

**EFFECT OF BALANCING OF RATION ON PRODUCTION PERFORMANCE OF
LACTATING BUFFALOES UNDER FIELD CONDITION**

THESIS

Submitted

in partial fulfillment of the requirements for the Degree of

MASTER OF VETERINARY SCIENCE

IN

ANIMAL NUTRITION

Univer: Library
Maharashtra Animal & Fishery Sciences University, Nagpur
ACC.No 24150
Prfce
Date 07/04/2010

BY

PATIL RAJKUMAR ARJUN

Enrolment No: V/02/1912

Bombay Veterinary College, Mumbai

MAHARASHTRA ANIMAL AND FISHERY SCIENCES

UNIVERSITY, NAGPUR- 440 006.

(INDIA)

2009

DECLARATION OF STUDENT

I hereby declare that the experimental Research work and interpretation of the thesis entitled “**EFFECT OF BALANCING OF RATION ON PRODUCTION PERFORMANCE OF LACTATING BUFFALOES UNDER FIELD CONDITION**” or part thereof has not been submitted for any other degree or diploma of any University, nor the data have been derived from any thesis/publication of any University or scientific organization. The sources of materials used and all assistance received during the course of investigation have been duly acknowledged.

Date:

Signature



(Patil Rajkumar Arjun)

Enrolment No: V/02/1912



Dr. V. D. Kank
Chairman,
Advisory Committee

DECLARATION OF ADVISORY COMMITTEE

Shri. Patil Rajkumar Arjun has satisfactorily prosecuted his course of research for a period of not less than one semester (for M.V.Sc.) and that the thesis entitled, **“EFFECT OF BALANCING OF RATION ON PRODUCTION PERFORMANCE OF LACTATING BUFFALOES UNDER FIELD CONDITION”** submitted by him is the result of research work is sufficient to warrant its presentation to the examination in the subject of **Animal Nutrition** for the award of **Master of Veterinary Science** degree by the Maharashtra Animal and Fishery Sciences University, Nagpur.

We also certify that the thesis or part there of has not been previously submitted by him for a degree of any other University.

Place : Mumbai

Date : / /



Signature

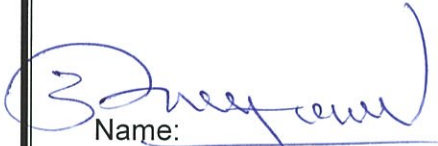
(Dr. V. D. Kank)
Advisor/Guide
Professor
Dept. of Animal Nutrition


Advisory Committee


Name	Designation	Signature
1. Dr. M. B. Patil	Head Dept. of Animal Nutrition	
2. Dr. M. I. Baig	Professor Dept. of Livestock Production & Management	
3. Dr. (Mrs.) S.U. Gulavane	Associate Professor Dept. of Animal Reproduction, Gynaecology & Obstetrics	
4. Dr. G. M. Gadegaonkar	Assistant Professor Dept. of Animal Nutrition	

CERTIFICATE

This is to certify that the thesis entitled, "EFFECT OF BALANCING OF RATION ON PRODUCTION PERFORMANCE OF LACTATING BUFFALOES UNDER FIELD CONDITION" submitted by **Shri. Patil Rajkumar Arjun** to the Maharashtra Animal and Fishery Sciences University in partial fulfillment of the requirement for the degree of **Master of Veterinary Science (M.V.Sc.)** has been approved by the Student's Advisory Committee after examination in collaboration with the External Examiner.


Name:
External Examiner


Dr. M. B. Patil
Head of Department


Dr. V. D. Kank
Advisor/Guide
Professor
Dept. of Animal Nutrition

Advisory Committee

Name	Designation	Signature
1. Dr. M. B. Patil	Head Dept. of Animal Nutrition	
2. Dr. M. I. Baig	Professor Dept. of Livestock Production & Management	
3. Dr. (Mrs.) S.U. Gulavane	Associate Professor Dept. of Animal Reproduction, Gynaecology & Obstetrics	
4. Dr. G. M. Gadegaonkar	Assistant Professor Dept. of Animal Nutrition	


Dean / Associate Dean
(Dr. A. Samad.)

Acknowledgements

ACKNOWLEDGEMENT

Language, though a very potent medium of expression, fails short many times, especially when feelings of gratitude and gratefulness are to be expressed. I am experiencing this fact while putting my feelings on paper.

It gives me a great pleasure, pride & privilege to quote heartily indebtedness with deep sense of gratitude and respect to my GUIDE and chairman, advisory committee Dr. V. D. Kank, Associate Professor, Department of Animal Nutrition, Bombay Veterinary College, who is a constant source of inspiration for his deep knowledge, erudite suggestions, invaluable guidance throughout the period of course as well as research work. I will forever remain proud of him for his continuous encouragement and appreciation.

I am very much obligate to Dr. M. B. Patil, H.O.D. & University Head, Department of Animal Nutrition, Bombay Veterinary College, for his unceasing interest, invaluable advice, guidance, executing & pursuance of the present research work. I will forever remain an admirer of his interest in work, his deep knowledge, his approach to the subject & his constant cooperation throughout my entire research work & P.G. studies.

I wish to thank Dr. M. I. Baig, Professor, Department of Livestock Production & Management and a member of my advisory committee for his critical suggestions & appropriate guidance during my research work.

I am thankful to Dr. (Mrs.) S. U. Gulavane, Associate Professor, Department of Animal Reproduction, Gynaecology & obstetrics, a member of my advisory committee for her valuable hints & guidance rendered to me.

I deeply acknowledge Dr. G. M. Gadegaonkar, Assistant Professor, Department of Animal Nutrition and a member of my advisory committee for his genuine & conservative guidance & for his constant help during my M. V. Sc. Degree programme.

I would like to express my sincere thanks to Dr. Karamble sir for his constructive suggestions & untiring co-operation through out my entire research work & postgraduate studies.

I would also like to express my sincere thanks to Dr. (Mrs.) Kakkar for their friendly help during my post graduation.

I am very much thankful Maharashtra feed for supplying the maize and wheat bran for my research work,

I express my heartfelt thanks to Mr. Riyaz sheikh, Mr. Imran sheikh, Mr. Ramesh Maruti Hadap, Mr. Rohidas saranga and Mr. Nandkumar kambre the farm owner in vangani village for their cooperation during my research work,

I extended my heartfelt thanks to Dr.Salunkhe Samadhan,Dr.Kesharkar,Dr.Avinash for on spot help during my postgraduate studies and research work. Thanks also reserved for the evergreen personalities of Animal Nutrition Department, Shri. Karambale, Sawant, Kasarand Jadhav bai for their assistance during the entire the postgraduate studies.

I express sincere thanks to my departmental seniors Drs. Nandkumar phalke, Sohan peche and Bahiram for helping me in completion of my research work. I am thankful to my departmental colleagues Drs. Sujay Mali, Anil Bhosale & Pooja Kala for their help during my P.G. studies & research work. I express thanks to my departmental juniors Drs. Kochare,.Chandan, Sneha and Rohini for helping me in completion of my research work,

I express my sincere thanks to my colleagues Drs. Sudam, Pratik, Ganesh, Balasaheb, Chandu, Vaibhav, suryakant, Sachin, prakash, pravin, sallu for their cooperation during my undergraduate & P.G. studies. I would also like to thank to my hearty friends Vishal surve for their constant encouragement at each stage of my life.

Close to my heart, my brothers Bhau, Sai and Machhu always stand by me providing rock-solid strength in all my ventures and sacrificed their moments of joy and enjoyment many times during these days. I shall be failing in my duties if I do not express here my gratitude towards my sister in law Jyoti, Chhaya and Manali vahini.

My Father Dada and My late mother Kamal Arjun Patil who are Adarniya and Vandaniya to me are the real force behind all the success and achievements in my life. Can a son thank his parents? No! Certainly not. I pray THEE for a healthy and long life to them so that they could proudly witness more and more achievements of their kids.

Last but not least, I must be thankful to all those whom I could not mention but who helped me, directly or indirectly during my study at this jubilant institute.

Date: 13th July, 2009

Place: Mumbai.


(Patil Rajkumar Arjun)

TABLE OF CONTENTS

<u>Chapter</u>	<u>Page</u>
1) INTRODUCTION	1 - 3
2) REVIEW OF LITERATURE	4 - 18
3) MATERIALS AND METHODS	19 - 25
4) RESULTS AND DISCUSSION	26 - 37
5) SUMMARY AND CONCLUSIONS	38 - 40
A) BIBLIOGRAPHY	i - v
B) APPENDIX :	vi - xiii
1) Details of experimental animals used in various groups.	
2) Fortnightly average total dry matter intake (kg) of buffaloes from different groups.	
3) Fortnightly average total milk yield (kg) of buffaloes from different groups.	
4) Fortnightly average milk protein (%) of buffaloes from different groups.	
5) Fortnightly average milk fat (%) of buffaloes from different groups.	
6) Fortnightly average milk total solid (%) of buffaloes from different groups.	
7) Fortnightly average milk SNF (%) of buffaloes from different groups.	
8) Fortnightly average milk specific gravity of buffaloes from different groups.	
C) VITA	xiv

LIST OF TABLES

Table No.	Title	Between Pages
1.	Average chemical composition (DMB %) of different concentrate mixture and paddy straw.	21
2.	The percent ingredient composition of area specific mineral mixture.	23
3.	Fortnightly average total dry matter intake (kg) of buffaloes from different groups.	26-27
4.	Fortnightly average total milk yield (kg) of buffaloes from different groups.	27-28
5.	Fortnightly average daily fat corrected milk yield (kg) of buffaloes from different groups.	28-29
6.	Fortnightly average daily TDN intake (kg) of buffaloes from different groups.	28-29
7.	Fortnightly average daily DCP intake (kg) of buffaloes from different groups.	29-30
8.	Fortnightly average total daily dry matter intake (kg) / kg FCM yield of buffaloes from different groups.	30-31
9.	Fortnightly average daily TDN intake (kg) / kg FCM yield of buffaloes from different groups.	30-31
10.	Fortnightly average daily DCP intake (kg) / kg FCM yield of buffaloes from different groups.	31-32
11.	Fortnightly average milk Protein (%) of buffaloes from different groups.	31-32
12.	Fortnightly average Milk fat (%) of milk of buffaloes from different groups.	32-33
13.	Fortnightly average milk Total solids (%) of buffaloes from different groups.	33-34

14.	Fortnightly average milk Solid not fat (%) of buffaloes from different groups.	33-34
15.	Fortnightly average of milk specific gravity of buffaloes from different groups.	33-34
16.	Average percent digestibility coefficients, TDN and DCP contents for various experimental feeds.	34-35
17.	Input-Output relationships.	35-36
18.	Overall performances of buffaloes from different groups.	37-38

LIST OF FIGURES

Fig. No.	Name	Between Pages
I.	Fortnightly average total dry matter intake (kg) of buffaloes from different groups.	26-27
II.	Fortnightly average total milk yield (kg) of buffaloes from different groups.	27-28
III.	Fortnightly average daily FCM yield (kg) of buffaloes from different groups.	28-29
IV.	Fortnightly average daily DM, TDN, DCP intake (kg) / kg FCM yield of buffaloes from different groups.	31-32

LIST OF ABBREVIATIONS

DM	Dry matter	ADF	Acid Detergent Fibre
OM	Organic matter	NDF	Neutral Detergent Fibre
CP	Crude protein	DMI	Dry matter intake
EE	Ether extract	TDN	Total digestible nutrients
CF	Crude fibre	DCP	Digestible crude protein
NFE	Nitrogen free extract	FCM	Fat corrected milk
TA	Total ash	TS	Total solids
Ca	Calcium	SNF	Solid not fat
P	Phosphorus	VFA	Volatile fatty acid
mg	Milligram	Kg	Kilo gram
g	Gram		

Introduction

INTRODUCTION

India is an agriculture based country. Agriculture is the main occupation of the people and about 70% of the population is engaged in this activity. Livestock sector forms an integral part of agriculture. This sector is undergoing rapid changes in response to pressure from globalization and rapidly growing demand for agriculture food products in developing countries. The livestock population in the country has increased from 292.8 million in 1951 to 482.78 million in 2003 at an annual growth rate of 1.1% (Jakhmola, 2006). Both, the national economy as well as the socio-economic growth of the country is backed by the livestock sector. India is the largest producer of milk with a share of 17 per cent of total production of milk worldwide and more than 57 per cent of total Asian production. India has largest bovine population in the world, with 185 million cattle and 98 million buffaloes (Dairy Industry Conference, 2009). Milk production has been growing at average rate of 5 per cent per annum. In spite of all these achievements, the average productivity of animals in our country is very poor i. e. 1035 litres as against world average of 2070 litres per lactation (Agarwal, 2005).

The performance of the Indian dairy sector during the past three decades has been truly impressive. Milk production grew at an average annual rate of 4.6 percent during the 1970s, 5.7 percent during the 1980s, and 4.2 percent during the 1990s. Until 1991, the Indian dairy industry was highly regulated and protected. Despite it is being the largest milk producer in the world, India's per capita availability of milk is one of the lowest in the world, although it is high by developing country standards. The per capita availability of milk, which declined during the 1950s and 1960s (from 124 g per day in 1950-51 to 121 g in 1973-74), it increased substantially during the 1980s and 1990s and reached about 226 g per day in 2001-02. The per capita consumption of milk and milk products in India is among the highest in Asia. It is still below the world average of 285 g per day, and also the minimum nutritional requirement of 280 g per day as recommended by the Indian Council of Medical Research (Sharma *et al.* 2003).

Buffaloes in India are principally reared for milk purpose. India produces 104 million MT of milk annually. Even though India possesses largest buffalo population (98 million), there is wide gap between the availability and demand of milk in our country. The low productivity of buffalo is primarily due to inadequate supply of nutrients or unscientific approach for feeding. In order that cows and buffaloes with high milk yielding potential should produce milk to their inherited capacity, it is necessary to provide adequate, balanced and also economical nutrition. Over feeding, under feeding and imbalanced diets lead to nutritional and reproductive disorders. For this purpose assessment of feeding practices and nutritional status of animals is necessary.

The first unique characteristic of Indian dairy industry is that it is in the hands of small milk producers. The farmers are concerned about the return to make investment in dairying worthwhile. The production cost of milk is very important. Feed is the major component of the cost of milk production and account for 70-75% of the recurring expenses. This is because of increasing cost of livestock feed leading to the increased cost of milk production. The returns will be more if cost of feeding is cheaper and present production level is increased.

As per conventional feeding system farmers are feeding their animals with roughages and concentrates. The amount and type of the concentrate mixture fed to the animals by the farmers mainly depends upon the conventional thinking of the farmers and is not generally very scientific i.e. the mixtures formulated by farmers are not with the view of meeting the nutrient requirements of the animals and are many times uneconomical. Concentrate mixture, if formulated scientifically with locally available feedstuff, can prove beneficial in terms of animal performance as well as economics. For roughages there is no much choice for most of the farmers, however, quantitatively if corrections are made, the over all ration can become better balanced.

Cereals are the major and important component of human diet. However, among the cereals, maize is the only grains which do not form the main item of human food. Its production is also increasing rapidly in recent years. As a result,

maize is available throughout the year with an affordable cost for feeding to animals. Other important point regarding maize grains is, it is highest energy giving cereal. Apart from rich source of energy it also contains alpha polymerise amino acids. Its palatability is good and it is also free from antinutritional factor. Obviously one can use maize grains in rations of dairy animals to increase the energy level.

It has long been established that quality and yield can be improved largely by using nutritionally balanced feeds. Such ration increases fat content of milk (Wojtasik *et al.*, 1995), bring about the improvement in overall performance of animal. The pricing policy in India is primarily based on fat content of milk. The milk having lower fat content than the prescribed standards fetches lower price and under such circumstances farmers have to bear heavy economic losses. With this point in view the present study was planned to study the effect of balancing of ration on production performance of lactating buffalo under field conditions.

