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Effect of Nutritional Treatments on the Productive Performance of Brown Swiss Male Calves

1. Body weight gain and nutrients digestibility

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FIFTY-EIGHT Brown Swiss calves averaging about 189 kg of live body weight and 9 months of age were employed in this study. Calves were divided into four groups of 15, 15, 14 and 14 animals in groups, I, II, III and IV, respectively. Two levels of feedings ; mode rate (to allow 0.8 kg gain/animal/day) and high level (to allow 1.20 kg. gain/animal/day) and two concentrate (C) : roughage (R) ratios ; 3 : 1 and 2 : 1 were tested. So, the four experimental animal groups represented ; moderate level of feeding with either 3C : 1R ratio (group I) or with 2C : 1R ratio (group II) and high level of feeding with either 3C : 1R ratio (group III) or 2C : 1R ratic (group IV). The experiment lasted for 12 months. The effect of plane of nutrition on weight gains, efficiency of feed utilization and nutrients digestibility were studied.

Results indicated that averages of total and daily gains of the experimental groups during the whole growing period were ; 286.7, 287.9, 308.4 and 304.1 kg/animal ; 0.786, 0.789, 0.845, and 0 833 kg./animal/day, respectively for groups I, 11, III, and IV. Animals received the high level of feeding had significantly higher total and daily gain than those of the moderate level. However, the differences in weight gains between groups fed 3 : 1 and 2 : 1 concentrate : roughage ratics were found to be statistically insignificant. Body gains for the experimental animls differed significantly according to period of fattening. The highest values of averages daily gain (above one kg/animal/day) were observed at the first three monthly interval (1-3 months of the experiment).

Values of efficiency expressed as kg feeds/kg gain were, 11.98, 12.88, 14.18 and 15.53 for the respective groups. The corresponding values of feed efficiency expressed as kg. SE/kg. gain were, 5.31, 5.29, 6.20 and 6.30. Calves fed the moderate level were more efficient than those of the high level.

Resulie concerning nutrients digestibility indicated that calves received the moderate level of feeding had higher digestibility values for DM, OM, CP, CF, EE and NFE than those of the high level. However, differences were significantly higher for OM, EE and NFE digestibility values. Calves received the 3C : 1R ratio and insignificantly higher digestibility values for DM, OM, EE and NFE but lower for CF than those of the 2C : 1R ratio.

Level of nutrition as well as concentrate to roughage ratio may have affected the performance of fattening calves. Lawrence and Pearce (1964) found that feeding calves on high, moderate and low planes of nutrition resulted averages daily gain of 1·83, 0·98 and 0·18 lb. daily. However, Neumann, *et al.* (1975) reported on Black Pied calves that daily weight gains were slight greater in the animal group received the medium plane of feeding than both those received the low and the high plane of nutrition.

With respect to the importance of concentrate : roughage ratio, Richardson, *et al.*, (1961) found that a ratio of 1R:5C gave greater gain than those of 1R: IC and IR: 3C, In additon, White and Reynolds (1968) indicated that increasing the level of rice straw from 20 to 40% in the rations of Angus steers caused a decrease in average daily gain from 1.23 to 1·09 kg. However, Danner, *et al.*, (1980) indicated that growth of Angus x Hereford yearling bullocks was very similarwith 40 and 85% concentrates.

The present experiment was conducted to study the effect of two levels of nutrition (moderate and high) and two ratios of concentrate to roughage (3:1 and 2:1) on the fattening ability, efficiency of feed utilization and nutrients digestibility of Brown Swiss male calves.

