EFFECT OF GARLIC (*Allium sativum*) SUPPLEMENTATION ON THE GROWTH PERFORMANCE IN BUFFALO CALVES AT ORGANIZED FARM

By

SONY NAMDEVRAO LAD

B.Sc. (Agriculture)

A thesis submitted to

Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani

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VASANTRAO NAIK MARATHWADA KRISHI VIDYAPEETH,

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DECLARATION BY THE CANDIDATE

I hereby declare that the thesis entitled **"EFFECT OF GARLIC *(Allium sativum)* SUPPLEMENTATION ON THE GROWTH PERFORMANCE IN BUFFALO CALVES AT ORGANIZED FARM"** submitted by me is based on the actual work carried out by me under the guidance and supervision of **Dr. Datta V. Bainwad**, Associate Professor, Dept. of Animal Husbandry and Dairy Science, College of Agriculture, VNMKV, Parbhani. The extent of information derived from the existing literature have been duly cited and referenced. The existing research work or it's any part is not been submitted anywhere else for the award of any degree or diploma.

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(D. V. Bainwad)
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ABBREVIATIONS USED

/	Per
%	Per cent
@	At the rate of
a.m.	After meridian
ADG	Average daily gain
ANOVA	Analysis of variance
Ad-lib.	Adlibitum
AOAC	Association of official agricultural chemist
C.V	Coefficient of variation
Ca	Calcium
C.D	Critical Difference
CF	Crude fibre
Cm	Centimeter
CP	Crude protein
BG	Belly girth
BL	Body length
BW	Body weight
b.wt.	Body weight
CG	Chest girth
DCP	Digestible crude protein
dl	Deciliter
DM	Dry matter
DMI	Dry matter intake
Edn.	Edition
EE	Ether extract
Fig	Figure
et al.	And other
etc.	Etcectra (and other things)
G	Gram
hr	Hour
HW	Height at wither
i.e.	Idlest (that is)
kg	Kilogram
Lit	Liter
M	Meter
max.	Maximum
min.	Minimum
ml	Milliliter

No.	Number
NS	Non-significant
OM	Organic matter
Qtl	Quintal
Rs	Rupees
S.D.	Standard deviation
SE	Standard Error
Sr.No.	Serial number
TDN	Total digestible nutrient
Temp.	Temperature
viz.	Namely
^{0}C	Degree Celsius
VNMKV	Vasantrao Naik Marathwada Krishi Vidyapeeth
Wt	Weight
$W^{0.75}$	Metabolic body weight

THESIS ABSTRACT

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1	Title of the thesis	:	Effect of Garlic (*Allium sativum*) Supplementation on the Growth Performance in Buffalo Calves at Organized Farm
2	Full name of the candidate	:	Sony Namdevrao Lad
3	Full Name of the Research Guide	:	Datta V. Bainwad
4	Department	:	Animal Husbandry and Dairy Science
5	College / University	:	College of Agriculture, VNMKV, Parbhani.
6	Degree to be awarded	:	M.Sc.(Agriculture)

ABSTRACT

The present investigation is carried out to study "Effect of Garlic (*Allium sativum*) Supplementation on Growth Performance of Buffalo Calves at Organized Farm". An experiment was conducted on twelve Buffalo calves of 5 to 6 months age were selected and distributed to four treatments T_0, T_1, T_2 and T_3 respectively. Garlic (*Allium sativum*) contains enzymes, vitamin B, flavonoids and various minerals. Garlic is a high quality resource of antioxidants and protein. Garlic (*Allium sativum*) powder supplementation of calves with concentrate mixture. Treatment T_0 contain zero per cent garlic powder supplementation whereas T_1, T_2 and T_3 contain 200 mg, 300 mg and 400 mg per kg body weight, respectively. Garlic powder supplementation fed for continuous 90 days to determine its effect on growth performance, dry matter intake, blood parameters and cost structure. Analysis carried by using Complete Randomized Design (CRD). The Standard Errors (SE) and Critical Differences (CD) at 5 per cent level of significance were worked out for comparison of treatments. Body weight, weight gain, body length, height at wither, chest girth and belly girth of buffalo calves of treatment T_2 show superior significant difference over control treatment T_0. Dry mater intake (DMI) of treatment T_2 and T_1 shows superior significant difference over control treatment T_0. There is no any adverse effect of Garlic (*Allium sativum*) powder supplementation on albumin, blood glucose level of experimental calves. The total protein and serum globulin of calves of treatment T_2

and T_1 show superior significant difference over control treatment T_0. Cost of feeding treatment T_3 has highest cost per kg live weight gain and T_0 has low cost per kg live weight gain. It can be concluded that Garlic (*Allium sativum*) powder supplemented at 300 mg per kg body weight in diet improved growth performance in Buffalo calves.

(**Keywords:** Buffalo calves, garlic powder, body weight, dry mater intake, blood parameter, cost structure)

CHAPTER – I

INTRODUCTION

CHAPTER - I

INTRODUCTION

Livestock is an important component of agricultural sector in India. Livestock makes many-sided contributions to socioeconomic development. Its role in food and nutritional security has been well-known since times. But, in the mixed crop-livestock system its prominence goes beyond direct food production. It provides draught power and organic manure to crop sector and bones, blood, hides, skins and fiber to industries. Livestock in India is kept mostly by small landholders and the landless that form most of rural population. Thus, by being as an important source of income and employment for these house-holds livestock helps relieve poverty and smoothen income distribution and also, livestock asset can easily liquidate, and thus acts as a cushion against shocks of crop failure mainly in the less favored environments. A great promise can be seen through this livestock sector for developing farmers income.

Livestock sector alone contributes nearly 25.8 per cent of value of output at current prices and total value of output in agriculture, fishing and forestry sector. The annual contribution of livestock sector in total GDP is nearly 4.5 per cent at current prices during 2015-16. The livestock census started in the country in the year 1919. So far 19 of censuses have been conducted. Livestock census is a complete count of the livestock and the poultry at pre-defined reference point time. As in population census, primary workers were engaged to undertake house to house enumeration and ascertain the number, age, sex, etc., of livestock / poultry possessed by every household / household enterprise / non-household / non-household enterprise and institutions in rural and urban areas. (Department of Animal Husbandry and Dairying, Animal Husbandry Statistical Division, AHS Division).

India has total livestock population is 535.78 million increase of 4.6 per cent over livestock census 2012, 109.85 million buffaloes population increase of about 1.0 per cent over previous census, 192.49 million cattle population increase of 0.8 per cent over previous census, 74.26 million sheep population increase of 14.1 per cent over previous census, 148.88 million goat population increase of 10.1 per cent over previous census. (20^{th} Livestock census, 2019).

The buffalo plays a very important role in Indian economy as it alone contributes about 56 per cent of total milk production. In India buffaloes are important source of milk supply today and yield nearly three times as much milk as cows, more than half of the total milk produced (55 per cent) in the country was contributed by the 47.22 milch buffaloes, where as the 57.0 million cows contributes only 45 per cent of the total milk yield. Indian buffaloes are water buffaloes. There are 10 indigenous standard breeds of buffaloes, which are well-known for their milking qualities. The cattle crossbred in India constitutes 41 well defined breeds of cattle, 13 breeds of buffaloes, 28 breeds of goat and 42 breeds of sheep. (20th Livestock census, 2019).

Buffaloes are the backbone of rural economy in India. Buffaloes occupy a important place in the social, economic and cultural life of Indian rural communities and are useful as a triple purpose animal for milk, meat and draft power. Buffalo calves are the future replacement stock of the herd. Calves are often neglected because they required financial investment and they do not result in any immediate returns. However, serious attention should be given to calf rearing because initial growth of an animal is the most important phase of its life and induces immense bearing on the early maturity and production; initial body weight has been found to be associate with later body weight and the growth rates at any stage of development can also be taken as an aid to selection. Further, the sexual development depends mainly on body weight rather than age (Ghose *et al*. 1979). Production and reproduction status of any herd generally depends on growth and vigour of calves. Growth is a complex phenomenon and difficult to define in simple phrase. Growth is taken as increase in body weight. Overally dairy farm profit can be maximized by reducing calf fatality, better management practices and supplementation of the good nutrients and feed additives. The body weight of the calves is an essential parameter with respect to attainment of sexual maturity, age at first calving and the total number of lactations. Good supplementation of nutrients and feed additives are of paramount importance for calf growth and health. It is proven that supplementation of rumen function, modulators, liver tonics and immunomodulators, at an early age helps in strengthening the immunity and to prohibit diseases (Prasad *et al*., 2005). Therefore, attainment of optimum body weight at an initial age is very important. Many substances have been supplemented in calf diet to get the desired result, and a new development is the use of herbs. Beneficial effects of herbs or botanicals in farm

animals may arise from the activation of feed intake and the secretion of digestive secretions, immune stimulation, anti-bacterial, coccidiostatic, anthelmentic, antiviral, anti-bacterial or anti-inflammatory activity and inhibition or specially, antioxidant properties. Garlic (*Allium Sativum*) has been a subject of considerable interest as medicinal and therapeutic agent globally since ancient times. In ancient times, garlic was taken as remedy for intestinal disorders, flatulence, worms, respiratory infection, skin diseases, wounds, symptoms of ageing and many other illness. The main pharmacological effect of garlic are attributed to its organosulphur compounds (Tapieroa *et al*.,2004).

Garlic (*Allium Sativum*) is one of the most extensive bulb crop in India. The garlic bulb contain a dull, aromatic, and water-soluble component called allicin. Garlic contains enzymes, vitamin B, flavonoids, and various minerals. Garlic is a high quality resource of antioxidants and protein. Garlic supplementation through the feed has lots of encouraging health benefits and scientific effects, which comprise improvement of immune function, revised overseas compound detoxification, restitution of bodily potency, and fighting to diverse stresses cancer- preventive measures of garlic, garlic extracts and its mechanism have been established in the animals. Among the various supplements, aged garlic extract has been analyzed and considered widely for their exalted antioxidant substance and health-protective prospective (Rajan *et al*., 2020).

Therefore, the present study entitled "Effect Of Garlic (*Allium sativum*) Supplementation On The Growth Performance In Buffalo Calves At Organized Farms", was conducted at buffalo unit, Department of Animal Husbandry and Dairy Science, College of Agriculture, VNMKV, Parbhani with the fallowing objectives.

1. To study the effect of (*Allium sativum*) garlic supplementation on growth performance of buffalo calves.
2. To study the dry matter intake of buffalo calves.
3. To study blood parameter of buffalo calves.
4. To estimate the cost structure.

CHAPTER – II

REVIEW OF LITERATURE

CHAPTER - II

REVIEW OF LITERATURE

The present research work was therefore planned to study **"Effect of Garlic *(Allium sativum)* Supplementation on the Growth Performance in Buffalo Calves at Organized Farm"** at buffalo unit, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The past research work conducted on these aspects by research workers have been reviewed in this chapter under the following heads.

2.1 Growth performance

2.2 Dry matter intake

2.3 Blood parameter

2.4 Cost structure

2.1 Growth Performance of Buffalo calves

Badias and Yariz (2004) reported the effect of addition of aromatic plants in feed for lambs on daily weight gain and production index, dielary supplementation of garlic powder in the diet resulted in a significant ($P<0.05$) improvement in the body weight gain in lambs.

Bampidis *et al.,* (2005) studied the effect of dietary garlic(allium sativum) bulb and garlic husk supplementation on performance and carcass characteristics of growing lambs. In the experiment which lasted ten weeks, lambs were allocated to 5 treatments (GBGH0, GB30, GB60, GB50, and GH100) of 16 lambs (8 male and 8 female each). Male and female lambs had initial body weight (BW) of 13.9±2.1 and 12.8±1.7 kg, respectively, and were fed a concentrate mixture ad libitum and alfalfa hay at 0.2 kg/lamb/d. The concentrate mixture for treatment GBGH0 had no garlic bulbs or husks (control), while those for treatments GB30 and GB60 included 30 and 60 kg/t of garlic bulbs, respectively, and those for treatments GH50 and GH100 included 50 and 100 kg/t of garlic husks, respectively. Male lambs grew faster than female lambs, but there were no difference among garlic bulb and garlic husk fed lambs in final BW, BW gain, dry matter intake or feed conversion ratio. Males had heavier carcasses than females, but there were no differences in carcass yield, or other

carcass characteristics, between sexes. Garlic bulbs and garlic husk supplementation in isonitrogenous and iso (net energy) energetic diets for growing lambs did not effects their performances.

Hacpadis *et al.,* (2005) studied the dietary supplementation of garlic bulbs at the dose rate of 3per cent and 6 and garlic husk at the dose rate of 5per cent and 10per cent respectively in concentrate feed had no significant effect on the final body weight in growing lambs.

Ahmed *et al.,* (2009) studied the adding natural juice of vegetabl and fruitage to ruminant diets (B) nutrient utilization, microbial safety and immunity, effect of diets suplementated with lemon, onion and garlic juice fed to growing buffalo calves. Twenty four buffalo calves weighted 120.49±0.7 kg and 4.5±0.3 month of age were selected and divided randomly into 4 similar groups (6 animals each) in 140 days feeding trial. All calves in the different groups were fed similar basal diet of concentrate feed mixture (CFM), berseem hay (BH) and rice straw (RS). First group (D_1 control) fed basal diet. Group 2, 3 and 4 (D_2, D_3 and D_4) were supplemented with 2.5,5 and 7.5 per cent /kg diet/day natural additive of juice of garlic, onion and lemonade (1:1:0.125/liter clean water). Average daily gain was increased by 4.8 per cent in animals of D2 but the daily gain was significantly ($P<0.05$) decreased with the higher levels of natural additive 5 and 7.5 per cent (D_3 and D_4) comparing with D_2 and insignificantly comparing with the control animals.

Ghosh *et al.,* (2010) investigated the effect of dietary supplementation on body weight gain, feed intake, feed conversion efficiency, faecal score, faecal coliform count and feeding cost in crossbred dairy calves. Thirty-six crossbred calves (Holstein cross) of 5 days of age were used to effect of garlic extract feeding on their performance up to 2 months (pre-ruminant stage). They were randomly allotted into treatment and control group (18 numbers in each group). Diets were the same for the both groups. Treatment group received garlic extract supplementation at 250 mg/kg BW per day per calf. There was significant difference in body weight gain per calf per day between treatment and control groups. The body weight gain per calf per day in treatment group was 44.05 per cent higher than control group.

Hadiya *et al.,* (2009) reported the accelerated growth programme with polyherbal formulation for dairy calves. Calves were randomly selected four

groups,one control and three treatments. Treated groups were administered herbal formulation; Ruchamax, AV/DAC/16 @5gm/calf/day and Yakrifit @1 bolus/calf/day following treatment regimen of once a week per month for three consecutive months therapy. It was observed that supplementation of herbal growth promoter and liver tonic products significantly improved liver function, feed assimilation and digestibility of ration ultimately leading to gain in body weight as compared to untreated control group. The herbal ingredients of AV/DAC/16 and Ruchamax namely; *Allium sativum, Azhadirachta indica, Calotropis orocera, Centratherum anthelmenticum, Commiphora mukul, Eclipta alba, Picrorhiza kurroa, Zingiber officinale, Piper longum.*

Hassan and Abdel- Raheem (2013) reported the response of buffalo calves to dietary supplementation of caraway and garlic as natural additives. Sixteen buffalo calves of 12-14 months of age weighing 170±9.6 kg were divided into 4 groups, 4 animals / each. Caraway seed and garlic powder were added to calves basic diet (control) at levels of 2 g caraway seed (CS, T_1), 2 g dried garlic (DG, T_2), 2 g garlic (T_3) / kg diet and were fed for 6 months experimental period. Final body weight, weight gain were slightly improved ($P>0.05$) in calves fed both caraway and garlic (T3) than other groups.

Hasan *et al.,* (2015) studied the effects of garlic supplementation on parasitic infestation, live weight, and hematological parameter in black bengal goat. A total dry of 18 dry does of 18-32 months of age were divided into 3 groups as T_0, T_1 and T_2, each group comprised of 6 goats. The goat of T0 were fed feed with normal feeds, the goat T_1 and T_2 were fed with normal feeds plus 25 mL and 50 mL of 10 per cent water solution of garlic twice per days. Weight gain was recorded significantly higher than in the treatment groups.

Shokrollahi *et al.,* (2016) investigated the effect of garlic extract on growth, haematology and cell-mediated immune response of newborn goat kids. Twety four newborn goat kids (aged 7±3days) were divided into four groups. The groups consisted of control (received milk without garlic extract), T_1, T_2 and T_3 which received milk supplemented with 62.5, 125 and 250 aqueous garlic extract per kg live weight per day for 42 days. Total gain was significantly higher for kids in T_3 ($P<0.05$)

compared with the control group. Average daily gain (ADG) in T_3 group in week 4-5 was higher ($P<0.05$).

Balamurugan *et al.,* (2014) studied the effect of garlic (*allium sativum*) supplementation on the growth performance of crossbred calves. Jersey crossbred calves of both sexes were randomly separated into three treatments (T_1, T_2 and T_3) of six calves in each group. Calves in T_1 group were supplemented with garlic powder at the dose rate of 250 mg/kg BW in water whereas calves in the T_2 group were supplemented with 250 mg/kg BW in concentrate feed and the T_3 group was treated as control. It was found that the calves in T_1 and T_2 group gained significantly higher overally body weight and average daily gain compared with calves in T_3 group.

El-katcha *et al.,* (2016) reported the effect of garlic supplementation on growth performance, nutrient digestibility and some blood serum biochemical changes of fattening lambs. Twenty four growing lambs were allotted into two equal groups, first group fed on the basal diet without any supplement while second group fed on the basal diet and garlic extract (garlic) in drinking water for continuous 12 weeks. It was found that allicin supplementation non-significantly improved body weight of growing fattening lamb at the end of the experiment by about 0.52 per cent when compared with control. Garlic extract had no significant effect on growth performance of growing lambs.

Egunjobi, O. K., and Fatoba, O., (2017) studied the effect of varying levels of garlic (*Allium sativum*) powder on growth, apparent nutrient digestibility, rumen ecology, blood profile and cost analysis of feeding west African dwarf goats. 20 WAD bucks with mean average weight of 6.92±0.02 kg were balanced for weight and assigned to 4 treatment groups, i.e., Control, GP0.5 (0.5%/100 kg garlic powder supplementation), GP1.0 (1.0%/100 kg garlic powder supplementation), GP1.5 (1.5%/100 kg garlic powder supplementation). Results of this study showed that final weight, daily weight gain, were not significantly ($p>0.05$) affected by inclusion of garlic powder up to 1.5%. This study revealed that garlic powder supplementation up to 1.5% in concentrate diet did not exert any adverse effect on performance of WAD goats.

Duvvu *et al.,* (2018) investigated the effect of garlic supplementation on the growth performance and body condition score in murrah buffalo calves. 18 Murrah

buffalo calves in the age group of 4-5 months were randomly divided in to three groups (T_0, T_1, and T_2) with six calves in each group. The T_0 group served as the control whereas the T_1 and T_2 groups were supplemented with garlic powder at the dose rate of 250 and 300 mg per kg body weight. Dietary supplementation of garlic powder either at the dose rate of 250 or 300 mg per kg body weight has a significant impact on the growth performance in the murrah buffalo calves.

Mishra *et al.,* (2020) conducted on the twenty four crossbred calves for a period of 120 days to know the effect of garlic and turmeric powder supplementation on growth and nutrient utilization of female crossbred calves during winter season. The selected calves were divided into 4 groups on the basis of nearness of age and body weight viz., T_1 control, T_2-garlic powder, T_3-turmeric powder, T_4-garlic+turmeric powder (50:50) supplementation @ 15g/day/calves. Garlic powder supplemented @ 15g/day/calves in diet improved growth performance and reduced feed cost where as turmeric powder improved nutrient utilization of female CB calves during winter season.

