THE SUITABLE LEVEL FOR FEEDING DAIRY ANIMALS

II.—The Effect of Reducing the Level for Lactating Buffaloes, Local and Freizian Cows

By

A.K. ABOU-RAYA, M.A. RAAFAT, E.R.M. ABOU-HUSSEIN AND A. DARWISH

Animal Production Dept. (Nutrition)Faculty of Agric. Cairo Univ.

SUMMARY

Five experiments were undertaken to study the total suitable level for maintenace and milk production with buffaloes, local and Freizian cows. Ghoneim's standards for maintenance and production were taken for control levels using the "swing over method" for comparison of tested levels during a period from 92 to 108 days using 3 to 5 animals in each experiment. Reducing the total requirements by 25% did not significantly change milk or fat yield of local and Freisian cows. The average percentage difference was not exceeding 1.23 with milk yield and 2.96 with fat yield. The reduction also had no effect on milk composition and fat quality. Feeding the Friezian cows on a 25% increased level had no significant change on milk and fat yield or milk composition and fat quality. This was considered over feeding. With buffaloes, the 25% reduction in the total requirements resulted in a highly significant decrease of 15.35% in milk yield and 15.84% in fat yield along with a slight increase of fat percentage. The 8% reduction in the food level did not significantly affect milk and fat yield or milk composition and fat quality. Separating the maintenance requirement from that for production 0.4 Kg. starch value/100 Kg. L. W. in both species as previously found, it was possible to datermine the suitable level for milk production and to calculate from it the average utilization percentage of metabolizable energy. It was found 90% for cows and 70% for buffaloes.

INTRODUCTION

In the previous study by the authors * the importance of the suitable feeding level for dairy cows and buffaloes was realized for economy in feeding practice. Feeding the animals on the proper level without waste or underfeeding would participate indirectly in solving the problem of food shortage for farm animals. It was possible by prolonged feeding trials with mature oxen and dry mature buffaloes to reduce Choneim's level for maintenance to the extent of 33% in cows and 25% in buffaloes without any ill effect or reduction in live weight. It was concluded that a level of 0.4 kg. starch value per 100 kg. live weight could be applied for maintaining both species under our conditions and therefore saving a great deal in their maintenance requirements.

* Submitted for publication, 1963.

Extending the previous work, it was decided to study the effect of reducing the present total level for both maintenance and production on the dairy animals, their milk and fat yield as well as the quality of milk and fat produced. For convenience, a short critical review about the requirements for milk production by various workers was to be presented

Several attempts had been tried to find out the proper level for milk prodution. The range of requirements as pounds of total digestible nutrients per lb. F.C.M. was between 0.30—0.34 as produced by several workers from energy studies.

Kellner (12), using the respiration calorimeter along with carbon and nitrogen balance indicated that the requirements for producing 1gm. of milk nutrients were 0.94, 3.89 and 1.05 gm. starch value for protein, fat and sugar respectively. He indicated that 0.20 units of starch value were required for each unit of milk containing 3.2% fat and 4.6% protein. Morrison (17) suggested an allowance of 0.31 to 0.32 lb. T.D.N. for each lb. F.C.M.

From three complete energy balances by Kellner(12) and 11 ones by Forbes and Kriss (in ref 15). it was found that the average utilization of metabolizable energy for milk production was 69.3%. The metabolizable energy per 1 kg. starch value was found to be 3761 C by Kellner (1692 per pound) but the figure produced by Forbes and Kriss for each pound T.D.N for mixed ration was 1165 calories. From a consideration of the relation between fat percentage and energy content in milk, the latter authors were able to express the requirements in terms of metabolizable energy and then in terms of the commonly used T.D.N. Although, there was an agreement betwen Kellner's figure and that of Forbes and Kriss for the average utilization of metabolizable energy for milk production in cows, yet Mollgard obtained a higher figure from 83.3 to 89.5% (16). Therefore, the calculated requirements using Kellner's figure will be higher than those when using Mollgard's.

Kuhlman (14) suggested, that for producing 1 lb. of milk, 0.1005 lb. T.D.N. required for fatless milk along with 0.057 lb. T.D.N. more for each 1% fat in it. He summarized this in a simple equation which would allow 0.229 lb. T.D.N. for 1 lb. of F.C.M.

Gaines (8) recommended 0.275 lb. T.D.N. for each 1 lb. F.C.M. but Brody and Procter (2), by analysis of food consumption, milk production and live weight changes, considered 0.305 lb. T.D.N. to be suitable for producing 1 lb. F.C.M. Yates *et al* (20) recorded a level of feeding of about 2.8 lb. starch equivalent per gallon (10 lb.). of milk.

