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BIOCHEMICAL FEATURE AND HEMATOLOGICAL PROFILE OF NUKRI GOAT DURING DIFFERENT PHYSIOLOGICAL STAGE

Wasim Ikram Khan[1] Dr. Muhammad Tarique Tunio[2]

[1]MS Scholar Allama Iqbal University Islamabad, Pakistan

[2]Assistant Professor, Department of agriculture Sciences, Allama Iqbal Opent Universit Islamabad, Pakistan

Email: [1]drwasimikram1@gmail.com

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ABSTRACT

The present study was conducted to determine the effect of various feeding pattern upon biochemical and hematological blood profiles and their response at different days of lactation in goats. Total Twenty animals were allocated in to two groups. Animals in control group (A) were offered concentrate diet along with alfalfa hay fresh and clean water and in other group (B) animals were allocated for selected area of open grazing with Dam water. Total duration of experiment was 70 days and animals were given 10 days to adjust the experimental diet. Blood samples were taken at 30, 50 and 70 days of lactation period. Biochemical parameters i.e. blood glucose, total protein, albumin, blood urea nitrogen, uric acid, triglycerides, creatinine, alanine transaminase and aspertate transaminases were determined. The result of biochemical parameter remained same in control group (A) with reference of lactation stages. highest value of glucose (64.891±0.9762 mg/dl) was recorded at 70 days of lactation and lowest value (61.35±0.2286 mg/dl) was recorded at 30 days of lactation and mid value (62.249±0.249 mg/dl) at 50 days . However, in group B highest value of glucose (60.3±0.58329 mg/dl) was noted at 70 days lactation and minimum value (57.96±0.137233 mg/dl) was noted at 30 days mid value (59.96±0.2243 mg/dl) at 50 days of milking. with the small ruminants at peak milking increase the blood glucose level as the metabolism of insulin produce excessive amount of energy to meet up requirement of milking, ultimately the glucose level increases in group A while in group B concentration of Glucose level decreases below the normal level then animal become hypoglycemic chances of ketosis increases which leads to mortality.

The highest value of Total protein in group A is (6.90±0. 59g/l) was recorded at 70 days of lactation and minimum value (6.33±0.41g/l) was recorded at 30 day of lactation remain in normal range while in group B lowest highest value was recorded at 30 day (6.17±0.43g/l) and lowest value (5.14±0.99g/l) was noted at 70 days of lactation. So total protein deceases. The blood urea nitrogen (BUN) for group A was 13.99±0.99, 14.35±0.66 and 15.43±0.24 at day 30, 50 and 70 respectively and the mean blood urea nitrogen for group B 19.63±0.57, 21.33±0.55 and 23.45^{a}±0.74 respectively, , Uric Acid, Creatanine and ALT increases with the increase of lactation. The changes are due to feeding pattern which are significantly difference in group (A) and group (B) such as Creatinine showed significant increase. The values are 0.80±0.31, 1.30±0.62 and 2.1±0.94 (µmol/l) that causes damage to liver and kidney which lead to death.

In group A the blood profile did not show any significant change. However, in group B blood profile showed decline in RBCs, and platelets ,WBC increases in open grazing . High parasitic infestation, hilly climatic conditions, lower soil fertility and ground water unavailability are the predisposing factors of lower blood profile. This also makes difficult survival in hilly areas with open Grazing and Dam water. In conclusion, in hilly areas of Punjab, goats can be survive successfully only on grazing with mix Mineral and fresh water.

INTRODUCTION

The production of livestock sector has increased and currently it contributes about 60.5% in agriculture and 11.2 % in national Gross Domestic Product of the growth (Anonymous, 2019). About 63.33 % of population of Pakistan lives in the villages which are dependent on the livestock products like milk and meat as food for their sustainability. Livestock plays a very important role in the rural farmer's life.

