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Original Research

Effect of Inclusion of De-oiled Palm Kernel Cake in the Concentrate Mixture on Body Condition Score, Milk Yield and Reproductive Performance in Lactating Murrah Buffaloes

Anil Kumar Chitithoti[1]*, Srinivas Kumar Dhulipalla[2], Kalyana Chakravarthi Matha[3], Raja Kishore Konka[4] and Venkata Seshaiah Ch.[5]

Livestock Farm Complex, NTR College of Veterinary Science, Gannavaram, Andhra Pradesh, INDIA

*Corresponding Author: anilmanas@gmail.com

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Abstract

A study was carried out to investigate the effect of inclusion of agro-industrial by product viz. de-oiled palm kernel cake (DPKC) in the concentrate mixture on body condition score, milk yield and reproductive performance in lactating Murrah buffaloes. Twelve lactating Murrah buffaloes in early lactation were randomly divided into two groups of six animals each (control and treatment) taking into consideration parity, stage of lactation, daily average milk yield. These two groups were fed diets containing green fodder ad lib and concentrate mixture containing de-oiled palm kernel cake (DPKC) at 0 % (T1- Control) and 15% (T2- Treatment) level. Results revealed that feeding DPKC at 15% level in the concentrate mixture had no effect (P>0.05) on DMI, DCP, BCS, milk yield, calving interval, service period and dry period as compared to the control. Thus, it can be concluded that DPKC can be included up to 15% in the concentrate diet of lactating buffaloes without any adverse effect on production and reproduction.

Keywords: Agro-industrial by-product, Body Condition Score, De-oiled Palm Kernel Cake, Milk Yield, Murrah Buffaloes, Reproductive Performance

Introduction

Body condition scoring is a tool that enables a visual assessment of the amount of fat and muscle covering the bones of the animal, regardless of body size. It is based on evaluation of the external appearance of the animal which interacts with its body fat reserves there by directly influences the energy balance. BCS evaluates the energy reserves of murrah buffaloes, representing the biological relationship between body fat, milk production and reproduction. This is an universally accepted, non-invasive, quick and inexpensive method to estimate the degree of fatness (Bittante *et al.*, 2004; Drame *et al.*, 1999). Body condition influences productivity, reproduction, health, and longevity of dairy cattle. Thinness or fatness can be a clue to underlying nutritional deficiencies, health problems, or improper herd management. Generally, the lactating buffaloes will be in negative energy balance during the early lactation. As the energy intake does not maintain speed with continuous increase milk yield, there will be a short fall in energy during early lactation. Thus, there will be an imbalance between milk yield, fertility and health status of the animal as all these traits are interlinked with energy. In order to meet the energy requirements, high plane of balanced nutrition is to be provided to milch buffaloes duly considering the cost economics of the feed.

In the last decade, there is a drastic increase in feed prices and severe shortage of several feed grains and protein plant supplements *viz.* corn, soybean meal *etc* which influenced the production performance of livestock sector in India. In preparing balanced feed, the nutritionists opt for cheaper feed resources that are readily available in the market. However, the cost of feeding buffaloes increases significantly, due to high prices of the feed ingredients used in concentrate mixture. Hence, they select the low-cost feed ingredients without compromising the nutritive value to meet the dietary requirements. One such feed ingredient is oil palm (*Elaeis guineensis Jacq*.), a by-product from palm industry.

Palm kernel by products have been used for feeding ruminants as less expensive source of protein and other digestible nutrients (Silva *et al.*, 2013). Of these by-products, palm kernel cake (PKC) has been found to be a good for feeding ruminants (Abdullah *et al.*, 1995). With a plan to appraise and decipher the impact of inclusion of PKC for milch buffaloes, this trial was conducted to evaluate the inclusion of PKC in concentrate feed as a substitute for cotton seed cake on BCS and furthermore to assess its impact on milk yield and reproduction performance.

Materials and Methods

The experiment was carried out at Livestock farm complex, NTR College of Veterinary Science, Gannavaram, Andhra Pradesh from December 2018 to September 2019. Twelve lactating Murrah buffaloes in early lactation were randomly divided into two groups of six animals each (control and treatment groups) taking into consideration parity, stage of lactation, daily average milk yield and butter fat content. Both, control (T_1) and treatment (T_2) group animals were offered ration comprising of Super Napier green fodder and concentrate mixture to meet the maintenance and production requirements (ICAR, 2013). A concentrate mixture with 20% CP is prepared by using conventional feed ingredients and used as control (T_1). In this concentrate mixture, de-oiled palm kernel cake (DPKC) is incorporated at 15 (T_2), percent level to study the effect of inclusion of DPKC in the concentrate mixture on the body condition score, milk yield and reproductive performance. Both the concentrate mixtures were made iso-nitrogenous. Concentrate mixture was offered twice daily at the time of milking and chopped Super Napier was offered *ad libitum*. Individual feeding was carried out daily at 9.00 AM and 3.00 PM twice daily. The animals were offered fresh clean drinking water during the entire experimental period

