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Effects of Different Diets on Live Weight, Body Condition Score and Hematological Parameters of Calves Under Intensive Farming System

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Abstract **– The comprehensive study observed the effects of nutrition on live weight, Body Condition Score (BCS) and hematological parameters of calves under intensive farming system in Sylhet sub-district, Sylhet, Bangladesh. A total number of 45 crossbred (with Holstein Friesian) calves of 3 to 9 weeks of age were selected and divided into three equal groups as two treatment groups (T_1 and T_2) and one control group (T_0); where each group comprised of 15 calves. Calves of treatment group T_1 were kept under standard feeding practice, calves of treatment group T_2 were kept under commercial calf starter ration (Bovino Calf Starter® marketed by ACI Godrej Agrovet Private Limited) with normal diets and calves of control group T_0 were kept under traditional feeding practice for 02 months. Live weight and body condition score were measured at day 0, day 30 and day 60; whereas blood samples were collected for measuring hematological parameters at day 0 and day 60 of experiment. Live weight and BCS of all treated groups were increased significantly ($p<0.01$) than the control group. At the day 60 of experiment, the highest live weight and BCS were recorded in the treated group T_2 (69.00kg and 8.0) and the lowest were recorded in the control group (60.00kg and 5.0). Hematological parameters such as TEC, Hb and PCV were increased significantly ($p>0.01$) and the ESR level was decreased significantly ($p>0.01$) in the calves of treated groups (T_1 and T_2) than the control group. At the day 60 of experiment, the highest TEC (million/mm^3), Hb (gm%) and PCV (%) were recorded in the Bovino Calf Starter® treated groups - T_2 (5.21±0.16, 8.4±0.11 and 25.44±0.16 respectively) and the lowest value in the control group (4.34±0.13, 7.01±0.1and 23.54±0.14 respectively); whereas the ESR (mm in 1st hour) was highest in the control group (3.21±0.14) and lowest in Bovino Calf Starter® treated groups - T_2 (2.11±0.18). In conclusion, providing the balanced diet to the calves are highly beneficial for body weight gain, improvement of BCS and also beneficial for better health conditions in aspect of hematological parameters.**

Keywords **– Body Condition Score, Calves, Different Diets, Hematological Parameters, Intensive Farming System and Live Weight.**

I. INTRODUCTION

Bangladesh is an agro-based developing country where livestock contribute 1.66% of total GDP [1]. Cattle is one of the most important sectors which playing a vital role in the support of national economy by providing a large part of increasing demand for animal protein, side by side it is the source of income and can create employment opportunities for the people in the shortest possible time. There is a great possibility of growth and expansion of the dairy and fattening sector both at domestic and commercial level.

Calves of a farm are the future asset for it. In a dairy farm it is wise to replace the low performing cows with promising new heifers from the same farm rather to buying new milking animals. It will be cost efficient and the adaptability of the heifer will be excellent comparing to new stock introduced in farm as well. More over the pedigree analysis is possible if the farm rises from its own population of cattle. If we wish to make a population of maximum productivity there is no alternative to rear genetically improved calves in the scientific manner. In most cases farmer of Bangladesh inseminate their cows with the semen of high yielding variety (HYV) bull. Thus, they got genetically improved calves but due to lack of knowledge about rearing them especially about the balanced ration are to be supplied to them, a large number of calves cannot survive and those who survive cannot yield the maximum level of production as they suffer from severe malnutrition. If we consider the aspect of a dairy farm we can realize the importance of the good quality calves. The female calves of better genetic background are used for the replacement of low performing cows, again the male calves are sold out and a good number of profits are obtained from this selling of calves. So two things – selling of milk and selling of animals are the main income generating source of a dairy farm. It is also true for the fattening or beef producing farms. It is very essential to buildup awareness among the farmers of Bangladesh about the importance of good quality calves for their economic benefits. There is a high mortality of cross-breed calves in Bangladesh only due to negligence and lack of technical knowledge about the ration and management of calves. The traditional method of ration formulation cannot fulfill the maintenance and growth requirement of the calves as a result the weight gain is not in the desired level in our native farms. So we can prove it by supplying standard ration and traditional ration to the calves of similar management practice. Again another parameter of calf performance is body condition score (BCS), can be a tool to differentiate the competency of different diet. The hematological parameters as Total Erythrocyte Count

(TEC), Packed Cell Volume (PCV), Erythrocyte Sedimentation Rate (ESR) and Blood Hemoglobin level (Hb) are the tools to measure the internal physiological differences of the calves under different diets.

