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Feed Intake in Ossimi, Rahmani and Merino Rams

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Feed intake in Ossimi, Rahmani and Merino rams was measured in the Animal Breeding Department, Faculty of Agriculture, Cairo University, using different procedures, over a period of two months.

The following results were obtained :

1. The average actual daily feed intake of berseem was 7.4, 7.1, 6.8 kg for Ossimi, Rahmani and Merino rams, respectively.

2. The estimated feed consumption using the marker was 10% less than the actual feed intake in all breeds.

3. The daily intake using Cr_2O_3 marker technique in the berseem pasture was 8, 58, 8, 47 and 7.59 kg with a dry matter of 1.31, 1.24 and 1.15 kg for the three breeds, respectively.

4. The feed intake and dry matter consumption in pasture was greater than that in case feeding indoors on berseem.

5. The daily dry matter in take per 100 kg body weight was highest in Merino rams (2.51) followed by the Ossimi and Rahmani (2.01 and 1.96 kg respectively). While in the pasture it was 2.81, 2.34 and 2.35 kg for Merino, Ossimi and Rahmani rams, respectively.

6. It is suggested to use one fed. of berseem which produces 30 tons on the average taking four cuts. to feed 25 adult imported Merino and native sheep in Egypt.

Feed intake is partly a function of metabolic rate and body size. The daily intake of green forage (usually measured as dry matter intake) varies with the breed and age of sheep as well as the type and stage of forage growth.

The problem of measuring how much feed an animal obtains from the pasture is an important and difficult one. Considerable efforts were given to the improvement of the method and techniques by Raymond (1966).

By means of collection bags, the weight of faeces voided by animals can be measured "directly" to be able to calculate for age consumption, or estimated "indirectly" by dosing the animals with known weights of indigestible external traces as chromic oxide and measuring the concentration of tracer in a sample of faeces.

If errors are to be reduced this necessitates systematic sampling of faeces either directly from the sward (Raymond and Minson, 1955) or by "grab" sampling from the rectum (Lambourne and Reardon, 1963) to calculate the total faecal excretion from the concentration of the indicator in representative samples.

Material and Methods

Feed intake was estimated using four yearling rams (13 months old) from each of Ossimi, Rahmani and Merino breeds for a period of 2 months. Water was made available all the time.

The daily feed intake was estimated by different procedures :

1. *Actual consumption by berseem sward*

(*a*) *Direct technique*

Each ram was offered 10 kg of clover per day in the morning during a period of two months. The refused clover was weighed daily before offering the new fresh supply to find out the individual daily feed intake.

(*b*) *Chromic oxide technique*

To compare the accuracy of the chromic oxide technique with the direct weighing method, a solution of 5 g $Cr_2 O_3$ in 500 ml water was sprayed evenly on the 10 kg daily diet for each individual within a period of 3 days. The feed intake was estimated according to this technique and compared with the direct weighing method. Total faeces collections were made daily. For the estimation of feed intake by $Cr_2 O_3$ method, 1-1.5 g samples of dried berseem and faeces were digested with nitric acid and oxidized with perchloric acid and sodium molybdate mixture. The condition of the digestion and oxidation of specimens were fulfilled according to Carter *et al.* (1960), Whitby and Daphne Lang (1960). The concentration of Cr_2O_3 was estimated by colorimetric technique at 425 W.L.

2. *Feed consumption in the pasture*

Feed consumption in the pasture was estimated using Chromic oxide as a marker. The same rams used in the last experiment were allowed to graze on a fixed area of green berseem covering their requirements. This area was sprayed by a solution of 60 g $Cr_2 O_3$ in 6l of water. Two kg of gelatin were dissolved in the water to give sufficient viscosity to fix the solution on the berseem plants. The animals were grazed daily for a period of 8 hr from 8 a m to 4 p m. This time period was previously found to be optimum for sufficient feed intake with the same animals used (Khalil and Afifi, 1975).

According to Barnicoat (1945) and Lambourne (1957) each animal was given a 5g dose of Cr_2O_3 daily in a capsule for a period of four days to attain the general stable level of Cr_2O_3. The experiment began on the fifth day and continued for three days on each individual.

Samples were taken from the berseem and faeces to estimate Cr_2O_3 concentration. The concentration of the marker in the berseem was estimated in several samples taken from various locations in the fixed field area. The concentration of Cr_2O_3 and total dry matter per day were estimated in 2-5% from the total collection of the faeces on each individual.

Feed intake was calculated according to the equation of Raymond and Minson (1955) and Lambourne (1957).

$$\text{Dry matter consumption (g) per day} = \frac{Cr_2O_3 \text{ units per g dry faeces} \times \text{dry matter in faeces g per day}}{Cr_2O_3 \text{ per g dry matter of forage}}$$

Results and Discussion

Feed intake

(*a*) *Actual feed intake of berseem*

The average daily feed consumption of offered green berseem was 7.4, 7.1 and 6.8 kg for Ossimi, Rahmani and Merino rams, respectively (Table 1).

TABLE 1. Average actual berseem intake (kg) and dry matter consumption, 100 kg body weight by Ossimi, Rahmani and Merino rams.

Animals No.	Ossimi	Rahmani	Merino
1	5.8	7.3	6.5
2	7.2	7.4	7.0
3	8.5	6.6	6.6
4	7.9	7.0	7.2
Mean fresh berseem intake	*7.4±0.12	7.1±0.83	6.8±0.75
Mean dry matter intake	**1.129	1.083	1.038
Final body weight	56.20	55.30	41.30
Dry matter consumption / 100 kg body weight	2.009	1.958	2.513

* The average for each individual animals represents daily consumption during 63 consecutive days.

** The average dry matter during the total period of berseem was 15.26 %.

The daily dry matter intake 100 kg body weight was highest in Merino rams 2.51 followed by Ossimi and Rahmani 2.01 and 1.96 kg, respectively.

(b) Estimated feed intake by chromic oxide marker

When daily feed consumption was estimated by the marker technique for individual animals (Table 2), it was clear that estimated feed consumption was less than the actual value by 10 % in rams of all the breeds used. The difference may be due to the error caused by the uneven spreading of Cr_2O_3 on the offered feed, thus inducing-non accurate sampling.

TABLE 2. Average actual versus estimated berseem intake in Ossimi, Rahmani and Merino rams.

Breed	Food Intake							
	Actual				Estimated by marker(Cr_2O_3)			
	First day	Second	Third	Mean	First day	Second	Third	Mean
Ossimi	Fresh 7.7	7.3	7.2	7.4±0.03	6.7	6.6	6.5	6.6±0.02
	Dry mater 1.175	1.114	1.099	1.129	1.053	1.007	0.992	1.007
Rahmani	Fresh 7.1	6.6	6.8	6.9±0.01	6.4	6.2	6.0	6.2±0.03
	Dry matter 1.083	1.007	1.038	1.053	0.997	0.946	0.916	0.946
Merino	Fresh 7.2	7.1	7.0	7.1±0.03	6.5	6.4	6.2	6.4±0.37
	Dry matter 1.098	1.083	1.068	1.083	0.992	0.977	0.946	0.977

(c) *Feed intake in pasture*

Applying the chromic oxide (Cr_2O_3) marker technique in the berseem pasture, the estimated average dry matter consumed daily was 1.207, 1.260 and 1.126 kg in Ossimi, Rahmani and Merino rams, respectively. The daily berseem intake was 7.8, 7.7 and 6.9 for Ossimi Rahmani and Merino rams. respectively. This berseem contained 16.22% dry matter. Since the marker technique gave only 90% of the actual in the pasture, the daily berseem intake values could be adjusted to 8.58, 8.47 and 7.59 kg for the three breeds respectively (Table 3). These values of feed intake when rams grazed on berseem in pasture were greater than those in case of feeding indoors. This may be due to enhanced appetite and improved selectivity by the process of grazing.

The daily intake of bereem measured as a dry matter consumption per 100 kg body weight varied with the breeds mentioned. It was highest in the imported Merino rams followed by the Ossimi and Rahmani, respectively (Table 3).

TABLE 3. **Average berseem intake (kg) in grazing pasture estimated by marker (Cr_2O_3) for Ossimi, Rahmani and Merino rams.**

Breed	Items	Food intake*	
		Estimated	Corrected for accuracy 90%
Ossimi	Fresh	7.8±0.58	8.6 ± 0.99
	Dry matter.	1.190	1.312
	Dry matter consumption per100kg body weight .	2.117	2.335
Rahmani	Fresh	7.7±0.58	8.5 ± 0.69
	Dry matter	1.175	1.297
	Dry matter consumption per100kg body weight.	2.125	2.345
Merino	Fresh	6.9±0.03	7.6±0.03
	Dry matter	1.053	1.159
	Dry matter consumption per 100kg pody weight.	2.549	2.806

* Mean of the three days

According to Maynard and Loosli (1962) and Ghoneim (1955) feeding standards, the average feed requirements for the adult sheep in 700g starch equivelant and 110 g digested protein which correspond toabout 7 kg of berseem, (average feed consumption in the experiment). Bearing in mind that one fed. of berseem produces 30 tons on the average taking four cuts.

It can be calculated that the number of adult sheep which can be fed per fed. is about 25 heads.

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كمية الغذاء المأكول لاغنام الاوسيمى والرحمانى والمرينو

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أجرى بحث تجريبى لدراسة كمية الغذاء المأكول من البرسيم لاغنام الأوسيمى والرحمانى والمرينو فى مزرعة كلية الزراعة ـ جامعة القاهرة بالجيزة • واستعملت لذلك طرق مختلفة أولها وزن المقدار المأكول فعلا من الكمية المعطاه . ثم اضافة المرقم (اكسيد الكروميك) وحساب كمية الغذاء المأكول الحقيقى ثم باستعمال المرقم فى الحظيرة ثم رش المرقم فى المرعى على البرسيم وحساب الغذاء المأكول فى المرعى كأساس لمعرفة الفروق بين الاغنام المستوردة والاغنام المحلية •

وتتلخص النتائج التى توصل اليها البحث فيما يلى : ـ

(١) كان متوسط كمية البرسيم المأكوله يوميا والتى استمرت ٦٠ يوما هو ٧ر٤ ، ٧ر١ ، ٦ر٨ ـ كيلو جرام لكباش الاوسيمى والرحمانى والمرينو بالترتيب•

(٢) بتقدير كمية البرسيم المأكولة بطريقة المرقم اتضح أن هذه الطريقة تعطى قيمة أقل من المستهلك الحقيقى المأكول بمقدار ١٠٪ تقريبا للأنواع الثلاثة •

(٣) كان معدل الاستهلاك الحقيقى المحسوب بالمرعى هو ٨ر٦ ، ٨ر٥ ، ٨ر٦ كيلو جرام لكباش الأوسيمى والرحمانى والمرينو بالترتيب •

(٤) كمية البرسيم المستهلكة فى المرعى زادت عن كمية البرسيم المستهلكة فى الحظيرة •

(٥)كانت كمية المأكول كمادة جافه بالنسبة الى كل ١٠٠ كيلو جرام من الوزن الحى أكبر فى أغنام المرينو ٢ر٥١ ثم ٢ر٠١ ثم الرحمانى ١ر٩٦ كيلو جرام فى الحظيرة بينما كانت فى المرعى ٢ر٨١ ، ٢ر٣٤ ، ٢ر٣٥ كيلو جرام للأنواع الثلاثة بالترتيب •

(٦) يوصى هذا البحث بتخصيص فدان برسيم لكل ٢٥ رأسا من الأغنام المستوردة والمختلفة لتكفى احتياجاتها الغذائية فى جمهورية مصر العربية •

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Passage of Ingesta through the Digestive Tract in Sheep by Using Chromic Oxide as a Marker

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Comparative study was undertaken between Merino and native sheep breeds (Ossimi and Rahmani) at the Faculty of Agriculture Cairo University, with the aim of studying the rate of passage of ingesta through the digestive tract, using chromic oxide as a marker.

Four rams of each breed were slaughtered successively after 6,12,24 and 48 hr from feeding the marker to measure the weight of the contents and the concentration of Cr_2O_3 in each compartment of the digestive tract. The main results were :

1. 6 hr after dosing,, 90% of the feed consumed was still retained in the rumen . The Merino showed the greatest retention.
2. After 12 hr the rumen contained only 20% of the feed . The Merino showed the highest retention. The same trend for breed differences was observed in the colon.
3. After 24 hr the Merino retained 15% of the feed in the ruminoreticulum while the native breeds retained only 10%.
4. After 48 hr the forestomach (ruminoreticulum and omasum) of the native breeds were completely free of Cr_2O_3 while the Merino still showed the presence of the marker in the forestomach (omasum).

The rate of passage of digesta is one of the important factors in determining the efficiency with which the animal utilizes a given amount of feed, another important factor is the rate of breakdown of the feed to provide the requirements of the animal (Blaxter *et al.*, 1956).

Various terms are used to describe the flow of ingesta through the digestive tract including transit time, retention time, rate of passage, and rate of flow or rate of transport Any of these terms implies the time taken by undigested residues from a given meal to reach the faeces or any point in the gut(Kotb and Luckey, 1972).

The problem of measuring this time has been approached using chromic oxide ($Cr_2 O_3$) techniques (Lambourne, 1957), to show the time taken by clover or berseem to pass completely through the digestive tract.

Balch (1950), Blaxter *et al.* (1956) and Phillipson and Ash (1965) suggested that the passage of ingesta through the digestive tract of ruminants could be regarded as a kinetic process. They proposed the following model.

$$A \xrightarrow{(K_1)} B \xrightarrow{(K_2)} C \xrightarrow{(r)} R$$

Rumen Abomasum Duodenum Faeces

There was no direct experiment to show that those three constants actually represent events in the specific parts of the tract.

In the present experiment the following model was suggested:

$$A \xrightarrow{(K_1)} B \xrightarrow{(K_2)} C \xrightarrow{(K_3)} D \xrightarrow{(K_4)} E \xrightarrow{(K_5)} F \xrightarrow{(r)} R$$

Rumino reticulum Omasum Abomasum Small intestine Cecum Colon Faeces

Where K_1, K_2, K_3, K_4, and K_5, are constants of passage and (r) is a time delay between F and R.

Little information is available for Egyptian clover (*Trifolium Alexandrinum*), the main animal feed in Egypt, concerning its rate of passage and the quantity of digesta that passes a point along the digestive tract in a given time period.

Another objective of this study was to find out any difference that may exist between imported Merino and the native sheep breeds, Ossimi and Rahmani, in this respect.

Material and Methods

The rate of passage of the ingesta through the digestive tract was recorded using chromic oxide as a marker. Four rams, aged 15 months, from each of the Ossimi, Rahmani and Merino breeds were used. Each ram was given 5g of Cr_2O_3 in a capsule. Each animal was given 10 kg of berseem *adlibitum*.

Rams of each breed were slaughtered successively after 6, 12, 24 and 48 hr, to find out the concentration of Cr_2O_3 in each compartment of the digestive tract after the lapse of the specified period of time denoting the rate of passage through the digestive tract within that fixed period.

The mean concentration of Cr_2O_3 was determined according to the following equation after Lambourne (1957).

The percentage of maker in each compartment =

$$\frac{\text{weight of markers in any compartment}}{\text{Total weight of the marking dosing}} \times 100$$

The procedures used were those described by Smith (1955), Analytical Methods Committee (1960), Carter *et al.* (1960), Whitby and Daphne Lang (1960) and Ali and Evane (1967).

The concentration of Cr_2O_3 was estimated by colorimetric technique at 425 W.L.

Results and Discussion

After 6 hr from dosing, the rumen retained more than 90% of the feed consumed (Table 1). The Merino showed the greatest feed retention (Fig. 1).

