

# **PRODUCTIVE PERFORMANCE OF SAHIWAL COWS SUBJECTED TO DIFFERENT LEVELS OF HERBAL SUPPLEMENTS**

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*In partial fulfilment of the requirements for the Degree of*

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**IN**

**LIVESTOCK PRODUCTION AND MANAGEMENT**



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**ASSAM AGRICULTURAL UNIVERSITY**  
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This is to certify that the thesis entitled “**PRODUCTIVE PERFORMANCE OF SAHIWAL COWS SUBJECTED TO DIFFERENT LEVELS OF HERBAL SUPPLEMENTS**” submitted to the Faculty of Veterinary Science, Assam Agricultural University, in partial fulfilment for the degree of **MASTER OF VETERINARY SCIENCE** in **LIVESTOCK PRODUCTION AND MANAGEMENT** is a record of research work carried out by **Dr. MANMI KALITA** under my personal supervision and guidance.

All kinds of help received by her have been duly acknowledged.

No part of this thesis has been reproduced elsewhere for any degree.

Dated .....

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## ABSTRACT

A study was conducted to investigate the effect of different levels of herbal supplements on productive performance of Sahiwal cows. Fifteen healthy Sahiwal cows of similar age and body weight were allocated to three experimental groups namely T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> with five animals in each group. T<sub>0</sub> was fed with balance ration (concentrate mixture, para grass and paddy straw) as per requirement, T<sub>1</sub> group was supplemented with 25 gms of fenugreek seed (*Trigonella foenum graecum*) along with balance ration and T<sub>2</sub> was fed with 50gms of fenugreek seeds along with balance ration.

It was observed that overall mean daily dry matter intake (kg/day) in T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> were 10.01±0.02, 10.24±0.03 and 10.22±0.08 respectively. Analysis of data on dry matter intake showed no significant difference (p>0.05) between control and treatment groups respectively. Furthermore, non-significant differences was found in DMI/100kg body weight between the control and treatment groups.

The average digestibility coefficient (%) of DM in T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> groups was: 71.12±0.27, 73.58±0.26 and 74.72±0.22); 72.97±0.08, 73.78±0.06 and 75.34±0.09 for organic matter (OM); 67.89±0.11, 65.54±0.05 and 68.48±0.07 for crude protein (CP); 70.70±0.05, 70.98±0.09 and 72.06±0.08 for ether extract (EE); 48.80±0.37, 50.04±0.29 and 56.24±0.28 for crude fibre (CF) and 77.14±0.15, 77.35±0.04 and 78.13±0.09 for nitrogen free extract (NFE) respectively. Analysis of the data revealed significantly (P<0.01) higher digestibility of the nutrients in herbal supplement (fenugreek seeds) fed treatment groups than control group.

The overall mean for milk yield (kg) in the experimental cows were 7.00±0.05, 7.56±0.08 and 7.99±0.10 respectively in T<sub>0</sub>(control), T<sub>1</sub> and T<sub>2</sub> groups. Feeding of fenugreek found to have positive effect in the treatment groups. Highly significant differences in milk yield was found (p<0.01) between treatment groups. Also, Milk efficiency was significantly higher (p<0.01) in treatment groups compared to control. However, there was no significant effect of fenugreek seeds in the duration of peak milk and lactational milk yield of the experimental cows.

Milk composition like total fat(%), solid-not-fat(%), lactose(%), protein(%), ash(%), specific gravity was within the normal range. However highly significant difference (p<0.01) was observed in fat, SNF, lactose, protein and ash content.

The blood constituents like blood glucose and total serum protein were within the normal value among the treatment groups and showed no significant differences (p>0.05) between the treatment groups.

Daily cost of feeding per cow per day were Rs. 182.20, Rs. 192.20 and Rs. 195 in T<sub>0</sub>(control), T<sub>1</sub> and T<sub>2</sub> respectively. Cost of feeding per kg milk yield was Rs. 26.02, Rs. 25.15 and Rs. 24.40 in T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> respectively. The benefit cost ratio was found to be higher in treatment groups than in control group. Based on the results of the present study it could be concluded that feeding of fenugreek seed at the level of 50gms daily along with the normal diet increased performance in terms of milk yield, milk composition and digestibility of nutrients. However, there was no significant effect in duration of peak milk yield, lactational milk yield and blood constituents.

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## LIST OF ABBREVIATIONS

Abbreviation	Full form
% ...	Percentage
& ...	and
@ ...	at the rate
AAU ...	Assam Agricultural University
ANOVA	Analysis of variance
AOAC ...	Association of Official Analytical Chemist
BW ...	Body weight
C.D ...	Critical difference
CF ...	Crude fibre
CP ...	Crude protein
CPCSEA	...Committee for the Purpose of Control and Supervision of Experiments in animals
d.f. ...	Degree of freedom
DCP ...	Digestible crude protein
DM ...	Dry matter
DMI ...	Dry Matter Intake
EE ...	Ether extract
et al. ...	and co-workers
	Fig ... Figure
gm ...	Gram
i.e. ...	That is
ICAR ...	Indian Council of Agricultural Research
Kg ...	Kilogram
mg ...	Milligram
MS ...	Mean square
NFE ...	Nitrogen-free extract
OM ...	Organic matter
Rs. ...	Rupees

SE	...	Standard error
SNF	...	Solid-not-Fat
SS	...	Sum of square
T.A.	...	Total ash
T <sub>0</sub>	...	Control
T <sub>1</sub>	...	Treatment
T <sub>2</sub>	...	Treatment 2
TDN	...	Total digestible nutrient
viz.	...	Such as/ namely



# CHAPTER-I

## INTRODUCTION

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With more than 37.28 percent of all cattle, 21.23 percent of all buffalo, 26.40 percent of all goats, and 12.17 percent of all sheep produced, India is the world's top producer of cattle and buffalo. There are 302.71 million bovines (including cattle, buffalo, mithun, and yaks) as of the 20th livestock census, a rise of 1%. Total cattle population in India is 193.46 million, a rise of 0.8% from the previous census (As per 20<sup>th</sup> Livestock census). Rural communities rely on livestock for more than two thirds of their income. Additionally, it employs around 8.8% of India's total population. India has a huge resource base for cattle. The involvement of livestock in total agriculture and allied sector GVA has increased from 24.32 percent to 28.63 percent (National Accounts Statistics, 2020). Livestock is one of the best kinds of insurance against natural disasters since it not only produces nutrient-rich food like milk, meat, and eggs, but it also acts as a natural food source. The cattle industry has a substantial impact on rural households' socioeconomic growth. (Bairwaet *al.*, 2013). The backbone of India's livestock industry, which consists primarily of cattle and buffalo plays a significant role in providing job opportunity for millions of people. India is fortunate to have a huge population of indigenous cattle with a diverse genetic heritage. There are currently 50 identifiable breeds of cattle and 17 distinct breeds of buffalo spread around the nation, however the majority of Indian cattle are non-descript.

Worldwide demand for dairy products is increasing day by day, which has great impact on per unit of population of dairy products. India is ranked 1<sup>st</sup> in world's total milk production and has 23% share in worldwide milk population (Economic Survey 2021-2022). From 146.31 million tonnes in 2014–15, India's total milk production has increased to 210 million tonnes. (Economic survey, 2020-2021) which exhibits a 6.2 percent annual growth rate. In India, the daily milk consumption per person is 427 grams in 2020-21. Total milk production in Assam increased from 6.82 lakh tonnes in 2001-02 to 8.82 lakh tonnes in 2018-19. In recent years, Assam's milk production has steadily increased. However, India's productivity per animal is still low as compared to the

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worldwide average due to various disease conditions and management issues related to the lactating animals (Mishra *et al.* 2006).

Indigenous and non-descript cattle comprise 73% of the total cattle population in India whereas the exotic and crossbred animals constitute more than 26%. Out of the indigenous breeds Gir, Sahiwal, Red Sindhi and Tharparkar are best milch breeds of India. The presence of large population of milch and dualpurpose breeds in many of the states marked the importance of milk production.

Sahiwal cattle is one of the best dairy breeds of zebu cattle. Its indigenous habitat is in Pakistan's Punjab province's Montgomery district. Sahiwal's coat colour ranges from reddish brown to red, with varying amounts of white on the collar and underline. Animals have large humps, short horns, and well-developed udders. Additionally, the breed is noted for its drooping ears. The animal is best known for its ability to produce high quality milk with high fat content. Unlike other imported breeds, it can also endure extremely harsh weather conditions. It can withstand heat and is immune to ticks, and parasites both internally and externally. In comparison to other breeds of cattle, Sahiwal has the greatest benefit in terms of milk production. They have been exported to other Asian nations, Africa, the Caribbean, and other places worldwide because of their heat tolerance and excellent milk production. The whole lactation milk output ranges from 1600 to 2750 kg. However, certain herds could be more productive than others.

The basic requirement in organization of dairy economics is the adequate milk production. Beyond proper feeding management the administration of certain additives such as plant extracts, enzymes, probiotics, certain herbs may be beneficial in efficient nutrient utilization resulting improvement in milk yield and milk quality. With the purpose of prevention of extreme stress on the production capacity and to augment milk yield various herbal preparations, mineral supplements and feed additives have been tried with diverse results.

Galactogogues are chemicals used in human and animal dairy industries to initiate, maintain, and increase milk yield. Galactagogue may be plant derived or synthetic. They act through inhibiting dopamine producing neuron. Galactogogues of herbal origin is found to have positive effect on milch-herd health without causing any

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harmful effect on health. The most often reported herbal galactagogues include asparagus, fenugreek, brewer's yeast, blessed thistle, milk thistle, alfalfa. Although majority of these herbal galactagogue have not been technically evaluated but their traditional use has recommended its efficacy and safety.

For thousands of years, fenugreek has been used as a spice and medicine throughout India and the Middle East. It is the most popular herbal galactagogue since ancient times. Fenugreek (*Trigonella foenum-graecum* family—Papilionaceae—Leguminosae), which is widely cultivated in India, has been utilised as a nutritional and therapeutic supplement. For ages, galactagogues have been made from fenugreek (*Trigonella foenum-graecum*) (Swaffors and Berens, 2000). These galactagogue herb's beneficial effects on ruminant milk production have previously been documented by Patel et al. (2013) for cattle, Balgees et al. (2013) for goats, and Degirmencioglu et al. (2016) for buffaloes. Diosgenin is a naturally occurring saponin that have structural similarities with oestrogen and is found in fenugreek. It stimulates the release of growth hormone, which then increases milk production. (Sayed et al 2005). Fenugreek seeds and oil both activate the oviduct and increase ovarian activity according to Hassan *et al.* (2006). As a result, it is found to have active substances such saponins and alkaloids, may improve animal performance. However, the galactagogue property of fenugreek seed supplementation has not been explored much in Sahiwal breed of cattle. Considering the above facts, the present study has been planned to investigate the effect of different levels of fenugreek seeds on productive performance of Sahiwal cows with the following objectives:

- To study the effect of different levels of herbal galactagogue on daily milk yield, lactational milk yield and milk quality of indigenous cattle.
  - To study the duration of peak milk yield.
  - Economics of milk production
-





## CHAPTER-II

# REVIEW OF LITERATURE

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India is a developing country where more than 70% population relies upon agriculture and livestock sector for their livelihood. Livestock sector plays an essential role in well-being of human population. Livestock contributes 40% global value of agricultural output and supports the livelihoods (FAO). The most valuable sector among agricultural fields is animal production which can be attained through implementation of sustainable animal husbandry practices by locally available resources.

Traditionally, Arab women use fenugreek ‘*Trigonella foeniculina* L’ seed as part of their diets after child birth to increase their milk (unpublished observation) (Shaikh et al). Fenugreek is one of the world’s oldest medicinal herbs with immunomodulatory, antimicrobial, antispasmodic effect. (Priyanjali et al., 2005). The literature available on herbal supplementation and its effect on production performance of Sahiwal cattle has been reviewed as per the objectives of the study under the following heads :-

### 2.1 FEED CONSUMPTION

#### 2.2.1 Dry matter intake (kg)

Degirmencioglu *et al.* (2016) studied the effect of ground fenugreek seeds (*trigonella foenum-gracium*) on feed consumption and milk performance in anatolian water buffaloes. Total 24 buffaloes were selected which was randomly divided into two groups (12 animals each). The study revealed that the diet containing ground fenugreek seeds improved total dry matter (13.17–14.00 kg day<sup>-1</sup>) ( $P < 0.05$ ) and daily concentrated feed consumption (2.90–3.81 kg day<sup>-1</sup>) ( $P < 0.01$ ) and remarkably increased milk production (7.34–8.01 kg day<sup>-1</sup>) ( $P < 0.01$ ).

Kumar *et al.* studied the effect of dietary supplementation of fenugreek (*Trigonella foenum-graceum* L.) seeds powder on the performance of feed consumption and feed conversion ratio in commercial broilers. Four treatment groups were selected T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> for the experiment. T<sub>1</sub> group was fed diet as per NRC standard and T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> were fed standard ration T<sub>1</sub> supplemented with 0.25, 0.5, 0.75 percent FSB ad lib. It

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was recorded that T<sub>4</sub> give high feed intake and high feed conversion ratio as compared to other treatment groups.

Ghosh *et al.*(2009) evaluated the effect of dietary garlic supplementation on body weight gain, feed intake, feed conversion efficiency, faecal score, faecal coliform count and feeding cost in crossbred dairy calves and found that there was significant increase in average body weight gain, feed intake and feed conversion efficiency and significant decrease in severity of scours in the treatment group as compared to control group.

Elmnanet *al.* (2016) investigated the effect of concentrate rations with four levels of crushed fenugreek seeds on feed intake and biochemical parameters in Nubian goats at their early lactation stage. 12 animals were evaluated for this experiment containing three animals in each group. It was concluded that the increasing level of crushed fenugreek seeds increased feed intake, also increases physiological glucose secretion.

Abuet *al.* (2018) evaluated the effect of onion, garlic, fenugreek seeds as feed additives on feed intake, blood plasma constituents and ruminal fermentation of ossimi ewes. Twenty pregnant ossimi ewes were randomly divided into four similar groups containing 5 animals each. Control group was fed basal diet which consisted of 60% concentrate feed mixture and 40 % roughages and other three treatment groups were fed with same basal diet supplemented with either 3 % onion powder, 3% garlic powder, or 3 % fenugreek seeds powder. It was concluded that feed intake ( $p < 0.05$ ) increased during the late pregnancy of ewes fed with onion, garlic and fenugreek seeds.

Sherwani *et al.* (2015) investigated to record the effect of feeding fenugreek seeds on dry matter intake and found that daily feed intake increased significantly ( $p < 0.05$ ) compared to non-feeding fenugreek seeds in Hamdani ewes.

Shah and Mir (2004) revealed the effect of providing fenugreek seeds on dairy cow performance. Daily DM intakes were recorded for all the animals for a period of three weeks. The results showed that there was non-significant difference in dry matter intake between treatment and control groups.

Nasser *et al.* (2013) studied the effect of fenugreek seeds powder in rations of Sharabi local cows. 9 animals were selected for the experiment which were divided into

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three groups. 1<sup>st</sup> group was left as a control. The other two groups were fed a basal ration along with fenugreek as feed additive at a level of 50g or 100g/cow/day. The results showed that feed intake was significantly increased ( $p < 0.05$ ) in 3<sup>rd</sup> group compared to 2<sup>nd</sup> and control group.