Cabrera (4), studying the production ration for milk above maintenance computed a production equation based on fat in milk. Breirem (3) found that a production ration of 0.4 feed unit (= 0.28 S. E.) was sufficient for kilogram of F.C.M. A similar level was used by Huth (11) being 0.275 kg. starch value per kg. F.C.M. Fekete and Honsch (6) estimated the requirements for production of 1 liter of milk was 0.365 kg. S.E., which appears to be a high level relative to others recorded.

In Egypt for milk production Ghoneim (9) calculated the required starch value from estimating the calorific value of the milk produced from the percentage of fat in milk according to Mollgard's equation for cows (16) and Ghoneim' equation for buffaloes (9). The net energy calculated in milk produced was considered to be 75% of the metabolizable energy. From the calculated metabolizable energy, the amount of starch value necessary for production was obtained from the metabolizable energy of 1 kg. S. V. (3761C after Kellner).

The utilization figure of metabolizable energy used by Ghoneim appears to follow Nils Hanson who indicated that for 3 kg. milk produced (containing 2100 C) 2800 C are required as metabolizable energy (13). Ghoneim used the same figure for buffaloe milk containing higher fat percentage. It seems questionable whether both cow and buffaloe milk have the same utilization figure.

From this review it was realized that there was some agreement among several workers about the level for milk production but relatively wide range was recorded in the literature being 0.21 up to 0.365 starch value unit for producing 1 unit of fat corrected milk (ca 0.23-0.38 T. D. N.). The highest level was ca 80% more than the lowest one.

It seems that other factors are involved other than the weight of the animal and the quality of milk. The environmental condition particularly, atmospheric temperature, the types of rations locally used and perhaps the ability of different breeds to deal with such rations are important factors to be considered for arriving to the proper level suitable for direct practical application. From these consideration it was realized that testing the proper level should be made by direct feeding experiment with local breeds using the common feedingstuffs.

Therefore, a series of experiments were designed with local cattle and buffaloes to test the effect of reducing the level recommended by Ghoneim for both maintenance and milk production. The combined effect of reducing the total requirements was to be tested in comparative feeding studies during lactation. A test was also made to find any benefit from liberal feeding of Friezian cows during the first years of acclimatization.

EXPERIMENTAL AND METHODS

Five experiments were performed at the Experiment Station Faculty of Agriculture Giza. Experiment 1 was undertaken with local cows using a 25% reduction from Ghoneim's standard for both maintenance and production. In experiment II and III with Friezian cows a 25% decrease and 25% increase of the level were tested. With buffaloes, two experiments (IV and V) were performed for testing 25% decrease then 8% decrease. The desgin of the experiments followed the " swing over method " as indicated by Kellner (12) and Abou-Hussein (1). Each animal was fed on the "control level " for an " initial control period', followed by the "tested period " using the reduced level, and then back on the control level during a" final control period'. Assuming a constant natural decrease in milk between the initial and final control periods, the percentage change in milk yield could be known during the tested period, by a knowledge of the experimental yield obtained during the tested period and the calculated yield which was supposed to be "the natural" yield had no reduction in the food level occured during the tested period.

Animals

Thirteen cows and seven buffaloes were chosen after the Peak of their lactation.

Feeding

The daily requirements of starch value and digestible protein were calculated for each animal by a knowledge of the average live weight, milk yield and fat percentage during the week before the experiment, *i.e.*, before the transition period for the control ration as indicated in Table 1. Ghoneim's system (9) was followed for calculating the maintenance and production levels, *i..e*, the total requirements for the control level. For maintenance 0.51 and 0.58 kg. S.V./100 kg. live-weight were taken for buffaloes and cows respectively. For production, two equations were used for calculating the calorific value per kg. of milk from fat percentage (9, 16). The starch value required was calculated assuming that 3761C metabolizable energy are produced per 1 kg. S.V. and that the produced net energy in milk is 75% from the metabolizable energy. The tested level for both mantenance and production was calculated from the average milk yield and fat percentage of the last week of the initial control period and the average weight of the animal at the last two days of this week. Reduction in food level was in the total requirements. During the final control period, the initial control level was kept the same for total, requirements. The food-stuffs were of that commonly used in Egypt including wheat straw, clover hay and a food mixture (wheat bran, rice bran and cotton seed cake). A chart of feeding individual animals during the different periods of each experiment represented in Table I.

Sampling

Proportionate milk samples were taken daily individuals from two milkings at 3 p.m. and 9 a.m. Composite samples were also taken at the middle day of the periods to represent the mixed milk of the group in each period.

Analytical methods

The conventional methods of the A.O.A.C. were used for summative analysis of milk and for Iodine, Riechert Meissel and Poleneske numbers.

