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EFFECTS OF GERMAN AND MAIZE GRASSES ON MILK AND BLOOD OF DAIRY COWS

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ABSTRACT

The objectives of this study were to determine carbohydrates such as glucose, total protein, lipid parameters, mineral levels in blood; qualitative characteristics such as fat, SNF, lactose, total solids and protein percentages of milk; and the quantity of milk after feeding german and maize fodders. Thirty clinically and apparently healthy cows were selected and divided into three homogenous groups. Control group was fed mixed grass, another group was fed german grass and the last one was fed maize grass. Milk and blood samples were collected from the cows (n-30) before the study commenced. Again milk and blood samples were collected on day 30 and day 60. After collection, milk samples were analyzed by Milk Analyzer MIA-SLP-60 for proximate components. Serum samples were analyzed by different colorimetric techniques using a spectrophotometer (Humalyzer 3000®) and kits from Randox (Ireland). In addition, daily milk production records of cows were maintained. The study found a significant rise of SNF and solids, a highly significant increase of lactose and protein in the maize feed group (M), and a highly significant positive change of fat percentage in the german fed (G) group. The average daily milk production of the M and G group were respectively 11.39% and 6.98% higher than the control group. No significant change was found in hematological and biochemical parameters of blood. Further intensive long term investigation to establish relation between blood parameters and milk yield and milk quality should be carried out.

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INTRODUCTION

Bangladesh, being located in a temperate and high humid region, is an agro based country where agriculture is the divine force of economy (Paul and Saadullah, 1991; Rahman, 2015). Livestock plays an important role in the agricultural production sphere. With the annual growth rate of 5.5%, the livestock sector covered 2.9% of the National GDP, moreover, the livelihood of about 20% population is directly connected with raising cattle and poultry (Banglapedia, 2021). However, there are few burning constraints to livestock development in developing countries. These are (a) the scarcity and fluctuating quantity and quality of available feed supply, (b) nutrient imbalance in many native pastures and (c) crop residues and/or lack of or limited usage of commercial concentrate feeds such as soybean, cottonseed and groundnut meals, etc. (FAO, 2012). Having fulfilled all other requirements such as proper management, accommodation, adequate amount of concentrates etc, the quality and quantity of milk depends on the fodders supplied to the animals (Collomb et al., 2004). Even the growth and maturity are highly influenced by the types of fodders (since the fodders are variable in nutritional value) fed to the animals (Bredon et al., 2009). The nutritive value of available fodders is variable across the country (Aregheore, 2004). Observation says that the quantity and quality of milk are directly related to the fodders fed to milking animals. The bioavailability of nutrients present in the fodders varies; thereby fodders with varied bioavailable nutrients affect the level of nutrition in blood which ultimately changes the quality and quantity of milk (Bhanderi et al., 2014). However, The Department of Livestock Service (DLS) of Bangladesh has introduced varieties of fodders namely german, napier, para, maize, sorghum to livestock sector with a view to provide nutrition to the animals keeping the concentrates minimum.

The established fact is that increased milk quality and quantity is directly related to good physiological standards of lactating animals (Sharif et al., 2017). Mixture of fodders, other than providing single random fodder has shown an incremental effect on milk yield and quality (Phipps et al., 1995). Feeding of maize fodder to lactating cows' increases digestibility of nutrients and milk production as well as milk quality (Naik et al., 2014). Again, on feeding of maize or other high quality fodders, milk yield and milk fat yield vary with chop length of fodders (Tayyab et al., 2018). At the same time cumulative effect of improved pasture nutritive value and increased pasture Dry Matter (DM) intake raise milk production and milk solids production (Roca-Fernandez et al., 2016). Excess intake roughages containing crude protein, associated with higher serum urea levels and low energy intake, associated with poor body condition, are the key factors for low reproductive efficiency which ultimately affects milk production (Kaim et al., 1983).

The changes in biochemical parameters in milk and hematological constituents are important indicators of the health and production state of animals (Siddiqe et al., 2015; Radkowska and Herbut, 2014). Depending on types of fodders fed to animals' red blood cells, haemoglobin and haematocrit concentration, neutrophil, platelet, monocyte, white blood cell and total lymphocyte count have shown significant variations (increases or decrease from the standard value) (Ramirez-Restrepo et al., 2010). Blood parameters displayed significant changes in animals grazed in pasture containing different fodders for glucose, albumin, total protein, urea, triglycerides, total and HDL cholesterol, NEFA, sodium and potassium and magnesium (Casamassima et al., 2007). Milk parameters originate from blood and food components, therefore certain parameters like blood urea nitrogen and serum protein affecting milk urea nitrogen and milk protein respectively, indicate milk yield and quality (Casamassima et al., 2007).

