

## **EFFECT OF DIFFERENT PLANS OF NUTRITION ON GROWTH, FEED EFFICIENCY, BLOOD METABOLITES AND RELATIVE ECONOMICS IN SAHIWAL HEIFERS**

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**ABSTRACT:** This trial was designed with the objectives to select best and economical feeding strategies to accelerate growth pattern for reducing age at maturity in buffalo heifers. Twenty Sahiwal heifers (Age = 24 ± 2-month and wt. = 200 ± 30 kg) were divided into four equal groups (n=5) on the basis completely randomized design, Control group (D) of heifers was fed on green fodder only and no ration was offered while test diets were comprised on TMR based on wheat straw (A), fodder (B) and silage (C) with crude protein 10-11 percent. Feed intake of each experimental animal were recorded daily. Animals were weighed at the start of experiment and fortnightly thereafter. Animals of group C gained higher body weight (averaged 580 grams daily) comparing with other groups while animals of group (D) fed on fodder only yielded very poorly growth. Dry Matter Intakes of all groups were similar and there was no effect of treatment of different plans of diet fed to animals. Dry matter, Crude protein and crude fiber digestibility values were higher in animals fed total mixed ration based on corn silage and dry ration as compared to those fed other diets. Blood urea nitrogen values were higher in group A fed on TMR wheat straw based diet while blood glucose values were higher in animals of group B and C fed corn silage or green fodder based diet as indicator for availability of nutrients for growth.

**Key words;** Sahiwal Heifer, Silage, Growth Performance, Digestibility, Blood Metabolites and Total Mixed Ration.

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### **INTRODUCTION**

Heifer growth rate and body weight at first calving are of extreme importance in dairy farm management (NRC, 2001). Increased growth rate in heifers can decrease the duration of nonproductive state (Sejrsen and Purup, 1997). The well grown heifer is actually a good investment to produce more milk in future. They yield more milk, come back in calf earlier and last longer in the milking herd if adequate nutrition is provided and health condition is optimal. Feeding management plays a vital role to improve the productivity of animal and provides a regimen enabling heifer to develop her full lactation potential at the minimum cost.

Balanced feeding, improved management and minimum disease prevalence can be helpful in reducing the age of first calving (Heinrichs et al. 2005). Bhatti et al. (2007) stated that in our system, forage should be the main feed supplemented with concentrate and suggested other performance modifiers to gain faster growth rate for early puberty on cost effective basis. The available feed ingredients for livestock in tropical and subtropical countries including Pakistan are low in crude protein (CP) and lipids whereas high in crude fiber (Ludri and Razdan, 1980), which adversely affects the onset of puberty independent of growth rate. Animal productivity

can be increased up to 40% just by manipulating the macro and micro nutrients with existing gene pool (Sarwar, 2010). Nutrient requirements recommended by NRC (2001) are widely adopted to formulate diets for ruminant animals around the world. The present study was thus planned keeping in view the best feeding plan of nutrition for optimum growth in Sahiwal heifers and to evaluate relative economics fed on different nutritional regimes.

### **MATERIAL AND METHODS**

**Experimental Animals:** Twenty Sahiwal heifers (Age = 24 ± 2-month and wt. = 200 ± 30 kg) having similar body condition were selected from the herd being maintained at livestock experiment station Bahadurnagar Distt. Okara and were kept at Nutrition Section, LPRI Bahadurnagar for research purpose. These were divided into four equal groups; A, B, C and D on the basis of similar average body weight. Before the start of experiment all the animals were injected Ivermectin (Ivermectin) for deworming against internal and external parasites. Group D served as control were kept as positive control under routine farm management for overall comparison with treated groups. The treatments were

assigned to experimental units under completely randomized design, each treatment having five replicates.