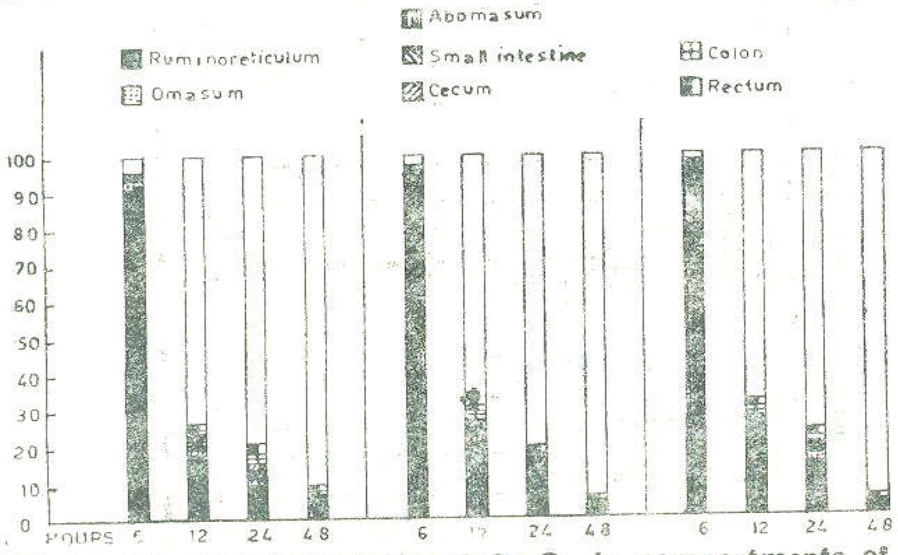

Fig. 1 The percentage value of Cr_2O_3 in compartments of the digestive tract of Ossimi, Rahmani and Merino sheep at 6, 12, 24 and 48 hr from dosing.

After 12 hr the rumen contained about 20% of the feed, the Merino showed also the highest retention after 24 hr, the Merino retained in its rumen 15% of the feed while the native breeds retained only 10%. Whether this greater retention of feed can be a criterion explaining the better rumen digestion in Merino is a question of concern in this work.

The ruminoreticulum and omasum of the native breeds were completely free of Cr_2O_3 at 48 hr after dosing (Fig. 1). On the other hand the Merino, however, still showed the presence of the marker in the omasum which denotes slowest evacuation of the ruminoreticulum.

It was reported that the marker of Cr_2O_3 had passed from the rumen throught the omasum the abomasum in ½ hr (Lambourne, 1957). This rumen evacuation is greatly related to feeding habits (Campling *et al.*, 1961; Balch, 1961 and Balch and Campling, 1965).

TABLE 1. The percentage value of Cr_2O_3 in the compartments of the digestive tract of Ossimi, Rahmani and Merino sheep at 6, 12, 24 and 48 hr from dosing.

Breed	Ossimi				Rahmani				Merino			
Compartment . . .	6	12	24	48	6	12	24	48	6	12	24	48
Rumenoreticlum . .	91.80	18.40	10.81	—	94.82	21.23	9.80	—	96.89	21.99	15.22	—
Omasum	2.41	0.20	0.52	—	2.01	0.97	0.48	—	1.03	0.64	1.06	0.40
Abomasum.	1.50	0.52	0.91	0.92	0.98	0.82	0.26	0.38	0.49	1.98	0.22	0.26
Small intestine. . .	—	1.63	2.88	2.20	—	2.24	1.88	1.03	—	1.84	0.54	0.88
Cecum.	—	2.14	1.04	2.80	—	1.15	2.04	2.01	—	0.96	0.38	0.56
Colon	—	2.37	2.07	1.40	—	2.02	2.80	1.95	—	2.98	0.80	0.86
Rectum	—	1.68	2.99	1.80	—	1.69	2.40	0.62	—	2.13	2.15	0.83
Total	95.71	26.94	21.22	9.12	99.81	30.12	19.66	5.99	98.41	32.52	20.37	3.79

The intestinal tract showed no breed difference in feed retention at 12 hr (around 8%), while at 24 hr, it showed less retention in Merino (4, 9 and 9% in Merino, Ossimi and Rahmani, respectively) and the same was also noticed at 48 hr (3,9 and 9% in Merino, Ossimi and Rahmani respectively).

Another characteristic breed difference was the very low retention of feed in the cecum of Merino compared to the native breeds at any time after Cr_2O_3 dosing (Table 1). The colon also showed the same breed difference but after 12 hr from dosing.

The results may indicate the good adaptation of the local breeds of sheep to the coarse roughages usually available for sheep feeding in Egypt.

The native breeds have adopted feeding habits which make contribute to their efficiency utilizing such feeds (Sharafeldin and Shafie, 1962).

This breed difference however needs more confirmation. Ruminal and caecal fistulae offer greater accuracy and better testing at shorter time intervals. Feed type and management for both local sheep and imported Merino must have particular consideration.

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سرعة مرور الغذاء خلال الجهاز الهضمى للأغنـام

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أجرى هذا البحث فى كلية الزراعة جامعة القاهرة بهدف دراسة سرعة مرورالغذاء فى الجهاز الهضمى للأغنام المحلية (الأوسيمى والرحمانى) والأغنام المستوردة (مرينو) واستعمل البرسيم (الغذاء الرئيسى للحيوانات فى مصر) فى تغذية هذه الأغنام وشملت التجربه ٤ ذكور من كل نوع وأعطيت جميعها الرقم (اكسيد الكروميك) ثم ذبحت على فترات بعد ٦ ساعات ، ١٢ ساعة ، ٢٤ ساعة ، ٤٨ ساعة ووزنت محتويات الكرش والشبكية والورقية والأنفحة والأمعاء الدقيقة والأعور والأمعاء الغليظة والمستقيم (الروث) وأخذت عينه من كل جزء لتقدير المادة الجافة ونسبة اكسيد الكروميك ٠

وكانت أهم النتائج :

(١) لم يتجاوز مرور البرسيم فى الجهاز الهضمى للأغنام بعد ٦ ساعات من اعطائها المرقم الكرش الذى كانت به نسبة ٩٠٪ من الغذاء المعطى كما كان المرينو أعلاها فى حفظ الغذاء ٠

(٢) لم يحتو الكرش بعد ١٢ ساعة الا على ٢٠٪ من البرسيم ، وكان المرينو كذلك أعلاها فى حفظ الغذاء ، ووضح ذلك ايضا فى الأعور ٠

(٣) وبعد ٢٤ ساعه احتفظ المرينو بمقدار ١٥٪ من الغذاء فى الكرش ، بينما لم يتجاوز ما احتفظت به الأغنام المصرية ١٠٪ من الغذاء المعطى ٠

(٤) وبعد ٤٨ ساعة كان المرينو لايزال يحتفظ بالغذاء فى أجزاء من المعدة المركبة (الورقيه) بينما كانت الورقيه خالية تماما فى الأنواع المحليه ٠ وبوجه عام فان دراسة هذا الموضوع يجب أن تستمر ومن الطبيعى أن استخدام الحيوانات ذات الفستيولا الدائمه فى الكرش والأعور سوف يعطى نتائج أكثر دقه وامكانيات أكبر للدراسه ٠

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Seasonal Variations in Semen Quality of Ossimi and Rahmani Rams

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Trials described here aimed to investigate seasonal fluctuations in semen quality of Ossimi and Rahmani rams. Nine rams 2 to 4 years old (five Ossimi and four Rahmani) were derived from the original flock of this department and were being trained for artificial semen collection. The investigation period comprised four equal intervals of one month each as follows : October (autumn), January (winter), April (spring) and July (summer). During the investigation intervals, semen was collected regularly 3 times/ week/ram. A total of 849 ejaculates was investigated. Semen ejaculates were tested for volume, advanced motility, pH, sperm-cell concentration/mm^3 and methylene blue reduction time (MBRT).

Data of the combined breeding groups show that the overal means for seminal attributes mentioned earlier were 0.53 ± 0.04 ml, 68.0 ± 2.0, 6.85 ± 0.03. $3.98\pm0.23\times10^6$ sperm-cell / mm^3 and 3.61 ± 0.46 min, respectively . Excluding semen reaction breed of ram affected investigated seminal characters non-significantly. Difference between breeds in semen reaction (0.04), however is significant, ($P<.05$) yet biologically is negligible.

Comparing semen characteristics of the two successive ejaculates, semen of the second ejaculate was smaller in volume, higher in motility and its reaction was very closer to neutrality, otherwise, semen characteristics of the two ejaculates were significantly not different. Moreover sperm out put of the second ejaculate (1.84×10^9 sperm cell / ejaculate) fell within the normal range of high quality semen.

Tested rams, however, are continuous breeding, yet seasonal variations in semen charateristics were observed. The best quality semen was that of the summer (volume, 0.70 ± 0.02 ml; motility 69.7 ± 1.0 pH, 6.72 ± 0.02; sperm concentration, $4.53\pm0.11\times10^6$ sperm- cell and MBRT, 2.48 ± 0.21 min. and the poorest quality semen was of the winter (volume, 0.34 ± 0.02 ml; motility, 56.9 ± 0.9; pH, 6.96 ± 0.02; sperm concentration, $2.47\pm0.10\times10$ sperm-cell/mm^3 and MBRT, 6.19 ± 0.24 min). Differences between means of the two seasons for all seminal characters are all significant ($P<.0.01$).

The sperm output of rams during autumn (2.85×10^9 sper-cell/ ejaculate) and spring (2.03×10^9 sperm-cell/ejaculate), however, was significantly ($P<.0.01$) lower than that of summer but excelled that of the winter. Seminal discharge of these two seasons was judged, according to the standard indices of semen characteristics, to be of good quality.

There have been very few experiments in which variations in semen quality of local breeds of sheep have been investigated. Hafez *et al.* (1955) working with Ossimi and Rahmani rams, claimed that the highest semen quality was that of spring and autumn, while semen of the summer was of inferior quality. El-Gamal (1975) noticed obvious deterioration in semen characteristics of Ossimi rams during summer. Thus, conclusion drawn from these researches suggests that summer of this country is associated with the production of inferior quality ram semen. This situation is certainly untolerable that is because the active mating season of Ossimi and Rahmani sheep occurs in summer. Logically, trials described here were being conducted to re-investigate seasonal changes in semen quality of Ossimi and Rahmani rams. Utmost attention will be given to minimize possible sources of variation of semen quality.

Material and Methods

A. *Location of observation animals accomodation and feeding*

Nine fat-tail rams 2 to 4 years old, five Ossimi and four Rahmani, were derived from the original flock of the experimental station of this department. All rams were healthy and clinically free of external and internal parasites. Palpation revealed that their external genitalia were typically normal. The testicular tone was glandular, all epididymal regions were present, both testicles were almost equal in size and moved freely up and down within the scrotal pouches. Copulatory patterns for all tested rams, at the beginning of the trials, were judged to be normal.

Animals were penned in two neighbouring semi-open compartments and were being exposed to the natural photoperiod. They were not permitted to graze, nevertheless, they were left free in open backyards for a considerable time of the day. Intentional exercise, however, was not practiced. Rams were shorn twice a year in April and September.

During the period from January through May, rams were lot-fed on berseem (*Trifolium alexandrinum*), rice straw and co-op feed, while during the rest of the year they were allowed diets composed of the latter two ingredients. Feed allowances were calculated according to the standards of this department.

B. *Semen collection and semen quality tests*

Prior to the onset of trials, rams were trained to mount anestrous ewe, thereafter, they were not exposed to ewes except at the time of collection. Semen collection was conducted outdoors and was made by the means of a short type artificial vagina. Its internal temperature at the time of collection was kept in the range of 41°-44°. Sterile inner linar and collecting tube were used at each collection. Each ram was scheduled for collection three times

a week at equal intervals and at each collection two successive ejaculates were separately obtained. Throughout the course of the study, time and place of collection and collector were not changed. Moreover, attention was given to protect semen ejaculates from cold shock and direct light.

The investigation period comprised four equal intervals representing the four seasons of the year as follows :

autumn : October, 1974.
winter : January, 1975.
spring : April, 1975.
summer : July, 1975.

After each period of sexual rest and just before intervals of semen investigation, semen was collected and ignored. Therefore, subsequent collection was scheduled according to the collection intervals stated earlier. When the act of ejaculation was not complete, seminal discharge was excluded, otherwise, semen was transferred immediatly to the laboratory and was subjected to the following tests :

Volume

Measured directlly in ml and to the nearest 0.1 ml using a trasparent calibrated tube.

Percentage of progressively motile sperms

Estimated on a microscope stage incubator at 38° under the high power (400 x). The percentage scale used was between 0 and 100. Normal physiological saline was used for dilution.

Hydrogen-ion concentration

Measured by using pH comparative indicator, ranging from 6.0 to 7.5 with 0.3 grades (Reagencio Phan, Czechoslovakia, TP-6-068-013-57).

Methylene blue reduction time

Estimated by using the method adopted by Herman and Madden (1953). Ejaculates of 0.3 ml or less were not tested.

Sperm-cell concentration

Hemocytometric counts of diluted semen (1 : 500) were obtained using the technique described by Herman and Madden (1953).

C. *Statistical procedures*

Since the number of animals in the two breeding groups were not equal. Unweighted means solution (Snedecor and Cochran 1968) was used to analyze

the effect of breed, sequence of ejaculation, season of the year and the interaction between them on different seminal traits. Duncan's multiple range tests (Duncan, 1955) were done to detect differences performed between pairs of means.

Results

Ejaculate volume

Results appeared in Table 1 show that the overall mean ejaculate volume was 0.53 ± 0.4 ml and means of the character for Ossimi and Rahmani rams were 0.53 ± 0.02 ml and 0.54 ± 0.02 ml, respectively. The ANOVA revealed that breed influence on the character was not significant (Table 6). The first ejaculate (0.60 ± 0.02 ml) was significantly ($P < 0.01$) larger in volume than the second ejaculate (0.47 ± 0.03 ml). This finding is valid for Ossimi (0.62 ± 0.02 ml vs. 0.44 ± 0.02 ml) and Rahmani (0.58 ± 0.02 vs. 0.50 ± 0.02 ml) rams. In the former breed; the volume of the second ejaculate accounted for 71.0% that of the first, while in the latter breed the percentage was 86.2%. Difference (15.2%) was statistically significant ($P < 0.01$).

Season of the year exerted a significant ($P < 0.01$) effect on ejaculate volume, being 0.70 ± 0.02 ml in summer, 0.62 ± 0.03 ml in autumn, 0.47 ± 0.02 ml in spring and 0.34 ± 0.02 ml in winter. Duncan's multiple range test revealed significant differences between all pairwise seasons. The interaction between season and breed was also significant ($P < 0.01$). In Ossimi, average ejaculate volume in autumn (0.67 ± 0.01 ml) and winter (0.38 ± 0.01 ml) was higher than the corresponding values of the two seasons for Rahmani (Table 1). The combined data of the two breeding groups show that the descrepancy between the first and the second ejaculates was high in summer and autumn than it was in other seasons of the year. Duncan's test indicated that volume differences between the two successive ejaculates for all pairwise seasons were significant ($P < 0.01$).

Sperm-cell concentration/mm³

The overall mean sperm-cell concentration/mm³ was 3.98 ± 0.23 × 10^6 cell (Table 2). Means of the character for Ossimi (4.02 ± 0.15 × 10^6 cell) and Rahmani (3.94 ± 0.18 x 10^6 cell) were statistically not different, thus breed was without significant contribution to the character. Similary, sequence of ejaculation affected the trait non-significantly (Table 6). Also, the ANOVA, between breed and sequence of ejaculation lacked significance. The ANOVA, however, revealed highly significant ($P < 0.01$) differences among seasons. Starting from spring through autumn, a gradual increase in sperm-cell counts was noticed. The lowest counts were recorded for winter. Duncan's test indicated that difference in sperm-cell counts between summer (4.53 ± 0.11 × 10^6 cell) and autumn (4.60 ± 0.11 x 10^6 cell) was not significant, otherwise, all seasons differed significantly ($P < 0.01$) from each other.