Table 1: Ingredient composition of concentrate mixtures fed to lactating buffaloes during the experiment

Ingredient	Control (T1)	Treatment (T2)
Maize	33	28
DORB	39	33
Cotton seed meal	25	21
De-oiled PKC	0	15
Mineral mixture	2	2
Salt	1	1
Total	100	100

Body Condition Score (BCS)

BCS systems have been developed earlier by many scientists like Jefferies (1961) using 0 to 5 scale in ewes, Lowman *et al.* (1976) using a 0 to 5 scale in beef cattle and Earle (1976) using eight grade system in dairy cows. Edmonson *et al.* (1989) developed a chart for body condition scoring of Holstein dairy cows on a 1 to 5 scale using 0.25 increments. Rao *et al.* (2002) and Anitha *et al.* (2007) have utilized this chart for scoring the crossbred dairy herd in India. In the present study, the body condition score of buffaloes were evaluated at the early, mid and late lactation period (10 months) using visual observation and palpation with the new chart for condition scoring in a 1 to 5 scale using 0.5 increments (Anitha *et al.*, 2011). Eight skeletal checkpoints were examined and merits within each area were used to indicate the body condition. The eight locations observed include tail head to pin bones (1), spinous processes of the lumbar vertebrae (2), depression between the spinous and transverse processes (3), transverse processes of lumbar vertebrae (4), point between 12^{th} and 13^{th} ribs (5), sacral crest (6), depression between sacral crest and hooks (7) and depression between hooks and pins (8).

Milk Yield

Animals were hand milked twice a day and the milk obtained from two times milking was combined together to get the actual milk yield of the buffaloes for that day. The data on daily milk yield was recorded for a duration of 10 months.

Reproductive Performance

The reproductive parameters were calculated from the data available in the farm records. The service period was calculated from the date of calving to date of successful service leading to conception. Calving interval was calculated as the gap between two subsequent calvings. The dry period was estimated from the date of dry off to calving.

Statistical Analysis

The data was analyzed statistically (Snedecor and Cochran, 1994) and tested for significance using independent t-test and ANOVA to estimate the equality of means using SPSS 24.0 version.

Results and Discussion

The ingredient composition of concentrate mixture is shown in Table 1. De-oiled palm kernel cake (DPKC) was incorporated in the concentrate mixture at 15% level in the treatment group substituting maize, DORB and cotton seed cake in the control group. Both the concentrate mixtures were made iso-nitrogenous. The average chemical composition of green fodder (Super Napier) and concentrate mixture fed to lactating Murrah buffaloes were presented in Table 2.

Table 2: Nutrient composition (% DM basis) of green fodder (super Napier) and concentrate mixtures

Nutrient	Green Fodder (Super Napier)	Concentrate mixture (Control)	Concentrate mixture (Treatment)
Dry Matter	23.16	93.82	94.04
Organic Matter	89.23	90.73	90.59
Crude Protein	11.91	20	20.01
Ether Extract	1.72	2.2	2.14
Crude Fibre	47.99	15.43	15.81
Nitrogen Free Extract	27.61	51.78	51.36
Total Ash	10.77	9.27	9.41
Silica	2.02	1.38	1.65

Values are on DMB except for CP

Plane of Nutrition

The total DM intake (kg/d) consumed by buffaloes from both roughage and concentrate (Table 3) was 14.2 and 13.8 in T_1 and T_2 groups, respectively. Inclusion of DPKC at 15% level in the concentrate mixture had no effect (P>0.05) on DMI (kg/d) as compared to the control and were comparable with the values recommended by ICAR (2013) standards. This indicates that the diets were palatable and that inclusion of DPKC at 15% in the concentrate mixture had not affected the palatability.

Table 3: Plane of nutrition in lactating buffaloes fed with and without DPKC in the concentrate mixture

Treatment	T1	T2	ICAR(2013)
Average Body Weight	570.83	581.5	550
$W^{0.75}$ kg	116.7	118.38	113.57
TDMI in kg	14.2	13.8	11.88
DMI as % body weight	2.51	2.38	2.16
DCP % in diet	7.28	7.72	-
DCP intake (kg)	1.03	1.07	0.96
TDN % in the diet	56.18	59.12	-
TDN intake (g)	7.98	8.16	7.94

Corroborating the present findings, Pimentel *et al*. (2015) reported that inclusion of PKC up to 15% level in the total DM had no effect (P>0.05) on DMI as compared to the control. Inclusion of DPKC at 15% in the concentrate mixture had no effect (P>0.05) on DCP and TDN contents expressed as % in the diet consumed or as kg/d as compared to the control reflecting the nutrient digestibility's observed in the present study. Similarly, several authors (Pimentel et al., 2018 and Silva et al., 2013) also reported no effect (P>0.05) on TDN intake in lactating cows upon feeding PKC in the diet. On the contrary, Cunha et al. (2013) reported the TDN intake expressed as kg/d or as g/kg LW decreased (P<0.01) linearly with inclusion of PKC at 0, 113, 228 and 342 g/kg DM in the diet of lactating cows.