Material and Methods

Fifty-eight male Brown Swiss calves averaging about 9 months of age and 189 kg. of live body weight were used. Calves were divided into four groups of 15, 15, 14 and 14 animal in groups, I, II, III and IV respectively. Four different nutritional treatments were tested. The treatments included two levels of feeding ; moderate level (to allow 0·80 kg gain/animal/day) and high level (to allow 1·20 kg gain/animal/day). Within each level of feeding, two concentrate (C): roughage (R) ratios were used, 3:1 and 2·1 on starch equivalent (SE) basis. So, the four experimental animal groups represented ; medium level of feeding with 3C : 1R ratio (I), medium level with 2C: 1R ratio (II), high level with 3C : 1R ratio (III) and high level with 2C 1R ratio (IV).

Calves were tied to individual feeding stalls and allowed to drink three times daily. Changes of live body weight were recorded monthly. The expriment lasted for 12 months.

Three animals from each group were employed in a digestibility trial at the end of the experimental period. Grab sample method was applied and silica as internal marker was used for determining digestibility. During the digestibility trial, animals were fed their daily allowances, faeces grab samples were collected handly for three successive days from each animal.

The experimental ration consisted of a local Co-op concentrate feed mixture, berseem hay and rice straw. The Co-op-concentrate feed mixture contained 40% undecorticated cottonseed cake, 26% wheat bran, 20% corn, 7% cane

molasses, 4% rice bran, 2% limestone and 1% salt. Chemical composition of the feedstuffs used is given in Table 1. Animals were fed according to El-Ashry allowances (1980). Animals requirements were adjusted monthly regarding live body weight changes.

TABLE 1. The chemical analysis of feedstuffs used %

Feedstuffs	Moisture %	Grude protein %	On day matter basis			
			Crude fiber %	Ether extract %	Ash %	NEE %
Co-op feed mix. . .	11.6	21.0	20.2	2.9	13.6	42.3
Rice straw	9.1	2.3	36.7	1.2	19.6	40.2
Hay	12.0	12.8	25.1	2.7	13.0	46.4

Results and Discussion

1. *Body weight gain*

Averages of body weights, total and daily gains at three months interval and cumulative periods of the different experimental groups are shown in Tables (2 and 3). In general, it is clear that averages of total gains of calves fed high plane of feeding (groups III and IV) were higher than those of the other two groups (I and II). Statistical analysis showed that the differences between the two levels of feeding were only significant ($P < 0.05$) at the third interval during the period from 7-9 months of the start of experiment (Table 2) and were also significantly higher at cumulative periods obtained from 1-9, 1-12 and 7-12 months of the start of experiment (Table 3). The weight gain obtained in this study seemed to agree with the general pattern reported by Lawrence and Pearce, (1964); Guenther, *et al.*, (1965) ; Henrickson, *et al.*, (1965), Minish, *et al.*, (1966) ; Levantin, *et al.*, (1969) ; Drennan, (1979) and Pydak, (1979).

Statistical analysis showed no significant differences between the two ratios concentrate to roughage at different intervals and cumulative periods. Similar findings were observed by Wise, *et al.*, (1961); (Davis, *et al.*, 1963); Car and Znider, (1967) and Lister, *et al.*, (1968). Nelson and Neumann, (1972) found that averages of daily gains were nearly equal when diets of 60:40, 80:20 or 97: 03 C:R ratios were given. Moreover, the present results are in full agreement with those of Ranjhan and Daniel, (1972) and Forbes and Renton (1975) when C:R ratios in rations were ; 1:1, 2:1 and 3:1.

TABLE 2. Mean body weights, total and daily gains at three months interval periods.