Seasonal influence on sperm-cell counts in the two breeding groups was different. This was shown by the highly significant ($P < 0.01$) breed / season interaction. In Ossimi, sperm counts of the winter ($2.84+0.07$ 10^6 cell) and spring (4.50 ± 0.08 x 10^6 cell) were significantly ($P<0.01$) higher than the corresponding values of Rahmani. The reverse is correct for autumn as counts of Ossimi (4.27 ± 0.07 / 10^6 cell) were significantly lower ($P < 0.01$) than those for Rahmani ($4.92 \pm 0.08 \times 10^6$ cell). In summer, means of the character for the two breeding groups differed non-significantly. There was a significant ($P < 0.01$) interaction between season and sequence of ejaculation on sperm concentration/mm_3. First ejaculate sperm counts in winter and autumn were significantly lower than those of the second ejaculate of the same seasons. In spring and summer, sperm counts of the first ejaculate were higher than those of the second ejaculate. Difference in spring was only significant and in summer it was highly significant.

Advanced motility

The overall mean percentage of advanced motility was $68.0+2.0$. The means for Ossimi and Rahmani rams were 68.1 ± 1.3 and 67.9 ± 1.6 (Table 3). Difference between means of the two breeding groups was not significant. The percentage of progressively motile sperms in the first ejaculate (66.4%) was significantly ($P < 0.01$) lower than that of the second ejaculate (69.6%). Advanced motility percentage was high in autumn ($74.2 \pm 1.0\%$) and obviously low in the winter ($56.9 \pm 1.0\%$). Values of spring and summer were $71. \pm 1.2$ and $69.9 \pm 1.0\%$ Duncan's test indicated that difference between all pairwise seasons are significant. Possible interactions of variables considered here did not influence the character significantly (Table 6).

Methylene blue reduction time (MBRT)

The overall average time required for the complete reduction of the colour of methylene blue was 3.61 ± 0.46 min (Table 4). Breed, sequence of ejaculation and the interaction between them did not exert any significant effect on the character. Season of the year, however, was shown to influence the character significantly ($P < 0.01$). The shortest reduction time was that of spring (2.30 ± 0.25 min) and summer (2.48×0.21 min), while the longest was that of the winter (6.19 ± 0.24 min). Autumn's estimate (3.46 ± 0.21 min) was of intermediate value between summer and winter. The interactions between breed / season and season x sequence of ejaculation were non-significant.

Semen reaction

The combined data of both breeding groups show that semen reaction was very close to neutral (6.85 ± 0.03). Values for Ossimi (6.83 ± 0.02) and Rahmani (6.87 ± 0.02), however are very close but differ significantly ($P < 0.05$). The reaction of the first ejaculate (6.80 ± 0.02) was slightly lower than that of the second ejaculate (6.89 ± 0.02), yet, difference between the means was significant (P 0.01). The ANOVA revealed highly significant ($P < 0.01$) differences among seasonal groups. Semen reaction in winter was 6.96 ± 0.02,

decreased gradually till became minimal in summer. In autumn, semen reaction restored its high value of the winter (Table 5). Duncan's test indicated that difference between autumn and winter was not significant, otherwise, values of any pair of seasons differ significantly ($P < 0.01$). Semen reaction was shown to be influenced by the interaction between season and breed (Table 6). In autumn and summer, semen reaction for Ossimi rams was significantly higher ($P < 0.01$) than that for Rahmani and the reverse is correct for winter and spring.

Discussion

It is intentionally planned to discuss the basic conclusions that receive the support of the present data. Conclusions appear debatable, for one reason or another, were left without discussion. For instance, the significantly longer MBRT of the winter could be due to a lower dehydrogenase activity of sperm-cells but possibly could be attributed to any interference with the normal process of breakdown or resynthesis of ATP such as cold shock. Measurements were taken to protect semen against cold shock may not be satisfactory. Similarly, it could not be outlined with certainty, whether the lower sperm output in this particular season was to a lower spermatogenic activity or resulted from a relatively less effective sympathetic impulses of ejaculation. These issues and many others were not considered in the present discussion.

Overall means

The overall mean ejaculate volume reported here (0.53 ± 0.04 ml) is smaller than volumes reported by other fat-tail rams investigators of this locality (Hafez *et al.*, 1955; El-Mikkawi *et al.*, 1967; El-Chahidi, 1973 and El-Gamal, 1975). None of these investigators did practice the intensive semen collection done here (25 ejaculate/ram/month). Their values were calculated on the basis of one ejaculate every 5 to 10 days. The system of collection adopted here approximated the usual frequency of breeding during the active mating season (about 6 weeks) where the ram is assigned to join 35 - 50 ewes/season.

Obvious decrease in ejaculate volume of the present study could be explained on dietary basis, as it is claimed that feeding programme of this study was below convential. Thus, rams, unitentionally, were being underfed. Research is in progress to investigate this possibility. Mann (1969) mentioned that underfeeding of mature males seemed not to influence the normal spermatogenic functions of the testicles but it did affect the functions of the accessory sex glands.

Sperm-cell concentration/mm^3 in the present study ($3.98 \pm 0.23 \times 10^6$) was very close to estimates elaborated by Hafez *et al.* (1955) and El-Chahidi (1973). Nevertheless, the present estimate is obviously higher than values reported by El-Mikkawi *et al.* (1967) and El-Gamal (1975). All authors were working with fat-tail rams. It should be mentioned that the overall mean of the character, given here, fell within the normal range ($2\text{-}5 \times 10^6$ cell/mm^3) reported for the species (Mann, 1969).

Semen reaction of the two breeding groups is very close to neutral and the overall mean reported here (6.85 ± 0.03) is very close to that (6.90), reviewed by White (1958) for several breeds sheep. El-Gamal (1975) gave a lower estimate of 6.61 for Ossimi rams. In rams and bulls, pH should be measured immediately after collection and any delay is accompanied by a drop in semen reaction due to accumulation of lactic acid.

The overall average MBRT was 3.61 ± 0.46 min. This figure was higher than estimates reported for fat-tail rams of this locality (El-Mikkawi *et al.*, 1967, El-Chahidi, 1973 and El-Gamal, 1975). Existing differences in MBRT are to a great extent, due to differences in techniques adopted. In the present study, the test was proved to be sensible to variations in semen density and motility. Thus, indicating that the test was measuring the dehydrogenase activity of sperm-cells. Moreover, time to complete decolorization was only considered.

The overall mean of advanced motility (68.0 ± 2.0) is considered normal. Most semen of good quality will not routinely contain more than 70% progressively motile sperms, the only exception to that is the dog semen which normally contains about 80% advanced motile sperms (Foote and Trimberger, 1968).

Breed effect

Excluding semen reaction, breed of ram was shown to influence all the investigated seminal attributes non-significantly. That is to say semen quality of Ossimi and Rahmani rams was not different, This conclusion is in accordance with that reached by Smyth and Gordon (1967), Land (1969), Sahni and Roy (1972) and El-Gamal (1975). All reported that breed of ram is without significant contribution to semen quality. It was noticed, however, that individual rams within breeds vary widely in most of the investigated seminal characters. The same conclusion was drawn from the researches of Ortavant *et al.* (1948), Hafez *et al.* (1955) and Sahni and Roy (1969). Thus, the picture depicted is that variations in semen charateristics within the two tested breeds of rams, under this locality, are much more important than those between breeds.

Semen reaction of Rahmani rams was significantly ($P < 0.05$) higher than that of Ossimi, but the difference between pH means (0.04) is actually negligible when considering the sensitivity of the pH measure and the biological significance of the test.

The effect of sequence of ejaculation

Comparing seminal characteristics of the two successive ejaculates, semen volume of the second ejaculate was smaller (78.3% of the first), motlity rating was higher (the finding is correct for mass and advanced motility) and the pH was comparatively closer to neutrality, otherwise, semen characteristics of the two ejaculates are statistically not different. The total sperm counts of the second ejaculate (1.84×10^9 cell/ejaculate) is even higher than the lower limit of the character for high quality ram semen (Foote and Trimberger,

1968). Thus small ejaculate volume is not harmful unless if accompanied by low sperm concentration, it lowers the total number of sperms available below desirable limits. From the biological point of view, the semen from the two successive ejaculates was of high quality.

Season effect

Data clearly show that Ossimi and Rahmani rams are continuous breeding as they are capable of producing semen all the year around. Seasonal fluctuations in semen characteristics, however, are observed. The highest spermatogenic output was recorded in summer (3.17×10^9 cell/ejaculate) and the lowest was that of the winter (0.84×10^9 cell/ejaculate). The former season is characterized by the longest day (13.6 hr), the highest average ambient temperature(27.1°) and less availability of green fodder. In winter, the day length is shorter (10,6hr), average temperature is the lowest (13.4° hr) and green fodder is available. Eventhough, semen of the best quality ; as judged byseminal tests tried here, was obtained in summer, meanwhile, semen of inferior quality was associated with the winter.

The ram of the temperate areas of the world retain a certain degree of fertility throughout the whole year, but in many cases fertility is curtailed during the spring and summer months. During summer, seminal degeneration may be severe enough that it causes temporary summer sterility (Moule, 1956; Dutt and Simpson, 1957; Loggins *et al.*, 1964 and Sahni and Roy, 1967). Two exteroceptive stimuli are usually considered in discussing season influence upon semen quality of rams. These are light and ambient temperature. Concerning the role of light some investigators (McDonald, 1961 ; Bruckner and Bauer, 1972 and Jackson and Williams, 1973) do believe that day length is the most important stimulus related to fluctuations of semen characteristics in the ram. Testicular weight, number of testicular and epididymal spermatozoa, ejaculate volume, sperm concentration and total number of sperms/ejaculate were greater during periods of short day length (Ortavant, 1956). Fowler (1962), working with ram semen, was able to show that increasing the natural day length by the administration of artificial light was against semen quality of rams. In this species it is claimed that 12 hr daily illumination gave optimal stimulus to sepermatogenesis (Ortavant, 1952). It should be mentioned however that experiments of light effect were conducted without controlling other exteroceptive stimuli known to be involved in semen production and characteristics. Possibley for this reason Clegg and Ganong (1969) believe that the influence of light duration upon semen characteristics in the ram has not yet been ruled out.

Some authors have suggested that the deterioration of ram semen during summer of the temperate localities is due to high ambient temperatures. This concept receives a rather strong experimental support. Semen from rams maintained at 45-48°F during summer has a better quality than that of animals kept under uncontrolled environment (Dutt and Bush, 1955 and Dutt and Simpson, 1957). Shearing of rams results in lower rectal temperature, was shown to improve conception rates (Dutt and Hamm, 1957).

TABLE 1. The effect of breed, sequence of ejaculation and season of the year on ejaculate volume (ml) ·

Season	Ossimi Rams			Rahmani Rams			Overall		
	Ej_1	Ej_2	Ej_1+Ej_2	Ej_1	Ej_2	Ej_1+Ej_2	Ej_1	Ej_2	Ej_1+Ej_2
All . . .	0.62±0.02	0.44±0.02	0.53±0.02	0.58±0.02	0.50±0.02	0.54±0.03	0.60±0.02	0.47±0.03	0.53±0.04
seasons .	(263)	(246)	(509)	(181)	(159)	(340)	(444)	(405)	(849)
Winter. .	0.44±0.03	0.33±0.02	0.38±0.01	0.31±0.02	0.29±0.02	0.30±0.01	0.37±0.01	0.31±0.01	0.34±0.02
	(66)	(63)	(129)	(49)	(37)	(86)	(115)	(100)	(215)
Spring .	0.51±0.03	0.39±0.02	0.45±0.01	0.49±0.02	0.48±0.03	0.49±0.01	0.50±0.01	0.43±0.01	0.47±0.02
	(69)	(63)	(132)	(57)	(42)	(93)	(120)	(105)	(225)
Summer .	0.70±0.04	0.51±0.02	0.61±0.01	0.83±0.04	0.76±0.04	0.80±0.02	0.76±0.01	0.63±0.01	0.70±0.02
	(60)	(54)	(114)	(32)	(33)	(65)	(92)	(87)	(179)
Autumn .	0.81±0.03	0.53±0.03	0.67±0.01	0.68±0.04	0.44±0.02	0.56±0.01	0.74±0.01	0.48±0.01	0.62±0.03
	(68)	(66)	(134)	(49)	(47)	(96)	(117)	(113)	(230)

Ej_1 = the first ejaculate and Ej_2 = the second ejaculate.

Number of ejaculates is given in parenthesis.

TABLE 2. The effect of breed, sequence of ejaculation and season of the year on sperm-cell count (million/mm³).

Season	Ossimi Rams			Rahmani Rams			Overall		
	Ej_1	Ej_2	Ej_1Ej_2	Ej_1	Ej_2	Ej_1+Ej_2	Ej_1	Ej_2	Ej_1+Ej_2
All . . .	4.14±0.10	3.90±0.11	4.02±0.15	3.92±0.12	3.95±0.13	3.94±0.18	4.03±0.16	3.92±0.17	3.98±0.23
Seasons .	(170)	(154)	(324)	(119)	(104)	(223)	(289)	(258)	(547)
Winter. .	2.74±0.11	2.93±0.12	2.84±0.07	1.87±0.12	2.33±0.16	2.10±0.08	2.30±0.07	2.63±0.08	2.47±0.10
	(46)	(43)	(89)	(41)	(31)	(72)	(87)	(74)	(161)
Spring .	4.67±0.09	4.32±0.09	4.50±0·08	4.05±0.19	4.23±0.16	4.14±0.10	4.36±0.09	4.27±1.0	4.32±0.13
	(34)	(29)	(63)	(23)	(17)	(40)	(57)	(46)	(103)
Summer .	4.92±0.11	4.03±0.13	4.48±0.07	4.89±0.19	4.27±0.24	4.58±0.09	4.90±0.08	4.15±0.08	4.53±0.11
	(45)	(39)	(84)	(26)	(27)	(53)	(71)	(66)	(137)
Autumn .	4.23±0.17	4.31±0.13	4.27±0.07	4.89±0.17	4.95±0.19	4.92±0.08	4.56±0.08	4.63±0.08	4.60±0.11
	(45)	(43)	(88)	(29)	(29)	(58)	(74)	(72)	(146)

Ej_1 = the first ejaculate and Ej_2 = the second ejaculate.
Number of ejaculates is given in parenthesis.

TABLE 3. The effect of breed, sequence of ejaculation and season of the year on the percentage of progressively motile sperm.

Seasoon	Ossimi Rams			Rahmani Rams			Overall		
	Ej	Ej_2	Ej_1+Ej_2	Ej_1	Ej_2	Ej_1+Ej_2	Ej_1	Ej_2	Ej_1+Ej_2
All . . .	66.7±0.9	69.5±0.9	68.1±1.3	66.1±1.1	69.7±1.1	67.9±1.6	66.4±1.4	69.6±1.5	68.0±2.0
Seasons .	(170)	(154)	(324)	(119)	(104)	(223)	(289)	(258)	(547)
Winter .	56.4±1.4	60.7±1.7	58.5±0.6	54.9±1.3	55.8±2.3	55.3±0.7	55.6±0.6	58.2±0.7	56.9±0.9
	(46)	(43)	(89)	(41)	(31)	(72)	(87)	(74)	(161)
Spring .	69.1±1.3	71.9±1.6	70.5±0.7	68.5±1.4	75.0±1.5	71.7±0.2	68.8±0.8	73.2±0.7	71.1±1.2
	(34)	(29)	(63)	(23)	(17)	(40)	(57)	(46)	(103)
Summer .	69.4±1.3	71.0±1.4	70.2±0.6	68.3±1.5	70.0±1.2	69.1±0.8	68.8±0.7	73.4±0.9	69.7±1.0
	(45)	(39)	(84)	(26)	(27)	(53)	(71)	(66)	(137)
Autumn .	71.8±1.7	74.5±1.6	73.1±0.6	72.8±1.2	77.9±0.8	75.3±0.7	72.3±0.7	76.2±0.7	74.2±1.0
	(45)	(43)	(88)	(29)	(29)	(58)	(74)	(72)	(146)

Ej_1 = first ejaculate and Ej_2 = second ejaculate
Number of ejaculates is given in parenthesis.

