmental factors, including housing, management, genetics, nutrition, stress, reproductive status, age, sex, and other environmental factors (such as temperature and relative humidity) (Balikci et al., 2007; Olayemi et al., 2009).

It frequently becomes apparent how important it is to identify an animal's indicators of hematology and biochemistry (Oduye et al., 1976; Oduye et al., 1977; Obi et al., 1980). The hematological and biochemical characteristics of goat breeds vary significantly from one another. (Azab & Abdel-Maksoud, 1999; Daramola J O et al., 2005; Tambuwal et al., 2002), and determining these is essential since they offer significant details regarding the breed, sex, and health status of the animal (Madan et al., 2016). and The literature currently in publication indicates that goat breeds differ greatly in terms of their hematological and biochemical profiles (Azab and Abde-Maksoud, 1999; Tambuwal et al., 2002; Tibbo et al., 2004). Blood variables are typically used to monitor and assess the nutritional, physiological, and health status of ruminants (Chapple et al., 1991; Al-Eissa et al., 2012; Gupta et al., 2007). Goats' immune status can also be evaluated using blood profiles (Al-Seaf and Al-Harbi, 2012). Seasonal changes also have an impact on these profiles (Abdelatif et al., 2009), and these profiles may change during pregnancy (Waziri et al., 2010).

In order to better assess the nutrition, management, and health of goat breeds produced under a feedlot management system (zero grazing), reference value data for their physiological characteristics must be established. The hematological values are commonly used to determine the biological relation and the physiological adaptability (Kamal Shah et al., 2007). The blood plasma components and biochemical profile indicate some variations based on the animals' productivity (Madan et al., 2016), growth requirements, breed, age, environmental factors, management conditions (Arfuso et al., 2016), sexual maturity, and other factors (Piccione et al., 2007).

1.1 Significant study

The purpose of this study was to examine the blood chemistry and hematology of the thari male goat kids fed small-sized fresh potatoes with varying percentages in the ration as a preliminary study. Therefore, the current experiment's goal was to examine the hematological and biochemical characteristics of the male goat kids raised in an intensive system.

2.1 MATERIALS

Materials and Methods

The present study was conducted at the Livestock Experimental Station, Faculty of Animal Husbandry and Veterinary Science, Sindh Agriculture University Tandojam, Pakistan.

Materials

Animals (twelve healthy male goat kids (weaned) were brought), Mangers (Plastic tubes were used for feeding kids.) Water trough, tags (plastic

numbered pieces were used for identification), jute threads (used for hanging tags in the neck region), syringe (to collect blood from the animal), blood tubes (used to collect blood samples), centrifugation machine (to separate serum from clotted blood), and sealed plastic tubes (for stored serum).

Animals and experimental design

For the experiment, it was preferable to use twelve male goat kids of the same age who had been aged about six months. Each group's first twelve days were allotted to adaptation. Before beginning experimental feeding, kids are raised in confined, well-ventilated animal sheds. Using plastic tags, each kid was assigned a distinctive recognition number during the adaptation period. Ivermectin and albendazole medications were used to treat both internal and external parasites. They showed no symptoms of external injury or clinical illness and were in good health. Three groups of four male goat kids each were formed: Group A (Control) was fed green fodder (maize) and a concentrated ration. Group B (Treatment) acquired a concentrated ration and green fodder (maize) with 5% cull potato. Group C (Treatment) was fed a concentrated ration of green fodder (maize) with 10% cull potato. At the livestock experimental station, each group was raised under an intensive management system (Table 1). Nevertheless, water was available to all animals at all times.

Table 1: Experimental design.

Groups	A (control)	B (treatment)	C (treatment)
No. of Animals	04	04	04
Cull potato	0%	5%	10%
Roughage	Maize	Maize	Maize
Concentrate	Master feed	Master feed	Master feed
System	Intensive management	Intensive management	Intensive management

During the experiment, the following parameters were recorded:

Blood sampling

Two tubes (Guangzhou Improve Medical, China) were used to collect blood samples from the jugular vein; one tube contained ethylene diamine tetra acetic acid for blood hematology, while the other tube contained no anticoagulants for the biochemical analysis. All of the samples were quickly transported in ice to the laboratory.