Nukri goat is famous for her beauty; white pink colour and good height. Its head is devoid excessive hairs. Jaws are strong and nostrils are roman style. Eyes alert, horns are small and stumpy. It is also famous for milk and meat production. Nukri goat is native in dist. Rajan pur. Southern Punjab peoples of Mainwali, Tonsa shreef, Deraghazi khan, Raheem yar khan raised as pet animals. Females of Nukri goats get maturity at the age of 10-12 month. These goats started to give 2-3 kids in one year from 2nd to 3rd pregnancy. The male buck of nukri breed gain up to 100kg body weight at the age of two years. Due to all these properties peoples of Pakistan are interested to raring this breed. Goats play very important role in poverty eleviation and are source of food for poor people. Goat rearing requires low cost and is suited to landless labors, marginal farmers and industrial workers (Monteiro, 2017). A characteristic like small compact body size enables to be tended by women and children and they provide valuable nutrients to the community. Furthermore, small gestation period with often double and triple kidding increases importance of goats. The farming of goat is profitable business especially in Pakistan. In livestock especially the goats in Muslim countries where at Eid-ul-Azha, there is large demand of live animals (Ibrahim, 2019). That's why, goat rearing in the developing countries like Pakistan can decrease the poverty and can provide cheaper source of milk and meat .

Different physiological stages including pregnancy, lactation, dry period etc some metabolic changes may alter physiological range of blood constituents.

Blood biochemical parameters including total protein, triglycerides, free fatty acids and urea are important indicators of the metabolic activity in animal physiological status. Amino acids which are basic building blocks of protein and plasma proteins are important components of plasma and they play vital role in maintaining homeostasis. Plasma proteins consist of three components albumin, globulin and fibrinogen (Okonkwo *et al.,* 2011). These plasma proteins have many important functions; albumin is the one of the abundant and osmotically active plasma protein (Alberghina *et al.,* 2010) and it act as carrier of many substances in the blood circulation. Albumin is the most abundant blood serum protein which is used to maintain colloidal osmotic pressure in the body and prevent leakage of fluid in the peripheral cavities of the body. Albumin may also play an important role in fetal nourishment.

It is well established that Biochemical profile plays a key role in diagnosis of health related issues in livestock species. Biochemical metabolites such as serum protein, fatty acids, and blood urea nitrogen can provide complete assessment of animal health. Enzymatic activity including aspertate transaminase (AST), alanine transaminase (ALT) in blood plasma is important tool for determining the malfunction of liver. Available review of literature suggests that enzymatic activity has been used for the assessment of various disorders of liver and metabolism of body which manifest the different levels of AST and ALT. Similarly the different levels of blood urea nitrogen (BUN) and creatinine can indicate the abnormalities of kidney and muscles. Thus the analysis of blood provides an important opportunity to investigate optimal level of different metabolites which play important role in maintaining good health of animal. Changes in blood metabolites are responsible for alteration of physiological condition of animals. Important factors which can change the physiological and biochemical state of animals are both genetic and other including feeding, season, age, sex of animal and management. The current study was to investigate the biochemical feature and hematological profile of Nurki goat during different days of lactation.

STATEMENT OF PROBLEM

The Biochemical metabolites such as Total protein, serum albumin, blood urea nitrogen, blood glucose had showed variation at different lactation stages, their higher & lower level of may have a directly effect on the lactation. These variation can suggest the upcoming diseases and are also responsible for failure of different organs of body. For example if the level of creatinine is increased in blood than animal may suffer from serious renal impairment that can leads to kidney stone or even death of animal. Therefore, present study was designed in lactating Nukri goat to check out the concentrations of different biochemical metabolites;

RESEARCH OBJECTIVES

General Objective

The main objective of this study was to Probe / investigate the biochemical profile and hematological profile of Nukri goat from serum at different days of lactation

Specific Objective

1.To investigate the Biochemical profile of Nukri goat .
2.To investigate the hematological profile of Nukri goat.

REVIEW OF LITERATURE

Blood contains a numerous metabolites and other constituents, which offer useful means for clinical examination and estimation of health condition of mammalian species including goats. This research study was done to assess the biochemical and hematological aspects in various physiological states in the Nukri goats.