TABLE 4. The effect of breed, sequence of ejaculation and season of the year on methylene blue reduction time (min).

Season	Ossimi Rams			Rahmani Rams			Overall		
	Ej_1	Ej_2	Ej_1Ej_2	Ej_1	Ej_2	$Ej + Ej_2$	Ej_1	Ej_2	$Ej_1 + Ej_2$
All . . .	3.50±0.20	3.73±0.21	3.61±0.30	3.79±0.25	3.41±0.26	2.48±0.21	3.64±0.31	3.57±0.34	3.61±0.46
Seasons .	(145)	(127)	(272)	(96)	(83)	(179)	(241)	(210)	(451)
Winter . .	6.13±0.50	6.13±0.56	6.13±0.15	7.33±0.73	5.16±0.42	6.24±0.18	6.73±0.16	5.64±0.18	6.19±0.24
	(30)	(26)	(56)	(23)	(17)	(40)	(53)	(43)	(96)
Spring . .	2.34±0.13	2.39±0.13	2.36±0.16	2.31±0.14	2.15±0.14	2.23±0.19	2.32±0.16	2.27±0.19	2.30±0.25
	(30)	(22)	(52)	(21)	(16)	(37)	(51)	(38)	(89)
Summer .	2.33±0.12	2.72±0.16	2.52±0.13	2.23±0.15	2.64±0.22	2.43±0.16	2.28±0.14	2.68±0.15	2.48±0.21
	(40)	(38)	(78)	(26)	(27)	(53)	(66)	(65)	(131)
Autumn .	3.20±0.31	3.68±0.31	3.44±0.12	3.28±0.24	3.68±0.46	3.48±0.16	3.24±0.14	3.68±0.15	3.46±0.21
	(45)	(41)	(86)	(26)	(23)	(49)	(71)	(64)	(135)

Ej_1 = first ejaculate and Ej_2 = second ejaculate.
Number of ejaculates is given in parenthesis.
Ejaculates of 0.3 ml or less were not tested.

TABLE 5. Semen reaction as influenced by breed of ram, sequence of ejaculation and season of the year.

Season	Ossimi			Rahmani			Overall		
	Ej_1	Ej_2	Ej_1+Ej_2	Ej_1	Ej_2	Ej_1+Ej_2	Ej^1	Ej_1	Ej_1+Ej_2
All Seasons	6.78±0.01 (263)	6.88±0.01 (246)	6.83±0.02 (509)	6.83±0.02 (181)	6.90±0.02 (159)	6.87±0.02 (340)	6.80±0.02 (444)	6.89±0.02 (405)	6.85±0.03 (849)
Winter	6.81±0.02 (66)	6.93±0.03 (63)	6.87±0.01 (129)	7.01±0.04 (49)	7.08±0.04 (37)	7.04±0.01 (86)	6.91±0.01 (115)	7.00±0.01 (100)	6.96±0.2 (215)
Spring	6.72±0.02 (69)	6.79±0.02 (63)	6.75±0.01 (132)	6.78±0.03 (51)	6.83±0.03 (42)	6.80±0.0[illegible] (93)	6.75±0.01 (120)	6.81±0.01 (105)	6.78±0.01 (225)
Summer	6.70±0.02 (60)	6.79±0.02 (54)	6.75±0.01 (114)	6.65±0.03 (32)	6.73±0.03 (33)	6.69±0.04 (65)	6.67±0.01 (92)	6.76±0.01 (87)	6.72±0.02 (179)
Autumn	6.89±0.02 (68)	7.03±0.03 (66)	6.96±0.01 (134)	6.91±0.03 (49)	6.98±0.03 (47)	6.94±0.01 (96)	6.90±0.01 (117)	7.00±0.01 (113)	6.95±0.01 (230)

Fj_1 = first ejaculate and Ej_2 = second ejaculate.
Number of ejaculates is given in parenthesis.

TABLE 6. **Mean squares for different sources of variation for different seminal characters.**

Source of variation	Vol./Ej.	Sperms/mm³	Motility	MBRT	pH
Season (S)	0.1011**	4.1090**	231.7**	963.6**	0.0607**
EjaculateNo. (Ej)	0.0655**	0.0496NS	41.5**	6.2NS	0.0291*
Breed (B)	0.0002NS	0.0286NS	0.2NS	0.5NS	0.0050*
B × Ej	0.0088**	0.0723NS	0.5NS	2.2NS	0.0009NS
B × S	0.0184**	0.3545**	5.9NS	10.7NS	0.0101**
S × Ej	0.0080**	0.2141**	1.8NS	6.1NS	0.0004NS
S×B×Ej	0.0003NS	0.0128NS	2.4NS	4739.4**	0.0002NS

** Significan ta t1% level.
* Significant at 5% level.
NS Non-significant.

More direct evidence for the deleterious influence of high ambient temperatures on semen characteristics was introduced by scrotal insulation (Moule and Waites, 1963 ; Braden and Mattner, 1970 and Glover 1955 and 1956) or direct exposure of rams to elevated temperatures (Dutt and Hamm, 1957 and Smith, 1971).

The present findings, indicating that the best quality semen was that of the summer, could not be explained on the basis of the researches discussed earlier. In the present work, the period of the highest ambient temperature and the longest daylight hr is related to the best semen quality and *vice versa.*

The sperm output of rams during autumn (2.85×10^9 cell/ejaculate) and spring (2.03×10^9cell/ejaculate), however/is significantly ($P < 0.01$) lower than that of the summer but it is 2.4 to 3.4 times higher than that of the winter. Moreover, according to the known indices, semen of these two seasons is judged to be of good quality.

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التغيرات الموسمية فى صفات السائل المنوى للكباش الأوسيمى والرحمانى

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استعمل فى البحث خمس كباش أوسيمى واربع كباش رحمانى مدربه على الجمع الصناعى للسائل المنوى •

شملت التجربه أربعة فترات، طول كل منها شهر، تمثل فصول السنة الأربعة على النحو التالى :

الخريف : اكتوبر ، الشتاء : يناير ، الربيع : ابريل ، الصيف : يوليو • وأثناء كل فتره من هذه الفترات كان يتم جمع السائل المنوى من كل كبش على فترات منتظمة بمعدل ثلاث مرات أسبوعيا ، وتتكون الجمعة الواحدة من قذفتين متتاليتين وكان مجموع القذفات المتحصل عليها هو ٨٤٩ قذفة • وكانت كل قذفة تختبر للصفات التالية : الحجم فى القذفة الواحدة ، النسبة المئوية للحيوانات المتحركة حركة تقدمية ، درجة تركيز أيون الأيدروجين ، عدد الحيوانات المنوية/مم٣ والوقت اللازم لاختزال أزرق الميثلين •

ودلت النتائج على عدم وجود اختلافات معنوية بين متوسط صفات القذفة — باستثناء درجة تركيز أيون الأيدروجين — للكبش الأوسيمى عن تلك للكبش الرحمانى كما أشارت النتائج أن الكباش تحت الدراسة لها القدرة على انتاج السائل المنوى فى فصول السنه الأربعة وكانت أجود الصفات هى للسائل المنوى المتحصل عليه فى الصيف بينما كانت صفات السائل المنوى المتحصل عليه فى الشتاء متدهوره فى حين كانت نوعية السائل المنوى للربيع والخريف وسط بين الشتاء والصيف •

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The Effect of Age and Weight at First Calving on the Productive and Reproductive Perfo-rmance of Primiparous Buffaloes

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A total of 109 pregnant buffalo heifers was derived from Mahellet Mousa Farm of Ministry of Agriculture and was used to determine the effect of age and weight of dam at first calving on calf birth weight (WCB), service period length (SPL), milk production in the first 120 days of lactation (IMY) and total milk production (TMP). All these characters belong to the first calving interval. Data were analyzed by the least squares method and with respect to weight of dam at parturition, buffaloes were divided into four groups. Group 1, included buffaloes weighing 400 kg or less after first calving, while groups 2, 3, and 4, included buffaloes having a post—partum body weight of 401-450 kg, 451 —500 kg and 501 kg or more, respectively.

The overall means of WCB, SPL, IMY and TMP were 33.98±0.52 kg, 151.74±6.52. days, 512.90±12.3 kg and 988.97±26.02 kg, respectively. On the basis of the investigated characters buffaloes of weight group 3 were shown to have the best performance while those of group 1 were the poorest. Buffaloes of group 2 were of intermediate performance between group 1 and 3. Buffaloes of group 4, however were the heaviest, but values of their investigated characters excluding WCB approximated those of group 1.

Increasing age of dam at parturition was shown to affect WCB (b= —0.2866), SPL (b=+3.7381), IMY (b= —9. 7505) and TMP (b = —14.2598) unfavourably. All partial regression coefficients were significant ($P < 0.01$). The present data indicate that buffalo heifers should be brought to conceive at the earliest possible age, at that time their live body weight should average 370.9±4.2 kg. This particular weight at conception corresponds to an average weight at parturition of 475.1±3.6 kg (range = 451—500 kg.

It is established that primiparous buffaloes were shown to have a markedly long service period length (Ragab *et al.*, 1956, El-Sheikh and Mohamed, 1965, and El-Fouly *et al.*, 1977) and a considerably low milk production (Ragab *et al.*, 1954 and 1956). Moreover, it is claimed that a considerable number of them either does not lactate or have an abnormally short lactation period length. Trials to evaluate the importance of age and weight at first calving on the subsequent productive and reproductive performance of the frist-calfbuffalo are lacking. Such information, if available, it will help in the determination of the optimal age and weight at first breeding, which are usually estimated on arbitrary basis.

Experiments reported here describe trials aimed to determine the contribution of age and weight at parturition, in Egyptian buffaloes, on some economical characters of the first lactation. These characters include weight of calf at birth, service period length, milk production in the first 120 days and total milk production.

Material and Methods

The study included 109 pregnant heifers that were made available from Mahellet Mousa Farm, in the Nile Delta, Egypt. Animals were born in September through December, 1971 and were reared under the same conditions of management. All terminated pregnancy normally without calving difficulties. Dams and calves were weighed within 24 hr after parturition. Suckling was allowed for one week, thereafter, calves were raised artificially and dams were hand milked twice daily at 8.00 a m and 4.00 p m. Daily production records were available for each animal. Buffaloes were dried up two months before the expected time of delivery, if still lactating.

During summer and autumn buffaloes were tied under semiopen sheds and were fed concentrate mixture along with wheat or rice straw. Maintenance and productive requirements were calculated according to the standards of Tommi (1963). During winter and spring animals were left free to graze Egyptian clover (*Trifolium Alexandvium*) . Heat was checked three times daily at 7.30 a m, 12.00 noon and 3.90 p m. Animals detected in heat were hand mated to bulls known to be fertile mating, however, was postponed for estrus buffaloes still in their post-partum refreshment period (6 weeks after calving). Mated buffaloes did not show heat symptoms for two months, were checked for pregancy. The interval from parturition to the fertile service was referred to as service period length.

Data were analyzed by the least squares method described by Harvey (1960) using a multiple classification model with regressions and unequal subclass number. The model included the fixed variable weight and age at parturition and lactation period length. With respect to weight after calving, buffaloes were divided into four different groups as follows :

Group 1 : 400 kg or less.

Group 2 : 401-450 kg.

Group 3 : 451-500 kg.

Group 4 : 501 kg or more.

The investigated characters were weight of calf at birth (WCB), service period length (SPL), milk production in the first 120 days (IMY) and total-milk production. The analyses of variances were done together with the tests of significance for individual means. These tests were Duncan multiple range tests (Duncan, 1955).

Results and Discussion

Least square means of weight of calf at birth (WCB), service period length (SPL), milk production in the first 120 days of lactation (IMY) and total milk production (TMP) of primiparous buffaloes are given in Table 1, and analysis of variances for all investigated characters are presented in Table 2.

TABLE 1. Least squares means (± S.E.) of weight of calf at birth (WCB), service period length (SPL), milk production in 120 days (IMY) and total milk production (TMP) in primiparous buffaloes.

Classification		N	WCB (kg)	SPL (day)	IMY (kg)	TMP (kg)
Overall mean		109	33.98±0.52	151.74± 6.52	512.90±12.30	988.97±26.02
Weight group	1	28	a 29.48±1.00	a 168.97±12.60	a 486.77±23.70	a 932.34±50.29
	2	36	b 34.02±0.88	a 145.49±11.10	a 502.33±20.95	a 976.72±44.31
	3	26	b 36.95±1.04	a 140.26±13.15	a 605.00±24.85	a 1097.61±52.50
	4	19	b 35.46±1.21	a 152.22±15.30	a 457.48±28.72	a 949.21±60.98

Means within a column having the same letter differ non-significantly from each other, otherwise, they differ significantly at $P<0.01$.

[1]Holding the other two variables (age of dam at claving and laction period) constant.

The overall means

The overall means of WCB, SPL, IMY and TMP were 33.98 0.52 kg, 151.74 ± 6.52 days, 512.9 ± 12.30 kg and 988.97 ± 26.02 kg, respectively.

TABLE 2. **Analyses of variances of weight of calf at birth (WCB), service period length (SPL), milk production in 120 days (IMY) and total milk production (TMP) in primiparous Egyptian buffaloes.**

Source of variance	D.F.	Mean squares	D.F.	Mean squares		
		W.C B.		SPL	IMY	TMP
Weight of dam, postpartum	3	272.76**	3	4321.35 NS	98228.87**	140441.34 NS
Regression on age of dam	1	245.25**	1	41463.29**	283857.27**	603390.29**
Regression on laction period	—	—	1	52726.60**	6456137.49**	37889925.39**
Residual	104	4861.29	103	4386.58	15651.98	70039.08

NS : Not significant ** Significant at the 1% level.

The effect of weight

The weight of primiparous buffaloes at parturition was shown to be significantly ($P < 0.01$) related to WCB of their first calf. Dams weighing 400 kg or less at parturition gave birth to the lightest calves (29.48 ± 1.00 kg), meanwhile, the most heavier calves (36.95 ± 1.04 kg) were those of group 3. Duncan's multiple range tests revealed that differences in WCB mean of group 1 and the other three groups were significant ($P < 0.01$), while differences between means of these three groups lacked significance. Using the same statistical technique Singh *et al.* (1970) came to a similar conclusion in cattle as they found that the influence of dam's weight at parturition on WCB was highly significant. It is understood that heavier buffaloes should have a bigger size and hence their calves were provided, during their prenatal life, with a more favourable maternal environment to express their genetically determined growth potentialities.

The weight of the first-calf buffalo at parturition affected SPL non-significantly. The length of the character decreased gradually from group 1 till it became of minimal value for buffaloes of group 3, thereafter, it underwent an increase in group 4. In multiparous buffaloes, weight of dam at calving was shown to be associated with SPL (El-Fouly *et al.*, 1977). In their work heavier buffaloes have a significantly ($P < 0.01$) short SPL than that for their lighter counterparts. It is interesting to mention that the present data demonstrate that retarded conception in first-calf buffaloes was, to a greater extent, due to a delay in the restoration of the post-partum ovarian functions. The interval from calving to the first service in buffaloes of group 1 and group 3 accounted for 83.2% and 86.3% of their corresponding SPL. This finding is in accordance with El-Fouly, (1977). Apparently, weight of dam after parturition is involved somehow, in the establishment of post-partum ovarian activity.