Kekana *et al.,* (2020) evaluated the effect of garlic, probiotics, and in combination on levels of immunoglobulin G (IgG) and growth performance in new-born Holstein Calves. Thirty-two Holstein calves were randomly allocated to treatments at four days old and were maintained on them until they were 42 days old. The treatment consisted of control (C), garlic powder at 5 g/calf/day (GA), probiotics at 4 g/calf/day (PB), and the combination of garlic and probiotics (GP). Supplementation of GA, PB and in combination did not affect feed intake and growth performance negatively, but improved serum IgG levels. Higher serum IgG in GP may indicate an improved intake and utilization of nutrients that are responsible for immunity modulation and regulation. Probiotics and their combinations with garlic have the potential to reduce the incidence of diarrhoea when fed to young calves.

Kewan *et al.,* (2021) studied the effect of yest (saccharomyces cerevisae), garlic *(allium sativum*) and their combination as feed additives in finishing diets on the performance, ruminal fermentation, and immune status of lambs. Four groups of male lambs (seven animal per/ group). Animal were fed a basal diet including concentrate feed mixture (CFM) at level of 70 per cent of total requirement and berseem hay (BH) was offered ad lib. The experiment diet were:1) a basal diet

without additive (control), (C); 2) a basal diet supplemented with 6 g dry yeast (2.44×10^{11} cfu/g)/head/day,(Y); 3) a basal diet supplemented with 40 g garlic powder/ head/ day, (G) and 4) a basal diet supplemented with 3 g dry yeast plus 20 g garlic powder /head/day, (YG). It could be conducted that using feed additive such as dry yeast (6 gm/h/d) or garlic powder (4 gm/h/d) of their combination (3 gm plus 20 gm, respectively) in finishing diet of lamb tended to increase digestibility coefficients for most of nutrients, increasing nutritive value as TDN and appeared to increase the daily gain as well as enhanced the immune status of animals.

2.2 Dry Matter Intake

Gill and Gill (1974) studied the dry matter intake of mature hay hybrid Napier was less as compared to immature hay in crossbred calves. The average dry matter intake (DMI) of immature hay was 2.12 kg/100 kg body weight.

Chauhan *et al.,* (1980) reported the nutritive value of five strains of Guinea grass (*panicum maximum*) for buffalo calves by conducting seven (7) days metabolic trial. The average dry matter intake (DMI) was following table

Table 2.1: Average dry matter intake (DMI) of five strains of guinea grass in buffalo calves.

Strains	Average dry matter intake (kg/day)	Average dry matter intake per 100 kg BW per day
No-59963	1.71	2.15
No-59917	1.98	2.32
No-59985	2.47	2.30
No-59996	1.87	1.99
No-mixed red	1.87	2.13

Chauhan *et al.,* (1983) reported the effect of stage of maturity on nutritive value of hybrid napier (NB 21) fodder in buffalo calves. the dry matter (DM) intake decreased with increased in plant height. The average dry matter intake (DMI) at 45 cm height were 3.115 kg, 75 cm – 2.594 kg, 105 cm – 2.5 kg, 2.120 cm – 2.19 kg/100 kg body weight.

Pachauri and Nair (1987) conducted the nutritive value of para grass at two stages of growth in cow and buffalo calves. Para grass was at the stages of growth, green (45 per cent dry matter) and partially dry (73 per cent dry matter) to growing cow and buffalo calves. In cow and buffalo calves, dry matter intake (DMI) was 119.39 and 105.16 g/kg $W^{0.75}$ from October to November and 103.32 and 98.87 g/kg $W^{0.75}$ from December to march.

Kumar and Garg (1996) reported the nutritive evaluation of baru grass in murrah buffalo heifers and concluded the dry matter (DM) intake (kg/day) 5.64±0.28, DM intake for 100 kg body weight (2.39±0.12), DM intake / kg $W^{0.75}$ 94.27±4.7 and the nutritive evaluation of MP Chari forage In Murrah buffalo heifers and determined the dry matter (DM) intake / kg $W^{0.75}$ (g)-66.57.

Goswami *et al.,* (1997) reported the comparative utilization of feed nutrients in different species of farm ruminants. Four buffaloes, four cattle, four goat were fed with hybrid napier grass and concentrate. Dry matter (DM) per 100 kg body weight was 3.68 kg in goats, 3.06 kg in cattle and 2.84 kg in buffaloes, while dry matter intake (DMI)/kg metabolic body weight was reverse order in the three species 92.80 g in buffaloes, 84.70 g in cattle and 62.33 g in goats.

Kumar and Garg (1997) determined the nutritive value of dhawalu (*Chrysopogonfulvus*) grass in murrah buffalo heifers. The dry matter intake (DMI) were observed 102.05 Kcal/kg $W^{0.75}$, body weight (wt) and the comparative nutritive value of signal (*Brachiaria decumbense*) and Guinea (*Pennisetum maximum*) grasses in Murrah buffalo heifers conducting seven days metabolic trial. The dry matter intake (DMI) was observed as 98.45±5.21, 96.03±4.96g/kg $W^{0.75}$, respectively.

Kariuki *et al.,* (1998) studied the performance of sahiwal and friesian heifers fed on napier grass supplemented with graded levels of lucerne. The experiments designated A & B were calculated to evaluate the effect of supplementing Napier grass with lucerne on dry matter intake (DMI) & weight gain (ADG) of friensian & Sahiwal heifers. In experiment A which lasted 92 days, 24 heifers from each of sahiwal and friesian breeds were blacked by breed and random allocated to the following treatments; young Napier + 0kg lucern (T_1); young Napier 1.5 kg lucerne (T_2); old napier + 0 kg lucerne (T_3); old Napier + 1.5 kg lucerne (T_4); old Napier + 2.5

kg lucern (T_5); old Napier + 3.5 kg lucern (T_6) Heifers^{-1} day^{-1}. Supplementation significantly ($p<0.05$) increased DMI from 4.3 to 6.7 kg. day^{-1} in sahiwals and 5.2 to 7.8 kg. day^{-1} in Friesians ($p<0.05$).

Singh *et al.,* (2001) studied the voluntary dry matter (DM) intake per 100 kg body weight of buffalo calves in varieties of Napier bajara hybrid as PBN-233 higher (1.96±0.19) than PBN-83 (1.68±0.39) kg.

Kumar *et al.,* (2004) studied the effect of crop residue based complete feed blocks on nutrients digestibility and growth in buffalo calves. Compared four different treatments in four four groups of buffalo calves for 90 days. the feeding treatment groups were T_1:-complete feed block with wheat straw and concentrate (1 : 1), T^2:- wheat straw-sugarcane bagasse (1 : 1), T_3:- wheat straw-mustard straw (1: 1), and concentrate and T_4:- wheat straw-paddy (1 : 1) and concentrate. The roughage to concentrate ratio was 60:40. They observed, the average daily dry matter (DM) /100kg body weight (BW) by calves under T_1, T_2, T_3 and T_4 as 2.20, 2.10 and 2.50kg, respectively.

Bhatti *et al.,* (2005) determined the nutritive value of Mott grass and Berseem fodder substituted with Saltbush fed to Nili-Ravi Buffalo heifers. A feeding experiment was conducted on fifteen buffalo heifers for twenty five weeks having five phases of five weeks each. The heifers were provided Mott + saltbush (50:50), Berssm + Saltbush (50:50), and Mott + Berseem + Saltbush(33.3:33.3:33.4) the diets designated as T_1, T_2, T_3, T_4, and T_5, respectively and observed DMI/day(kg) as 3.03 ± 0.12, 3.2 ± o.12, 2. Khan *et al.*(2005) evaluated the nutritive value of Dinanath grass *(Pennisetum pedicellatum)*fed to Nil-Ravi buffaloes and observed the kg per day dry matter intake for five experimental as 13.0, 15.49, 16.45, 16.108, 15.68, respectively. 65 ± 0.12 kg.

Khan *et al.,* (2005) reported the nutritive value of Dinanath grass *(Pennisetum pedicellatum)* fed to Nil-Ravi buffaloes and observed the kg per day dry matter intake (DMI) for five experimental as 13.0, 15.49, 16.45, 16.108, 15.68, respectively.

Bansod *et al.,* (2008) Studied the requirement of Gaolao Cow by offering Jawar straw, soybean straw, green hybrid Napier and concentrate mixture (sugras) the

average daily intake of DM was 7.492, 8.390 and 8.28 kg/day/cow in T1, T2 and T3 group, respectively. It was noted that the daily DM intake was offering significantly between treatments. This trend indicated that these was increase in daily DM intake when soybean straw was fed as sole roughages or incorporated as roughage with Jawar in the ration of cow. The average % BW DM intake was 2.668, 3.089, and 3.089 kg in T1, T2 and T3 treatments, respectively. The DM intake per 100 kg Body weight in T2 and T3 way found more by 15.78 per cent over that of the intake in T1 group.

Ghosh *et al.,* (2010) investigated the effect of dietary supplementation on body weight gain, feed intake, feed conversion efficiency, faecal score, faecal coliform count and feeding cost in crossbred dairy calves. Thirty-six crossbred calves (Holstein cross) of 5 days of age were used to effect of garlic extract feeding on their performance up to 2 months (pre-ruminant stage). They were randomly allotted into treatment and control group (18 numbers in each group). Diets were the same for the both groups. Treatment group received garlic extract supplementation at 250 mg/kg BW per day per calf. The mean total DM,TDN and CP intake per calf per day significantly ($p<0.01$) differed between treatment and control groups. The mean of dry matter intake per calf per day, TDN intake per calf per day and mean CP intake per calf per day in the treatment group were 12.44 per cent, 11.46 per cent and 12.42 per cent higher than contol group respectively.

Jagdamba *et al.,* (2010) determined the nutritional evaluation of perennial fodder varieties suitable for low irrigation input areas in male buffalo calves, and reported the dry matter intake (DMI) of APBN-1-2.34 ± 0.22, CO-3-2.30 ± 0.24, Congo signal- 2.47 ± 0.44, and CO-63-2.29 ± 0.17 per cent of body weight.

Khaing *et al.,* (2015) studied the feed intake growth performance and digestibility in goats feed whole corn plant silage and Napier grass. Fifteen male Boer cross goats around 6 month old and approximately 18.54 $\pm$ 1.83 kg body weight used as experimental animals. The goat were assigned into five treatment groups consisted of different proportion Napier grass (G) and whole plant corn silage (CS)-T_1: 100/0 G/CS; T_2: 75/25 G/CS; T_3: 50/50 G/CS; T_4: 25/75 G/CS and T_5: 0/100 G/GS. It can be calculated that High proportion of corn silage to grass diet. Had resulted in increases growth performance was observed in animals that were fed with T_5 diets.

Balamurugan *et al.,* (2014) studied the effect of garlic (*allium sativum*) supplementation on the growth performance of crossbred calves. Jersey crossbred calves of both sexes were randomly separated into three treatments (T1, T2 and T3) of six calves in each group. Calves in T1 group were supplemented with garlic powder at the dose rate of 250 mg/kg BW in water whereas calves in the T2 group were supplemented with 250 mg/kg BW in concentrate feed and the T3 group was treated as control. The monthly mean daily dry matter intake ranged from 0.97±0.02 to 2.00±0.04 kg from first month of experimental trial for calves supplemented with garlic in water (T_1). For the calves supplemented with garlic in concentrate feed it ranged from 0.95±0.01 to 2.03 kg (T_2) and for the calves in the control group it ranged from 0.92± 0.02 to 1.98±0.70 kg (T_2).

Duvvu *et al.,* (2018) investigated the effect of garlic supplementation on the growth performance and body condition score in murrah buffalo calves. 18 Murrah buffalo calves in the age group of 4-5 months were randomly divided in to three groups (T0, T1, and T2) with six calves in each group. The T0 group served as the control whereas 300 mg per kg body weight. The result of experiment reveled a significant ($P<0.01$) improvement in the overall feed intake, body weight gain, average daily gain, body condition score and feed conversion efficiency in garlic supplemented buffalo calves (T_1 and T_2) compared with the control group (T_0).

Bhoyarkar *et al.,* (2020) Effect of feeding improved varieties of fodder on growth performance and Nutrient digestibility in osmanabadi goat. The present research was under taken to study the eighteen osmanabadi does of one half 2 year of age were randomly selected and divided into 3 groups, 6 in each group on the basis of body weight & age the dry matter (DM), digestible crude protein (DCP) and total digestible nutrient (TDN) intake was significantly higher in group fed with DHN-6 fodder than gro up fed with marvel grass and maize fodder. The higher nutrient digestibility was observed in does fed with DHN-6 fodder than rest of all treatments.

Fajemisin and Omotoso (2020) Studied the Dry matter intake & weight gain of West African dwarf sheep fed *pennisetum purpureum* substituted with leaves of mulberry (morus alba). A sixty three day study with twenty West African Dwarf (WAD) sheep aged 8-9 months with average live weight of 9.98 $\pm$ 0.21 kg was carried out to determine feed intake and weight gain when a sole diet of fresh forage of

pennisetum purpureum was replaced at five level (0, 25, 50, 75 and 100%) with fresh leaves of mulberry (morus alba). The sheep divided into 5 groups of four sheep per group housed individual pens in a completely randomized design. There were linear or curvilinear increases in feed DM intake and in live weight gain, with related improvement in feed conversion, as mulberry leaves replaced *P. Purpureum* forage in the diet.

2.3 Blood parameter

Azza and Awadalla (2002) studied the garlic and onion supplementation in the diet caused a significant decrease in the serum glucose level, serum cholesterol and HDL cholesterol and a significant ($P<0.01$) increase in the total protein values in Zaraibi goats.

Ei-Ashry *et al.,* (2006) reported the effect of dietary supplemented with medicinal herb on nutrient digestibility and some blood metabolites of buffalo calves. 20 suckling buffalo calves were divide into four experimental groups from G_1 up to G_5 of five animals each. Animalsof G_1 were fed according to the ordinary feeding regimen of the station farm. While those of G_2 were fed a restricted amount of milk and ad libitum amount of the experimental starter. Each of the other groups from G_2 and G_5 received G_2 diet in addition to a supplement of one of the medicinal herb under investigation where G_3 group received lemon grass (Cymbopogon citrate: CC): G_4 received (Eucalyptus globules Labill: EG): G5 received a chamomile supplement (Matricria chamomile: CH) during the first three months of age. Concerning blood parameters during. Suckling period total plasma protein and albumin levels were higher in G_2, G_3, G_4 and G_5 than those of GI. Insignificant differences between experimental group were Observed in plasma glucose, urea creatinine, total lipids concentration, GPT and GOT activity.

Chaves *et al.,* (2008) investigated the supplementation of garlic essential oil in the diet has no significant effect on the serum glucose concentration in growing lambs.

Ahmed *et al.,* (2009) studied the adding natural juice of vegetables and fruitage to ruminant diets (B) nutrient utilization, microbial safety and immunity,

effect of diets supplemented with lemon, onion and garlic juice fed to growing buffalo calves. Twenty four buffalo calves weighted 120.49±0.7 kg and 4.5±0.3 month of age were selected and divided randomly into 4 similar groups (6 animals each) in 140 days feeding trial. All calves in the different groups were fed similar basal diet of concentrate feed mixture (CFM), berseem hay (BH) and rice straw (RS). First group (D_1 control) fed basal diet. Group 2, 3 and 4 (D_2, D_3 and D_4) were supplemented with 2.5,5 and 7.5 per cent /kg diet/day natural additive of juice of garlic, onion and lemonade (1:1:0.125/liter clean water). Sample of blood were drowning to evaluate hemaotcrate (Ht) count, red blood cell (RBC) count, white cells (WBC) count and its components and immunity. Blood components GPT and GOT were significantly increased ($P<0.05$) by increasing natural additive. Similarly, red blood cells and white blood cells increased ($P<0.05$). immunity (globulin fractions) increased in treatments group than that control group. Meanwhile, total lipids declined by increasing level of natural additives.

Kholif *et al.,* (2017) reported the effect of supplementing garlic oil on the biochemical profile in lactating goats and observed a non-significant increase in the total protein levels and a significant ($P<0.05$) increase in the serum glucose, albumin and globulin levels and a significant ($P<0.05$) decrease in the BUN and SGOT levels.

Hassan *et al.,* (2013) reported the response of buffalo calves to dietary supplementation of caraway and garlic as natural additives. Sixteen buffalo calves of 12-14 months of age weighing 170±9.6 kg were divided into 4 group, 4 animals / each. Caraway seed and garlic powder were added to calves basic diet (control) at levels of 2 g caraway seed (CS, T_1), 2 g dried garlic (DG, T_2), 2 g garlic (T_3) / kg diet and were fed for 6 months experimental period. the significant ($P<0.05$) increase in the serum total protein and globulin in the growing buffalo calves fed treated diet compared with those fed the control.

Amin *et al.,* (2014) reported the garlic administration had no significant effect on the total protein, albumin, globulin, urea and SGOT levels in grazing lambs.

Balamurugan *et al.,* (2014) studied the effect of garlic (*allium sativum)* supplementation on the growth performance of crossbred calves. Jersey crossbred calves of both sexes were randomly separated into three treatments (T_1, T_2 and T_3) of

six calves in each group. Calves in T_1 group were supplemented with garlic powder at the dose rate of 250 mg/kg BW in water whereas calves in the T_2 group were supplemented with 250 mg/kg BW in concentrate feed and the T_3 group was treated as control. The garlic powder supplementation at the dose rate of 250mg/kg BW had no significant effect on the serum glucose, total protein, albumin, globulin and BUN values in crossbred calves.

Zakeri *et al.,* (2014) reported the performance of the dairy goats on feeding garlic in their diet and concluded the garlic supplementation significantly ($P<0.05$) improved the serum glucose concentrations and no significant difference was observed in the total protein, albumin, serum calcium and serum phosphorus levels.

Anassori *et al.,* (2015) studied the effect of feeding raw garlic on the blood profile in sheep, concluded the garlic supplementation in the diet has no significant effect on the serum glucose, total protein, BUN and cholesterol levels.

El-katcha *et al.,* (2016) reported the effect of garlic supplementation on growth performance, nutrient digestibility and some blood serum biochemical changes of fattening lambs. Twenty four growing lambs were allotted into two equal groups, first group fed on the basal diet without any supplement while second group fed on the basal diet and garlic extract (garlic) in drinking water for continuous 12 weeks. It was found that allicin supplementation non-significantly improved body weight of growing fattening lamb at the end of the experiment by about 0.52 per cent when compared with control. Allicin supplementation non-significantly increased blood serum total protein, globulin and glucose concentrations and had no effect on calcium and phosphorus blood serum concentration when compared with the control. It can be concluded that garlic extract supplementation in drinking water for growing lambs may be slightly reduce efficiency of kidney and liver function through numerical higher creatinine, GOT and GPT blood serum concentrations throughout the whole experimental period when compared with the control and non-significantly reduced blood serum trig lycerides and total cholesterol.

Shokrollahi *et al.,* (2016) investigated the effect of garlic extract on growth, haematology and cell-mediated immune response of newborn goat kids. Twety four newborn goat kids (aged 7±3days) were divided into four groups. The groups

consisted of control (received milk without garlic extract), T_1, T_2 and T_3 which received milk supplemented with 62.5, 125 and 250 aqueous garlic extract per kg live weight per day for 42 days. The effect of garlic supplementation on haematology and blood parameters of newborn goat kids are shown in significant differences in globulin ($P<0.01$), Hb ($P<0.001$), PCV ($P<0.001$), RBC ($P<0.001$), neutrophil ($P<0.001$), lymphocyte ($P<0.001$) and WBC ($P<0.001$) were observed among groups. Hb, PVC, RBC, lymphocytes and WBC were higher in kids given garlic extract supplementation compared to those in the control group with group T_2 showing the highest levels, while neutrophil levels significantly decreased in garlic supplemented groups.