Glucose

Lima *et al.,* (2012) conducted an experiment on two groups of dairy goats to check out the profiles of different biochemical parameters and epidemiological data. The animals were placed in two groups; one was given low dietary protein (LDP) and other was given high dietary protein (HDP). Blood samples were taken at different stages means early, mid and late pregnancy and early, mid and late lactation. The results collected showed that demand for carbohydrate (glucose) increase at different stage of pregnancy. It also depends upon the size and number of fetus. The author declared that if concentrations of glucose decreased below the normal level than animal becomes hypoglycemic and chances of ketosis increases.

Blood Urea Nitrogen

Antunovic *et al.,* (2017) conducted a study on lactating goat and their kids to determine the levels of different biochemical parameter. Blood samples were taken at different stages i.e. during early lactation and late lactation. Blood sample from animals were taken at twenty and fifty days. The results showed that level of blood urea nitrogen decreased in early lactation until fifty day. Then the level of urea start to increase as lactation progress and reaches maximum level at 110^{th} days. However the concentration of protein, albumin, triglycerides and other biochemical parameters increased during the early lactation.

Hassan *et al.,* (2016) conducted an experiment on goats to determine the concentration of biochemical parameters and level of cortisol hormone at different stages of lactation. The animals were distributed into five groups. Dry animals were designated as control group and other group contains animals that were in different year of lactation. The result collected showed that blood urea nitrogen concentration increased in all stages of lactation except during dry period. The author further concluded that concentration of total protein decreased only during third lactation period and increased in all other lactation stages. The level of cortisole hormone showed a decreasing trend from early to late lactation stages.

Lima *et al.,* (2012) performed an experiment on two groups of goats to check out the levels of different biochemical parameters during different stages of gestation period. Animals were given different dietary protein diet and one

group was exposed to pregnancy toxaemia (PT). The results collected showed animals exposed with PT have increased blood urea nitrogen as compared to other group. The author suggested that due increasing number fetus, size and growth of fetus there is increased demand of protein and amino acids. When the rate of synthesis is not up to optimal level than there is production of keton bodies which increase the level of urea in blood that can leads to mortality of animal.

Total Protein

Virmani *et al.,* (2011) conducted an experiment on Sahiwal cattle to determine the relation of different biochemical parameters and concentration of minerals in response to anoestrus. The animals were placed in to two groups, one group was treated with ovary synch protocol and other was given controlled internal drug released (CDIR). The results collected showed that animals in both groups showed higher level of total protein and albumin as compared to earlier treatment. The author suggested that this was due to hormonal balance as the animals were in anoestrus stage before the introduction of different hormonal therapy.

Karapehliven *et al.,* (2007) conducted an experiment on Tuj ewes to find out the values of biochemical parameter during different stages of lactation and dry period. The result suggested show that after kidding the concentration of blood plasma protein was lower, but in last three weeks of dry period the level of total protein increased. The author further concluded that after thirty days of lactation the concentration of total protein increased as compared to early lactation.

Albumin Protein

Albumin is a type of protein that is made by liver of animals and necessary for different fluid of body in bloodstream. It acts as carrier to transport different kind of fluid, hormone, vitamins, mineral and other substances from one part to other part of body . Decrease level indicates that renal or dysfunction of liver that can leads to accumulation of fluid in to cavities of body.

Antunovic *et al.,* (2017) performed an experiment on lactating goat and their kids to find out the concentration of different biochemical and hematological parameter. Blood samples were taken at different stages of life i.e. during early lactation and late lactation. Blood sample from kids were taken at twenty and fifty days. The results showed that level of albumin protein, triglycerides and other biochemical parameters increased during the early lactation. In kids the concentration of albumin and total serum protein showed significant difference. The gestation period moves toward end the level of serum protein (albumin) start to reach at normal level. During the early lactation the concentration albumin increase and at fourth week the concentration start to decrease again.

Triglyceride

Antunovi *et al.,* (2017) performed a study on dairy goats and their kids to find out the values of biochemical and acid base profile of animals. The blood

sample from goat was taken at different weeks of lactation and was analyzed for different biochemical parameters. The results obtained suggested that there was significant decreased in the concentration of triglycerides and blood glucoses level during the lactation. However, there was increase in cholesterol, protein, albumin and globulin.