The lowest IMY was that for buffaloes of group 1 (486.77 ± 23.70 kg) and group 4 (457.48 ± 28.72 kg), while the highest value (605.00 ± 24.85 kg) was recorded for group 3. IMY of group 2 was of intermediate value (502.33 ± 20.95 kg) between groups 1 and 3. The ANOVA revealed highly significant differences among weight groups in IMY and Duncan's test indicated that differences between the mean of group 3 and those of the other three groups are significant ($P < 0.01$) ,otherwise, differences between other means are non-significant. The gradual increase in IMY by increasing dam's weight at first parturition, noticed in the three first groups is not surprising, but what is puzzling is the situation of group 4. It did include the heaviest first calf buffaloes, nevertheless, gave the lowest IMY.

Total milk production of the four investigated groups is given in Table 1. It appears evident that the character showed almost the same trend reported for IMY. The AVOVA, however, revealed that differences among groups lacked significance. It should be mentioned that buffalo cow weight changes during the first lactation period ($\bar{x}$ = 6.9 months and the range was between 0.0 and 14.1 months) have not been considered here. Weight changes may vary from one group to the other, moreover, it may vary between individuals of the one group.If this is the case, this certainly impairs the influence of dam's weight at first parturition on TMP of the first lactation period.

The effect of age

The effect of age at first calving on WCB, SPL, IMY and TMP was expressed in terms of partial regression coefficients (Table 3). The b values for these respective characters are -0.2866 ± 0.0966, + 3.7381 ± 1.2722, — 9.7505 ± 2.2896 and — 14.2598 ± 4.8583, all are statistically highly significant. Thus, when holding weight of dam at first parturition and lactation period length constant, age increase of the first-calf buffalo was shown to exert unfavourable effects on all investigated characters. One month increase in age at

TABLE 3. Partial regression coefficients (± S.E.) of weight of calf at birth (WCB), service period length (SPL), milk production in 120days(IMY)and total milk production(TMP) on age of dam at first calving and the first lactation period lenght(1).

Character	Age of dam (month)	First lactation period (day)
WCB (kg)	—0.2366**±0.0966	—
SPL (day)	+3.7381**±1.2722	+0.1719**±0.0496
IMY (kg)	—9.7505**±2.2896	+5.4240**±0.2671
TMP (kg)	—14.2598**±4.8583	+4.6063±0.1982.

1Holding post-partum weight of dams constant.

first calving was associated with a decrease in WCB (0.29 kg), IMY (9.75) and TMP (14.26 kg) and an increase in SPL (3.74 days). The determination of age at first calving free of, or with a less unfavourable effects has not been worked out.

The data clearly show that for the best productive and reproductive performances, during the first lactation, buffaloes heifers should be bred to calve at the earliest possible age. At calving their body weight should range between 451 and 500 kg ($\overline{X} = 476.1 \pm 3.6$ kg).

The effect of lactation period

Partial regression coefficients of SPL, IMY and TMP are shown in Table 3. The obtained values for the respective characters are ++ 0:1719 0:0496, + 5.4240 ± 0. 2671 and +4.6063 ± 0.1982. The first two regression coefficients are highly statistically significant while the third is not significant. The significant b value of SPL indicates that milking exerted some effects in delaying post-partum conception. El-Fouly *et al.* (1977) concluded that buffaloes with a short lactation period lenght of 120 days or less have a significantly ($P < 0.01$)

TABLE 4. Data on growth and reproductive performance of buffaloes of groups 1 and 3 during their nulliparous life.

Character	Group 1 mean ± S.E.	Group 3 mean ± S.E
Birth weight (kg)	a 31.8 ± 1.2	a 33.8 ± 1..6
Age at first service (month) . . .	23.2 ± 0.9	23.5 ± 0.06
Weight at first service (kg)	a 333.1 ± 17.3	b 360.5 ±4.1
Age at fertile service (months). .	a 24.1 ± 1.2	a 24.1 ±0.06
Weight at fertile service (kg). . .	c 341.7 ± 8.0	d 370.9 ± 4.2
Number of services/conception	a 1.6 ± 0.2	a 1.5 ± 0.2
Age at first calving (months) . .	a 34.1 ± 1.1	a 34.3 ± 0.6
Weight after calving (kg)	c 378.5 ± 7.a	d 476.1 ± 3.6

Means within a row having the same letter differ non-significantly from each other, otherwise they differ significantly at 5% level for means with letters a and b and at 1% level for means bearing c and d.

shorter SPL than their counterparts with a longer lactation periods. Moreover, in this species suckling was shown to be a more powerful stimulus, rather than milking in delaying post-partum conception (El-Fouly *et al.*, 1976).

Growth and reproductive performance of buffaloes of groups 1 and 3 before their first parturition

On the basis of the present findings, buffaloes of group 3 were the best with regard to their performance in the first lactation. On the contrary buffaloes of group 1 were the poorest. Of interest is to compare growth and reproductivity of animals of these two particular groups before their first parturition. Such data are given in Table 4. Buffaloes of group 1, however, were slightly lighter at birth (31.8 $\pm$1.2 kg) than their counterparts of group 3 (33.8 $\pm$ 1.6 kg), yet, difference in their birth weights is not significant. Apart from that, buffaloes of group 3 were significantly heavier at first breeding, conception and parturition. It should be noted that corresponding ages of the three parameters in the two groups were very close and statistically not different.

Results do suggest that, under managerial conditions similar to those of the current research, buffalo heifers should be bred for the first time whenever their body weight is about 360 kg and a corresponding age of about 23.5 months.

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تأثير العمر والوزن عند الوضع الأول للجاموس على بعض الصفات الانتاجية والتناسلية لفترات بين الولادتين

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استعمل فى البحث ١٠٩ عجله جاموسى حامل تابعة لمحطة التربية بمحلة موسى وذلك لدراسة تأثير العمر والوزن عند الوضع الأول على : وزن العجل الأول عند الميلاد ، طول فترة التلقيح الأولى ، انتاج اللبن فى الـ١٢٠ يوما الأولى من الوضع الأول ، الانتاج الكلى من اللبن فى موسم الحليب الأول ٠

وتتخلص نتائج تأثير الوزن عند الوضع الأول على هذه الصفات فى التالى :

١ ـ أحسن الصفات المتحصل عليها كانت للجاموس الذى وضع لأول مره ووزنه وعندما كان وزن الجاموسة بعد الوضع الأول أعلى من ٥٠٠ كيلو جراما كانت بعد الوضع الأول ٤٠٠ كيلو جراما متدهورة للغاية ٠

٢ ـ مجموعة الجاموس التى كان وزنها بعد الوضع الأول يتراوح بين ٤٠١ـ ٤٥٠ كليو جراما كانت صفاتها وسط بين تلك لمجموعتى الوزن السابقتين ، وعندما كان وزن الجاموسة بعد الوضع الأول أعلى من ٥٠٠ كيلو جراما كانت جميع صفاتها ـ باستثناء وزن عجلها الأول عند الميلاد متشابهه للمجموعة التى كان وزنها بعد الوضع الأول ٤٠٠ كليو جراما أو أقل ٠

وأثبتت النتائج أن زيادة العمر عند الوضع الأول له تأثيرات غير مرغوبة على جميع الصفات التى شملتها الدراسة ٠ وخلاصة البحث تفيد بأنه يجب توليد العجلات الجاموس لأول مره على أقل عمر ممكن بحيث يكون وزنها بعد الوضع الأول يتراوح بين ٤٥٠ ـ ٥٠٠ كليو جراما ٠

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The Effect of Artificial Light Treatment on Growth of Gonads and Endocrines of Fayoumi Chicks

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A TOTAL number of 708 day- old Fayoumi chicks were used to test the effect of extra light treatment of their rate of growth and endocrine glands development. The chicks were divided into two equal groups. One group was kept under natural day - light conditions. The other group received extra artificial light to extend the day-light gradually to 14 hr with steps of 15 min increment weekly.

The light treatment accelerated the growth rate equally in males and females. The body weight at 12 weeks was 350 and 319 g in the control group for the males and females while the treated group reached 435 and 387 g respectively, or more than 20% increase .

Researches on the effect of light on growth in chicks have dealt mainly with broiler strains and the results are some what conflicting. According to the work done by Mueller *et al.* (1951) on advantage in growth was achieved by using artificial light. However, Beane *et al.* (1962) and Siegel *et al.* (1963) proved beneficial growth effects when practising artificial light.

Some investigators recommended the application of almost continuous light (Moore, 1957 and Shultz *et al.*, 1959). Meanwhile, Cherry and Barwick (1962) recommended an alternating pattern consisting of a long light period and short (2 hr) dark period. Moreover, Kamar (1963) concluded that splitting of the long nights by 2 hr artificial lighting improved growth rate and increased body weight among Fayoumi chicks until 26 weeks of age. Improvement in growth rate was quite pronounced when light treatment was applied after the season of the shorter days. Besides, the females were more responsive artificial lighting than the males.

Recent studies conducted by Weaver and Siegel (1968) confirm the opinion that continuous light from hatch till 56 days of age resulted in body weight incre ments over than the control or when applying a period of darkness.

The aim of this work was to find out the effect of artificial lighting on the rate of growth of the naturally slow growing chicks of the Egyptian native breed "Fayoumi".

Material and Methods

The work was executed in the Poultry Research Station of the Faculty of Agriculture, Cairo University, Egypt.

A total number of 708 day-old chicks hatched on 7, April 1968 were available. They were divided into two groups. On group was kept under natural conditions as control while the other received artificial lighting. The control group comprised 108 and 147 females, the treated goup contained 248 males and 205 females. The birds were individually weight to the nearest 5 g at two weeks intervals starting from day-old hatched chicks till 12 weeks of age. At 12 weeks of age, 10 females from each group were slaughtered and the thyroids, adrenals, pituitaries, thymus, ovaries and oviducts were dissected out and weighed to the nearest mg. The tests of 10 individuals of each group was also weighed at this age.

The pens of the treated groups were artificially illuminated by 160 watt incandescent bulbs with a reflector located in the centre of the ceiling approximately 7 feet above the floor level. Automatic devices were used to switch the light on, at the fixed time according to the design of the experiment. The lighting regimes used in the experiment was gradually increase in the daily light-length by artificial illumination, at sun-set, on the basis of 15 min weekly increments to attain 14 hr of both natural and artificial light daily, the day-light length in Cairo during April is 12, 54 hr, then this level remained constant to the end of the experiment.

Result and Discussion

Body weight

Exposing chicks to gradual increase in day-length resulted in body weight increment over that of the control. The growth rate of both males and females increased by extending day-length (Table 1). On the average, the percentage increase in treated males and females over the control was 17% and 21% at 4 weeks of age to 24% and 21% at 12weeks of age, with a peak of 31% and 32% respectively at 8 weeks of age. Analysis of variance, "F" value, proved the significant effect of light treatment after four weeks, also the sexes varied significantly in their reaction to lighting (Table 1).

Endocrine glands

Adrenal, thyroid and thymus glands weighed higher in the treated group than the control, whereas, the pituitary gland was smaller in the treated than in the control group. The percentage increases in adrenal, thyroid and thymus weight due to light treatment were 30%, 151% and 178% respectively (Table 2).

TABLE 1. Effect of light treatment on body weight in male and female Fayoumi chicks at successive weeks of age.

Age in weeks	Body weight (g) Illuminated		control		% increase due to light treatment		"F" value	
	Male	Female	Male	Female	Male	Female	Treatment	Sex
Hatch	29.7+ 20-39ϕ	29.6 22-38	27.3 20-34	26.9 21-34	9	10		
2	51.3 35-75	50.3 30-65	53.2 30-80	49.7 35-70	4	1		
4	105.4 55-160	97.9 50-155	89.4 45-115	80.9 45-130	17	21	55.03**	22.26**
6	183.3 75-275	164.7 90-255	153.8 70-240	136.9 65-250	19	20		
8	274.8 115-385	248.5 110-340	210.0 110-310	188.2 80-330	31	32	268.14**	68.93**
10	343.7 145-560	311.2 150-485	272.6 125-440	245.1 115-410	26	27		
12	434.8 155-360	386.8 165-580	350.2 135-580	318.6 130-540	24	21	127.26**	54.18**

+ = Mean value
ϕ = Range
** = Significant effect at 0.01

TABLE 2. Effect of light treatment on the absolute (mg) and relative (mg / 100 g) weights of the different endocrine glands in twelve weeks old Fayoumi chicks.

Glands	Weight of glands: Illuminated		Control		% variation due to light treatment
	Absolute	Relative	Absolute	Relative	
Adrenal . .	60.5+ 47-90 ϕ	11.8 8.1-15.8	46.4 30-65	15-2 8.8-22.5	30
Thyroid . .	37.6 25-85	7.4 4.0-17.5	15.0 5-25	4.7 2.5-7.7	151
Thymus	3045.0 1000-4100	568.8 235.3-689.7	1094.4 650-1500	363.5 178.1-500	178
Pituitary	7.0 5-12	1.4 0.8-2.2	8.77 3-14	2.9 1-5.5	-20

+ Mean value ϕ Range

It is interesting to notice that those glands related directly with growth, thymus and thyroid, were highly enlarged by light treatment. Kleinpeter and Miner (1947) indicated birds showed thyroid stimulated activity by added light. D'Angelo (1963) and Critchlow (1963) concluded that ill umination may influence thyroid activity, but the precise pathway, receptors and their mechanisms through which the light acts to stimulate thyroid activity are not known. Also, the exact function of the thymus gland is still obscure (Hohn, 1961).

Ovary, oviduct and testes

Although absolute ovary and oviduct weights of the treated group were larger than the control, the relative weights (mg ovary and oviduct weight to 100 g body weight) were nearly the same for both groups. This means that the increase in their growth is not a special effect depending on light treatment or on related endocrines, but it may be due to the effect on general growth of body tissues. On the other hand, testes weight showed negative response to light treatment, they were smaller in weight in the treated group than in the control (Table 3). This reduction in the rate of growth in tests may be a secondary effect to the reduction in the pituitary rate of growth or to great increase in cortical hormones and thyroid hormones. According to Kumeran and Turner (1949), and Marshall (1961), both adrenal and thyroid hormones reduce the secretion of gonadotrophins in birds. Marshall (1961) added that thyroid hormone is required for normal growth, but excessive thyroid hormone resulted in gonadal and gonadotrophines depression particularly in chickens. However, this age, is 12 weeks, were relatively young to test the effect of light on testes, or ovary growth as testes always mature sexually at not less than four months (Kamar, 1960). Also, ovaries may not initiate any sexual activity before four months (Hafez and Kamar, 1955). In general, it can be stated that until three months of no sexual activity was initiated either in males or females, as far as testes and ovary growth was concerned.

TABLE 3. **Effect of light treatment, on the sbsolute (mg) and relative (mg/100 g) weights of the ovary, oviduct and testes in Fayoumi chicks at twelve weeks of age**

Organs	Weight of organs				%Variation due to light treatment
	Alluminated		Control		
	Absolute	Relative	Absolute	Relative	
Ovary . . .	241.5+ 155-290ϕ	46.6 33-60.5	144.0 75-232	45.6 36.2-56.9	68
Oviduct . .	121.0 85-165	23.2 13.1-31.8	75.7 37-125	24.0 17.5-34.7	60
Testes . . .	445.5 200.1300	72.4 33.3-194	1265.0 250-5300	284.9 38.1-1420.9	-65

\+ Mean value ϕ Range

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تأثير الاضاءة الصناعية على النمو والغدد التناسلية والصماء فى الدجاج

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استخدمت ٧٠٨ كتكوت فيومى عمر يوم لاختبار تأثير المعامله بضوء اضافى على سرعة النمو وتطور الغدد الصماء • قسمت الكتاكيت الى قسمين متساويين وضعت احدى المجموعتين تحت الظروف الطبيعية لضوء النهار ، وعرضت المجموعة الأخرى لضوء صناعى لاطالة ضوء النهار تدريجيا ليصل الى ١٤ ساعة بزيادة ١٥ دقيقة أسبوعيا •

زادت سرعة النمو بمعاملة الضوء بالتساوى لكلا من الاناث والذكور وكان الوزن الحى عند العمر ١٢ أسبوعا ٣٥٠ ، ٣١٩ جم فى مجموعة المقارنة لكلا من الذكور والاناث • بينما المجموعة التى عوملت وصل وزنها الى ٣٨٧ر٤٣٥ جم أى أكثر من ٢٠٪ زيادة •

وبالنسبة للغدد الدرقية والتيموسية وفوق الكلية ظهرت زيادة واضحة فى الوزن نتيجة لمعاملة الضوء بينما أظهرت الغدة النخامية انخفاضا فى الوزن •

زاد وزن المبيض وقناة المبيض لمعاملة الضوء مع زيادة وزن الجسم ، ولذلك فان الزيادة النسبية لوزن الجسم لم تتأثر •

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Critical Study of the Associative Effect of Direct and Indirect Feeding in Metabolism Trials with Sheep Using Flax Product, Clover Hay and Barley Grains

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The associative effect in direct and indirect feeding trials as well as the effect of the type of the basal ration on the digestibility and feeding value of feeds were investigated.