Considering the above facts the research work was undertaken to determine the effects of different diets on live weight, Body Condition Score (BCS) and hematological parameters such as Total Erythrocyte Count (TEC), Packed Cell Volume (PCV), Hemoglobin (Hb) concentration and Erythrocyte Sedimentation Rate (ESR) in calves.

II. Materials and Methods

The experiment was carried out to investigate the effect of nutrition on live weight, BCS and some hematological parameters of calves under intensive farming system.

A. Study Duration and Area

The present study was conducted during the period from March to May 2015 in Sylhet sadar sub-district (located at 24.8917°N 91.8833°E with an elevation of 35 meter from sea level), the north eastern part of Bangladesh. Three dairy farms such as Uttara Dairy Farm at Mejortilla, Tashfia Dairy Farm at Akhalia and Sonargaon Dairy Farm at South Surma of Sylhet were selected for the experimental study. All the farms are near to each other under the same climatic condition and demographic location. Laboratory tests were conducted at the laboratory of the Department of Physiology, Sylhet Agricultural University, Sylhet, Bangladesh.

B. Experimental Animals and Design

A total number of 45 crossbred (with Holstein Friesian) calves were selected from the above mentioned farms in the study areas which were reared under intensive farming system. All the 45 calves were 3 to 9 weeks of age, which were tagged with a specific ID number and divided into three equal groups. 15 calves were selected from Sonargaon Dairy Farm constitute treatment group 1 (T_1), 15 calves were selected from Uttara Dairy Farm constitute treatment group 2 (T_2) and 15 calves were selected from Tashfia Dairy Farm remains as control group (T_0). Calves of Treatment Group T_1 were kept under standard feeding practice [2], calves of Treatment Group T_2 were kept under commercial calf starter ration (Bovino Calf Starter® marketed by ACI Godrej Agrovet Private Limited, Bangladesh) with normal diets and calves of control group T_0 were kept under traditional feeding practice for 02 months. Live weight and BCS were measured at day 0, day 30 and day 60; whereas blood samples were collected for measuring hematological parameters at day 0 and day 60 of experiment.

C. Experimental Diets

A concentrate mixture for balanced ration was given daily to all the calves of all groups as mentioned in Table 1 and Table 2. Besides the concentrate mixture all the calves were fed with milk, green grass, rice straw and adlibitum fresh drinking water as following as Table 3.

Table 1. Concentrate mixture used in the experiment

Experimental groups	Concentrate mixture		Source
	Feed ingredients	Composition	
Control group (T_0)	Broken rice	34%	Traditional method
	Wheat bran	66%	
Treatment group (T_1)	Ground maize	40%	Banerjee (2005a)
	Wheat bran	40%	
	Linseed meal	20%	
Treatment group (T_2)	Bovino Calf Starter®		ACI Godrej Agrovet Private Limited

Table 2. Nutritional value of concentrate mixture for control and treatment groups

Groups	Ingredients	Nutritional value					
		Crude protein %	Crude fiber %	Ether extract %	Calcium	Phosphorus	Total digestible nutrient (%)
T_0*	Broken rice	7.7	10	2	-	-	65
	Wheat bran	15.41	10.76	3.45	0.18	0.82	74.93
	Average	12.84	10.507	2.9667	0.12	0.5467	71.62
T_1*	Ground maize	10.6	2.2	3.3	-	-	76
	Wheat bran	15.41	10.76	3.45	0.18	0.82	74.93
	Linseed meal	30.51	9.48	6.57	0.37	0.96	70.70
	Average	16.506	7.08	4.014	0.146	0.52	74.512
T_2**	Bovino Calf Starter®	22	8	2.5-3.0	1	0.5	65

Source: * [3], ** Brochure of Bovino Calf Starter [4].