Experimental intervals from the start	Allowances for 0.8kg daily gain		Allowances for 1.2 kg daily gain	
	G. I C : R 3 : 1	G. II C : R 2 : 1	G. III C : R 3 : 1	G. IV C : R 2 : 1
First interval from 1-3 *months*:				
Number of animals	15	15	14	14
Average initial weight (kg)	190.53	189.00	187.50	187.43
Average final weight (kg)	281.33	285.33	288.36	283.50
Average total gain (kg)	90.47	96.33	100.86	100.07
Average daily gain (kg)	0.983	1.047	1.096	1.044
Second interval from 4-6 months:				
Number of animals	15	14	14	14
Average initial weight (kg)	281.00	287.14	288.36	283.50
Average final weight (kg)	365.93	360.07	360.21	360.86
Average total gain (kg)	84.93	72.93	71.85	77.36
Average daily gain (kg)	0.923	0.793	0.781	0.841
Third interval from 7-9 *months*:				
Number of animals	15	14	14	13
Average initial weight (kg)	365.93	360.07	360.21	367.92
Average final weight (kg)	427.00	425.43	437.36	438.00
Average total gain (kg)	61.07	65.36	77.15	70.08
Average daily gain (kg)	0.686	0.734	0.867	0.787
Fourth interval from 10-12 *months*:				
Number of animals	14	12	13	12
Average initial weight (kg)	426.43	423.58	436.39	437.00
Average final weight (kg)	478.00	478.83	495.31	489.58
Average total gain (kg)	51.57	55.25	58.92	52.58
Average daily gain (kg)	0.560	0.600	0.640	0.571

The present study indicate that body gains of the experimental animals differed significantly ($P < 0.01$) according to period of fattening. The data indicated that averages of daily gains above one kg were observed at the first three months interval (1-3 months). This fast gain could be attributed to the fact that the growth of muscle tissues during the growing period was characterized by an increase in cellularity (hyperplasia) as well as by increase in cell size (hypertrophy) (Trenk Ie, *et al.*, 1978).

TABLE 3. **Mean body weights, total and daily gains during the different age periods (Cumulative data).**

Experimental intervals from the start	Allowances for 0.8kg daily gain		Allowances for 1.2kg daily gain	
	G. I C: R 3: 1	G. II C: R 2: 1	G. III C: R 3: 1	G. IV C: R 2: 1
Period from 1-6 *months*:				
Number of animals	15	14	14	14
Average initial weight (kg)	190.53	190.50	187.50	187.43
Average final weight (kg)	365.93	360.07	360.21	360.86
Average total gain (kg)	175.40	169.57	172.71	173.43
Average daily gain (kg)	0.953	0.922	0.939	0.943
Period from 1-9 *months*:				
Number of animals	15	14	14	13
Average initial weight (kg)	190.53	190.50	187.50	189.31
Average final weight (kg)	427.00	425.50	437.36	438.00
Average total gain (kg)	236.47	0.34.93	249.86	248.69
Average daily gain (kg)	0.866	0.860	0.915	0.911
Period from 1-12 *months*:				
Number of animals	14	12	13	12
Average initial weight (kg)	191.29	190.92	186.92	185.50
Average final weight (kg)	478.00	478.83	495.31	489.58
Average total gain (kg)	286.71	287.91	308.39	304.08
Average daily gain (kg)	0.786	0.789	0.845	0.83
Period from 4-9 *months*:				
Number of animals	15	14	14	13
Average initial weight (kg)	281.00	287.14	288.36	287.08
Average final weight (kg)	427.00	425.13	437.36	438.00
Average total gain (kg)	146.00	138.29	149.00	150.92
Average daily gain (kg)	0.807	0.764	0.823	0.834
Period from 4-12 *months* :				
Number of animals	14	12	13	12
Average initial weight (kg)	281.36	287.42	287.46	383.58
Average final weight (kg)	478.00	478.83	495.31	489.58
Average total gain (kg)	196.64	191.141	207.85	206.00
Average daily gain (kg)	0.720	0.701	0.761	0.755
Perio from 7-12 *months*:				
Number of animals	14	12	13	12
Average initial weight (kg)	365.86	358.17	359.46	366.08
Average final weight (kg)	478.00	478.83	495.31	489.58
Average total gain (kg)	112.14	120.66	135.85	123.50
Average daily gain (kg)	0.620	0.667	0.750	0.682

Averages of daily gains for the different groups during the cumulative periods showed that the highest daily gain was recorded during the period from 1-3 months (0·983-1·096 kg./day) followed by that obtained during the first six months of the start of experiment (0·922-0·953 kg/day), beyoung 6 months, averages of daily gain began to decrease noticeably and gradually. These results are in har- mony with those obtained by Diku and Astahova (1962) on Simmental and Brown Swiss bulls, who found that the best fattening period was that ranged from 9 to 12 months of age.