Egunjobi and Fatoba (2017) studied the effect of varying levels of garlic (Allium sativum) powder on growth, apparent nutrient digestibility, rumen ecology, blood profile and cost analysis of feeding west African dwarf goats. 20 WAD bucks with mean average weight of 6.92±0.02 kg were balanced for weight and assigned to 4 treatment groups, i.e., Control, GP0.5 (0.5%/100 kg garlic powder supplementation), GP1.0 (1.0%/100 kg garlic powder supplementation), GP1.5 (1.5%/100 kg garlic powder supplementation). Haematological parameters measured in this study were not significantly ($P>0.05$) different with garlic powder supplementation. Total protein (TP), glucose and albumin decreased significantly ($P<0.05$) with higher levels of garlic powder supplementation.

Kekana *et al.,* (2020) evaluated the effect of garlic, probiotics, and in combination on levels of immunoglobulin G (IgG) and growth performance in new-born Holstein Calves. Thirty-two Holstein calves were randomly allocated to treatments at four days old and were maintained on them until they were 42 days old. The treatment consisted of control (C), garlic powder at 5 g/calf/day (GA), probiotics at 4 g/calf/day (PB), and the combination of garlic and probiotics (GP). Bodyweight, body length and hearth girth measurements were taken to determine growth and blood was drown to determine glucose and IgG. Supplementation of GA, PB and in combination did not affect feed intake and growth performance negatively, but improved serum IgG levels. Higher serum IgG in GP may indicate an improved intake and utilization of nutrients that are responsible for immunity modulation and

regulation. Probiotics and their combinations with garlic have the potential to reduce the incidence of diarrhoea when fed to young calves.

2.4 Estimate the cost structure

Kumar *et al.,* (2004) studied the effect of crop residue based complete feed blocks on nutrients digestibility and growth in buffalo calves. The complete diet (block) for buffalo calves (60 roughages + 40 concentrate) replacing 100 per cent wheat straw, 50 per centof wheat straw with mustard straw, sugarcane bagasse and paddy straw. they concluded that the feed cost Rs/kg body weight (BW) growth was 35.1, 42.5, 39.5 and 30.3 Rs/kg body weight gain (BWG), respectively.

Ghosh *et al.,* (2010) investigated the effect of dietary supplementation on body weight gain, feed intake, feed conversion efficiency, faecal score, faecal coliform count and feeding cost in crossbred dairy calves. Thirty-six crossbred calves (Holstein cross) of 5 days of age were used to effect of garlic extract feeding on their performance up to 2 months (pre-ruminant stage). They were randomly allotted into treatment and control group (18 numbers in each group). Diets were the same for the both groups. Treatment group received garlic extract supplementation at 250 mg/kg BW per day per calf. Feed cost of rearing per calf per day based on current market rate was calculated by multiplying feed consumed by a calf per day with cost of each feed items (whole milk, skim milk, concentrate and green fodder) including garlic. Feed cost per kilogram gain in body weight was calculated by dividing feed cost per calf per day by body weight gain per calf per day.

Vohora *et al.,* (2012) conducted the Effect of feeding bypass nutrients to growing buffalo heifers under field condition. A field study was conducted to study the effect of feeding bypass fat and bypass protein to buffalo heifers in the Dahod dstrict of Gujart for a period of 90 days. Forty growing buffalo calves were divided in two groups consisting of one control group (CON) fed with a basal diet without supplementation and other treatment group (BYNUTR) fed with basal diet plus bypass nutrients (extruded soybean meal as bypass protein @200g/head/d and calcium salt of palm oil fatty acids as bypass fat @ 50g/d). Body weight and measurements were recorded at forthinghtly intervals. The economics of feeding was calculated. The results revealed that there were significant (P>0.001) improvement in

average daily weight gain in the buffalo heifers of the BYNUTR groups compared to control group. Body length, height and heart girth were also increased in the BUNUTR group. Feeding of bypass nutrient decreased cost of feeding per kg live weight gain.

Rashid *et al.,* (2015) studied the effect of concentrate to roughage ratio on cost effective growth performance of Brahman crossbred calves receiving three diets with varying concentrate to roughage ratio (C:N) of 75:25, 65:35 and 55:45 on dry matter (DM) basis. Twelve bull calves (aging 11.5±1.2 months and 170±13.0 kg live weight) divided into three equal groups were fed on three diets. The diet consisting of 55% concentrate mixture showed similar result with the diet consisting of 75% concentrate mixture, but was comparatively economic. Therefore, considering the growth performance and cost per kg gain of Brahman crossbred growing calves, it may be concluded that the diet consisting of 55:45 C:R may be used for economic beef production.

Patel *et al.,* (2015) the experiment was conducted to growth performance, Nutrient digestibility, feed conversion ratio and cost of feeding in Mehsana Heifers fed cotton seed cake and Rumen protected methionine & lysine supplement. Results revealed that supplementation of cotton seed cake & Rumen protected methionine & lysine in mehsana Heifers resulted in better growth rate feed intake and feed conservation ratio, but Nutrient digestibility and cost of feeding were unaffected.

Sorathiya *et al,*. (2015) studied the effect of sugar beet tubers as a partial replaces to green fodder on production performance and economics of lactating surti buffaloes in lean period. Partial replacement of Hybrid napier with that of sugar beet tuber Numerically improved dry matter intake, milk yield, 4% fat corrected milk and milk composition parameters such as fat, solid non-fat protein and lactose, but not significantly. The blood parameters were in normal range and non significant except that of glucose and triglucerides, which were increased in the sugar beet group replacing sugar beet tubers also proved to be cost effective with improved profit around Rs. 6.63/day. Relative market price (Rs/kg) of various feed ingredients i.e., concentrate, cottonseed cake, hybrid Napier, paddy straw and sugar beet were 14.5, 17.5, 2, 2 and 2, respectively. Cost of feeding in both the group was almost similar.

Varma *et al.,* (2015) evaluate the effect of feeding Hydropinics barley (*Hordeum Valgare*) fodder on Nutrient Utilization, growth, blood metabolites and cost effectiveness in Hariana male calves. Twelve hariana male calves of similar age (6-8 months of age) and body weight (99.5 kg) were distributed in three groups of 4 animals each in order to study the effect of feeding of hydroponics barley fodder on intake, digestibility of nutrients and growth in calves. There was a reduction of 33% in feeding cost per kg weight gain/calf/day in group T_2 in comparison to T_1. Therefore, feeding of hydroponics barley fodder increased DM intake, digestibility of nutreitns and growth rate in calves while increasing the profit.

Lowe *et al.,* (2016) studied the cost of feeding bred dairy heifers on native warm-season grasses and harvested feed stuffs. Heifer rearing is one of the largest production expenses for dairy cattle operations, which is one reason milking operations outsource heifer raring to custom developers. The cost of harvested feedstuffs is a major expense in heifer rearing. A possible way to lower feed costs is to graze dairy heifers, but little research exists on this topic in the mid-south United States. The objectives of this research were to determine the cost of feeding bred dairy heifers grazing native warm-season grasses (NWSG), with and without legumes, and compare the cost of grazing with the cost of rearing heifers using 3 traditional rations. The 3 rations were corn silage with soybean meal, corn silage with dry distillers gain, and a wet distillers gain-based ration.

Egunjobi and Fatoba (2017) studied the effect of varying levels of garlic (*Allium sativum*) powder on growth, apparent nutrient digestibility, rumen ecology, blood profile and cost analysis of feeding west African dwarf goats. 20 WAD bucks with mean average weight of 6.92±0.02 kg were balanced for weight and assigned to 4 treatment groups, i.e., Control, GP0.5 (0.5%/100 kg garlic powder supplementation), GP1.0 (1.0%/100 kg garlic powder supplementation), GP1.5 (1.5%/100 kg garlic powder supplementation). The cost of analysis of feeding different levels of garlic powder to west African dwarf goats. Cost of total grass consumed was not significant ($P>0.05$) across treatment groups. Total cost of concentrate intake increased significantly ($P<0.05$) as the level of garlic powder inclusion increased. Result of cost per kg weight gain was significantly ($P<0.05$) different across the treatment groups. Significantly higher cost of feed consumed in

supplemented group was as a result of market cost of 1 kg garlic powder given that while maize cost ₦63/kg, garlic powder cost ₦3400/kg. It is this same cost of feed consumed that influenced the cost per weight gain which was also significantly higher in supplemented group compared to control.

Mishra *et al.,* (2020) conducted on the twenty four crossbred calves for a period of 120 days to know the effect of garlic and turmeric powder supplementation on growth and nutrient utilization of female crossbred calves during winter season. The selected calves were divided into 4 groups on the basis of nearness of age and body weight viz., T_1 control, T_2-garlic powder, T_3-turmeric powder, T_4-garlic+turmeric powder (50:50) supplementation @ 15g/day/calves. Cost of rearing of the female CB calves were lowest in garlic treated group as compared to the turmeric, a combination of garlic and turmeric, a combination of garlic and turmeric powder supplementation fulfilled the nutrient requirement and improved growth rate of the calves and reduced the cost of feeding was observed.

CHAPTER – III

MATERIALS AND METHODS

CHAPTER - III

MATERIAL AND METHODS

The present investigation was carried out to assesss the "Effect of Garlic *(Allium sativum)* Supplementation on Growth Performance of Buffalo Calves at Organized Farm" the trial was conducted at Buffalo Unit, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani.

3.1 Place of work

The experiment was conducted at Buffalo Unit, Department of Animal Husbandry and Dairy Science, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. Here, the temperature ranges from 9.9º to 45ºC and relative humidity ranges from 11 to 93 per cent. However the temperature during the study ranged from 14.4 to 29.4 and humidity from 40 to79.6 per cent.

3.2 Selection of experimental animals

Total 12 Buffalo calves of same age and uniform conformation were selected from the Buffalo Unit to conducted the experiment. Calves were grouped under same weight and average age in four treatments groups and three calves in each group. All the calves were free from diseases and physiological disorders.

3.3 Experimental period

The experiment was conducted during 1st March 2021 to 31 May 2021 at Buffalo unit. The experimental period was 90 days and 15 days pre-experimental period.

3.4 Management of experimental animals

3.4.1 Experimental animals and their husbandry

To maintain the health of the animals at optimum level, they were placed in a clean and well ventilated and hygienic byre. The house was disinfected with Delta methrin (2.80%) before start of the trial; all the animals were dewormed with a broad spectrum dewormer.

The experimental buffalo calves were secured individually with nylon rope and provided with individual feeder during the preliminary feeding period of 15 days. Measured quantity of concentrate, dry roughages and green roughages were offer throughout experimental period.

Table 3.1 Details of selected experimental Calves

Treatments	Calves Tag No.	Body weight in (Kg)	Age in (months)
T_0	M-334	82.7	5-6
	J-235	82.2	5-6
	J-121	82.7	5-6
	S-331	82.3	5-6
Mean		**82.48**	
T_1	M- 310	82.1	5-6
	J-120	82.6	5-6
	M-333	81.9	5-6
	J-232	82.4	5-6
Mean		**82.25**	
T_2	M-332	82.4	5-6
	S-279	82.3	5-6
	S-296	82.7	5-6
	J-234	82.6	5-6
Mean		**82.50**	
T_3	J-119	81.9	5-6
	M-312	82	5-6
	S-280	82.9	5-6
	M-331	82.7	5-6
Mean		**82.38**	

3.4.2 Watering of animals

Clean and fresh drinking water was provided *ad.libitum* to each calf throughout the experimental period.

3.5 Body weight

The body weight of buffalo calves were calculated by using Shaeffer's formula at 15 days interval during the period of investigation.

$$\text{Shaeffer's formula: Live body weight (in pounds)} = \frac{\text{Length} \times (\text{Girth})^2}{300}$$

Plate 3.1 Raw garlic (*Allium sativum*)

Plate 3.2 Garlic (*Allium sativum*) powder

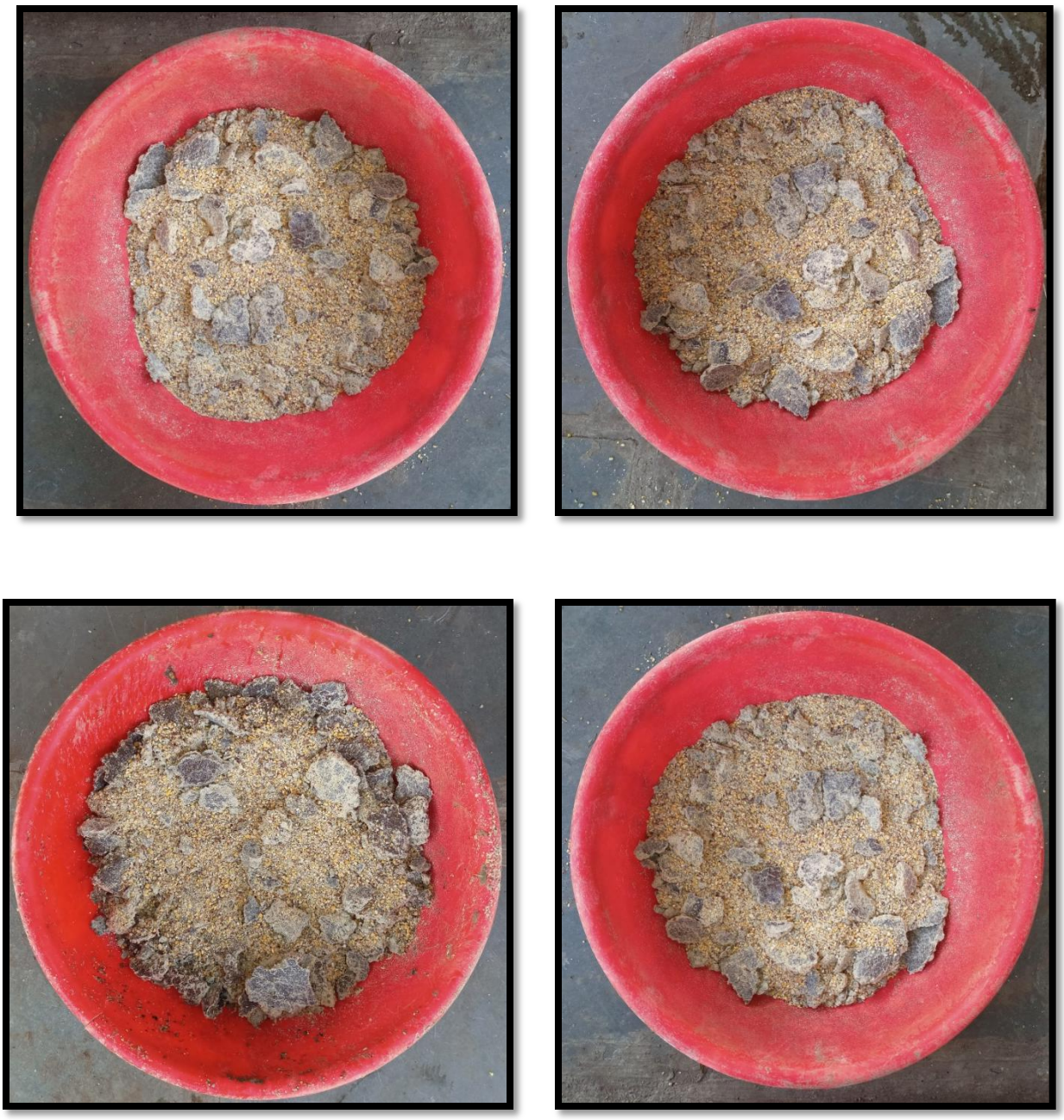

Plate 3.3 Experimental feed of mixtured Garlic (*Allium sativum*) powder

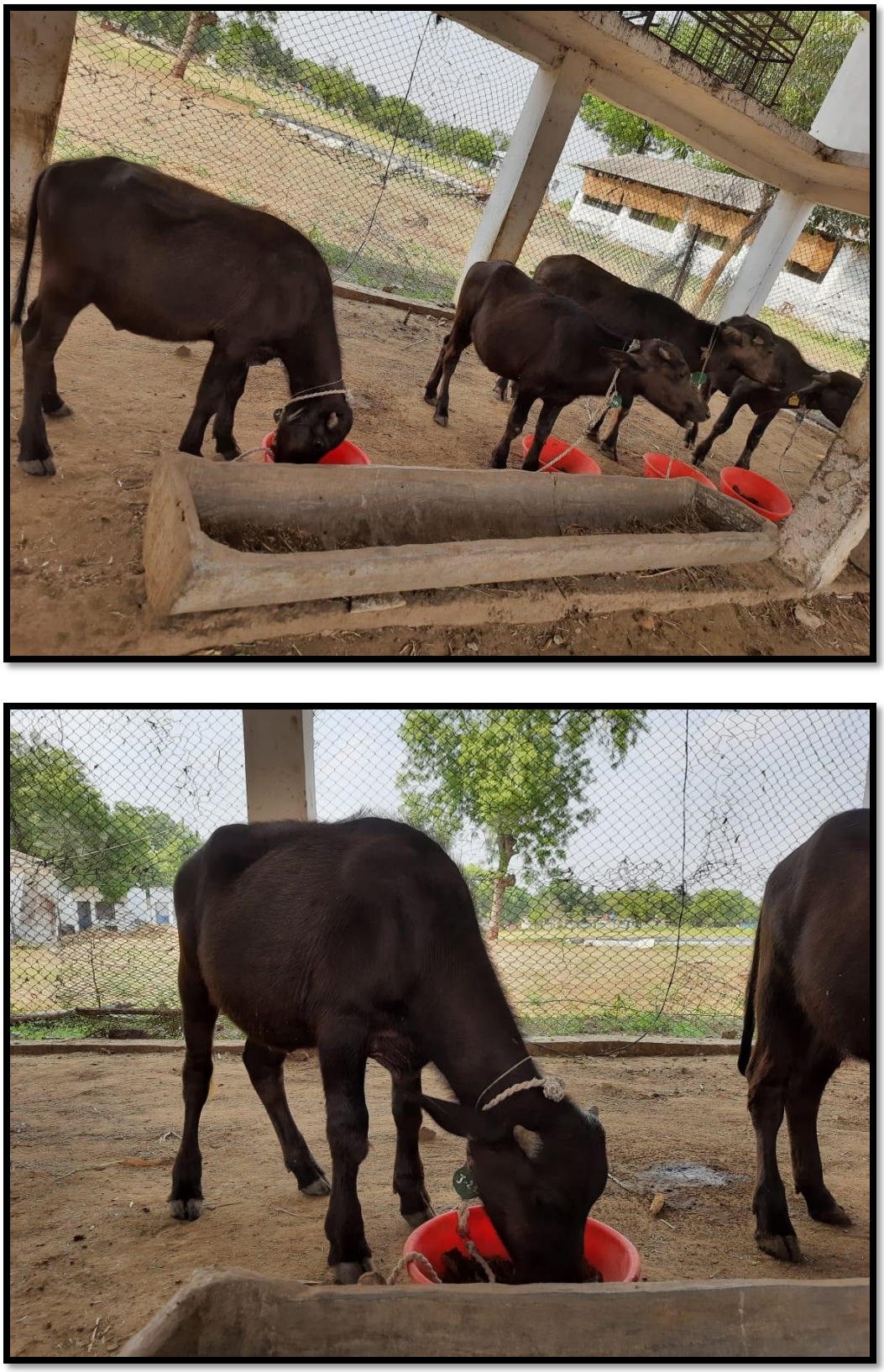

Plate 3.4 Experimental calves and their individual feeding

Where,

Length = Distance between point of shoulder to pin bone in inches

Girth = Entire circumference of the body behind the point of elbow in inches

3.6 Body measurement

The linear body measurement viz., chest girth, body length, height at wither, belly girth were recorded with the help of measuring tape at 15 days interval during the period of investigation. The measurements were recorded by allowing the animals at normal standing positions. Generally all measurements were recorded in the morning time before Buffalo calves were get loose for feeding. Following are the different body measurements.