Body Condition Score (BCS)

The effect of inclusion of DPKC in the concentrate mixture on body condition score of lactating buffaloes is presented in Table 4.

Table 4: BCS of lactating Murrah buffaloes fed diets with and without DPKC in the concentrate mixture at various stages of lactation

Group	n	Early Lactation	Mid Lactation	Late Lactation	Mean
Control*	6	$3.04^{a} \pm 0.05$	$3.38^{b} \pm 0.06$	$3.58^{c} \pm 0.06$	3.33 ± 0.06
Treatment*	6	$3.02^{a} \pm 0.06$	$3.33^{b} \pm 0.16$	$3.53^{c} \pm 0.12$	3.53 ± 0.12

**Mean values in the rows with different superscripts differ significantly (P<0.05)*

The present study revealed that the mean BCS in lactating buffaloes during the early, mid and late lactation was similar in control (T_1) and treatment (T2) groups indicating that inclusion of DPKC at 15% level in the concentrate mixture had no effect (P>0.05) on BCS of lactating buffaloes. The overall mean BCS values were 3.33 and 3.53 in control and treatment groups, respectively and are in the normal range of 3.0 - 3.5 as suggested by Anitha *et al.* (2011). Similarly, Iqbal *et al.* (2019) also reported that BCS was not affected (P>0.05) in lactating crossbred dairy cattle fed PKC at 0, 20 and 40% level in the concentrate diet. The continuous increase in BCS observed throughout the study period in both the groups could be attributed to higher plane of nutrition with feeds having high digestibility which met the nutrient requirements of the animals in all the stages of lactation. Further, the present findings indicated that BCS is positively correlated with dry matter intake in buffaloes. However, there was significant difference (P<0.05) in the BCS of lactating Murrah buffaloes in both the control and treatment groups during different stages of lactation.

Milk Yield

The effect of inclusion of DPKC in the concentrate mixture on productive and reproductive performance is presented in Table 5. The average daily milk yield were 7.86 and 7.96 kg/day in T_1 and T_2 groups, respectively. The study revealed that inclusion of inclusion of DPKC at 15% level in the concentrate mixture had no effect (P>0.05) on milk yield as compared to the control group. The present findings agree with Iqbal *et al.* (2019) who reported that increasing the level of palm kernel cake up to 40% level in the concentrate diet had no effect (P>0.05) on milk yield in lactating crossbred cattle. Similarly, several authors (Carvalho *et al*., 2006; Jin *et al.*, 2007; van Wyngaard *et al*., 2015) reported no effect (P>0.05) of feeding PKC in the diet on milk yield of lactating cattle. In contradiction, van Wyngaard and Meeske (2017) in grazing Jersey cows reported decreased (P<0.05) milk yield with increased levels of inclusion of PKC from 10 to 30% in the diet as compared to the control.

Table 5: Productive and reproductive performance of buffaloes fed with and without DPKC in the concentrate mixture during the experimental period

Parameters	Control	Treatment
Milk yield (Kg/d)	7.86±0.48	7.96±0.22
Calving Interval (d)	392.67±58.63	391.83±58.48
Service period (d)	40.0±5.55	45.38±4.92
Dry period (d)	62.17±7.36	56.33±4.12

Reproductive Performance

The study revealed that inclusion of inclusion of DPKC at 15% level in the concentrate mixture had no effect (P>0.05) on calving interval, service period and dry period as compared to the control group. Anitha *et al.* (2011) reported that a BCS of 3.5-3.99 in lactating buffaloes showed early resumption of ovarian activity, which is an indicator of good reproduction performance. No negative effect on reproductive parameters upon feeding agroindustrial byproduct like DPKC might be attributed to ideal post-partum managemental and feeding practices followed during the entire experimental period as evidenced from the BCS of lactating buffaloes in the present study.

Conclusion

Thus, it is concluded that de-oiled palm kernel cake (DPKC) can be included up to 15% level in the concentrate mixture without any adverse effect on BCS, milk yield and reproductive performance in lactating Murrah buffaloes.

Conflict of Interests

There is no conflict of interest.

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