Ali *et al.,* (2016) conducted an experiment a local sheep in India to find out the normal biochemical values at various physiological stages of animal. The result suggested that many factor affect the normal concentration of biochemical parameter including glucose, total protein, triglycerides, albumin, globulin and fibrinogen. The author declared that as the age of animal increases the concentration of triglyceride increases and also the level of triglycerides increases in female as compared to male. However, old studies suggested that there was no sex differentiation in case of triglycerides and cholesterol.

Piccione *et al.,* (2012) performed and experimental study on dairy cattle during late pregnancy, early lactation and dry period to check out the alteration in hematological and biochemical parameters. The animals were provided with nutritionally balanced ration throughout the experimental study. Blood samples were taken during late gestation period, early lactation and dry period. The result collected showed that level of triglyceride increases during late gestation period and mid lactation stage. The author thought that might be due to demand in energy to regulate the different physiological process in body i.e. milking, suckling as the author declared that during parturition and late pregnancy the metabolism of lipid increases which results in uplifting the level of triglyceride in body.

Animals were fed with nutritionally balance diet to meet up their physiological phases. The results collected showed that during late gestation period the level of blood serum lipids increases which decreases the concentration of triglycerides in blood. However, during early an late lactation the level of triglyceride increases. Similar results were also share that in mare during late gestation period the concentration of triglycerides decrease also share during early lactation in dairy cattle as the amount of energy is increased to meet up milk synthesis.

Animals were divided in to three groups according to stage of lactation and average milk production. The results collected showed that blood glucose, different minerals and liver enzymes have positive effect during different stages of lactation. The author stated that level of triglyceride was reduced during 2nd lactation and author suggested that this might be due to increased milk production. The effect of hot summer and nutrition on the biochemical profile of milking goat during mid lactation. Animals were divided in to three groups. Animals in control group were offered pasture fed grass second group was given concentrate ration and pasture grass and third group was offered hay along with concentrate. Blood samples were taken during mid lactation at 85 days of milking and were analyzed. The results collected showed that concentration of triglyceride increased during the mid lactation. They suggested that could be due to rectification of non esterified fattly acid (NEFA) that increases the level of triglycerides in blood.

Uric Acid

Antunovic *et al.,* (2011) conducted an experiment of ewes to check out values of liver enzymes and biochemical parameters during lactation. The animals were kept under observation and samples were taken 20, 40 and 60 day of lactation. All the animals were offered mixture of grain based diet along with hay. The results collected showed that with the advancement of lactation period the concentration of uric acid, protein and triglyceride increases as compare to early lactation.

Creatinine

Soares *et al.,* (2018) performed an experiment on dairy goat to find out the alternative adaption in blood biochemical parameter during last week of gestation and first week of lactation. Blood samples were taken at different days during transition period. The result collected showed that in late pregnancy period the concentration of creatinine increased in blood along with triglycerides. The author concluded that outcomes of that specific research can be used a tool to find out the pathological diseases in transition period.

Elzein *et al.,* (2016) conducted a study on goats to determine the effect of pregnancy and lactation biochemical and hematological profile. Animals were divided in to two groups; animals in control group were in cyclic stage but not pregnant but animal in second group were in gestation phase. The results collected showed that total protein, blood urea nitrogen, globulin concentration decreases in late gestation phase, while the level of creatinine and liver enzyme increases in this stage. However during the kidding and lactation total protein, blood urea nitrogen, globulin, creatinine and liver enzyme showed significant difference. The author declared that during gestation, kidding and lactation female goats under goes different physiological states and most of biochemical parameter are adopted by goat during these phases.

Santos *et al.,* (2012) conducted an experiment to check out the effect of supplementation of propylene glycol, cobalt and addition of vitamin B_{12} on biochemical profile and liver enzyme. The animals were divided in to three groups fed with three different dietary diets. The results collected showed that there was no significant effect on metabolic and biochemical profile of goats. The concentration of creatinine remained almost similar among all groups. However, highest value was calculated in control group fed with propylene glycol and vitamin B_{12}. The author suggested that no significant difference was due to mobilization of muscle protein which produce metabolize able energy during the early lactation.

