Journal of Entomology and Zoology Studies
Available online at www.entomoljournal.com
JEZS Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2018; 6(1): 1427-1430

Received: 14-11-2017
Accepted: 15-12-2017

Nadar Khan
Department of Animal Nutrition, Dean, Faculty of Animal Husbandry and Veterinary Sciences, Pakistan

Shoaib Sultan
Department of Animal Nutrition, Dean, Faculty of Animal Husbandry and Veterinary Sciences, Pakistan

Altaf-UR-Rehman
Department of Animal Nutrition, Dean, Faculty of Animal Husbandry and Veterinary Sciences, Pakistan

Tariq Ahmad
Department of Animal Nutrition, Dean, Faculty of Animal Husbandry and Veterinary Sciences, Pakistan

M Saqib
Department of Animal Nutrition, Dean, Faculty of Animal Husbandry and Veterinary Sciences, Pakistan

M Subhan Qureshi
Ex-Dean Department of Livestock Management Breeding and Genetics. The University of Agriculture Peshawar, Khyber Pakhtunkhwa, Pakistan

Muhammad Islam
Department of Agronomy, The University of Agriculture Peshawar, Pakistan

Correspondence
Nadar Khan
Department of Animal Nutrition, Dean, Faculty of Animal Husbandry and Veterinary Sciences, Pakistan

Effect of variable dietary energy level on dry matter intake, milk production and milk composition of early lactating Friesian cows

Nadar Khan, Shoaib Sultan, Altaf-ur-rehman, Tariq Ahmad, M Saqib, M Subhan Qureshi and Muhammad Islam

Abstract
The aim of the study was to evaluate the effect of three different dietary energy levels on dry matter intake, milk production and composition of early lactating Friesian cows at University dairy farm Peshawar. Nine multiparous early lactating (10±5days in milk) cows were selected and divided into three groups with three animals in each group with three dietary energy levels, (E-100%), (E-88%) and (E-112%); respectively. High DMI ($P<0.05$) was recorded for diet E-112 (13.78±0.17kg/day) followed by diet E-100 (13.14±0.12kg/day). Significantly high milk yield (14.80±0.10lit/day) was observed in diet E-112 and lower milk yield (13.01±0.10kg/day) for diet (E-88%). High milk fats (3.91±0.02%) were found at low energy diet and no statistical difference found among other composition of milk. It was concluded that diets containing high dietary energy above than the recommended ME level by NRC for early lactating cows can increase DMI and milk yield under local environment of Peshawar.

Keywords: dietary energy, DMI, milk production, milk composition

1. Introduction

During early lactation, the dietary energy requirements of high yielding dairy cows for maintenance and milk production exceed the amount of energy obtained from dietary sources. Thus, the high energy requirement at the onset of lactation results in a negative energy balance (NEB) that begins a few days pre-partum and usually reaches its maximum two weeks post-partum [4]. Traditional system of raising animals either by grazing or by providing poor quality roughages with or without any supplementation is not satisfactory to meet the nutrient requirement of high milk producing animals particularly energy, protein and minerals [27]. In nutritional needs of dairy animals postpartum, energy is one of most critical nutrients which may affect production performance. Earlier studies [9] and [8] reported that sufficient dietary energy is an important factor in high lactating animals which may prevent negative energy balance and other metabolic disorders. Increase in milk yield of dairy cows that results from their genetic improvement requires the use of large amounts of concentrates: forage ratios that are rich in energy and crude protein (CP) to meet their nutrient requirements [7]. Dairy feed in terms of both availability and nutritive value is the most important constraint affecting productivity of dairy cows [2].

Lactating animals fed low energy diet may able to produce equal quantity of milk than diets at or above NRC recommendations, but decline rapidly after few weeks of lactation [11]. In Pakistan, dairy cows are mostly fed on low quality roughages and crop residues, which are poor in energy, protein, minerals and vitamin contents [18]. Keeping in view that the availability of common feed sources is seasonal and is mostly of poor quality to support high milk production of high yielding animals. Milk composition of cow is very important for the dairy industry. Several nutritional management strategies have been proposed to increase energy intake during early lactation. Feeding high quality forages, an increase in dietary energy concentration of ration, increasing the concentrate: forage ratio, or adding supplemental fat to diets are some of the most common ways to improve energy intake in cows. On the basis of above facts the current study was designed to evaluate the effect of three different dietary energy levels on milk yield and composition of early lactating dairy cows.