Table 3. Feeding chart followed for the control and treatment groups

Age (week)	Milk (liter)	Concentrate (gram)	Green grass and or rice straw
1	3-4	0	0
2	3-4	0	0
3	2.5-3.5	50	300
4	3	300	500
5	2.5	400	550
6	2.5	600	600
7	2	700	700
8	1	800	800
9	1	1000	1000
10	0	1200	1100
11	0	1300	1200
12	0	1400	1400
13	0	1700	1900

Source: Brochure of Bovino Calf Starter [4].

D. Measurement of Live Weight of the Animals

Live weight of the animals was measured with a spring balance (50 kg capacity) and with measuring tape. Initially, when the live weight was low, it was measured by spring balance and when the weight seams more it was measured by measuring tape with the following formula.

Live weight in kg = $\frac{L \times G^2}{300}$ x 2.2; where, L = length from shoulder to the pin bone in inch and G = hearth girth in inch.

E. Measurement of Body Condition Scoring (BCS)

Body condition scores (BCS) were measured following standard methods [5] as mentioned in Table 4.

Table 4. Reference table for BCS

Reference point		Point value for BCS								
No.	Point	1	2	3	4	5	6	7	8	9
1	Physically weak	Yes	No	No	No	No	No	No	No	No
2	Muscle atrophy	Yes	Yes	Slight	No	No	No	No	No	No
3	Outline of spine visible	Yes	Yes	Yes	Slight	No	No	No	No	No
4	Outline of ribs visible	All	All	All	3-5	1-2	0	0	0	0
5	Outline of hip & pin bones visible	Yes	Yes	Yes	Yes	Yes	Yes	Slight	No	No
6	Fat in brisket and flanks	No	No	No	No	No	Some	Full	Full	Extreme
7	Fat udder & patchy fat around tail head	No	No	No	No	No	No	Slight	Yes	Extreme

So, BCS = Sum of the point value for each point/ Total point number (7)

F. Collection of Blood Samples and Hematological Examinations

For the hematological examinations, blood samples were collected aseptically from all the 45 animals of the experiment using sterile syringe and needle from the jugular vein. Immediately after collection, 5ml of blood samples were transferred immediately into a clean, dried, sterile test tube containing anticoagulant (EDTA @ 1:10). These samples were transferred to the laboratory of the Department of Physiology, Sylhet Agricultural University, Sylhet, Bangladesh via ice cubes containing thermo flask and were performed within 2-4 hours after collection of blood. Estimation of Total Erythrocyte Count (TEC), Hemoglobin (Hb) concentration, Packed Cell Volume (PCV) and Erythrocyte Sedimentation Rate (ESR) were performed following standard methods [6].

G. Statistical Analysis of Experimental Data

Experimental data were calculated and expressed as Mean ± SE on live weight, BCS and hematological parameters (e.g. TEC, Hb concentration, PCV and ESR) were analyzed statistically using MS-STAT statistical software [7] with the help of a one way ANOVA method was made by F variance test.

III. Results and Discussion

The present research work was conducted to evaluate the effects of different concentrate mixtures on live weight, BCS and hematological parameters (such as TEC, Hb, PCV and ESR) of calves.

A. Effect of Different Concentrate Mixtures on Live Weight of Calves

The changed live weight of calves after the feeding with different concentrate mixtures at day 0, 30 and 60 of experiment is presented in table 5.

Table 5. Effect of different concentrate mixtures on body weight of different groups of calves

Groups	Live weight (kg) (Mean ± SE)		
	Day 0	Day 30	Day 60
Control group - T_0 (n=15)	38.00±0.57	51.00±0.52	60.00±0.47
Treatment group - T_1 (n=15)	39.00±0.51	56.00±0.5	66.00±0.51
Treatment group - T_2 (n=15)	42.00±0.52	60.00±0.49	69.00±0.49

Results showed that, live weight was gradually increased due to proper nutrition supplied through balanced diet and at the end of experiment the average live weight of all treated groups were increased significantly ($p<0.01$) than the control group. At the day 60 of experiment, the highest live weight was recorded in the treated group T_2 (69.00±0.49kg) and the lowest live weight was recorded in the control group (60.00±0.47kg). The increased rate of live weight gain in the treated groups might be due to the increased digestibility of dry matter, crude protein, nitrogen, non starch polysaccharides and other indigestible feed [8]. From the present study, observed that live weight was more rapidly increased in the Bovino Calf Starter® treated groups (T_2) and treated groups (T_1) than control group which is more or less similar with the result reported in another study [9].