Piccione *et al.,* (2012) performed an experimental study on dairy cattle to find out the changes in biochemical parameters during late gestation, early lactation, and end of lactation and during dry period. All animals were fed nutritionally balanced diet and were provided proper management throughout the experiment. The result collected showed that there was significant difference in creatinine, protein, blood urea nitrogen, and other minerals. The declared that during late gestation and early pregnancy there was increased concentration of

creatinine in blood. The author assumed that was due to organic waste of fetus that circulates during fetal maternal circulation By the increasing fetal size and growth in late gestation period increases the concentration of creatinine in maternal blood. The author further declared that process is very common in sheep and goat.

Similar results were shared by Antunovic *et al.,* (2011), as the author declared that biochemical and hormonal concentration changes during different physiological stages of life. The concentration of creatinine and liver enzyme increases during the transition period and first week of lactation, while serum protein and urea increase in early and mid lactation.

Waziri *et al.,* (2010) conducted an experiment to determine the alteration in biochemical, hematological and blood protein of goat during gestation period. Animals were divided in to two groups; animals in one group were in pregnancy phase and animals in other group were in cyclic phase. The results collected showed biochemical parameters including creatinine remained constant throughout the experiment. The author concluded that if the goats are given nutritionally balanced diet than biochemical parameter i.e. protein, fatty acids, liver enzymes and creatinine remained constant. Similar results declared that concentration of liver enzyme, creatinine, blood urea nitrogen and alkaline phosphate showed no significant difference among treated groups. The author concluded that during the trial the kidney and liver of treated animals were not affected clinically and were functioning normally.

Alanine transaminase (ALT) & Aspartate transaminase (AST)

Alanine transaminase (ALT) is enzyme found in kidney and liver, however the much smaller amount of it is present in other organ of body especially heart. The concentration of ALT in blood is normally low, but if there is damage to liver and kidney than the concentration of ALT increases. If animal is suffering from any pathological condition than the level of ALT increases in body. Aspartate transaminase (AST) that is present in smaller amount in muscles of body and act as an enzyme of liver in body. When there is damage to muscle or liver the level of AST increases immediately in blood. A higher level of these liver enzymes shows the damage of liver or manifests the chances of different viral diseases of liver.

Soares *et al.,* (2018) investigate the alteration in biochemical values of blood in milking goats during transition period. Animals were offered byproduct of sugar cane, green forage and mixture of grain based diet. The blood samples were taken during transition period. The results collected showed that concentration of AST changed and showed significant difference in early lactation as compared to pregnancy. The author suggested that these results can be used as an assisting tool for detection of changes during early lactation. The author further concluded that early lactation period is period of higher energy demand that increase the values AST in blood. As the peak lactation goes down the concentration of AST comes to normal level.

All animals were given nutritionally balanced diet to meet up their requirements during pregnancy, lambing and lactation. The results collected and showed that liver both liver enzymes tend to increase in concentration form fourth week gestation to until lambing; However, AST started to increase in 2nd week of gestation. The author suggested that it does not indicate the malfunctioning of liver rather it might be due the higher activity of muscles to produce energy and glucose during pregnancy to meet up the requirement of animal. As during gestation the process of gluconeogenesis increases as a result the values of AST and ALT increase. They suggested that might be due sever exercise of muscles to meet up demand of energy during racing and working.

Blood Cells Count

Significant alterations in WBCs, RBCs, and platelets were reported in goats at different age of lactation in both groups. The levels of eosinophils were extremely high. The values were reduced due to major consequences of feed and environment. The parasite cause severe anemia in grazing animals. These results were found similar as the study of Abid, (2016). Authors found an increase in blood count in both groups as the days passed. However there is major difference in both groups. As a result of comprehensive feeding plan of experimental groups, the animals gained.