Thus, the main objectives of the present study were as follows;

1. To study the effect of Balancing of ration on milk yield and composition of milk.
2. To study the effect of Balancing of ration on feed intake and efficiency of feed utilization in the buffaloes.
3. To study the economics of milk production, with balancing of ration under field conditions.

Review of Literature

2. REVIEW OF LITERATURE

Energy content of ration has got prime importance in maintenance, production as well as reproduction in farm animal. To quantify the lactation response of buffaloes, among the other factors which affect milk production, much attention has been focused on the dairy ration. Looking at the conventional concentrate feeding to dairy animals, in most of the places, it is observed that high fiber cotton seed cake and variable quantity dal chunies (pulses milling by product) are the major ingredients. This leads to lower supply of available energy, particularly when roughages component is very poor in nutritive value. Suboptimal amount of energy in the ration adversely affects milk yield and composition. Heavy losses in milk production can be averted by feeding enhanced available energy ration. With this view, effect of feeding balanced ration, mainly through use of high available energy feed ingredient was studied in lactating animal.

Therefore, references pertaining mainly to the effect of energy content of ration on milk yield and its composition, nutrient digestibility and feed efficiency were referred and presented.

Huber *et al.* (1963) studied effect of corn supplemented feeding of cows on pasture on milk composition and yield. In trial A, they reported significant effect of ration on SNF, Protein, fat and milk yields. In this the values for cows on corn supplemented and silage supplemented rations were 8.65, 3.22, 3.05 and 39.9lb and 8.44, 3.11, 3.65 and 35.8 lb, respectively. In trial B, persistency of milk production was over 8 % for all groups. They reported that cows on grain and silage supplementation had highest milk yields. SNF decreased as level of corn decreased. Milk protein accounted for most of the change in SNF. Milk fat was lower on high corn rations. Corn silage alleviated milk fat depression noted on high corn rations.

Owen *et al.* (1967) studied the effect of normal and high grain rations on utilization of nutrients for lactation. They observed that increasing the grain from 40-60% in haylage ration increased dry matter intake, but decreased feed

efficiency. However, raising the grain level to 60% with the wilted silage increased milk fat percentage, FCM yield and lowered the consumption, resulting in improved efficiency.

Patel (1968) compared the effect of four different concentrates with same roughage source on the milk yield and fat percentage in surati buffaloes. The group I:- cotton seeds; group II:- cotton seed cake; Group III:- mixture of cotton seed 25 parts, GNC 30 parts, Maize bran 25 parts, Rice polish 20 parts. Group IV: - cotton seed cake 25, GNC 25, Maize bran 30, rice polish 20 parts. In the first lactation, the milk yield of the animals in group II and IV was higher than other groups whereas reverse trend was observed in the second lactation. The cost of feeding cotton seed cake in group II was comparatively cheaper than cotton seed feeding. It was therefore concluded that feeding balanced concentrate mixture with oil seed residues is more economical for milk production, than oil seeds.

Jakson and Gupta (1971) studied the effect of concentrate supplementation in comparison to berseem forage for milk production and composition in buffaloes. The ration consists of 1.5 kg chopped sorghum straw and green berseem *ad lib.* and 0.1, 0.4, 0.7 and 1.0 kg of concentrate per kg of milk produced. The total dry matter consumption per day per animal for the four levels of concentrate was 13.1, 15.5, 16.7, 16.6 kg and milk yield was 7.2, 7.9, 7.8 and 7.9 kg per day per buffaloes, respectively. The calculated 7% FCM yield was 7.5, 7.8, 8.4 and 8.3kg per day in the respective concentrate supplementation. The corresponding daily TDN intake was 8.8, 10.4, 11.3 and 11.2 kg and TDN intake per kg of milk produced was 0.71, 0.89, 0.93 and 0.93 kg per kg of FCM. Increasing concentrate supplementation from 0.1 to 0.7 kg increased FCM yield by 12 percent and there was no effect of ration on fat or SNF of milk. Hence, it was concluded that concentrate supplement of 0.7 kg per kg of milk produced was beneficial.

Singh *et al.* (1976) studied the effect of various planes of nutrition on milk production in crossbred cows. They used 3 groups of HF crosses and fed 3 rations containing oat silage and concentrate mixture as per NRC recommendation (A), 10% below (B) and 10% above (C) of the recommended allowance. The trial lasted for 12 weeks. They reported that averages FCM yield

in respect of groups A, B and C was 10.1, 10.1 and 10.4 kg daily, respectively. The average gains in weight per day were 362, 124 and 392 g, respectively. The significant lower growth rates ($P < 0.01$) in group B coupled with a comparable milk yield showed that these animals utilized the nutrients for milk production at the cost of growth production. It was concluded that TDN levels recommended by NRC (1988) for maintenance, growth and milk production are adequate for growing crossbred (1/2 HF and 1/2 Haryana) milch cows.

Garcia and Gonzalez (1985) observed the effect of concentrate levels on milk production by dairy cows during the 1st half of lactation. The cows were given concentrate twice daily at 8.0, 4.0 or 1.0 kg/500kg BW for initial 5 months of lactation. The daily average milk yields were 20.4, 16.5 and 18.7 kg in 1st month and decreased to 17.8, 15.8 and 15.4 kg by month 5 of lactation for the three levels of concentrate feeding, respectively. Further, it was seen that milk yield was directly correlated with the amount of concentrate in the diet ($r = 0.54-0.61$). They concluded that the effect of concentrate and energy consumption appeared to be most critical in the months 1-3 of lactation.

Poole (1986) studied the effect of low and high energy complete diet on feed intake, milk production and body weight change of milking cows. In each of 2 years, 20 Friesian cows were given a low energy or a high energy complete diet to appetite during weeks 3 to 20 of lactation. The diets for trial 1 contained concentrate, lucerne silage and chopped grass hay in the proportion 33:47:20 or 58:29:13. In trial 2 concentrate and lucerne silage were mixed in proportion 38:62 or 75:25. These mixtures had energy concentration of 10.2 or 11.2 and 10.3 or 11.9 MJ metabolizable energy/kg DM and crude protein concentration of 144 or 160 and 140 or 157 g/kg DM in the low- and high energy diets of trial 1 and 2, respectively. Cows offered the low energy diets took less DM daily (14.5 vs. 17.4, $P < 0.001$ and 15.2 vs. 18.2, $P < 0.001$, kg DM daily in trials 1 and 2, respectively). Daily milk yield were lower with low energy diets (19.2 vs. 22.43, $P < 0.001$ and 18.7 vs. 24.2, $P < 0.001$, kg daily in trials 1 and 2) and there were significant differences between treatment in milk composition and live weight changes. The correlation between feed intake and milk yield during weeks 3 to 20 was moderately strong ($r^2 = 0.58$).

Reddy and Reddy (1986) studied the effect of feeding of complete feeds on nutrient utilization and milk production in crossbred cows. In a latin square design 3 crossbred cows were given napier grass to appetite with concentrate at 1kg/ 2.5kg milk (control), or complete diets with dried grass 47.5%, maize, groundnuts oil meal and molasses each at 10%, wheat bran 20% and mineral and vitamins fed as a mash or pelleted. For the 3 diets respectively, the daily DM intake averaged 11.6, 14.8 and 16.0 kg and milk yield 8.1, 8.7 and 8.8 kg, both being higher with the complete diets ($P < 0.05$). Milk composition, feed efficiency and feed cost/kg fat corrected milk did not differ significantly among with treatments, but feed intake per kg milk tended to lowest with the control diet and feed cost per kg milk lowest with the complete mash diet.

Simonov *et al.* (1986) studied of ration structure in three groups (8 each) of dairy cows with matched previous lactation milk yield (av. 4400-4600 kg). The groups were given daily (i) 14.4 kg mixed grass haylage, 29.7 kg maize silage, 6.7 kg concentrate 1.4 kg molasses and 50 g vitamin/ mineral premix; (ii) 7.3 kg grass/ legume hay, 9.9 kg haylage, 25 kg silage, 13.3 kg fodder beet, 4.3 kg concentrates, and premix and (iii) 6.6kg hay, 9.1 kg haylage, 22.8kg silage, 12 kg beet, and 4 kg concentrates (control). The rations (i) and (ii) were formulated to balance 20 nutritional characteristics (including sugars, cellulose, fat, minerals and vitamins); the control ration was only formulated with respect to feed units, digestible protein, NaCl, Ca, P and carotene. They observed that the cows on 3 rations, the milk yield averaged 5012, 5124 and 4776 kg with fat 3.87, 3.94 and 3.74 %, respectively. Nutrient digestibilities were highest for ration (ii) and lowest for control ration.

Depeters *et al.* (1987) studied complete mixed, cubed diets containing corn or barley as the cereal component, in eight cows. Diets were fed for *ad libitum* intake in two periods of 21 days each. Percentages of milk fat, protein, lactose and total solids were not affected by corn or barley in the diets. Apparent digestibility of dry matters and energy was not different but fiber digestibility was significantly lower for barley diet. Intake of dry matter and digestible energy and yield of milk were not different, for both the diets.

Molokoedova (1987) studied the efficiency of milk production in cows at various stages of lactation on diet containing different amount of energy. Increasing the amount of readily utilized energy by increasing the amount of grain feeds during the first third of lactation to 45% of dietary nutrients ensured a rise of 22% in milk production throughout lactation. They recommended that for traditional feeding of lactating cows in west Siberia, the ration should have proportion of energy from roughage to energy from concentrates, respectively during the 1st, 2nd and 3rd periods of lactation, be 55:45, 75:25 and 94:6. Such a scheme of feeding has resulted in a yield of 4% fat corrected milk of 4785kg/lactation.

Nadalyak *et al.* (1987) studied the improved standards for high yielding cows fed on diet of concentrate 35, green herbage 38, tubers 10, silage and roughages 17%. The feeding was based principally on the energy requirement and ensured an optimum ratio of energy to the other nutrients. They reported that cow which produces daily 30kg milk requires daily 194, 198, 207, 211, 215, 219 and 221 MJ ME during months 1, 2, 3,4,5,6 and 7 of lactation.

Bertrand *et al.* (1988) conducted an experiment on forage intake and milk production response to feeding three levels of concentrates to Holstein cows. The cows were given concentrate at the rate of 0.44, 0.40 or 0.36 kg/l milk. At corresponding concentrate intake, daily milk yield was 30.22, 28.44 and 26.87 kg; milk fat % was 3.12, 3.15 and 3.37 and 4% FCM yield was 26.11, 24.92 and 24.18 kg, milk protein was 3.17, 3.10 and 3.09%, respectively. They also noticed that only the cows given concentrate at 0.44 kg/L milk could obtain their digestible energy requirement.

Grummer *et al.* (1988) studied factor associated with variation in milk fat depression resulting from high grain diets fed to dairy cows. The cows were given diet with concentrate, Lucerne silage and maize silage DM in the ratio of 45:31:24 (control) or 76:14:10 (high concentrate), respectively. Daily DM intake (average 19 kg) and milk yield (average 29.5kg) did not differ significantly between diets, but milk protein was increased from 3.17 to 3.30% and milk fat decreased from 3.39 to 2.87% by the high concentrate diet ($P < 0.01$).

Nalsen *et al.* (1988) the effect of substituting wheat for corn on a weight rather than a protein basis was determined using 18 Holstein cows in their second lactation. Treatment consisted of concentrate mixture as follows: a) control (75% corn adjusted to 12.1% protein) b) wheat (75% wheat, 15.1% protein) c) wheat (75% wheat, 12.1% protein). All three rations were isocaloric. Alfalfa hay was the only forage, fed in a 50:50 ration. Intake of dry matter was lower for cows fed the wheat rations. Milk yield by cows fed the wheat rations was decreased, with the yield of cows fed the ration where wheat was substituted for corn on a weight basis being intermediate to those of cows fed the other rations (74.1 vs. 76.0 & 72.6 lb/ day). Milk fat test & milk protein were similar for all treatments.

Spain *et al.* (1990) studied effect of different sources of protein and energy on milk composition in mid lactation dairy cows. The percentage of milk fat, protein and protein yield decreased with inclusion of fish meal in the diet. In another experiment they observed that milk fat and lactose % and FCM yield (kg) were higher on diet containing maize gluten meal (3.13, 5.30, 23.0, respectively) than on fish meal (2.11, 3.0, 20.5, respectively). It was concluded that protein source may affect milk composition in cows given maize silage diets.

Gruzdev *et al.* (1991) studied the diets containing varying level of energy. Three groups of cows were given a basal diet without or with concentrate 0.5 or 1.0 kg/ day during the 1st 2/3 of lactation or 0.35 or 0.7kg/day during the last 1/3 of lactation. For corresponding groups, average daily yield of 4% FCM during 281 days of lactation was 23.7, 24.6 and 24.5 kg. they reported that the cows took 0.73, 0.78 and 0.80 feed units; 7.8, 7.9 and 8.1 MJ metabolizable energy, 76.2, 80.4 and 85.9 g digestible protein and 435, 446 and 459g concentrate to produce 1 kg 4% FCM respectively.

Malossini *et al.* (1991) studied the effect of diets differing in energy level and forage concentrate ratio to measure the effect on milk production and composition. Group-N received meadow hay 15 Kg, protein supplement 0.85 Kg and Group-A was given crushed maize grain partially replacing hay thus containing 14% more net energy (NE). Group-A recorded significant increase in

milk yield (27.3 Vs 24.7 Kg/d), milk protein (3.14Vs 2.98%) and lactose (5.08Vs 3.96%). However, the milk fat content was reduced (3.30 Vs 3.46% N.S).

Spiekers *et al.* (1991) studied the effect of different concentrate levels on milk yield and feed intake, in dairy cows. Average daily intakes of concentrate for the groups were 2.9, 4.7, 6.4 and 8.1 kg. For these levels of concentrates the corresponding daily yields were 18.4, 20.6, 21.2 and 21.5, kg respectively. No influence of the amount of concentrate on milk fat content was found. Milk protein content increased from 3.20 % to 3.42 % with increasing level of concentrate. With higher level of concentrate, lower intake of forage was recorded.

Khalili *et al.* (1992) studied the effect of forage type and level of concentrate supplementation on food intake, diet digestibility and milk production in crossbred cows. A cross bred cows in early lactation were given diet of native grass hay (H) or oat- vetch hay (OV) *ad libitum* supplemented with wheat middling based concentrate 0, 2.5 or 5.0 kg/day. A period partially balanced, change-over design was used and the treatments were arranged as a 2x 3 factorial. They observed that daily milk yield was 1.24 kg higher ($P<0.01$) for cows on oat vetch hay (OV) diet compared with grass hay (H) diets. Milk fat concentration was higher ($P<0.05$), but milk protein concentration was lower ($P<0.01$) with H diets. The daily DM intake increased by 3.72 kg/day ($P<0.01$) when the amount of concentrate increased from 0 to 0.5 kg per day indicating a minor substitution of basal forage by concentrate. The apparent DM digestibilities of the diets were higher when the diets supplemented with concentrate. Milk yield increased linearly from 0 to 5 kg resulting in 0.52 kg more milk per day per kg additional concentrate given.

Davies (1993) studied the effect of protein and energy content of compound supplements offered at low levels to October calving dairy cows given grass silage *ad-libitum*. He found that over an average of 152 days, milk yields were significantly increased by 0.49 kg/day per 100g supplementary ME ($P<0.05$). An increase in supplementary ME significantly reduced protein yield. Yield of fat was significantly increased (75 g/day).