2. Materials and Methods

Current study was conducted in the months of March to May 2013, For this study, nine early lactating multiparous Holstein Friesian cows (BW 400±10kg) were selected for the experiment from the University of Agriculture Peshawar Dairy Farm Malakandeer. The experimental animals were divided into three groups randomly (each group consists of three cows) named A, B & C under completely Randomized design. The animals were assigned to three dietary energy based treatments one was NRC recommended level (100 %) ME and diet B ME level (88%) and diet C high ME level (112%) DM basis were provided to their respective animals in a group. The total mix ration (TMR) diets were formulated as Iso-nitrogenous (CP 16%) having varying dietary energy levels. The diets were fed twice daily in the morning and evening to individual animals and the feed refused were measured next morning to determine daily feed intake expressed in (DMI), the experiment was last for seventy-four days (74) including adaptation period. Feed intake of each animal was individually recorded daily; DMI [8] was calculated as percent dry matter in feed consumed multiplied by feed consumed for all the experimental groups. Milk production was recorded daily and milk samples were collected weekly for milk composition. Milk sample (100 ml) was taken from each cow for determination of Milk fats (%), solids not fat (SNF), Milk protein and lactose (%) contents with the help of Lactoscane (auto analyzer machine) at Center of Animal Nutrition, Livestock Research and Dairy development (LR&D) Peshawar, Khyber Pakhtunkhwa. Concentrates and berseem samples were analyzed for proximate composition, NDF, ADF and *In vitro* digestibility at laboratory of Animal Nutrition University of Agriculture Peshawar before the start of experiment and during provision to the dairy cows. Proximate analyses of feed samples were done according to Association of Official Analytical Chemists [3] while NDF and ADF were performed according to [33] in the Laboratory of Animal Nutrition given in Table 1.1. Digestible nutrients and ME were calculated by the following formulas after determination of TDN value of the feed sample.

DE (Mcal / kg DM) = TDN% × 0.04409
ME (Mcal / kg DM) = (1.01 × DE)-0.45.

Statistical Data analyses

Data were analyzed by using the GLM procedure (Proc GLM; SAS®, Version 8.02; SAS Institute Inc., Cary, NC) as described by [31]. Effects of factors were declared significant at P<0.05. The model given below was adopted to study the effect.

$$Yij = \mu + \tau_i + \varepsilon_{ij}$$

Where
Yij = The i-th observation on j-th animal
μ = over all sample mean,
τ_i = Effect of i-th treatment (energy level)
ε_{ij} = treatment error

3. Results

The effect of different dietary energy levels on Dry matter intake, Milk production and milk composition in early lactating Holstein Friesian cows are given in Table 1.2. Mean dry matter intake of the dairy cows was increased significantly with increasing energy concentration in the diet (p<0.05). High DMI (13.78 kg/day) was observed for high energy diet C (112%) followed by diet B- 100% (13.14) and A-88 (12.68 kg/day) showed in Table 4.1.

There was a significant difference (P<0.05) found for Milk yield between dietary treatments, high yield was recorded at Diet C (14.80±0.10 lit/day) followed by treatment A (14.06±0.15), respectively, while low milk yield was observed (13.01±0.10 kg/day) for diet having less dietary energy than the recommended level of NRC. Dietary treatment has a significant effect on milk fats as high milk fats (3.91±0.021) percentage was found at low energy dietary treatment B followed by A (3.75±01) and C (3.58±0.03), whereas no statistical difference P>0.05 were observed in between treatments for rest of milk composition. Although milk protein (3.55±0.07) and milk lactose (4.77±0.03) were found numerically high at diet C. The level of solid not fat were not significantly different >0.05, in between treatments.