Good numbers of research have taken place to detect the effects of fodders on blood parameters, some of them were aimed to find out the effects of fodders from varied pastures containing variable plant nutrition on milk and blood. Likewise many researches took place so far. But a comparative study to show effects of different fodders on blood, milk yield and quality has not yet been listed. Therefore, this research work was carried out to find out the effects of feeding fodders like maize, german and mixtures of para, oats, straw and kaon on crossbred dairy cattle at various lactation stages and parity. Different blood and milk parameters were determined and compared at different stages of the research. The comparative result was used to find recommendations for a fodder to be fed to animals to get maximum quality of milk yield in addition to standard concentrate supply.

MATERIAL AND METHODS

The study was conducted in a government dairy farm (Military Farm) in Trishal for sampling from crossbred dairy cows. This farm has about 450 cattle out of which 125 are lactating and 90 are dry cows. A total of 30 cross breed dairy cattle were included in this study. All these animals, which were in lactation period, were selected randomly.

Selection of cows

There are about 450 cattle in the farm, among them 125 are lactating cows. A total of 30 crossbred of Holstein-Frisian (HF) cows were selected for the study so that a sustainable result is obtained.

Experimental grouping of cows

Out of 30 cows 21 were in 3rd and 09 were in 2nd parity. Out of 21 cows of 3rd parity 13 were in early and 8 were in late lactation stage. Again, out of 09 cows of 2nd parity 03 were in early and 06 were in late lactation stage. Total 03 groups were prepared out of 30 cows. While forming the control group 07 cows were taken from 3rd parity out of which 03 were in early and 04 were in late lactation stage; 03 cows from 2nd parity out of which 01 was in early and 02 were in late lactation stage. The first experiment group contained 07 cows of 3rd parity out of which 03 were in early and 04 were in late lactation stage; 03 cows from 2nd parity – 01 was in early and 02 were in late lactation stage. The second experiment group contained 07 cows of 3rd parity and all of them were in early lactation stage; 03 cows from 2nd parity – 01 was in early and 02 were in late lactation stage. First, second and third groups were fed a mixture of different grasses, german grass and maize grass respectively.

Time of collection of sample

Blood and milk samples were collected on day 0, day 30 and day 60 for subsequent analysis the blood samples were collected within 1200 to 1230 on mentioned days. Milk samples were collected at 1000 and 1800 each day. The said intervals were taken so that changes in blood and milk for feeding of different fodders can be analyzed clearly.

Collection and processing of samples

Blood samples were collected from jugular vein in two separate vacutainers, one having anticoagulant (Na2- EDTA, BD Vacutainer®, BD Franklin lakes, NU, USA.) and other without anticoagulant (for serum collection) and stored at ice box and brought to the laboratory within 16-18 hours of collection. The serum was separated from blood without anticoagulant using centrifuge machine at 3000 RPM for 15 min and transfer immediately in Eppendorf tube (Axygen, USA), marked with specific identification mark mentioning respective date of collection and stored at −20ºC until further analysis.

Serum biochemical analysis

The following biochemical parameters were measured by different colorimetric techniques using a spectrophotometer (Human analyzer 3000®) and kits from Randox (Ireland). According to the manufacturer instructions, glucose, total protein, lipid parameters such as triglyceride and cholesterol, mineral levels such as calcium, phosphorus and magnesium were measured.

Following were the condition for the analysis of Glucose, Triglyceride (TG), Cholesterol, and Total Protein (TP):

Wavelength: 500-600 nm; (different parameters)
Cuvette: 1 cm path length
Temperature: 15-25^{O}C or 37^{O}C
Measurement: Against reagent blank

Sample was prepared according to the protocol provided with commercially available kit (Randox, Ireland) and incubated as per protocol. Run through Human analyzer 3000® and record the displayed result for individual parameters. Results were expressed in mg/dl.

Mineral level such as Calcium (Ca), Phosphorus (P) and Magnesium (Mg) were analyzed with following conditions:

Wavelength: 500-540 nm
Cuvette: 1 cm light path
Temperature: 25^{O}C, 30^{O}C, 37^{O}C
Measurement: Against Reagent Blank

Sample was prepared according to the protocol of commercially available kits (Linear, Spain). Run through Human analyzer 3000® and record displayed results for individual parameters. No need for external incubation, it was done within a machine. Results were expressed in mg/dl.