3.6.1 Chest girth

It was measured around the chest behind the elbow joint.

3.6.2 Belly girth

It was measured around the abdomen just in front of hind legs.

3.6.3 Height at wither

It was measured immediately behind the hump to the ground (where sole of hoof touch to the ground).

3.6.4 Body length

It was measured from point of shoulder to the point of pin bone.

3.7 Feeding of experimental animals

3.7.1 Collection of Garlic

Garlic was purchased from local market and was dried under the shade for a period of 13 days. After drying, the outer husks were removed and the bulbs were ground to powder by electrical mixer.

During The garlic powder preparation we got 3.5 kg garlic powder form 10 kg raw garlic bulbs.

3.8.2 Feeding

All the experimental calves were fed with chopped green, dry fodder and concentrate as the basal diet individually as per their body requirements. The feed offered and the feed left over was recorded daily at 9:30 A.M in the morning. The calves in the group T_0 were treated as control and were fed only with the basal diet whereas, the calves in the groups T_1, T_2 and T_3 were known as treatment groups and were supplemented with garlic powder at the dose rates of 200 mg, 300 mg and 400 mg per kg body weight, respectively along with the basal diet. A brief account of feeding treatment followed is presented below.

Treatment (T_0): Green, dry roughages and concentrate as per requirement.

Treatment (T_1) : Green, dry roughages and concentrate as per requirement + Garlic powder @ 200 mg/kg b.wt.

Treatment (T_2) : Green, dry roughages and concentrate as per requirement + Garlic powder @ 300 mg/kg b.wt.

Treatment (T_3) : Green, dry roughages and concentrate as per requirement + Garlic powder @ 400 mg/kg b.wt.

3.8 Dry matter

Dry matter of feed stuff was estimated as per the procedure recommended by of A.O.A.C (1990).

Clean dried aluminum moisture cup was kept in hot air oven at 100ºC following by cooling and weighing. 10 gm sample was placed into the aluminum moisture cup and was kept in hot air oven at100º±2ºC for 10 hour. After 10 hour the cup was removed and placed in desiccators for cooling and weighing. Process of heating, cooling and weighing was repeated till constant weight was obtained and the difference between two successive weights was not more than ±0.5 mg the weight of cup with moisture free sample was noted. Dry matter of sample was calculated by the following formula (Anonymous 1990).

$$\text{DM}(\%) = \frac{\text{Weight of sample after drying}}{\text{Weight of sample before drying}} \times 100$$

Plate 3.5 Measurement of body length

Plate 3.6 Measurement of height at wither

Plate 3.7 Measurement of chest girth

Plate 3.8 Measurement of belly girth

Plate 3.9 Collection of blood sample

3.8.1 Dry matter percentage of feed stuff

Table 3.2: Dry matter percentage of feed stuff

Sr. No	Feed stuff	DM percentage	References
1	Garlic powder	68.70	Mishra et al., (2020)
2	Concentrate	92.61	Barman et al., (2018)
3	Dry roughages (dry kadbi)	90.23	Sonone et al., (2018)
4	Green roughages (Hybrid Napier)	29.75	Sonone et al., (2018)

3.9 Blood Parameters

Blood parameters of experimental buffalo calves were analyzed at the start of experiment (0 days) and at the end of experiments (90 days). Various blood parameters *viz.*, Total protein, serum albumin, serum globulin and glucose level was determined from local pathological lab as per standard methods.

3.10 Estimation of feeding cost

Feeding cost was calculated at the end of 90 days of experimental period. The feed cost was calculated based on actual cost of feed and garlic at market.

3.11 Statistical analysis

The data obtained was analyzed by using Complete Randomized Design (CRD). The standard errors (SE) and critical differences (CD) at 5 per cent level of significance were worked out for comparison of treatments and presented in the respective table.

CHAPTER – IV

RESULTS AND DISCUSSION

CHAPTER - IV

RESULTS AND DISCUSSION

This chapter deals with the findings of the research experiment entitled "Effect of Garlic (*Allium sativum)* Supplementation on The Growth Performance in Buffalo Calves at Organized Farm" carried out at the Buffalo Unit, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during the period from 1 March 2020 to 31 May 2021.

The results are presented in the following sub titles along with discussion on the findings. Finally the results have been interpreted in view of the work done in the past on the similar and or coinciding work.

4.1 Effect of garlic *(Allium sativum*) supplementation on the growth performance in Buffalo calves

4.1.1 Body weight

4.1.2 Body weight gain

4.1.3 Body length

4.1.4 Height at wither

4.1.4 Body girth

4.1.5 Belly girth

4.2 Dry matter intake

4.3 Effect of garlic (*Allium sativum)* supplementation on blood parameters

4.5 Estimate cost structure

4.1 Effect of garlic (*Allium sativum)* supplementation on the growth performance in Buffalo calves

Garlic contains enzymes, vitamin B, flavonoids, and various minerals. It is a high- quality resource of antioxidants and protein which make us to study how it affect the growth of animals. Buffalo calves were fed with garlic powder during

experimental period of 90 days. Its effect on growth performance in the form of body weight, height at wither, body length, chest girth, and belly girth recorded at fortnightly interval. Weight gain recorded at the end of experiment. Analysis was carried carried out and explained as follows.

4.1.1 Body weight

The observations on body weight of each calves were recorded fortnightly interval during the experimental period of 90 days and analyzed. The mean of the treatments has been presented in Table 4.1 and illustrated in Fig. 4.1

Table 4.1: Effect of garlic (*Allium sativum)* supplementation on the body weight (kg) in Buffalo calves

Time interval (days)	T_0 (control)	T_1	T_2	T_3	SE	CD (0.05)
0th	82.48	82.25	82.50	82.38	**1.349**	**NS**
15th	87.88	89.65	91.00	89.30	**1.104**	**NS**
30th	96.63	97.03	99.85	96.98	**1.140**	**NS**
45th	104.08	105.10	107.15	104.95	**1.402**	**NS**
60th	112.83^{b}	114.43^{ab}	118.15^{a}	112.68^{b}	**1.250**	**3.853**
75th	119.83^{b}	122.50^{ab}	125.85^{a}	120.05^{b}	**1.111**	**3.424**
90th	127.13^{c}	130.80^{ab}	132.95^{a}	128.38^{bc}	**1.097**	**3.380**

Note: The means with different superscripts in the same row differed significantly ($P<0.05$)

From the table 4.1 result shows that, at fortnightly interval body weights of calves were 82.48, 82.25, 82.50 and 82.38 kg in the treatment T_0, T_1, T_2 and T_3 respectively. Initially treatments was non significant up to fourth fortnightly interval. From the fifth fortnightly interval to seventh fortnightly interval treatment showed significant different. The body weight of calves at fifth fortnightly interval was 112.83, 114.43, 118.15 and 112.68 kg in Treatment T_0 , T_1, T_2 and T_3 respectively which show significant difference. In the fifth fortnightly interval treatment T_2 was significantly superior over treatment T_0 and T_3. The body weight at seventh fortnightly interval was 127.13, 130.80, 132.95 and 128.38 kg in treatment T_0, T_1, T_2 and T_3, respectively.

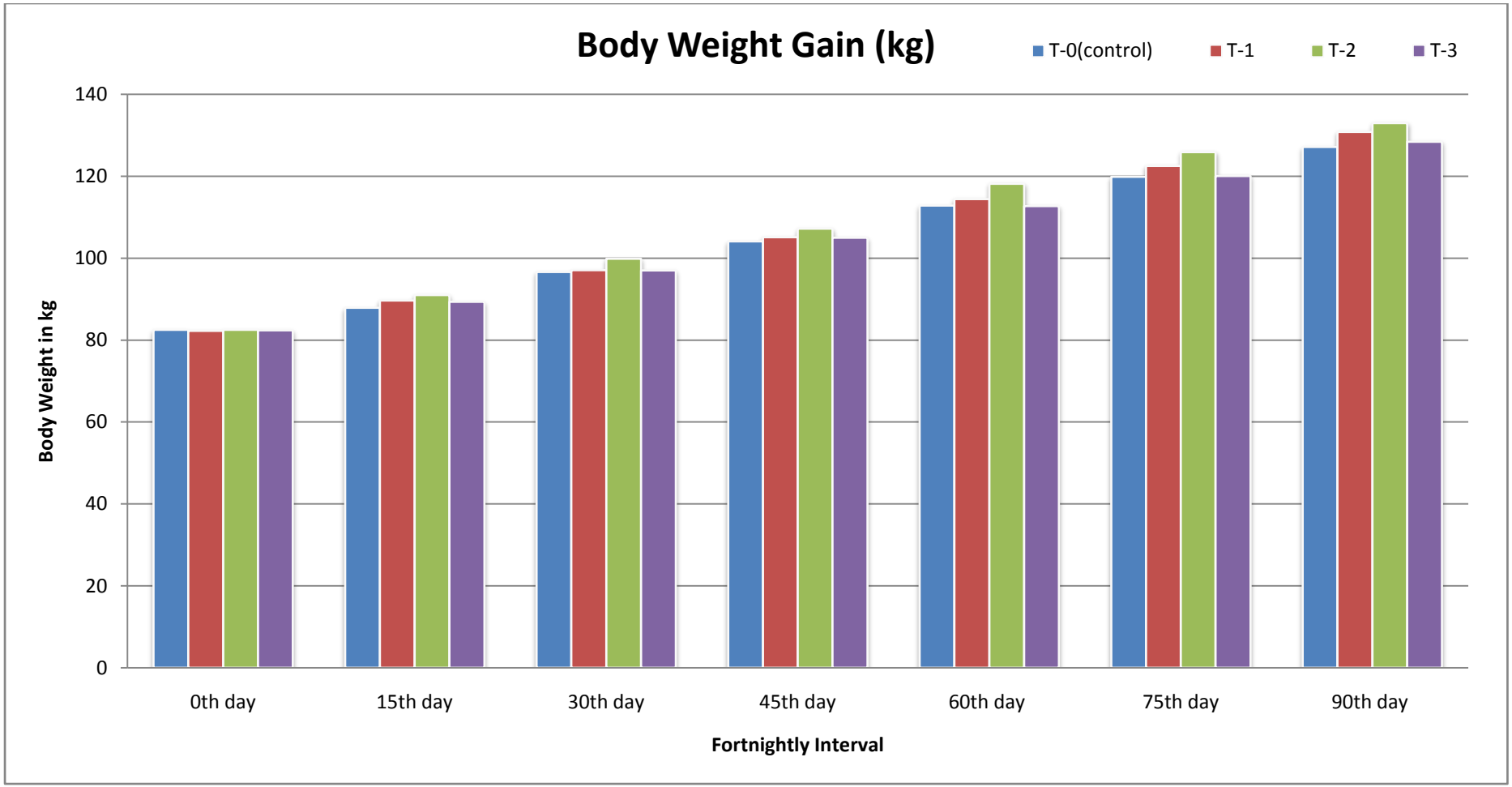

Fig. 4.1: Effect of garlic (*Allium sativum*) supplementation on body weight gain (kg) of buffalo calves

Body weights were increasing during the experimental period in all treatments and it showed significant difference. T_2 showed significant difference over treatment T_0 and T_3. T_1 showed significant difference over treatment $T_{0.}$ There was no significant difference between treatment T_0 and $T_{3.}$

The maximum increase in body weight was seen in treatment T_2 and minimum was seen in treatment $T_{0.}$ The significant difference in treatments showed that the body weight was increasing level of garlic powder. The 300 mg/kg b.wt. showed high impact on body weight followed by 200 mg/kg b.wt., 400 mg/kg b.wt. and 0%. The results obtained in present study are concordant with Ghosh *et al*., (2010) who observed the Treatment group received garlic extract supplementation at 250 mg/kg BW per day per calf. The body weight gain per calf per day in treatment group was 44.05 per cent higher than control group.

From the Table 4.1 it is Similar findings were observed by Balamurugan *et al*., (2014) the calves in T_1 and T_2 group gained significantly higher overall body weight and average daily gain compared with calves in T_3 group. The result obtained in this experiment agreement with the results of Duvvu *et al*., (2018) who observed that the increase in body weight in murrah buffalo calves fed with garlic powder. Overall weight gain in murrah buffalo calves were higher in group T_2 (300 mg/kg b.wt.), T_1 (250 mg/kg b.wt.) and T_0 (0%).

The result corresponds with Mishra *et al*., (2020) who also reported that the average overall Body gain differed significantly ($P<0.05$) with highest in the T_2 (90.00±8.52kg) followed by T_4 (84.50±10.12kg), T_3 (80.82±9.17kg) and lowest in the T_1 (72.67±8.12kg) group.

4.1.2 Body weight gain

The body weight gain was calculated from difference between initial body weight (0 days) and final body weight (90 days) and has been analyzed and represented in Table 4.2 and illustrated in Fig. 4.2

Table 4.2: Effect of garlic (*Allium sativum*) supplementation on body weight gain (kg) of buffalo calves

Treatments	Initial body weight (Kg)	Final body weight (Kg)	Avg. Total body weight gain (Kg)	Avg. daily body weight gain (gm)
T_0 (control)	82.48	127.13^{c}	44.65^{b}	0.496
T_1	82.25	130.80^{ab}	48.55^{ab}	0.539
T_2	82.50	132.95^{a}	50.45^{a}	0.560
T_3	82.38	128.38^{bc}	46.00^{b}	0.511
CD	**NS**	**3.380**	**4.220**	**0.048**
SE(m)	**1.349**	**1.097**	**1.370**	**0.015**

Note: The means with different superscripts in the same row differed significantly ($P<0.05$)

It is observed from Table 4.2 that, the average total body weight gain of experimental calves was 44.65, 48.55, 50.45 and 46.00 kg in Treatment T_0, T_1, T_2 and T_3 respectively and average daily body weight gain of experimental calves was 0.496, 0.539, 0.560 and 0.511 gm in Treatment T_0, T_1, T_2 and T_3 respectively. The minimum weight gain was observed in Treatment T_0 and while the maximum in Treatment T_2. All treatments were significantly differed with each other which shows increasing level of garlic *(Allium sativum*) powder increases the body weight gain in buffalo calves. 300 mg/kg b.wt level of garlic (*Allium sativum)* powder accrue the body weight gain of calves than 0, 200, 400 mg/kg b.wt. The results obtained in present study are concordant with Balamurugan *et al*., (2014) who observed that the calves in T_1 and T_2 group gained significantly higher overall body weight and average daily gain compared with calves in T_3 group.

Results obtained in this experiment agreement with the results of Duvvu *et al*., (2018) who observed that the increase in body weight in murrah buffalo calves fed with garlic powder and average daily weight gain in body weight of calves was 486.66±4.22, 532.78±5.40 and 540.55±2.64 gm in Treatment T_0, T_1 and T_2 respectively.

From the Table 4.2 it is Similar findings were observed by Mishra et al., (2020) who also reported that the average daily body weight gain of the female crossbred calves also differed significantly ($P<0.05$) and the highest value in the T_2

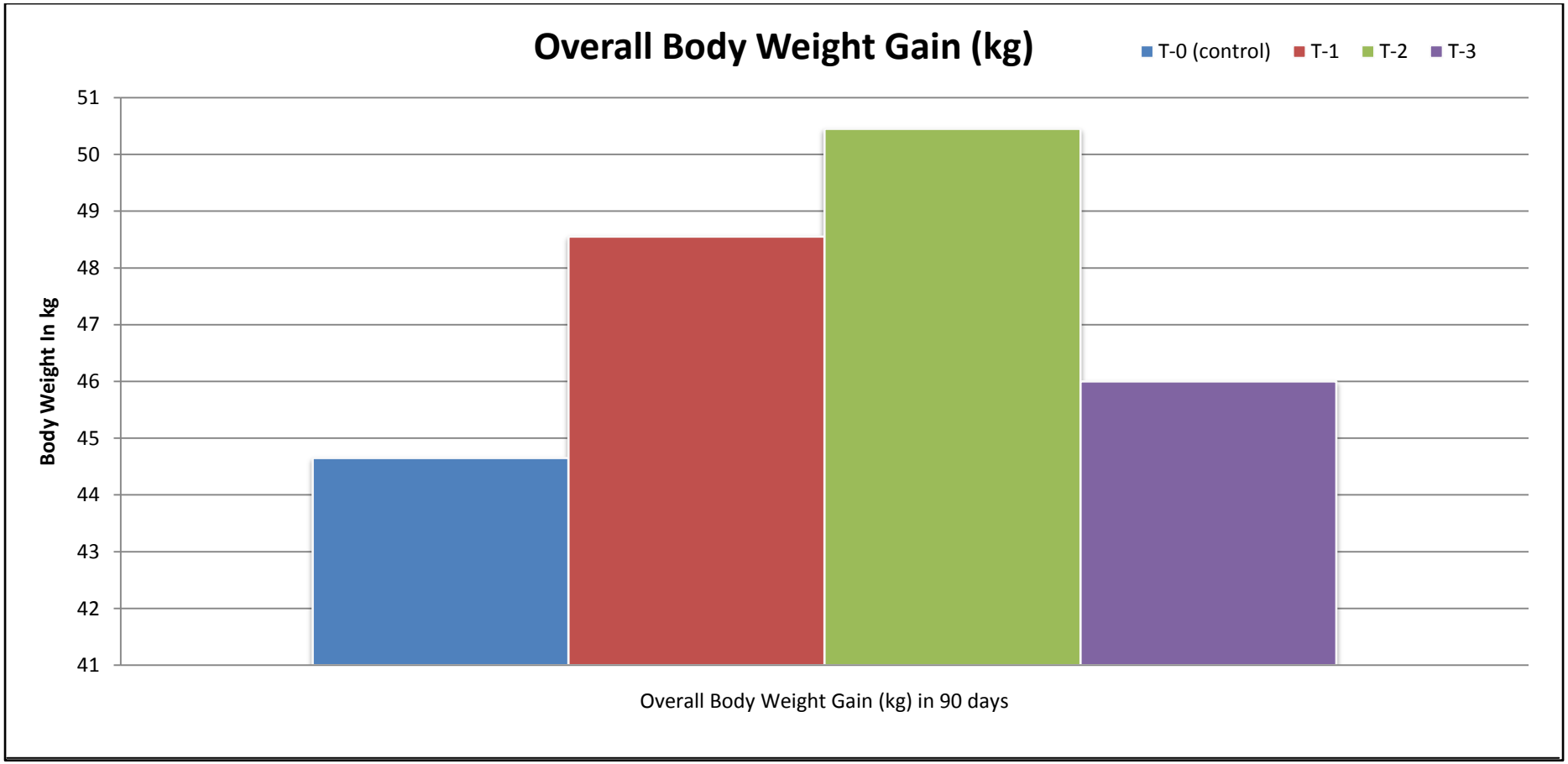

Fig.4.2: Effect of garlic (*Allium sativum*) supplementation on body weight gain (kg) of buffalo calves

(750.00±0.08) followed by T_4 (702.00±0.08), T_3 (673.00±0.7) and lowest in the T_1 (605.00±0.07,750).

