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EFFECT OF DIFFERENT LEVELS OF NDF ON VOLUNTARY FEED INTAKE, DRY MATTER DIGESTIBILITY AND NUTRIENTS UTILIZATION IN DRY NILI RAVI BUFFALOES

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ABSTRACT

A study was conducted to determine voluntary nutrient intake, its digestibility and optimum fiber requirements in dry Nili Ravi buffaloes kept at Buffalo Research Institute (BRI), Pattoki district Kasur Punjab province Pakistan for a period of 60 days. The buffaloes (n=25) were selected from amongst the existing herd and randomly divided into five groups. These animals were fed isonitrogenous and isocaloric diets i.e. A, B, C, D and E based on different NDF levels i.e.23, 28, 33, 38 and 43%, respectively. Nutrient intake and nutrients digestibility differed ($P<0.001$) significantly among the dietary groups. In group C dry matter, (14.42±0.09 kg/d), crude protein (1.58±0.01 kg/d) and in group E neutral detergent fiber intake (5.52±0.010kg/d) were highest than rest of other treatment groups. Whereas, DM, and NDF digestibility was observed highest in the group B (62.5±1.04kg/d) and C (64.46±0.99kg/d) respectively as compared to other groups. The CP digestibility was non-significantly different among treatment groups. The average weight gain in dry Nili Ravi buffaloes was 0.48±0.045 kg/d. The results of this study indicate that dietary NDF level (33.0%) is better in terms of nutrients intake and digestibility in these animals.

Keywords: NDF, Nili Ravi buffalo, dry matter, digestibility, weight gain

INTRODUCTION

In Pakistan insufficient feed resources and traditional feeding practices have been identified as major cause of low production in ruminants. It is estimated that in Pakistan energy and protein are 40 and 60% deficient than the actual requirements of the animals, respectively (Bibi *et al*. 2012). Due to this shortage, current feed resources permit animals to exhibit only 40-50% of their intrinsic production ability. Forages are greater source of total digestible nutrients in livestock. The supply of available forage is 40 to 60 percent less than actually needed. The further increase in forage production potential is a time taking issue due to declining land resources and research etc. Hence, there is a need for judicious use of fodders and other feed resources.

Traditionally wheat straw is fed along with green fodder to meet DM requirements of the animals. The mixing of wheat straw along with the concentrate ration is the major source of NDF for feeding to buffaloes should remain at optimum level. It will not only provide balanced feed round the year especially in fodder scarcity period but will also increase the performance in all physiological stages of buffaloes.

NDF comprehensively measures almost total fiber that is the combination of cellulose, hemicellulose, lignin which increased the rate of passage of digesta and intestinal bulk (Merten, 2009). Quality and particle size of fiber ensures maximum dry matter intake. High NDF based diet may have an adverse effect on feed intake of ruminants. It is observed that heifers and dry cows are offered the forages that may have lower neutral detergent fiber digestibility. The demand of energy in such animals is not high and low NDF digestible forages equally good for them. Reports on optimum fiber needs of buffalo in general and dry buffaloes in particular are scanty, hence the present study was designed to evaluate optimum dietary fiber level for dry Nili-Ravi buffaloes.

MATERIALS AND METHODS

The study was conducted at Buffalo Research Institute (BRI), Pattoki district Kasur (Pakistan). Dry Nili Ravi buffaloes (n=25) were randomly divided into five groups having similar body condition score and weight.

Five total mixed rations (TMR) were formulated with different NDF levels (Table 1) for different groups. Rations C had 33% NDF level as per NRC (NRC, 2001) requirements. Ration A and B had 23 and 28% NDF levels while rations D and E were having 38 and 43% levels of NDF, respectively. All total mixed rations were isocaloric and isonitrogenous. The chemical composition of each ration is presented in Table 2.

The experiment lasted for 75 days in which initially 15days were spent for adjustment for their respective diets. Whereas, remaining 60 days were used for collection of data. All animals of each group were stall fed and were allowed *ad libitum* feeding in mangers

having individual feeding arrangement. Rations were offered daily at 9:00 am to the respective groups. Representative samples of feed and orts were taken weekly from the manger of each animal.