Collection of milk sample and data

The cows are milked twice daily, therefore, at evening milk of both times was mixed properly by the use of milk stirrer and 250 ml milk was taken in an plastic jar. The collected samples were cooled in reefer containers, stored in ice boxes and were sent to the dairy laboratory within 4-6 hours for further analysis.

Milk Analysis

According to manufacturer instructions, lactose and fat percentage, solid nonfat (SNF), DM and mineral level such as calcium, phosphorus, magnesium of milk were measured by Milk Analyzer MIA-SLP-60 (made by Medical Research Council, England; model 01-11.12). The cold milk samples were let to warm up to room temperature. 50 ml of milk was taken to the sample holder. The output pipe was dripped in to the sample holder containing milk. After starting the analyzer options came and COW option was selected. Data was recorded and printed. After analysis of each sample the analyzer was cleaned with 3% NaOH solution followed by water. Results were expressed in percentage (%). Measuring Range were: fat - from 0.01% to 25%; SNF - from 3% to 15%; Density - from 1015 to 10 40 kg/m^3; Proteins - from 2% to 7%; Lactose - from 0.01 % to 6 %; Water content - from 0 % to 70 %; Temperature of milk - from 1^{O}C to 40^{O}C; Freezing point - from – 0,400^{O}C to – 0,700^{O}C; Salts - from 0, 4 to 1,5%; PH - from 0 to 14; Conductivity – from 3 to 14[mS/cm]; and Total Solids - from 0 to 50 %

Statistical analysis

Collected data were recorded into MS Excel-2010, sorted out and entered into the Statistical Package for Social Sciences version 20 (SPSS Inc., Chicago, IL). Results are presented as percentage, means ± SDs, unless stated otherwise. Student's t-test, linear correlation and multiple regressions were performed and p value differences of < 0.05 were considered as statistically significant.

RESULTS

Fat, SNF, Lactose, Total Solids and Protein Percentages in Three Different Groups of Dairy Cows

The milk components analysis result (fat, SNF, lactose, total solids and protein) following different stages of the milking period is shown in Table 1.

Table 1. Comparative assessment of fat, snf, lactose, total solids and protein percentages in three different groups

Day	Groups	Milk Analysis Report (g/100g)				
		Fat	**SNF**	**Lactose**	**Solids**	**Protein**
Day 0	Group C	4.96±0.13	8.03±0.04	4.42±0.07	0.65±0.01	2.92±0.02
	Group G	4.35±0.07	8.02±0.05	4.41±0.05	0.65±0.01	2.91±0.04
	Group M	5.26±0.11	8.04±0.02	4.41±0.13	0.65±0.02	2.90±0.05
Day 30	Group C	5.28±0.24	8.05±0.09	4.48±0.06	0.65±0.01	2.91±0.03
	Group G	5.05±0.23	8.34±0.08	4.45±0.05	0.68±0.01	3.05±0.07
	Group M	5.44±0.28	8.43±0.23	4.61±0.06	0.70±0.02*	3.07±0.06
Day 60	Group C	5.30±0.20	8.19±0.09	4.60±0.10	0.65±0.01	2.92±0.09
	Group G	5.76±0.27**	8.41±0.17	4.57±0.10	0.71±0.03	3.07±0.04
	Group M	5.92±0.21	8.66±0.13*	4.71±0.09**	0.71±0.01*	3.20±0.06**

Group C: Fed with mixture of grasses (control group); Group G: Fed with german grass; Group: Fed with maize grass; SNF: Solid nonfat; * significantly differ within the group; ** highly significant within the group

Assessment of milk production in three different groups of dairy cows

Table 2 shows the daily average milk production for each group of animals. The lowest average milk production was observed before the experiment commenced. Highest average milk productions were 9.05 liters, 9.64 liters and 10.10 liters in group C, G and M respectively at 11th, 39th and 47th day of the study (Fig. 1).