**Diet-A:** Total Mixed Ration (10-11 %CP) containing growing/heifer ration mixed with wheat straw. (**Heifer ration 62%, Wheat straw 36% & Berseem Fodder 02%**)

**Diet -B:** Total Mixed Ration (10-11 %CP) containing growing/heifer remixed with green fodder of berseem. (**Heifer ration 10%, Wheat straw 40% & Berseem Fodder 50%**)

**Diet- C** Total Mixed Ration (10-11 %CP) containing growing /heifer ration mixed with corn silage. (**Heifer ration 33%, Wheat straw 07% & Corn Silage 60%**)

**Diet -D** Total Mixed Ration (10-11 %CP) containing green fodder of berseem only without Heifer ration. (**Heifer ration 0%, Wheat straw 45% & Berseem Fodder 55%**)

Grower ration contained 15.9 % CP and 76% TDN. The quantity of diet offered to animals was increased as they gained weight and again recalculated on the day of body weight recording. The measured quantity of diet was offered individually to animals of group A, B, C and daily in the morning & evening and orts were measured at the next morning throughout the study period. All experimental heifers in each treatment group had easy access to fresh and clean water round the clock. A period of 14 days were given as adjustment period so that animals could adopt to the experimental conditions before the observations being recorded. This study was lasted for three months. At the end of the study during last week, a digestibility trial was conducted on two animals of each group. Blood samples were collected by jugular vein puncture after two hours of morning feeding fortnightly throughout the study to test blood urea nitrogen and blood glucose. Feed offered and orts was sampled daily and composited for analysis. Diets, orts and fecal samples were analyzed for DM, Fiber and CP (AOAC, 1990). Formula of heifer ration comprised on maize grain 13,maize bran 17,rape seed cake 08,gluten 30 percent 20,wheat bran 08,rice polishing 05,soy husk 14,mineral mixture 02 and molasses 13 percent.

## **RESULTS & DISCUSSION**

**Dry Matter Intake and Growth Performance:** Dry matter intakes (DMI) were  $6.85 \pm 1.04$ ,  $6.95 \pm 0.91$ ,  $6.59 \pm 0.71$  and  $6.57 \pm 0.64$  kg daily in animals of group A, B, C and D, respectively. Heifer of group C fed on silage based diet consumed lower dry matter intakes compared with other groups. This may be due to higher concentration of VFA while group D had lower values of DMI as compared to group A and B and is almost equal to group C because it contained no ration in their diet

which may affect the palatability of diet. Mean values of DMI in group A fed on wheat straw based diet was higher due to more palatable and higher proportions of ration in feed improved the palatability. It is very significant that dry matter intake increased in animals when fed on green fodder supplemented with ration. Statistically the difference was non significant among the treatments. Animals fed Hybrid Maize Silage (group C) gained significantly higher weight ( $0.555 \pm 0.35$  kg daily) followed by those of group A, B and D. The results were similar in animals fed other diets A and B, Conversely, mean values of feed conversion ratio (FCR) were significantly lower in animals fed Hybrid Maize Silage (group;  $12.27 \pm 2.04$ ) followed by those of group A and B. The growth of control group was lowest and feed efficiency were high contrast with other test groups. The possible reason for this improvement might be due to factor that high concentrate diet might provide adequate dietary energy and other nutrients which may be lacking in high forage diet.

Results of the current study are supported by the findings of Bilal et al. (2001) who reported that DMI was not affected in Nili Ravi buffaloes by feeding silage based diet as total mixed ration or in combination with fresh fodder. Hilscher et al. (2016) reported that feeding silage of 37% DM resulted in greater daily gain and lower Feed: Gain compared to 43% silage in cattle calves. Results of research study performed by Fayyaz et al (2018) supported the results of entire study who observed non -significant dry matter intakes in Sahiwal calves when fed different types of corn silages along with fattening ration @ 1.5% of the body weight which might have marked the difference in palatability of various silage diets and ultimately feed intake was not affected by treatments. Al-Shami (2007) reported that feeding grass hay supplemented with concentrate to Hassawi heifers improved average daily gain and indicated that ADG (0.76 kg/d) in 2 kg concentrate supplemented group was higher than that (0.51 kg/d) in 1 kg supplemented group and (0.16 kg/d) in group of heifers fed hay only. The improvement in ADG of heifers fed concentrate supplement might be due to factor that concentrate would provide dietary energy which was lacking or deficient in hay. Cicciole et al. (2005) reported that concentrate supplementation had highly significant effect on feed conversion efficiency during pre-pubertal period in dairy heifers. Zanton and Heinrichs (2007) reported that high concentrate feeding improved body structure. Alemu et al. (2005) reported no difference ( $p > 0.05$ ) in weight gain between the weaned crossbred calves fed on the urea treated stover diet and those fed hay based diet. Similar results were also observed by Tran and Nguyen (2000) who concluded that urea treated maize stover could be used to replace grass for ruminant feeding as cattle had acceptable weight gains.