Hematological parameters:

The blood will be used to figure out what normal values are (WBC, RBC, Hb, HCT, HCV, MCH, MCHC, and platelets). This process began at the beginning of the experiment, and the same numbers of samples were obtained for full blood count analysis at the conclusion of the study from each group.

Biochemical parameters:

Immediately 3 ml of the blood was poured into the simple plastic tube and then allowed to clot at room temperature. The serum was extracted from the clotted blood by centrifugation at 3000 rpm for 15 minutes, and it was collected and kept in sealed plastic tubes at -20°C until analysis. This procedure was started at the beginning of the experiment, and the same numbers of samples from each group were obtained at the end of the trial for the quantitative determination of total protein, glucose, triglyceride, and cholesterol.

Statistical analysis

A statistical analysis (Statistix 8.1) was used to do an analysis of variance on the collected data to find out if there were any significant differences between the three different groups. LSD (Least Significant Difference) and SE (Standard Error)

tests were also required to evaluate the level of significance between group mean values.

3. Result and Discussion

Table 3: Hematological values of male goat kids reared in intensive management system fed different levels of potato.

Parameters	Sample	A	B	C	LSD	S.E
White Blood cells (10^3/uL)						
	Initial (0 day)	12.350	12.350	11.850	0.9732	0.3786
	Final (90 day)	11.400	12.500	12.350		
Red blood cells(10^6/uL)						
	Initial (0 day)	14.750	14.850	13.500	2.0058	0.7803
	Final (90 day)	15.150	14.250	13.750		
Hemoglobin concentration (g/dl)						
	Initial (0 day)	10.700	10.600	10.350	0.8558	0.3329
	Final (90 day)	11.250	10.950	10.100		
HCT (%)						
	Initial (0 day)	34.25	29.10	34.75	2.9431	1.1449
	Final (90 day)	37.15	37.10	37.00		
MCV (fL)						
	Initial (0 day)	17.915	18.700	20.250	1.8525	0.7206
	Final (90 day)	18.250	19.650	21.400		
Platelets counts (10^3/uL)						
	Initial (0 day)	375	400	379	82.344	32.033
	Final (90 day)	475	450	426		

Normal Values: WBC: 4-13, RBC: 8-18, HC: 8-12, HCT: 22-38, MCV: 16-25, Platelets counts: 300-600

The present research shows that the final white blood cells (10^3/ul) measure of different feeding levels of potatoes in male goat kids. The data in table (3) represents that the final white blood cells measured in group A, B, and C were noted at 11.40 (10^3/ul), 12.50 (103/ul), and 12.350 (10^3/ul). Further analysis showed that significant difference ($P<0.05$) was seen in the white blood cells of male goat kids among the three groups, but white blood cells were analyzed in the first week and last week of the trial in normal range in all three groups. The current study's findings align with those achieved by Kaneko et al., (2008), who reported that the white blood cell levels were within 5.27-9.13 x 103/ml, which is in the usual range of 7.4 to 9.0 x 103/ml. Although Hyelda et al., (2017) reported lower WBC counts (24.9-38.3 103/ml). The data in table (3) shows that the final red blood cells measurements for group A, B, and C were noted at 15.15, 14.25, and 13.75. Further analysis declared that the red blood cells showed a significant difference ($P<0.05$) of male goat kids among the three groups, but red blood cells were analyzed in the first week and last week of the trial in normal range in three groups. The findings of the current research do not agree with those reported by Weiss and Wardrop, (2011). The maximum red blood cells were obtained from group-A as compared to group-B, and C, The obtained value of RBC was significantly above the average range of 3.90 to 4.34 x 103/ml and Okunlola et al., (2015) RBC was far greater than the documented ranges of 1.80-2.10 x 106/l. Low RBC counts can be caused by vitamin deficiency, iron shortages, hemorrhages and anemia. The elevated RBC values in this study could be explained by the diets high level of nutrients. Further result in table (3) found a significant difference ($P<0.05$) in the hemoglobin count of male goat kids among the three groups, but the hemoglobin