Statistical Analysis

The average percentage difference in milk yield at the control level and tested one for the group of animals in each experiment was obtained as well as its standard error. The significance of this difference was tested applying the test of nill hypothesis (19).

RESULTS AND DISCUSSION

Experiment 1

Effect of using a 25% reduced level for feeding local cows on milk and fat yield as well as milk composition and fat quality

The results in Table II indicated that the average milk yield with the control level using the standard level adopted by Ghoneim was 17.67 lb. The 25% reduction in the level decreased milk yield negligibly. The average percentage change in yield was -1.23 ± 0.888 being -2.41, 0.509 and -1.78 for cow No.1, 2 and 3 respectively. The reduction in yield was not statistically significant (calculated $t = 1.309$, theoritical $t_{0.05} = 4.303$).

The respective percentage change in fat yield among the cows was 2.25, 1.52 and 4.85%, the average being 2.96 ± 0.986. Such percentage increase was also insignificant ($t = 3.00$). Therefore, the reduction in the food level practically has no effect on milk and fat yield.

TABLE I.—**Chart of the calculated requirements for different animalsin various experiments during the control period and tested one**

No. of Expt.	No. of Animal	Intial add final control period				Tested period				
		Weight	Yield	Fat %	Control level S.V.	Weight	Yield	Fat %	Calculated control level S.V.	Tested level S.V.
		Kg.	Kg.	%	Kg.	Kg.	Kg.	%	Kg.	Kg.
Expt. 1—(25 %)reduction	1	296	6.98	5.5	3.99	300	6.12	5.20	3.66	2.74
	2	398	8.55	5.3	4.99	402	7.69	5.10	4.69	3.52
	3	341	10.35	4.9	5.08	345	9.59	4.50	4.70	3.53
Expt. 2—(25 %)	4	410	9.00	3.4	4.52	415	7.64	4.10	4.39	3.29
	5	410	9.50	3.3	4.60	414	7.61	3.80	4.35	3.26
	6	330	9.25	3.5	4.15	335	7.18	3.80	3.77	2.83
	7	360	10.00	3.8	4.63	368	7.57	4.00	4.12	3.09
	8	340	9.00	3.6	4.19	343	7.57	3.80	3.92	2.94
Expt. 3—(25 %)	9	370	9.75	3.6	4.55	372	8.57	3.80	4.07	5.43
	10	390	10.25	4.0	4.95	393	8.86	4.10	4.35	5.80
	11	480	8.50	3.7	4.91	484	6.32	4.00	4.19	5.59
	12	420	10.50	3.8	5.11	422	8.29	3.90	4.31	5.74
	13	390	8.50	3.5	4.32	395	7.18	3.80	3.86	5.15
Expt. 4—(25 %)	14	421	8.55	6.3	5.10	420	7.52	6.50	4.51	3.59
	15	452	9.45	6.7	5.72	441	7.97	6.70	4.81	3.85
	16	306	8.78	5.6	4.35	303	7.56	5.50	3.68	2.94
Expt. 5—(8 %)	17	385	7.43	7.2	4.79	385	6.62	6.50	4.30	3.96
	18	385	9.00	5.7	4.82	387	7.65	5.30	4.31	3.97
	19	363	8.10	6.5	3.91	364	7.43	6.50	4.48	4.21
	20	511	7.88	6.8	5.48	515	7.34	6.60	5.25	4.83

* The tested level was obtained after calculating the control level necessary for the live weight, milk yield and fat percentage during the last seven days of the initial control period.

TABLE II.—**Effect of reducing 25% of the total food, level (for maintenance and milk production) with local cows, on milk and fat yield. The control level as recommended by Ghoneim.**

No. of Animal	Average milk yeild with initial control 26th day	Average milk yiled with final control 98th day	Average daily decrease	Average milk yeild with tested level		Difference	Difference of yield from initial	
				actual milk yield	calculated milk yield		Milk yield	Fat yield
1	14.07	10.61	0.048	12.00	13.73	– 0.34	– 2.410	+ 2.52
2	17.67	15.43	0.031	16.64	17.76	+ 0.09	+ 0.509	+ 1.52
3	21.31	15.50	0.080	18.00	20.88	– 0.38	– 1.780	+ 4.85
Average..	17.67	13.85	0.053	15.55	17.46	– 0.21	– 1.230 ± 0.880	2.90

The data in Table III indicated clearly that there was no practical difference between the milk composition (of the composite samples of the three cows) or fat quality during the initial, final or tested period using the reduced level. The range was 5.2 - 5.3 for fat, 3.51 - 3.70 for crude protein and 13.49 - 13.78 for total solids.

