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Effect of Dry Matter and Roughage Intake in Buffalo's Rations on Milk Yield and its Constituents

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THREE FEEDING experiments were imposed over three periods of thirty days duration confirming 3x3 simple Latin-square design (Lucas, 1957). The fourth treatment served as comparison. Feed was offered twice daily and animals were hand milked twice daily. Records were kept for feed consumption and milk yield. Samples of both feed and milk were analyzed for their conventional analysis. The experimental rations were designed to supply every treatment with five kilograms starch equivalent daily using different ratios of roughages to concentrates (100:0 60:40 and 20 : 80). The starch equivalent allowances for the comparison group were supplied from 95:5 concentrate to roughages.

It was reported that increasing concentrate ratio decreased the dry matter intake. However, buffaloes fed on relatively low dry matter intake, due to increased concentrate ratio, yielded more milk. The comparison group which received the lowest dry matter and the lowest roughage (7.74 kg daily) showed a marked decrease in milk yield. In regardes the milk fat yield, there was a trend to increase milk fat yield due to high concentrate content in the diets and accordingly low dry matter intake. Decreasing dry matter intake to a minimum by increasing concentrates to 95% in the comparison group caused a sudden drop in milk fat yield. The milk fat composition of different treatments varied considerably.

The relationship between the metabolizable energy intake and heat production by milking cows is linear (Flatt, 1966).

It was found that diminishing increments of milk output per unit of feed inputs (as the intake increase) results from a decreasing digestibility of energy and an increasing diversion of energy into body gain and the interaction of these with the increasing dilution of energy cost (Reid, 1965; Reid *et al.*, 1966; Tyrell *et al.*, 1966 and Reid, 1970).

Many experiments have shown a relationship between the digestibility of a diet and the dry matter intake of ruminants. However, Montgomery and Baumgardt (1965) stated that dry matter intake decreased as the digistibility of the diet increased. Three factors are responsible for the better digestive utilization of a diet, the amount of feed intake, the physical state of the diet and the chemical composition of the diet (Vaz Portugal, 1972).

It was the trend in the last few decades to lower the roughage percentage and increase concentrates in milking animal's rations. Therefore, this study was carried out to search the effect of dry matter intake in rations of milking buffaloes on milk yield and milk constituents.

Material and Methods

Four lactating buffaloes, similar in age and season of lactation were subjected to three feeding treatments in a 3x3 simple latin square experiment (Lucas, 1957). The three treatments were designed to supply animals with five kilograms starch equivalent daily from three different allowances varying in their dry matter content and roughage content. The fourth treatment received the five kilograms starch equivalent from a mixture containing 95% concentrates and 5% roughages and this treatment served as a comparison for the other treatments. Animals were fed individually. Feed were offered twice daily. Each period of the 3×3 Latin-square experiment was thirty days. The abrupt change from one treatment to another was avoided by allowing a transitory period of one week between each successive treatments.

Rations used consisted of clover *(Trifolium alexandrinum)* and wheat straw as roughages. The Co-op feed mixture and yellow maize were the concentrates. Co-op feed mixture consists of 63% cottonseed cake; rice bran; 10% wheat bran; 3% molasses; 3% limestone and 1% sodium chloride. The chemical composition and amount of meal offered for different treatments are given in Table 1. The amounts of roughages and concentrates were computed to allow the maintenance requirements as well as the production requirements based on the starch value of each material. Maintenance requirements were taken as 2.55 kg starch equivalent and 245 g digestible protein for every 400 kg live body weight. Each $\pm$ 50 kg live body weight require 0.2 kg starch equivalent containg 30 g digestible protein. Productive requirements were taken as 0.25 kg starch equivalent containining 70 mg digestible protein for each 1.0 kg milk 4% fat. Each $\pm$ fat requires 0.05 kg starch equivalent containing 10 mg digestible protein.

Milk yield was recorded daily for each treatment. A composite sample on weight basis were analysed for fat percentage, total protein, total solids and total and lower fatty acids, using A.OA.C. (1960) procedures. Milk fat yield was obtained by multiplying fat percentage by milk yield.