4.1.3 Body length

The observations on body length of each calf were recorded fortnightly interval during the experimental period of 90 days and analyzed. The mean of treatments has been presenting Table 4.3 and illustrated in Fig. 4.3

Table 4.3: Effect of garlic (*Allium sativum*) supplementation on body length (cm) of buffalo calves

Time interval (days)	T_0 (control)	T_1	T_2	T_3	SE	CD (0.05)
0th	85.50	86.00	85.50	86.75	**3.016**	**NS**
15th	87.25	88.25	87.75	88.50	**3.120**	**NS**
30th	89.25	90.50	91.00	89.75	**2.808**	**NS**
45th	92.00	94.25	95.25	93.25	**2.873**	**NS**
60th	95.75	97.25	98.50	96.50	**2.652**	**NS**
75th	98.50^{b}	102.25^{ab}	105.75^{a}	101.50^{ab}	**1.591**	**4.902**
90th	103.75^{b}	107.25^{ab}	110.00^{a}	105.25^{b}	**1.488**	**4.225**

Note: The means with different superscripts in the same row differed significantly ($P<0.05$)

The table 4.3 show body lengths of calves were 85.50, 86.00, 85.50 and 86.75 cm in Treatment T_0, T_1, T_2 and T_3, respectively in first fortnightly interval. Initially there was no significant difference up to fifth fortnightly interval but from sixth to seventh fortnightly interval treatment differs significantly. The body length gain in sixth fortnightly interval was 98.50, 102.25, 105.75 and 101.50 cm in treatment T_0, T_1, T_2 and T_3 respectively. The body length at seventh fortnightly interval was 103.75, 107.2, 110.00 and 105.25 cm in Treatment T_0, T_1, T_2 and T_3 respectively.

Body length was increasing during the experimental period in all treatments. T_2 shows significant difference over treatment T_0 and T_3. There is no effect of garlic (*Allium sativum*) supplementation on treatment T_0, T_1 and T_3 which shows non significant difference. T_1 and T_2 also shows non significant difference.

The maximum increase in body length was observed in Treatment T_2 and minimum increase in body length was seen in Treatment T_0. 300 mg/kg b.wt garlic (*Allium sativum*) supplementation boosts body length of calves than 0 and 400 mg/kg b.wt.

The results obtained in present study are concordant with Mishra *et al*.,(2020) who reported the average overall body length gain of the female crossbred calves at end of the study differed significantly ($P<0.05$) with highest in the T_2 (30.52±1.02kg) followed by T_3 (22.05±0.57kg), T_4 (19.60±0.96kg) and lowest in the T_1 (18.76±0.67kg) group.

The data from the Table 4.3 showed similarities with Kekana *et al*., (2020) who also shows evaluated the effect of garlic, probiotics, and in combination on levels of immunoglobulin G (IgG) and growth performance in new-born Holstein Calves.

4.1.4 Height At Wither

The observations on height at wither of each calf were recorded fortnightly interval during the experimental period of 90 days and analyzed. The mean of treatments has been presented in Table 4.4 and illustrated in Fig. 4.4

Table 4.4: Effect of garlic *(Allium sativum)* supplementation on height at wither (cm) of buffalo calves

Time interval (days)	T_0 (control)	T_1	T_2	T_3	SE	CD (0.05)
0th	91.50	92.25	93.00	92.00	**1.778**	**NS**
15th	93.25	94.00	95.50	93.50	**1.675**	**NS**
30th	95.50	96.25	98.50	95.75	**1.497**	**NS**
45th	96.75	98.50	102.75	98.00	**1.503**	**NS**
60th	99.00^{b}	102.00^{ab}	105.75^{a}	100.50^{b}	**1.539**	**4.743**
75th	101.75^{b}	105.00^{ab}	107.75^{a}	103.75^{ab}	**1.340**	**4.130**
90th	104.25^{b}	107.50^{ab}	110.25^{a}	106.00^{b}	**1.358**	**4.184**

Note: The means with different superscript in the same row differed significantly ($P<0.05$)

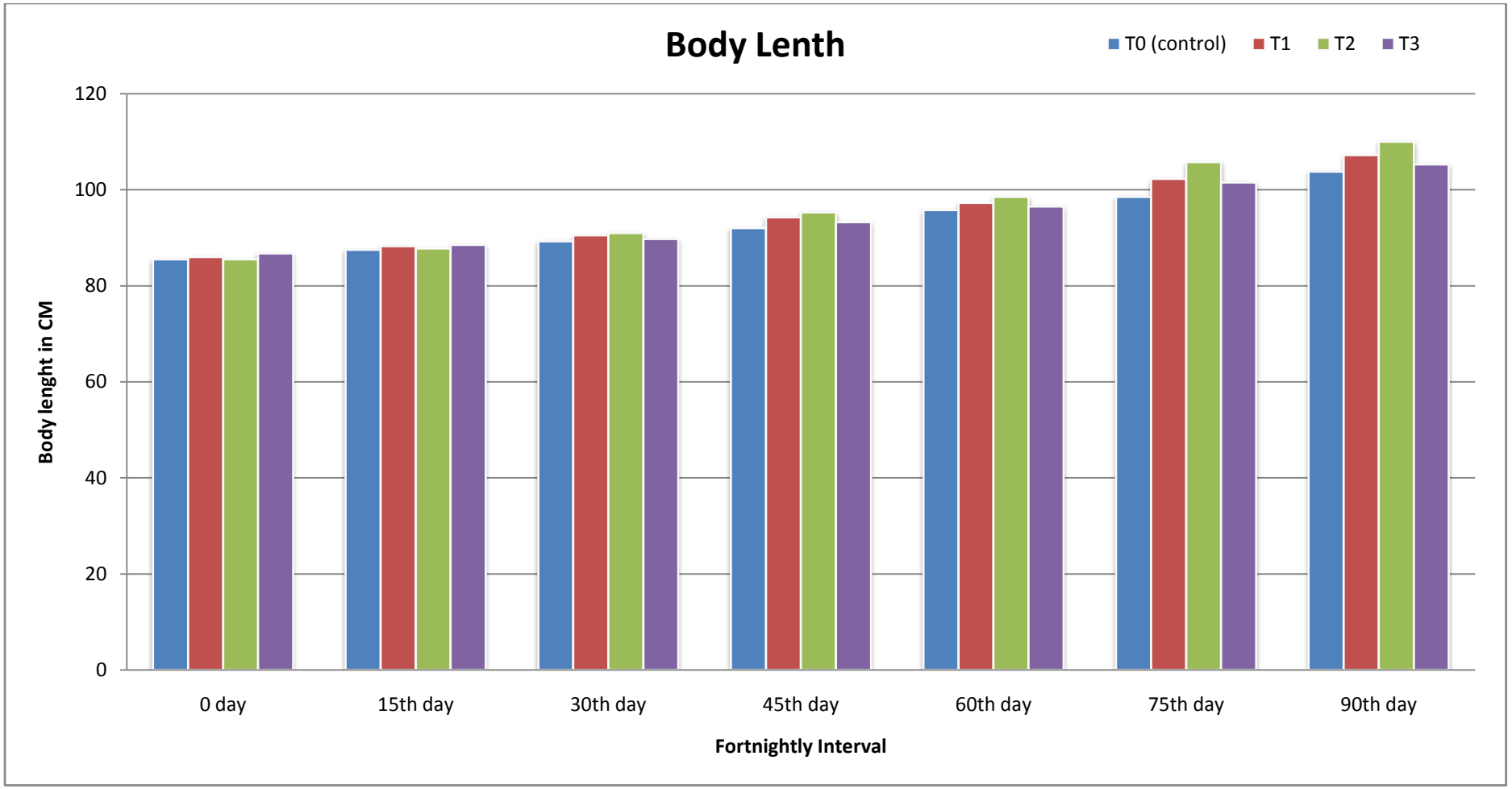

Fig.4.3: Effect of garlic (*Allium sativum*) supplementation on body length (cm) of buffalo calves

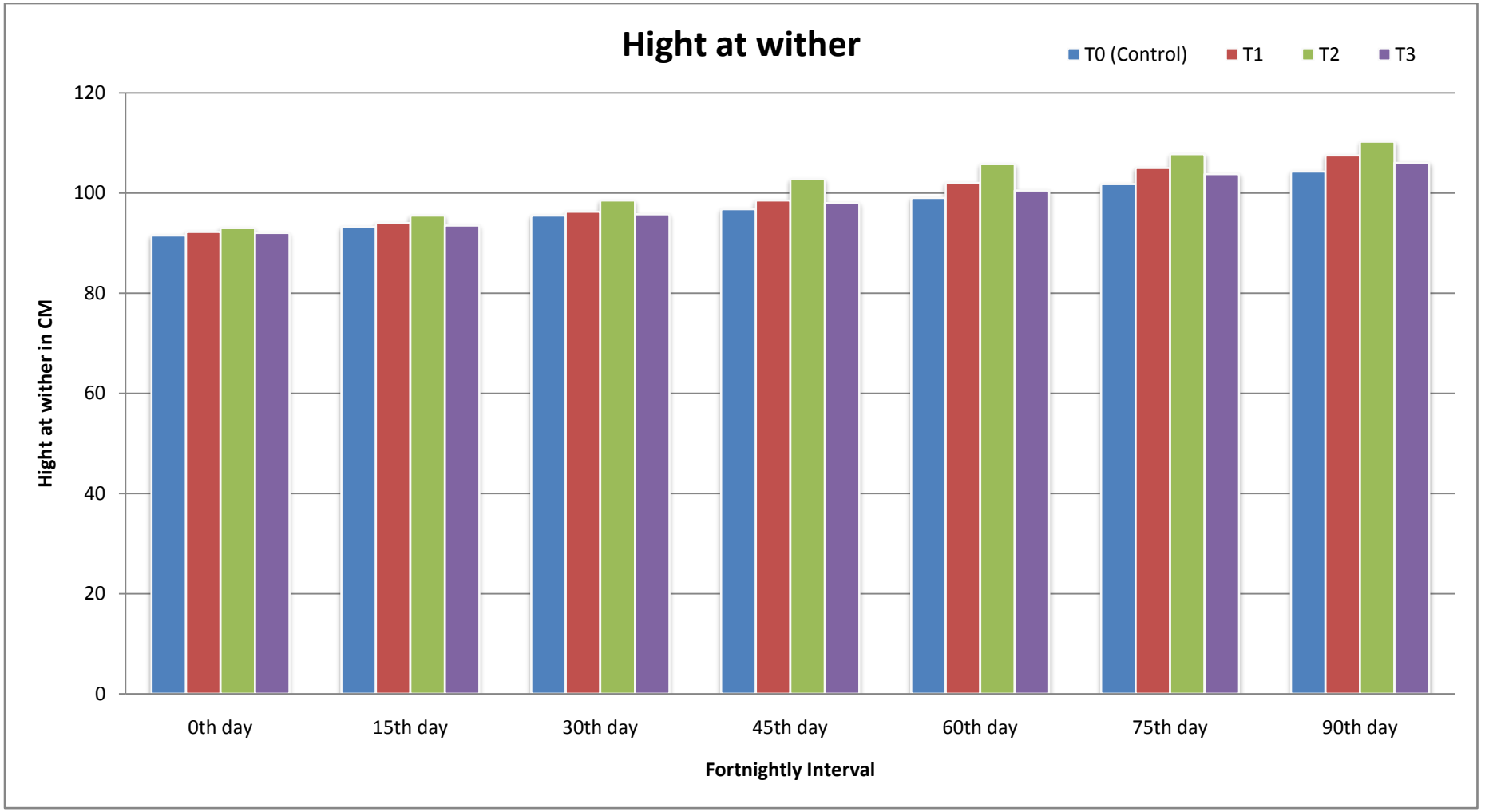

Fig. 4.4: Effect of garlic (*Allium sativum*) supplementation on height at wither (cm) of buffalo calves

The Table 4.4 indicates that height at withers of calves from first fortnight interval increased non significantly in treatments. Height at wither of calves were 91.50, 92.25, 93.00 and 92.00 cm in treatment T_0, T_1, T_2 and T_3 respectively at first fortnightly interval. From fifth fortnightly interval to seventh fortnightly interval show significant difference. The height at wither at fifth fortnightly interval was 99.00, 102.00, 105.75 and 100.50 cm in treatment T_0, T_1, T_2 and T_3 respectively. The height at wither at seventh fortnightly interval was 104.25, 107.50, 110.25 and 106.00 cm in treatment T_0, T_1, T_2 and T_3 respectively. Height at wither was increasing during the experimental period in all treatments but it shows difference. T_0 shows significant difference with treatment T_1, T_2 and T_3. There is no significant difference between treatment T_1, T_2 and T_3. Numerically height at wither was increasing 104.25, 107.50, 110.25 and 106.00 c in treatment T_0, T_1, T_2 and T_3 respectively.

It is revealed from Table 4.4 that maximum increase in height at wither was observed in Treatment T_2 and minimum was seen in treatment T_0. Increasing level of garlic (*Allium sativum)* supplementation affect the height at wither of calves.

The result obtained in present study are concordant with Mishra *et al*.,(2020) who reported that the average overall height at wither gain of the female crossbred calves at end of the study differed significantly ($P<0.05$) with highest in the T_2 (23.27±1.56kg) followed by T_4 (18.22±0.87kg), T_3 (15.22±1.25kg) and lowest in the T_1 (14.67±0.55kg) group.

4.1.5 Chest Girth

The observations on chest girth of each calf were recorded fortnightly interval during the experimental period of 90 days and analyzed. The mean of treatments has been presented in Table 4.5 and illustrated in Fig. 4.5

Table 4.5: Effect of garlic (*Allium sativum)* supplementation on chest girth (cm) of buffalo calves

Time interval (days)	T_0 (control)	T_1	T_2	T_3	SE	CD (0.05)
0th	91.75	91.00	92.75	92.50	**2.275**	**NS**
15th	93.50	93.75	95.25	94.50	**2.759**	**NS**
30th	96.00	96.75	97.00	96.50	**2.715**	**NS**
45th	98.25	99.25	101.25	99.00	**2.701**	**NS**
60th	100.75^{b}	104.75^{ab}	107.50^{a}	103.75^{ab}	**1.467**	**4.520**
75th	104.75^{b}	109.50^{a}	111.50^{a}	108.00^{ab}	**1.519**	**4.681**
90th	109.25^{b}	113.75^{ab}	117.25^{a}	111.25^{b}	**1.738**	**5.356**

Note: The means with different superscript in the same row differed significantly ($P<0.05$)

Table 4.5 makes us known about the chest girths of calves. At first fortnightly interval chest girths of calves were 91.75, 91.00, 92.75 and 92.50 cm in treatment T_0, T_1, T_2 and T_3 respectively. Initially treatments for four fortnightly interval non significant. The chest girth at fifth fortnightly interval was 100.75, 104.75, 107.50 and 103.75 cm in Treatment T_0, T_1, T_2 and T_3 respectively. It is identified that Treatment for fifth fortnightly interval and onward showed significant difference. The chest girth at seventh fortnightly interval was 109.25, 113.75, 117.25 and 111.25 cm in treatment T_0, T_1, T_2 and T_3 respectively.

It is revealed from Table 4.5 that maximum increase in chest girth was observed in Treatment T_2 and minimum was seen in treatment T_0. T_2 shows significant difference with Treatment T_0 (control) and T_3 and also non significant difference among Treatment T_1 and T_2.

High level of garlic (*Allium sativum*) supplementation affect the girth of calves. 300 mg/kg b.wt and 200 mg/kg b.wt garlic (*Allium sativum*) supplementation were good for accretion of girth. These results obtained in present study are concordant with Mishra *et al*., (2020) who reported that the average overall chest girth gain of the female crossbred calves at end of the study differed significantly ($P<0.05$)

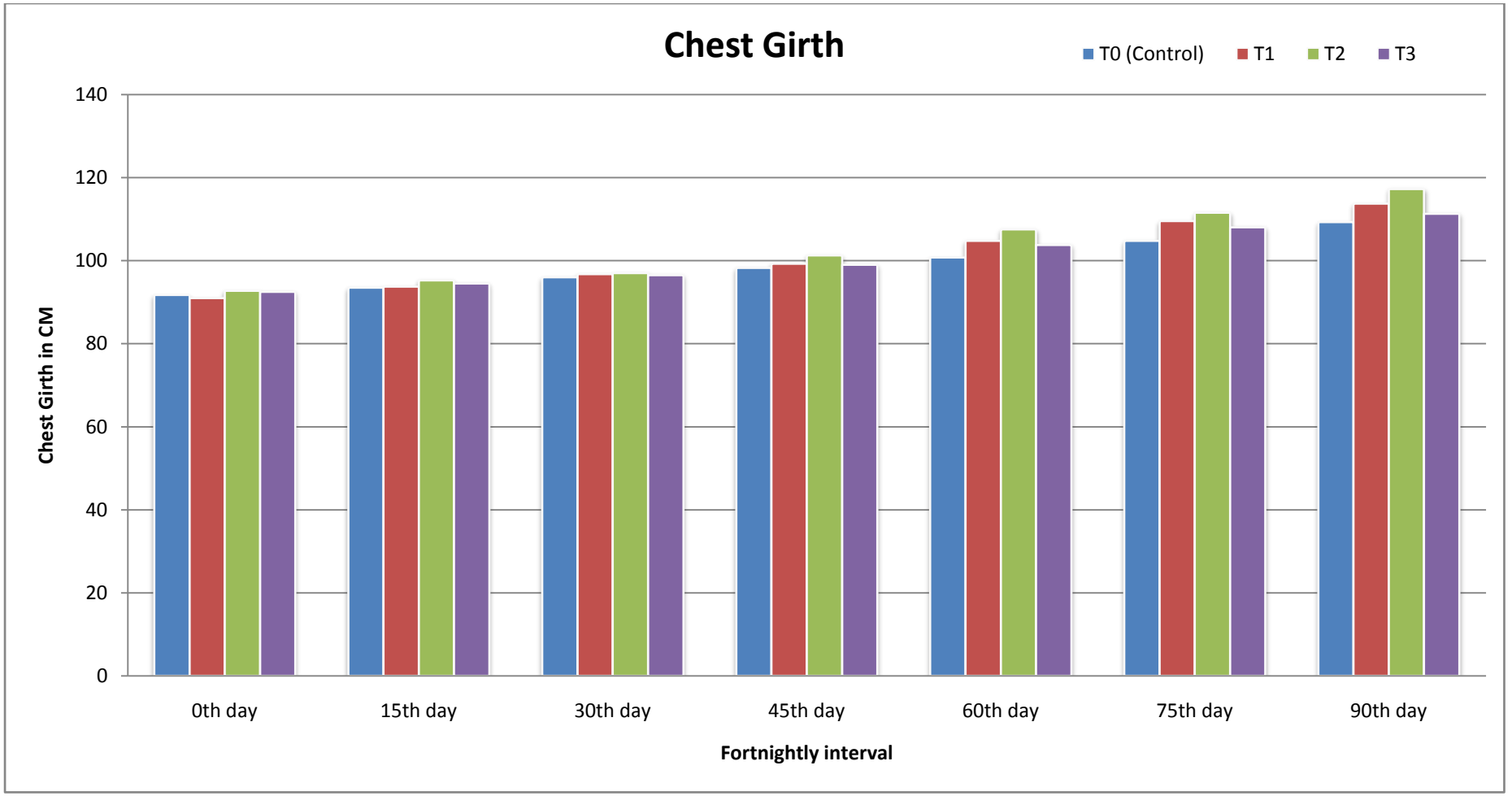

Fig.4.5: Effect of garlic (*Allium sativum*) supplementation on chest girth (cm) of buffalo calves

with highest in the T_2 (31.41±1.07kg) followed by T_3 (30.54±0.77kg), T_4 (30.25±1.18kg) and lowest in the T_1 (23.23±1.14kg) group.

The data from the Table 4.5 showed similarities with Kekana et al., (2020) who also shows evaluated the effect of garlic, probiotics, and in combination on levels of immunoglobulin G (IgG) and growth performance in new-born Holstein Calves.