The results with Reichert Meissel, Polenske and Iodine number were identical in the control level and reduced level. The respective range of them was 28.23 - 28.43, 2.46 - 2.52 and 41.32 - 41.69 being within the recorded data with cows milk in Egypt by Abou - Hussein (1).

Therefore, it can be concluded that a 25% reduction in Ghoneim's level in both maintenance and production did not affect milk yield, fat yield, milk composition and fat quality.

Experiment 2

Effect of using a 25% reduced level for feeding Friezian cows on milk and fat yield as milk composition and fat quality

The results in Table IV indicated that the average milk yield with the control level using the standard level adopted by Ghoneim was 7.94 kg. Reduction in the level to 25% increased milk yield negligibly. The percentage increase in yield was 0.151 ± 0.61 being -0.13, -0.12, -0.838, - 0.655 and + 2.500 for cows 4, 5, 6, 7 and 8 respectively. The increase was not statistically significant (calculated t = 2.50, theoritical $t_{0.05}$ = 2.77). The respective percentage change in fat yield among the cows was - 1.32, + 3.01, + 1.44, - 0.304 and - 0.33, the average being + 0.52 ± 0.77. Such percentage increase was also insignificant ($t_{0.05}$=067).

TABLE III.—Effect of using changed level for feeding local and freizian cows on milk composition and fat quality.

Item	Expt. 1			Expt. 2			Expt. 3		
	Initial Control	Tested Level	Final Control	Initial Control	Tested Level	Final Control	Initial Control	Tested Level	Final Control
Nutrtiion milk									
Total	13.49	13.52	13.78	12.77	12.96	13.00	12.53	12.48	12.66
Moisture	86.51	86.48	86.22	87.23	87.04	87.00	87.47	87.52	87.34
Crude protein	3.51	3.70	3.62	3.29	3.37	3.33	3.44	3.38	3.45
Fat	5.20	5.30	5.20	4.20	4.40	4.30	4.10	4.00	4.20
Carbohydrate	4.12	3.86	4.30	4.50	4.52	4.70	4.34	4.44	4.35
Ash	0.66	0.66	0.66	0.68	0.67	0.67	0.65	0.66	0.64
Fat quality									
Reichert Meissel number	28.37	28.23	28.43	27.63	27.74	27.65	27.82	27.73	27.79
Polenske number	2.46	2.46	2.52	2.41	2.43	2.39	2.35	2.33	2.37
Iodine number	41.52	41.69	41.32	39.62	39.46	39.67	40.13	40.34	40.20

TABLE IV.—**Effect of reducing and increasing 25% of the total food level (for maintenance and milk production) with Freizian cows, on milk and fat yield. The control level as recommended by Ghoneim.**

No. of Expt.	No. of Animal	Average milk yield with initial control Kg.	Average milk yield with final control Kg.	Average daily decrease Kg.	Average milk yield with tested level: actual milk yield Kg.	Average milk yield with tested level: calculated milk yield Kg.	Difference	% difference of yield from initial: yield	% difference of yield from initial: Fat yield
Expt.3 (-25%)	4	7.93	5.45	0.0420	6.53	7.92	- 0.010	- 0.130	- 1.320
	5	8.17	6.23	0.0330	7.07	8.16	- 0.010	- 0.120	+3.010
	6	7.52	5.80	0.0290	6.50	7.46	- 0.063	- 0.838	+1.440
	7	8.09	5.75	0.0390	6.75	8.04	- 0.053	- 0.655	- 0.304
	8	8.00	5.63	0.0400	6.88	8.20	+0.200	+2.500	- 0.330
	Average	7.94	5.77	0.0366	6.75	7.96	+0.013	+0.151	+0.520
Expt.4 (+25%)	9	8.69	7.67	0.0173	8.03	8.60	- 0.090	- 1.03	- 1.230
	10	9.29	6.98	0.0390	8.00	9.29	zero	zero	+0.263
	11	6.76	5.25	0.0260	6.15	7.01	+0.248	+3.68	+2.940
	12	8.82	7.80	0.0170	8.48	9.05	+0.231	+2.61	+2.200
	13	7.26	5.62	0.0290	6.42	7.38	+0.117	+1.61	+1.800
	average	8.16	6.66	0.0260	7.42	8.27	+0.101	+1.[illegible]7	1.190

Therefore, the reduction in the food level practically has no effect on milk yield and fat yield.

The data in Table III showed that there was no practical difference between the milk composition (comepsite samples of the five cows) or fat quality during the initial, final or tested period using the reduced level. The range was 4.20 - 4.4 for fat, 3.29 - 3.37 for crude protein and 12.77 - 13.00 for total solids.