Five digestibility trials were performed using two or four Rahmany rams. The direct feeding included three feeds singly fed (clover hay, barley grains and flax product) and two mixtures (flax- product : clover hay and flax- product : barley grains). The two mixtures were used for indirect feeding using four cases of basal rations and tested ones.

Using clover hay as a basal ration, the feeding value of flax product obtained by difference was distinctly lower than that of the product when fed alone (19.7 against 26. % VS). A much lower feeding value of the product was observed (16.2% SV) when barley was used as a basal ration. When the situation was reversed by assuming flax product to be the basal ration, a serious reduction in the feeding value of hay (28 against 34.9% SV) as well as that of barely grains (50.3 against 80.9% SV) occurred.

It was also discovered that the biological addition of two feeds in a mixture would result in a different response producing deviated feeding value from "Weighted means" calculated by mathematical addition (assuming that the feeding value of the single feed would remain the same in the mixture). This assumption is biologically erronious. Such behaviour would make us conclude that adding a feed to another in a mixture a "mutual associative effect" occurs.

This study was a continuation to previous work in this Department (Animal Nutrition Section) on the extent of the associative effect, in digestion trials with ruminants including the type of the basal ration in indirect feeding (Abou-Raya *et al.*, 1966, Abd-El-Rahman, 1966 ; El-Serafy, 1968, Al-Refaai, 1972 and El-Talty, 1973). To realise more fully the extent of this effect, a comparative study between results of indirect and direct feeding with the same feeds was undertaken choosing three distinct feeds which could be fed alone (directly) and indirectly : medium quality roughage (flax product), good quality roughage (clover hay) and a concentrate feed (barley grains).

Asplund and Harris, (1971) set up an experiment with two variable feeds (alfalfa hay and dried beet pulp with molasses) and a mixture of them in equal parts to produce the maximum associative effect. They also compared the results of direct feeding of each feed singly fed with those obtained by difference making use of the mixture. The observed feeding value of the mixture and the majority of nutrient digestibilities were higher than calculated (74% for DM, 72% for GE,-44% for EE and 82% for NFE against 73%, 71%,-14% and 80%, respectively). They also found that the feeding value and digestibilities obtained by difference were more deviated from those obtained from direct feeding. Digestibilities with alfalfa hay fed alone were 59% for OM, 58% for GE, 28% for EE, 79%of N, 52% for CF and 66% for NFE, against 61%, 60%, 15%, 71%, 54% and 71%,respectively when calculated by difference. Results with beet pulp were 86%, 85%,-57%, 63%, 84% and 94% against 88%, 87%-96%, 66%, 87%, and 96%, respectively when directly andindirectly fed.

Meantime, a flax product is accumulated at the flax companies in Egypt after separating seeds including some of the shives. The palatability and the feeding value of this product were necessary seeking a reduction of the cost of roughages in feeding practice owing to the shortage and high price of wheat straw. Various flax products had been recorded in the literature with variable crude protein (CP) content (2-15%) and crude fibre (CF) content (35-70%) according to the proportions of plant parts, capsule hulls, fibres and shives, having a wide range of feeding value from 30 to 44%. Total Digestible Nutrients, TDN (Pott in Ghoneim 1964, Schneider, 1947 and Ministry of Agric, 1968).

Material and Methods

Five metabolism trials were set up using the same duplicate Rahmany rams (three years old, castrated) to determine the digestibilities, feeding value and N-balance, except with Trial 1 when two more rams were used. Flax plant-product (4%CP and 35% CF, dry mather basis) from *Linum usiatissimum*, clover hay (*Trifolium alexandrinum*) sun cured, chopped and barley grains (*Hordeum valgare*), coarsely ground, were used as single feeds (Trials 1, 2 and 3) or combined in two feeds (flax-product : hay, Trial 4, and flax-product: barley Trial 5). Flax product was provided by Tanta Company for Flax and Oil, Gharbieh Governorate, after seed separation including some shiver.

Each of Trial 4 or 5 served for triple purposes for determining the digestibility and feeding value of either the first feed indirectly fed using the second feed as basal ration, or the second feed indirectly fed using the first as basal and thirdly the combined feed mixture directly fed. This will result into five cases of direct feeding and four cases of indirect feeding. The preliminary period was ten followed by a collection period of seven days. Table 1 presents basic information about the trials.

TABLE 1. Dry matter intake and % dry matter of basal ration in different digestion trials.

Trial No.	Feed in trial	Total dry matter intake (g)	% Dry matter of basal in the mixture
	Direct feeding trials		
1	Hay	862.0	—
2	Barley	437.2	—
3	Flax by-product	1153.8	—
4	Hay: flax bp. (mixture) . . .	879.6	—
5	Barley: flax b.p (mixture)	901.3	—
	Indirect feeding trials		
4	(*a*) Hay (tested)	428.1	51.3
	(*b*) Flax b.p. (tested)	541.5	48.7
5	(*a*) Flax b.p.(tested)	639.1	29.0
	(*b*) Barely (tested)	262.2	71.0

The methods of the A.O.A.C. were used for the ordinary nutrient analyses of dry matter (DM), CP, ether extract (EE), CF and ash. Nitrogen-free extract (NFE) was determined by the difference method. The feeding value was recorded as TDN and starch value (SV).

Results and Discussion

Results (Table 2) indicate that the conventional analyses of the hay and barley grains are within the range of nutrients of the same type of feed, particularly Egyptian feeds having relatively high ash content. With flax-product, results were within the range published by Pott (in Ghoneim 1964) and Schneider, (1947) with the majority of nutrients. Ash was higher and CP was lower than published limits.

Results with direct feeding using single feeds and their two component feed mixture

Results (Table 3) with flax fed alone showed that its feeding value was 26.4% SV and 47.4% TDN (on dry matter basis), being similar to medium quality roughage but with relatively low digestible CP (1.3). Although the protein level in the product was low, yet it was more palatable than wheat straw to sheep when fed alone. In this connection Abou-Raya *et al.* (1966) found that the intake of Egyptian wheat straw fed alone was very low (320-

376 g using two adult rams). The intake here during the *ad libitum* feeding (the preliminary period with flax product in 2 × 2 × 1 m. fenced pen) reached 1153.8 g DM daily /ram (being 60.7 g 1. The relative intake (considering the standard 80 g) would be 75%. The intake was not enough, to give the animal the energy requirements for maintenance, in addition the N-balance was slightly negative. Therefore, the flax product could substitute well the wheat straw and still should be mixed with energy and protein supplementing feeds for maintenance and production.

TABLE 2. Nutritive analysis of experimental feeds (%).

Item	Clover hay 7.34% moisture (H)	Barley grains 10.10% moisture (B)	Flax product 7.77 % moisture (F)	(H:F)mixture moisture 48.7: · 51.3%	(B:F)mixture moisture 29 : 71 %
International feed number:	1—01—340	4—08—343	1—02—036	—	—
Nutritive analyses					
Ash	13.00	2.39	13.84	13.44	10.52
Crude protein . .	11.15	12.10	6.97	7.46	6.34
Ether extract . .	2.16	1.97	1.58	1.85	1.70
Crude fibre . . .	28.10	8.90	35.48	31.89	27.75
N-free extract . .	45.59	74.64	45.13	45.36	53.69

* Analyses expressed on dry (100% dry matter) basis.

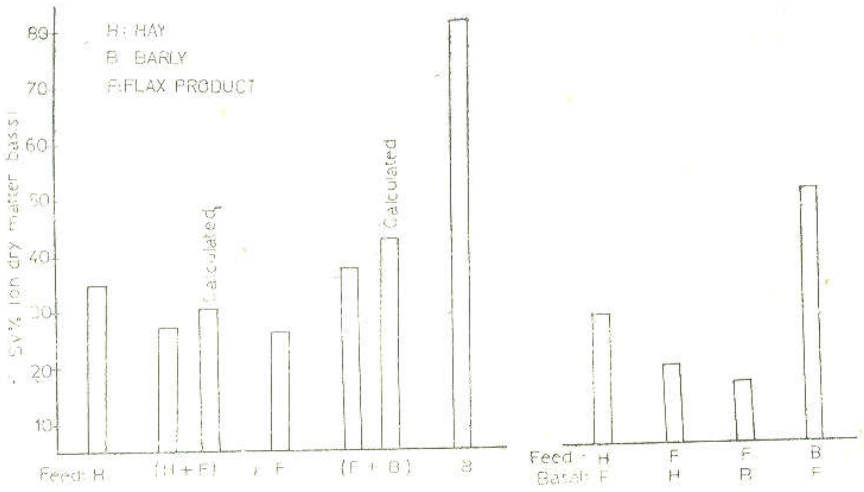
Results with clover hay (11.2% CP and 28.1% CF on DM basis) indicated that the feeding value was similar to that of medium quality of clover hay in Egypt (Abou-Raya *et al.*,1969 including 60 trials), being 34.9% SV, 52.1% TDN and 7.5% digestible crude protein, DCP. It was noticeable that the hay CF digestibility was lower than that of flax product (47.6 against 37.7%), in spite of the fact that hay contained lower CF content. This appeared to be due to differences in the physical nature and chemical composition of CF.

With barley grains, results were within the published range (80.9% SV, 84.4 TDN and 9.6DCP.) by Schneider, (1947), Ministry Agric., (1968); Abou-Raya, (1967); Abd-El-Motagali, (1972), and Abou-Raya and El-Talty (1976). The CF digestibility was very low (27.4%) most likely due to the high soluble carbohydrates content of the grains. Although the obtained feeding value with barley grains when fed alone was high, it was observed that at the end of the collection period, faecal material became soft as a sign to start slacking.

TABLE. 3. Comparative study on the effect of direct and indirect feeding on digestibility and feeding value of feeds.

Items	Direct feeding							Indirect feeding			
	Flax (F)	Hay (H)	Barley (B)	(H+F) 48.7%+51.3%		(B+F) 29%+71%		Flax as basal		Hay as basal	Barley as basal
				Exp.	Calcu.	Expt	Calcu.	(H)	(B)	(F)	(F)
No.of trial	1	2	3	4		5		4	5	4	5
Nuts.digestibility											
OM. . . .	54.0 ± 1.69	58.3	83.7	51.6	56.1	54.6	63.4	49.2	56.0	45.2	41.1
CP	32.4 ± 3.80	67.4	79.2	51 1	57.2	47.6	58.4	58.2	60 0	8.1	8.2
EE	39.2 ± 2.18	53.2	88.6	66.0	47.1	81.4	49.2	86 4	162.5	82.4	87.5
CF	47.6 ± 2.26	37.7	27.4	29.7	43.4	11.9	45.7	6.0	0.0	23.7	10.3
NFE	61.4 ± 1.28	69.0	91.6	66.5	65.1	23.3	73.6	71.8	99.2	64.1	66.6
Feeding value (DM)											
SV	26.4 ± 1.27	34.9	80.9	27.1	30.5	37.9	42.2	28.0	50.3	19.7	16.2
TDN . . .	47.4 ± 1.29	52.1	84.4	46.2	49.7	50.6	58.1	45.2	53.4	40.5	37.1
DCP . . .	1.3 ± 0.15	7.5	9.6	3.8	4.3	3.0	3.7	6.5	7.3	0.3	0.3

The observed feeding value and nutrients digestibilities of the feed mixtures in Trial 4 and 5, by direct feeding were examined. Comparison was made in each mixture with calculated figures as a weighted mean by a knowledge of the proportion of each feed in the mixture and its data when fed alone (direct feeding) assuming no change in digestibilities or feeding value after mixing with the other feed (Table 3 and Histogram 1).



Histogram 1. Direct and indirect feeding value of feeds

It was found that the calculated weighted mean differed from that experimentally obtained. The observed figures with H : F mixture were noticeabley lower in feeding value (27.1against 30.5% SV) and OM digestibility (51.6 against 56.1) and distinctly low with CF digestibility . On the other hand those withCP were distinctly lower (51.1 against 57.2) and slightly higher with NFE (66.5 against 65.1) but EE digestibility was distinctly higher (66 against 47.1). This means that combining H and F in the mixture has a variable extent of depressing or increasing effect on nutrient digestibility, *i.e.* varying in sign and magnitude according to the nutrietn. The overall result has a depressing effect on the feeding value.

In the case of F : B mixture, the effect of the combination was clearer producing distinct decrease with OM digestibility (54.6 against 63.4) and a very sharp decrease in the case of CF (11.9 versus 45.7) and NFE (23.3 versus 73.6). A distinct decrease occurred with CP (47.6 versus 58.4) but very sharp increase with EE (81.4 versus 49.2). The resultant was a distinct decrease in the feeding value (37.9 versus 42.2% SV).

From the previous results, it was clear that relying on the feeding value of single feeds directly fed to calculate the feeding value of a combination of mixtures from such feeds would result in a serious error. The biological addition of two feeds in the mixture would result in a different response producing feeding value deviating from "weighted means" calculated by mathematical addition (supposing that the feeding value of the single feed would remain the same in the mixture). The deviation in biological addition is due to a certain associative effect which may decrease or increase the digestibility of a certain nutrient. In other words a negative or positive associative effect might occur. This will lead us to think of each nutrient alone ; the specific associative effect of CF digestibility might vary in sign as well as in magnitude from that of the CF. Asplund and Harris, (1971) concluded that the magnitude of the associative effect was relatively small and might be of minor importance compared to other sources of error and variation in the assessment of the value of feeds. This conclusion must be ristricted to the studied case because our results indicate great differences and great effect of the associative effect giving greatly different figures which are more than could be ignored and exceeding the experimental error in the digestion trials.

Such behaviour would make us to conclude that adding feed A with feed B in a mixture a "mutual associative effect" occurs, feed *i.e.* feed A introduces an effect on B and *vice versa* resulting into decreasing or increasing effect in digestibility having variable intensity according to the nutrient in question. In other words one cannot assume that the digestibility of a certain nutrient in feed A would remain the same when feed B is added to A. The same would be with the nutrient in B, its digestibility changes by mixing feed A to B.

This comparison of direct feeding in feed mixtures as well as single feed clarified to us the doubtfulness in the principle of determing the digestibilities calrified to us the doubtfulness in the principle of determing the digestibilities of tested ration *via* application of a basal ration, *i.e.* the so called "the difference method" (indirect feeding). Assuming that the digestibilities of nutrients in the basal ration to remain the same when adding the tested ration appeared not to rely on sound physiological basis.

To clarify this, careful critical study is presented on the effect of "indirect feeding" not only on digestibility of nutrients in the tested ration but also on the basal ration (considering the reverse situation).