Degano (1993) carried out trial on 2 groups of cows to demonstrate the effect on milk yield and milk quality, of 50% flaked maize and barley flaked + 50% meal (group T) compared with 100% meal of the same cereals (group C). The experiment period was 24 week and the observations were recorded at fortnightly, interval. The results showed increase in mean milk yield of group T compared with Group C (23.4 vs. 22.98 kg), milk protein content for respective groups was 3.32 and 3.20%. Coagulation parameters especially, coagulum firmness 30 min after the start of the process and milk fat creaming was 75.58 and 73.61 %, respectively. No significant differences were observed regarding milk fat content.

Hauway *et al.* (1993) studied the effect of energy supply on performance of dairy cows fed with hay based ration. In week 1 of lactation, concentrates were increased by 0.25 kg/day. Cows on treatment H were given 2 kg more concentrate than cows on treatment L. The ingredient composition of the concentrate was adjusted to provide the same nitrogen supply for all cows. In week 1 to 16 of lactation, the milk yield was 17.2 and 16.7 kg/day for groups H and L, respectively. Milk protein content was higher in treatment H; however, loss of body condition was higher in L.

Malossini *et al.* (1993) studied the effect of a moderate increase in energy intake on milk composition. They found that breed had no effect on milk production and composition. When dietary energy density was increased, concentration of protein and lactose in milk increased after the first recording and fat and fat correct milk increased after second recording (recorded fortnightly). It was seen that the protein content increased by 0.12 point and lactose by 0.99 point in second group, which received high energy density diet.

Ruhle *et al.* (1993) studied the performance of dairy cows fed concentrate differing in their contents of easily fermentable carbohydrates with roughages fed either *ad libitum* or at a restricted rate. They observed that during the first 200 days of lactation, average daily intake of concentrate exceeded 9 kg DM per cows in each experimental group. Milk yield and milk fat content were not affected by the diet. They also noticed that cows fed the starchy concentrate produced significantly more milk protein than cows fed fibrous concentrate.



Feeding roughages *ad libitum* increased live weight of the cows with no significant effect on production of milk, milk fat or protein.

Schuler (1994) studied the effect of mixed feed with a high proportion of maize on milk yield and composition of dairy cows. A compound feed for high yielding cows containing 20% starch plus sugar was compared with a special diet with 30% maize meal and 40% total starch. The results indicated a significant increase in milk protein (0.08%). Total intake of DM, CP, crude fibre, sugar, starch and energy were different, but milk yield and milk fat were not affected.

Uremovic *et al.* (1994) studied the effect of dietary energy content on performance of high yielding cows. The daily net energy intake of two groups of 22 pregnant cows during the last 50 days of their dry period was 50.23 and 62.91 MJ/head. During the first 90 days after calving, cows net energy intake was 119.78 and 137.07 MJ/head. The average daily milk yield was 33.9 and 40.5 kg, respectively and average milk fat content was 3.55 and 3.37%, indicating beneficial effect high intake of net energy.

Wojatasik *et al.* (1995) studied the effect of different level of protein and energy in dairy cows. Group I received energy and protein as per Polish standard (std.) level, Group II energy at std level but protein 25% below std, Group III had normal protein but energy was 25% less than std and Group IV received protein and energy at 25% below std. The average daily yield of 4% fat corrected milk was 18.6, 17.7, 18.5, and 18.5 Kg, respectively for groups I to IV. For corresponding groups milk contained 3.28, 3.06, 3.19 and 3.08% protein and 3.89, 3.96, 4.0 and 3.95% fat, respectively. Body weight at start of feeding was 602, 591, 585 and 582 kg and after 4 months it was 618, 607, 604 and 589 Kg respectively. They concluded that the cows used the excess nutrient for body weight gain instead of an increased milk production.

Prasad and Tomar (1997) studied the effect of postpartum plane of feeding on milk yield and composition of crossbreed dairy cows. 24 cows subjected to 3 energy level 100 (M), 130(H), or 80 % (L) of NRC (1998) standard during prepartum period. During 126 days post partum animals in H and L group were put to H and L feeding (4 animal /treatment) with group M remaining

unchanged thus having 5 treatment combination viz. MM, HL, HH, LH and LL. Milk yield as well as FCM yield was highest in group HH followed by MM, LH, HL and LL. The decline in yield over the fortnights was more evident in group HL, HH and LL and was least in group LH. Treatment group HL and LL, produced milk with higher ($P < 0.05$) fat content compared to group LH and HH. The content of milk SNF revealed on significant treatment effect. The yield of fat and SNF, tended to follow the pattern as observed in case of milk yield.

Paul *et al.* (2002) studied the feeding standards for lactating riverine buffaloes in tropical conditions. Data from 33 feeding trials, conducted on lactating riverine buffaloes from different institutes across India, were subjected to multiple regression analysis to derive nutritional requirements for dry matter (DM), total digestible nutrients (TDN), crude protein (CP) and digestible crude protein (DCP) for maintenance, milk production and body weight gain. Maintenance requirements for DM, TDN, CP and DCP were 59.9, 35.3, 5.43 and 3.14 g/kgW^{0.75}, respectively; corresponding requirements for producing 1 kg 6% FCM were 688, 406, 90.3 and 55.2 g and for 1 g gain in body weight were 3.37, 1.97, 0.327 and 0.23 g. Regression equations had high R^2 values (0.61, 0.66, 0.84 and 0.68 for prediction of DM, TDN, CP and DCP, respectively) and the equations (F -value) as well as coefficients were highly significant ($P < 0.001$). Regressed values were used to derive feeding standards. Derived values matched well with the actual intake versus performance of animals under diverse feeding conditions. New standards predicted requirements and intake of nutrients for different production levels better than existing feeding standards. Because they are based on a more thorough analysis of data, the new feeding standards will be appropriate for use widely in India.

Chavan *et al.* (2005) studied the effect of different levels of energy on milk composition in cross bred lactating cow. Twelve crossbred (HF x Gir) lactating cows, divided in to the two groups of six each, with same stage of lactation and average daily milk production were used. Group-I (control) received basal ration comprising green and dry fodder and concentrate mixture (60% TDN). Group - II (Experimental) received concentrate mixture containing 5% higher energy (TDN) than control. Both the groups received same roughages comprising of green (maize) and mixed hay. Average daily DM intake in groups I and II was 12.09 and

12.15 kg, respectively and the variation between the groups was non-significant. Supplementation of extra 5% energy in the form of TDN for period of 13 weeks in group II resulted in significantly higher milk fat percentage than control. The average specific gravity and total ash percentage of milk revealed non-significant difference among the treatments. However, total solid, solid not fat and protein percentage of the milk were significantly lower in treatment group than control group. It was concluded that for improving performance in respect of milk fat, in early lactating crossbred cows, the energy content of routinely used concentrate mixture (containing 60 % TDN) can be increased by 5%.

Bartocci *et al.* (2006) studied the utilization of a high level energy/protein diet for lactating Mediterranean buffaloes. Intake capacity and effects on quantitative milk parameters. The trial was carried out using 14 multiparous buffaloes divided into two groups according to yield in the previous lactation (2653 vs. 2625 kg), number of lactations (4.8 vs. 4.1), live weight (670.6 vs. 657.1 kg), days post-calving (21.6 vs. 23.6 days) and average yield at the on-set of the trial (11.18 vs. 10.90 kg/day). The effects of both feed intake and the quantitative parameters of the milk yield were evaluated following the *ad libitum* administration of two diets containing two different forage/concentrate ratios, diet 1 = 48: 52 (0.94 Milk FU/kg DM, 158.3 g/kg DM of crude protein); diet 2 = 55: 45 (0.85 Milk FU/kg DM, 144.4 g/kg DM of crude protein). The trial lasted for 114 days, on average from day 23 to 137 of lactation. The dry matter intake for diet 1 was 16.37 kg/day, for diet 2 it was 16.53 kg/day. No significant differences were found with live weight of the animals; however, the buffaloes in group 1 showed gains of 35.0 kg compared to 54.2 kg of those in group 2. A significant difference ($P < 0.05$) in milk yield favouring group 1 (11.66 vs. 9.42 kg/day) was observed while fat (73.20 vs. 80.08 g/kg) and protein content (43.24 vs. 46.41 g/kg) was higher for group 2. Coagulation data indicated that the milk yield of group 2 showed better coagulation properties ($r = 18.35$ min, $K_{20} = 3.88$ min, $A_{30} = 47.00$ mm), than group 1.

Nielsen *et al.* (2006) studied the effect of changes in diet energy density on feed intake, milk yield in dairy cows in early lactation. The purpose of this experiment was to investigate how early lactating cows adjusts their metabolism and production to acute, but moderate changes in the energy density of the diet.

Sixty dairy cows were randomly assigned to one of four treatments: two change-over groups (HNH and NHN) and two control groups (HHH and NNN), where H and N refer to a high and normal energy density in the total mixed ration (TMR), respectively. The experimental period covered was the first 9 weeks post calving, which was split up in three 3-week periods. When the diet changed from N to H and H to N, cows increased and decreased their dry-matter intake (DMI), respectively compared with control groups. Cows adjusted milk yield accordingly to changes in DMI, although not always significantly. Energy-corrected milk yield was not significantly affected by any of the changes in the energy density of the diet but generally showed same tendencies as milk yield. Collectively, these results suggest that cows adjust their DMI and partly milk yield according to the energy density of the diet and therefore only limited effects were observed in physiological parameters.

Sharma *et al.* (2006) studied nutritional and socio-economic implications of feeding cereal straws supplemented with higher dietary level of de-oiled cakes to lactating buffaloes (*Bubalus bubalis*): an on-farm study Lactating buffaloes (35) were randomly selected to receive enhanced level of oil cakes (ES) in the concentrate (Parts/100: soybean meal/mustard cake 20/30, wheat bran 80/70). Fifteen buffaloes were given a concentrate mixture usually formulated by the farmer (Parts/100: mustard cake 8: wheat bran 92) and designated as control. The basal diet of cereal (wheat/paddy) straws was offered *ad libitum* while the amount of supplements was adjusted in consultation with the farmers during 10 months of feeding trial. Total dry matter intake was similar in lactating buffaloes given control or ES supplement. The digestibility coefficient of various nutrients did not differ significantly ($P < 0.05$) between both the treatments. However, the nutrient concentration of composite diet in terms of digestible crude protein (DCP) and total digestible nutrients (TDN) was significantly ($P < 0.05$) higher in ES group as a consequence of higher level of protein. The intake ($\text{g/kg BW}^{0.75}$) of digestible organic matter, TDN and DCP was also significantly ($P < 0.05$) higher in the buffaloes given ES supplement. The average milk production (kg/d) was comparable irrespective of dietary supplement up to first 60 days of lactation. A significant improvement in daily milk production was evident from 61 days onwards in buffaloes given ES supplement. Each buffalo in control and ES produced 1114 ± 29.7 and 1488 ± 30.1 litres milk, respectively during 300 d of

lactation. However, the milk composition did not differ significantly in buffaloes fed either control or ES supplement. The percent marginal rates of return calculated over additional feed cost at different stages of lactation in buffaloes fed ES were 180, 591, 224, 232 and 156 during 0-60, 61-120, 181-240 and 240-300 days of lactation, respectively. In the opinion of the participating farmers, though enhancement of cake in the concentrate brings overall improvement in the milk yield, body condition of animals and level of cash benefits, requirement of assured cash out lays may be a possible constraint in adoption of this strategy.

Bhat *et al.* (2007) studied the effect of different concentrate levels on milk yield and feed intake, in dairy cows. An experiment was conducted on 18 healthy pregnant high yielding buffaloes (2000–2500 L potential) maintained at PAU dairy farm, Ludhiana. The animals were randomly divided into 3 groups (6 each) on basis of their body weight, previous lactation yield and parity; and provided normal pregnancy allowances of 2 kg (T_c) and challenge-fed ($T_1 = 3$ kg & $T_2 = 4$ kg), in addition to maintenance ration during 3 weeks pre-partum period. Post-partum feeding levels were kept uniform. The buffaloes were hand-milked scientifically in milking parlor. Milk samples were analyzed for milk fat, solid-not-fat (SNF), lactose and total solids. Buffaloes in T_1 & T_2 groups produced 3–5% more milk during 150 days lactation than control and showed higher peak yield (13.91 & 14.06 v/s 13.58), persistency (1.42 & 1.49 v/s 1.39) and extra net profit of Rs. 3.20 and 3.79 d^{-1} buffalo⁻¹, respectively. Similarly, differences in yields of different milk components were non-significant. The challenge-fed buffaloes excelled in nutrients body gains. The feeding schedule of T_2 group comparatively fared well amongst the 2 challenge-fed groups and thereby stands recommended.

Upadhyay and Sharma (2007) studied the effect of balanced feed on the performance of milch cows—comparative study. Generally dairy farmer are not aware of balanced feeding to their milch animals. Hence, the present study was conducted to know the effect of balance feed on the performance of milch animal in comparison to conventional feeding used by farmers. In this study, six dairy farmers were selected. Balanced feed comprised of maize 40, cotton seed cake 15, mustard cake 15, wheat bran 27, mineral mixture 2 and salt 1 kg each and fed to two groups of HF cows and two group of (Jersey x HF) cows for 90 days.

Feeds were given at the rate of one Kg per 2.75 l in Jersey x HF cows and 3.5 l in HF cows in addition to maintenance ration per day. 30 kg green fodder and 10 kg dry fodder were also fed to the animal per day. Progressive increase in milk yield was observed in the cows fed with balanced feed. During last week daily milk yield was 20.75 to 21.27 l/d, which was 18 l initially in HF cows. In crossbreed (J x HF), during last week, milk yield was 15.5 l and initially it was 12.5 l. They also observed that the health and reproductive performances of balanced feed fed groups improved and there was control of deficiency disease.

Chuadhary and Hemraj (2008) studied the effect of feeding different levels of cottonseed on the performance of surti buffaloes. Eighteen lactating Surti buffaloes in early stage of lactation were divided into three groups of six animals each on the basis of body weight (475.83 ± 13.23 kg) and milk yield (6.75 ± 0.32 kg) and were allotted to three dietary treatments viz. T₁ – zero per cent cottonseed in concentrate mixture, T₂ – 30 per cent cottonseed in concentrate mixture and T₃ – 60 per cent cottonseed in concentrate mixture. Additionally, all groups were fed on basal roughage consisting of 15 kg green Lucerne and *ad libitum* sorghum stover. The buffaloes of T₃ group consumed significantly ($P < 0.05$) more DM, DCP and TDN than T₁ group, but there were no significant differences were observed between T₂ and T₁ groups. The milk yield and fat in milk were affected ($P < 0.05$) by the level of cottonseed given to buffaloes. The average 6 per cent FCM yield 9.21, 10.16 and 11.32 kg in T₁, T₂ and T₃ groups, respectively. Higher ($P < 0.05$) milk yield was recorded in T₃ as compared to T₁ group. However, there was no difference in milk yield of T₂ and T₁ groups. A vasectomised bull was paraded among the experimental animals daily for finding the buffaloes in heat and buffaloes showing complete estrus symptom were inseminated. The average post partum oestrus interval in T₁, T₂ and T₃ was 142.33, 85.0 and 83.0 days, respectively. The mean service period was 292.50, 184.50 and 172.33 days, respectively in T₁, T₂ and T₃ treatments. The numbers of services required per conception were 5.83, 3.50 and 3.00 in T₁, T₂ and T₃, respectively. The results showed that higher levels of cottonseed in the diet substantially improved the milk yield and post partum reproductive performance of buffaloes.

Thus, the perusal of literature cited above indicates that there is close relationship between use balanced ration with high energy increased available energy and milk yield and its composition. It is seen that the feeding of balanced ration which fulfill nutrient requirement of dairy animals particularly with respect to energy and minerals is helpful in increasing DM intake, milk production, fat corrected milk yield, fat percentage, protein percentage of milk and general health and reproductive performance of animals.