SUMMARY, CONCULSION & RECOMMENDATION

Summary

Goats are always considered very valuable animals because of their better adjustability to indicate hilly areas, extreme weather conditions and increased breeding capability. Goats are among those animals that were domesticated by human about ten thousand years ago. Due to better adaption and their selective browsing ability they are found in almost every corner of the world. However, major population of goat is present in Asia especially subcontinent and Africa. In rural areas of Pakistan most of the farmers have limited or less than one acre land which are used for agriculture production and there is continuous feeding issue for small ruminants. Goats are given less importance as compared to other buffalo and cattle and are mostly fed on vegetable by products or rotten fruits and sometime are grazed along roadside herbs. Due to limited provision of protein and energy in feed goats are unable to attain their maximum growth potential. The conventional feed is mostly used by large ruminants. Therefore, non-conventional feed and feed byproducts are good option for small ruminants; as they not only provide ample amount of protein and energy but also decreases the chances of diseases.

During pregnancy, lactation, dry period and transition period small ruminants undergo serious physiological changes and different adaptations are taken by animals to maintain the concentration of biochemical and hematological parameters. Biochemical parameters such serum protein, fatty acids and urea nitrogen can provide complete assessment of animal health. Similarly, enzymatic activity including aspertate transaminase (AST), alanine transaminase (ALT) in blood plasma is important tool for determining the

malfunction of liver. Biochemical parameters are good indicators for any alteration in physiological and reproductive disorder of animals. The current study was performed to check the changes in biochemical values during different days of lactation. A total of 20 animals were selected and were placed in to two groups. Animal in control group were offered nutritionally balanced ration and animals in treated group were offered selected area for grazing. Animal were given 10 days to adopt the experimental diet and total duration of experiment was 70 days. Blood samples was done in both groups at 30, 50 and 70 days of milking to check the values of different biochemical parameters including blood cells(RBC, WBC & Platelets) blood glucose, total protein, albumin protein, triglyceride, blood urea nitrogen, uric acid, creatinine, alanine transaminase and aspertate transaminase. The data collected was analyzed through one way analysis of variance (ANOVA) and results were declared statistically significant $P<0.05$ using SPSS software. The results collectively showed except creatinine (P=0.177 vs 0.151) all other biochemical parameters showed no significant difference in both groups.

CONCLUSION

The present experiment highlights the importance of the biochemical parameter and hematological profile during the lactation period. Because these parameters can provide the assessment of animal health and inform the status of kidney and liver. In my research, the goats were divided into two groups, group A control group and the group B with open grazing. The study have three stages started from day 30,50,70 in which different parameter of hematological and biochemical profile were checked. The following important points were noted,

In control group (group A) Glucose level remain in normal range while in group B it gradually decreases. The reason behind this, in open grazing of Hilly areas there is un-balance diet with low calories. which leads to hypoglycemia .The total protein remain constant in group A, while it decreases gradually in group B as grazing on low protein shrubs. This low level of protein is not sufficient for metabolic and routine activity so animals become lethargic. As Glucose and Protein level decrease ALT and AST level increases ultimately . The normal function of liver and kidney become disturb. Waste products accumulation in body of animals that leads to ketosis and Mortality. The water supply of dam water with contaminated heavy metal effect the kidney of animals. All these combine reasons effected the group B animals and their raring could not be beneficial in Hilly areas. My observation prove that Nukri goat can be rare with control environment and it could be beneficial for farmer of this area.

RECOMMENDATIONS

1. A strategy may be devised for proper grazing in hilly areas to ensure balance diet with clean water .

2. A comprehensive measures should adopted for treatment of parasitic infection .

3. Genetic makeup this breed is not suitable for harsh climate , so proper goat form should

be establish for this beautiful breed .

4. **.** Livestock researcher should take interest in small ruminant to check out biochemical and hematological values during different stages of gestation and dry period .

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ANNEXTURE

ANOVA of mean blood glucose of Nukri goat given grain mix feed

Groups	Df	Sum of square	Mean square	F value	P value
Between groups	2	29.8	15.352	193.222	0.000
Within groups	17	1.21	0.003		
	19	31.01			

ANOVA of mean blood glucose of Nukri goat grazed on open grazin

Groups	Df	Sum of square	Mean square	F value	P value
Between groups	2	27.3	12.212	191.032	0.000
Within groups	17	0.43	0.001		
	19	27.73			

ANOVA of mean BUN (mg/dl) of Nukri given grain mix diet with alfalfa hay

Groups	Df	Sum of square	Mean square	F value	P value
Between groups	2	22.9	10.111	172.018	0.000
Within groups	17	0.31	0.005		
	19	23.21			