Results with tested ration fed along with basal ration using the indirect feeding

When hay was taken as a basal ration in Trial 4, the feeding value of flax product obtained by difference, was distinctly lower than that of the product when fed alone (19.7 against 26.4% SV). A distinct decrease in the digestibility of OM, CP and CF, occurred while a distinct increase occurred with that of EE and slight increase in the case of NFE. It was clear that assuming that hay nutrient digestibilities remained as obtained when hay was fed alone in

Trial 2, would make the "mutual associative effect" (already proved to be present) to be charged on the expense of nutrient digestibility in flax-product, this would result in an "apparent" distinct decrease in flax-product feeding value.

The same argument could be discussed with flax product when using barley as basal ration (Trial 15). But here "the mutual associative effect appeared to be greater and to the negative side resulting in a great lowering effect on OM, CP and CF digestibility and a much lower feeding value (16.2 against 26.4% SV). The type of the basal ration decidedly affect the digestibility results obtained by the "difference method."

Reversing the situation in Trial 4 and 5, assuming flax-product to be the basal ration to calculate digestibilities of the tested rations, hay and then barley grains, it was clear that a serious reduction in the hay feeding value (28 against 34.9% SV) as well as that of barley grains (50.3 against 80.9% SV) occurred. The two feeds singly fed had much higher feeding value. This apparent reduction when using the basal ration resulted without doubt from assuming the same digestibility of nutrients of the "flax-product" in the two cases : fed alone or being used as a basal ration. The "mutual associative effect" between hay and flax-product or flax-product and barley grains in two component feed mixture outlined in the previous discussion with direct feeding, would be charged against the tested ration when following the indirect feeding principle. Following this principle appeared to lead to faulty determination of digestibilities and feeding value of the tested ration beside producing "impossible digestibilities" such as over-100 figures.

More logically, it seems that the nutrient digestibilities of the feed A when fed alone cannot remain the same when mixed with another feed B. The reverse appeared to be true, B digestibilities when fed alone would be altered when added to feed A. The concept of "mutual associative effect" among feeds when mixed should start to be accepted. A mean for determing the extent of such "associative effect" on each single feed in the mixture, should be searched for.

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دراسة متقدمة عن التأثير الاضافى للأعلاف فى حالة التغذية المباشرة وغير المباشرة فى تجارب تمثيل غذائى على الضأن باستخدام هدير الكتان ودريس البرسيم وحبوب الشعير ٠

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عنى البحث بدراسة التأثير الاضافى بين العلفين المخلوطين فى تجارب الهضم المباشرة وغير المباشرة بالاضافة الى دراسة تأثير العليقة الأساسية على كل من معاملات الهضم والقيم الغذائية للاعلاف المختبرة ٠

وقد أجريت خمس تجارب هضم باستخدام كبشين أو أربعة كباش فى تجارب التغذية المباشرة للاعلاف المستخدمة وهى الدريس والشعير وهدير الكتان ٠ كما شملت هذه الدراسة مخلوطين هما هدير الكتان مع كل من الدريس (كمخلوط أول) ومع الشعير ـ (كمخلوط ثان) وهذان المخلوطان استخدما فى حسابات تجارب الهضم غير المباشرة باستخدام أى من العلفين كعليقة أساسية لحساب معاملات الهضم والقيم الغذائية للعلف الآخر ٠

وقد وجد أن استخدام الدريس كعليقة أساسية أدى الى انخفاض القيمة الغذائية لهدير الكتان (المقدرة بطريقة الفرق) بصورة ملحوظة عن مثيلتها المقدرة بطريقة التغذية المباشرة وكانت النتائج هى ١٩ر٧٪ ، ٢٦ر٤٪ معادل نشا على التوالى ٠

وعندما عكس الوضع (استخدم الهدير كعليقة أساسية لحساب الدريس) كانت النتائج منخفضة بوضوح وكانت قيمة الدريس ٢٨٪ معادل نشا من التغذية غير المباشرة بينما مع التغذية المباشرة كانت ٣٤ر٩/ كما كان الانخفاض واضحا جدا للشعير عندما استخدم الهدير كعليقة أساسية فكانت قيمة الشعير من التجربة المباشرة ٨٠ر٩٪ وانخفضت الى ٥٠ر٣٪ معادل نشا ٠

وقد اكتشف ان اضافة علفين فى مخلوط يعطى قيمة غذائية بيولوجية مختلفة عما يمكن حسابه من معلومية القيم الغذائية لكل علف على حدة (بفرض أن القيمة الغذائية للعلفين تظل ثابتة فى المخلوط) وهذا الفرض ثبت خطؤه بيولوجيا وهذا السلوك للأعلاف فى التغذية المباشرة والغير مباشرة أمكن منه الاستنتاج بحدوث التأثير الاضافى المتبادل بين علف وقرينه فى مخلوط مكون منهما ، لأن دراسة التأثير الاضافى فى التغذية الغير مباشرة كانت تدرس التأثير الاضافى من جانب واحد ٠

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Effect of Hot and Cold Weather on Body Reactions of Chickens

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Body, skin and feather temperatures and respiration rate in Fayoumi, Rhode Island Red and their cross were studied for a whole year. Body temperature was slightly higher in the hot than in the cold season. Relative humidity and wind velosity reduced body temperature during hot weather. Wide diurnal variations in body temperature were observed in hot weather. Fayoumi and its cross were of higher body temperatures than the Rhodes. The lowest feather and skin temperatures were during cold, while the highest values were during the hot season. Diurnal variations in feather and skin temperatures were observed. Breed differences were similar to body temperature. Males had higher feather temperature than females when air temperature was high, while the females had the highest values during cold weather. Respiration rate increased during hot, while it decreased during cold weather. Breed and cross differences were observed in respiration rate. Males were of lower respiration rate than females. Body, skin and feather temperatures and respiration rate were within narrow limits at air temperatures of 5 to 30°. Over 31° the values of different characters increased greatly. The difference between body- skin, skin - feather, feather-air and body - air temperatures decreased with the increase in air temperature.

Air temperature up to 29.4° is without any significant effect on body temperature (Lee *et al.*, 1945). At air temperature of 32.2° body temperature begins to increase above the normal (Yeates *et al.*, 1941). Diurnal variation seems to be mainly attributed to the variation in air temperature (Wilson,1948). Breed differences in body temperature is observed in chickens (Scholes and Hutt, 1942). When humidity increases, body temperature slightly increases (Lee *et al.*, 1945). The rate of respiration is low in cold weather, but increases gradually as the air temperature rises to 32.2°(Lee *et al.*, 1945). The increase in air movement is an important factor in cooling the birds in hot humid or dry weather (Lee *et al.*, 1945). Skin temperature is higher than feather temperature and it differs according to body regions (Wilson *et al.*, 1952). Above air temperature of 32.2 to 35°, the birds are not longer able to lose heat from their body feather, however still a small amount of heat is lost from the unfeathered portions through evaporation (Wilson *et al.*, 1952).

Material and Methods

The birds were kept in wired houses and open yards which were provided with shade only during hot weather. During cold weather, the wired houses were covered with canvas. The birds were fed a ration composed from 19%

corn, 15% barley, 10% wheat, 15% wheat bran, 15% rice bran, 11% broad beans, 15% cotton seed cake, 1.5% lime stone and 0.5% salt. Fresh liquid blood or skim milk was supplied. Green fodder was supplied as Egyptian clover in winter and chopped green maize leaves in summer. Body temperature was measured by inserting a thermometer in the cloaca. Skin and feather temperatures were measured by a touch thermocouple apparatus. Respiration rate was measured by the movement of the abdomen. Air temperature, relative humidity and wind velosity were measured at the time of each test.

Four males and eight females of 12 months of age, from Fayoumi (F), Rhode Island Red (RIR) and the cross of Fayoumi male with Rhode females (FR) were used. The different reactions were studied for one year. The studied characters were recorded for each bird every week during the period of study. The weekly tests were done at 7-9 am (M), 1-3 pm (N) and at 7-9 pm (E). The weekly tests were grouped into two categories, namely, the hot and the cold seasons, which is a characterisitic of the weather in this locality.

Results and Discussion

Body temperatures were slightly higher in the hot than in the cold season (Table 1). It seems that the coincidence of dry weather and fast winds with the high air temperature enables the birds to practice efficient evaporative cooling that reduced the rise in body temperature during the hot season. yeates *et al.* (1941) also concluded that relative humidity and wind velosity have significant effect on body temperature, only when air temperature is high. The highest body temperatures were observed in the noon, whilst the lowest were observed in the evening. Diurnal variations were more obvious during the hot than during the cold season. Body temperatures during the hot evenings were lower than those of the cold noons. It seems that the most effective factor in the differences between the two seasons is the noon temperature of the hot season. Breed differences in body temperatures were observed between the two breeds and the cross used. Other workers, such as Ohamoto *et al.* (1956), also observed these breed differences. No sex differneces were observed in body temperatures in the two seasons.

The lowest feather and skin temperatures were during the cold season, while highest were during the hot season (Table 1). The degree of response to climatic changes varied according to body regions.

The widest variations were observed in comb temperature. Diurnal variations in feather and skin temperatures coincided with similar variations in air temperatures. The greatest diurnal variations were observed during the hot season. Breed differences were observed in feather and skin temperatures. Males had almost higher skin temperatures than females in both seasons. However, males were of higher feather temperatures than females during the hot season ; while the females had the higher ones during the cold season.

There were no differences in respiration rate between the two seasons, as far as the morning and evening tests were concerned. However, respiration rates were higher in the noons of the hot season than the noons of the cold season. This trend was more obvious in the Rhodes and their cross with the Fayoumi, especially in the females. The Fayoumi birds were of almost faster respiration rates than the other birds in the two seasons. FR birds

TABLE 1. Effect of season on different body reactions.

Item	Breed and sex	Hot season (May — October)			Cold season (November — April)		
		M	N	E	M	N	E
Air temp. °C . . .	—	29	34	27	20	22	14
Rel. Humidity % .	—	54	83	53	58	44	75
Wind velocity km/hr	—	4	8	6	2	6	3
Body temp. °c . . .	F ♂	42.1	42.2	41.8	42.0	42.0	41.2
	F ♀	41.9	42.3	41.6	41.8	42.0	41.1
	FR ♂	41.8	42.4	41.5	41.8	41.7	41.0
	FR ♀	41.8	41.5	41.3	41.8	42.0	41.0
	R ♂	41.9	41.9	41.2	41.7	41.6	40.8
	R ♀	41.8	42.4	41.3	41.6	41.6	40.9
Comb. temp. °c . .	F ♂	35.9	38.9	35.4	31.7	36.7	30.1
	F ♀	35.7	38.4	35.9	32.2	34.0	31.0
	FR ♂	37.3	39.4	35.5	35.1	35.9	29.8
	FR ♀	37.0	39.1	36.0	34.0	35.4	31.5
	R ♂	37.1	38.9	35.0	35.0	35.8	29.8
	R ♀	37.3	38.9	36.1	33.5	34.3	30.7
Abdomen skin temp°c.	F ♂	40.6	41.4	40.6	39.1	40.3	39.3
	F ♀	40.1	41.1	40.1	39.0	40.0	28.8
	FR ♂	40.5	41.6	40.5	39.8	40.7	39.3
	FR ♀	40.5	41.6	40.0	39.7	40.2	29.0
	R ♂	40.6	41.2	40.1	40.0	40.3	39.1
	R ♀	40.3	41.4	40.0	39.3	39.7	38.3
Back skin temp°c.	F ♂	40.4	41.2	40.7	38.8	39.9	39.0
	F ♀	40.1	41.1	40.1	39.1	40.0	38.8
	FR ♂	40.3	41.3	39.1	39.4	40.1	39.1
	FR ♀	40.3	41.5	39.9	39.6	40.0	38.8
	R ♂	40.4	41.0	40.1	39.6	39.8	38.8
	R ♀	40.2	41.3	39.9	39.5	39.7	38.2
Back feather temp°c.	F ♂	38.4	39.9	39.0	35.1	36.6	35.1
	F ♀	38.5	39.8	38.8	36.0	36.9	35.8
	FR ♂	38.5	39.9	38.8	35.7	36.3	35.1
	FR ♀	38.6	40.0	38.4	36.3	36.7	35.0
	R ♂	38.5	39.8	38.5	35.7	35.7	34.3
	R ♀	38.5	39.8	38.1	35.7	34.9	34.5
Respiration rateper min.	F ♂	39	46	42	41	47	44
	F ♀	50	64	50	55	61	59
	FR ♂	30	45	28	32	31	30
	FR ♀	44	83	40	47	54	45
	R ♂	27	30	25	28	30	27
	R ♀	37	52	31	38	39	6

were of medium respiration rate between the two purebreeds. Males were of lower respiration rate than females.

Interrelationships

Body, back skin, feather and comb temperatures increased slightly with the increase in air temperature at cold weather, but they increased greatly with the increase of air temperature at hot weather (Table 2). Respiration rate was somewhat high at low temperatures. This may be due to the increased metabolic activity which caused that increase in respiration rate (Hutchinson

TABLE 2. The effect of air temperature gradients on heat regulation reaction.

		Temperature °c				
Air temperature	Breeds	Rectal	Respiration rate/min.	Back skin	Back feather	Comb
5 — 10		41.0	54	38.5	32.9	27.4
11 — 20	Fay.	41.7	51	39.0	35.4	31.7
21 — 30	—	41.9	48	40.4	38.6	35.8
31 — 40		42.2	55	41.5	40.2	39.3
5 — 10		40.8	38	38.9	33.5	28.5
11 — 20	FR	41.5	39	39.2	35.3	32.8
21 — 30		41.7	36	40.3	38.3	36.7
31 — 40		42.3	57	41.7	40.1	39.9
5 — 10		40.8	32	38.5	32.4	28.4
11 — 20	R.I.R.	41.2	33	38.8	34.5	32.1
21 — 30		41.6	32	40.1	28.0	36.4
31 — 40		42.1	40	41.5	40.2	39.6
5 — 16		40.9	41	38.6	32.9	28.1
11 — 20	Average	41.5	41	39.0	35.1	32.2
21 — 30		41.7	39	40.3	38.3	36.3
31 — 30		42.2	51	41.6	40.3	39.6

and Sykes, (1953). Respiration was slightly lowered at the warm weather (21-30°). Over the air temperature of 30°, respiration rate increased greatly to aid in heat loss by evaporative cooling.

The values of the four gradients decreased with the increase in air temperature intervals (Table 3). The differences were high when between body or feather and air temperature, while they were low between body-skin or skin-feather gradients. The highest differences in body-air and feather-air, and the least differences in body-skin and skin-feather gradients were observed for the Fayoumi and its cross with the Rhode. This may indicate that these birds were able to keep the variations in the internal temperature within narow limits irrespective to varying air temperatures.