Materials & Methods

3. MATERIALS AND METHODS

The present study was conducted in the Department of Animal Nutrition, Bombay Veterinary College, Parel, Mumbai-12 and different buffalo farms of Vangani village of Karjat taluka in Raigad district of Konkan region of Maharashtra. The buffaloes with medium milk yield i.e. 5-8 litres were used for this study. In this experiment, the effect of balancing of ration was evaluated in terms of milk production, composition, efficiency of feed utilization in terms of DM, DCP and TDN intake per kg FCM yield and economics of milk production.

3.1. Experimental animals:

For this trial five farmers from different *padas* of Vangani village of Karjat taluka in Raigad district were identified. Twenty lactating murrah buffaloes – four from each farmer, were included in the study. The animals were selected on the basis of daily milk yield and stage of lactation. The selected buffaloes were divided into two groups of ten each. The details of the buffaloes selected for the experiment are presented in Appendix – I.

3.2. Plan and Design of Experiment:

Out of four selected buffaloes from each farmer two were included in control group and two were allotted to treatment group. Thus, the selected buffaloes from all the five farmers were divided into two groups, viz. I, II of ten buffalo each. The animals of Group I served as control and received ration as per the prevailing practices of the farmers. The animals of group II (treatment group) were fed balanced ration with the modified concentrate mixture. The concentrate mixture was mainly balanced with respect to the available energy. For this, part of tur chuni from control, was replaced with maize and wheat bran.

During trial period, the observations pertaining to milk yield, milk composition and feed intake were recorded at fortnightly interval for both the groups. The milk composition was studied in terms of milk protein, fat, total solids, SNF and specific gravity. The fortnightly efficiency of feed utilization was also calculated in terms of DM, TDN and DCP intake per kg FCM yield. The economics of milk production was also studied over the feed cost. The experiment lasted for thirteen weeks. At the end of experiment, a digestibility trial of seven days duration was conducted with total collection method to study the digestibility of various nutrients from different feeding treatments.

3.3. Experimental Feeds and Feeding Schedule:

The experimental groups were randomly allotted to different feed treatments. The details of feed treatments allotted were as given below:

Group I (Control) : Received concentrate mixture as per the prevailing practices of the farmers i.e. mixture of tur chuni (57.5%) and cotton seed cake (42.5%).

Group II (Treatment): Received concentrate mixture consisting of tur chuni (38%) cotton seed cake (40%) maize (12%) and wheat bran (10%). In addition each animal from group II received 30 g area specific mineral mixture and salt each, daily.

All the animals of both the groups received paddy straw as the only roughage. Conventional practice of feeding concentrates and roughages separately was followed throughout the experiment. The farmers procured the feed ingredients from local market in bulk quantities. The concentrate mixture was prepared fresh every day by hand mixing and kept for soaking in water for 4 to 5 hours before feeding and was fed in two installments i. e. at 3.30 PM and 3.30 AM in the morning just before milking.

The animals were offered dry roughage i. e. paddy straw throughout the experiment between 6.30 AM to 10.00 AM and between 12.00 noon to 3.30 PM and once between 6.30 PM to 3.30 AM.

The representative samples of concentrate mixtures and paddy straw were collected at fortnightly interval, oven dried and stored for further analysis. At the end, representative pooled samples were analyzed for chemical composition. The chemical composition of concentrate mixture and Paddy straw is presented in Table 1.

Table: 1. Average chemical composition (% DMB) of concentrate mixture and paddy straw:

Nutrient	Concentrate mixture		Paddy straw
	G- I	G- II	
Dry matter	96.15	94.65	95.24
Organic matter	93.57	93.38	91.64
Crude protein	19.27	18.81	4.52
Ether extract	3.95	3.98	1.98
Crude fiber	15.18	12.92	38.71
N.F.E.	55.17	57.67	44.43
Total Ash	6.43	6.62	8.36
AIA	1.21	1.51	4.74
Calcium	1.05	1.13	0.32
Phosphorus	0.39	0.54	0.18



3.4. Housing, Management and Health Care:

The animals were housed in the sheds available with the farmers. The sheds had adequate ventilation, pucca flooring and tying arrangements. Normal standards of hygiene, management, vaccination and deworming programs were followed for all the buffaloes throughout the experimental period. Animals were let loose daily in an open paddock for watering and exercise.

3.5 Preparation of area specific mineral Mixture:

Earlier in the department of animal nutrition, an area specific mineral mixture was developed for north Konkan region where the present experiment was undertaken. The area specific mineral mixture was formulated taking into consideration the mineral status of animals, soil and contents in feed and fodders in this area, to support optimum productivity of the dairy animals.

This specially made area specific mineral mixture for Konkan region had dicalcium phosphate (DCP), magnesium oxide (MgO), and sulphates of Zinc and copper as ingredients. The percent composition of it is presented in table-2. This mineral mixture was supplemented @ 30 g/animal/day for animals from group II, as mentioned above.

Table 2 The percent ingredient composition of area specific mineral mixture.

Ingredients	Percent
DCP	87.14
MgO	9.11
ZnSO₄	3.35
CuSO₄	0.40

3.6 Observations Recorded:

The following observations were recorded during the entire experimental period of 90 days:

- 1) Fortnightly morning and evening milk production of individual animal from both the groups.
- 2) Fortnightly intake of concentrate mixture and roughages by individual animal from both groups.
- 3) Total DM intake (kg) recorded fortnightly and presented as % DM intake, absolute DM intake and as DM intake/ kg W^{0.75}.
- 4) Fortnightly efficiency of feed utilization in terms of DM, TDN and DCP intake per kg FCM yield.
- 5) Milk samples from individual animals were collected fortnightly for estimation of specific gravity and percentage of total milk solids, fat, SNF and protein by using Auto-analyzer.

- 6) Digestibility Trial: During last week of the experiment, a digestibility trial of seven days duration by total collection method was undertaken on two animals from each group.
- 7) At the end, economics of the use of balanced ration was studied over feed cost.

3.7 Digestibility trial:

In the last week of the experiment a digestibility trial of seven days duration was conducted by total collection method. Two animals from each group were used for the digestibility trial. The animals were tied separately with sufficient space to avoid eating of feed/fodder of each other. During trial period daily intake of the concentrate mixture and roughage was recorded individually. Total quantity of dung voided during 24 hours period by individual animal was recorded. Daily $1/200^{\text{th}}$ part of feces voided by each animal was oven dried to constant weight for moisture estimation and the pooled dried samples for seven days were used for proximate analysis. Daily $1/400^{\text{th}}$ part of total fecal matter was preserved, animal wise, for nitrogen estimation. The fecal samples for nitrogen estimation were preserved in sulfuric acid (5% w/v) used at the rate of 10ml/50 g of fecal sample, and animal wise pooled samples were used for protein estimation.

3.8 Analysis of feed, fodders, milk samples:

Representative samples of concentrate mixtures, paddy straw used for feeding of animals were collected at fortnightly interval through out the experimental period, oven dried and the pooled samples were analyzed. The analysis for proximate principles and phosphorus was undertaken as per A.O.A.C. (1990) and calcium estimation was done as per Talapatra *et al.* (1940) in the Laboratory of Department of Animal Nutrition, Bombay Veterinary College, Parel, Mumbai - 400012.

The composition of milk in relation to Fat, Protein, SNF and Specific gravity was studied at fortnightly interval by using Akashganga Complete Milk Analyzer (M/s. Shri. Kamdhenu Electronics Pvt. Ltd., Gujarat). The total solids of milk samples were calculated. The fat corrected (4%) milk yield was calculated by using Gain's formula as per Manual in Dairy Chemistry (1972).

$$\text{FCM} = 0.4 \text{ M} + 15 \text{ F}$$

Where, M = Amount of milk (Kg) actually produced per day.

F = Amount of fat (Kg) secreted in that much milk.

3.9 Economics:

Group wise average daily total feeding cost per animal was calculated based on the average consumption of concentrate mixture, roughages separately. Gross returns from sale of milk from different groups were calculated considering average daily milk production per animal over 90 days period and farm selling price of Rs.25 per kg of milk. Daily gross profit per buffalo was worked out taking into account, average daily feeding expenses and milk production per animal and sale price of milk.

3.10 Statistical Analysis:

Observations of various parameters recorded during experimental period were tabulated and data were statistically analyzed as per Snedecor and Cochran (1994).

Results & Discussion

4. RESULTS AND DISCUSSION

The present study was conducted on different buffalo farms of Vangani village of Karjat taluka in Raigad district of Konkan region of Maharashtra. In this experiment, the effect of balancing of ration on feed intake, milk yield and its composition was studied in buffaloes. Finally, efficiency of feed utilization in terms of DM, DCP and TDN intake per kg FCM yield and economics of feeding was also worked out. A digestibility trial was also conducted during last week of experiment.

4.1 Dry matter intake:

The fortnightly average daily dry matter intake of different groups is presented in Table 3. The same is presented graphically in Figure I.

It is seen from the table that the average daily dry matter intake of buffaloes ranged from 13.80 to 14.54 kg. The average total dry matter intake of buffaloes from groups I and II was 14.07 and 14.34 kg, respectively. Thus, it is seen that the daily dry matter intake of buffaloes receiving balanced ration was higher than that of the control group.

The fortnightly average daily total dry matter intake data were subjected to statistical analysis by using 't' test and it is seen that the average daily total dry matter intake of buffaloes from treatment group were significantly ($P \leq 0.05$) higher than control.

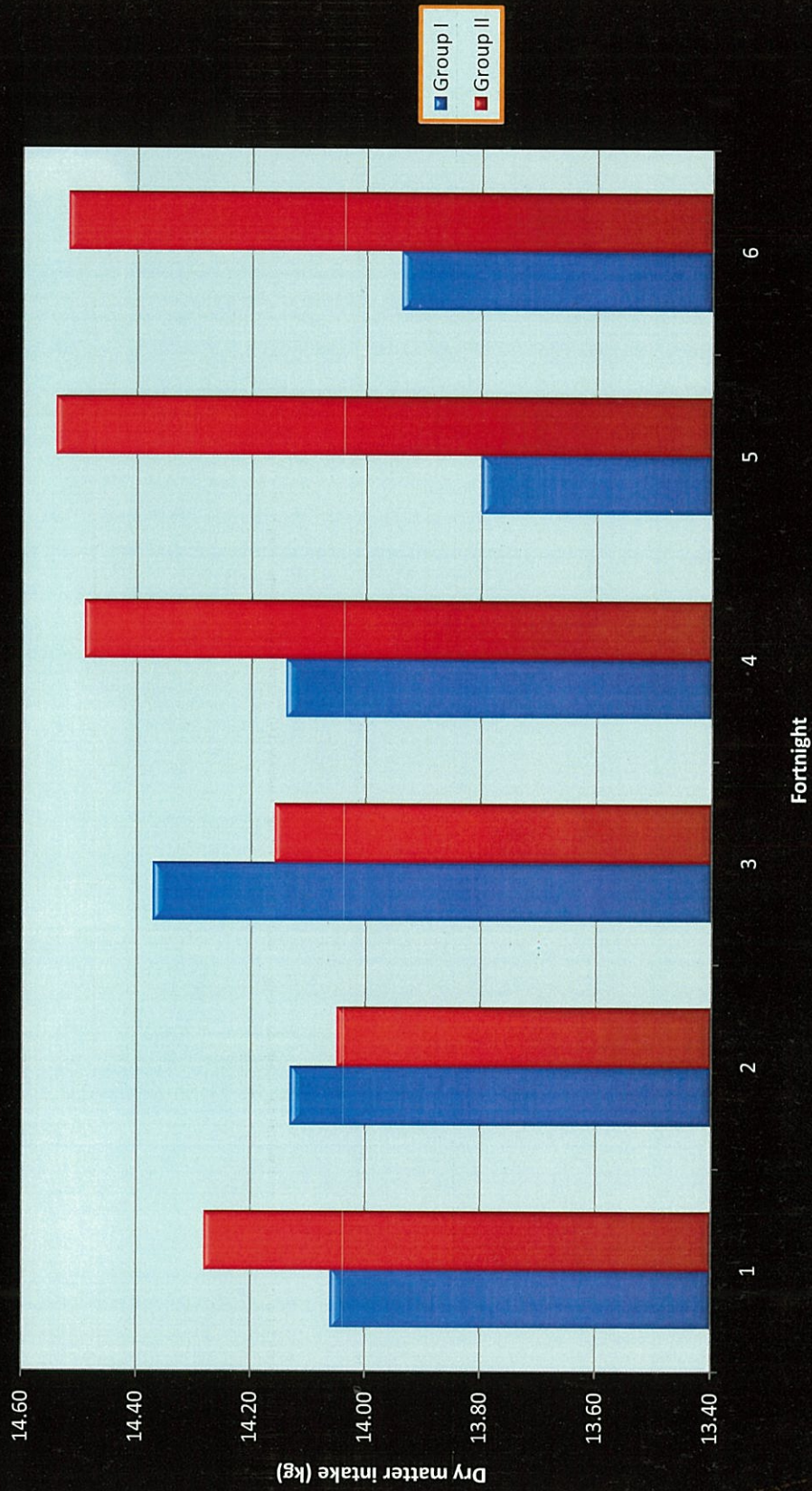
The findings of the present trial are in agreement with Spain *et al.* (1990) they reported greater DM intake on high TDN diet. Khalili *et al.* (1992) also observed that daily DM intake increased by 3.72kg/day ($P \leq 0.01$) when amount of concentrate increased from 0 to 0.5 kg per day.

Table 3 Fortnightly average total dry matter intake (kg) of buffaloes from different groups.

Fortnight	Group I	Group II
1	14.06	14.28
2	14.13	14.05
3	14.37	14.16
4	14.14	14.49
5	13.80	14.54
6	13.94	14.52
Average ± S.E.	14.07 ± 0.079	14.34 ± 0.085

Significance $t_{10} = P < 0.05$

Fig: I Fortnightly average total dry matter intake (kg) of buffaloes from different groups



4.2. Milk yield:

The fortnightly average daily milk yield of buffaloes from both the groups is presented in Table 4. The same is presented graphically in Figure II. It is seen from the table that average daily milk yield of buffaloes ranged from 5.94 to 7.55 kg. The average daily milk yield of buffaloes from groups I and II was 6.26 and 6.99 kg, respectively. Thus, it is seen that average daily milk yield of Gr. II receiving balanced ration was 11.66% higher than Gr. I maintained on control ration as per practice of farmers.

The fortnightly average daily milk yield data were subjected to statistical analysis by using 't' test and it is seen from the table that the average daily milk yield of buffaloes from treatment group was significantly ($P \leq 0.05$) higher than control. This suggested that feeding of balanced ration in lactating buffaloes is beneficial in increasing the milk production.

Uremovic *et al.* (1994) observed 19.47% increase in milk production of cows supplemented with high energy diet than control. Garcia and Gonzalez (1985) also reported 23.64% increase in milk yield of cows supplemented with 50% more energy than control. Bertrand *et al.* (1988) observed increase in milk yield by 11.08% by supplementation of 18.18% more energy per kg milk. Chavan *et al.* (2005) observed that the treatment group having 5% more energy than control resulted in increase in milk yield of cows. Upadhyay *et al.* (2007) also observed increase in milk production of cows receiving balanced feed. Thus, the observation in the present experiment regarding increased milk production with use of high energy sources, corroborated with the above.