Data on voluntary feed intake were recorded on daily basis. In the last, a digestibility trial was carried out for five days using total collection method. Three dry buffaloes from each group were selected randomly and feces from each animal was collected for 24 hour period. Feed and fecal samples were pooled separately for each buffalo. All collected samples were subjected to proximate analysis (AOAC, 2000), NDF and ADF analysis(Van Soest,1994).

Data thus obtained on nutrients intake and their digestibility were analyzed using ANOVA technique (Steel *et al*. 1997). Statistical analysis system (SAS, 1997) was used for all these analyses. Means were compared for significance of difference with the Duncan's Multiple Range Test (Duncan, 1955). Mathematical model is given as under:

$$Y_{ij} = \mu_{ij} + \tau_i + \varepsilon_{ij}$$

Where,

Y_{ij} = Each observation on j^{th} animal due to i^{th} treatment.

μ = overall mean

τ_i = effect of ith treatment ($\sum \tau i = 0$ and i = 1---5)

ε_{ij}=random error associated with i^{th} treatment and j^{th} animal with the restriction that variance $\sigma 2$ and mean zero.

RESULTS AND DISCUSSION

The average DM intake in dry Nili Ravi buffaloes was 13.84 ± 0.049 kg/d with varying in neutral detergent fiber contents (Table 3). In response to the increase in NDF levels, the DMI increased in a quadratic fashion having peak when NDF level was 33%.It was reduced with increase in NDF contents as in group D and E. The average CP intake in the dry Nili Ravi buffaloes was 1.51±0.0258 kg/d. A similar trend was observed in CP intake as in case of dry matter intake. The average NDF intake in these animals was 4.51 ± 0.0074 kg/d. In response to the increase in NDF level, the NDF intake increased in a quadratic fashion with maximum NDF intake when NDF level was 43%.

The average DM degradability in dry Nili Ravi buffaloes was 55.19±1.18 %. In response to the increase in NDF level, the DM degradability also increased in a quadratic fashion with maximum DM degradability at dietary NDF level up to 33% (Table 3). It was reduced with increase in NDF contents as in group D and E.

Results showed a significant difference in DM, CP and NDF intake. Among the five diets, DM and CP intake was higher in the groups fed on diets C (33.0% NDF) and minimum in the groups D and E. Comparative increase in trend of DM intake from 23to 28%NDF may due to the provision of optimum environment for the ruminal micro flora, whereas voluntary intake of DM was reduced in groups D and E having 38 and 43% NDF levels, respectively. The reduction in DM intake might be due to the fill effect of high NDF level, as fiber is considered to be the negative index of feed intake. These results are in line with the findings of Mertens (1987) who concluded that feed intake can be limited by the bulkiness (fill effect) of the feed in relation to the voluntary intake of the reticulo-rumen. Similar observations were also recorded by Forbes (1995) who reported that ruminant's reticulo-rumen volume determines the potential physical intake of forages.

In the group E, intake of NDF was found higher and it may due to more intake of DM because the diet of the group was comprised of the highest NDF level. The highest intake of CP in the group B was due to increased intake of dry matter. It might be due to the fact that all experimental diets were iso-nitrogenous in composition and were TMR based which might have prevented selection of feed ingredients by experimental animals. These results are partly according to Blackwelder *et al*. (1998) who reported increased CP intake due to increased DM intake.

The DM digestibility increased in a quadratic way in first three i.e. up to C group and was recorded minimum in the last two groups i.e. D and E. The NDF digestibility was maximum in the group C and minimum in the groups D and E. The average CP digestibility in dry Nili Ravi buffaloes was 71.83 ± 0.80 %. When NDF levels were increased, the CP digestibility also remained constant among all treatment groups. The average NDF digestibility in these buffaloes was 60.84 ± 1.09 %. It was found that the NDF digestibility also increased in a quadratic fashion. The maximum NDF digestibility was observed when dietary NDF level was 33%. Whereas, it reduced with increase in NDF contents in groups D and E. Similar observations were also reported by Tjardes *et al*. (2002) who conducted an experiment on Holstein steers by offering high and low fiber diets.

Average weight gain in dry Nili Ravi buffaloes was recorded as 0.48 ± 0.045 kg/d. In response to the increase in NDF level, there was no change in weight gain among treatment groups. Live weight changes did not vary among the buffaloes offered five diets. Weight gain is a good indicator of animal's performance on particular diets. Statistically changes in weight gain were non-significant different among treatment groups. Similar observations were also recorded by Zinn (1988) who conducted a trial on comparative feeding value of alfalfa press cake (high NDF) and alfalfa hay (low NDF) as finishing diet on feedlot steers. Results showed non-significant difference in weight gain among treatment groups. Similar observations were also recorded by Adin *et al*. (2009) who prepared two total mixed rations.