Table 2. Comparative assessment of milk production in three different groups of dairy cows

Groups	Milk Production Report (liter)											
	1D	**2D**	**3D**	**4D**	**5D**	**6D**	**7D**	**8D**	**9D**	**10D**	11D	12D
Group C	8.11	8.39	8.41	8.50	8.59	8.78	8.80	8.87	8.93	8.99	9.05	9.00
Group G	8.40	8.45	8.46	8.44	8.52	8.61	8.57	8.66	8.79	8.80	8.78	8.87
Group M	9.03	9.05	9.09	9.08	9.17	9.18	9.22	9.21	9.24	9.23	9.28	9.33
	13D	**14D**	**15D**	**16D**	**17D**	**18D**	**19D**	**20D**	**21D**	**22D**	**23D**	**24D**
Group C	8.93	8.91	8.87	8.71	8.76	8.73	8.81	8.79	8.75	8.69	8.74	8.73
Group G	8.89	9.01	8.95	9.12	8.91	9.06	9.14	9.22	9.29	9.18	9.21	9.28
Group M	9.35	9.38	9.36	9.38	9.39	9.45	9.44	9.42	9.44	9.48	9.47	9.49
	25D	**26D**	**27D**	**28D**	**29D**	**30D**	**31D**	**32D**	**33D**	**34D**	**35D**	**36D**
Group C	8.68	8.68	8.69	8.66	8.65	8.61	8.63	8.93	8.58	8.48	8.49	8.51
Group G	9.23	9.27	9.36	9.35	9.34	9.36	9.44	9.51	9.48	9.49	9.51	9.42
Group M	9.59	9.50	9.53	9.50	9.54	9.54	9.65	9.58	9.54	9.60	9.66	9.69
	37D	**38D**	**39D**	**40D**	**41D**	**42D**	**43D**	**44D**	**45D**	**46D**	**47D**	**48D**
Group C	8.57	8.55	8.54	8.59	8.58	8.63	8.56	8.54	8.55	8.58	8.49	8.47
Group G	9.47	9.62	9.64	9.59	9.51	9.57	9.50	9.59	9.52	9.49	9.55	9.59
Group M	9.73	9.75	9.77	9.79	9.88	9.86	9.88	9.93	9.98	9.99	10.10	10.06
	49D	**50D**	**51D**	**52D**	**53D**	**54D**	**55D**	**56D**	**57D**	**58D**	**59D**	**60D**
Group C	8.49	8.49	8.52	8.44	8.49	8.42	8.45	8.43	8.44	8.41	8.39	8.41
Group G	9.52	9.45	9.53	9.54	9.48	9.42	9.39	9.41	9.36	9.44	9.47	9.54
Group M	9.96	9.92	9.94	10.09	9.99	9.95	9.98	9.99	9.97	9.95	9.88	9.91

Group C: Fed with mixture of grasses (control group); Group G: Fed with german grass; Group: Fed with maize grass

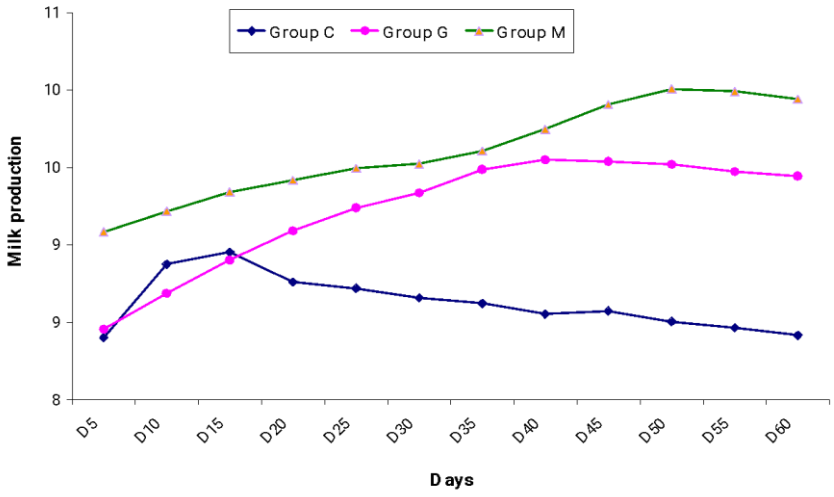

Figure 1. Daily Average Milk Production in Three Different Groups

Average Milk Production in Three Different Groups of Dairy Cows

The comparative Assessment of average milk production in three different groups of dairy cows were made and it was found that the highest average milk production during 60 days study was found in Group M (9.606) which is 11.39% higher than that of Group C. Average daily milk production in Group G (9.226) was found 6.98% higher than that of Group C. The average daily milk production in Group M increased significantly ($p<0.001$).