4.3. Fat corrected milk yield:

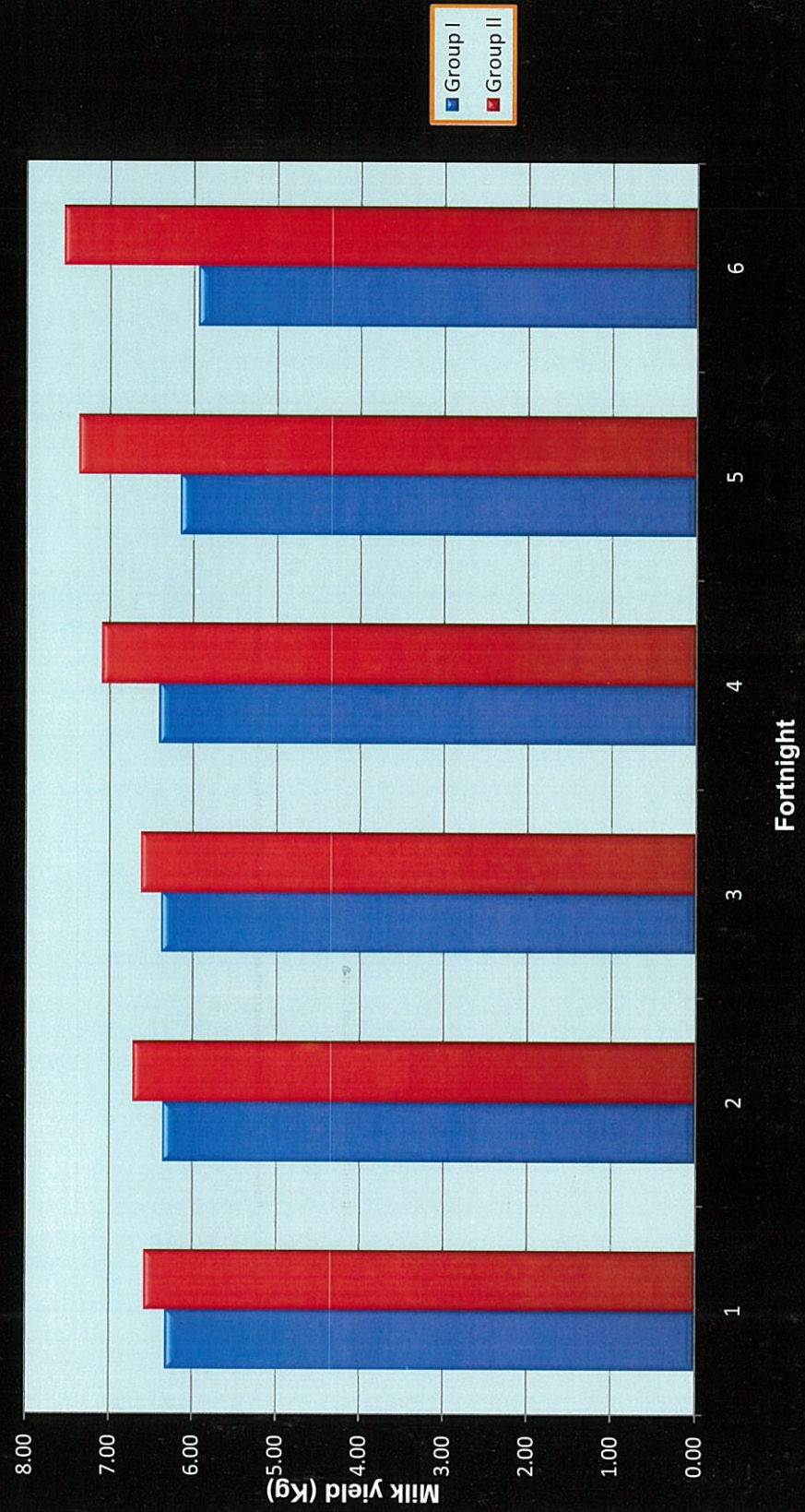
The fortnightly average milk production data were corrected to 4% fat and the daily FCM yield was calculated for different groups and is presented in Table 5. The same is depicted graphically in Figure III. The average FCM yield for

Table 4 Fortnightly average total milk yield (kg) of buffaloes from different groups.

Fortnight	Group I	Group II
1	6.32	6.57
2	6.35	6.71
3	6.37	6.62
4	6.40	7.09
5	6.15	7.37
6	5.94	7.55
Average ± S.E.	6.26 ± 0.073	6.99 ± 0.169

Significance $t_{10} = P < 0.05$

Fig. II Fortnightly average total milk yield (Kg) of buffaloes from different groups



groups I and II was 9.98 and 12.24 kg, respectively. Thus, it is seen that average FCM yield of group II was higher (22.65%) than group I.

The average FCM yield data were subjected to statistical analysis by using 't' test and result of same indicated that the average FCM yield of buffaloes from treatment group was significantly ($P \leq 0.01$) higher than control. Thus, it is seen that the buffaloes receiving balanced ration produced significantly more FCM than the control group, indicating the beneficial effect of balanced ration.

Gruzdev *et al.* (1991) reported 4% increase in FCM yield when cows were fed with high energy diet. Wojtasik *et al.* (1991) reported increase in FCM yield by 5.1% for cows fed energy allowance as per polish standard than cows fed 25% below polish standard. Singh *et al.* (1976) also observed increase in FCM production by 3% when cows were fed 10% above NRC recommendation. The present observations are in agreement with the same.

4.4 TDN intake:

Total Digestible Nutrients (TDN) and Digestible Crude Protein (DCP) intake were calculated for the buffaloes by considering the TDN and DCP content of different rations as obtained during the digestibility trial.

The average daily TDN intake for buffaloes from different groups is presented in Table 6. The average daily TDN intake by buffaloes from groups I and II was 9.35 and 9.95 kg, respectively. Thus, it is seen that average daily TDN intake by buffaloes of group II receiving balanced ration was 6.42% higher than group I i.e. control, receiving conventional ration.

The average daily TDN intake data were subjected to statistical analysis by using 't' test and result of same indicated that the average daily TDN intake of buffaloes from treatment group was significantly ($P \leq 0.01$) higher than control.

Table 5 Fortnightly average daily fat corrected milk yield (kg) of buffaloes from different groups.

Fortnight	Group I	Group II
1	10.09	10.64
2	10.33	11.76
3	9.98	11.59
4	10.39	12.37
5	9.72	12.83
6	9.35	13.71
Average ± S.E.	9.98 ± 0.160	12.24 ± 0.464

Significance $t_{10} = P < 0.01$

Fig. III Fortnightly average daily fat corrected milk yield (Kg) of buffaloes from different groups

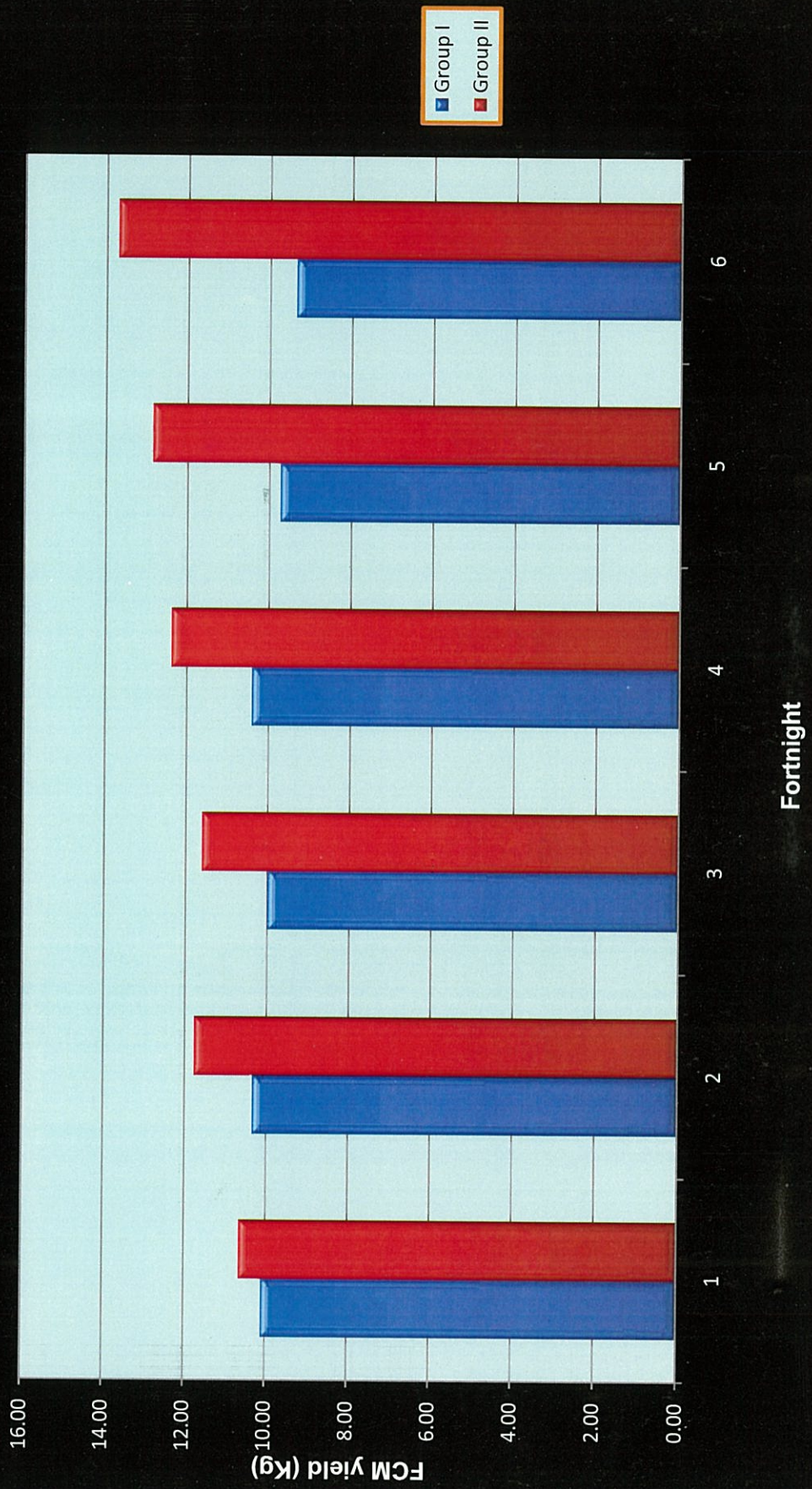


Table 6 Fortnightly average daily TDN intake (kg) of buffaloes from different groups.

Fortnight	Group I	Group II
1	9.34	9.91
2	9.38	9.75
3	9.55	9.82
4	9.39	10.05
5	9.17	10.09
6	9.26	10.08
Average ± S.E.	9.35 ± 0.053	9.95 ± 0.059

Significance $t_{10} = P < 0.01$

4.5 DCP intake:

The average daily DCP intake of buffaloes from different groups is presented in Table 7. It is seen from the table that the average daily DCP intake by buffaloes from groups I and II was 1.32 and 1.43 kg, respectively. Thus, it is seen that the average daily DCP intake by buffaloes of group II receiving balanced ration was 8.33% higher than group I i.e. control, receiving conventional concentrate mixture.

The average daily DCP intake data were subjected to statistical analysis by using 't' test and result of same given indicated that the average daily DCP intake of buffaloes from treatment group was significantly ($P \leq 0.01$) higher than control.

Thus, it is seen that balancing of ration in group II, through modified concentrate mixture, significantly increased the DM, energy and protein intake of buffaloes, which was also reflected in increased milk and FCM yield of the animals as compared to control.

4.6 Feed efficiency:

The efficiency of feed utilization by buffaloes on different feed treatments was calculated in terms of DM, TDN, DCP required per kg of FCM produced.

4.6.1 Dry matter intake / kg FCM:

The fortnightly average daily DM required per kg FCM for buffaloes from different groups is presented in Table 8. The same is presented graphically in Figure IV.

Table 7 Fortnightly average daily DCP intake (kg) of buffaloes from different groups.

Fortnight	Group I	Group II
1	1.32	1.42
2	1.32	1.40
3	1.35	1.41
4	1.33	1.44
5	1.29	1.44
6	1.31	1.44
Average ± S.E.	1.32 ± 0.008	1.43 ± 0.007

Significance $t_{10} = P < 0.01$

It is seen from the table that the average DM required per kg FCM production for buffaloes from groups I and II was 1.45 and 1.21 kg, respectively. The group II was 16.55 % more efficient than group I.

The average daily DM intake per kg FCM yield data were subjected to statistical analysis by using 't' test and result of same shows that feed treatment had significant ($P \leq 0.01$) effect on efficiency of feed utilization when considered in terms of DM required per kg FCM. Thus, it is seen that efficiency of feed utilization in terms of DM intake per kg FCM in balanced ration fed group was significantly higher than control group.

4.6.2 TDN intake / kg FCM:

The efficiency of feed utilization calculated at fortnightly interval in terms of TDN required per kg FCM for buffaloes from different groups is presented in Table 9. It is also presented graphically in Figure IV. It is noticed that the buffaloes from groups I and II required 0.96 and 0.84 kg TDN per kg FCM produced, respectively. Thus, the buffaloes from group II receiving balanced ration, required 0.12 kg less of TDN for production of each kg of FCM, indicating better efficiency of treated group over control group.

The data were subjected to statistical analysis by using 't' test and result of same indicated that balanced ration had significant ($P \leq 0.05$) effect on the TDN required per kg of FCM produced by buffaloes. The significant effect was seen in improving the efficiency of feed utilization in terms of TDN required per kg FCM produced in treatment group (II) as compared to control group.

4.6.3 DCP intake / kg FCM:

The fortnightly average DCP required per kg FCM produced by different groups is presented in Table 10. The same is depicted in figure IV. It is noticed

Table 8 Fortnightly average total daily dry matter intake (kg)/kg FCM yield of buffaloes from different groups.

Fortnight	Group I	Group II
1	1.44	1.40
2	1.43	4.23
3	1.48	1.26
4	1.37	1.18
5	1.44	1.13
6	1.51	1.06
Average ± S.E.	1.45 ± 0.020	1.21 ± 0.048

Significance $t_{10} = P < 0.01$

Table 9 Fortnightly average daily TDN intake (kg)/ kg FCM yield of buffaloes from different groups.

Fortnight	Group I	Group II
1	0.95	0.97
2	0.95	0.86
3	0.98	0.87
4	0.91	0.82
5	0.96	0.78
6	1.00	0.73
Average ± S.E.	0.96 ± 0.012	0.84 ± 0.034

Significance $t_{10} = P < 0.05$

from the table that the average efficiency was 0.13 and 0.12 kg for groups I and II, respectively, when considered in terms of DCP required per kg FCM. Thus, it indicated that for group II the efficiency of DCP utilization for FCM was 7.69% higher than control group, receiving no balanced ration.

The above data were subjected to statistical analysis by using t test and result of the same indicated that balanced ration had significant ($P \leq 0.05$) effect on the parameter. The DCP required per kg FCM revealed same trend as that observed for DM and TDN required per kg FCM.

Thus, when considered in terms of DM, TDN and DCP required per kg FCM produced for groups, the efficiency of feed utilization was significantly higher for group II, receiving balanced ration.

4.7 Milk composition:

The fortnightly samples from individual buffaloes from different groups were collected for estimation of total solids, milk fat, SNF, protein content and specific gravity.

4.7.1 Milk protein:

The fortnightly average milk protein percentage of milk from both the groups is presented in Table 11. The average milk protein for groups I and II was 4.22 and 4.38%, respectively. It is seen that the protein percentage of milk receiving balanced ration was 0.16 unit higher than that of control.

The fortnightly average daily milk protein data were analyzed statistically by using 't' test. It is observed from the statistical analysis that treatments had no significant effect on milk protein content. Thus, the apparent beneficial effect of

Table 10 Fortnightly average daily DCP intake (kg)/ kg FCM yield of buffaloes from different groups.