Dosky and Taher (2015) reported the combined effects of black cumin and fenugreek seeds in Karadi Lambs. The results revealed significant differences in daily feed intake, dry matter intake, organic matter intake, crude protein intake and metabolizable energy intake.

Jain *et al.* (2011) reported the effect of herbal mixture supplementation on milk production in cattle. Twelve crossbred cattle (2<sup>nd</sup> and 3<sup>rd</sup> lactation) were taken for the study for a period of 90 days. The animals were divided into two groups control without supplementation and treatment with 1000ppm herbal mixtures supplementation. At the end of the experiment they reported that there was no effect on total dry matter intake in the supplementation group.

### **2.1.2 Milk efficiency**

Biggs (2022) observed the effect of fenugreek cotyledon on milk yield of Holstein-Friesian cows and found that there was significantly higher feed efficiency in fenugreek fed group compared to control group.

Cui *et al.* (2021) in an experiment studied the effect of Chinese natural herbal supplements found that there was enhanced feed efficiency in peri-partum dairy cows which leads to higher lactational performance.

### **2.2 Utilization of Nutrients**

Elmnanet *et al.* (2013) revealed the effect of supplementation of fenugreek seeds on digestibility of Nubian goats and found that nutrient digestibility (DM, CP and OM) were higher in goats fed with fenugreek seeds than the control group.

Mir *et al.* (2012) examined the effect of raw fenugreek seeds at the rate of 3% DMI on nutrient utilization in goats and revealed that digestibility coefficient of dry

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matter, organic matter, crude protein, crude fibre were significantly higher in treatment groups than in control groups.

Naseriet *al.* (2012) observed the effect of fenugreek seeds and asparagus roots on in vitro nutrient digestibility and found that fenugreek seeds increased in vitro organic matter digestibility and decreased crude protein digestibility. Results showed fenugreek seeds and asparagus root may be used as feed additives to increase the efficiency of nutrient utilization.

Mirzaei *et al.* (2012) evaluated the effect of feeding fenugreek seed powder on crossbred dairy goats @ 250mg/head/day and found that the dry matter intake was slightly higher and apparent nutrient digestibility and total digestible nutrients contents were also improved in fenugreek seed fed group.

Ali (2015) conducted a study to determine the effect of fenugreek seeds which are natural supplement in Nubian goat diets. Results showed significant effect ( $P > 0.05$ ) on both dry matters and crude proteins intake at different levels of fenugreek seed supplementation. The digestibility (%) of these nutrients (DM and CP) were not significantly affected ( $P < 0.05$ ) however addition of fenugreek seeds had reduced digestibility (%) of DM and CP in treatment group as compared to control group.

Salama *et al.* (2015) found that adding fenugreek seeds (2%) in basal fattening rations of male kids led to inconsiderable increase in ration palatability and intake. They also reported increase in digestibility coefficients for most of ration nutrients i.e. higher ( $P < 0.05$ ) digestibility of DM, OM, CP, CF and EE except NFE.

Al-Wazeer (2017) experimented by giving Awassilams graded level 0, 2.5, 5 and 7.5 gm/head/day of fenugreek seeds. There were no significant differences ( $P > 0.05$ ) observed in DM, OM, CP and ME intakes for lambs diet fed with graded levels of fenugreek seeds. Increasing the amount of level of fenugreek seeds had no effect on digestibility of DM, OM, CP, NDF and ADF. NDF and ADF digestibility slightly decreased ( $p > 0.05$ ) as level of fenugreek seeds increased in the diet.

Mahgoub and Sallam (2016) reported the effect of basal diet by supplementing crushed fenugreek seeds on Egyptian buffaloes. The crushed fenugreek seeds are added

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as feed additive to the basal ration at a level 100, 150 and 200 g/buffalo/day for 2nd, 3rd and 4th treatments, respectively. The results revealed that nutrient digestibility significantly increased in treatment group compared to control group.

Attia-Ismail (2000) studied the effect of fenugreek seeds on sheep performance fed @ 10 to 30 g/head/day for 180 days and found that total dry matter intake (TDMI), total digestible nutrient (TDN) and digestible crude protein (DCP) intakes were significantly ( $P < 0.05$ ) higher in treatment groups than in control groups.

Pujari (2015) conducted an experiment on commercial broiler chicks that were divided randomly in four groups T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>. Chicks of T<sub>1</sub> group are fed with basal diet while T<sub>2</sub>, T<sub>3</sub>, and T<sub>4</sub> are fed basal diets supplemented with dried fenugreek leaf powder @ 0.5, 1 and 1.5% respectively. The results showed that nutrient utilization in terms of DM, CP, EE was higher in treatment group fed with 1% dried fenugreek leaf powder.

Abdalla *et al* (2011) investigated the impact of employing several herbal remedies and their mixtures on the biochemical characteristics of Gimmizah chicken and found that fenugreek seed supplementation @ 1gm/kg diet considerably improved the digestion of crude protein and ether extract but had no impact on digestibility of dry matter, organic matter, crude fibre and nitrogen free extract.

### **2.3 MILK QUANTITY AND QUALITY PARAMETERS**

Al-Shaikh *et al.* (1998) studied the effect of fenugreek seeds on lactational performance of dairy goats. 21 lactating goats were randomly divided into three groups (A, B, C) based on level of fenugreek seeds (0%, 25% and 50%) and found that group B showed increased level of milk yield than the other groups.

Choubey *et al.* (2017) observed the effect of supplementation of fenugreek seeds on lactating surti buffaloes. For this experiment, eighteen lactating buffaloes were divided into three homogenous groups and fed with basal diet along with overnight soaked fenugreek seeds @ 0%, 1.5% and 3% of total ration. He concluded that there was an increase in total milk production fed with 1.5% fenugreek seeds. However, there were no change in the constituents of milk components.

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Patel *et al.* (2017) revealed the combined effects of Shatavari, Jivanti and Fengreek on production performance of lactating Kankrej cows. Twenty-four lactating cows were chosen for the experiment which was divided into four equal groups. T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> were fed basal diet along with herbal supplementations @ 30gm, 60gm and 90gm/head/day while T<sub>1</sub> group was kept as control group. He concluded T<sub>3</sub> group results in significant increase in milk yield. However, there were no significant change in milk composition.

El-Nor (1999) evaluated the impact of fenugreek seeds on lactating buffaloes fed diets comprising 100g and 200g of fenugreek seeds and found that milk yield and 4% FCM were significantly higher ( $p < 0.01$ ) in treatment group compared to control group. However, fenugreek supplementation had no effect on the milks composition except for total protein and lactose content which considerably increased as the amount of fenugreek seeds in the diet increased.

Kholif and Abd-El-Gawad (2001) examined the impact of adding fenugreek and fennel flower seeds on milk yield and milk composition at levels of 10g fenugreek/day and 5gfennel/day. The results showed that supplementation of fenugreek seeds significantly increases total milk yield, total nitrogen and salts of milk.

Allam *et al.* (1999) conducted an experiment to study the combined effects of four medicinal herbs (garlic, fenugreek, fennel flower and chamomile) in Zaraibi goats. Fenugreek was supplemented at the level of 500mg/kg LBW and found that average daily milk yield and FCM increases in treatment groups as compared to control group.

Tomar *et al.* (1996) investigated the impact of several feed additives including fenugreek on DM intake, milk yield, milk composition, haemoglobin, blood glucose, blood sugar in Murrah buffalo. The results revealed that DM intake and milk yield differed considerably in the treatment groups while control group's milk output was the lowest. However, there was no change in milk or blood composition.

In an experiment, Kirar *et al.* (2018) studied the effect of soaked fenugreek seeds @100g/animal/day on twelve lactating Murrah buffalo. The animals were randomly divided into two groups consisting of 6 animals in each group. The results showed that

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fenugreek supplemented group had higher milk yield compared to control group. However, there was no significant variation in milk components and blood parameters.

Hasinet *et al.* (2019) evaluated the effect of fenugreek supplementation on milk production and hormonal profile in Bakarwal goats. They concluded that there was an considerable rise in glucose, while there was no significant variations in fat, protein, lactose, SNF. There was also a remarkable increase in milk production in fenugreek supplemented group.

Al-Kudsiet *al.* (2011) studied the impact of different fenugreek seed addition rates on the milk production and blood components of Damascus goats. Twenty Damascus goats were randomly distributed into four equal groups and supplemented with 6%, 10%, 14% fenugreek seed. The fourth group was however regarded as control group. They concluded that animal group fed diet with 14% fenugreek seed showed increase in milk production. Although there was no significant change in fat percentage.

Sharma *et al.* (2017) conducted a comparative study on the role of giloy and fenugreek as herbal galactogogues in jersey crossbred cows. Four groups of lactating cows, each with six animals were randomly distributed. The three groups (T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>) were fed with concentrate supplemented with giloy stem powder (150 g), Fenugreek seed powder (150 g), and a combination of both the herbs (75 g of each) respectively whereas the control group (T<sub>0</sub>) was fed concentrate without any supplements. From day 0 to day 75 milk yield was recorded. They reported that feeding of fenugreek or giloy had no significant change in milk yield and milk composition.

Bipate and Misha (2020) investigated the effect of polyherbal supplementation on milk production and post-partum reproduction in crossbred cattle. Sixteen animals were selected and divided into two groups (T<sub>0</sub> and T<sub>1</sub>) consisting of eight animals in each group. T<sub>1</sub> group was supplemented with polyherbal mixture by preparing 25 g each of *Foeniculum vulgare* (Saunf), *Trachyspermum ammi* (Ajwain), *Trigonella foenum-graecum* (Methi), *Zingiber officinale* (Sundh), *Anethum graveolens* (Sowa) and *Elettaria cardamomum* (Cardamom) whereas T<sub>0</sub> was treated as control group. Their research revealed that there was a significant increase ( $P < 0.05$ ) in milk yield in T<sub>1</sub>

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compared to T<sub>0</sub>. There was an average increase of 21.53 % in milk yield due to supplementation of polyherbal mixture as compared to 6.91% in unsupplemented group.

Revathi *et al.* (2020) examined the impact of supplementation of fenugreek seed in crossbred dairy cattle. Twelve cows were allotted for the experiment six cows in each group. The experiment was divided as 30 days of post-supplementation, 60 days of supplementation and 30 days of post-supplementation periods. Results revealed that mean milk yield was significantly higher in fenugreek supplementation group. Also there was higher fat, SNF, total solids and protein percent in supplementation group. Therefore he concluded that fenugreek seed supplementation had shown positive results in both milk yield and milk composition.

## 2.4 BLOOD BIOCHEMICAL PARAMETERS

Ahmed and Al-Janabi (2012) evaluated the effect of fenugreek supplementation on serum constituents in lactating Damascus crossbred goats. The animals were randomly divided into three groups. The second and third group were supplemented with 4% and 6% fenugreek seeds powder whereas the first group was kept as control. Their research revealed that goats supplemented with fenugreek seeds powder showed increased serum protein level and lower blood glucose level as compared to control group.

Naseer *et al.* (2013) investigated the effect of fenugreek seeds powder as a feed additive in basal ration of Sharabi local cows to study haematological and biochemical parameters. They found that there was significant increase in percentages of lymphocytes and acidophil, and levels of total protein, globulin and glucose. However, percentage of neutrophil, cholesterol and blood urea were significantly decreased in treatment group as compared to control group.

In an experiment, Al-Sherwany (2015) studied the effect of feeding fenugreek seeds on blood biochemical parameters: total protein, globulin, glucose, cholesterol, triglyceride, protein albumin, urea, and liver enzymes 25 AST, ALT in Hamdani ewes and reported that glucose, cholesterol, triglyceride and globulin level were lower and

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blood urea, GOT and GPT were higher in treatment group as compared to control group, but these differences were not statistically significant.

Ishtiyaket *et al.* (2013) investigated the effect of adding raw fenugreek seeds on blood biochemical profile in goats. Twelve local male goats of similar age group were selected and randomly divided into two groups. The treatment group was fed basal diet along with raw fenugreek seeds @3% dry matter intake. They concluded that there was significant increase ( $P<0.05$ ) in serum albumin and serum protein in treatment group as compared to control group.

Yatooet *et al.* (2012) observed the effect of fenugreek and black cumin seeds supplementation on the performance and blood biochemical profile in broiler. Four groups were selected for the experiment, each group consisted of 25 birds. The results showed that there was an increase in body weight gain, FCR, Hb (g/dl), PCV (%), total protein and albumin (g/dl) in treatment groups as compared to control.

Babekir (2015) conducted a study to observe the effect of fenugreek seeds as feed additives on blood chemical profile of Nubian Goats. They concluded that adding fenugreek seeds into the diet @ 5%, 10% and 15% showed significant ( $P>0.05$ ) decrease in total protein level as compared to control group. Though not statistically significant, increasing the amount of fenugreek to 15% resulted in decrease in glucose level.

Abbas *et al.* (2012) reported a study to examine the effect of fenugreek seed on Saidu lambs. The results revealed that supplementing fenugreek seeds to the basal diet @3% body weight had non-significant decrease in total serum protein and plasma glucose level.

Al-dainet *et al.* (2015) experimented with certain medicinal herbs including fenugreek on some biochemical metabolites in Awassi lambs and found that there was significant increase in total protein level and globulin concentration whereas glucose level decreases.

Shaikh *et al.* (1999) performed a study on 21 lactating dairy goats to evaluate the effect of fenugreek supplementation. The animals were divided into three groups and fed fenugreek along with concentrate @ 0, 25% and 50% respectively. The results showed

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that there were no significant differences in glucose level and plasma protein level between the treatment groups.

Tarabany *et al.* (2017) conducted a study on lactating Baladi goats to study the effect of dietary fenugreek supplementation @100g/head/day. They found that total protein, albumin, globulin concentration increased significantly in treatment group compared to control group.

Khosla *et al.* (1993) analysed the effect of fenugreek seed administration in normal and diabetic rats. After the experiment, it was found that there was significant decrease in blood glucose level both in normal and diabetic rats.

El-Rawi (2012) investigated the impact of using different levels of fenugreek in Awassi lambs and analysed the blood biochemical parameters. The study revealed that concentration of total serum protein, blood glucose level significantly increased in treatment group.

### **3.4 COST OF FEEDING**

Tanwar *et al.* (2008) studied the outcome of shatavari supplementation to improve the economic efficiency and milk production in dairy animals and found that cost benefit ratio was 1:2.95 in buffalo and 1:3.65 in cow.

Kumar *et al.* (2018) studied the effect of supplementing different herbal galactagogues and reported the economics of lactating crossbred cows. The results showed that the cost benefit ratio was higher in treatment groups than in control groups. This indicated that the productivity was increased with the supplementation of galactagogue.

Choubey *et al.* (2017) studied the effect of overnight soaked fenugreek seeds (1.5%) in lactating surti buffaloes and found that milk production increased significantly without affecting cost of production.

Patel *et al.* (2017) conducted a study on the outcome of herbal galactagogue in lactating Kankrej cows. Twenty Four animals were divided into four groups T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub>. T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> were supplemented with 30g, 60g and 90g herbal galactagogue

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whereas T1 was kept as control. The results revealed that the percentage daily return over control in T2, T3 and T4 was 23.95, 24.89 and 19.25 respectively.

Bhatt *et al.* (2009) evaluated the consequences of supplementing herbal preparations in crossbred lactating cows and found that the percentage monetary gain over control was 50.37 as compared to 23.49 in control.

Bipate and Mishra (2020) calculated the cost benefit ratio to evaluate the effect of polyherbal supplementation in crossbred cattle. The results revealed that the net benefit from polyherbal supplemented diet per animal was Rs 83.54/day which indicated higher daily return compared to control group.