2. *Feed efficiency*

Feed efficiency expressed as kilograms of air dry feeds, SE and digestible protein (DP) required to produce one kilogram gain at different intervals separately and cumulatively are presented in Tables 4 and 5. The data indicated that animals which received moderate level of feeding were more efficient in feed utilization at the different experimental intervals than those received the high level. Such trend is in agreement with the results reported by Blaxter and Wainmann, (1964) ; Henrickson, *et al.*, (1965) and El-Kholy, (1975).

In respect to the effect of C:R ratios on feed efficiency (Tables 4 and 5), data showed that within each level of feeding at both different interval and cumulative periods, efficiencies of feed utilization were nearly similar. Forbes and Renton, (1975) found that using three different concentrate ; hay ratios, 1:1, 2:1 and 3:1 did not affect the conversion of metabolizable energy (ME).

Inspection of data concerning feed efficiency at the different interval periods of the experiment, it is clear that the amounts of feed, SE and DP consumed/kg gain increased gradually at the successive periods. The principal explanation of this phenomenon is based on the fact that younger and lighter animals use a smaller percentage of the ration to statisfy maintenance requirements than that of the older and heavier animals, thus making available a greater percentage of total feed consumed for the production of growth and fat (Snapp and Neumann, 1963). The same findings were reported by Maymone and Matassino, (1963).

3. *Nutrients digestibiliy*

Data concerning nutrients digestibility (Table 6) indicated that animals received the moderate level of feeding had higher digestibility values for DM, OM, CP, CF, EE and NFE than those of the high level. However, differences were significantly higher for OM, NFE (P - 0·05) and EE ($P < 0·01$). It is observed during the collection period of the digestion trial that calves received

TABLE 4. **Mean feed efficiency for different groups at three months interval periods.**

Experimental intervals from the start	Allowances for 0.8kg daily gain		Allowance for 1.2kg daily gain	
	G . I C : R 3 : 1	G . II C : R 2 : 1	G. III C : R 3 : 1	G . IV C : R 2 : 1
First experimental interval from 1-3 *months*:				
Kgfeeds/kg* gain	8.05	8.07	9.19	10.40
Kg SE/kg** gain	3.52	3.29	4.00	4.20
Kg DP/kg*** gain	0.648	0.545	0.719	0.678
Second experimental interval from 4-6 *months.*				
Kg feeds/kg gain	9.87	12.41	14.88	15.00
Kg SE/kg gain	4.37	4.84	6.52	6.05
Kg DP/kg gain	0.819	0.863	1.187	0.994
Third experimental interval from 7-9 *months*:				
Kg feeds/kg gain	14.63	14.76	14.55	17.30
Kg SE/kg gain	6.49	6.07	6.38	7.03
Kg DP/kg gain	1.219	1.030	1.167	1.158
Fourt expeimental interval. from 10-12 *months*:				
Kg feeds/kg gain	19.00	19.13	21.29	25.85
Kg SE/kg gain	8.45	7.88	9.32	10.48
Kg DP/kg gain	1.596	1.347	1.712	1.731

* kg. air dry feeds.
** SE : starch equivalent.
*** DP : Digestible protein.