The results with Reichert Meissel, Polenske and Iodine number were identical in the control level and reduced level. The respective range of them was 27. 63 - 27.74, 2.39-2.43 and 39.46 - 39.67 being within the recorded data with Friezian cows fat (5).

Therefore, it can be concluded that a 25 % reduction in Ghoneim's level in both maintenance and production requirements did not affect milk yield, fat yield, milk composition and fat quality.

The behaviour of Friezian cows appeared to be practically as local cows being not affected by a 25 % reduction. The reduced level could be applied in practice to reduce feeding cost and raise the efficiency of food utilization with cows.

Experiment 3

Effect of using a 25 % increased level for feeding Friezian cows on milk and fat yield as well as milk composition and fat quality

The results in Table V indicated that the average milk yield with the control level using the standard level adopted by Ghoneim was 8.16 kg. during the initial control period, Increasing the level to 25 % increased milk yield negligibly. The percentage increase in yield was 1.37 ± 0.668 being — 1.03, zero, + 3.66, + 2.61 and + 1.61 % for cows 9, 10, 11, 12 and 13 respectively. The increase was not significant (calculated $t_{0.05} = 2.05$, theoritical $t = 2.77$). The respective percentage change in fat yield among the cows was — 1.23, + 0.263, + 2.94, + 2.20 and 1.80 %, the average being 1.19 0.748. Such percentage increase was also insignificant ($t = 1.59$).

Therefore, increasing the food level practically has no effect on milk yield and fat yield.

The data in Table 2 indicated that there was no practical difference between the milk composition of the composite samples of the five cows or fat quality during the different periods. The range was 4.0 - 4.2 for fat, 3.38 - 3.45 for crude protein and 12.48 - 12.66 % for total solids.

TABLE V.—**Effect of using reduced level for feeding buffaloes in milk composition and fat quality**

Item	Expt. 4			Expt. 5		
	Initial Control	Tested Level	Final Control	Initial Control	Tested Level	Final Control
Nutrition Milk						
Total solids	16.39	16.34	16.64	16.37	16.70	16.38
Moisture	83.51	83.46	83.36	83.63	83.30	83.62
Crude protein	4.57	4.77	4.97	4.39	4.20	4.29
Fat	6.30	6.60	6.30	7.00	7.10	7.00
Carbohydrate	4.77	4.61	4.61	4.24	4.66	4.35
Ash	0.75	0.76	0.76	0.74	0.74	0.74
Fat quality						
Reichart Missel number .	30.34	30.13	30.36	29.52	29.43	29.46
Polenske number	2.68	2.66	2.68	2.46	2.45	2.45
Iodine number	46.24	46.83	46.02	48.32	48.58	48.52

The results with Reichert Meissel, Polenske and Iodine number were similar during the control level and the increased level. The respective range of them was 27.73 - 27.82, 2.33 - 2.37 and 40.13 - 40.34.

Therefore, this indicated that increasing a 25% in Ghoneim's level for both maintenance and production did not affect milk yield, fat yield, milk composition, and fat quality with Friezian cows.

It could be concluded that increasing the present standard recomended by Ghoneim, has no benefit in increasing milk yield or changing the composition of milk or fat quality. Such addition would be wasteful and cannot be adopted in practice. There is no need to feed Friezian cows liberally during the *1st* years of acclimatization.

The results in previous experiments supported this view as 25% reduction in the level still did not affect both milk and fat yield or composition and fat quality.

Experiment 4.

The effect of using a 25 % reduced level for feeding buffaloes on milk and fat yield as well as milk composition and fat quality

The results in Table VI indicated that the average milk yield with the control level (using the standard level recommended by Ghoneim) was 17.80 lb during the initial control period and 13.12 lb during the tested one. A pronounced decrease in milk yield occured. The percentage decrease in individual animals was 15.49, 14.52 and 16.03 for buffaloes no 14, 15 and 16 respectively, the average being 15.35 0.439.

The difference was highly significant (calcultaed t = 34.9). The respective percentage change in fat yield among the buffaloes was 16.69, — 14.14 and — 16.69 % the average being — 15.84 0.850. Such percentage decrease was also highly significant (t = 18.64).

Therefore, the reduction in the food level to this extent would reduce milk and fat yield.