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## CHAPTER-III

# MATERIALS AND METHODS

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In this chapter the methodologies adapted for studying the various parameters are discussed in details:

### **3.1 LOCATION AND DURATION OF STUDY**

The experimentation was carried out under Sahiwal Cattle Farm, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam. The research was done for a period of 90days. All the experimental animals were raised under similar climatic and managerial conditions.

### **3.2 ANIMAL SELECTION AND GROUPING OF ANIMALS**

Fifteen lactating Sahiwal cows of similar body weight and age were selected for the study. All cows were fed according to balance ration. The cows were divided into three groups T<sub>0</sub> (control), T<sub>1</sub> and T<sub>2</sub> group.

### **3.3 HOUSING AND MANAGEMENT**

The animals were housed in the existing conventional house of the farm. They were kept in tail-to-tail arrangement. The floor, feeding troughs and mangers were regularly cleaned and disinfected periodically. The footbath placed at the entrance was maintained regularly and replaced by disinfectant solutions every day.

### **3.4 MILKING MANAGEMENT**

Hand milking was practiced under clean and hygienic conditions. Before milking the udder was cleaned to remove dirt applied in the teats to remove dirt from the teats. Full hand milking was practised in the farm. After milking the udder was washed and dried off so as to prevent infection. The cows were milked twice daily in the morning and evening .

### **3.5 FEEDING SCHEDULE DURING EXPERIMENTAL PERIOD**

All animals were stall fed. The quality supply of green fodder and concentrate mixture was provided according to standard requirement. Feeding was done twice daily

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in the morning at 9.30 a.m and evening at 3p.m in separate feeding troughs. Ad libitum water was made available throughout the day and night.

### 3.5.1 Experimental rations

Animals were fed with standard concentrate mixture which consist of Maize, wheat bran, rice polish, deoiled rice bran, soyabean meal, groundnut cakemineral mixture and salt which was prepared as per ICAR (2013) recommendation.

**TABLE 3.1 PERCENT COMPOSITION OF CONCENTRATE MIXTURE USED IN EXPERIMENT**

Sl no	Ingredients	Parts (kg)
1	Maize	19
2	Wheat Bran	23
3	Deoiled Rice bran	22
4	Rice polish	14
5	Groundnut Cake	10
6	Soyabean Meal	9
7	Mineral Mixture	2
8	Salt	1
	<b>Total</b>	<b>100</b>

### 3.6 TECHNICAL PROGRAMME OF WORK

A total of 15 healthy animals of similar age and body weight were selected for the investigation. The selected animals were randomly divided into three groups viz., T<sub>0</sub>(control), T<sub>1</sub>, and T<sub>2</sub> of five animals in each group.

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**TABLE 3.2 DISTRIBUTION OF ANIMALS IN DIFFERENT TREATMENT GROUPS**

<b>Treatments groups</b>	<b>No of animals</b>	<b>Treatments</b>
T <sub>0</sub>	5	Balance ration
T <sub>1</sub>	5	Balance ration + 25gms of fenugreek seeds per animal per day
T <sub>2</sub>	5	Balance ration + 50 gms of fenugreek per animal per day

### **3.7 PARAMETERS STUDIED AND METHODOLOGY**

#### **3.7.1 Feed Consumption**

##### **3.7.1.1 Dry matter intake (kg)**

Daily feed offered and residue left has been measured. Dry matter intake was calculated at fortnightly basis and then DMI/100 kg bodyweight was calculated.

##### **3.7.1.2 Milk Efficiency**

Milk efficiency was calculated from amount of milk produced (kg) per unit of feed consumed on dry matter basis.

#### **3.7.2 Utilization of the nutrients**

A digestibility trial was conducted for a period of 5 days. Faeces were collected on 24 hourly basis during the period. Feed offered, faeces voided and residue left were collected and recorded to determine digestibility of various organic nutrients present in the feed. After that proximate analysis was done in feed and faecal samples to determine the digestibility of dry matter, crude protein, crude fibre, ether extract, organic matter and nitrogen free extract as per procedures Association of Official Analytical Chemists (AOAC, 2005).

##### **3.7.2.1 Dry matter (DM%)**

Feed sample, residues and faecal sample were weighed in a dry petridish was kept in the oven at  $100 \pm 5^{\circ}$  C for 24hrs. The loss in moisture was calculated using the formula:

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$$\text{Moisture (\%)} = \frac{(W2 - W3)}{(W2 - W1)} \times 100$$

Where, W1 = weight of clean and dry petridish

W2 = weight of petridish + sample before drying

W3 = weight of petridish + sample after drying

$$\text{Dry matter (\%)} = 100 - \text{moisture}$$

### 3.7.2.2 Crude Protein (%)

Crude protein of the samples was estimated by Kjeldahl method. The total nitrogen present in the sample was determined and protein content was obtained by multiplying the nitrogen content with the factor 6.25. The sample was weighed and about 1-2g sample was transferred to a clean dry Kjeldahl flask. 10g digestion mixture (sodium sulphate and copper sulphate at 20:1) along with 25 ml of conc. H<sub>2</sub>SO<sub>4</sub> is added in the kjeldahl flask for digestion. Then the flask was placed on digestion bench and was heated for 5-6hrs till the contents became clear blue. Then 25ml distil water was added and transferred to 250 ml volumetric flask. Then the Kjeldahl flask was washed several times by adding little amount of distil water and was made upto volume upto 250ml. After that 10 ml of 2% boric acid was added with the help of pipette. 10 ml of aliquot was taken for distillation and about 10ml of 40% NAOH was added to the distillation assembly. The contents of the flask was titrated with N/10 H<sub>2</sub>SO<sub>4</sub> till the end point was reached.

$$N = \frac{\text{Volume of N/10 H}_2\text{SO}_4 \text{ used} \times 0.0014 \times 250}{\text{Volume of aliquot} \times \text{wt. sample taken}} \times 100\%$$

$$\text{Crude protein (\%)} = \%N \times 6.25$$

### 3.7.2.3 Ether Extract (%)

A quantity of dry sample (5gm) was weighed and transferred to an extraction thimble. The top of the thimble was plugged with a thin layer of absorbent cotton to avoid escape of the materials. A clean dry receiver flask was taken from the Soxhlet assembly and its weight was recorded. The thimble was put into the Soxhlet extractor and petroleum ether was poured at the top by means of a glass funnel until it begins to

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siphon off. The apparatus was placed on heating mantles at 60-80°C for 6-8hrs. the thimble was removed after the extraction was over. The apparatus was run again till all the ether was recovered from the receiver flask. The flask was then dried in hot air oven at 100°C for 1 hr. It was cooled in a desiccator and then weighed.

$$\% \text{ EE} = \frac{W_2 - W_1}{\text{Weight of the sample}} \times 100$$

Where,

W1 = weight of the empty receiver flask

W2 = weight of the receiver flask + fat after extraction

W2-W1 = weight of the ether extract

#### 3.7.2.4 Crude fibre (%)

About 2gm of moisture and fat free sample was weighed and transferred to a spoutless beaker. 200ml of 1.25% H<sub>2</sub>SO<sub>4</sub> was added into the beaker and then the round bottom condenser was placed over the beaker. After that it was put on the hot plate and heated for about 30 minutes. The contents of the beaker then filtered through a muslin cloth. The residue was washed with water till it was free from acid. The material was then transferred from muslin cloth back to the beaker. 200ml of 1.25% of NaOH solution was added and was boiled for exactly 30minutes. The contents of the beaker was then filtered through muslin cloth and washed with water till it become free from alkali. The residue was then transferred to a clean dry crucible and dried at 100± 5°C in hot air oven for about 6 hrs. it was then cooled in a dessicator and its weight was recorded. The dried sample in silica crucible was ignited in muffle furnance at 550-600°C for 30 minutes and after cooling, the weight was recorded.

$$\% \text{ CF} = \frac{\text{Weight of the crucible + contents after drying} - \text{Weight of the crucible + contents after ashing}}{\text{Weight of the sample}} \times 100$$

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### 3.7.2.5 Total Ash (%)

5g of dried sample was taken into the pre weighed silica crucible and its weight was recorded. The sample was burned in an electric heater till the smoke ends up leaving. The crucible was then transferred into a muffle furnace with the help of metal tong and ignited at 550-600<sup>0</sup> C for 4 hrs. after that it was allowed to cooled and the crucible was removed and cooled in a dessicator and the weight was recorded.

$$\% \text{ Total ash} = \frac{\text{Weight of the crucible with ash} - \text{Weight of the crucible}}{\text{Weight of the sample}} \times 100$$

### 3.7.2.6 Organic matter (%)

Organic matter was calculated by subtracting total ash content from 100

$$\text{Organic matter (\%)} = 100 - \text{total ash}$$

### 3.7.2.7 Nitrogen Free Extract (%)

This fraction was obtained by subtracting the percentage of crude protein(CP), ether extract(%), crude fibre(CF), and total ash(TA) from 100

$$\% \text{NFE} = 100 - (\text{CP\%} + \text{EE\%} + \text{CF\%} + \text{TA\%})$$

## 3.7.3 Milk quantity and quality parameters

### 3.7.3.1 Milk quantity

Average daily milk yield was recorded from each animal on fortnightly basis.

### 3.7.3.2 Lactational milk yield

305 days lactational milk yield of all the cows in the three groups was taken from farm records.

### 3.7.3.3 Duration of peak milk yield

Days attaining peak milk yield was recorded for each of the animal. Simultaneously days terminating peak milk yield was recorded. The duration was then calculated.

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### **3.7.3.4 Milk quality**

Fat (%), SNF (%), lactose (%), protein (%), ash (%) and specific gravity was determined using ultrasonic milk analyser.

### **3.7.4 Blood Biochemical Parameter**

#### **Collection of blood:**

Blood samples were collected from each animal of all the three groups. The animals were restrained in standing position and blood samples were collected from jugular vein under aseptic conditions by using 18G needle in clot activator vial. Then the tubes were centrifused at 3000rpm for 10-15min and separated for biochemical analysis.

#### **Biochemical Analysis**

Serum samples were used for determination of biochemical parameters i.e blood glucose and total serum protein at 37<sup>0</sup> C in a semi automated clinical chemical analyzer Benesphera™ C61 by using commercially available invitro diagnostic kit as per manufactured protocol.

#### **3.7.4.1 Estimation of Blood Glucose**

The serum glucose was estimated by GOD-POD method by using invitro diagnostic kit and the result was expressed in mg/dl.

#### **3.7.4.2 Estimation of Total serum Protein**

The serum protein was estimated by modified Biuret method and the result was expressed in g/dl.

### **3.7.5 Cost of Feeding**

The cost of feeding the animals was worked out considering the cost of concentrate, green grass, paddy straw and fenugreek seed. The prices were Rs. 26 per kg concentrate (as per CVSc, AAU price list), Rs. 2 per kg green grass and Rs. 4 per kg. paddy straw. The cost of the herbal supplement fenugreek was calculated out based on actual market price.

### **3.8 Statistical Analysis**

Statistical analysis was done as per Snedecor and Cochran (1994)

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**FIG.3.1 : EXPERIMENTAL SHED**



**FIG. 3.2: FEEDING OF EXPERIMENTAL ANIMALS**



Fig 3.3: Fenugreek seed (*Trigonella foenum Graecum*)



FIG 3.4: PROXIMATE ANALYSIS OF EXPERIMENTAL SAMPLES

## Chapter IV

# EXPERIMENTAL FINDINGS

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The experiment was conducted to investigate the effect of different level of herbal supplements on productive performance on Sahiwal cows. The results of the present study have been listed under the following heads:

### 4.1 FEED CONSUMPTION

#### 4.1.1 Dry matter intake (kg/day)

The average fortnightly feed intake(kg/day) on dry matter basis of different treatment groups have been presented in Table 4.1. The bar diagram presentation of fortnightly dry matter intake of different treatment groups has been presented in Fig 4.1.

Overall mean of daily feed intake on dry matter basis in control( $T_0$ ), Treatment 1 ( $T_1$ ) and Treatment 2( $T_2$ ) were  $10.01\pm 0.02$ ,  $10.24\pm 0.03$  and  $10.22\pm 0.08$  respectively. Statistical analysis in Table 4.2 revealed non-significant differences between different treatment groups.

The average DMI/100kg body weight for each fortnightly interval has been presented in Table 4.3 and Fig 4.2. Overall mean of the DMI/100kg bodyweight in the treatment groups were  $2.57\pm 0.03$ ,  $2.59\pm 0.01$  and  $2.80\pm 0.79$  respectively.

However, Table 4.4 shows statistical analysis which revealed that there were no significant differences ( $p < 0.05$ ) found between the three treatment groups with respect to overall mean.

#### 4.1.2 Milk efficiency

Overall mean of milk efficiency of the treatment groups has been presented in Table 4.5. Overall mean of milk efficiency in  $T_0$ ,  $T_1$  and  $T_2$  were  $0.70\pm 0.01$ ,  $0.75\pm 0.01$  and  $0.77\pm 0.01$  respectively. Statistically there was significantly higher value in treatment group compared to control group.

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**TABLE 4.1 AVERAGE FORTNIGHTLY (MEAN±SE) DRY MATTER INTAKE (kg/day) IN DIFFERENT TREATMENT GROUP**

Treatments	Fortnights						Overall ( $\mu$ )
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>	
T <sub>0</sub>	9.84±0.45	9.63±0.32	10.26±0.39	10.31±0.17	9.93±0.13	10.09±0.00	10.01±0.02
T <sub>1</sub>	10.18±0.01	10.29±0.00	10.18±0.14	10.13±0.08	10.33±0.00	10.34±0.00	10.24±0.03
T <sub>2</sub>	10.36±0.01	10.24±0.13	9.88±0.22	10.43±0.00	10.27±0.24	10.16±0.36	10.22±0.08

**TABLE 4.2 ANOVA OF AVERAGE FORTNIGHTLY DRY MATTER INTAKE IN DIFFERENT TREATMENT GROUPS**

Source of Variation	df	SS	MS	F
Treatment	2	1.0008	0.5004	2.339 <sup>NS</sup>
Fortnight	5	0.506	0.101	0.463 <sup>NS</sup>
Treatment x Fortnight	10	2.312	0.231	1.089 <sup>NS</sup>
Error	72	12.712	0.176	