Total Milk Production in Three Different Groups of Dairy Cows

A comparative assessment of the total milk production in three different groups were also done. Highest milk production during the 60 days study was found in the maize grass fed group (5,763.30 liters) which is 588.7 liters higher than that of the control group (5,174.60 litres). Milk production in german fed group was 5,535.60 liters which is 361.00 liters higher than that of control group

Chloride, Calcium, Phosphorus and Magnesium Levels in Blood Serum

The blood biochemical profile (chloride, calcium, phosphorus and magnesium) at three different stages of experiment is shown in Table 3. A non-pattern increase and decrease in said parameters were found.

Table 3. Comparative assessment of chloride, calcium, phosphorus and magnesium levels in blood sera

Day	Groups	Mean			
		CL (mg/dl)	CAL (mg/dl)	P (mg/dl)	MG (mg/dl)
Day 0	Group C	139.13	8.32	7.83	3.00
	Group G	120.21	8.50	6.41	3.42
	Group M	144.44	8.36	6.05	2.81
Day 30	Group C	109.73	10.75	3.35	1.36
	Group G	137.83	10.84	4.41	1.34
	Group M	132.97	11.58	4.95	1.67
Day 60	Group C	140.14	9.51	8.55	3.57
	Group G	115.43	10.31	7.89	3.92
	Group M	136.70	10.22	8.53	3.75

Group C: Fed with mixture of grasses such as para, kaon, german, maize etc. (control group); Group G: Fed with german grass; Group: Fed with maize grass; CL: Chloride; CAL: Calcium; P: Phosphorous; MG: Magnesium

Glucose, triglycerides and total protein levels in blood serum of three different groups of dairy cows

The blood biochemical profile (glucose, triglycerides and total protein) at three different stages of experiment is shown in Table 4. A non-pattern increase and decrease in said parameters were found.

Table 4. Comparative assessment of glucose, triglycerides and total protein levels in blood sera

Day	Groups	Mean values		
		Glucose (mg/dl)	Triglycerides (mg/dl)	Total protein (mg/L)
Day 0	Group C (Fed with mixture of grasses; Control)	46.54	55.87	8.82
	Group G (Fed with german grass)	56.37	57.12	8.67
	Group M (Fed with maize grass)	58.17	43.65	8.42
Day 30	Group C (Fed with mixture of grasses; Control)	31.33	39.85	6.93
	Group G (Fed with german grass)	33.09	22.74	7.66
	Group M (Fed with maize grass)	31.67	13.65	7.02
Day 60	Group C (Fed with mixture of grasses; Control)	52.88	67.41	5.79
	Group G (Fed with german grass)	61.38	50.81	6.43
	Group M (Fed with maize grass)	57.30	51.25	6.82

Assessment of Blood Cells in Three Different Groups of Dairy Cows

Table 5 shows the results of blood cell count along with other parameters of blood at three different stages of experiment. A non-pattern change is revealed here.

Table 5. Comparative assessment of blood cells in three different groups of dairy cows

Day	Groups	Mean									
		WBC*	RBC*	HB (g/dl)	PCV (%)	ESR (mm/hr)	L (%)	N (%)	E (%)	M (%)	B (%)
Day 0	Group C	10.07	5.72	7.56	25.51	0.00	41.00	49.50	3.50	4.50	0.00
	Group G	9.15	5.03	7.06	23.90	0.00	46.10	44.80	4.60	4.50	0.00
	Group M	12.38	5.95	8.38	28.47	0.00	47.60	44.30	3.30	3.80	0.00
Day 30	Group C	6.32	6.78	9.67	32.27	0.00	60.40	34.20	2.90	2.50	0.00
	Group G	5.88	7.07	9.66	32.26	0.00	53.33	38.67	3.33	4.67	0.00
	Group M	8.76	6.59	9.22	32.14	0.00	47.80	42.90	4.90	4.70	0.00
Day 60	Group C	15.06	8.22	12.31	41.40	0.00	29.80	62.60	4.50	3.10	0.00
	Group G	13.85	11.21	15.92	52.82	0.00	24.30	63.30	7.40	5.00	0.00
	Group M	9.63	7.23	10.10	34.85	0.00	49.80	43.10	4.20	2.90	0.00