TABLE VI.—**Effect of reducing 25 % and 8 % of the total food level (for maintenance and milk production) with buffaloes on milk and fat yield. The control level as recommended by Ghoneim.**

No. of Animal	Average milk yeild with initial control	Average milk yeild with final control	Average daily decrease	Average milk yield with tested level		Difference	% difference in yield from initial	
				actual	calculated		milk yield	Fat yield
14	17.36	15.21	0.0299	13.59	14.67	-2.69	-15.49	-16.69
15	18.45	13.57	0.0678	13.33	15.77	-2.68	-14.52	-14.14
16	17.59	12.95	0.0644	12.45	14.77	-2.82	-16.03	-16.69
Average	17.80	13.91	0.0540	13.12	15.07	-2.73	-15.35	-15.84
17	15.05	11.76	0.0457	13.45	15.10	+0.05	+ 0.33	zero
18	17.90	14.09	0.0529	15.93	17.84	-0.06	- 0.33	-0.59
19	16.83	13.21	0.0502	15.21	17.02	+0.19	+ 1.12	-1.09
20	16.62	11.67	0.0682	14.29	16.77	+0.15	+ 0.90	+1.06
Average	16.60	12.68	0.0543	14.72	16.68	0.083	+ 0.51	-0.154

The data in Table VI indicated clearly that there was no practical difference between the milk composition (of the composite samples of the three buffaloes) during the initial, final or tested period using the reduced level. The range percentage composition was 4.57-4.97 in case of crude protein, 16.34-16.64 for total solids. In case of fat, the percentage of fat during the tested level increased from 6.3 to 6.6% than with control periods. For fat quality there was no practical difference between the data obtained during the initial, final control along with the tested level. Reichert Meissel, Polenske number were practically identical. The range was 30.13 - 30.36 for Reichert Meissel and 2.66 - 2.68 for Polenske number. With the Iodine number, there was a slight increase during the tested level from 46.24 to, 46.83. This results agreed with that recorded by Riddet *et al* (18).

Therefore, from this Expt. eriment it can be concluded that 25% reduction in both maintenance and production for buffaloes reduced milk and fat yeild appreciably. Such reduced level appeared to be below the necessary requirement of the animals and it cannot be adopted in prac- tice For this reason Expt. 5 was undertaken using less reduction in both maintenance and production.

The highest decrease in fat yield was 16.69% which corresponded to 25% reduction in the level. For this reason only 8% (25−17=8) was tested.

Experiment 5

Effect of using 8% *reduced level for feeding buffaloes on milk and fat yield as well as milk composition and fat quality*

The results in Table V indicated that the average milk yield with the control level using the standard level adopted by Ghoneim was 16.60 lb. Reduction in the level to 8% increased the milk yield negligibly. The percentage change in yeild was + 0.51 ± 0.339 being +0.33, −0.33, +1.12 and +0.90 for buffaloes no. 17, 18, 19 and 20 respectively. The difference was not statistically significant, $t_{0.05}$ =1.54. The respective percentage change in fat yield among the buffaloes was zero, - 0.59, −1.09 and + 1.065, the average being 0.15 Such change was also insignificant (t = 0.021.)

Therefore, the reduction in the food level practically has no effect on milk yield and fat yield. The data in Table VI indicated clearly that there was no practical difference between the milk composition (of the composite samples of the four buffaloes) or fat quality during the initial, final or tested period using the reduced level. The range was 7.0 - 7.1 for fat, 4.20 - 4.39 for crude protein and 16.37 - 16.70 for total solids.

The results with Reichert Meissel, Polenske and Iodine number were identical in the control level and reduced level. The respective range of them was 29.43 - 29.52, 2.45-2.46 and 48.32-48,58 being within the recorded data with buffaloes in Egypt (1).

Therefore, it can be concluded that a 8% reduction in Ghoneim's level in both maintenance and production did not affect milk yield, fat yield, milk composition and fat quality.

From the previous results of reducing the control level of the total requirements (maintenance and production), it was clear that with local cows and Frezian ones, a 25% reduction could be applied in practice without reducing milk or fat yield or changing milk composition or fat quality with buffaloes . 8%reduction in the total food level did not affect the yeild or quality of milk and its fat. Buffaloes were more sensitive to the reduction, the 25% reduction seriously reduced milk and fat yield. Ghoneim's level for maintenance appeared to be more liberal with cows than with buffaloes, being in the former case ca. 13.5% more than with the latter case. Therefore,the 25% reduction in the buffaloe's control level (0.3825 kg. S.V./100 kg. L.W.) would equal ca. 34% reduction from that of the control level for cows (0.58 kg. S.V./100 kg. L.W.).

As 25% reduction in maintenance level for buffaloes proved to satisfy maintenance requirements[1]' the 25% reduction in production level appeared not to satisfy the requirements for milk production.

The success in production with the 8%reduced level in both types of requirements appeared to be due to the fact that the surplus in maintenance requirements compensated the shortage in milk production requirements.

In case of cows' it was already found that33% reduction[1] in Ghoneim's maintenance level satisfied maintenance requirements. Here. the 25% reduction in cow's level for both maintenance and milk production levels, would allow also a surplus in maintenance requiremnts which would be utilized in milk production.