B. Effect of Different Concentrate Mixtures on BCS of Calves

The effect of different concentrate mixtures on BCS of different groups of calves at day 0, 30 and 60 of experiment is presented in table 6.

Table 6. Effect of different concentrate mixtures on BCS of different groups of calves

Groups	BCS (Mean ± SE)		
	Day 0	Day 30	Day 60
Control group - T_0 (n=15)	5.0±0.23	4.8±0.12	5.0±0.21
Treatment group - T_1 (n=15)	5.0±0.21	6.5±0.25	8.0±0.21
Treatment group - T_2 (n=15)	5.0±0.23	7.0±0.34	8.0±0.23

Table 6 showed that, BCS was increased due to proper nutrition supplied through balanced diet and at the end of experiment the average BCS of all treated groups were increased significantly ($p<0.01$) than the control group. At the day 60 of experiment, the highest BCS was recorded in the treated groups T_1 and T_2 (8.0±0.21 and 8.0±0.23) and the lowest BCS was recorded in the control group (5.0±0.21). From the research work we can see that, at the beginning of the study all the calves of three groups showing the same average BCS but at the end of the experiment BCS were improved in the treatment groups (T_1 and T_2); whereas the calves of control group showed the same BCS at day 0 and day 60 of experiment. It implies that diet of treated groups T_1 and T_2 were improved the calves' BCS. The increased amount of nutrients of diets improved their BCS which is similar to other findings [10].

C. Effect of Different Concentrate Mixtures on Hematological Parameters of Calves

The effect of different concentrate mixtures on hematological parameters of different groups of calves at day 0 and 60 of experiment is presented in table 7.

Table 7. Effect of different concentrate mixtures on hematological parameters of different groups of calves

Groups	Day of exp.	Hematological parameters (Mean ± SE)			
		TEC (million/mm^3)	Hb (gm %)	PCV (%)	ESR (mm in 1st hour)
Control group T_0 (n=15)	0	4.47±0.17	7.15±0.2	23.77±0.17	3.02±0.12
	60	4.34±0.13	7.01±0.1	23.54±0.14	3.21±0.14
Treatment group T_1 (n=15)	0	3.08±0.15	7.2±0.19	23.04±0.3	3.02±0.16
	60	4.57±0.12	8.7±0.11	24.94±0.14	2.32±0.12
Treatment group T_2 (n=15)	0	4.02±0.1	7.01±0.3	23.74±0.15	3.12±0.12
	60	5.21±0.16	8.4±0.11	25.44±0.16	2.11±0.18

Results showed that, hematological parameters TEC, Hb and PCV were increased significantly ($p>0.01$) in the calves of treated groups (T_1 and T_2); whereas the value of these parameters were decreased in the calves of control groups. But the ESR level were decreased significantly ($p>0.01$) in the calves of treated groups (T_1 and T_2); whereas the ESR level was increased in the calves of control groups. At the day 60 of experiment, the highest TEC (million/mm^3), Hb (gm%) and PCV (%) were recorded in the Bovino Calf Starter® treated groups - T_2 (5.21±0.16, 8.4±0.11 and 25.44±0.16 respectively) and the lowest value in the control group (4.34±0.13, 7.01±0.1and 23.54±0.14respectively); whereas the ESR (mm in 1st hour) was highest in the control group (3.21±0.14) and lowest in Bovino Calf Starter® treated groups - T_2 (2.11±0.18).

In the present findings hematological parameters of all treated groups (T_1 and T_2) remained within normal range but differ significantly ($p>0.01$) with control group (T_0) due to the effect of diet, which is resembles to the findings of other studies [11, 12, 13]. The hematological parameters in present findings were similar to the findings of other study where it was reported that the number of erythrocyte and other components of blood varied due to the effects of amino acids, sex, environment, exercise and climate on hematopoietic organs [14]. Decrease ESR value might be due to improved colloidal state by increased level of protein supplementation and the present finding is also resembles to the study [15], where it was reported that the blood profile in terms of TEC, Hb content, PCV and ESR were comparable for all dietary groups of more lysine and methionine containing feeds with normal diet.

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