Group C: Fed with mixture of grasses such as para, kaon, german, maize grass etc. (control group); Group G: Fed with german grass; Group: Fed with maize grass; WBC*: x1000; RBC*: $x10^6/mm^3$; WBC: White Blood Cells; RBC: Red Blood Cells; HB: Hemoglobin; PCV: Packed Cell Volume; ESR: Erythrocyte Sedimentation Rate; L: Lymphocyte; N: Neutrophil; E: Eosinophil; M: Monocyte; B: Basophil

DISCUSSION

Milk Composition

Generally cow milk contains 3.9g/100g fat, 8.5g/100g SNF, 0.7 g/100g solids, 3.2g/100g protein and 4.6g/100g lactose (Jenness, 1988). Our result suggested that maize grass fed groups of cows produced milk with more fat value, highest at day 30 and day 60 of the study (5.44±0.28g/100g and 5.92±0.21g/100g fat respectively). Similarly, this group of cows yielded milk with highest amount of SNF (Solid Nonfat), lactose, solids and protein at day 30 and day 60 which are as SNF 8.43±0.23g/100g and 8.66±0.13 g/100g, lactose 4.61±0.06g/100g and 4.71±0.09g/100g, solids 0.70±0.02g/100g and 0.71±0.01g/100g and protein 3.07±0.06g/100g and 3.20±0.06g/100g respectively. German grass fed group scored the second highest at day 30 in terms of SNF (8.34±0.08g/100g), solids (0.68±0.01g/100g), protein (3.05±0.07g/100g) amount and at day 60 in terms of SNF (8.41±0.17g/100g), protein (3.07±0.04g/100g) amount. This group scored highest in solids amount (0.71±0.03g/100g) at day 60.

The nutritive evaluation of 100g maize fodder reveals 20.55g dry matter, 8.46g crude protein (CP), crude fiber (CF) 24.8g, minerals 8.4g and 100g german fodder reveals 21.6g dry matter, 7.5g crude protein, crude fiber 38.0g, minerals 11.1g (Kanak et al., 2012; Bakshi et al., 2017). Maize being rich in crude protein (CP) but less in crude fiber (CF) is responsible for higher absorption of amino acids in the gut and thereby milk with high protein value in maize grass fed cows (Naik et al., 2014). Because of the increased availability of protein, more amino acids on reaching the small intestine causes higher availability which result in higher absorption of amino acids from the small intestine (Stern et al., 1985).

A comparative study conducted by Dewhurst et al. (2001) in the UK found lesser concentration of volatile fatty acids (VFA) (butyric acid) in grass silage than corn silage (Dewhurst et al., 2001). The corn silage had a higher DM (37.5 vs. 30.5%) and starch (35.7 vs. 30.1% of DM) concentrations, and the silage was more extensively fermented (pH 3.83 vs. 3.51; lactic acid: 4.0 vs. 7.9% of DM). Diet with a higher amount of desired VFA increases milk fat content. A study conducted by Dijkstra (1994) on production and absorption of volatile fatty acids in the rumen shows that absorption of VFA from rumen increases with its concentration Dijkstra (1994). Latham et al. (1974) conducted a study on Fermentation and Microorganisms in the Rumen and the Content of Fat in the Milk of Cows Given Low Roughage Rations and established positive relation between VFA concentration and milk fat production (Latham et al., 1974).

McCullough (1966) analyzed the information from 34 feeding trials (animals supplied with different amount of volatile fatty acids) on fat content of milk before and during the trials, the molar proportions of acetic, propionic and butyric acids in the rumen, and intakes of feed and found significant difference in fat content of milk (Dewhurst. 2013). Our study is completely consistent with Dewhurst et al. (2001) and McCullough (1966) being able to find high fat and protein content in maize (corn) grass fed groups. As per Naik et al. (2014) and Dewhurst (2013) german grass being rich in crude protein increases milk quality. The diets with maize silage had higher milk protein concentrations than the diet with grass silage (Dewhurst, 2013). O'Maraa et al. (1998) illustrated that maximum milk protein concentration (31.6 g/kg) and yield of fat and protein (1.59 kg/d) were achieved on the mixed forage diet containing 67% maize silage. Phipps et al. (1988) and Phipps et al. (1995) have all reported increased milk protein and fat concentration when grass silage was replaced by maize silage. Khan et al. (2015) found, on average, the inclusion of maize silage in grass silage-based diets improved the milk protein content by 0.12g/100g.