TABLE 5. **Mean feed efficiency during the different age periods (cumulative data).**

Experimental intervals from the start	Allowances for 0.8kg daily gain		Allowances for 1.2kg daily gain	
	G . I G : R 3 : 1	G . II G : R 2 : 1	G . III G : R 3 : 1	G . IV G : R 2 : 1
Period from 1-6 months:				
Kg feeds/kg gain	8.90	9.93	11.56	12.41
Kg SE/kg gain	3.93	4.07	5.05	5.03
Kg DP/kg gain	0.731	0.682	0.914	0.819
Period from 1-9 months:				
Kg feeds/kg gain	10.38	11.28	12.49	13.53
Kg SE/kg gain	4.59	4.62	5.46	5.49
Kg DP/kg gain	0.856	0.799	0.992	0.898
Period from 1-12 months:				
Kg feeds/kg gain	11.98	12.88	14.18	15.53
Kg SE/kg gain	5.31	5.29	6.20	6.30
Kg DP/kg gain.	0.993	0.894	1.130	1.034
Period from 4-9 months:				
Kg feeds/ Kg gain	11.85	13.52	14.72	15.67
Kg SE/kg gain	5.26	5.56	6.45	6.37
Kg DP/kg gain	0.985	0.941	1.117	1.047
Period from 4-12 months:				
Kg feeds/kg gain	13.79	15.29	16.59	18.07
Kg SE/kg gain	6.12	6.29	7.29	7.33
Kg DP/kg gain	1.151	1.070	1.330	1.208
Period from 7-12 months:				
Kg feeds/kg gain	16.68	16.74	17.51	20.82
Kg SE/kg gain	7.41	6.89	7.67	8.45
Kg DP/kg gain	1.395	1.159	1.405	1.394

the high level of feeding (groups III and IV) consumed more nutrients than those of the moderate level (groups I and II). So, amounts of feed intakes may have affected nutrients digestibility. Blaxter and Wainmann, (1964) ; Brown, (1966) ; Putnam, *et al.*, (1966) and Leaver, *et al.*, (1969) concluded that increasing feed intake resulted in a decline in nutrients digestibility.

With respect to the effect of C : R ratios, the data (Table 6) showed that digestibility values were insignificantly higher for DM, OM, CP, NFE and significantly ($P < 0.05$) higher for EE of animals received the 3C:IR ratio than those received the 2C : IR ratio. However, CF digestibility insignificantly decreased as the level of concentrate increased.

TABLE 6. **Means of apparent digestibility coefficient of nutrients.**

Group	Nutrient					
	DM	OM	CP	CE	EE	NFE
I	74.64	75.72	77.25	66.57	70.89	80.67
II	73.76	74.97	73.64	65.64	60.33	81.30
Mean for the moderate level	74.20	75.35	75.45	66.11	65.61	80.99
III	70.96	71.50	72.87	58.73	58.97	79.24
IV	69.72	69.75	69.85	83.10	54.67	74.79
Mean for the high level . . .	70.34	70.63	71.36	60.92	56.82	77.02
Mean for 3 : 1 C:R ratio	72.80	73.61	75.06	62.65	64.93	79.96
Mean for 2 : 1 C:R ratio .	71.74	72.36	71.75	64.37	57.50	78.05

These results are in full agreements with those of Lamming, *et al.*, (1966); White, *et al.*, (1971) ; Forbes and Renton, (1975) ; Price, *et al.*, (1980) ; Eliseeu, *et al.*, (1981) and Gut, (1981) who showed that reduction of CF in the diet increased the digestibility of nutrients. Bacvanski, *et al.*, (1983), found that digestibility of all nutrients except CF decreased with increasing proportion of roughage in the ration. In addition, Stone and Fontenot, (1965) and Nelson, (1968) reported that the increase of dietary energy improved the digestilility of DM, OM and energy, however, digestion of fiber in the rumen and reticulum was inversely related to the increase in energy concentration.

It can be concluded from the data of the present study that Brown Swiss calves can be considered a good source of red meat when moderate feeding regimes are applied.