4. Discussion

In postpartum dairy cows optimum performance in term of dry matter intake and Milk yield was achieved in the diet which is having high energy than the NRC recommended level for dairy cows. This study confirms that the NRC recommendations for dairy cows are not suitable for early lactating cows in environment of Pakistan, therefore further it need an extra energy in diet for early lactating cows above NRC recommended levels ME (112%) to attain high milk yield/animal and DMI after postpartum. Reason for that might be due to the difference in animal physiological status, breed of animal, dietary ingredients and its nutritive composition, Available feed, environmental changes and other manage mental practices.

Varying dietary energy levels significantly influenced (P<0.05) DM intake and milk yield in early postpartum cows. The results of the present study are in line with findings of Vazquez-Anon *et al*. (1997) who reported that increasing dietary energy density in ration improved DM intake of dairy animals. In agreement to our results [25] reported a greater DMI (11.30 kg/day) for high energy diet (1.70Mcal NEL/kg) while 10.5 kg/day for low energy diet (1.58 Mcal NEL/kg). [16] Stated that DMI was slightly increased (4.84, 4.90, 4.93 kg/day) in Sahiwal heifers fed with different energy diet (80, 100 and 120% ME) in tropical environment. While, diet low in energy (E-80) is a detrimental effect on dairy cows' milk production that decreased quickly. There was a significant difference (P<0.05) found for Milk yield between dietary treatments, high yield was recorded at Diet C (14.80±0.10 lit/day) followed by treatment A and B respectively. Current finding of the study are supported by some researcher works like [16, 28, 23, 32, 24, 10]. reported that high energy diet significantly increased milk yield than low ME diet in post partum cows [17]. also observed similar results that cows which were on high-energy group produced slightly more milk than the low energy diet.

Current study was really in line with [16] observed that the contents of milk protein, lactose, solids not fat and total solids were not influenced (P>0.05) by varying dietary energy levels in lactating Nili-Ravi buffaloes followed by the findings of [1] who concluded that enriched dietary energy and protein, with varying milking frequency did not affect milk protein percent. Likewise [17], also found that milk composition was not affected by feeding an energy-rich diet (added dietary fat) to Holstein cows. This study was supported by the data of [30] and [26] where he found no significant differences regarding milk protein content between different types of diets and feeding period [13]. Found little increase in milk protein concentration with increasing dietary energy intake but not statistically significant (P>0.05) among the treatments. Milk protein reflects the balance of dietary protein and energy intake [29, 7]. Suggested that milk protein can be used as an indicator for energy intake, because it responds to the energy supply level of the dairy cows up to some extent. However, [34] who studied the effect of high energy diet during mid to late lactation enhanced milk protein yield. This may be due to difference in lactation stage and the proportion of protein in the diet.

Table 1.1: Ingredients and nutrient composition of experimental ration

Ingredients	A- (100 %)	B-(88 %)	C-(112%)
Cotton Seed Cake	06	12	04
Maize oil cake	04	04	11.2
Wheat Bran	18	18	7.2
Maize Glutton (20%)	04	3.2	08
Maize grain	04	00	06
Mustard seed cake	3.2	02	2.8
Di-Calcium Phosphate	0.8	0.8	0.8
Berseem	40	40	40
Wheat Straw	20	20	20
Total	100	100	100
CP%	15.99	16.02	16.01
ME M-cal/kg	2.50	2.10	2.90
NDF %	46	49	41
ADF	26	21	29

Table 1.2: Effect of different dietary energy levels on dry matter intake, milk production and composition of early lactating Holstein Friesian cows.

Description	A (100 %)	B (88 %)	C (112%)
DM intake (kg/day)	$13.14^b \pm 0.12$	$12.68^c \pm 0.11$	$13.78^a \pm 0.17$
Milk yield(kg/day)	$14.06^b \pm 0.15$	$13.01^c \pm 0.01$	$14.80^a \pm 0.10$
Body weight ± (Kg)	7.00 ± 1.73^b	23.00 ± 0.57^a	-9.00 ± 0.57^c
Milk Composition (%) Fats	$3.75^b \pm 0.01$	$3.91^a \pm 0.02$	$3.58^c \pm 0.03$
Protein	3.52±0.04	3.51±0.01	3.55±0.13
Lactose	4.75±0.02	$4.73^a \pm 0.11$	4.77±0.01
Total Solid	12.71±0.07	12.80±0.14	12.57±0.17
Solid not fats	8.93±0.12	8.96±0.15	8.99±0.11

Values having different superscripts within same row are significantly different (P<0.05)

5. Conclusion

After postpartum optimum performance in term of dry matter intake and Milk yield was achieved at diet having high dietary energy (112%) for early lactating Holstein Friesian cows than the NRC recommended level. The reason for that may be the difference in animals' physiological status, breed of dairy animal, dietary ingredients and its nutritive composition, environmental changes and other management practices. By providing high energy diet in dense form can reduce risk of negative energy balance and other nutritional factors. It will ultimately improve animal health and production and economy of the poor farmers.