4.1.6 Belly Girth

The observations on belly girth of each calf were recorded fortnightly interval during the experimental period of 90 days and analyzed. The mean of treatments has been presented in Table 4.6 and illustrated in Fig. 4.6

Table 4.6: Effect of garlic (*Allium sativum)* supplementation on belly girth (cm) of buffalo calves

Time interval (days)	T_0 (control)	T_1	T_2	T_3	SE	CD
0th	93.75	94.25	95.00	93.50	**2.153**	**NS**
15th	95.00	95.75	97.50	96.25	**2.238**	**NS**
30th	97.00	98.75	101.75	98.50	**2.373**	**NS**
45th	100.25	102.25	106.50	101.75	**1.495**	**NS**
60th	103.25^b	104.00^b	109.75^a	103.75^b	**1.502**	**4.627**
75th	106.00^b	107.50^b	113.25^a	107.00^b	**1.631**	**5.027**
90th	108.25^b	110.25^b	116.00^a	109.75^b	**1.609**	**4.958**

Note: The means with different superscript in the same row differed significantly ($P<0.05$)

The table 4.6 indicates that belly girth of calves from first fortnight interval increased non significantly in treatments. Belly girth of calves was 93.75, 94.25, 95.00 and 93.50 cm in treatment T_0, T_1, T_2 and T_3 respectively at first fortnightly interval. From fifth fortnightly interval to seventh fortnightly interval show significant difference. The belly girth at fifth fortnightly interval was 103.25, 104.00, 109.75 and 103.75 cm in treatment T_0, T_1, T_2 and T_3 respectively. The belly girth at seventh fortnightly interval was 108.25, 110.25, 116.00 and 109.75 cm in treatment T_0 (control), T_1, T_2 and T_3 respectively. Belly girth was increasing during the

experimental period in all treatments but it shows difference. T_0 shows significant difference with treatment T_1, T_2. There is no significant difference between treatment T_0, T_1 and T_3. Numerically belly girth was increasing 108.25, 110.25, 116.00 and 109.75 cm in treatment T_0, T_1, T_2 and T_3 respectively.

It is revealed from Table 4.6 that maximum increase in belly girth was observed in Treatment T_2 and minimum was seen in treatment T_0. Increasing level of garlic (Allium sativum) supplementation affected the belly girth of calves.

4.2 Dry matter intake

4.2.1 Fortnightly interval dry matter intake (DMI) (kg)

The observations on dry matter intake of each calf were recorded fortnightly interval during the experimental period of 90 days and analyzed. The mean of treatments has been presented in Table 4.7 and illustrated in Fig. 4.7

Table 4.7: Effect of garlic (*Allium sativum)* supplementation on dry matter intake (DMI) (kg) of buffalo calves

Time interval (days)	T_0 (control)	T_1	T_2	T_3	SE	CD (0.05)
0 - 15th	2.27	2.27	2.28	2.28	**0.067**	**NS**
15 - 30th	2.41	2.41	2.42	2.44	**0.070**	**NS**
30 - 45th	2.71	2.74	2.77	2.76	**0.055**	**NS**
45 - 60th	2.86^{b}	2.95^{ab}	3.03^{a}	2.88^{b}	**0.040**	**0.125**
60 - 75th	2.91^{b}	2.99^{ab}	3.08^{a}	2.96^{b}	**0.031**	**0.104**
75 - 90th	3.04^{b}	3.09^{ab}	3.16^{a}	3.02^{b}	**0.032**	**0.098**

Note: The means with different superscript in the same row differed significantly ($P<0.05$)

The Table 4.7 indicates that DMI of calves from first fortnight interval increased non significantly in treatments. DMI of calves were 2.27, 2.27, 2.28 and 2.28 kg in treatment T_0 (control), T_1, T_2 and T_3 respectively at first fortnightly interval. From fourth fortnightly interval to sixth fortnightly interval show significant difference. The DMI at fourth fortnightly interval was 2.86, 2.95, 3.03 and 2.88 kg in treatment T_0 (control), T_1, T_2 and T_3 respectively. The DMI at sixth fortnightly

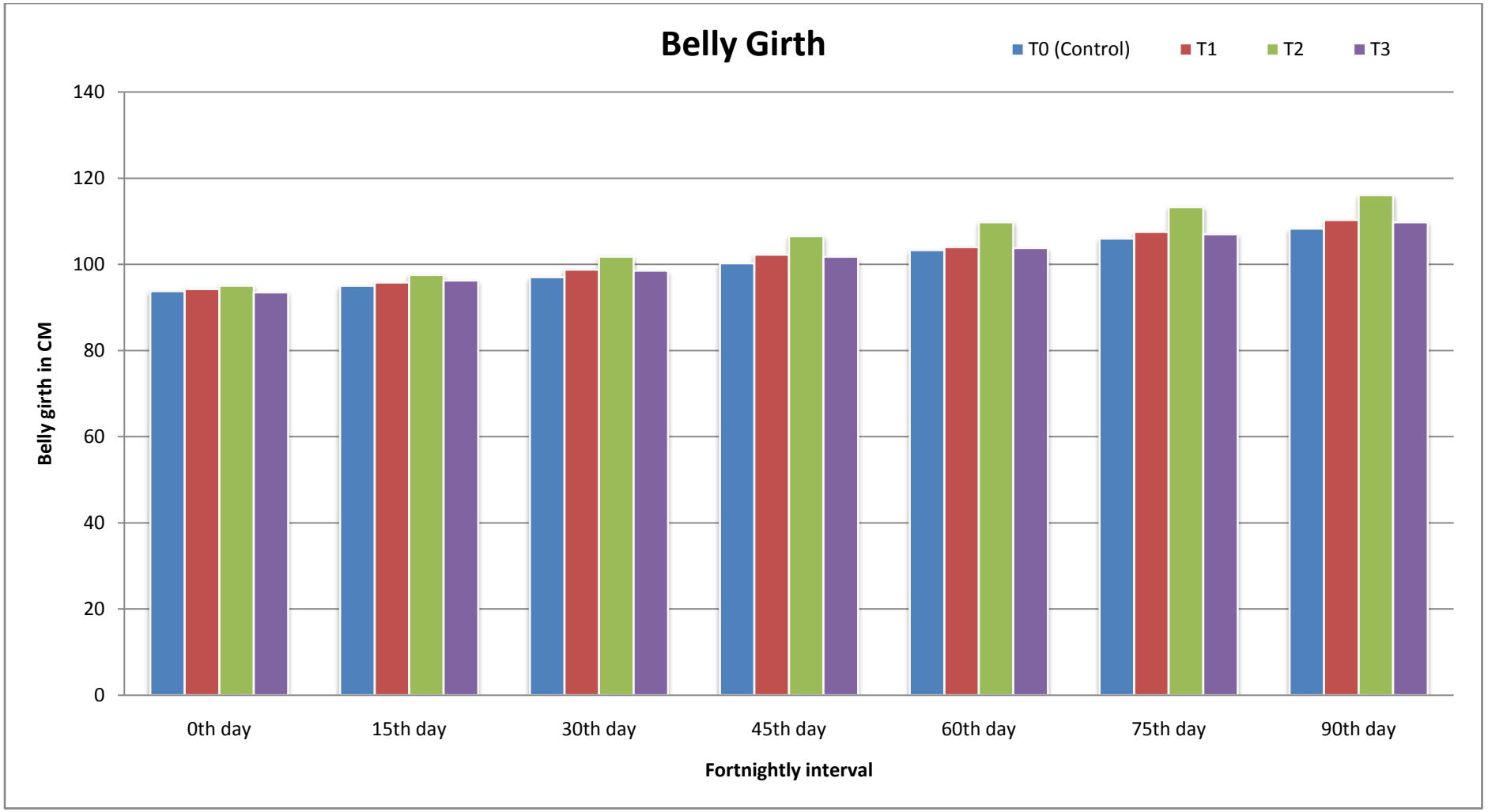

Fig.4.6: Effect of garlic (*Allium sativum*) supplementation on belly girth (cm) of buffalo calves

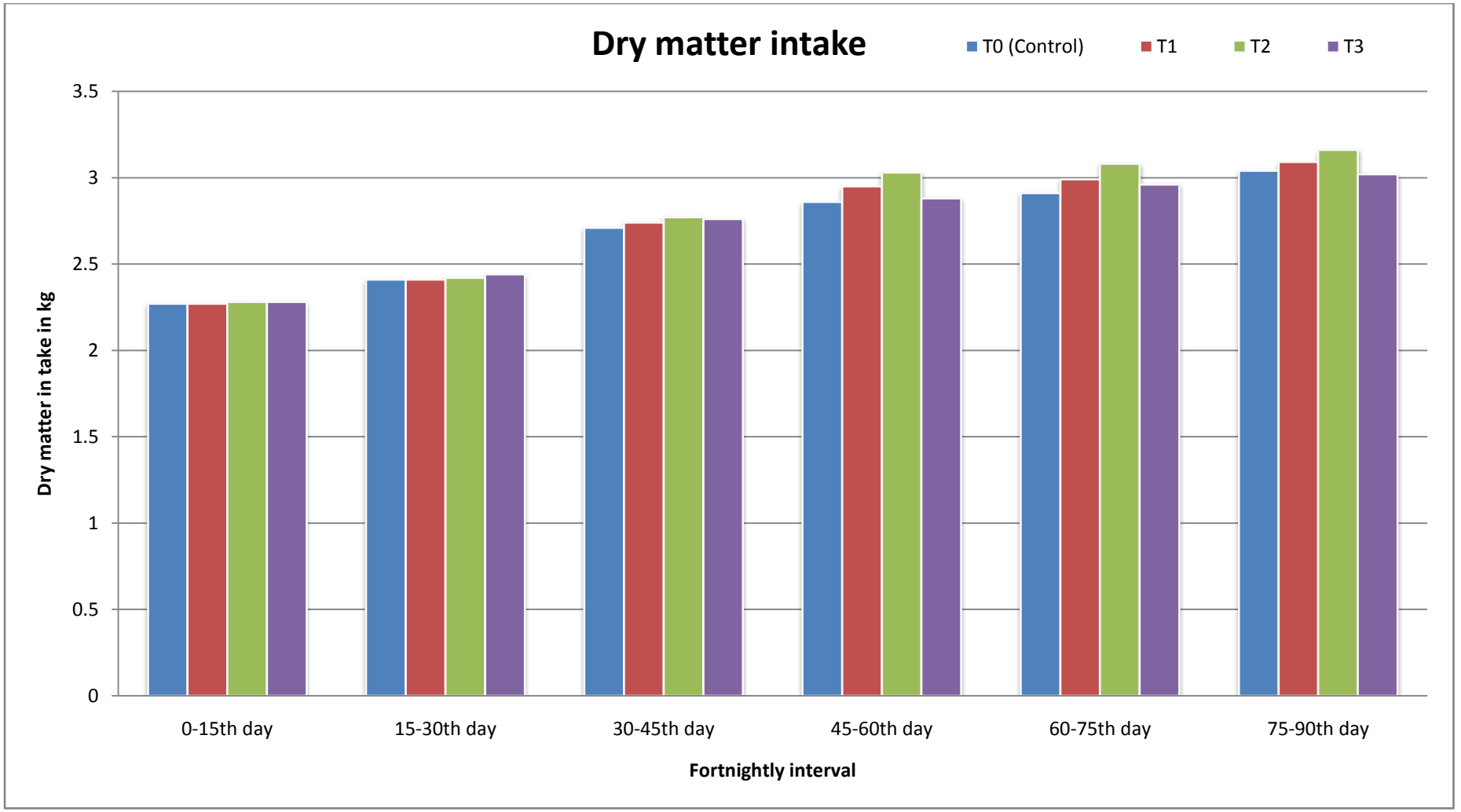

Fig.4.7: Effect of garlic (*Allium sativum*) supplementation on DMI (kg) of buffalo calves

interval was 3.04, 3.09, 3.16 and 3.02 kg in treatment T_0 (control), T_1, T_2 and T_3 respectively. It is identified that Treatment for fourth fortnightly interval and onward showed significant difference. DMI was increasing during the experimental period in all treatments.

It is revealed from Table 4.7 that maximum increase in DMI was observed in Treatment T_2 maximum and minimum was seen in treatment T_3. T_2 shows significant difference with Treatment T_0 (control) and T_3 and also non significant difference among Treatment T_1 and T_2.

The result obtained in present study are concordant with Duvvu *et al*., (2018) who reported that the dry matter intake higher in T_2 and lower T_0. From the Table 7 it is Similar findings were observed by Balamurugan *et al*., (2014) who also reported that the monthly mean daily dry matter intake ranged from 0.97±0.02 to 2.00±0.04 kg from first month of experimental trial for calves supplemented with garlic in water (T_1). For the calves supplemented with garlic in concentrate feed it ranged from 0.95±0.01 to 2.03 kg (T_2) and for the calves in the control group it ranged from 0.92± 0.02 to 1.98±0.70 kg (T_2).

Results are also corroborated with Ghosh et al., (2010) who investigated the mean of dry matter intake per calf per day in the treatment group were 12.44 per cent higher than control group respectively.

4.2.2 Daily dry matter intake (DMI) (kg)

The data regarding the daily DMI over an experimental period of 90 days under four different treatments were recorded, analyzed and presented in Table 4.8 and illustrated Fig 4.8

Table 4.8: Effect of garlic (*Allium sativum)* supplementation on average daily dry matter intake (DMI) (kg) over experimental period (kg) of buffalo calves

Treatments	Daily dry matter intake (DMI)	Overall dry matter intake (DMI)
T_0 (control)	3.24^{b}	291.6^{d}
T_1	3.29^{ab}	296.1^{b}
T_2	3.34^{a}	301.32^{a}
T_3	3.26^{b}	294.12^{c}
S.E.	**0.023**	**2.064**
CD at 0.05	**0.071**	**6.362**

Note: The means with different superscript in the same row differed significantly ($P<0.05$)

It was observed from Table 4.8 that the average daily dry matter intake of calves were 3.24, 3.29, 3.34 and 3.26 kg in treatment T_0, T_1, T_2 and T_3 respectively. The daily dry matter intake under treatment T_2 was significantly higher than calves of the rest of treatments.

It is revealed from Table 4.8 that maximum increase in DMI was observed in Treatment T_2 and minimum was seen in treatment T_0. T_2 shows significant difference with Treatment T_0 (control) and T_3 and also non significant difference among Treatment T_1 and T_2. Increasing level of garlic (*Allium sativum*) supplementation affected the daily dry matter intake of calves.

The result obtained in present study are concordant with Balamurugan *et al*., (2014) who observed that the monthly mean daily dry matter intake ranged from 0.97±0.02 to 2.00±0.04 kg from first month of experimental trial for calves supplemented with garlic in water (T_1). For the calves supplemented with garlic in concentrate feed it ranged from 0.95±0.01 to 2.03 kg (T_2) and for the calves in the control group it ranged from 0.92± 0.02 to 1.98±0.70 kg (T_2). The results agree with Ghosh *et al*., (2010) who investigated the mean of dry matter intake per calf per day in the treatment group were 12.44 per cent higher than control group respectively.

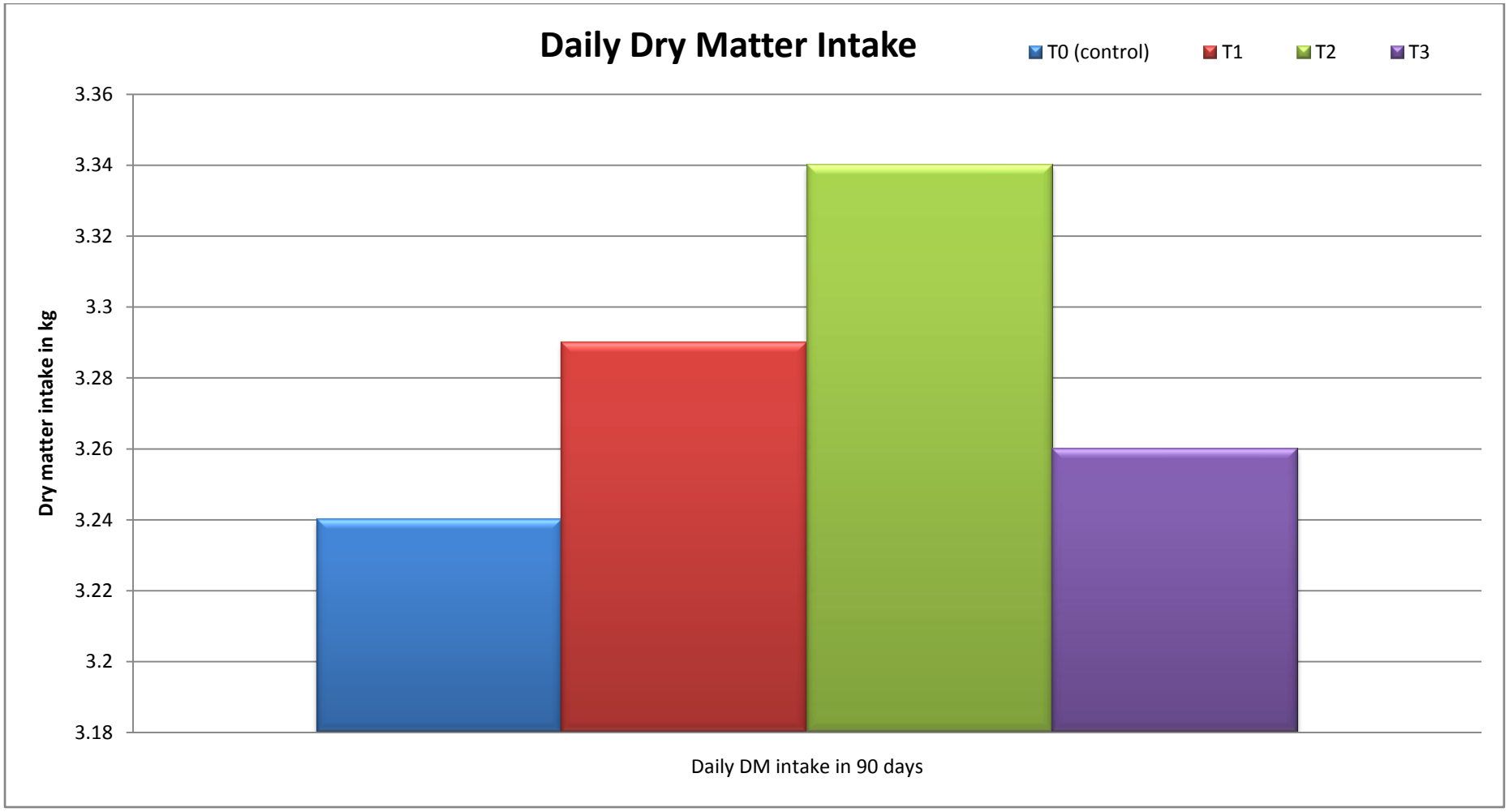

Fig.4.8: Effect of garlic (*Allium sativum*) supplementation on daily DMI (kg) of buffalo calves

Results are also corroborated with Duvvu *et al*., (2018) who reported effect of garlic supplementation on the growth performance and body condition score in murrah buffalo calves.

4.3 Effect of garlic (*Allium sativum*) supplementation on blood parameters

Blood parameters of experimental claves were analyzed at the start of experiment (0 days) and at the end of experiment (90 days). It is important to record effect of garlic (*Allium sativum*) supplementation on blood parameter viz, total protein, serum albumin, serum globulin and blood glucose level which are explained as follows

4.3.1 Total Protein

Total Protein was recorded at the start of experiment (0 days) and at the end of experiment (90 days) and given in Table 4.9 and illustrated in Fig. 4.9

Table 4.9: Effect of garlic (*Allium sativum)* supplementation on Average total protein (g/dl) of buffalo calves

Treatments	Initial Total protein (g/dl) (0 days)	Final Total protein (g/dl) (90 days)
T_0 (control)	**5.95**	**6.31^{b}**
T_1	**5.85**	**6.45^{ab}**
T_2	**6.11**	**6.84^{a}**
T_3	**6.21**	**6.25^{b}**
CD (0.05)	**NS**	**0.391**
SE	**0.134**	**0.127**

Note: The means with different superscript in the same row differed significantly ($P<0.05$)

Table 4.9 shows the initial average total protein of claves was 5.95, 5.85, 6.11 and 6.21 g/dl for treatments T_0, T_1, T_2 and T_3, respectively. Initially all treatments were not significant. The final average total protein of calves was 6.31, 6.45, 6.84 and 6.25 g/dl for treatments T_0, T_1, T_2 and T_3, respectively. Treatment T_2 showed significant difference over treatment T_0 and T_3. Treatment T_1 shows significant difference over T_3. There is no significant difference in treatment T_0 and T_3,

Treatment T_3 and T_1. Initially total protein content was non significant but at the end experiments differed significantly which may due to different levels of garlic (*Allium sativum*) supplementation and its protein content.