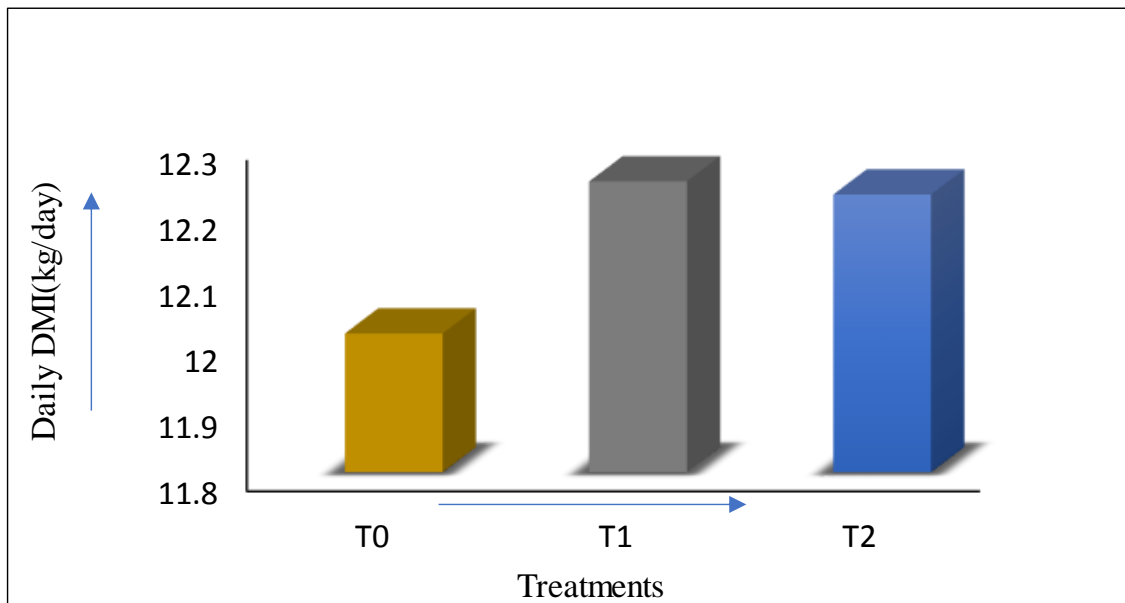
<sup>NS</sup>= Non significant

**TABLE 4.3 AVERAGE FORTNIGHTLY DMI/100 kg BODY WEIGHTDIFFERENT TREATMENT GROUPS**

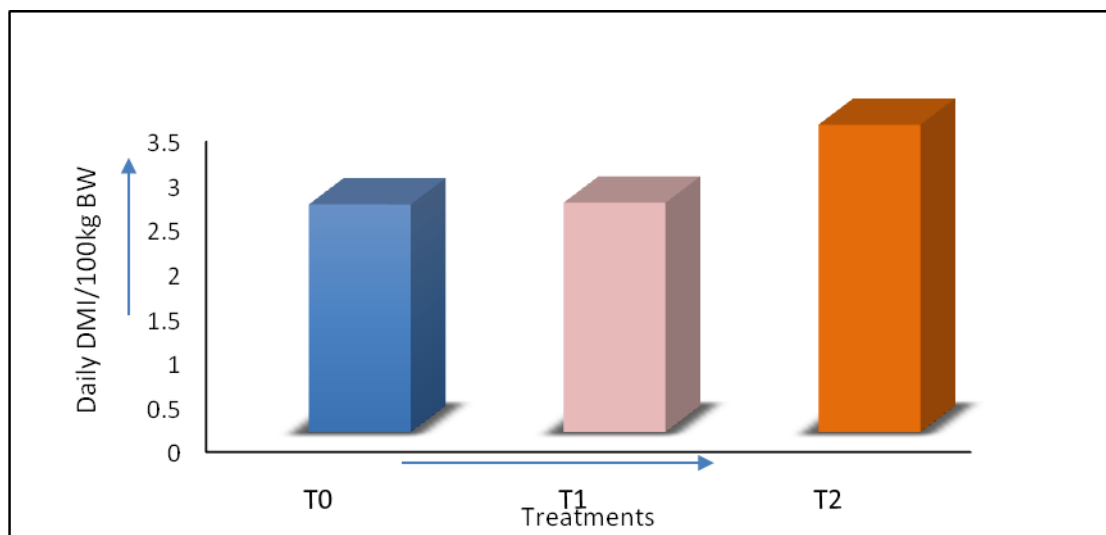
Treatments	Fortnights						Overall ( $\mu$ )
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>	
T <sub>0</sub>	2.55±0.08	2.44±0.10	2.62±0.07	2.66±0.03	2.55±0.05	2.58±0.03	2.57±0.03
T <sub>1</sub>	2.59±0.03	2.60±0.03	2.58±0.03	2.62±0.03	2.59±0.03	2.59±0.03	2.59±0.01
T <sub>2</sub>	2.66±0.01	2.63±0.02	2.86±0.01	3.45±4.75	2.55±0.04	2.66±0.05	2.80±0.79

**TABLE 4.4 ANOVA OF AVERAGE FORTNIGHTLY DMI/100kg BODY WEIGHT IN DIFFERENT TREATMENT GROUPS**

Source of variation	df	SS	MS	F
Treatment	2	15.727	7.863	1.253 <sup>NS</sup>
Fortnight	5	33.786	6.757	1.076 <sup>NS</sup>
Treatment x Fortnight	10	61.836	6.183	0.985 <sup>NS</sup>
Error	72	451.929	6.276	



**FIG. 4.1: AVERAGE FORTNIGHTLY DAILY DMI(kg/day) IN DIFFERENT TREATMENT GROUPS**



**FIG. 4.2: AVERAGE FORTNIGHTLY DMI/100kg BODY WEIGHT IN DIFFERENT TREATMENT GROUPS**

**TABLE 4.5 AVERAGE FORTNIGHTLY (MEAN±SE) MILK EFFICIENCY IN DIFFERENT TREATMENT GROUPS**

Treatments	Fortnights						
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>	Overall (μ)
T <sub>0</sub>	0.71±0.02 <sup>A</sup>	0.72±0.02 <sup>A</sup>	0.66±0.03 <sup>A</sup>	0.66±0.01 <sup>A</sup>	0.71±0.01 <sup>A</sup>	0.70±0.01 <sup>A</sup>	0.70±0.01 <sup>A</sup>
T <sub>1</sub>	0.75±0.01 <sup>B</sup>	0.74±0.01 <sup>A</sup>	0.72±0.02 <sup>A</sup>	0.72±0.01 <sup>B</sup>	0.74±0.02 <sup>A</sup>	0.72±0.02 <sup>A</sup>	0.75±0.01 <sup>B</sup>
T <sub>2</sub>	0.69±0.02 <sup>AB</sup>	0.76±0.02 <sup>A</sup>	0.81±0.01 <sup>B</sup>	0.76±0.00 <sup>B</sup>	0.82±0.02 <sup>B</sup>	0.82±0.02 <sup>B</sup>	0.77±0.01 <sup>C</sup>

Means with different superscripts differ significantly (p<0.05)

**TABLE 4.6 ANOVA OF AVERAGE FORTNIGHTLY MILK EFFICIENCY IN DIFFERENT TREATMENT GROUPS**

Source of variation	df	SS	MS	F
Treatment	2	0.0727	0.03635	24.9267**
Fortnight	5	0.01609	0.003218	2.20674 <sup>NS</sup>
Treatment x Fortnight	10	0.044048	0.004405	3.020546**
Error	72	0.104995	0.001458	

\*\* Highly Significant (p<0.01), <sup>NS</sup> non-significant

## 4.2 UTILIZATION OF NUTRIENTS

The average value of proximate composition of the nutrients fed to the experimental cows has been presented in the Table 4.7. Graphical representation of digestibility of the nutrients has been presented in Fig 4.3. Analysis of variance showed that the nutrients fed to the experimental groups was significantly higher in treatment group compared to control group.

**TABLE 4.7: AVERAGE (MEAN±SE) OF NUTRIENTS FED TO THE EXPERIMENTAL ANIMALS IN DIFFERENT TREATMENT GROUPS**

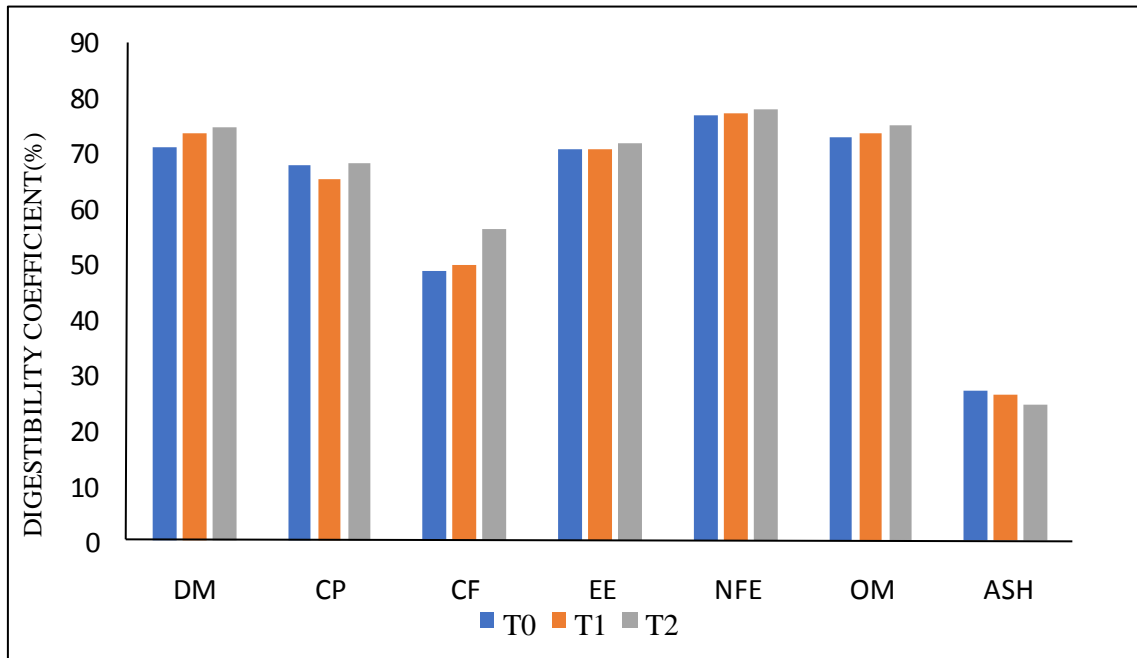
Nutrients	Treatments		
	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>
DM	71.12±0.27 <sup>a</sup>	73.58±0.26 <sup>b</sup>	74.72±0.22 <sup>c</sup>
CP	67.89±0.11 <sup>a</sup>	65.54±0.05 <sup>b</sup>	68.48±0.07 <sup>c</sup>
CF	48.80±0.37 <sup>a</sup>	50.04±0.29 <sup>a</sup>	56.24±0.28 <sup>b</sup>
EE	70.70±0.05 <sup>a</sup>	70.98±0.09 <sup>a</sup>	72.06±0.08 <sup>b</sup>
NFE	77.14±0.15 <sup>a</sup>	77.35±0.04 <sup>a</sup>	78.13±0.09 <sup>b</sup>
OM	72.97±0.08 <sup>a</sup>	73.78±0.06 <sup>b</sup>	75.34±0.09 <sup>c</sup>

Means with different superscripts differ significantly (p<0.05)

**TABLE 4.8: DIGESTIBILITY COEFFICIENT OF THE NUTRIENTS IN DIFFERENT TREATMENT GROUPS**

Parameters	Source of variation	df	SS	MS	F
DM	Treatment	2	60.93	30.46	52.54**
	Error	24	13.91	0.57	-
CP	Treatment	2	5.78	2.89	6.18**
	Error	24	11.31	0.47	-
CF	Treatment	2	286.85	143.42	14.33**
	Error	24	240.18	10.0	-
EE	Treatment	2	9.22	4.61	8.64**
	Error	24	12.80	0.53	-
NFE	Treatment	2	22.04	11.02	11.53**
	Error	24	22.93	0.95	-
OM	Treatment	2	26.09	13.04	22.83**
	Error	24	13.71	0.57	-

NB: \*\* Highly Significant (p<0.01)



**Fig 4.3 DIGESTIBILITY COEFFICIENT OF THE NUTRIENTS FED TO THE EXPERIMENTAL ANIMALS**

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### **4.3 MILK QUANTITY AND QUALITY PARAMETERS**

#### **4.3.1 Milk Quantity**

Average daily milk yield was recorded for each animal. Table 4.9 shows the average milk yield records of the animals in different treatment groups. The average daily milk yield increased in treatment groups (Fig 4.4). Overall mean milk yield increased from  $7.00\pm 0.05$  kg to  $7.99\pm 0.10$  kg.

Statistical analysis found that milk yield increased significantly and there were highly significant differences ( $p < 0.01$ ) between all the three treatment groups. It was found that milk yield was apparently higher in Treatment 2 ( $T_2$ ) group. Milk yield increased in 3<sup>rd</sup> and 5<sup>th</sup> fortnights in the  $T_2$  group.

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**TABLE 4.9 AVERAGE FORTNIGHTLY (MEAN±SE) MILK YIELD IN DIFFERENT TREATMENT GROUPS**

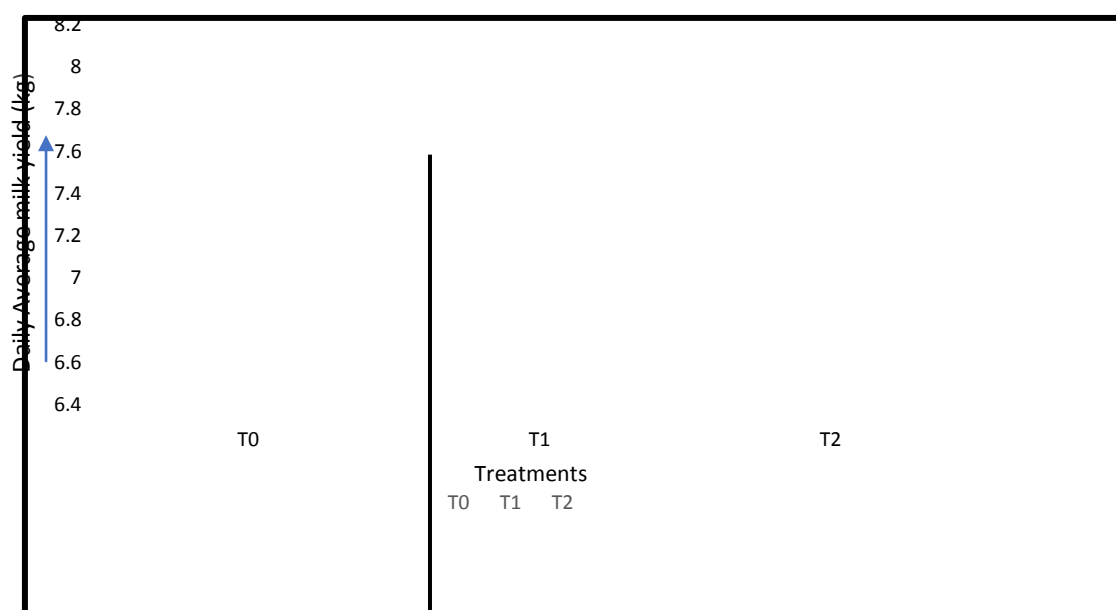
Treatments	Fortnights						Overall ( $\mu$ )
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>	
T <sub>0</sub>	7.00±0.00 <sup>Aa</sup>	7.00±0.2 <sup>Aa</sup>	6.94±0.24 <sup>Aa</sup>	6.82±0.02 <sup>Aa</sup>	7.10±0.15 <sup>Aa</sup>	7.16±0.10 <sup>Aa</sup>	7.00±0.05 <sup>A</sup>
T <sub>1</sub>	7.76±0.11 <sup>Ba</sup>	7.70±0.12 <sup>Ba</sup>	7.36±0.15 <sup>Aa</sup>	7.34±0.14 <sup>Ba</sup>	7.66±0.28 <sup>Ba</sup>	7.54±0.27 <sup>Aa</sup>	7.56±0.08 <sup>B</sup>
T <sub>2</sub>	7.20±0.20 <sup>Aa</sup>	7.80±0.20 <sup>Bb</sup>	8.10±0.10 <sup>Bbc</sup>	7.94±0.02 <sup>Cb</sup>	8.48±0.12 <sup>Cc</sup>	8.40±0.18 <sup>Bc</sup>	7.99±0.10 <sup>C</sup>

Means with different superscript in a row (small) in a column (capital) differ significantly

**TABLE 4.10 ANOVA OF AVERAGE FORTNIGHTLY MILK YIELD IN DIFFERENT TREATMENT GROUPS**

Source of variation	df	SS	MS	F
Treatment	2	14.588	7.294333	58.66756**
Fortnight	5	2.257	0.4514	3.630563**
Treatment x Fortnight	10	4.307	0.430733	3.464343**
Error	72	8.952	0.124333	

\*\* = Highly significant (p<0.01)



**Fig 4.4: AVERAGE FORTNIGHTLY MILK YIELD IN DIFFERENT TREATMENT GROUPS**

### 4.3.2 Lactational Milk Yield

Estimated Lactational Milk Yield of the experimental animals have been recorded from the farm records and have been presented in Table 4.11.