Fortnight	Group I	Group II
1	0.13	0.14
2	0.13	0.12
3	0.14	0.13
4	0.13	0.12
5	0.13	0.11
6	0.14	0.11
Average ± S.E.	0.13 ± 0.002	0.12 ± 0.005

Significance $t_{10} = P < 0.05$

Fig. V Fortnightly average daily DM, TDN and DCP intake (Kg) / Kg FCM yield of buffaloes from different groups

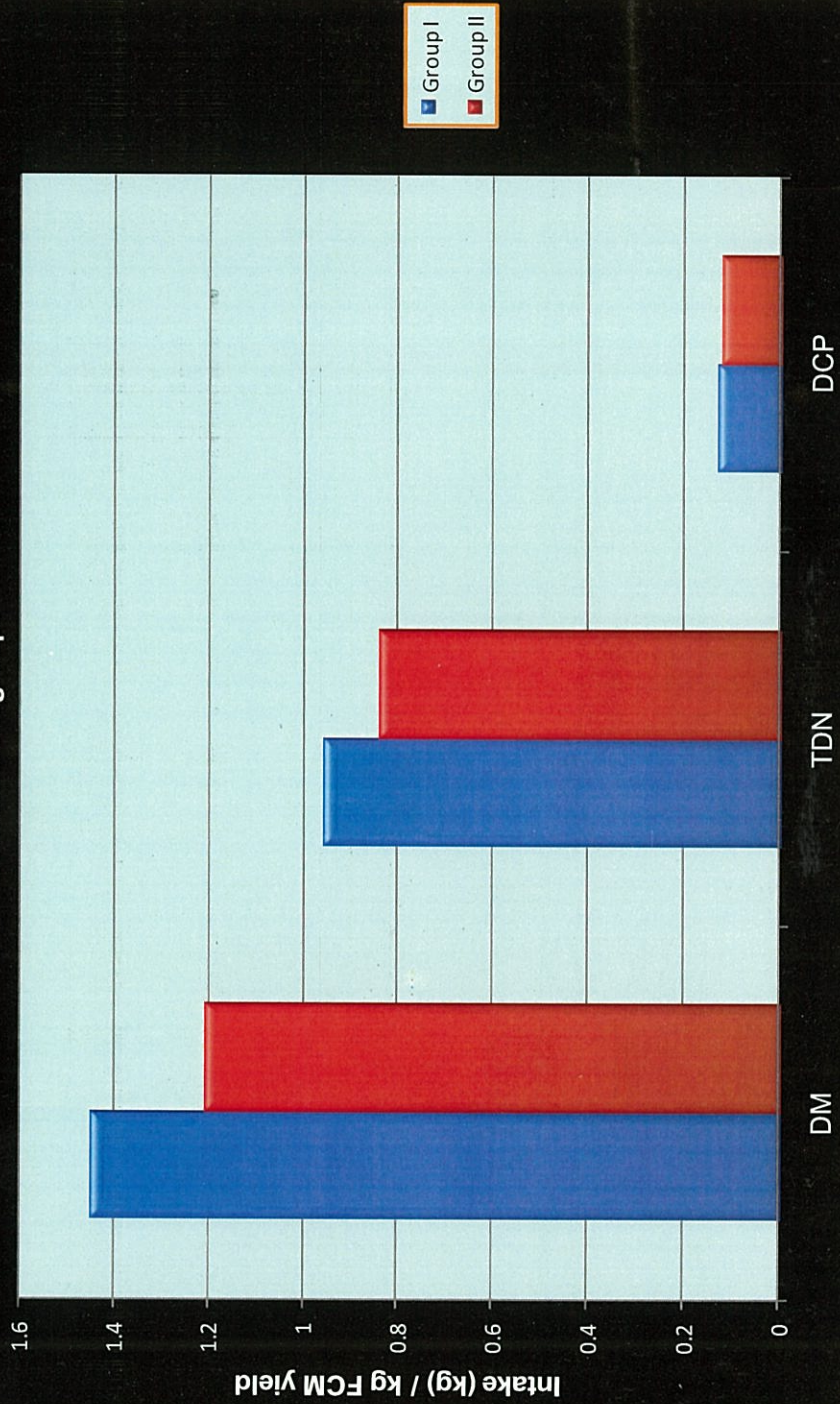


Table 11 Fortnightly average milk protein (%) of buffaloes from different groups.

Fortnight	Group I	Group II
1	4.28	4.08
2	4.29	4.11
3	4.07	4.42
4	4.16	4.49
5	4.19	4.56
6	4.35	4.62
Average ± S.E.	4.22 ± 0.042	4.38 ± 0.094

Significance t_{10} : NS

NS – Non-significant.

balanced ration on milk protein content was found to be statistically non-significant.

Chavan *et al.* (1992) observed that percentage of milk protein was reduced with the high energy protein diet. Davies *et al.* (1993) reported that increases in supplementary metabolic energy significantly reduced protein concentration in the milk. Contrary to this in the present study milk protein content improved on ration with higher available energy, although the effect was statistically non significant.

4.7.2 Milk fat:

The fortnightly average fat percentage of milk from both the groups is presented in Table 12. It is noticed from the table that average milk fat percentage for groups I and II was 7.95 and 8.99, respectively. Thus, the average milk fat for treatment group was higher than control group. On the percent basis the milk fat percentage was 13.08 % higher in treatment group than control.

The data obtained for milk fat percentage were subjected to statistical analysis by using 't' test. It is seen that balanced ration had significant ($P \leq 0.01$) effect on milk fat percentage. Thus, feeding of the balanced ration to buffaloes resulted in significant increase in milk fat content.

Wojtasik *et al.* (1995) reported 2.83% increase in milk fat percentage by feeding high energy diet in the form of pure maize starch. Chavan *et al.* (2005) also observed that the treatment group having 5% more energy than control resulted in increase in milk fat percentage of cows with high energy ration. Bartocci *et al.* (2006) observed that increase in milk fat percentage in buffaloes giving high level of energy and protein diet.

Table 12 Fortnightly average milk fat (%) of buffaloes from different groups.

Fortnight	Group I	Group II
1	7.95	8.10
2	8.14	9.00
3	7.76	8.99
4	8.17	9.16
5	7.86	9.13
6	7.82	9.54
Average ± S.E.	7.95 ± 0.070	8.99 ± 0.195

Significance $t_{10} = P < 0.01$

4.7.3. Total Solids:

The fortnightly average total solids percentage of milk from both the groups is presented in Table 13. The table revealed that the average total solids for groups I and II was 18.97 and 20.09 %, respectively. It is seen that group II receiving balanced ration recorded higher (5.9 %) total solids percentage of milk than control group. The statistical analysis of data recorded for total solids percentage revealed that use of balanced ration significantly ($P \leq 0.01$) increased the total solids percentage of milk.

4.7.4. Solids Not Fat content:

The fortnightly average SNF percentage of milk from both the groups is presented in Table 14. It is seen from the table that average SNF percentage for groups I and II was 11.03 and 11.11, respectively. It is seen that the SNF percentage of milk from buffaloes receiving balanced ration was slightly higher than control.

The data of milk SNF were subjected to statistical analysis by using 't' test. The statistical analysis indicated that treatments had non-significant effect on SNF content of milk. Thus, indicating that SNF content of milk was comparable for both the groups.

4.7.5. Specific gravity:

The data pertaining to average specific gravity of milk recorded at fortnightly interval from both the groups are presented in Table 15. The average specific gravity of milk for groups I and II was 1.0358 and 1.0364, respectively. This indicated marginally beneficial effect of balanced ration on average specific

Table 13 Fortnightly average milk total solids (%) of buffaloes from different groups.

Fortnight	Group I	Group II
1	19.15	18.98
2	19.32	19.88
3	18.70	20.32
4	19.45	20.78
5	18.52	20.12
6	18.73	20.49
Average ± S.E.	18.97 ± 0.155	20.09 ± 0.256

Significance $t_{10} = P < 0.01$

Table 14 Fortnightly average milk SNF (%) of buffaloes from different groups.

Fortnight	Group I	Group II
1	11.21	10.88
2	11.18	10.88
3	10.95	11.33
4	11.28	11.62
5	10.67	10.99
6	10.91	10.95
Average \pm S.E.	11.03 \pm 0.094	11.11 \pm 0.123

Significance t_{10} : NS

NS – Non-significant.

Table 15 Fortnightly average of milk specific gravity of buffaloes from different groups.

Fortnight	Group I	Group II
1	1.0360	1.0360
2	1.0358	1.0349
3	1.0355	1.0378
4	1.0360	1.0359
5	1.0362	1.0375
6	1.0354	1.0368
Average ± S.E.	1.0358 ± 0.000	1.0364 ± 0.000

Significance t_{10} : NS

NS – Non-significant.

gravity of the milk. This may be attributed to overall improvement in composition of milk for treatment group.

The data of Specific gravity of milk were subjected to statistical analysis by using 't' test. It is observed from the table that treatments had no significant effect on specific gravity of milk. Thus, the apparent beneficial effect of balanced ration on specific gravity was found to be statistically non-significant.

4.10 Digestibility Trial

During the last week of study a digestibility trial of seven days duration was conducted by total collection method on two animals from each group and the digestibility coefficients for different nutrients were calculated. The digestibility coefficients for dry matter, organic matter, crude protein, ether extract, crude fiber and NFE for different groups are presented in Table 16.

It is evident from the table that average digestibility coefficients for dry matter were 68.01 and 71.47% for groups I and II, respectively. Thus, the digestibility of DM in Gr. II was higher than that in Gr. I.

The average digestibility coefficient for organic matter was 69.30 and 73.27% for groups I and II, respectively, indicating the same trend as that for DM digestibility.

It is seen from the table that average coefficients for digestibility for crude protein were 72.53 and 78.33 % for control and treatment groups, respectively. Thus, the digestibility of crude protein was considerably higher (5.8 unit) for balanced ration group than control.

The average digestibility coefficients for ether extract and crude fibre were 70.80 and 63.79% and 76.02 and 66.89% for groups I and II, respectively, which again indicated that balanced ration group had higher digestibility coefficient for these nutrients as compared to control group.

Table 16 Average percent digestibility coefficient, TDN and DCP contents for various experimental group.

Sr. No.	Nutrient	Group I	Group II
1	Dry matter	68.01	71.47
2	Organic matter	69.30	73.27
3	Crude protein	72.53	78.33
4	Ether Extract	70.80	76.02
5	Crude fiber	63.79	66.89
6	Nitrogen Free Extract	71.12	74.89
7	TDN	66.42	69.39
8	DCP	9.37	9.93

It is also seen from the table that the average digestibility coefficients for groups I and II for NFE were 71.12 and 74.89 %, respectively. Thus, the digestibility of NFE was higher by about 1.46 units in balanced ration group than control group. In general, it is seen that although extent varied, the digestibility coefficients for all the nutrients were higher in buffaloes receiving balanced ration as compared to control group.

It is revealed from Table 16 that average TDN content of ration for groups I and II were 66.42 and 69.39%, respectively. While, the average DCP percentages for corresponding groups were 9.37 and 9.93. This indicated that the TDN and DCP content of ration improved considerably due to balanced ration.

Thus, in general, it is seen that in lactating buffaloes overall digestibility of all the nutrients was higher for Gr. II, receiving balanced ration than control group. This, in turn, was reflected in higher TDN and DCP values for the corresponding ration.

4.11. Economics

The profit in dairy animal production depends mainly on input-output relationship. Hence, attempt was made to evaluate the economics of production performance of buffaloes maintained on control conventional ration and modified balanced ration (group II) for the input costs and daily returns per buffalo from both the groups. The profit was worked out by considering mainly the cost of feed supplements, feeds and fodders and the amount realized on the sale of the milk. The input-output relationship for both the groups is presented in Table 17.

It is seen from the table that cost per kg concentrate was Rs.11.94 and 11.25 for groups I and group II, respectively. The cost of feeding mineral mixture and salt was Rs.0.89 and 0.17, respectively for group II. The total cost of feeding per buffalo was Rs.100.85 and 99.71 per day, for groups I and II, respectively. Thus, feeding cost was almost same for both the groups.

Table 17 Input-Output relationships.

Particulars	Group I	Group II
Intake (kg/day)/animal		
Concentrate	7.14	7.40
Paddy straw	7.80	7.70
Mineral mixture	--	0.03
Salt	--	0.03
Cost (Rs/kg)		
Concentrate	11.94	11.25
Paddy straw	2.00	2.00
Mineral mixture	--	29.60
Salt	--	5.50
Total feed cost (Rs/day)/animal		
Concentrate	85.25	83.25
Paddy straw	15.60	15.40
Mineral mixture	--	0.89
Salt	--	0.17
Total feed cost (Rs)	100.85	99.71
Miscellaneous cost* (Rs/day)	15.00	15.00
Total expenses (Rs/day)	115.85	114.71
Average daily milk production (kg/buffalo)	6.26	6.99
Total cost of milk production (Rs/kg)	18.51	16.41
Average daily FCM Production (kg/buffalo)	9.98	12.24
Total cost of FCM production (Rs/kg)	11.61	9.37
Daily income from milk sale** (Rs)	156.50	174.75
Daily profit through sale of milk (Rs/buffalo)	40.65	60.04

*- Includes labour, vaccination and other overhead costs.

** - Rate of milk was Rs. 25.00 per kg.

The total cost per kg milk production was Rs. 18.51 and 16.41 for groups I and II respectively. Thus, indicating that total cost per kg milk production was considerably reduced (11.35%) due to better balancing of nutrients in the ration for treatment group II. When the cost was considered on the basis of fat corrected milk production, it was again higher for group I (Rs.11.61) than group II (Rs.9.37), which further prominently (19.29%) expressed the cost effectiveness of balanced ration in Gr. II over control group.

The milk was sold at farm price of Rs. 25/kg. The average total daily income earned from sale of milk was Rs.156.5.00 and 174.75 for groups I and II, respectively. The corresponding values for profit realized per buffalo were Rs.40.65 and 60.04. Thus, more profit was recorded with group II fed with better balanced ration over group I. The extra net profit of Rs. 19.39 per buffalo per day was realized when modified ration was used in present study. The net profit per buffalo is likely to increase further, if the milk is sold as per fat content.

Thus, it is observed that the use of balanced ration mainly with respect to available energy and minerals was cost effective as compared to control buffaloes receiving conventional farm ration.

4.12. Overall performance:

The overall performance of buffaloes from different groups is presented in Table 18. It is seen from the table that values for average DM intake were significantly different in both the groups. The nutrient intake, considered in terms of TDN and DCP, revealed that the intake in group II receiving balanced ration was significantly higher than group I. It is also seen from the table that absolute and FCM yields were also significantly higher in treatment group than the control group. The efficiency of feed utilization in terms of DM, TDN, and DCP intake per kg FCM production was also significantly better for group II than the group I. The table also revealed that the composition of milk improved in treatment group for

all the parameters studied, although the improvement was significant only with respect to total solid and fat.

The overall results indicated that in the situation of farm feeding practice, similar to present study; the use of changed proportion of concentrate ingredients particularly with respect to available energy and minerals, proved beneficial in terms of dry matter intake, increased milk yield, improved milk composition, higher efficiency of feed utilization and the digestibility of DM, CP, EE, CF, NFE improved by the of balanced ration and it also revealed that the use of balanced ration is cost effective.

Table 18 Overall performances of Buffaloes from different groups.

Parameters	Group I	Group II	Result of t test
Initial body weight (kg)	472	483	-
Final body weight (kg)	468	487	-
Dry matter intake (kg)	14.07	14.34	*
TDN %	66.42	69.39	--
TDN intake (kg)	9.35	9.95	**
DCP %	9.37	9.93	--
DCP intake (kg)	1.32	1.43	**
Milk Yield (kg)	6.26	6.99	*
FCM yield (kg)	9.98	12.24	**
DM intake/ kg FCM	1.45	1.21	**
TDN intake/ kg FCM	0.96	0.84	*
DCP intake/ kg FCM	0.13	0.12	*
Protein %	4.22	4.38	NS
Fat %	7.95	8.99	**
Total solid %	18.97	20.09	**
S.N.F. %	11.03	11.11	NS
Specific gravity %	1.0358	1.0364	NS

NS – non-significant.