Experimental TMR contained 20.5% less physically effective NDF than control TMR. Result showed that there was no change in the body weight gain. Similar observations were recorded by Lippek *et al*. (2000) who determined the effect of supplementary fiber on weight gain in steers. They concluded that there was no change in body weight gain at different supplementary fiber levels in total mixed rations.

Table 1. Composition of experimental rations fed to dry Nili Ravi buffaloes

Ingredients	A	B	C	D	E
Wheat straw	10.0	17.0	20.0	27.0	37.0
Cotton seed meal	10.0	7.0	8.0	8.0	7.0
Maize gluten 30%	8.0	7.0	12.0	9.0	8.5
Maize grain	18.0	15.0	12.0	8.0	7.0
Wheat bran	8.0	13.0	13.0	12.0	7.0
Rice polishing	14.0	10.0	12.0	12.0	9.0
Molasses	18.0	15.0	12.0	10.0	10.0
Fat	2.0	3.0	1.0	0.5	1.0
Maize gluten60%	3.0	6.0	4.0	7.0	8.0
Sunflower meal	6.0	4.0	3.0	4.0	3.0
Soda Bicarbonate	1.0	1.0	1.0	0.5	0.5
Mineral mixture	2.0	2.0	2.0	2.0	2.0
Total	100	100	100	100	100
NDF%	23%	28%	33%	38%	43%
CP%	11.07%	11.25%	11.12%	11.09%	11.08%
ME (M Cal/Kg)	2.23	2.22	2.23	2.24	2.26

Table 2. Chemical composition of experimental rations fed to dry Nili Ravi buffaloes

Rations	DM%	CP%	EE%	Ash%	NFE%	NDF%	ADF%
A	89.22	11.64	2.34	5.56	52.08	23.21	20.89
B	90.09	11.45	2.14	4.89	52.26	28.67	22.42
C	90.45	11.32	2.10	5.49	50.09	33.78	25.35
D	88.86	11.53	2.05	6.65	45.15	38.35	28.35
E	90.81	11.37	2.25	5.39	46.01	43.76	30.87

Dry matter (**DM**), Crude protein (**CP**), Ether extract (**EE**), Crude fiber (**CF**), Nitrogen free extract (**NFE**) and Metabolize able energy (**ME**)

Table 3: Mean (±S.E) for nutrients intake and digestibility in dry Nili Ravi buffaloes at different NDF levels.

Groups NDF%	A (23%)	B (28%)	C (33%)	D (38%)	E (43%)	Sig. level
Intake(Kg/ day)						
DM	13.82^{b}±0.03	14.36^{a}±0.08	14.42^{a}±0.096	13.75^{b}±0.025	12.85^{c}±0.016	<0.001
CP	1.52^{b}±0.003	1.57^{a}±0.009	1.58^{a} ±0.01	1.51^{b}±0.002	1.41^{c}±0.0018	<0.001
NDF	3.17^{e}±0.005	3.98^{d}±0.005	4.66^{c} ±0.007	5.25^{b}±0.010	5.52^{a} ±0.010	<0.001
Digestibility%						
DM	60.66^{a}±2.33	62.5^{a}±1.04	58.83^{a}±0.44	53^{b}±1.52	41^{c}±0.57	P<0.001
CP	72.16±0.60	71.10±1.15	72.16 ±0.92	71.76±0.90	72.16±0.44	NS
NDF	62.3^{ab}±0.70	62.6^{ab}±1.31	64.46^{a}±0.99	58.93^{bc}±0.80	56.03^{c}±1.69	P<0. 01

Means with different superscripts within same row are significantly different (P<0.05); Sig. = significance; **NS**= non significant (P>0.05),Neutral detergent fiber (**NDF**),Dry matter (**DM**), Crude protein (**CP**)

Conclusion: Hence it is concluded that 33.0% dietary NDF level is better in respect of intake and digestibility of nutrients in dry Nili Ravi buffaloes. However further research is needed to determine optimum fiber requirements in other breeds of buffaloes like Kundi and AzaKheli.

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