Statistical analysis showed that there were no significant differences in lactational milk yield between the treatment groups.

**TABLE 4.11: AVERAGE (MEAN $\pm$ SE) LACTATIONAL MILK YIELD BETWEEN DIFFERENT TREATMENT GROUPS**

GROUPS	LACTATIONAL MILK YIELD
T <sub>0</sub>	2145.8 $\pm$ 3.82
T <sub>1</sub>	2146 $\pm$ 3.74
T <sub>2</sub>	2147.2 $\pm$ 1.92

**TABLE 4.12: ANOVA OF LACTATIONAL MILK YIELD BETWEEN DIFFERENT TREATMENT GROUPS**

SOURCES OF VARIATION	LACTATIONAL MILK YIELD			
	df	SS	MS	F
Group	2	5.73	2.866	0.070 <sup>NS</sup>
Error	12	489.6	40.6	

<sup>NS</sup>=Non-significant (P>0.05)

### 4.3.3 Duration of Peak Milk Yield

Peak milk yield attained was recorded for all the experimental animals. Also, days attaining peak milk yield was recorded along with days terminating peak milk yield has been presented in the Table 4.13. The average duration of peak milk yield (days) in T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> were 5.4 $\pm$ 0.24, 4.4 $\pm$ 0.4 and 4.4 $\pm$ 0.4 respectively. However, analysis of variance showed no statistical differences between the treatment groups.

**TABLE 4.13: AVERAGE (MEAN±SE) PEAK MILK YIELD, DAYS TO ATTAIN PEAK MILK YIELD, DAYS TERMINATING PEAK MILK YIELD AND DURATION OF PEAK MILK YIELD BETWEEN DIFFERENT TREATMENT GROUPS**

TREATMENTS	PMY (kg)	DAPMY (days)	DTPMY (days)	DURATION OF PMY (days)
T <sub>0</sub>	7.98±0.02	41.2±0.26	46.6±0.5	4.4±0.24
T <sub>1</sub>	8.86±0.24	40.8±0.21	45.6±0.2	4.4±0.4
T <sub>2</sub>	8.9±0.34	40.2±0.21	45.2±0.67	5.4±0.4

**TABLE 4.14 ANOVA TABLE OF PEAK MILK YIELD, DAYS TO ATTAIN PEAK MILK YIELD, DAYS TERMINATING PEAK MILK YIELD AND DURATION OF PEAK MILK YIELD BETWEEN DIFFERENT TREATMENT GROUPS**

Source of variation	PMY				DAPMY			DTPMY			DURATION OF PMY		
	df	SS	MS	F	SS	MS	F	SS	MS	F	SS	MS	F
Treatment	2	1.8	0.91	2.7 <sup>NS</sup>	2.53	1.26	0.924 <sup>NS</sup>	6.53	3.2	2.578 <sup>NS</sup>	3.33	1.66	2.63 <sup>NS</sup>
Error	12	4.008	0.352		16.4	1.36		15.2	1.2		7.76	0.63	

<sup>NS</sup>=Non-significant (P>0.05)

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#### 4.3.4 Milk Quality

For analysis of milk constituents, milk samples from the experimental animals were analyzed at fortnightly basis. The average fortnightly changes in fat (%), SNF (%), protein (%), lactose (%), ash(%) and specific gravity between different treatment groups has been presented in Table 4.15

##### 4.3.4.1 Milk Fat (%)

The average fortnightly fat (%) of the milk samples of T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> initially was 4.02±0.08, 4.04 ±0.15 and 4.22±0.22. Overall mean of fat (%) in the three groups were 4.18±0.03, 4.16±0.04 and 4.35±0.04 respectively. Analysis of variance revealed that the treatment groups had highly significant differences(p<0.01) between each other whereas there were significant differences(p<0.05) between the fortnights. However, there were no significant differences between the treatment and fortnights.

##### 4.3.4.2 Solid- not- Fat (%)

Overall mean of solid-not-fat (%) of the T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> were 8.65±0.02, 8.68±0.03 and 8.79±0.03 respectively. Statistically there was significant differences between the treatment groups(p<0.05). However, there was no significant differences (p>0.05) between the treatment and fortnights. Similarly non-significant differences were found between the fortnights.

##### 4.3.4.3 Lactose (%)

Average fortnightly lactose (%) between different treatment groups have been listed in the TABLE below. Overall mean lactose (%) in T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> were 5.32±0.02, 5.37±0.01 and 5.49±0.03 respectively. Analysis of variance showed that there were highly significant differences (p<0.01) between treatment groups and significant differences between the fortnights. However, no significant differences were found between the treatments and fortnights.

##### 4.3.4.4 Ash (%)

Overall mean ash (%) of different treatment groups were 0.78±0.02, 0.78±0.01 and 0.84±0.01 respectively. Statistically there were highly significant differences (p<0.01) between the treatment groups. Also, there was highly significant differences

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( $p < 0.01$ ) between the different fortnights. Although non-significant differences was found between the treatment and fortnights.

#### **4.4.4.5 Specific gravity**

Specific gravity of the treatment groups was within the normal range. The overall mean of specific gravity in T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> were 1.036, 1.036 and 1.033 respectively. Analysis of variance showed there were no significant differences ( $p > 0.05$ ) between the treatment groups.

#### **4.4.4.6 Protein(%)**

Protein (%) of different groups increased significantly. Analysis of variances showed highly significant differences ( $p < 0.01$ ) between the treatment groups. Also, there was significant differences ( $p < 0.05$ ) found between the fortnights. However, there was no significant differences between treatments and fortnights.

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**TABLE 4.15 AVERAGE FORNITGHTLY (MEAN±SE) MILK COMPOSITION BETWEEN DIFFERENT TREATMENT GROUPS**

Parameters	Fortnights							Overall ( $\mu$ )
	Groups	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>	
Fat (%)	T <sub>0</sub>	4.02 ±0.08	4.18±0.07	4.22±0.07	4.14±0.09	4.26±0.04	4.24±0.07	4.18±0.03 <sup>A</sup>
	T <sub>1</sub>	4.04±0.15	4.10±0.11	4.14±0.09	4.20±0.10	4.26±0.13	4.20±0.09	4.16±0.04 <sup>A</sup>
	T <sub>2</sub>	4.22±0.14	4.24±0.12	4.36±0.11	4.38±0.11	4.56±0.09	4.36±0.04	4.35±0.04 <sup>B</sup>
SNF(%)	T <sub>0</sub>	8.64±0.05	8.64±0.04	8.66±0.05	8.62±0.06	8.66±0.04	8.68±0.04	8.65±0.02 <sup>A</sup>
	T <sub>1</sub>	8.60±0.03	8.64±0.05	8.68±0.07	8.76±0.09	8.74±0.10	8.72±0.06	8.69±0.03 <sup>A</sup>
	T <sub>2</sub>	8.64±0.06	8.70±0.04	8.72±0.04	8.76±0.07	8.80±0.03	8.86±0.12	8.75±0.03 <sup>B</sup>
Lactose (%)	T <sub>0</sub>	5.24±0.04	5.34±0.05	5.26±0.02	5.34±0.04	5.40±0.03	5.36±0.02	5.32±0.02 <sup>A</sup>
	T <sub>1</sub>	5.38±0.02	5.32±0.05	5.34±0.02	5.38±0.05	5.36±0.02	5.42±0.02	5.37±0.01 <sup>A</sup>
	T <sub>2</sub>	5.42±0.07	5.44±0.07	5.46±0.05	5.50±0.09	5.54±0.05	5.56±0.05	5.49±0.03 <sup>B</sup>
Ash (%)	T <sub>0</sub>	0.76±0.02	0.74±0.04	0.78±0.04	0.78±0.05	0.78±0.05	0.84±0.04	0.78±0.02 <sup>A</sup>
	T <sub>1</sub>	0.70±0.03	0.74±0.02	0.78±0.04	0.82±0.02	0.80±0.03	0.82±0.02	0.78±0.01 <sup>A</sup>
	T <sub>2</sub>	0.78±0.21	0.78±0.18	0.84±0.22	0.88±0.16	0.88±0.20	0.90±0.15	0.84±0.01 <sup>B</sup>
Specific Gravity	T <sub>0</sub>	1.035±2.9E-4	1.036±4.3E-4	1.036±4.7E-4	1.036±4.9E-4	1.036±5.4E-4	1.036±6.3E-4	1.036±1.9E-4
	T <sub>1</sub>	1.035±3.9E-4	1.035±3.8E-4	1.036±3.7E-4	1.036±2.4E-4	1.036±1.6E-4	1.036±0.4E-4	1.036±1.2E-4
	T <sub>2</sub>	1.032±4.3E-4	1.033±3.6E-4	1.033±4.0E-4	1.033±2.7E-4	1.033±4.8E-4	1.033±4.1E-4	1.033±1.6E-4
Protein (%)	T <sub>0</sub>	3.44±0.02	3.50±0.03	3.50 ±0.03	3.52 ±0.04	3.54 ±0.04	3.46±0.04	3.49±0.01 <sup>A</sup>
	T <sub>1</sub>	3.46±0.02	3.52 ±0.04	3.52 ±0.04	3.56 ±0.02	3.50 ±0.00	3.56±0.02	3.52±0.01 <sup>A</sup>
	T <sub>2</sub>	3.52±0.04	3.54 ±0.06	3.62 ±0.02	3.68 ±0.04	3.60±0.05	3.56±0.08	3.59±0.02 <sup>B</sup>

Means with similar superscript do not differ significantly

**TABLE 4.16 ANOVA OF FORTNIGHTLY MILK COMPOSITION BETWEEN DIFFERENT TREATMENT GROUPS**

Parameters	Source of Variation	df	SS	MS	F
Fat%	Treatment	2	0.702	0.351	7.10**
	fortnight	5	0.604	0.120	2.44*
	Treatment x fortnight	10	0.117	0.011	0.236 <sup>NS</sup>
	Error	72	3.56	0.049	
SNF%	Treatment	2	0.141	0.07	3.64*
	Fortnight	5	0.167	0.033	1.72 <sup>NS</sup>
	Treatment x Fortnight	10	0.089	0.008	0.458 <sup>NS</sup>
	Error	72	1.4	0.019	
Lactose%	Treatment	2	0.429	0.214	19.52**
	Fortnight	5	0.136	0.027	2.48*
	Treatment x Fortnight	10	0.066	0.006	0.604 <sup>NS</sup>
	Error	72	0.792	0.011	
Ash%	Treatment	2	0.084	0.042	8.47**
	Fortnight	5	0.134	0.026	5.367**
	Treatment x Fortnight	10	0.020	0.002	0.413 <sup>NS</sup>
	Error	72	0.36	0.005	
Specific gravity	Treatment	2	0.0001	8.33E-05	104.28 <sup>NS</sup>
	Fortnight	5	5.59E-06	1.12E-06	1.39 <sup>NS</sup>
	Treatment x Fortnight	10	6.74E-07	6.74E-08	0.084 <sup>NS</sup>
	Error	72	5.75E-05	7.99E-07	
Protein (%)	Treatment	2	0.132	0.069	8.851**
	Fortnight	5	0.105	0.021	2.689**
	Treatment x Fortnight	10	0.054	0.005	0.663 <sup>NS</sup>
	Error	72	0.562	0.007	

NB:\*\*Highly significant (p<0.01), \*Significant (p<0.05) and <sup>NS</sup>Non-significant (p>0.05).