Milk Production

Significant variation ($p<0.001$) in the daily average milk production in three different groups was found in our study where daily average milk productions were 8.624 liter in control, 9.226 liter in german grass fed and 9.606 liter in maize grass fed group. Along with higher nutritive value maize fodder is highly digestible (Chaudhury et al., 2014) which in turn results in greater absorption in the intestine. Higher nutrition in blood results in increased milk yield. This result is consistent with the findings of Naik et al. (2014) who got 13.7% increase in the milk yield of fresh hydroponics maize fodder (4.64, kg/d) than the conventional Napier Bajra Hybrid (NBH) green fodder group (4.08 kg/d) (Dewhurst, 2013). Wohlt et al. (1978) illustrated diets containing higher crude protein with low soluble nitrogen yields of milk, protein, and nonfat solids increased. In our study, high crude protein in german grass (7.5g/100g) and maize grass (8.46g/100g) may be responsible for increased milk yield in the concerned group. Phipps et al. (1995) has reported, when grass silage was replaced by maize silage, increased milk yield of cows 0·88 kg/day. Study conducted by Dewhurst (2013) described the prominence of maize silage over other fodder silage in milk yield. Schmidely et al. (2005) found that inclusion of DM in diet increases milk and fat yield in dairy cows and goats. Our study with maize and german grass, being high in DM (maize grass 20.55g/100g and german grass 21.6g/100g), revealed the same as Schmidely et al. (2005).

Hematological and Biochemical Parameters of Blood

Generally the cow blood contains 4-12(x1000) WBC, 5-10x106mm3 RBC, 8-15 g/dl Hb, 40-70% lymphocyte, 1-6% monocyte, 40-75% neutrophil, 0-4% eosinophil and 0-2% basophil with 24-48% PCV (RAR, 2009; Manual, 2012). Our findings are consistent with the reference value. Different feed formulation, specially the grass on feed has little impact on hemato-biochemical properties in different stages of lactation period. Same way, in our study no significant variation in biochemical parameters was found. All cows were in good health in the study period and we did not observe any physiological abnormalities all through this. But after a study in cattle, sheep and red Sokoto goats Etim et al. (2014) concluded there is great variation in the hematological parameters between breeds, ages, sexes, management systems among others in farm animals and again we didn't have breed or sex or management system variation and all of the animals were in almost same age range. He finally opined to establish appropriate physiological baseline values for livestock which could help in realistic evaluation of the management practice, nutrition, diagnosis of health as well as in determining the physiological status of farm animals. Moreover, it is important to establish a baseline indices for hematological parameters on the basis of the factors studied and also carry out further studies to determine the effects of these factors on these indices (Etim et al., 2014).

A study on determining reference limits for metabolic profiles in Holstein late-pregnant heifers and dry cows considering the effects of parity, days relative to calving, and season; Brscic et al. (2015) illustrated that the class of days relative to calving had a significant effect on the concentrations of total protein, globulins, fatty acids, cholesterol, total bilirubin, and sodium. Season affected plasma concentrations of creatinine, glucose, fatty acids, lactate dehydrogenase, and sodium. Interactions between parity and class of days relative to calving and between parity and season did not significantly affect any of the blood analytes tested. Coroian et al. (2017) found the number of lactations and lactation rank had influenced blood biochemical and hematological parameters in dairy cows. Biochemical parameters are influenced by postpartum day, showing the lowest values in the early days of the colostral period and the highest in the last few days of the same period. The lactation rank and parity were not considered during the current study.[35] Study conducted on cows with different management systems by Radkowska and Herbut (2014) found significant differences in blood parameters. Our study was conducted under the same management system. Therefore, our result is consistent with Coroian et al. (2017) and Radkowska and Herbut (2014).

CONCLUSIONS

The present study found different milk yield in crossbred Holstein Friesian with different grass including german, maize and mixed grasses. Milk qualities increased highly in the maize grass fed group and moderately in the german grass fed group. Significant ($p<0.001$) increase of daily milk yield took place in maize grass fed groups. No significant changes in hematology and serum chemistry properties of three different groups were revealed. But those parameters were within reference value of dairy cows; therefore those findings of this study may serve as reference values in which alteration due to metabolic, nutrient deficiency, physiological and health status can be compared for diagnostic and therapeutic purposes in crossbred Holstein Friesian dairy cows. Further intensive long term investigation to establish relation between blood parameters and milk yield and milk quality should be carried out.

COMPETING INTEREST

The authors declare that they have no competing interests.

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