count was analyzed in the first week and last week of the trial, revealing normal range in all three groups. The finding of the present study agrees with Daramola et al., (2005) who reported that the hemoglobin ranged from 7.87–10.4 g/dl fell in the range, while Mahammed et al., (2016) observed a mean value of 8.6 g/dl, which is somewhat less than the high result found in this research. Normal hemoglobin levels (12.72-13.36 g/dl) were observed by Oloche et al., (2019). This indicates that the diets had no deleterious impact on blood formation. According to Okunade et al. (2016), hemoglobin ranged from 7.87 to 10.4 g/dl, falling between 7 and 15 g/dl, the lowest value found in this study is slightly greater than the mean value of 8.6 g/dl reported by Umar et al. (2020). Table (3) represented that the initial hematocrit count of groups A, B, and C were analyzed as 34.25 (%), 29.10 (%), and 34.75 (%) approximately, and the final hematocrit count of groups A, B, and C were noted as 37.15 (%), 37.10 (%), and 37 (%). Further analysis showed that no significant difference (P>0.05) was found in the hematocrit count of male goat kids among the three groups, but hematocrit count was analyzed in the first week and last week of male goat kids, with in normal range in three groups. Similar results also observed in Barbari Black Aardi breeds (2007) and Feldman et al. (2002). In contrast, the values of RBCs, HGB, and HCT were higher than that reported in the Damascus breed (2007). Table (3) represent that the initial mean corpuscular volume measured of groups A, B, and C were analyzed as 17.95 (fL), 18.70 (fL), and 20.05 (fL) approximately, and the final mean corpuscular volume measured of groups A, B, and C was noted as 18.25 (fL), 19.65 (fL), and 21.40 (fL). Further analysis proved that a significantl difference (P<0.05) existed in mean corpuscular volume of male goat kids among the groups, but mean corpuscular volume was analysed in the first week and last week of male goat kids between the normal range in three groups. The current research agree with the study's MCV values fell between 17.17-22.17 fl, which is within the typical range (Weiss and Wardrop, 2011) and the range of 17.09-17.60 fl found by Oloche et al. (2019). The data in Table (3) show that the initial platelet count of groups A, B, and C was approximately 375 (103/uL), 400 (103/uL), and 379 (103/uL), and the final platelet count of groups A, B, and C was 475 (103/uL), 450 (103/uL), and 426 (103/uL). Further analysis showed that there was a significant difference (P<0.05) in platelet count of male goat kids among the three groups, but platelet count was analyzed in the first week and last week of the trial, within normal range of three groups.

Table 4: Biochemical values of the male goat kids reared in intensive management system fed different levels of potato.

Parameters	Sample	A	B	C	LSD	S.E
Protein (g/dl)						
	Initial (0 day)	6.9	6.35	6.05	0.4145	0.1612
	Final (90 day)	6.65	6.40	6.45		
Glucose (mg/dl)						
	Initial (0 day)	68	73	74	12.368	4.8114
	Final (90 day)	62	66	70		
Triglyceride (mg/dl)						
	Initial (0 day)	138	132.50	139.50	15.509	6.0332
	Final (90 day)	175	161	150		
Cholesterol (mg/dl)						
	Initial (0 day)	120.50	127	134	25.725	10.007
	Final (90 day)	220.50	209.50	194		

Normal Values: Protein: 6.4-7 or 7.5, Glucose: 50-75, Triglyceride: less than 150, Cholesterol: 80-130