Therefore it was more convenient to seperate both types of requirements using 33% reudction in the control maintenance level for cows and 25% reduction in that of buffaloes. When this was calculated for each buffaloe in Experiment 5 and each cow in Experiments 1 and 2, and then subtracting from the total requirements given during the tested periods of these experiments, the remaining requirements was suitable for producing the milk.

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(1) Previous paper by the author submitted for publication, 1963.

The following data were obtained :

	Milk yield	Fat yield	Starch value left forproduct.	Effeciency of metabolizable being %
Expt. 1 (--25%)				
No. 1	6.12	5.20	1.57	92.3
2	7.69	5.10	1.96	90.0
3	9.59	4.50	2.19	92.2
Ёxpt. 2 (-25%)				
No. 4	7.64	4.10	1.68	88.7
5	7.61	3.80	1.65	88.6
6	7.18	3.80	1.53	89.6
7	7.57	4.00	1.66	89.8
8	7.57	3.80	1.61	92.7
Expt. 5 (- 8%)				
No. 17	6.62	6.50	2.49	70.4
18	7.65	5.30	2.49	70.4
19	7.43	6.50	2.72	72.2
20	7.34	6.60	2.86	68.7

The left requirements for milk production appeared to be suitable requirment for producing the normal amount of milk produced for each animal without any reduction in milk yield as found from the feeding experiments. Therefore' separating the suitable requirements for milk production, could allow calculating the suitable efficiency of transforming the metabolizable energy into net energy for milk. For example' in case of cow no. 2, producing 769 kg. containing 5.1 % fat (containing calories net energy), the requirements left for its production was found to be 1.96 kg. S.V. The calculated control production requirements was found to be 2.36 following Ghoneim's method for calculating in the ordinary way, assuming that 75% of the metaboli- zable energy was produced as net energy in milk.

The 1.96 kg. S.V. would produce 7371.6 (1.96 × 3761) colories metabolizable energy which was able to produce 7.69 kg. milk or 6751.8 colories. Therefore' the percentage utilization of metabolizable energy would be 91.6%. Summing up the data with cows it was found that the average percentage utilization was 90.05%, the range was between 88.6% (No.5) and 92.7 (No.8) being similar to thatobtained by Molgard. This means that less food units are necessary for producing milk for cows then when 75%figure was used. This means that the present level of Ghoneim for milk production could be reduced by 16 .6%.

In case of buffaloes' the average percentage utilization of metabolizable energy was 70.4%. Therefore' the present 75% figure utilized by Ghoneim for buffaloes seems to render the calculated require nints for milk production to be less than necessary. This utilization figure obtained experimentally would allow 7% more than the present standard given by Ghoneim for buffaloes.

Therefore, it could be concluded from these results that the suitable level for maintenance would be by reducing Ghoneim's level by 33% in case of cows and 25% in case of buffaloes. This was practically found to be of the same order in both species being 0.4 kg. S.V./100kg. L.W. (1)

For milk production, the present standard for Ghoneim could be reduced by 16.6% in case of cows and increased by 7% in case of buffaloes. In other words, the efficiency of utilizing metabolizable energy should better be 90% for cows and 70% for buffaloes.

It seems more logical that the efficiency of utilizing metabolizable energy in buffaloes to be less than cows. Buffaloes, milk contain higher fat content in proportion to protein and milk sugar. It hs been found by Kellner (12) that 1gm. of milk nutrients requires 3.89, 1.05 and 0.94 g. starch value for fat, sugar and protein respectively. This indicates that the efficiency of utilizing the digestible energy is less in case of fat than other nutrients supporting the view that the milk of higher fat content needs more metabolizable energy.

Calculating the required starch value unit for cows, milk using the 90% efficiency, the unit F.C.M. would need 0.218; with buffaloes using the 70% efficiency, the requirements would be 0.273.

Comparing the different standards in the literature for producing 1 kg. F.C.M., it was found to be 0.21 by Kellner up to 0.365 kg. S.V. Most workers used 0.27-0.28kg. S.V./kg.F.C.M. This standard appeared suitable for buffaloes and appeared to be higher than required for cows under our conditions.

Comparing the suggested scheme for feeding dairy animals in Egypt with that already used, the following annual requirements for dairy animals could be obtained assuming 400 kg. per cows and 500 kg. per buffaloes as an average live weight and that the average annual milk production is 2000 lb (900 kg.) per cow and 3000 lb. (1350 kg.) per buffalo (7), the average fat percentage being 5 and 7% respectively :

(1) Previous paper by the authors submitted for publication. 1963.