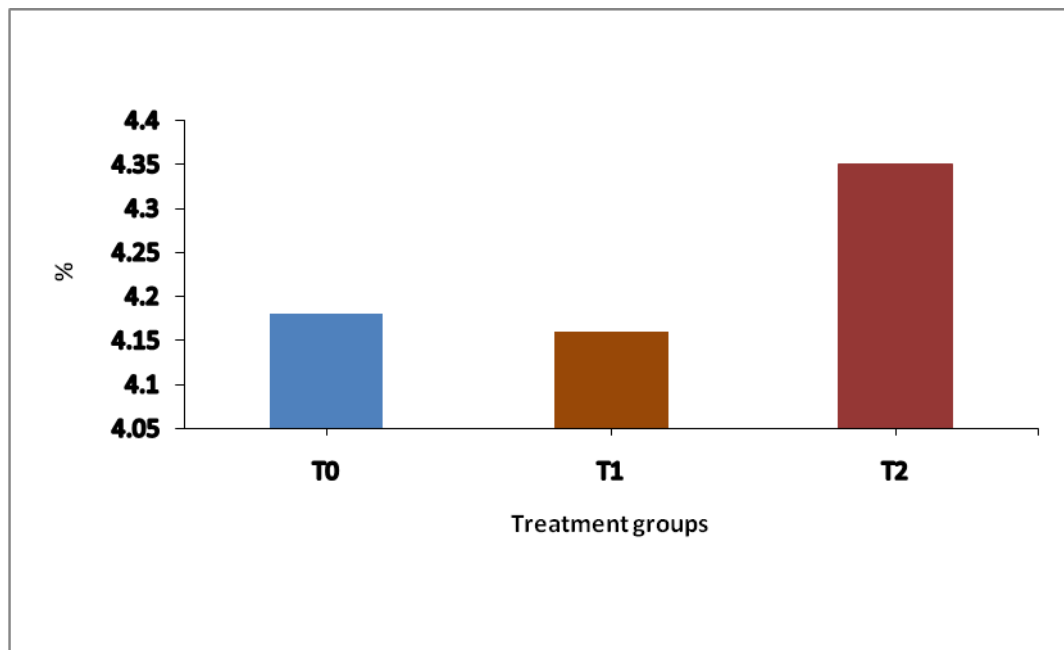


FIG 4.5 AVERAGE FAT(%) OF MILK

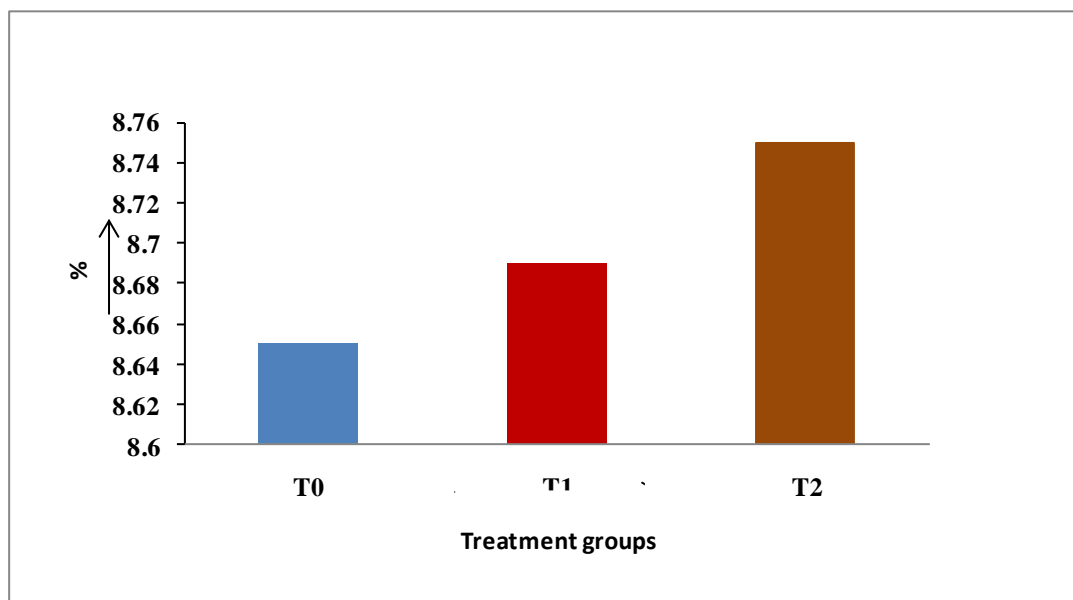


FIG 4.6 AVERAGE SNF (%) OF MILK

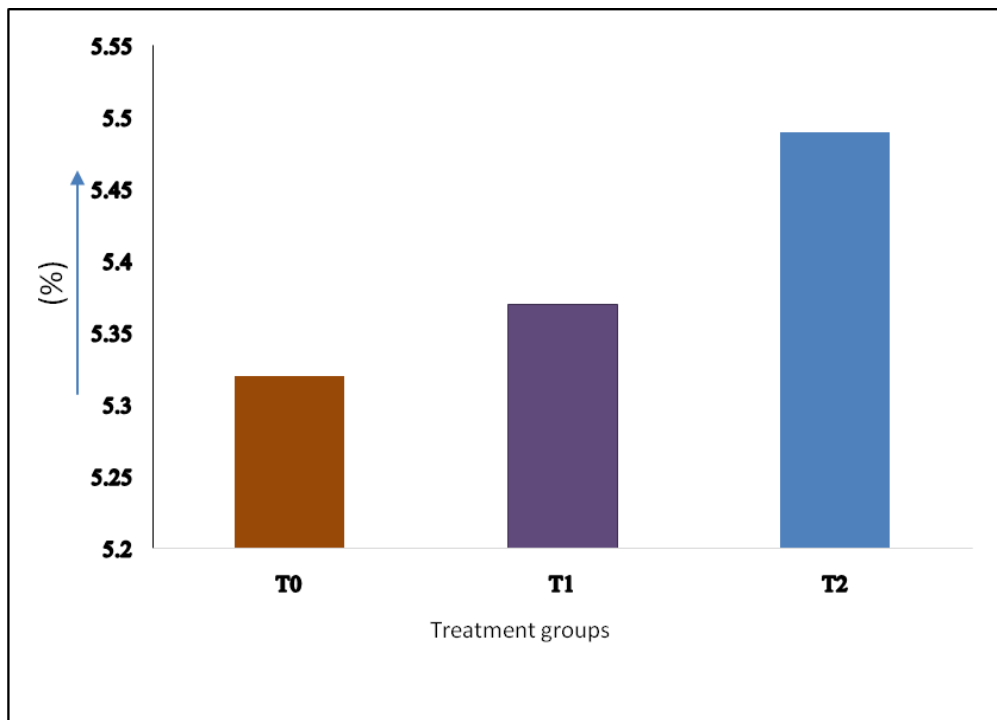


Fig 4.7 : AVERAGE LACTOSE (%) OF MILK

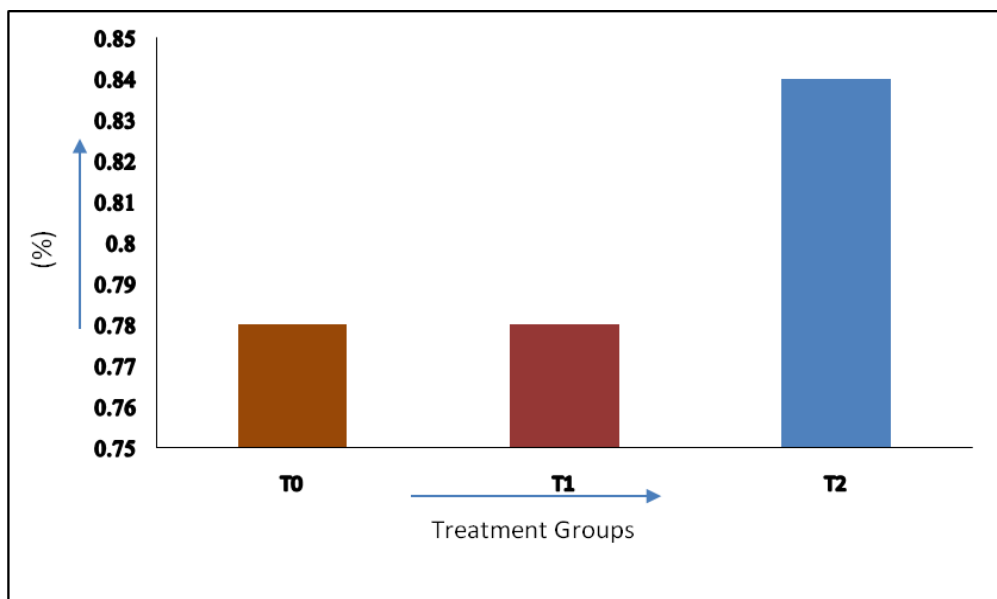


Fig 4.8 AVERAGE ASH(%) OF MILK

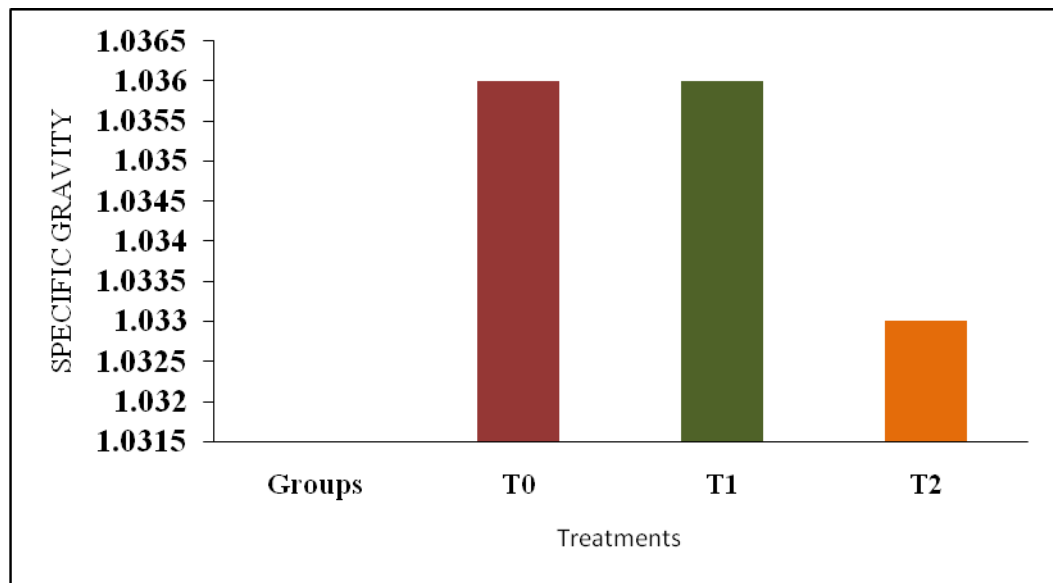


Fig. 4.9 : AVERAGE SPECIFIC GRAVITY OF MILK

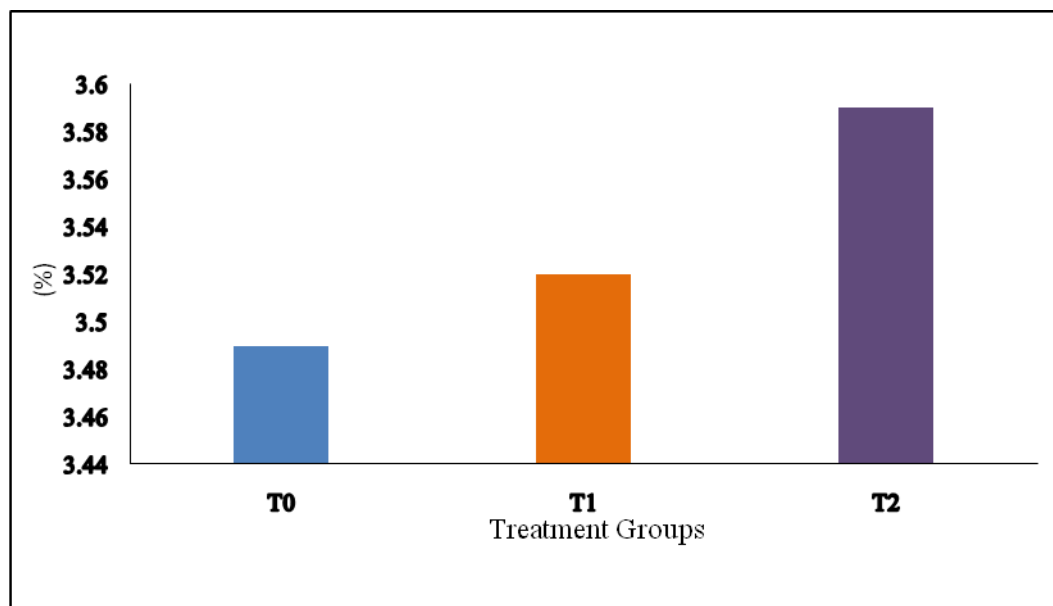


Fig 4.10 AVERAGE PROTEIN(%) OF MILK

## 4.4 Blood Biochemical Parameters

### 4.4.1 Blood Glucose (mg/dl)

The blood glucose level was estimated at the initial, 30<sup>th</sup>, 60<sup>th</sup> and 90<sup>th</sup> day of the experimental period. The average values of the blood glucose level (mg/dl) have been presented in Table 4.17. The average final blood glucose level in control (T<sub>0</sub>) and Treatment 1 (T<sub>1</sub>) and Treatment 2 (T<sub>2</sub>) were 76.74±2.22, 74.2±1.61 and 79.36±1.07 respectively.

No significant ( $p < 0.05$ ) differences were found between the control and treatment groups with respect to initial and final blood glucose and overall mean glucose level.

### 4.4.2 Total Serum Protein (g/dl)

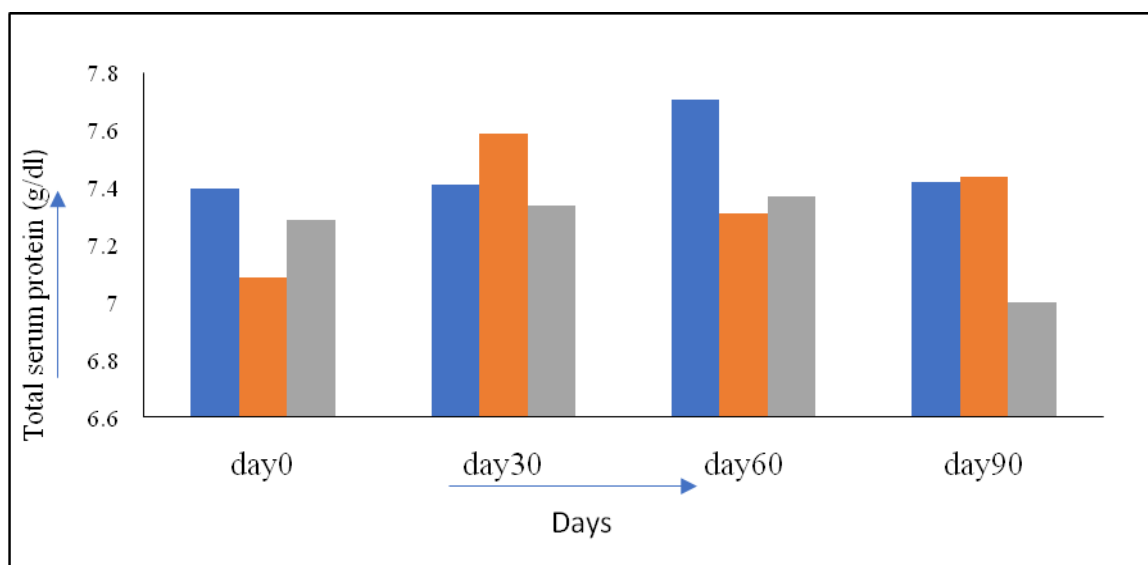
The total serum protein level was estimated at the initial, 30<sup>th</sup>, 60<sup>th</sup> and 90<sup>th</sup> day of the experimental period. The average values of the total serum protein level (g/dl) have been presented in Table 4.17. The average final total serum protein level in control (T<sub>0</sub>) and Treatment 1 (T<sub>1</sub>) and Treatment 2 (T<sub>2</sub>) were 7.42±0.35, 7.44±0.39 and 7.00±0.10 respectively. The difference observed was statistically non significant ( $p < 0.05$ ) between control and treatment groups with respect to initial and final total serum protein level and overall mean glucose level.

**TABLE 4.17 AVERAGE (MEAN±SE) OF BLOOD BIOCHEMICAL PARAMETERS BETWEEN DIFFERENT TREATMENT GROUPS**

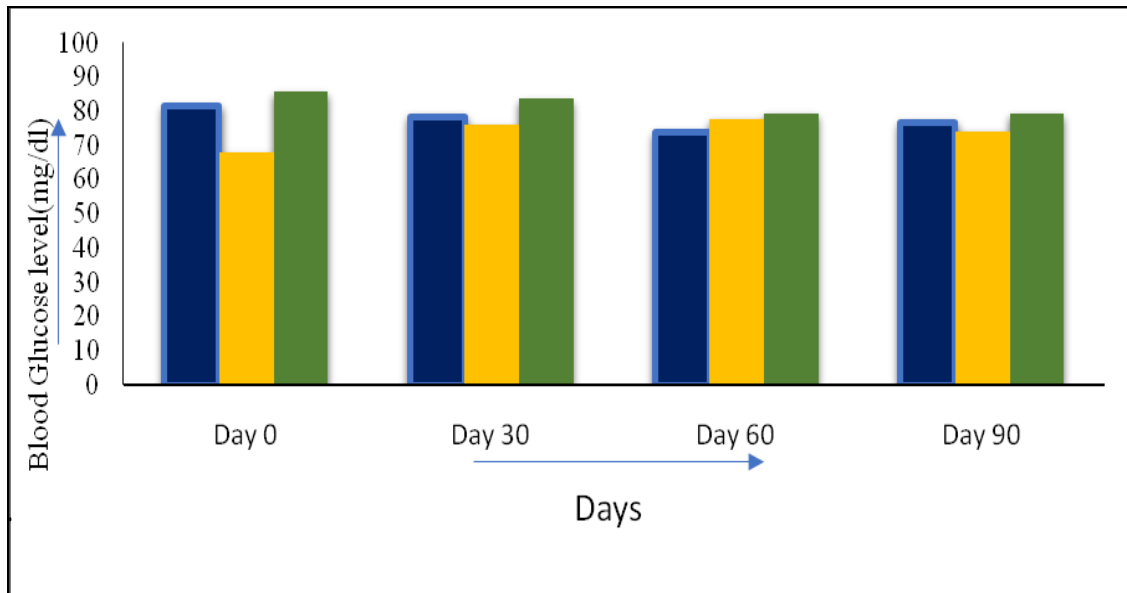
Parameters	Days					Overall ( $\mu$ )
	Treatments	Day 0	Day 30	Day 60	Day 90	
Total serum protein (g/dl)	T <sub>0</sub>	7.40±0.20	7.41±0.24	7.71±0.33	7.42±0.35	7.48±0.13
	T <sub>1</sub>	7.09±0.28	7.59±0.61	7.31±0.33	7.44±0.39	7.36±0.20
	T <sub>2</sub>	7.29±0.32	7.34±0.14	7.37±0.27	7.00±0.10	7.25±0.11
Blood glucose (mg/dl)	T <sub>0</sub>	81.52±5.13	78.5±3.13	73.76±2.26	76.74±2.22	77.63±1.69
	T <sub>1</sub>	67.86±15.44	76.06±1.53	77.82±0.88	74.2±1.61	73.99±3.69
	T <sub>2</sub>	85.76±2.09	83.62±1.79	79.48±2.02	79.36±1.07	82.06±1.03