**Table I; Performance of Sahiwal heifer fed on different plans of diet.**

Parameter	Group I & Diet A	Group II & Diet B	Group III & Diet C	Group IV & Diet D	SEM	Linear	Quadrat	Cubic
DMI (kg)	6.85±1.04	6.95±0.91	6.59±0.71	6.57±0.65	0.17	N.S	N.S	N.S
Growth(kg)	0.477±0.32	0.473±0.24	0.555±0.35	0.333±0.28	0.30	N.S	N.S	N.S
FCR (Kg)	0.333±0.28	14.69±1.65	12.27±2.04	19.40±1.69	1.42	N.S	N.S	N.S

**Nutrient Digestibility:** Dry matter digestibility value was higher in animals fed on diet A (total mixed ration wheat straw based diet) as compared to those fed other diets. Inversely, animals fed Diet B and C have rarely lower values but statistically difference was non-significantly. It showed no treatment effect on nutrient digestibility. Similarly, higher nutrient digestibility of Crude Protein and Crude Fat was observed in animals of group B and C fed green fodder or corn silage based diets followed by group A and D but statistically difference was non-significant. Nutrient digestibility of DM,CP and CF were lowest in animals of group D fed on control diet only green fodder without any supplementation of ration. Feed intake was improved by supplementation of fermentable energy diet (ration) and nutrient digestibility could also be enhanced though it (Sarwar et al., 2004). It is evident from the results that nutrient digestibility decreased in the animals fed on Diet D (green fodder only). This may be due to higher level of crude fiber and

acid detergent fiber contents as higher level of ADF present in fodder lead to reduce the nutrient digestibility. Lower digestibility also effects the growth performance in animals. Results of present study also supported by the results of Fayyaz et. al (2018) who conducted a study to test the performance of five different silages in growing Sahiwal calves. Higher CP digestibility was observed in animals fed corn stover silage with molasses and urea. Result of present study are in agreement of Yann *et al* (2008) who conducted a study on total mixed rations containing brown midrib sorghum-sudan grass silage (bmrSS) or corn silage (CS) at either 35 or 45% of dietary dry matter fed to Holstein dairy cows to determine the effect on nutrient digestibility. Neutral detergent fiber digestion was 46.0% for Corn Silage and 58.3% for bmrSS. In vivo digestibility's of organic matter and crude protein were greater for the CS diets than the bmrSS diets.

**Table II; Digestibility of Dry matter, Crude protein and crude fiber in heifers fed on different plans of diet.**

Digestibility	Group I & Diet A	Group II & Diet B	Group III & Diet C	Group IV & Diet D	SEM	Linear	Quadrat	Cubic
Dry Matter	74.18±2.18	70.22±5.18	68.03±1.98	67.3.±1.03	1.1	N.S	N.S	N.S
Crude Protein	76.65±0.70	78.60±2.90	75.48±1.03	70.53±0.08	1.45	N.S	N.S	N.S
Crude Fiber	63.03±2.53	71.32±3.77	67.32±1.02	65.03±0.03	1.09	N.S	N.S	N.S