6. Acknowledgement

I really acknowledge the laboratory staff of animal nutrition, and staff of University dairy farm Peshawar. Thanks to Higher education Pakistan for their financial support during my M.Sc. (Hons) studies.

7. References

1. Aghaziarati N, Amanlou H, Zahmatkesh D, Mahjoubi E, Yazdi MH. Enriched dietary energy and protein with more frequent milking offers early lactation cows a greater productive potential. Livestock Sci. 2011; 136(2):108-113.
2. Association of Official Analytical Chemists. Official Methods of Analysis, 17th edition. AOAC, Arlington, Virginia, USA, 2000.
3. Azage Tegegne, Alemu Gebrewold. Prospects for Peri-urban Dairy Development in Ethiopia. In: Proceedings of 5th national Conference of Ethiopian Society of Animal Production, 15-17 May 1997, Addis Ababa, Ethiopia, 1998, 248.
4. Bell AW. Regulation of organic nutrient metabolism during transition from late pregnancy to early lactation. J. Anim. Sci. 1995; 73:2804-2819.
5. Broderick GA. Effect of varying dietary protein and energy levels on production of lactating dairy cows. J. Dairy Sci. 2003; 86:1370-1381.
6. Collomb M, Butikofer U, Sieber R, Jeangros B, Bosset JO. Correlation between fatty acids in cow's milk fat produced in the Lowlands, Mountains and Highlands of Switzerland and botanical composition of the fodder. Int. Dairy J. 2002b; 12:661-666.
7. Coulon JB, Remand B. Variations in milk output and milk protein content in response to the level of energy supply to the dairy cow: A review. Levst. Prod. Sci. 1991; 29(1):31-47.
8. Gong JG, Lee WJ, Garnsworthy PC, Webb R. Effect of dietary induced increases in circulating insulin concentrations during the early postpartum period on reproductive function in dairy cows. Reprod. 2002; 123:419-427.
9. Grummer RR, Hoffman FPC, Luck ML, Bertics SJ. Effect of prepartum and postpartum dietary energy on growth and lactation of primiparouscows. J. Dairy Sci. 1998; 78:172-80.
10. Grummer RR, Hoffman FPC, Luck ML, Bertics SJ. Effect of pre- partum and postpartum dietary energy on growth and lactation of primiparous cows. J. Dairy Sci.