	Cows	buffaloes	Total
Number	600,000	800,000	1,400,000
Maintenance ration Ton S.V.			
1.- Ghoneim	500,000	744,600	1,244,600
2.- New system	350,400	584,000	934,400
% Difference	-30.00	-21.20	-24.40
Production ration Ton S.V.			
1.- Ghoneim	162,000	400,000	562,000
2.- New system	135,000	428,000	563,000
% Difference	-16.66	+7.1	+0.20
Maintenance + Producti.n Ton S.V.			
1.- Ghoncim	662,000	1,144,600	1,806,600
2.- New system	485,400	1,012,000	1,497,400
% Difference	-26.67	-11.58	17.11

Therefore, it would seem that applying the new system would save 24.4% in the maintenance ration for milking cows and buffaloes (310, 200 tons per year). For production, the suggested Scheme reduces the production requirements for cows by 16.66% (- 27,000 tons S.V.) and increase that of buffaloes by 7.1% (28,000 Tons S.V.). For both species, the increase in buffaloes nearly equals the decrease in cows, requirements so that the total requirements for both remain practically constant.

Adding up the resultant of both types of production, the net reduction for cows would be 26.67% (176,600 Tons S.V.) and for buffaloes would be 11.58% (132, 600 Tons S.V.). For both species and both types of production the total reduction would be equal 17.11% (309,200 Tons S.V.).

This suggested system needs further confirmation using wider application under controlled feeding and different conditions

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المستوى الغذائى المناسب لحيوانات اللبن

٢ ــ تأثير تخفيض المستوى الغذائى للجاموس والأبقار المحلية والفريزيان الحلابة

أحمد كمال أبو رية ، محمد على رأفت ، السيد رفعت أبو حسين
وعبد المجيد درويش

الملخص

اجريت خمس تجارب لدراسة المستوى المناسب للعليقة الكلية لحفظ الحيوان وانتاج اللبن على الجاموس والبقر المحلى والفريزيان باتخاذ مستويات غنيم للعليقة الحافظةوالعليقة الانتاجية للمقارنة اوتباع طريقة "Swing over method" لمدة تتراوح بين ٩٢ ــ ١٠٨ يوما واستخدام ٣ ــ ٥ حيوانات فى كل تجربة . فى حالة البقر وجد انه بعد تخفيض المستوى فى العليقة الكلية ٢٥ ٪ كان التغير فى الادرار هو ــ ٢٣ر١ ٪ وفى محصو لالدهن ٩٦ر٢ ٪ للبقر المحلى مقابل ١٤ر٠ ٪ و ٥٢ر٠ ٪ فى البقر الفريزيان وكانت هذه الفروق غير مؤكدة كما وجد أن تغذية البقر الفريزيان على مستوى يزيد ٢٥ ٪ من المعدل لم تحدث عنه زيادة مؤكدة فى ادرار اللبن (٣٧ر١ ٪) ومحصول الدهن (١٩ر١ ٪) بل اعتبر ذلك اسرافا فى التغذية ــ وفى حالة تغذية الجاموس على المستوى المنخفض ٢٥ ٪ كان النقص مؤكدا حيث بلغ ٣٥ر١٥ ٪ فى الادرار و ٨٤ر١٥ ٪ فى محصول الدهن أى أن هذا المستوى يقل كثيرا عن احتياجات الجاموس ــ وعند التغذية على مستوى مخفض ٨ ٪ فقط لم يتغير ادرار اللبن أو محصول الدهن (٥١ر٠ ٪ ، ١٥ر٠ ٪) ونستنتج من هذه التجارب أنه يمكن تخفيض مستويات العليقة الكلية بمقدار ٢٥ ٪ ، فى حالة البقر و ٨ ٪ فى حالة الجاموس كما وجد أن تخفيض المعدل أو زيادته لم تؤثر عمليا فى تركيب اللبن .

ومن نتائج البحث السابق على العليقة الحافظة التى ثبت نجاح تخفيضها ٣٣ ٪ فى حال البقر و ٢٥ ٪ فى حالة الجاموس أى استخدام ٤ر. كجم معادل نشا كمعدل واحد للعليقة الحافظة فى النوعين ، أمكن فصل العليقة الحافظة من الانتاجية والاستدلال على انسب معدل تحويل عند حساب العليقة الانتاجية للبن وانه وجد أن ٧٠ ٪ فى الجاموس ، ٩٠ ٪ فى البقر بدلا من المعدل الحالى (٧٥ ٪) لتحويل الحرارة الفسيولوجية النافية الى حرارة فى اللبن وينصح باتباع هذه الطريقة للتغذية السليمة فى الجمهورية العربية المتحدة ولا يجب زيادة العليقة الكلية بعد حسابها عن ١٠ ٪ عند وجود الغذاء بكمية كافية .