The method of Storry and Millard (1965) was adopted for the extraction of lipid and determination of fatty acids in milk fat samples. Methyl esters of fatty acids were prepared and purified using the method of Luddy *et al.* (1960). The methyl esters of the fatty acids were identified by gas liquid chromatography using a Perkin-Elmer apparatus model 154D with hydrogen flame ionization detector. The area of each chromatographic peak was determined by the triangulation method of Horning *et al.* (1964). Fatty acids content of feeds offered were determined using the same procedure.

The data were analysed statistically by methods applicable to the Latin-square design

Results and Discussion

The nutritive analysis of the different feeds offered in the different treatments (Table 2) was based on data given by Ghoneim, 1955 for animal feed analysis and amounts of offered as shown in Table 1. The daily feed allowances expressed as starch value, fibre, dry matter, digestible protein and total digestible nutrients are presented in Table 3. It should be recalled that the daily allowances were based on the starch equivalent needed for maintenance and production. In order to furnish the same amount for every treatment the ration between roughage materials and concentrates was changed in every treatment. The data in Table 3 indicate that fibre intake and TDN and dry matter intake were decreasing by the increase of concentrate material in the ration. It was observed that digestible protein was reduced slightly when rations contained increasing percentages of concentrates.

Table 4 presents the average daily milk yield of the buffaloes given the different teatments, values are expressed as the total milk yield of three ten days intervals due to the 3×3 Latin square design. The results indicate that the third treatment was higher than both the second and the first treatment, and milk yield in the second treatment was higher than that obtained for the first treatment. Statistical analysis shows that milk yield differed significantly among treatments with higher value for the latter group. Generally speaking, results given support the evidence that lowering the dry matter intake and decreasing fiber intake by increasing concentate content of the ration resulted in an increase in the milk yield. These results are in accordance with the previous finding of El-Shobksy *et al.* (1972). Further, more, the fourth treatment where the animal was fed the lowest dry matter, fiber and TDN, showed lower yield of milk than trement 2 and 3 but higher than treatment 1. It seems that lowering the fiber content and dry matter intake by increasing concentrate and decreasing roughage in buffaloes rations is associated with rise in milk yield up to a certain level, where concentrate increase becomes of less use, if not harmful. However, feeding more concentrate was found to be uneconomic by Patterson and Cruchton, (1965.)

Milk fat yield was obtained by multiplying fat percentage by milk yield. Values given in Table 4 revealed that buffaloes on treatments 2 and 3 produce the more milk fat per day than the buffaloes on treatment 1. It is evident from

the results that minimizing the dry matter matter and fibre content of feeds offered for the buffaloes resulted in an increase in milk fat yield. However, treatment 4 where 95% concentrate and 5% roughage supplied the lowest level of fibre and dry matter showed a dramatic fall in the milk fat yield. Statistical analysis showed high significant variations between treatments (P.05). Total protein of milk showed no trend and the differences between treatments are not significant.

TABLE 1. **Chemical composition of feedstuffs and amounts offered for every treatment.**

Ingredients	Dry matter	Ash	CP	EE	CF	Amounts offered			
						1	2	3	4
Berseem	14.1	2.06	1.88	0.41	3.65	46.9	28.125	9.375	2.344
Wheat straw	88.99	14.88	4.12	1.91	22.34	5.0	3.0	1.000	0.250
Co-op feed mix.	90.15	6.04	29.34	7.91	21.02	—	2.4	4.8	5.7
Yellow corn	85.89	3.00	6.85	0.94	2.37	—	1.0	2.0	2.375
Total kilograms fed / animal/day						51.9	34.525	17.175	1.75.10.669

TABLE 2. **The nutritive value of the different feeds.**

Ingredients	Starch value	Digestible protein	TDN
Berseem	8.01	2.00	11.80
Wheat straw	26.30	1.10	39.30
Co-op feed mix.	52.47	13.11	59.23
Yellow corn	80.00	5.90	82.60

TABLE 3. **Daily feed allowances for milking buffaloes as kg/head/day.**

Treatment	Strach value	Fibre	Dry matter	Digestible protein	TDN
R : C					
1 (100 : 0)	4.98	2.83	11.04	0.993	7.49
2 (40 : 60)	5.10	2.22	9.66	0.960	6.75
3 (20 : 80)	5.00	1.607	8.26	0.951	5.99
4 (5 : 95)	5.00	1.40	7.74	0.940	5.722

R : C roughage to concentrate ratio in the total feed intake.