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تأثير المعاملات الغذائية على الأداء الانتاجى للعجول البراون سويس
١ ـ النمو ومعاملات الهضم

محمد عبد المنعم العشرى ، حمدى محمد خطاب ، السيد السيد راغب وعبد الحليم أنيس عشماوى

كلية الزراعة ـ جامعة عين شمس والشركة المصرية لانتاج اللحوم والألبان ـ القاهرة ـ مصر

اجريت التجربة على عدد ٥٨ عجل براون سويس متوسط أوزانها ١٨٩ كجم ومتوسط اعمارها ٩ اشهر مقسمة على أربع مجاميع على أساس ١٥ ، ١٥ ، ١٤ ، ١٤ عجل فى المجموعات الأولى والثانية والثالثة والرابعة على الترتيب ـ غذيت المجموعة الأولى والثانية على مستوى غذائى يسمح بمعدل نمو يومى مقداره ٨ر كجم للحيوان وتحصل فيها الحيوانات على احتياجاتها الكلية من المواد المركزه والمواد الخشنة بنسبة ٣ : ١ ، ٢ : ١ على التوالى ـ غذيت المجموعة الثالثة والرابعة على مستوى غذائى يسمح بنمو يومى مقداره ٢ر١ كجم للحيوان وتحصل فيها الحيوانات على احتياجاتها الكلية من المواد المركزة والمواد الخشنة بنسبة ٣ : ١ ، ٢ : ١ على التوالى واستمرت التجربة لمدة ١٢ شهر تم فيها دراسة تأثير المعاملات الغذائية على معدلات النمو وكذلك معاملات هضم العناصر الغذائية المختلفة ٠

وقد أوضحت النتائج ما يلى :

١ ـ متوسطات الزيادة الكلية فى الوزن الحى هى ٧ر٢٨٦ ، ٩ر٢٨٧ ، ٤ر٣٠٨ ، ١ر٣٠٤ كجم / حيوان للمجاميع الأربعة على التوالى وكانت متوسطات الزيادة ـ اليومية لنفس المجاميع على الترتيب هى ٧٨٦ر ـ ٧٨٩ر ـ ٨٤٥ر ـ ٨٣٣ر ـ كجم / حيوان وكانت الفروق معنوية فيما يختص بالمستوى الغذائى وغير معنوية فيما يختص بنسبة المواد المركزة الخشنة ٠

٢ ـ كانت أعلى معدلات نمو لكل المجاميع التجريبية فى خلال الثلاثة أشهر الأولى من التجربة ٠

٣ ـ كانت الكفاءة الغذائية معبرا عنها بعدد كيلو جرامات الغذاء الماكول ومعادل النشا اللازمة لكل كيلو جرام نمو للمجاميع الأربعة على التوالى هى ٩٨ر١١ ، ٨٨ر١٢ ، ١٨ر١٤ ، ٥٣ر١٥ ـ ٣١ر٥ ، ٢٩ر٥ ، ٢٠ر٦ ، ٣٠ر٦ وتشير النتائج الى الكفاءة الأعلى للمجاميع المغذاة على المستوى الغذائى المتوسط عن المغذاة على المستوى الغذائى العالى ٠

٤ ـ تشير نتائج تجارب الهضم الى أن الحيوانات المغذاة على المستوى الغذائى المتوسط أعطت قيم أعلى لهضم كل من المادة الجافة والعضوية والبروتين الخام والألياف الخام ومستخلص الاثير ومستخلص المواد الخالية من الأزوت عن الحيوانات المغذاة على المستوى الغذائى العالى ٠

٥ ـ أوضحت النتائج أن الحيوانات المغذاة على نسبة ٣ : ١ مواد مركزة الى مواد خشنة أعطت قيم أعلى معنويا لهضم كل من المادة الجافة والمادة العضوية ومستخلص الاثير ومستخلص المواد الخالية من الأزوت بينما أعطت قيم منخفضة لهضم الألياف الخام عن الحيوانات المغذاة على نسبة ٢ : ١ مواد مركزة الى مواد خشنة ٠