Table (4) represented the initial and final total protein measure of different feeding levels of potatoes in male goat kids. The data represent that the initial total protein measured for groups A, B, and C were analyzed as 6.9 g/dl, 6.35 g/dl and 6.05 g/dl, approximately, in the final total protein measured for groups A, B, and C were noted at 6.65 g/dl, 6.40 g/dl, and 6.45 g/dl. According to current research, The total protein observed from the control and treatments groups was significantly higher ($P<0.05$) in A group (controlled), while in groups B and C, the minimum total protein was measured in group B (treatment). Further study revealed a significant difference ($P<0.05$) in the total protein of male goat kids among the three groups, but total protein was recorded in the first week and last week of trial within the normal range. Recent research agrees with Omer, (2011), who found that including blood plasma total protein was not significantly impacted by PPW in sheep feed, and Gado et al., (1998), found that there was no significant ($P > 0.05$) change in serum urea nitrogen when concentrate was substituted with potato processing waste at 0, 25, 50, or 100 percent in growing Baladi goats, but disagrees with Yashim, (2017), who found that including PPW in sheep diets had a significant ($P<0.05$) impact of the potato peels' addition. The serum glucose group-A (controlled) 62 (mg/dl), 66 (mg/dl) in B group (treatments) and 70 mg/dl in group C (treatments). According to recent research, the glucose records from the controlled and treatments groups showed a significantly ($P<0.05$) high glucose level in C group (treatments) than in A and B groups. The results of further study revealed a significant difference ($P<0.05$) in the glucose of male goat kids among the three groups, but glucose was recorded in the first week and last week of the male goat kids between the normal range. The results obtained by current research agree with the results obtained by Omer, (2011), who found that added PPW to sheep's food had no obvious impact on blood plasma glucose levels and Gado et al., (1998), who observed that there was not a significant ($P>0.05$) alterations in blood urea nitrogen levels in growing Baladi goats when concentrate was substituted with potato processing waste at 0, 25, 50, or 100% and according to Kaneko (1997), glucose typically ranges between 2.78 to 4.16 mmol/l. Male goat kids in group-A (controlled) had a triglyceride of 175 mg/dl, 161 mg/dl in B (treatments) and 150 mg/dl in C group (treatments). According the current study, further analysis showed that the triglyceride was obtained from A group was significantly higher ($P<0.05$) than in B and C groups. The current research agrees with the results obtained by Omer, (2011), proving that the addition of PPW to sheep feed had no significant effect on blood triglycerides and Gado et al., (1998), who discovered that there was not a significant ($P>0.05$) change in blood urea nitrogen levels in growing Baladi goats when concentrate were substituted with potato processing waste at 0, 25, 50, or 100%. Male goat kids in group-A (controlled) had a cholesterol level of 220.5 (mg/dl), compared to 209.5 (mg/dl) in B group (treatments) and 194 (mg/dl) in C group (treatments). According to current research, the cholesterol observed from controlled and treatments group, the maximum cholesterol measured from group-A (controlled) was significantly ($P<0.05$) higher than in B and C groups. This research agrees with the results obtained by Omer, (2011), showing that including Blood plasma cholesterol was not significantly impacted by PPW in sheep feed and Gado et al., (1998) found that there was not a significant ($P>0.05$) alterations in blood urea nitrogen levels in growing Baladi goats when concentrate was substituted with potato processing waste at 0, 25, 50, or 100%.

Conclusion

Breed and age have a significant impact on hematological parameters in healthy goats. To properly evaluate the physiological state and general health of animals, especially during the fattening period, standards for these parameters must be established. The significance of reading these values within suitable biological circumstances is further illustrated by our findings, which show notable differences in hematological profiles among different goat breeds and age groups. Furthermore, the study showed that feeding growing male goat kids up to

10% cull potatoes has no negative effects on their feed intake, hematological, or serum biochemical parameters. Therefore, as soon as animal health is routinely checked to maximize management techniques, cull potatoes can be used as a safe dietary component at this phase of growth.

Recommendation

Further studies should be focused on increased level of potato on different species of ruminants.

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