TABLE 4. **Effect of different feed treatments on milk yield and milk constituents.**

Treatment	Average daily milk yield (kg)	Average daily fat %	Average daily milk (g/day)	Average total protein %
1	3.57	6.14	229.81	2.87
2	4.56	6.48	294.16	3.22
3	4.81	6.69	321.43	2.99
4	4.42	6.76	298.51	3.49

TABLE 5. **Effect of different feeding treatments on the production of lower and fatty acids in milk.**

	Treat. 1		Treat. 2		Treat. 3		Treat; 4	
	A	B	A	B	A	B	A	B
Lower fatty acids	11.2	6.7	13.9	7.8	15.3	7.3	15.6	7.4
Higher fatty acids	88.0	45.0	134.4	46.8	163.3	44.2	170.1	45.4
$^{c}14:0$	1.7	4.1	0.92	3.3	0.34	3.1	0.16	2.7
$^{c}16:0$	5.4	16.9	3.9	13.3	2.7	12.3	2.3	12.9
$^{c}18:0$	0.94	6.28	1.6	8.7	2.1	8.9	5.5	10.9
$^{c}18:1$	0.88	12.1	2.7	13.3	3.8	13.2	7.2	13.6

A)Fatty acid intake based on fatty acids content of feedstuffs.
B) Fatty acids content of milk

The effect of feeding minimized quantities of dry matter and crude fiber on microflora of the rumen caused a marked fall in the digestion of cellulose (Storry and Rock, 1965) and the absence of protozoa (Chalupa *et al.*, 1967) in the rumen of cows on low roughage diets and with milk fat depression. It seems that the fiber low dry matter diets causes a fall in the rumen pH due to a diminshed secretion of saliva. Davis, 1967 revealed that cows fed such diets showed a diminished buffering capacity of rumen digesta which then allows the survival of microflora producing the change in the pattern of volatile fatty acids.

The data shown in Table 5 pertaining to the intake from different fatty acids and the production of such fatty acids revealed that the intake from lower fatty acids was relatively lower than the intake fhigher fatty acids due to the high content of feeds in such acids. The milk fat content from higher fatty acids was higher than its content from lower fatty acids. As a matter of fact statistical analysis for the individual fatty acids from $C_{14:0}$ to $C_{18:1}$ showed no significant differences among treatments.

However, the evidence in this work with Egyptian Buffaloes with respect to milk fat yield is conflficting with the results obtained for dairy cows. The evidence that reducing acetate percentages in the rumen due to reduced dry matter fed, is not particularly convencing and needs particularly a research programme which is now undertaken.

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تأثير التغذية على المـادة الجافة ومواد العلف الخشنة على انتاج اللبن فى الجاموس ٠

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المركز القومى للبحوث

أستخدم ٣ علائق فى ٣ مدد مختلفـة كل مدة ٣٠ يوم واستخدمت المجمـوعة الرابعة للمقارنة وقدم الغذاء مرتين يوميا وحلب الجاموس يدويا مرتين يوميا٠ وسجلت كمية الأعلاف المـأكولة وكمية اللبن الناتج ٠ وقد أخذت عينات للعلف واللبن للتحليل ٠ وكانت الأعلاف محسوبة لكى تعطى ٥ كيلو جرام نشا يوميا وكانت نسبة العلف المركز الى الخشن ٨٠ر٢٠ : ٤٠ر٦٠ ووجد أن زيادة كمية العلف المركز تؤدى الى نقص كمية المـادة الجافة المـأكولة ٠ وذلك يرجع الى أن زيادة المـادة المركزة تؤدى الى زيادة كميـة اللبن النـاتج ٠ أما مجموعة المقارنة التى أكلت أقل كمية من المـادة الجافة وأقل كمية من مواد العلف الخشنة فقد أعطت أقل انتاج من اللبن ٠

ونقص اعطاء المـادة الجافة الى أقل مستوى وذلك بزيادة المركزات يؤدى الى نقص مفاجىء فى انتاج كمية الدهن ٠ وقد اختلفت نسبة الدهن فى المعاملات المختلفة اختلافا كبيرا ٠