The results obtained in present study are comparable with Hassan *et al*., (2013) who reported that the significant (P<0.05) increase in the serum total protein and globulin in the growing buffalo calves fed treated diet compared with those fed the control.

Whereas some research studies also observed non-significant difference in total protein concentration in animals which are supplemented with garlic (*Allium sativum*). El-katcha *et al*., (2016) ; Egunjobi & Fatoba (2017) who reported that the total protein (TP), glucose and albumin decreased significantly (P<0.05) with higher levels of garlic powder supplementation.

Results are also corroborated with Ei-Ashry *et al*., (2006) who reported the effect of dietary supplemented with medicinal herb on nutrient digestibility and some blood metabolites of buffalo calves.

4.3.2 Serum Albunim

Serum albumin was recorded at the start of experiment (0 days) and at the end of experiment (90 days) and given in Table 4.10 and illustrated in Fig.4.10

Table 4.10: Effect of garlic (*Allium sativum)* supplementation on average serum albumin (g/dl) of buffalo calves

Treatments	Initial Albumin (g/dl) (0 days)	Final Albumin (g/dl) (90 days)
T_0 (Control)	**2.41**	**2.19**
T_1	**2.37**	**2.20**
T_2	**2.30**	**2.29**
T_3	**2.24**	**2.23**
CD	**NS**	**NS**
SE	**0.045**	**0.048**

NS = Non significant

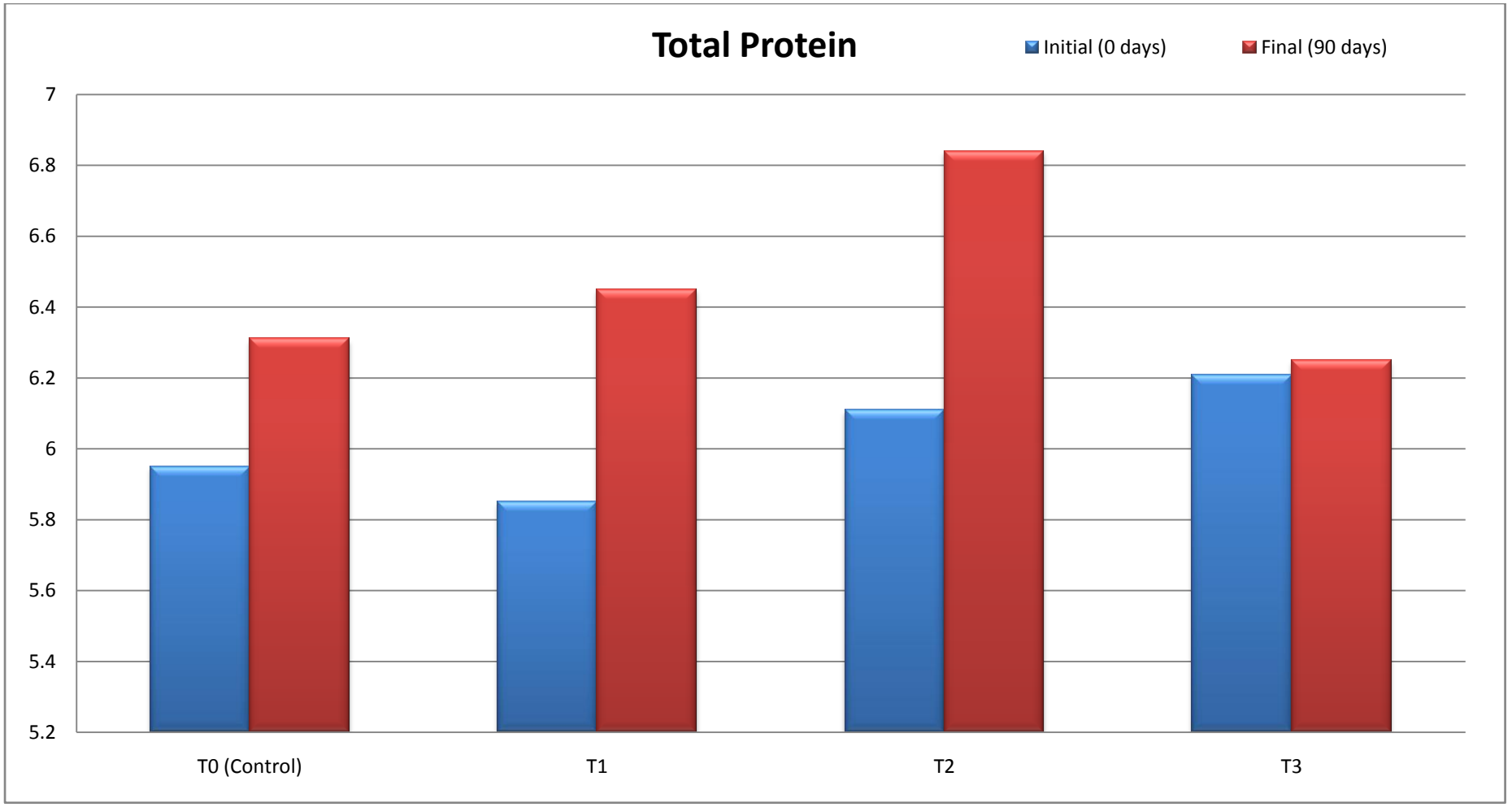

Fig.4.9: Effect of garlic (*Allium sativum*) supplementation on total protein (g/dl) of buffalo calves

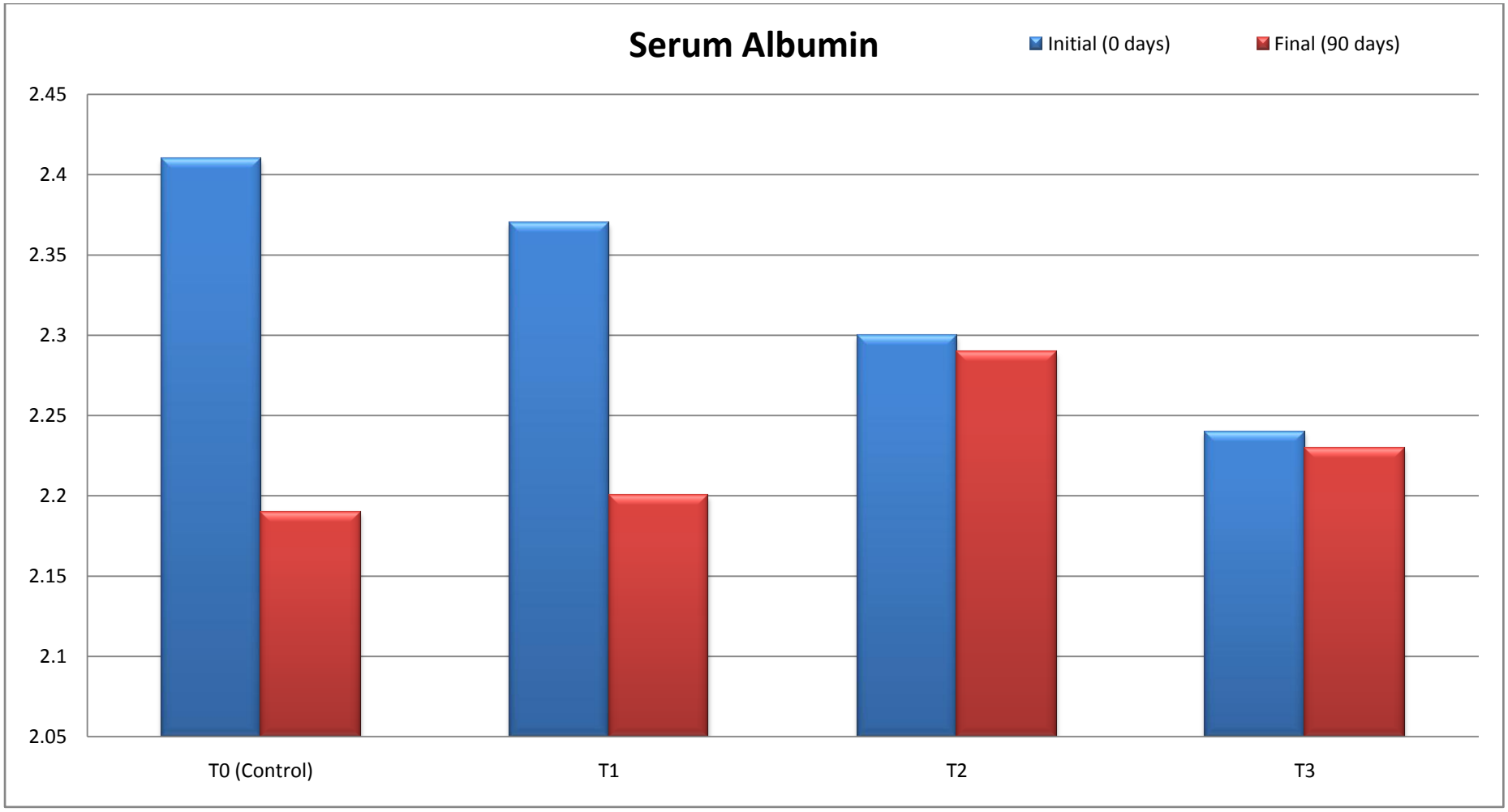

Fig.4.10: Effect of garlic (*Allium sativum*) supplementation on serum albumin (g/dl) of buffalo calves

From Table 4.10 it is perceived that the initial average serum albumin of calves was 2.41, 2.37, 2.30 and 2.24 g/dl for treatments T_0, T_1, T_2 and T_3, respectively. The final average serum albumin of calves was 2.19, 2.20, 2.29 and 2.23 g/dl for treatments T_0, T_1, T_2 and T_3, respectively. The serum albumin was numerically higher under T_2 treatment than T_0, T_1 and T_3 treatment however, the differences observed were non-significant. There was non significantly affected by the inclusion of varying levels of garlic supplementation on serum albumin.

The result obtained in present study are concordant with Hassan *et al*., (2013) who reported that the serum albumin were significantly decreased ($P<0.05$) in the buffalo calves fed treated diet at levels of 2 g caraway seed (CS, T1), 2 g dried garlic (DG, T2) compared with those fed the control one.

The results obtained from this study corresponds with the Egunjobi & Fatoba (2017) who reported the total protein (TP), glucose and albumin decreased significantly ($P<0.05$) with higher levels of garlic powder supplementation and El-katcha *et al*., (2016) It was observed garlic extract supplementation slightly decreased blood serum albumin.

Results are also corroborated with Ahmed *et al*. (2009) who reported that the adding natural juice of vegetable and fruitage to ruminant diets (B) nutrient utilization, microbial safety and immunity, effect of diets suplementated with lemon, onion and garlic juice fed to growing buffalo calves.

4.3.3 Serum Globulin

Serum globulin was recorded at the start of experiment (0 days) and at the end of experiment (90 days) and given in Table 4.11 and illustrated in Fig. 4.11

Table 4.11: Effect of garlic (*Allium sativum)* supplementation on average serum globulin (g/dl) of buffalo calves

Treatments	Initial Globulin (g/dl) (0 days)	Final Globulin (g/dl) (90 days)
T_0 (control)	**3.48**	**4.10^{b}**
T_1	**3.47**	**4.21^{b}**
T_2	**3.65**	**4.59^{a}**
T_3	**3.66**	**4.33^{ab}**
CD (0.05)	**NS**	**0.319**
SE	**0.094**	**0.104**

Note: The means with different superscript in the same row differed significantly ($P<0.05$)

Table 4.11 shows the initial average total serum globulin of claves was 3.48, 3.47, 3.65 and 3.66 g/dl for treatments T_0, T_1, T_2 and T_3, respectively. Initially all treatments were not significant. The final average serum globulin of calves was 4.10, 4.21, 4.59 and 4.33 g/dl for treatments T_0, T_1, T_2 and T_3, respectively. Treatment T_2 showed significant difference with Treatment T_0 and T_1. Treatment T_3 shows significant difference with T_0. There was no significant difference in Treatment T_0 and T_1, Treatment T_1 and T_3. Initially serum globulin content was non significant but at the end experiments differed significantly which may due to different levels of garlic (*Allium sativum*) supplementation.

The results obtained in present study are comparable with Hassan *et al*., (2013) who reported the significant ($P<0.05$) increase in the serum globulin in the growing buffalo calves fed treated diet compared with those fed the control.

Table 4.11 showed compatibility Egunjobi & Fatoba (2017) who observed that the serum globulin significantly increased with higher level of garlic powder supplementation. Similar result reported by Ahmed *et al*., (2009) who observed that the adding natural juice of vegetable and fruitage to ruminant diets (B) nutrient utilization, microbial safety and immunity, effect of diets suplementated with lemon, onion and garlic juice fed to growing buffalo calves.

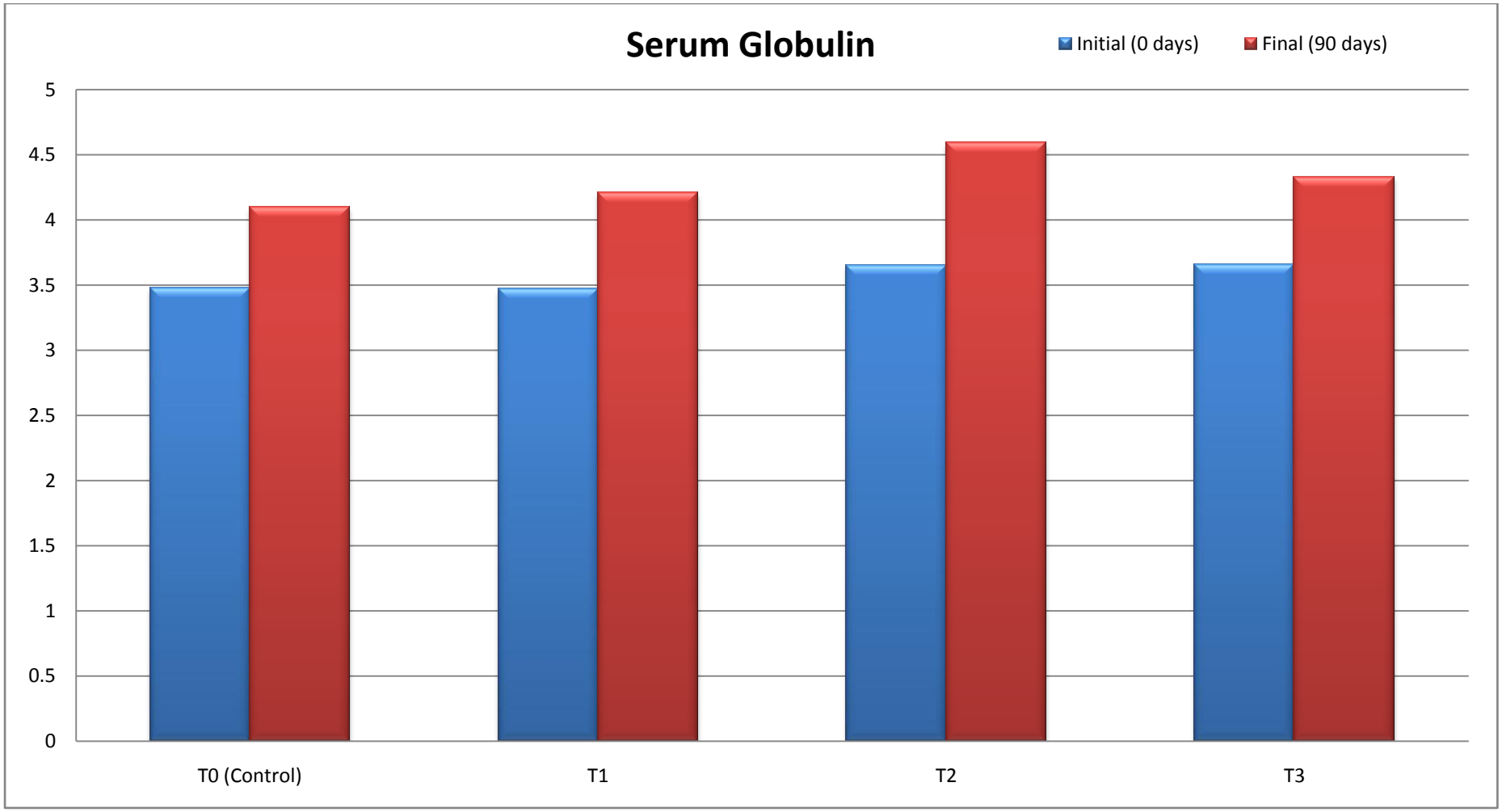

Fig.4. 11: Effect of garlic (*Allium sativum*) supplementation on serum globulin (g/dl) of buffalo calves

Results are also corroborated with Shokrollahi *et al*., (2016) who investigated the Serum globulin was higher in kids given garlic extract supplementation compared to those in the control group with group T1 showing the highest levels.

4.3.4 Blood Glucose Level

Blood Glucose Level was recorded at the start of experiment (0 days) and at the end of experiment (90 days) and given in Table 4.12 and illustrated in Fig. 4.12

Table 4.12: Effect of garlic (*Allium sativum)* supplementation on average blood glucose level (mg/dl) of buffalo calves

Treatments	Initial blood glucose level (mg/dl) (0 days)	Final blood glucose level (mg/dl)(90 days)
T_0 (control)	58.95	63.64
T_1	60.97	58.28
T_2	62.73	58.31
T_3	63.32	59.48
CD	NS	NS
SE	2.437	4.134

NS = Non significant

It was observed from Table 4.12 that the initial average blood glucose level of calves was 58.95, 60.97, 62.73 and 63.32 mg/dl for treatments T_0, T_1, T_2 and T_3, respectively. The final average blood glucose level of calves was 63.64, 58.28, 58.31 and 59.48 mg/dl for treatments T_0, T_1, T_2 and T_3, respectively. The highest value was observed under treatment T_0 than the treatment T_3, T_2 followed by treatment T_1. The differences observed were non significant among the treatments. This showed that there was no affect on blood glucose level of calves under the feeding control diet.

The results obtained in present study are concordant with Egunjobi & Fatoba (2017) who observed that the glucose decreased significantly ($P<0.05$) with higher levels of garlic powder supplementation.

Results are also corroborated with El-katcha *et al*., (2016) who reported that the Allicin supplementation non-significantly increased blood serum total protein, globulin and glucose concentrations.

4.5 Estimate cost structure

The cost of feeding garlic (*Allium sativum*), green roughages, dry roughages and concentrate was recorded and presented in Table 4.13 and illustrated in Fig. 4.13

It is observed from Table 4.13 total feed cost was 8024.6, 10179.45, 11504.65 and 10475.45 Rs. In treatment T_0, T_1, T_2 and T_3, respectively. The cost per kg live weight gain 179.72, 209.66, 228.04 and 227.72 Rs. In treatment T_0, T_1, T_2 and T_3, respectively. It was seen from the results treatment T_2 has highest cost per kg live weight gain and treatment T_0 has lowest cost per kg live weight gain. The results obtained in present study are concordant with Ghosh *et al*., (2009) who investigated the supplementation of garlic powder can be effective for production cost efficiency.

The data from the table 4.13 showed similarities with Egunjobi & Fatoba (2017) who observed that the cost per weight gain which was also significantly higher in supplemented group compared to control.