**TABLE 4.18 ANOVA OF BLOOD BIOCHEMICAL PARAMETERS BETWEEN DIFFERENT TREATMENT GROUPS**

Parameters	Source of Variation	df	SS	MS	F
Total serum protein	Treatment	0.544223	2	0.272112	0.527923 <sup>NS</sup>
	Fortnight	0.503725	3	0.167908	0.325758 <sup>NS</sup>
	Treatment x Fortnight	0.95987	6	0.159978	0.310373 <sup>NS</sup>
	Error	24.74104	48	0.515438	
Blood glucose	Treatment	653.277	2	326.6385	2.587507 <sup>NS</sup>
	Fortnight	67.78333	3	22.59444	0.178985 <sup>NS</sup>
	Treatment x Fortnight	523.7297	6	87.28828	0.691465 <sup>NS</sup>
	Error	6059.364	48	126.2368	



**Fig 4.11: AVERAGE TOTAL SERUM PROTEIN LEVEL (g/dl) IN DIFFERENT TREATMENT GROUPS**



**Fig 4.12: AVERAGE BLOOD GLUCOSE LEVEL (mg/dl) IN DIFFERENT TREATMENT GROUPS**

#### 4.5 Cost of Feeding

The cost of feeding the experimental cows have been presented in Table 4.19. The average daily cost of feeding per cow in control( $T_0$ ), Treatment 1 ( $T_1$ ) and Treatment 2 ( $T_2$ ) were Rs. 182.20, Rs.190.20 and Rs. 195.00. Benefit Cost Ratio was found higher in treatment groups than in control groups.

**TABLE 4.19 AVERAGE COST OF FEEDING INDICES OF DIFFERENT TREATMENT GROUPS**

Particulars	Groups		
	$T_0$	$T_1$	$T_2$
i) Daily cost of feeding/cow (Rs.)	182.20	190.20	195.00
ii) Cost of fenugreek/cow/day (Rs.)	0.00	2.50	5.00
iii) Total cost of feeding/cow/day	182.20	192.50	200.00
iii) Average daily milk yield/cow (kg)	7.00	7.56	7.99
iv) Cost of feeding per kg milk yield (Rs.)	26.02	25.15	24.4
v) Sale price of milk (Rs.)	60.00	60.00	60.00
vi) Profit per kg of milk production (Rs.)	33.90	34.80	35.50
vii) Daily profit per cow (Rs.)	237.80	263.40	283.20
viii) Benefit Cost Ratio (BCR)	1.30	1.38	1.45

## CHAPTER-V

# DISCUSSION

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The results of the present study conducted to investigate the effect of different levels of herbal supplements on Sahiwal cows have been elaborately discussed below:

### 5.1 FEED CONSUMPTION

#### 5.1.1 Dry matter intake (DMI)

The average dry matter intake (kg/day) at 1<sup>st</sup> fortnight in different treatment groups were 9.84±0.04, 10.10±0.01 and 10.36±0.01 respectively. The values in 6<sup>th</sup> fortnight were 10.09±0.00, 10.34±0.00 and 10.16±0.36 respectively overall mean at the end of the experiment were 10.01±0.02, 10.24±0.03 and 10.22±0.08 respectively. ANOVA revealed that feeding of fenugreek seed as galactagogue had no significant ( $p>0.05$ ) difference in DMI between treatments as well as between fortnights

Furthermore, the average DMI/100 kg body weight for each fortnightly interval has been presented in Table 4.3 and Fig 4.2. The average DMI/100kg bodyweight initially was 2.55±0.88, 2.59±0.03 and 2.66±0.01 in T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> respectively. Overall mean of the DMI/100kg bodyweight in the three treatment groups were 2.57±0.03, 2.59±0.01 and 2.80±0.79 respectively. Statistical analysis showed no significant differences ( $p<0.05$ ) between the three treatment groups with respect to overall mean.

Similar findings were reported by Jain *et al.* (2011) who found that supplementation of herbal mixture did not show any effect on DMI as well as on DMI/100kg body weight. Furthermore, Shah and Mir (2004) revealed the effect of providing fenugreek seeds on dairy cow performance. Daily DM intakes were recorded for all the animals for a period of three weeks. The results showed that there was non-significant difference in dry matter intake between treatment and control groups.

On the contrary, Sherwani *et al.* (2015) investigated the effect of feeding fenugreek seeds on dry matter intake in Hamdani ewes and found that daily feed intake increased significantly ( $p<0.05$ ) compared to non-feeding fenugreek seeds. This differences in findings may be due to various factors as dry matter intake depends on

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various factors like level of milk production, environmental conditions, managerial factors, type and quality of feed ingredients.

### **5.1.1 Milk efficiency**

Milk efficiency expressed as mean milk yield per kg DMI was calculated and statistically analyzed. Statistical analysis showed that there was statistically higher value in treatment groups than control group. The present findings might be due to effect of fenugreek seed fed to the treatment groups. In support of the findings Biggs (2022) found that feed efficiency was higher in fenugreek fed group compared to control group.

## **5.2 Utilization of nutrients**

### **5.2.1 Digestibility coefficient (%) of dry matter (DM)**

The average digestibility coefficient (%) of dry matter in T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> are 71.12±0.27, 73.58±0.26 and 74.72±0.22 respectively. Results of Analysis revealed that supplementation of fenugreek seed had highly significant (p<0.01) effect on digestibility of DM intake. The significantly higher digestibility of dry matter may be due to fenugreek contain saponins which are considered as an appetizer and helps in better digestion which lead to better utilization of nutrients.

The results agree with the findings of Mirzaei *et al.* (2012) who evaluated the effect of feeding fenugreek seed powder and found that total digestible nutrients contents improved in fenugreek seed fed group. Salama *et al.* (2015) also found that adding fenugreek seeds (2%) in basal fattening rations led to considerable increase in ration palatability and reported significant increase in (P<0.05) digestibility of DM. Mahgoub and Sallam (2016) also investigated the effect of basal diet by supplementing crushed fenugreek seeds on Egyptian buffaloes and revealed that nutrient digestibility significantly increased in treatment group compared to control group. However, workers like Al-Wazeer (2017) experimented by giving Awassi lambs graded level 0, 2.5, 5 and 7.5 gm/head/day of fenugreek seeds and found no significant differences (P>0.05) in digestibility of DM.

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### 5.2.2 Digestibility Coefficient (%) of Crude Protein (CP)

The average digestibility coefficient (%) of crude protein in control (T<sub>0</sub>), treatment 1 and treatment 2 were 67.89±0.11, 65.54±0.05 and 68.48±0.07 respectively. Analysis of variance revealed that there was highly significant difference (p<0.01) between the control and treatment groups. The higher crude protein may be due to efficient utilization of the nutrients due to supplementation of fenugreek seeds in the diet.

The presents findings agree with the findings of Elmnan *et al.* (2013) who investigated the effect of supplementation of fenugreek seeds on digestibility of Nubian goats and found that nutrient digestibility CP were higher in goats fed with fenugreek seeds than the control group. Mir *et al.* (2012) examined the effect of raw fenugreek seeds at the rate of 3% DMI on nutrient utilization in goats and revealed that digestibility coefficient of crude protein, were significantly higher (p<0.05) in treatment groups than in control groups. On the contrary Ali (2015) conducted a study to determine the effect of fenugreek seeds which are natural supplement in Nubian goat diets. Results showed that the digestibility (%) of these nutrients were not significantly affected (P>0.05) and addition of fenugreek seeds reduced digestibility (%) of CP in treatment group as compared to control group.

### 5.2.3 Digestibility coefficient (%) of crude fibre

The digestibility coefficient (%) of crude fibre have been presented in Table 4.7 . The average digestibility coefficient of crude fibre in T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> were 48.80±0.37, 50.04±0.29 and 56.24±0.28 respectively. Statistical analysis revealed that fenugreek fed groups had significantly better digestibility than the control groups. The highly significant (p<0.01) increase in digestibility of CF may be due to better utilization of nutrients aiding to better digestion.

The present findings are concurrent to the results of Mir *et al.* (2012) who examined the effect of raw fenugreek seeds at the rate of 3% DMI on nutrient utilization in goats and revealed that digestibility coefficient of crude fibre was significantly higher (p<0.05) in treatment groups than in control group. Other workers like Salama *et al.* (2015) found that adding fenugreek seeds (2%) in basal fattening rations of male kids led

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to inconsiderable increase in ration palatability and intake and reported increase in higher digestibility coefficients ( $P < 0.05$ ) of CF. However, Abdalla *et al.* (2011) investigated the impact of employing several herbal remedies and their mixtures and found that fenugreek seed supplementation @ 1gm/kg diet considerably had no impact on digestibility of crude fibre.

#### **5.2.4 Digestibility coefficient (%) of ether extract (EE)**

The average digestibility coefficient (%) of ether extract in T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> were  $70.70 \pm 0.05$ ,  $70.98 \pm 0.09$  and  $72.06 \pm 0.08$  respectively. Analysis of variance results highly significant differences ( $p < 0.01$ ) between the control and the treatment groups. This might be due to better efficient utilization of nutrients in fenugreek fed diet which leads to improved digestion.

The current results agree with the findings of Salama *et al.* (2015) who studied effect of adding fenugreek seeds (2%) in basal fattening rations and found that there was improved digestibility of EE in fenugreek fed diet. Also, Pujari (2015) experimented on commercial broiler chicks supplemented with dried fenugreek leaf powder @ 0.5, 1 and 1.5% respectively and found that there was better utilization of nutrients in terms of ether extract

#### **5.2.5 Digestibility coefficient (%) of Nitrogen Free extract (NFE)**

The average digestibility coefficient of NFE in T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> were  $77.14 \pm 0.15$ ,  $77.35 \pm 0.04$  and  $78.13 \pm 0.09$  respectively. Analysis of variance results that the fenugreek fed groups have higher significant difference ( $p < 0.01$ ) than the control group. This increase in digestibility may be due to efficient utilization of nutrients in the treatment groups. The present results agree with the findings of EL-Mallal *et al.* (2005) noted that adding fenugreek @2% in the ration of turkey increases NFE digestibility. Also, Abo-El-Nor (1999) recommended that fenugreek seeds might have a direct effect on the hypothalamus and trigger hunger center in the brain which leads to desire for eating and hence improved appetite and digestion. On the contrary Abdalla *et al.* (2011) investigated the impact of employing several herbal remedies and their mixtures and

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found that fenugreek seed supplementation @ 1gm/kg diet did not show any change in digestibility of nitrogen free extract.

### **5.2.6 Digestibility coefficient (%) of Organic Matter (OM)**

The average digestibility coefficient of organic matter in different treatment groups were  $72.97 \pm 0.08$ ,  $73.78 \pm 0.06$  and  $75.34 \pm 0.09$  respectively. Statistical analysis reported that there was highly significant difference ( $p < 0.01$ ) between the control and treatment groups. The increase in digestibility might be due to better utilization of nutrients in treatment groups. The improvement could be justified on the basis of that fenugreek seeds contain saponins which might stimulate an aerobic fermentation of organic matter that improved efficiency of nutrient utilization. (Elmnan *et al.* 2013). The findings of the study are in close agreement with the results of Naseri *et al.* (2012) who experimented the effect of fenugreek seeds and asparagus roots on in vitro nutrient digestibility and found that fenugreek seeds increased in vitro organic matter digestibility. Other workers like Mir *et al.* (2012) examined the effect of raw fenugreek seeds at the rate of 3% DMI on nutrient utilization in goats and revealed that digestibility coefficient organic matter increased in treatment group as compared to control group. However, Al-Wazeer (2017) experimented by giving Awassi lambs graded level 0, 2.5, 5 and 7.5 gm/head/day of fenugreek seeds and found that there were no significant differences ( $P > 0.05$ ) in digestibility of organic matter.

## **5.3 Milk Quantity and Quality Parameters**

### **5.3.1 Milk Quantity**

#### **5.3.1.1 Milk yield**

The average fortnightly milk yield (kg) of the experimental cows has been presented in Table 4.9. The overall mean of fortnightly milk yields were  $7.00 \pm 0.05$ ,  $7.56 \pm 0.08$  and  $7.99 \pm 0.10$  respectively. Analysis of variance revealed that milk yield of the treatment group was significantly ( $p < 0.01$ ) higher than the control groups. This improvement in milk yield may be attributed to fenugreek seeds as feed additive in the treatment groups. Fenugreek seeds might increase prolactin hormone secretion which is considered as one of the major hormones for milk synthesis and secretion (El-Nor 1999).

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Also, fenugreek contains saponins which is structurally similar to estrogen which may lead to increased release of growth hormone and ultimately milk production (Sayed *et al.* 2005). The present findings are in close agreement with Hasin *et al.* (2019) who observed the milk production by supplementing fenugreek seeds in lactating animals and found higher milk production in fenugreek fed group. He concluded that fenugreek supplementation enhanced milk production by increasing nutrient utilization of the feed. Also, Al-Shaikh *et al.* (1998) studied the effect of fenugreek seeds on lactational performance of dairy goats and observed increased level of milk yield in fenugreek fed group than the other groups. In an experiment, Kirar *et al.* (2018) observed the effect of soaked fenugreek seeds @100g/animal/day on twelve lactating Murrah buffalo and the results showed that fenugreek supplemented group had higher milk yield compared to control group. Bipate and Misha (2020) studied the effect of polyherbal supplementation on milk production in crossbred cattle and reported that there was an average increase of 21.53 % in milk yield due to supplementation of polyherbal mixture as compared to 6.91% in nonsupplemented group.

#### **5.3.1.2 Lactational Milk yield**

Lactational milk yield of the experimental animals recorded from the farm records have been presented in Table no 4.11. Though the values were within the normal range but there was no effect of fenugreek seeds on the lactational yield. The average value of the lactational yield in T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> were 2145.8±3.82, 2146±3.74 and 2147.2±1.92 respectively. The 300 days lactational milk yield were found to be similar and non-significant for all three groups. The present results might be due to reasons that there was similar initial average milk yield in all the three groups as well as shorter post trial residual effect of fenugreek seed on milk production and the cows came back to similar production shortly.

#### **5.3.1.3 Duration of Peak Milk yield**

Duration of peak milk yield was non-significant in all the groups which might be due to breed characteristics. However, the slightly higher numerical value in T<sub>2</sub> group might be due to the effect of feeding higher quantity of fenugreek.