1995; 78:172-180.
11. Hoogendoorn AL, Grieve CM. Effect of varying energy or roughage in rations for lactating dairy cows on feed intake and milk production. J. Dairy Sci. 1970; 48:1028-1033.
12. Hwang SY, Lee MJ, Chiou WS. Monitoring nutritional status of dairy cows in Taiwan using milk protein and milk urea nitrogen. Asian-Aust. J. Anim. Sci. 2000; 13(12):1667-1673.
13. Jabbar MA, Hussain M, Pasha TN. Effect of different dietary energy levels on growth and onset of sexual maturity in Sahiwal heifers. 21st Annual Report. Livestock Production Research Institute, Bahadurnagar, Okara, Pakistan. 2000, 76-77.
14. Jabbar MA, Pasha TN, Jabbar L, Khanum SA. Effect of different dietaryenergy levels on growth rate and age at sexual maturity in growing buffaloheifers. Pakistan J. Zool. Suppl. 2009; (9):397-400.
15. Jabbar Fiaz M, Iqbal T, Abdullah M, Marghazani IB. Effect of different dietary energy levels on milk production in lactating nili-ravi buffaloes M. A. The Journal of Animal and Plant Sciences. 2013; 23(1):13-16. ISSN: 1018-7081.
16. Kamoragiri MVS, Casper DP, Erdman RA. Factors affecting tissue mobilization in early lactation dairy cows. 2. Effect of dietary fat on mobilization of body fat and protein. J. Dairy Sci. 1998; 81:169-175.
17. Khanum SA, Yaqoob T, Sadaf S, Hussain M, Jabbar MA, Hussain HN *et al*. Nutritional evaluation of various feedstuffs for livestock production using *in vitro* gas method Pakistan vet. J 2007; 27(3):129-133.
18. LeBlanc S. Monitoring metabolic health of dairy cattle in the transition period. Journal of Reproduction and Development. 2010; 56:S29-35.
19. Khan MAA, Islam MN, Khan MAS, Akbar MA. Effects of Feeding High and Low Energy Levels during Late Pregnancy on Performance of Crossbred Dairy Cows and Their Calves Asian-Aust. J Anim. Sci. 2004; 17(7):947-953.
20. Khan MA, Iqbal Z, Sarwar M, Nisa M, Khan MS, Lee WS *et al*. Urea Treated Corncobs Ensiled with or without Additives for Buffaloes: Ruminal Characteristics, Digestibility and Nitrogen Metabolism Asian-Aust. J. Anim. Sci. 2006; 19(5):705-712.
21. National Research Council. Nutrient Requirements of Dairy Cattle, 7th revised ed. National Academic Science, Washington, DC, USA, 2001.
22. Nishany KBM, Ramachandra S, Kumara Mahipala MBP, Jayawardane VP, Wijayagunawardane MPB. Influence of Energy Balance on Reproductive Performance and Milk Production of Dairy Cows at Pre-partum and Early Lactation Periods. International Journal of Animal and Veterinary Advances. 2013; 5(3):98-102.
23. Patton J, Kenny DA, Mee JF, O'mara FP, Wathes DC, Cook M *et al*. Effect of milking frequency and diet on milk production, energy balance and reproduction in dairy cows. J. Dairy Sci. 2006; 89:1478-87.
24. Rabelo E, Rezende RL, Bertics SJ, Grummer RR. Effects of transition diets varying in energy density on lactation performance and ruminal parameters of dairy cows. J. Dairy Sci. 2003; 86:916-925.
25. Roy B, Mehla RK, Sirohi SK. Influence of milk yield, parity, stage of lactation and body weight on urea and protein concentration in milk of Murrah Buffaloes. Asian-Aust. J. Anim. Sci. 2003; 16(9):1285-1290.
26. Safa S, Soleimani A, Heravi Moussavi A. Improving Productive and Reproductive Performance of Holstein Dairy Cows through Dry Period Management Asian Australas. J. Anim. Sci. 2013; 26(5):630-637.
27. SAS/STAT® User's Guide: Statistics, Version 8, SAS Inst., Inc., Cary, NC, 2000.
28. Sato H. Correlation between milk urea and plasma metabolites and milk fat and protein concentrations in dairy cows. Journal Japan Veterinary Medicine Association. 1998; 51(5):242-245.
29. Shahram Nozad, Ali-Gholi Ramin, Gholamali Moghadam, Siamak Asri-Rezaei, Azadeh Babapour, Sina Ramin. Relationship between blood urea, protein, creatinine, triglycerides and macro-mineral concentrations with the quality and quantity of milk in dairy Holstein cows Veterinary Research Forum. 2012; 3(1):55-59.
30. Steele RGD, Torrie JH. Principle and procedures of statistics. McGraw Hill Book. Co. Inc. New York, 1997.
31. Urdlet M, Gruber L, Schauer A, Maierhofer G, Häusler J, Steinwidder A. Einfluss der Energieversorgung vor undnach der Abkalbung auf die Stoffwechselsituation vonMilchkühen - Teilbereich Produktionsdaten. In: Forumangewandte Forschung in der Rinder-undSchweinefütterung. 2007, 10-13.
32. Vazquez-Anon M, Bertics SJ, Grummer RR. The effect of dietary energy source on during mid to late lactation on liver triglyceride and lactation performance of dairy cows. J Dairy Sci. 1997; 80:2504-2512. No. 7: 947-953.