**Blood Metabolites:** Blood urea nitrogen (BUN) were significantly higher in animals fed on diet A followed by thSEMose fed on diets B, C and control diet. Statistically, the difference was non-significant in animals of group C fed on silage based diet with other groups of treatments while this difference was significantly higher in other groups The higher BUN in animals fed on total mixed ration wheat straw based may be due to higher proportion of ration in their diet which not only provide nitrogen and carbon chain for the synthesis of protein in the rumen but also improved their digestibility. While blood glucose values were higher in animals of group B and C but this value was comparatively lower in group A fed on Total Mixed Ration. Escalated nutrient digestibility in animals fed diet A, B and C could be a reason for improved blood glucose in these animals. Triggered nutrients digestibility provided more nutrient flow towards lower digestive tract which improved blood glucose level of treatments. It corresponds to an end product of protein metabolism,

used as a sensitive indicator of crude protein intake and ruminal protein-energy synchrony ( Melendez et al., 2003). This ammonia nitrogen is necessary to promote growth of fiber degrading bacteria which use ammonia nitrogen as nitrogen source, resulting in improved fiber digestion. The lower urea concentrations recorded in the control group fed on green fodder only are attributed to a better synchrony and utilization of energy and nitrogen release in the rumen, due to the energy intake through the corn silage (Barrientos et al., 2013). Serum glucose, total protein and albumin concentrations in calves were not affected when holstein calves were fed milk replacer containing different amounts of energy and protein (Lee et.al, 2008) .Tauqir et. al (2013) conducted a 73-day study using 20 Sahiwal heifer to investigate the effect of supplementing maize fodder with urea molasses block. Blood urea concentration was higher after 3 hours of feeding in animal fed the UMB. Our results are in agreement with Ahooei et al. (2011) who reported non-

significant effect of dried citrus pulp on blood urea nitrogen in male fattening calves.

**Table III; Blood urea Nitrogen and Blood Glucose in heifers fed on different plans of diet.**

Particulars	Group I & Diet A	Group II & Diet B	Group III & Diet C	Group IV & Diet D	SEM	Linear	Quadrat	Cubic
Blood urea Nitrogen(mg/dl)	27.56±1.48	25.14±0.29	25.73±0.37	21.76±0.60	0.66	**	N.S	**
Blood Glucose(mg/dl)	45.69±0.69	50.72±0.25	50.35±3.47	38.07±3.58	1.66	**	**	N.S

**Economics:** Economically the diet D containing berseem fodder without heifer ration (control group) had lower cost of production as compared to other diets while profit to produce one kg increase in body weight was greater in animal fed on diet B which were reared on green fodder of berseem and heifer ration followed by diet C and D. profit was lowest in animal fed on diet A comprised on TMR based on wheat straw because it contained high proportion of ration which increase the production cost and decrease the actual profit. This picture shows that actual gain was high in animal fed on diet C (silage based) but high cost of silage decreases the profit ratio. Production cost was calculated by the sum up of total

feed cost consumed daily by the animals and price of daily gain in body weight. All other expenses like labor, medicine, housing and other were kept constant in all groups. The results related to cost of production in the current study are also in agreement with that of Allen and Rebeiro (1999) who concluded that the diet containing 12% CSL on DM basis had lower cost of production in finishing ration. Results revealed that Sahiwal heifers can be reared successfully on green fodder or corn silage along with heifer ration and yielded better results in terms of gain, body score, nutrient digestibility, blood metabolites and fetched maximum profit.

**Table IV; Production cost and economics of Sahiwal heifers fed on different diets plan.**

Particulars	Diet A	Diet B	Diet C	Diet D
No. of heifers	05	05	05	05
Trial days	90	90	90	90
Daily growth (kg)	0.477	0.473	0.555	0.333
Daily DMI(kg)	6.44	6.95	6.81	6.26
Cost of DMI(Rs)/kg	32.0	16.0	26.35	18.25
Total cost of feed	206	111.2	179.44	114.25
Total cost of daily growth(rs)	238.5	236.5	277.5	166.5
Daily profit(rs)	32.5	125.3	98.1	52.0
Per kg profit(rs)	68.13	264.9	176.75	156.15

**Acknowledgement:** Different plans of diet were tested in Sahiwal heifers to improve the body weights and relative economics. Diet containing corn silage and ration yielded comparatively better growth while diet comprising TMR wheat straw based or fodder based proved equal in all respects in Sahiwal heifers. However, this research should be carried out in other classes and breeds of livestock.

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