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### 5.3.2 Milk Quality

#### 5.3.2.1 Milk Fat (%)

The average fortnightly fat percentage of milk in control and treatment groups has been presented in Table 4.15. The overall mean of fortnightly milk fat percentage in T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> were 4.18±0.03, 4.16±0.04 and 4.35±0.04 respectively. The milk fat percentage of treatment group differ significantly from the control group. The higher fat percentage might be due to high fibre intake which leads to more production of acetate ultimately leads to more production of fat percentage in milk. The presents findings are similar with the findings of Revathi *et al.* (2020) who found that fenugreek seed supplementation in cross bred cattle had positive effect on milk composition and showed significantly higher values in fat percentage. Other workers like Abo El-Nor (1999) and Abo El-Nor *et al.* (2007) in buffaloes found that there was higher fat percentage in fenugreek fed group as compared to control group. However, Al-Kudsi *et al.* (2011) studied the impact of different fenugreek seed addition rates on the milk components and found that there was no significant change in fat percentage.

#### 5.3.2.2 Solid-not-fat (SNF)

The average fortnightly changes in SNF percentage in control and treatment groups have been presented in Table 4.15. Overall mean of the fortnightly changes in the control(T<sub>0</sub>), Treatment 1(T<sub>1</sub>) and Treatment 2 (T<sub>2</sub>) were 8.65±0.02, 8.69±0.03 and 8.75±0.03 respectively. Statistically there was significant difference (p<0.05) between treatment groups. Increase in SNF percentage might be attributed to the effect of fenugreek seed to act as appetite stimulant which lead to proper utilization of nutrients which ultimately increased solid-not-fat content. (Abo-El-Nor and Kholif 2005). The findings are comparable to the results of Revathi *et al.* (2020) who found significantly higher SNF percent in fenugreek fed diet in crossbred cattle. However, contradictory to my findings Tomar *et al.* (1996) investigated the impact of several feed additives including fenugreek on milk composition in Murrah buffalo and the results revealed that there was no change in milk composition.

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### 5.3.2.3 Lactose (%)

Table shows the average fortnightly lactose percentage in different treatment groups during the experimental period. Overall mean of the fortnightly lactose percent in T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> were 5.32±0.02, 5.37±0.01 and 5.49±0.03. Statistically there was significant increase in lactose percentage between treatment groups. The correspondence increase in lactose percentage may be attributed to better assimilation of feed. The present findings agree with the findings of Taylor et al. 2011 who found significant increase in lactose content in Holstein cows fed with herbal galactagogue. However, Sharma *et al* (2017) conducted a comparative study on the role of giloy and fenugreek as herbal galactagogue in jersey crossbred cows and reported that there was no significant change in milk composition. Also, In an experiment, Kirar *et al* (2018) studied the effect of soaked fenugreek seeds @100g/animal/day in twelve lactating Murrah buffalo and found no significant variation in milk components.

### 5.3.2.4 Ash (%)

The overall mean fortnightly changes of ash content in different treatment groups were were 0.78±0.02, 0.78±0.01 and 0.84±0.01 respectively. Analysis of variance showed that there was highly significant differences (p<0.01) between the treatment groups. This increase in ash content might be the effect of mineral mixture which is being fed to the experimental animals during the whole period. The findings agree with the results of Khattab and Saada (2010) who studied the effect of different herbal supplements including fenugreek in lactating buffaloes and found that total ash contents were significantly higher in treatment groups as compared to control group. Although, Tomar *et al* (1996) in an experiment studied the effect of several feed additives including fenugreek on milk composition and revealed that there was no change in milk composition. Other workers like El-Nor (1999) found that fenugreek supplementation @100g and @200g in lactating buffaloes had no effect on milk composition.

### 5.3.2.5 Specific Gravity

Overall mean of specific gravity in the treatment groups were 1.036, 1.036 and 1.033 respectively. Although the values of specific gravity are within the normal range,

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statistically there were no significant differences between the treatment groups. The results agree with the findings of Patel *et al* (2017) who examined the combined effects of Shatavari, Jivanti and Fenugreek on production performance of lactating Kankrej cows and found that there were no significant change in milk composition. Also, Choubey *et al.* (2017) reported the effect of supplementing fenugreek seeds in lactating Surti Buffaloes and found that there was no variation in milk constituents.

### **5.3.2.6 Protein (%)**

Overall average protein percentage in T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> were 3.49±0.01, 3.52±0.01 and 3.59±0.02 respectively. Analysis of variance showed that there were highly significant differences ( $p<0.01$ ) between T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub>. Increase in protein percentage may be attributed to better utilization of feed which leads to increased energy density of the feed following increased milk yield and milk composition. Similar findings are observed by El-Nor (1999) who evaluated the impact of fenugreek seeds on lactating buffaloes fed diets comprising 100g and 200g of fenugreek seeds and reported that total protein content increased as the amount of fenugreek seeds in the diet increased. Other workers like Rewvathi *et al* (2020) reported the impact of fenugreek seeds in crossbred cattle and found that milk protein percentage were significantly higher ( $p<0.01$ ) in supplementation group. However, other workers like Hasin *et al* (2019) who evaluated the effect of fenugreek supplementation in Bakarwal goats concluded that there was no significant variations protein content.

## **5.4 Blood Biochemical Parameters**

### **5.4.1. Blood glucose level (mg/dl)**

The overall mean of the blood glucose level (mg/dl) in T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> were 77.63±1.69, 73.99±3.69 and 82.06±1.03 respectively. Although the values are within the normal range but statistical analysis show that there was no significant differences between the control and treatment groups. The findings are similar with the results of Al-Sherwany (2015) who studied the effect of feeding fenugreek seeds on blood biochemical parameters the blood glucose level was statistically non-significant between the treatment groups. Other workers like Babekir (2015) conducted a study to observe

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the effect of fenugreek seeds as feed additives on blood chemical profile of Nubian Goats. They concluded that adding fenugreek seeds into the diet @ 5%, 10% and 15% showed significant ( $P>0.05$ ) decrease blood glucose level

#### **5.4.2 Total Serum Protein (g/dl)**

The overall mean of the total serum protein (g/dl) in  $T_0$ ,  $T_1$  and  $T_2$  were  $7.48\pm 0.13$ ,  $7.36\pm 0.20$  and  $7.25\pm 0.11$ . analysis of variance revealed that there was no significant variations ( $p>0.05$ ) between the treatment groups. However, the total serum protein level was within the normal range. The findings are in close agreement with the results of Kirar *et al.* (2018) who conducted an experiment to study the effect of soaked fenugreek seeds @ 100g/animal/day in lactating Murrah buffalo and found that there was no significant variation in blood parameters. Also, Abbas *et al* (2012) reported a study to examine the effect of fenugreek seed on Saidi lambs and found non-significant decrease in total serum protein in fenugreek fed diet. However, El-Rawi (2012) investigated the impact of using different levels of fenugreek in Awassi lambs and analysed the blood biochemical parameters. The study revealed that concentration of total serum protein significantly increased ( $p<0.05$ ) in treatment group.

#### **5.5 Cost of Feeding**

The data of different cost components and return there on during the experimental period in control and treatment groups were presented in Table 4.19. The daily cost of feeding per cow was calculated and found to be Rs. 182.20 in  $T_0$ , Rs. 190.20 in  $T_1$  and Rs. 195 in  $T_2$  respectively. When compared with the milk production per day the cost of feeding per kg milk yield was found to be Rs. 26.02 in  $T_0$ , Rs.25.15 in  $T_1$ , Rs. 24.4 in  $T_2$ . The lowest cost of production in terms of milk production in treatment group might be due to higher milk yield in treatment groups as compared to control group. This indicated that feeding of fenugreek seeds had positive impact on the economic efficiency. The Benefit cost ratio was found to be higher in treatment groups which is 1.38 in  $T_1$ , 1.45 in  $T_2$  compared to 1.30 in  $T_0$ .

The results are in close agreement with the findings of Tanwar *et al* (2008) who studied the outcome of shatavari supplementation to improve the economic efficiency

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and milk production in dairy animals and found that cost benefit ratio was 1:2.95 in buffalo and 1:3.65 in cow. Also, Choubey *et al* (2017) studied the effect of overnight soaked fenugreek seeds(1.5%) in lactating surti buffaloes and found that milk production increased significantly without affecting cost of production.

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## CHAPTER-VI

# SUMMARY AND CONCLUSION

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The present experiment was conducted to investigate the effect of different levels of herbal supplements on productive performance of Sahiwal cows. The experiment was carried out in the Sahiwal Cattle Farm, College of Veterinary Science, Khanapara, Guwahati-22.

A total of 15 healthy lactating Sahiwal cows of similar age and body weight selected from the college herd were utilized for the investigation. The selected animals were randomly divided into three treatment groups viz., T<sub>0</sub>(control), T<sub>2</sub> and T<sub>3</sub> of five animals in each group.

All the cows of the three experimental groups were fed balance diet constituted of concentrate mixture and roughage. The concentrate ration was prepared with maize (19%), wheat bran (23%), rice polish (14%), ground nut cake (10%), deoiled rice bran (22%), soyabean meal (9%), mineral mixture (2%), and salt (1%) containing 16.33 % DCP and 72.5% TDN. Para grass and paddy straw were given ad lib as roughage. All the animals of the treatment groups were provided with wholesome potable water. Regular cleaning and washing of the shed and utensils as well as all other routine managemental works were carried out. At the end, a digestion trial was conducted for 5 days on all the experimental cows to assess the digestibility of the nutrients fed to the animals.

The results revealed that the overall total dry matter intake (kg/day) and DMI/100kg body weight in T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> were 10.01±0.02 and 2.57±0.03, 10.24±0.03 and 2.59±0.01, and 10.22±0.08 and 2.80±0.79 respectively. The fortnightly average values of DM intake/100kg body weight and total dry matter intake (kg/day) values of the experimental cows in T<sub>0</sub> (Control), T<sub>1</sub> and T<sub>2</sub> groups respectively at different fortnights were 9.84±0.45, 10.18±0.01 and 10.36±0.01 at 1<sup>st</sup>, 9.63±0.32, 10.29±0.00 and 10.24±0.13 at 2<sup>nd</sup>, 10.26±0.39, 10.18±0.14 and 9.88±0.22 at 3<sup>rd</sup>, 10.31±0.17, 10.13±0.08 and 10.43±0.00 at 4<sup>th</sup>, 9.93±0.13, 10.33±0.00 and 10.27±0.24 at 5<sup>th</sup>, 10.09±0.00, 10.34±0.00 and 10.16±0.36 at 6<sup>th</sup> fortnight periods.

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Results of analysis of variance revealed no significant ( $P>0.05$ ) difference on DM intake/100kg body weight and total DM intake of the experimental cows in all the treatment groups. However, feeding of fenugreek had a positive effect indicating numerically higher DM intake in the treatment groups.

The average digestibility coefficient of the nutrients in  $T_0$ ,  $T_1$  and  $T_2$  groups respectively were:  $71.12\pm 0.27$ ,  $73.58\pm 0.26$  and  $74.72\pm 0.22$  for dry matter (DM);  $72.97\pm 0.08$ ,  $73.78\pm 0.06$  and  $75.34\pm 0.09$  for organic matter (OM);  $67.89\pm 0.11$ ,  $65.54\pm 0.05$  and  $68.48\pm 0.07$  for crude protein (CP);  $70.70\pm 0.05$ ,  $70.98\pm 0.09$  and  $72.06\pm 0.08$  for ether extract (EE);  $48.80\pm 0.37$ ,  $50.04\pm 0.29$  and  $56.24\pm 0.28$  for crude fibre (CF) and  $77.14\pm 0.15$ ,  $77.35\pm 0.04$  and  $78.13\pm 0.09$  for nitrogen free extract (NFE). Analysis of the data revealed significantly ( $P<0.01$ ) higher digestibility coefficient of all the organic nutrients in herbal supplemented (fenugreek seed)  $T_1$  and  $T_2$  groups compared to the control group ( $T_0$ ).

The overall average milk yield (kg) in the experimental cows were  $7.00\pm 0.05$ ,  $7.56\pm 0.08$  and  $7.99\pm 0.10$  in  $T_0$ ,  $T_1$  and  $T_2$  respectively. Analysis of variance revealed highly significant differences among all the treatment groups. Milk efficiency ratio in  $T_0$ ,  $T_1$  and  $T_2$  groups were  $0.70\pm 0.01$ ,  $0.75\pm 0.01$  and  $0.77\pm 0.01$  respectively. Statistically there were highly significant differences in milk efficiency ratio among all the treatment groups.

Milk compositions like fat, SNF, lactose, protein, ash, specific gravity were within the normal range. The overall mean of milk composition in  $T_0$ ,  $T_1$  and  $T_2$  were  $4.18\pm 0.03$ ,  $4.16\pm 0.04$  and  $4.35\pm 0.04$  for fat (%),  $8.65\pm 0.02$ ,  $8.69\pm 0.03$  and  $8.75\pm 0.03$  for SNF(%),  $5.32\pm 0.02$ ,  $5.37\pm 0.01$  and  $5.49\pm 0.03$  for lactose (%),  $0.78\pm 0.02$ ,  $0.78\pm 0.01$  and  $0.84\pm 0.01$  for ash(%),  $1.036\pm 1.6E-4$ ,  $1.0361.2E-4$  and  $1.033\pm 1.9E-4$  respectively. ANOVA of milk composition revealed highly significant difference ( $p<0.01$ ) in respect of fat, SNF, lactose, protein and ash content.

The overall mean of the blood glucose level (mg/dl) in  $T_0$ ,  $T_1$  and  $T_2$  were  $77.63\pm 1.69$ ,  $73.99\pm 3.69$  and  $82.06\pm 1.03$  respectively. All the values revealed no significant differences and remained within their normal ranges. The overall mean of the

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total serum protein (g/dl) in T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> were 7.48±0.13, 7.36±0.20 and 7.25±0.11. All the values revealed no significant differences and remained within their normal ranges.

The economic analysis relating to cost of feeding the experimental cows revealed the following: daily cost of feeding per cow per day were Rs. 182.20, Rs. 192.20 and Rs. 195, cost of feeding per kg milk yield was Rs. 26.02, Rs. 25.15 and Rs. 24.40 in T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> groups respectively. The benefit cost ratio was found to be higher in treatment groups 1.38 in T<sub>1</sub> and 1.45 in T<sub>2</sub> than in control group 1.30. It was observed that cost of feeding per cow per day is higher in treatment groups however daily milk yield is higher in treatment groups which resulted in lower cost of feeding per kg milk yield.

Based on the present findings it might be concluded that feeding of herbal supplement (Fenugreek seed) had shown encouraging results in the treatment group. Therefore, it can be concluded that feeding of herbal supplements (fenugreek seed)@ 50gms/cow/day is economically beneficial and imparts better result in terms of milk yield, milk composition and digestibility of the nutrients. However, further study may be carried out with more numbers of animals for a longer period to extend collaborate findings obtained in the present experiment.

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# APPENDICES

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## APPENDIX

### APPENDIX-I

#### NAME OF THE REAGENT

#### 1. CRUDE PROTEIN

Reagents required

- 1) Concentrated Sulphuric acid
- 2) Digestion mixture [ $\text{CuSO}_4$ :  $\text{Na}_2\text{SO}_4$ , {1:10}]
- 3) Anhydrous Sodium/Potassium sulphate
- 4) N/10  $\text{H}_2\text{SO}_4$
- 5) 40% NaOH
- 6) 2% Boric acid
- 7) Mixed indicator (Methyl red and Bromocresol green)

#### 2. CRUDE FIBRE

Reagents required

1. 1.25%  $\text{H}_2\text{SO}_4$  (W/V) solution
2. 1.25% NaOH (W/V) solution
3. Ether