ANOVA of mean BUN (mg/dl) of Nukri goat grazed on open grazin

Groups	Df	Sum of square	Mean square	F value	P value
Between groups	2	24.3	14.582	187.012	0.002
Within groups	17	0.13	0.07		
	19	24.43			

ANOVA of mean total protein (g/l) of Nukri goat given grain mix diet with alfalfa hay

Groups	Df	Sum of square	Mean square	F value	P value
Between groups	2	20.2	19.036	122.021	0.000
Within groups	17	0.11	0.007		
	19	20.31			

ANOVA of mean total protein (g/l) of Nukri goat grazed on open grazin

Groups	Df	Sum of square	Mean square	F value	P value
Between groups	2	26.4	10.741	163.094	0.004
Within groups	17	0.22	0.01		
	19	24.43			

ANOVA of mean albumin (g/l) of Nukri goat given grain mix diet with alfalfa hay

Groups	Df	Sum of square	Mean square	F value	P value
Between groups	2	24.09	11.099	133.099	0.000
Within groups	17	2.045	0.1673		
	19	26.135			

ANOVA of mean albumin (g/l) of Nukri goat grazed on open grazin

Groups	Df	Sum of square	Mean square	F value	P value

Between groups	2	25.12	13.084	181.077	0.002
Within groups	17	1.11	0.1947		
	19	26.23			

ANOVA of mean triglycerides (mg/dl) of Nukri goat given grain mix diet with alfalfa hay

Groups	Df	Sum of square	Mean square	F value	P value
Between groups	2	0.55	0.354	2.221	0.000
Within groups	17	1.236	0.51		
	19	1.786			

ANOVA of mean triglycerides (mg/dl) of Nukri goat grazed on open grazin

Groups	Df	Sum of square	Mean square	F value	P value
Between groups	2	0.61	0.962	4.991	0.003
Within groups	17	1.793	0.32		
	19	2.403			

ANOVA of mean uric acid (µmol /l) of Nukri goat given grain mix diet with alfalfa hay

Groups	Df	Sum of square	Mean square	F value	P value
Between groups	2	239.142	135.372	33.44	0.000
Within groups	17	119.451	7.052		
	19	358.593			

ANOVA of mean uric acid (µmol /l) of Nukri goat grazed on open grazin

Groups	Df	Sum of square	Mean square	F value	P value
Between groups	2	242.691	139.55	35.76	0.004
Within groups	17	116.742	5.034		
	19	3359.433			

ANOVA of mean creatinien (µmol /l) of Nukri goat given grain mix diet with alfalfa hay

Groups	Df	Sum of square	Mean square	F value	P value

Between groups	2	0.912	0.309	3.039	0.177
Within groups	17	4.014	0.22		
	19	4.926			

ANOVA of mean creatinine (µmol /l) of Nukri goat grazed on open grazin

Groups	Df	Sum of square	Mean square	F value	P value
Between groups	2	0.729	0.402	4.091	0.151
Within groups	17	3.017	0.29		
	19	3359.433			

ANOVA of mean ALT (U /L) of Nukri goat given grain mix diet with alfalfa hay

Groups	Df	Sum of square	Mean square	F value	P value
Between groups	2	0.157	0.872	58.83	0.000
Within groups	17	0.24	0.007		
	19	0.397			

ANOVA of mean ALT (U/L) of Nukri goat grazed on open grazin

Groups	Df	Sum of square	Mean square	F value	P value
Between groups	2	0.447	0.366	51.21	0.005
Within groups	17	0.11	0.022		
	19	0.557			

ANOVA of mean AST (U /L) of Nukri goat given grain mix diet with alfalfa hay

Groups	Df	Sum of square	Mean square	F value	P value
Between groups	2	15.687	4.782	4.36	0.002
Within groups	17	30.341	3.939		
	19				

ANOVA of mean AST (U/L) of Nukri goat grazed on open grazin

Groups	Df	Sum of square	Mean square	F value	P value

Between groups	2	17.821	3.249	4.12	0.002
Within groups	17	27.413	2.681		
	19				