Results are also corroborated with Mishra *et al*., (2020) who reported the T_4 group reduced the cost of feeding was observed. The result is agreement with Rashid *et al*., (2015) who observed that the cost per kg gain of Brahman crossbred growing calves, it may be concluded that the diet consisting of 55:45 C:R may be used for economic beef production.

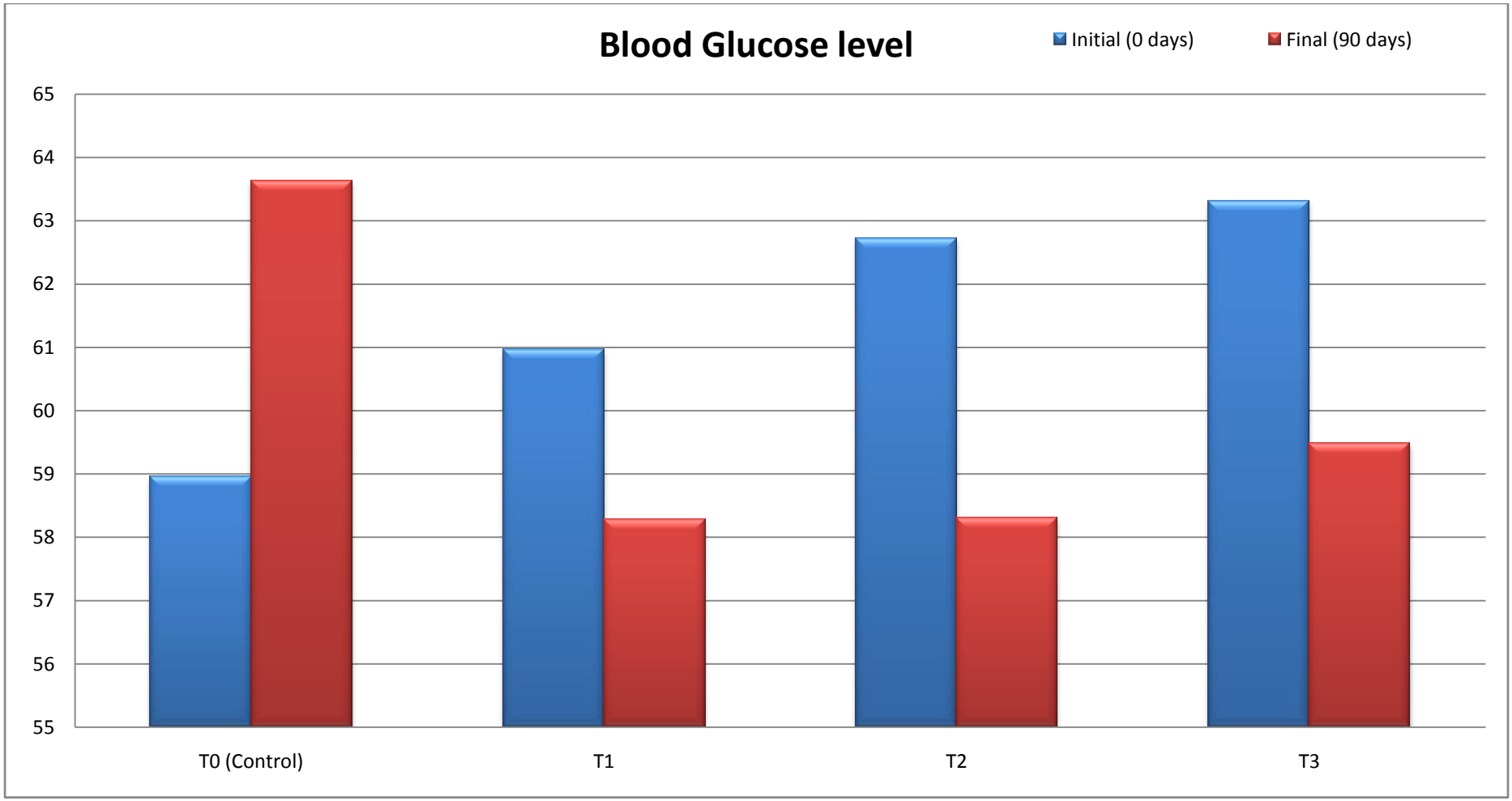

Fig.4.12: Effect of garlic (*Allium sativum*) supplementation on blood glucose level (mg/dl) of buffalo calves

Table 4.13: Cost of feeding garlic (*Allium sativum*), green roughages, dry roughages and concentrate (kg) to buffalo calves

Sr. No	Treatments	T_0 (control)		T_1		T_2		T_3	
	Particulars	Quantity (kg)	Cost (Rs)	Quantity (kg)	Cost (Rs)	Quantity (kg)	Cost (Rs)	Quantity (kg)	Cost (Rs)
1	Garlic (Rs. 70/kg)	-	-	15.65	1095.5	23.97	1677.9	31.08	2175.6
2	Concentrate (Rs. 20/kg)	248.98	4979.6	281.38	5627.6	292.18	5843.6	289.78	5195.6
3	Green roughages (Rs. 2/kg)	1012.05	2024.1	1152.4	2304.8	1217.2	2434.4	1055.25	2050.5
4	Dry roughages (Rs.3/kg)	340.65	1021.95	383.85	1151.55	416.25	1248.75	351.45	1054.35
5	Total feeding cost	-	8024.6	-	10179.45	-	11504.65	-	10475.45
6	Total live weight gain	-	44.65	-	48.55	-	50.45	-	46.00
7	Cost per kg live weight gain (Rs. /kg)	-	179.72	-	209.66	-	228.04	-	227.72

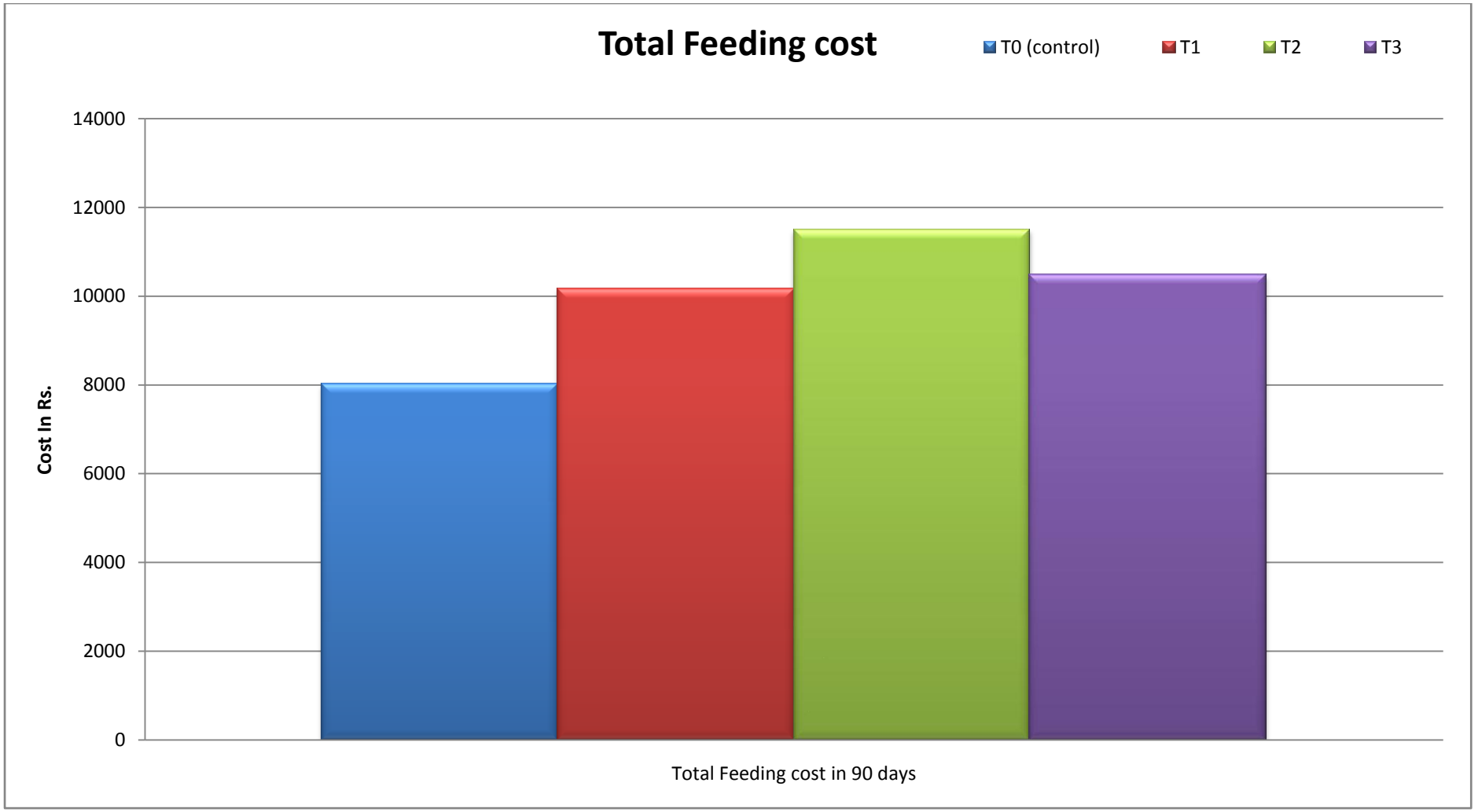

Fig. 4.13: Total feeding cost of garlic (*Allium sativum*), green roughages, dry roughages and concentrate (Rs) to buffalo calves

CHAPTER – V

SUMMARY AND CONCLUSIONS

CHAPTER - V

SUMMERY AND CONCLUSION

Livestock is the backbone of rural economy in India. Buffaloes occupy a important place in the social, economic and cultural life of Indian rural communities and are useful as a triple purpose animal for milk, meat and draft power. Buffalo calves are the future replacement stock of the herd. Calves are often neglected because they required financial investment and they do not result in any immediate returns. However, serious attention should be given to calf rearing because initial growth of an animal is the most important phase of its life and induces immense bearing on the early maturity and production. Growth is a complex phenomenon and difficult to define in simple phrase. Growth is taken as increase in body weight. Overally dairy farm profit can be maximized by reducing calf fatality, better management practices and supplementation of the good nutrients and feed additives. Good supplementation of nutrients and feed additives are of paramount importance for calf growth and health. It is proven that supplementation of rumen function, modulators, liver tonics and immunomodulators, at an early age helps in strengthening the immunity and to prohibit diseases.

Garlic (*Allium Sativum)* was one of immunomodulators which has a auspicious effect on the health of the animals. The garlic bulb contain a dull, aromatic, and water-soluble component called allicin. Garlic contains enzymes, vitamin B, flavonoids, and various minerals. Garlic is a high quality resource of antioxidants and protein. Garlic supplementation through the feed has lots of encouraging health benefits and scientific effects, which comprise improvement of immune function, revised overseas compound detoxification, restitution of bodily potency, and fighting to diverse stresses cancer- preventive measures of garlic.

The present investigation entitled “Effect of Garlic (*Allium sativum)* Supplementation on Growth Performance of Buffalo Calves at Organized Farm” the trial was conducted at Buffalo Unit, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The total experimental period was of 90 days excluding 15 days as a pre experimental period. Twelfth Buffalo claves of 5 to 6 months age were selected and distributed to four treatments groups T_0, T_1, T_2 and T_3 having 3 calves in each group. The T_0 group served as control and was not

supplementation with garlic powder in the concentrate feed. The calves in the T_1, T_2 and T_3 were supplementation with garlic powder at the rate of 200 mg, 300 mg and 400 mg per kg body weight in the concentrate feed, respectively. The calves were fed continuously for 90 days. The calves were maintained under uniform managements and housing condition and were fed with Hybrid Napier (green roughages), Jowar Kadbi (dry roughages) and concentrate mixture as the basal diet. Raw garlic was purchased from the local market and was dried andmade into fine garlic powder and this powder was supplemented to the treatment group (T_1, T_2 and T_3) calves.

The observations of body weight and measurements, dry matter intake, initial and final blood analysis and at the last estimate cost structure of feeding also calculated. The results obtained during the study are summarized here.

5.1 Growth performance

Observations of body weight, body length, height at wither, chest girth and belly girth on each calf was recorded and analyzed.

5.1.1 Body weight

Analysis of body weight showed increased in body weight. The final mean values of body weight at seventh fortnightly interval was 127.13, 130.80, 132.95 and 128.38 kg in treatment T_0 (control), T_1, T_2 and T_3, respectively. T_2 showed significant difference over treatment T_0 (control) and T_3. T_1 showed significant difference over treatment T_0. Treatment T_2 has highest value than other treatment.

5.1.2 Body weight gain

Analysis of body weight gain showed significant difference**.** the average total body weight gain of experimental calves was 44.65, 48.55, 50.45 and 46.00 kg in Treatment T_0, T_1, T_2 and T_3 respectively and average daily body weight gain of experimental calves was 0.496, 0.539, 0.560 and 0.511 gm in Treatment T_0, T_1, T_2 and T_3 respectively. Weight gain was high at 300 mg per kg body weight garlic powder followed by 200 mg, 400 mg per kg body weight garlic powder and control treatment which contain 0% of garlic (*Allium Sativum)* powder.

5.1.3 Body length

The final mean values of body length at seventh fortnightly interval was 103.75, 107.2, 110.00 and 105.25 cm in Treatment T_0 (control), T_1, T_2 and T_3 respectively. Body length was increasing during the experimental period in all treatments. T_2 shows significant difference over treatment T_0 and T_3. Treatment T_2 has highest value than other treatment.

5.1.4 Height at wither

Analysis of height at wither show that the treatment T_2 was significant over control treatment T_0. The final mean values of height at wither at seventh fortnightly interval was 104.25, 107.50, 110.25 and 106.00 cm in treatment T_0 (control), T_1, T_2 and T_3 respectively. Treatment T_2 has highest value followed by treatment T_1, T_3 and T_0.

5.1.5 Chest girth

It is identified that chest girth had higher gain in treatment T_2 was significant over control treatment T_0. The final mean values of chest girth at seventh fortnightly interval was 109.25, 113.75, 117.25 and 111.25 cm in treatment T_0 (control), T_1, T_2 and T_3 respectively. Treatment T_2 has highest value than other treatment.

5.1.6 Belly girth

The final mean values of belly girth at seventh fortnightly interval was 108.25, 110.25, 116.00 and 109.75 cm in treatment T_0 (control), T_1, T_2 and T_3 respectively. Belly girth was increasing during the experimental period in all treatments but it shows difference. Treatment T_2 has highest value followed by treatment T_1, T_3 and T_0.

5.2 Dry matter intake

5.2.1 Fortnightly interval dry matter intake

The DMI at sixth fortnightly interval was 3.04, 3.09, 3.16 and 3.02 kg in treatment T_0 (control), T_1, T_2 and T_3 respectively. Treatment T_2 has highest value than other treatment. T_2 shows significant difference with Treatment T_0 (control) and T_3 and also non significant difference among Treatment T_1 and T_2. DMI was increasing during the experimental period in all treatments.

5.2.2 Daily dry matter intake

The average daily dry matter intake of calves were 3.24, 3.29, 3.34 and 3.26 kg in treatment T_0 (control), T_1, T_2 and T_3 respectively. The daily dry matter intake under treatment T_2 was significantly higher than calves of the rest of treatments. T_2 shows significant difference with Treatment T_0 (control).

5.3 Blood parameter

Blood parameters of experimental claves were analyzed at the start of experiment (0 days) and at the end of experiment (90 days). Blood parameter viz, total protein, serum albumin, serum globulin and blood glucose level summarized as follows.

The mean value of total protein of calves was 6.31, 6.45, 6.84 and 6.25 g/dl for treatments T_0, T_1, T_2 and T_3, respectively. Treatment T_2 showed significant difference over treatment T_0 and T_3. Treatment T_1 shows significant difference over T_3. There is no significant difference in treatment T_0 and T_3, Treatment T_3 and T_1. It is observed that highest value for total protein found treatment T_2 and lowest in treatment T_3.

The mean value of total serum albumin of calves was 2.19, 2.20, 2.29 and 2.23 g/dl for treatments T_0, T_1, T_2 and T_3, respectively. The serum albumin was numerically higher under T_2 treatment than T_0, T_1 and T_3 treatment however, the differences observed were non-significant.

The mean value of total serum globulin of calves was 4.10, 4.21, 4.59 and 4.33 g/dl for treatments T_0, T_1, T_2 and T_3, respectively. Treatment T_2 showed significant difference with Treatment T_0 and T_1. Treatment T_3 shows significant difference with T_0. There was no significant difference in Treatment T_0 and T_1, Treatment T_1 and T_3. It is observed that highest value for total protein found treatment T_2 and lowest in treatment T_1.

The mean value of blood glucose level of calves was 63.64, 58.28, 58.31 and 59.48 mg/dl for treatments T_0, T_1, T_2 and T_3, respectively. The highest value was observed under treatment T_0 than the treatment T_3, T_2 followed by treatment T_1. The

differences observed were non significant among the treatments. This showed that there was no affect on blood glucose level of calves under the feeding control diet.

5.4 Estimate cost structure

The cost of feeding garlic (*Allium sativum*), green roughages, dry roughages and concentrate is summarized here.

It is observed that total feed cost was 8024.6, 10179.45, 11504.65 and 10475.45 Rs. In treatment T_0, T_1, T_2 and T_3, respectively. The cost per kg live weight gain 179.72, 209.66, 228.04 and 227.72 Rs. In treatment T_0, T_1, T_2 and T_3, respectively. It was seen from the results treatment T_2 has highest cost per kg live weight gain and treatment T_0 has lowest cost per kg live weight gain.

Conclusion

Based on the results of the present study the following conclusion are drown,

1. Treatment T_2 (300 mg per kg body weight) garlic (*Allium sativum*) powder supplementation of Buffalo calves which can improve higher growth performance than the others.
2. There was significant effect on body weight, body length, height at wither, chest girth and belly girth of Buffalo calves under different diets.
3. The Dry matter intake was significantly improved in Treatment T_2 (300 mg per kg body weight) garlic (*Allium sativum*) powder supplementation than the other treatments.
4. There is no adverse effect of garlic (*Allium sativum)* powder on serum albumin, blood glucose level of Buffalo calves. Improvement in total protein and serum globulin is identified for all treatments groups.
5. The cost of feeding per kg live weight gain was highest in T_2 as compared to T_0, T_1, and T_3.
6. The feeding cost per kg live weight gain in Buffalo calves fed with Treatment T_2 (300 mg per kg body weight) garlic (*Allium sativum*) powder and basal diet was the highest cost of feeding.

From the present investigation it could be concluded that treatment T_2 (300 mg per kg body weight) had significant effect on growth performance of growing Buffalo calves as it helps in raising them economically.

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CURRICULUM VITAE

CURRICULUM VITAE

Full Name of The candidate	:	Sony Namdevrao Lad
Date of Birth	:	25/06/1995
Nationality	:	Indian
Department	:	Animal Husbandry and Dairy Science
Permanent address	:	At Post Jamb Tal. Dist. Parbhani
Mobile No	:	9511228246
Email ID	:	sonylad1962@gmail.com
Title of the Thesis	:	Effect of Garlic (Allium sativum) Supplementation on The Growth Performance in Buffalo calves at Organized Farm

ACADEMIC QUALIFICATION

Course/ Degree	Name Of The College / Institute	University/ Board	Year of Passing	Percentage (%)/CGPA	Class/ Grade
SSC	Z.P.H. Jamb	Aurangabad	2012	67.64	First Class
HSC	Nutan College Parbhani	Aurangabad	2014	60.92	First Class
B.Sc. (Agri.)	College of Agriculture, Pathri	VNMKV, Parbhani	2018	7.56	First Class

Signature of The candidate

(Lad Sony Namdevrao)

Place: Parbhani

Date: 24 / 11 /2021