* -- Significant at 5% level.

** -- Significant at 1% level.

Summary & Conclusions

5. SUMMARY AND CONCLUSIONS

The experiment was conducted in lactating buffaloes at Different buffalo farms of Vangani village of Karjat taluka in Raigad district of Konkan region of Maharashtra. The effect of balanced ration on the performance of lactating buffaloes in relation to milk yield and its composition, digestibility of feed and feed efficiency was studied.

The study involved twenty murrah buffaloes divided into two equal groups with ten buffaloes each. The buffaloes were selected on the basis of stage of lactation and milk yield. All animal had medium milk production ranging between 5 to 8 litres. The animals of Group I (control group) served as control and received concentrate mixture as per the prevailing practices of the farmers i.e. mixture of turchuni (57.5%) and cotton seed cake (42.5%). The animal of group II received balanced ration with modified concentrate mixture. The concentrate mixture was mainly modified with respect to the available energy and minerals. For this part of turchuni from control, was replaced with maize and wheat bran. Thus, the concentrate mixture for group II (treatment group) were consist of turchuni (38%) cotton seed cake (40%) maize (12%) and wheat bran (10%). In addition animal from group II will receive 30 gm area specific mineral mixture and salt each.

During the trial fortnightly daily milk yield and feed intake were recorded. From this data fortnightly efficiency of feed utilization by both the groups was calculated. Besides this the milk samples from individual buffalo was collected at fortnightly intervals for the study of milk composition. At the end of the experiment, a digestibility trial of seven days duration was conducted by total collection method involving two buffaloes from each group.

The average fortnightly daily dry matter intake of buffaloes was 14.07 and 14.34 kg, for the groups I and II, respectively. The statistical analysis of the data revealed that treatments had significant ($P \leq 0.05$) effect on average daily dry matter intake of buffaloes from different groups.

Average daily milk production of buffaloes from groups I and II was 6.26 and 6.99 kg, respectively. It is noticed that the difference in milk production of buffaloes in control and treatment groups was statistically significant ($P \leq 0.05$). This indicated that balanced ration significantly increased milk production of buffaloes.

The average daily fat corrected milk yields for the groups I and II was 9.98 and 12.24 kg, respectively. It is seen that the buffaloes receiving balanced ration produced significantly ($P \leq 0.01$) more FCM than control group.

The buffaloes from groups I and II consumed on an average 9.35 and 9.95 kg of TDN, respectively. The TDN intake of buffaloes receiving balanced ration was significantly ($P \leq 0.01$) higher than control group.

The buffaloes from groups I and II consumed on an average 1.32 and 1.43 kg of DCP, respectively. The DCP intake of buffaloes receiving balanced ration was significantly ($P \leq 0.01$) higher than control group.

The efficiency of feed utilization by buffaloes from different groups was calculated in terms of DM, TDN and DCP required per kg of FCM yield. The average daily dry matter intake per kg FCM produced was 1.45 and 1.21 kg, for control and treatment groups, respectively. The efficiency of feed utilization of buffaloes receiving balanced ration was significantly ($P \leq 0.01$) higher than control group. The buffaloes from groups I and II required 0.96 and 0.84 kg TDN and 0.13 and 0.12 kg DCP, respectively per kg FCM produced. It was seen that when feed efficiency was considered in term of these, it was significantly ($P \leq 0.05$) higher in treatment group (II) receiving modified concentrate mixture.

The fortnightly average milk fat content was 7.95 and 8.99 % for groups I and II, respectively with significant ($P \leq 0.01$) increase in the milk fat percentages for group receiving balanced ration. The average total solid of milk recorded at fortnightly interval was 18.97 and 20.09% for group I and II respectively; the difference being statistically significant ($P \leq 0.01$). The average solid not fat (SNF) percentage was 11.03 and 11.11 %, the fortnight average specific gravity was 1.0358 and 1.0364 for groups I and II, respectively. The statistical analysis of

data indicated that the SNF and specific gravity of milk of buffaloes receiving balanced ration diet was comparable with control. The fortnightly average milk protein was 4.22 and 4.38% for groups I and II, respectively. It was seen that the treatment had non significant effect on average milk protein percentage

The digestibility trial conducted during last week of experiment revealed that the digestibility of DM in Gr. II was higher than Gr. I. The respective values for groups I and II were 68.01 and 71.47%. The average digestibility coefficients for OM were 69.30 and 73.27 % for groups I and II, respectively. The average digestibility coefficients for CP and CF were 72.53 and 63.79% and 78.33 and 66.89 % for groups I and II, respectively. The values of digestibility coefficients for EE and NFE were 70.80 and 71.12% and 76.02 and 74.89 % for groups I and II, respectively. The TDN and DCP content of control and treatment feeds were 66.42 and 9.37% and 69.39 and 9.93% respectively. Thus, it is seen that digestibility coefficients for different nutrients and the contents of TDN and DCP in ration were higher for buffaloes receiving balanced ration (group II) than control group.

The economics of the study revealed that average daily feed cost of the buffaloes was Rs. 100.85 and 99.71 for groups I and II, respectively. The total cost per kg of milk production was Rs. 18.51 and 16.41 and total cost per kg FCM yield was Rs. 11.61 and 9.37 for groups I and II, respectively. Thus, it was seen that the use of balanced ration (Gr II) was cost effective when compared with control ration given as per the practice of farm.

Thus, from the overall results it was seen that in the situation of farm feeding practice, similar to present study; the use of modified concentrate mixture with changed proportion of concentrate ingredients particularly with respect to available energy and minerals, proved beneficial in terms of dry matter intake, increased milk yield, improved milk composition, higher efficiency of feed utilization and increased digestibility of different nutrients. It also revealed that the use of such ration is cost effective. Thus, it can be inferred that for improved production and better profit margin use of balanced ration for lactating animals is beneficial.

Bibliography

BIBLIOGRAPHY

Agarwal, K. P. (2005) Conserving cattle wealth of India. Souvenir, "Workshop on Genetic Improvement in cattle and buffalo." Pune, pp. 46-52.

A.O.A.C. (1990) Association of Analytical Chemists, Official method of analysis, 15th editions, Washington, D. C. – 2004: 957.

Bartocci, S., S. Terramocchia and C. Tripaldi (2006) Studied the utilization of a high level energy/protein diet for lactating Mediterranean buffaloes. *Livestock sci.*, **99** (2-3) 211-219.

Bertrand, J. A., H. E. Amos and L. O. Ely (1988) Effect of feeding three levels of concentrates on forage intake and milk production response in Holstein cows. *Dairy sci. Abst.*, **50** (2): 420.

Bhat, A. S., O. S. Parmer and R. S. Gill (2007) Effect of different concentrate levels on milk yield and feed intake, in dairy cows. *Applied Biological Research* **9** (1 & 2): 972-979.

Chavan, S.S., V.D. Kank., M.B.Patil., B.G. Hol and G.M. Gadegaonkar (2005) Effect of different levels of energy on milk composition in crossbred lactating cows. *The Jr. Bom. Vet. College* **13** (1 & 2) :971-1643.

Chuadhary, J.L. and Jat. Hemraj (2008) Effect of feeding different levels of cottonseed on the performance of surti buffaloes. *Anim. Nutr. and Feed Tech.*, **8** (1): 972-2963.

Dairy Industry Conference 2009: 37th Dairy Industry Conference 2009 of Indian Dairy Association at Panjim.

Davies, O. D. (1993) effect of protein and energy content of compound supplements offered at low levels to October calving dairy cows. *Nutr. Abst. and Rev.*, **63** (1): 330.

Degano, L. (1993) Effect of flaked maize and barley on milk yield and composition in dairy animal. Dairy Sci. Abst., **55** (99): 4494.

Depeters, E. J., S. J. Taylor, C. M. Finley and T. R. Fomula (1987) Effect of feeding corn or barley on composition of milk and diet digestibility. J. of Dairy Sci., **70** (6): 1192-1199.

Garcia, F. and F. Gonzalez (1985) Effect of concentrate levels on milk production by dairy cows during the lactation. Nutr. Abst. and Rev., **55** (9): 4494.

Grummer, R. R., A. L. Jacob and J. A. Woodford (1988) Studied factor associated with variation in milk fat depression resulting from high grain diets fed to dairy cows. Nutr. Abst. and Rev., **58** (5): 2310.

Gruzdev, N. V., V. V. Polezhaev and V. F. Fishchuk (1991) Studied the diets containing varying level of energy. Dairy Sci. Abst., **53** (6): 3477.

Hauwuy, A., J. Paradis and J. B. Coulon (1993) Effect of energy supply on performance of dairy cows fed with hay based ration. Dairy Sci. Abst., **55** (10): 6152.

Huber, J. T., G. C. Graf and R. W. Engle (1963) Effect of supplemented feeding of cows on pasture on milk composition and yield. J. of Dairy Sci., **47** (1): 63-67.

Jakhmola, R. C. (2006) Strategies for sustaining ruminant production in hilly and desert regions of India. Proc. XIIth Animal Nutrition conference. **Vol II**: 26-32.

Jackson and Gupta (1971) effect of concentrate supplementation in comparison to berseem forage for milk production and composition in buffaloes. Nutr. Abst. and Rev., **54** (2): 435.

Khalili, H., T. Varvikko and S. Crosses (1992) Effect of forage type and level of concentrate supplement on food intake, diet digestibility and milk production in crossbred cows. Nutr. Abst. and Rev., **62** (8): 4135.

Malossini, F., M. Pinosa, S. Bovolenta and M. Valentinotti (1993) Effect of diets differing in energy level and forage concentrate ratio to measure the effect on milk production and composition. *Nutr. Abst. and Rev.*, **63** (4):1942.

Malossini, F., M. Pinosa, M. Valentinotti and S. Bovolenta (1991) Effect of diets differing in energy level and forage concentrate ratio to measure the effect on milk production and composition. *Nutr. Abst. and Rev.*, **61** (1): 353.

Manual of Dairy Chemistry (1972) National Dairy Research Institute, Bangalore

Molokoedova, F. A. (1987) Rational methods of organizing the feeding of lactating cows. *Nutr. Abst. and Rev. (Series B)*, **57** (7): 3281.

Nadalyak, E. A., V. I. Agafonov and V. B. Reshetov (1987) Improved standards for high yielding cows. *Dairy Sci. Abst.*, **49** (10): 6157.

Nalsen, T., L. J. Bush and G. D. Adams (1988) Substituting wheat for corn in concentrate mixture for dairy cows on weight basis. *Dairy Sci. Abst.*, **50** (4): 2904.

Nielsen, N. I., N. C. Friggens, T. Larsen, J. B. Andersen, M. O. Nielsen and K. L. Ingvarsten (2006) Effect of change in diet energy density on feed intake, milk yield and metabolic parameters in dairy cows. *The animal consortium* **1**: 335-346.

NRC (1988) *Nutrient requirement of dairy Cattle* National academy of science, Washington, D.C.

Owen, F. W., D. W. Kellogg and W. T. Howard (1967) Effect of normal and high grain rations on utilization of nutrients for lactation. *J. of Dairy Sci.*, **50** (7): 1120-1125.

Patel, S. (1968) Effect of four different concentrates with same roughage source on the milk yield and fat percentage in surati buffaloes. *Nutr. Abst. and Rev.*, **61** (2): 753.

Paul, S. S., A. B. Mandal and N. N. Pathak (2002) Feeding standards for lactating riverine buffaloes in tropical conditions. *J. of Dairy research*. **69** (2):179-180.

Poole, D. A. (1986) Food intake, milk production and body-weight change of milking cows given complete diets to appetite. *Nutr. Abst. and Rev. (Series B)*, **56** (10): 5535.

Prasad, S. and O.S. Tomar (1997) Effect of postpartum plane of feeding on milk yield and composition of crossbreed dairy cows. *Indian J. of Dairy Sci.*, **50** (6):1997.

Reddy, D. N. and M. R. Reddy (1986) Effect of feeding of complete feeds on nutrient utilization and milk production in cross-bred cows. *Nutr. Abst. and Rev. (Series B)*, **56** (1): 292.

Ruhle, R., H. Spiekers, V. Potthast and E. Pfeffer (1993) Performance of dairy cows fed concentrate differing in their contents of easily fermentable carbohydrates. *Nutr. Abst. and Rev.*, **63** (1): 329.

Schuler, D. (1994) Effect of mixed feed with a high proportion of maize on milk yield and composition of dairy cows. *Nutr. Abst. and Rev.*, **64** (6): 2908.

Sharma, K., N. Dutta and U. Naulia (2006) Nutritional and socio-economic implications of feeding cereal straws supplemented with higher dietary level of de-oiled cakes to lactating buffaloes (*Bubalus bubalis*): an on-farm study. *Livestock Research for Rural Development*. **18**, Article 4. <http://www.lrrd.org/lrrd18/1/shar18004.htm>.

Sharma, M. C., C. Joshi and T. K. Sharkar (2003) Status of macro mineral in soil, fodder, and serum of kumaon hills. *Indian J. Anim. Sci.* 73:90-94

Simonov, G., A. P. Kalashnikov and M. Magomedov (1986) Effect of ration structure and balance on dairy cows. *Nutr. Abst. and Rev. (Series B)*, **56** (10): 5536.

Singh, K., Pradhan and D. S. Balaine (1976) Effect of various planes of nutrition on milk production in crossbred cows. Indian J. of Dairy Sci., **29**: P-264.

Snedecor, G. W. and W. G. Cochran (1994) Statistical methods, 8th Edition, Oxford and IBH publishing company, New Delhi.

Spain, J. N., M. D. Alvarado, C. E. Polen, C. N. Miller and M.L. Mcgilliard (1990) Effect of protein and energy on milk composition in mid lactation dairy cows. Dairy Sci. Abst., **52** (10): 7018.

Spikers, J. N., A. M. Klunter and Pfeffer (1991) Effect of different concentrate levels on milk yield and feed intake, in dairy cows Nutr. Abst. and Rev., **61** (9): 4637.

Talpatra, S. K., S. N. Ray and K. C. Sen (1940) The analysis of mineral constituents in biological material. Part I estimation of phosphorus, Calcium, Magnesium, Sodium and Potassium in feed stuffs. Indian J. Vet. Sci. Anim. Husb. **10**:243.

Upadhyay, S. K. and Kavita Sharma (2007) Effect of balanced feed on the performance of milch cows– A comparative study. International tropical animal nutrition conference **Vol II**: 14.

Uremovic, M., Z. Uremovic and I. Katalinic (1994) Effect of dietary energy content on performance of high yielding cows. Nutr. Abst. and Rev., **64** (6): 2909.

Wojtasik, J., J. Matras, T. Soroka and S. Wojcik (1995). Effect of feeding dairy cow diets with different level of protein and energy. Nutr. Abst. and Rev., **65** (12): 6155.



Appendix

Appendix - 1

Details of experimental animals used in various groups.

Sr. No.	Name of cow	Breed	Average milk yield (litre)	Lactation stage (days)	Lactation No.
Group I					
1.	Panjab	Murrah	6.50	180	5
2.	Lally	Murrah	6.20	175	2
3.	Kochari 1	Murrah	7.60	150	1
4.	Diwani	Murrah	6.20	155	2
5.	Patri	Murrah	7.00	105	2
6.	Pardi 1	Murrah	6.00	175	2
7.	Kochari 2	Murrah	5.00	110	4
8.	Pardi 2	Murrah	6.40	165	4
9.	Gujar	Murrah	6.80	145	3
10.	Chakari	Murrah	6.50	110	2
Average			6.42	147	2.7
Group II					
1.	Pinty	Murrah	6.30	145	4
2.	Patri 1	Murrah	7.00	157	3
3.	Panjab 1	Murrah	7.80	165	3
4.	Panjab 2	Murrah	8.00	175	1
5.	19716	Murrah	7.40	165	5
6.	lally	Murrah	5.20	110	4
7.	Pardi	Murrah	6.00	105	3
8.	Khandi	Murrah	6.80	155	4
9.	Kochari	Murrah	5.20	175	2
10.	Patri 2	Murrah	5.00	115	1
Average			6.47	146.7	3

Appendix 2 Fortnightly average total dry matter intakes (kg) of buffaloes from different groups

Group I							
Fortnight	1	2	3	4	5	6	Average
Panjab	14.32	13.98	14.56	13.5	12.38	13.62	13.73
Lally	13.98	14.25	14.36	15.35	13.55	15.28	14.46
Kochari 1	13.56	13.95	14.15	15.2	12.95	12.82	13.77
Diwani	14.18	13.86	14.56	12.86	14.25	15.08	14.13
Patri	14.58	14.43	14.38	15.78	13.28	14.86	14.55
Pardi 1	14.42	14.50	14.64	13.25	15.27	14.5	14.43
Kochari 2	12.56	12.88	13.32	12.98	14.53	13.38	13.28
Pardi 2	13.76	13.56	14.22	13.18	12.88	12.53	13.36
Gujar	14.36	14.68	14.72	13.95	15.65	13.88	14.54
Chakari	14.86	15.18	14.82	15.35	13.28	13.45	14.49
Average	14.06	14.13	14.37	14.14	13.80	13.94	14.07
Group II							
Fortnight	1	2	3	4	5	6	Average
Pinty	14.58	13.92	14.58	15.38	15.35	14.35	14.69
Patri 1	14.32	14.22	14.36	13.05	13.19	13.75	13.82
Panjab 1	13.20	13.08	13.88	15.58	14.35	15.38	14.25
Panjab 2	14.52	14.18	14.15	12.89	14.75	15.98	14.41
19716	15.05	14.86	14.88	15.95	14.25	15.35	15.06
lally	14.25	14.18	14.30	14.38	15.78	14.55	14.57
Pardi	14.40	14.28	14.18	15.98	14.2	14.18	14.54
Khandi	13.56	13.24	13.12	12.35	14.86	14.38	13.59
Kochari	15.18	14.98	14.86	13.72	14.28	13.16	14.36
Patri 2	13.72	13.56	13.24	15.58	14.39	14.12	14.10
Average	14.28	14.05	14.16	14.49	14.54	14.52	14.34

Appendix – 3 Fortnightly average total milk yield (kg) of buffaloes from different groups

Group I							
Fortnight	1	2	3	4	5	6	Average
Panjab	6.40	6.60	6.20	6.50	6.35	5.80	6.31
Lally	6.30	6.10	6.00	6.25	5.80	5.70	6.03
Kochari 1	7.40	7.50	7.20	7.05	6.90	6.80	7.14
Diwani	6.20	6.30	6.00	6.20	5.80	5.80	6.05
Patri	6.80	6.90	6.80	7.20	6.75	6.50	6.83
Pardi 1	5.60	5.90	5.80	6.15	5.95	5.80	5.87
Kochari 2	5.20	4.90	6.20	5.55	5.40	5.25	5.42
Pardi 2	6.50	6.30	6.40	6.15	6.05	5.95	6.23
Gujar	6.60	6.65	6.70	6.80	6.60	6.25	6.60
Chakari	6.20	6.35	6.40	6.15	5.90	5.50	6.08
Average	6.32	6.35	6.37	6.40	6.15	5.94	6.26
Group II							
Fortnight	1	2	3	4	5	6	Average
Pinty	6.45	6.80	6.50	7.20	7.40	7.60	6.99
Patri 1	7.20	7.10	7.00	7.50	7.60	7.80	7.37
Panjab 1	7.70	7.60	7.60	7.82	7.90	7.95	7.76
Panjab 2	7.85	7.70	7.65	7.95	8.25	8.20	7.93
19716	7.50	7.60	7.40	7.80	7.90	8.10	7.72
lally	5.40	5.80	5.60	6.40	6.80	7.20	6.20
Pardi	6.20	6.80	6.80	7.40	7.60	7.50	7.05
Khandi	7.10	7.00	7.10	7.30	7.62	7.80	7.32
Kochari	5.10	5.40	5.30	5.80	6.50	6.80	5.82
Patri 2	5.20	5.30	5.25	5.70	6.15	6.50	5.68
Average	6.57	6.71	6.62	7.09	7.37	7.55	6.99

Appendix - 4 Fortnightly average milk protein (%) of buffaloes from different groups

Group I							
Fortnight	1	2	3	4	5	6	Average
Panjab	4.66	4.56	4.62	4.56	4.35	4.60	4.56
Lally	4.70	4.73	4.68	4.62	4.28	4.58	4.60
Kochari 1	4.69	3.63	3.43	3.68	3.32	4.15	3.82
Diwani	4.09	4.28	4.21	4.02	3.85	4.28	4.12
Patri	3.21	4.61	3.86	3.38	3.86	4.09	3.84
Pardi 1	3.87	4.47	4.18	4.2	4.58	4.28	4.26
Kochari 2	4.58	3.51	3.21	3.92	4.26	4.20	3.95
Pardi 2	4.58	4.42	4.32	4.58	4.44	4.32	4.44
Gujar	3.89	4.05	3.98	4.15	4.35	4.60	4.17
Chakari	4.52	4.63	4.23	4.52	4.56	4.38	4.47
Average	4.28	4.29	4.07	4.16	4.19	4.35	4.22
Group II							
Fortnight	1	2	3	4	5	6	Average
Pinty	4.73	4.66	4.72	4.75	4.82	4.72	4.73
Patri 1	4.68	4.67	4.78	4.85	4.65	4.69	4.72
Panjab 1	4.39	3.92	4.53	4.72	4.53	4.68	4.46
Panjab 2	4.42	3.90	4.26	4.36	4.5	4.86	4.38
19716	3.59	3.83	4.05	4.18	4.38	4.58	4.10
lally	3.14	3.02	3.98	4.1	4.42	4.62	3.88
Pardi	4.23	4.40	4.38	4.4	4.62	4.74	4.46
Khandi	3.54	4.40	4.42	4.54	4.32	4.52	4.29
Kochari	3.71	4.56	4.84	4.72	4.68	4.32	4.47
Patri 2	4.33	3.71	4.25	4.32	4.72	4.42	4.29
Average	4.08	4.11	4.42	4.49	4.56	4.62	4.38

Appendix -5 Fortnightly average of milk fat (%) of buffaloes from different group.

Group I							
Fortnight	1	2	3	4	5	6	Average
Panjab	8.20	7.81	7.98	8.42	8.18	7.94	8.09
Lally	9.38	9.22	9.45	8.95	8.52	8.28	8.97
Kochari 1	9.04	9.42	9.14	8.83	9.1	8.92	9.08
Diwani	8.32	7.82	7.46	7.68	7.38	7.28	7.66
Patri	5.98	9.50	6.26	6.80	7.18	7.38	7.18
Pardi 1	5.40	4.03	5.15	6.95	6.75	6.25	5.76
Kochari 2	8.02	8.76	8.42	8.66	8.12	8.18	8.36
Pardi 2	8.86	8.56	8.14	8.25	7.32	7.86	8.17
Gujar	8.27	8.65	8.22	8.74	8.32	8.19	8.40
Chakari	7.98	7.59	7.34	8.43	7.68	7.92	7.82
Average	7.95	8.14	7.76	8.17	7.86	7.82	7.95
Group II							
Fortnight	1	2	3	4	5	6	Average
Pinty	10.40	10.30	10.20	10.15	9.80	10.30	10.19
Patri 1	9.62	9.64	9.66	9.65	9.25	9.85	9.61
Panjab 1	7.70	9.79	9.42	9.82	9.75	9.95	9.41
Panjab 2	8.15	9.74	9.54	9.64	9.72	9.87	9.44
19716	6.35	6.68	7.14	7.45	7.85	8.25	7.29
lally	7.39	8.64	8.68	8.75	8.72	8.89	8.51
Pardi	6.98	8.58	8.92	9.21	9.35	9.50	8.76
Khandi	9.29	9.54	9.23	9.52	9.32	9.68	9.43
Kochari	7.71	8.71	8.52	8.75	8.95	9.50	8.69
Patri 2	7.43	8.33	8.58	8.65	8.57	9.60	8.53
Average	8.10	9.00	8.99	9.16	9.13	9.54	8.99

Appendix- 6 Fortnightly average milk total solids (%) of buffaloes from different groups

Group I							
Fortnight	1	2	3	4	5	6	Average
Panjab	20.30	19.51	19.78	20.32	19.38	19.64	19.82
Lally	21.58	21.22	21.05	21.05	20.02	20.08	20.83
Kochari 1	21.04	19.22	18.98	18.77	19.30	19.42	19.46
Diwani	19.02	19.02	18.46	18.98	17.88	17.48	18.47
Patri	15.07	21.30	17.66	19.00	16.98	18.58	18.10
Pardi 1	15.80	15.53	16.35	17.75	17.35	17.15	16.66
Kochari 2	19.72	18.35	17.84	18.64	18.04	18.38	18.50
Pardi 2	20.56	20.36	19.44	20.05	18.62	18.96	19.67
Gujar	18.67	19.15	18.42	19.54	18.17	18.49	18.74
Chakari	19.78	19.49	19.04	20.43	19.48	19.12	19.56
Average	19.15	19.32	18.70	19.45	18.52	18.73	18.97
Group II							
Fortnight	1	2	3	4	5	6	Average
Pinty	22.40	22.90	22.70	22.45	22.60	22.40	22.58
Patri 1	21.52	21.54	21.86	21.45	21.55	21.05	21.50
Panjab 1	19.10	20.19	20.62	21.42	21.15	20.45	20.49
Panjab 2	19.55	20.04	20.74	22.04	20.52	21.67	20.76
19716	15.91	16.98	17.64	18.65	18.55	18.03	17.63
lally	16.38	17.44	17.66	17.99	17.51	18.01	17.50
Pardi	18.08	19.98	20.22	20.41	20.65	20.30	19.94
Khandi	19.22	20.94	20.83	21.62	19.72	20.38	20.45
Kochari	17.71	20.41	20.12	20.55	19.55	20.70	19.84
Patri 2	19.93	18.33	20.78	21.25	19.37	21.90	20.26
Average	18.98	19.88	20.32	20.78	20.12	20.49	20.09

Appendix- 7 Fortnightly average milk SNF (%) of buffaloes from different groups

Group I							
Fortnight	1	2	3	4	5	6	Average
Panjab	12.10	11.70	11.80	11.90	11.20	11.70	11.73
Lally	12.20	12.00	11.60	12.10	11.50	11.80	11.87
Kochari 1	12.00	9.80	9.84	9.94	10.20	10.50	10.38
Diwani	10.70	11.20	11.00	11.30	10.50	10.20	10.82
Patri	9.09	11.80	11.40	12.20	9.80	11.20	10.92
Pardi 1	10.40	11.50	11.20	10.80	10.60	10.90	10.90
Kochari 2	11.70	9.59	9.42	9.98	9.92	10.20	10.14
Pardi 2	11.70	11.80	11.30	11.80	11.30	11.10	11.50
Gujar	10.40	10.50	10.20	10.80	9.85	10.30	10.34
Chakari	11.80	11.90	11.70	12.00	11.80	11.20	11.73
Average	11.21	11.18	10.95	11.28	10.67	10.91	11.03
Group II							
Fortnight	1	2	3	4	5	6	Average
Pinty	12.00	12.60	12.50	12.30	12.80	12.10	12.38
Patri 1	11.90	11.90	12.20	11.80	12.30	11.20	11.88
Panjab 1	11.40	10.40	11.20	11.60	11.40	10.50	11.08
Panjab 2	11.40	10.30	11.20	12.40	10.80	11.80	11.32
19716	9.56	10.30	10.50	11.20	10.70	9.78	10.34
lally	8.99	8.80	8.98	9.24	8.79	9.12	8.99
Pardi	11.10	11.40	11.30	11.20	11.30	10.80	11.18
Khandi	9.93	11.40	11.60	12.10	10.40	10.70	11.02
Kochari	10.00	11.70	11.60	11.80	10.60	11.20	11.15
Patri 2	12.50	10.00	12.20	12.60	10.80	12.30	11.73
Average	10.88	10.88	11.33	11.62	10.99	10.95	11.11

Appendix-8 Fortnightly average milk specific gravity of buffaloes from different group

Group I							
Fortnight	1	2	3	4	5	6	Average
Panjab	1.0383	1.0389	1.0385	1.0387	1.0374	1.0368	1.0381
Lally	1.0389	1.0390	1.0387	1.0378	1.0328	1.0352	1.0371
Kochari 1	1.0388	1.0298	1.0314	1.0368	1.0358	1.0318	1.0341
Diwani	1.0327	1.0367	1.0374	1.0384	1.0368	1.0346	1.0361
Patri	1.0299	1.0378	1.0364	1.0354	1.0342	1.0332	1.0345
Pardi 1	1.0338	1.0374	1.0356	1.0359	1.0347	1.0316	1.0348
Kochari 2	1.0369	1.0296	1.0306	1.0312	1.0342	1.0369	1.0332
Pardi 2	1.0381	1.0371	1.0363	1.0386	1.0398	1.0384	1.0381
Gujar	1.0331	1.0322	1.0318	1.0342	1.0405	1.0398	1.0353
Chakari	1.0392	1.0398	1.0386	1.0328	1.0354	1.0357	1.0369
Average	1.0360	1.0358	1.0355	1.0360	1.0362	1.0354	1.0358
Group II							
Fortnight	1	2	3	4	5	6	Average
Pinty	1.0378	1.0403	1.0386	1.0398	1.0392	1.0405	1.0394
Patri 1	1.0381	1.0381	1.0383	1.0378	1.0388	1.0358	1.0378
Panjab 1	1.0392	1.0318	1.0402	1.0382	1.0372	1.0354	1.0370
Panjab 2	1.0375	1.0317	1.0398	1.0413	1.0403	1.0387	1.0382
19716	1.0360	1.0343	1.0356	1.0328	1.0365	1.0316	1.0345
lally	1.0300	1.0304	1.0318	1.0310	1.0328	1.0342	1.0317
Pardi	1.0371	1.0369	1.0376	1.0396	1.0386	1.0375	1.0379
Khandi	1.0293	1.0363	1.0358	1.0312	1.0340	1.0386	1.0342
Kochari	1.0322	1.0380	1.0394	1.0332	1.0402	1.0384	1.0369
Patri 2	1.0423	1.0316	1.0406	1.0341	1.0374	1.0368	1.0371
Average	1.0360	1.0349	1.0378	1.0359	1.0375	1.0368	1.0364

Vita

VITA

Dr. Rajkumar Arjun patil was born on 19th December 1984 in Balkum, Thane Dist. of Maharashtra. He finished his lower education at Thane Dist. from Ganesh Vidya Mandir high school and secured 64.56%. For studies in science, he took admission in Hindi Junior college of science in Kalyan and passed with 60.00 % in H.S.C. from Mumbai Board. He joined Bombay Veterinary College on 2 Aug. 2002. In 2007, he completed his graduation (B.V.Sc. & A.H.) with first class from same college. Then he forwarded his steps towards M.V.Sc. (Animal Nutrition) in Bombay Veterinary College. He successfully completed his M.V.Sc. course work with first class.

Two fruitful years resulted in the submission of present thesis successfully. As part of his training in Department of Animal Nutrition, he assisted various research works. He actively participated in N.S.S. camp. He has good knowledge of computer & Internet.

He considered him lucky to have gained the love and respect of his superiors and entire staff of the department.