TABLE 3. **The relationship between the environmental temperature and internal temperatures.**

Breeds	Temp. gradients	5—10°	11—20°	21—30°	31—40
Fay.	B-S	2.5	2.7	1.5	0.7
	S-F	5.6	3.6	1.8	1.3
	F-A	25.4	20.4	13.6	5.2
	B-A	33.5	26.7	16.9	7.2
FR	B-S	1.9	2.3	1.4	0.6
	S-F	4.4	3.9	2.0	1.3
	F-A	26.0	20.3	13.3	4.5
	B-A	33.3	26.5	16.7	7.3
R.I.R.	B-S	2.3	2.4	1.5	0.6
	S-F	6.1	4.3	2.1	1.3
	F-A	24.9	10.5	13.0	5.2
	B-A	33.3	26.2	16.6	7.1
Average	B-S	2.2	2.5	1.5	0.6
	S-F	5.7	3.9	2.0	1.3
	F-A	25.4	20.1	13.3	5.3
	B-A	33.4	26.5	16.7	7.2

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تأثير الاجواء الحارة والباردة على درجات حرارة جسم الدجاج

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درست درجات حرارة الجسم والجلد والريش فى كل من الدجاج الفيومى والرود أيلاند رد وخليطهما طوال ١٢ شهر ووجد أن حرارة الجسم ترتفع قليلا فى الجو الحار وكان لنسبة الرطوبة المنخفضة وسرعة الرياح العالية تأثير ملطف لدرجة الحرارة فى الصيف • وتختلف درجة حرارة الجسم للدجاج أثناء النهار ودرجة حرارة جسم الفيومى والخليط أعلى من الدجاج الأجنبى وهو الرود أيلاند رد • وتنخفض درجة حرارة الريش والجلد فى الشتاء فى الجو البارد وترتفع فى الصيف فى الجو الحار وحرارة جسم وريش وجلد الذكور أعلى من الاناث وذلك خلال الجو الحار بينما تكون الاناث أعلى فى الجو البارد • ويزيد معدل التنفس فى الجو الحار وينخفض فى الجو البارد والديوك تتنفس ببطىء عن الاناث فى جميع الأجواء • عندما تكون درجات الحرارة معتدلة فى الربيع والخريف لا يحدث اختلاف فى درجات الحرارة فى الجلد والجسم والريش ولا بين الذكور والاناث •

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Production of Meat from Egyptian Buffaloes. I. The Effect of Using Different Sources of Roughages on Rate of Gain, Gross and Net Efficiency During the Growth and Finishing Periods

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In an attempt to study the fattening ability of buffalo calves fed rations containing different sources of roughages. This work was carried ourt at Mahallet Mousa Experimental Farm of the Ministry of Agriculture. The experiment included 58 buffalo male calves divided into 3 groups. The first fed on rice straw consisted of 18 animals; while the second on wheat straw and the third group (bean straw) comprising 20 animals each.

The initial body weight was 110.17, 107.85, 108.15kg for the three groups respectively, while their average age was 153,147 and 150, days in the same order. Two different feeding allowances were applied, the first was used during the growing period, from the beginning of the trial until the animals attained 360 kg live weight. The second was used during the finishing period which followed and lasted for 70 days.

The results obtained are summarized in the following:

1. Average daily gain of calves during the growing period was 0.710, 0.680 and 0.644 kg for rice straw, wheat straw and bean straw respectively. The corresponding figures for the finishing period were 1.018,0.708 and 0.691 kg. Such difference being highly significant.

2. The months of year showed a considerable influence on daily gain which reached its minimum values in Jan. Aug.

3. Average gross efficeincy during the growth period was 4.418, 4.682 and 4.804 kg S.E./kg gain for animals fed on ration containing rice straw, wheat straw and bean straws respectively, while it was 5.602, 7.850 and 7.428/kg S.E./kg gain during the finishing period.

4. Average of net efficiency during the growth period was 2.602, 2.812 and 2.840 kg productive S.F. intake/kg gain for the rice straw, wheat straw and bean straw groups respectively, while it was 3.279, 4.789 and 4.351/kg during the finishing period.

According to the recent statistics of (1972), total meat production averaged 362,000 tons of with 64% was the contribution of cattle and butffaloes; while the contribution of poultry, sheep and goats, camels and swine were 22%, 12% and 2% respectively.

Despite the number of buffalo male calves slaughtered annually is considerably large (400,000), their contribution to the local meat supply is relatively small. This is because farmers normally dispose male calves at an early age of 40 days. Farmers are encouraged by the high price of both veal and milk. Hence raising to maturity of 400,000 male calves which are bron yearly should be taken into consideration in orded to increase the output of meat from buffaloes There is an opportunity of increasing the supply of meat by prpoper feeding, fattening and finishing these calves.

This study is, therefore, concerned with raising the buffalo calves under standard system of feeding and finishing until they reach the optimum live weight and condition before slaughtering. The Egyptian buffalo is known to consume large quantities of roughages, and wheat straw is most preferred roughage by farmers. Since its price is raising enormously during the past five years, it is thought to use other cheaper ones such as rice and bean straws.

This experiment, therefore, is planned to investigate and compare the effect of feeding rice, wheat and bean straws on daily gain, efficiency of feed utilization during both growing and finishing periods.

Material and Methods

Series of experiments were carried out to study the fattening ability of buffalo calves fed rations containing different sources of roughages. This work was carried out at Mehallet Mousa Experimental Station which belongs to the Ministry of Agriculture.

Experimental animals.

Fifty eight male buffalo calves abouts 5 months old at the beginning of the experiment were chosen at random from the farm's herd.

Animals were divided into 3 groups. The first consisted of 18 animals while the second and the third groups included 20 animals each. The animals were kept under semi-open sheds and allowed to drink twice daily.

Feeding system

The animals of the different groups were fed according to Tommi, (1963) as shown in Table 1.

During the period of the study two different feeding allowances were applied. The first was used from the beginning of the trial until the animals attanied 360 kg as an average live weight for the different groups. The second was used during the finishing period which followed and lasted for 70 days.

TABLE 1. Buffalo feed requirements according to Tommi allowance.

Liveweight (kg)	Requirements (kg)		Expected daily gains (kg)
	S.E.	D.P.	
	*A. : Growth**		
91 — 135	2.340	0.470	0.250
136 — 180	2.580	0.515	0.850
181 — 225	3.060	0.565	0.800
226 — 270	3.480	0.580	0.700
271 — 315	3.650	0.580	0.700
316 — 360	4.020	0.605	0.700
	*B. : Finishing***		
360 — 400	5.22	0 695—0 800	1.000
400 — 450	5.46	0.700—0.800	1.000

* Tommi, 1963 — Table 53, page 71
** Tommi, 1963 — Table 65, page 86

About 62% of the dietary starch equivalent in the rations for different animal groups were provided by concentrates, while the rest were made up by roughages as shown in Table 2. The first group of animals was rationed rice straw while the second and the third groups received wheat straw and bean straw respectively.

The calves were group fed according to their average body weight. The standard feed mixture and corn were given twice daily at 9.00 a m and at 3.00 pm. The actual amount of feeds consumed daily by each group was recorded regularly through out the study. Animals were weighed every fortnight and their weight were recorded to the nearest kg after fasting period of 16 hr.

Results and Discussion

Growth period

The main objective of this part is to study the growth performance of the male buffalo calves fed different kinds of straw from the beginning of the experiment until they attain 360 kg live weight.

Body weight changes

The changes in body weight during this period are presented in Table 3 and Fig 1. It can be seen that the average initial body weight of calves of the three groups was nearly equal, being 110.17, 107.85 and 108.15 kg for the rice straw, wheat straw and bean staw groups respectively. The difference in initial body weight was not significant.

TABLE 2. **Daily ration per head during the experimental period according to Tommi allowances.**

Live weight (kg)	Winter feeding				Summer feeding			
	Corn (kg)	Concentrate (kg)	Clover (kg)	Straw (kg)	Corn (kg)	Con. mix (kg)	Clover (kg)	Straw (kg)
(A) Growth								
91—135	0.5	1.7	12.0	1.0	0.5	1.7	2.7	1.0
136—180	0.7	2.5	9.0	1.5	0.7	2.5	2.0	1.5
181—225	1.0	3.0	11.0	1.5	1.0	3.0	2.5	1.5
226—270	1.0	3.1	13.0	1.7	1.0	3.1	2.9	1.7
271—315	1.0	3.1	13.5	2.0	1.0	3.1	3.0	2.0
316—360	1.5	3.3	14.1	2.25	1.5	3.3	3.1	2.20
(B) Finishing								
360—400	2.0	3.5	15.0	3.0	3.0	3.5	3.75	3.0
400—450	2.25	3.5	15.0	3.5	2.25	3.5	3.75	3.5

It was observed that during the growing period the live body weight of the animals fed on rice straw was slightly higher than the corresponding weight of the other two groups, while the animals which were fed on bean straw ration showed the lowest weight. The difference between the groups in body weight was insignificant.

Daily gain

The data (Table 4) indicate that the average daily gain of the first group overall the period was slightly higher than that of the other two groups, being 0.710, 0.680 and 0.644 kg for the rice straw, wheat straw and bean straw groups, respectively. The difference in average daily gain between groups lacks significance.

The relative growth rate nearly followed the same trend as it is reflected by the daily gain shown in Table 4.

These averages of daily gains obtained in the present study are higher than that reported by several investigators for Egyptian buffalo. Abdel-Rahman (1966) ranged from 0.471 to 0.699 kg, Choneim *et al.* (1957), namely 0.46 kg and Ragab and Abdel-Salam (1962) being in average 0.389 kg.

TABLE 3. Average live body weight of calves at different periods of feeding from five months old until they attain 360 kg live body weight.

Days from the start of experiment	I. Rice straw (group) No. of animals 18		II. Wheat straw (group) No. of animals 20		III. bean straw (group) No. of animals 20		Analysis of variance
	A.B.wt. kg	S.D	A.B.wt. kg	S.D.	A.B.wt. kg	S.d.	
0	110.17	13.1	107.85	12.8	108.15	12.9	N.S 1.75
90	164.94	24.4	161.30	21.7	160.40	22.1	N.S 0.21
176	240.17	31.9	236.90	32.3	225.90	28.4	N.S 1.13
274	283 60	34.4	274.40	32.0	263.70	31.8	N.S 1.78
358	364.28	36.7	355.95	33.7	336.55	37.9	N.S 2.99
372	—	—	361.00	36.9	341.70	37.7	N.S 1.64
386	—	—	—	—	356.80	40.0	

N.S = not significant

Yet, they agree well with the findings of El-Ashry *et al.* (1972) namely 0.61 and 0.71 kg obtained for buffalo calves fed on 50% and 80% concentarate rations respectively.

From the results given in Table 4 it is noticed that the average daily gain attained during the third feeding interval was much lower than that found for the preceeding and following intervals as it was 0.444,0.355 and0.376 kg for the three groups, respectively.

It is believed that the cold weather prevailing in December and January, when the temperature reached its minimum (5.7°) is the cause of such drop in the daily gain, (Fig. 2), as the animals were kept in open sheds and they were exposed to the cold during night. In the connection, Afifi *et al.* (1974) found that the average daily gain of different age groups of male buffalo calves was the lowest during January being 182 g, while they were 583 and 104 g in December and February.

Another cause may be that the animals were approaching puberty during the third feeding interval as the animals reached the age of 11-14 months.

Feed efficiency

1. *Gross efficiency* : the data relevant to the efficiency of feed utilization are presented in Table 5. The figure of 4.418 S.K/kg gain obtained for animals fed on rice straw was lower than that of 4.682 and 4.804 S.E./kg gain obtained for animals fed on wheat and bean straws, respectively. Yet, the difference between the groups in this respect is practically negligible.

TABLE 4. **Average daily gain, relative growth rate during the first experimental period (growth exp.).**

Days from the stat of experiment	Groups												Analysis of variance	
	I. Rice straw				II. Wheat straw				III. Bean straw					
	No. of animals = 18				No. of animals = 20				No. of animals = 20					
	A.D.G.		R.G.R %		A.D.G.		R.G.R. %		A.D.G.		R.G.R. %			
	$\bar{x}$	S.d	$\bar{x}$	S.d	$\bar{x}$	S.d	$\bar{x}$	S.d	$\bar{x}$	S.d	$\bar{x}$	S.d	D.G.	D.G.R
Start-90	0.609	0.162	39.2	7.6	0.594	0.119	39.5	4.9	0.581	1.156	38.1	7.2	0.174 N.S	0.215 N.S
91 - 176	0.868	0.140	54.4	7.3	0.878	0.173	56.2	10.6	0.762	0.107	49.0	6.6	4.010 *	3.977 *
177 - 274	0.444	0.137	16.8	5.3	0.355	0.128	25.9	24.1	0.376	0.125	17.7	10.1	2.405 N.S	2.036 N.S
275 - 358	0.960	0.116	25.0	3.8	0.971	0.120	25.6	5.3	0.867	0.135	24.4	3.4	4.46 *	0.413 N.S
359 - 372	—	—	—	—	0.375	0.528	1.3	2.1	—	—	—	—	—	—
359 - 386	—	—	—	—	—	—	—	—	0.723	0.280	5.83	2.2	—	—
From the start to the end of the growth period	0.710	0.085	107.0	6.6	0.680	0.079	107.77	6.5	0.644	0.093	108.20	8.5	2.79 N.S.	0.130 N.S.

* ($P < 0.05$) N.S. = Not Significant Relative growth rate calculated as = $R.G.R = \frac{(Wt_2 - Wt_1)}{Wt_2 + Wt_1} X100$

TABLE 5. Average S.E./kg gain (gross efficiency) during the first experimental period.

Days from the start of the growth period	Groups								
	I. Rice straw			II. Wheat straw			III. Bean straw		
	No. of animal : 18			No. of Animals : 20			No. of animals : 20		
	Total intake of S.E. (kg)	Absolute gain (kg)	Feed efficiency (kg)	Total intake of S.E. (kg)	Absolute gain (kg)	Feed efficiency (kg)	Total intake of S.E. (kg)	Absolute gain (kg)	Feed efficiency (kg)
Start — 90	3209.515	986	3.255	3513.082	1069	3.286	3485.904	1045	3.336
91 — 176	4458.959	1354	3.293	5206.939	1510	3.448	5160.468	1310	3.939
177 — 274	5965.518	783	7.619	6666.685	752	8.865	6352.505	756	8.403
275 — 358	6574.381	1451	4.531	7028.085	1631	4.309	6400.104	1457	4.393
359 — 372	—	—	—	1291.892	101	12.791	—	—	—
359 — 386	—	—	—	—	—	—	2489.649	405	6.147
From the start to the end of growth period . . .	20208.373	4574	4.418	23706.683	5063	6.682	23888.630	4973	4.804

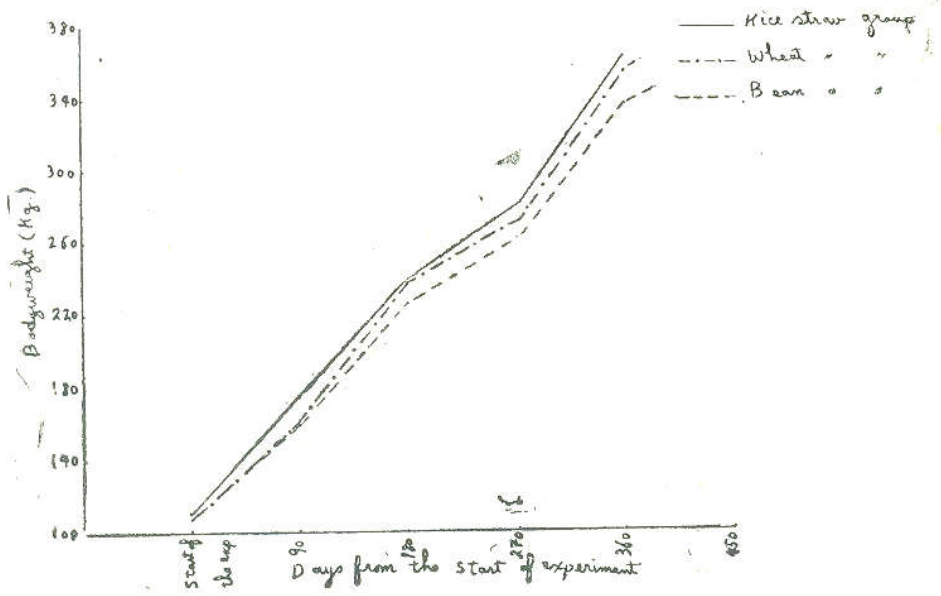

Fig. 1.—Average body weight during the first period (Growth period).

The average estimates of S.E.kg gain obtained in this work were lower than those reported by El-Ashry *et al.* (1972), who found 11.5, 5.6 and 5.7 kg S.E/g gain respectively for buffaloes fed 100 of roughages, 50% concentrate, and 20% roughages, but were higher than that of Ghoneim *et al.* (1959) who reported 3.25 kg S.E./kg gain.

B .2. Net efficiency: was calculated according to the following formula : Productive S.E. intake = Total S.E. intake — Maintenance *S.E.

$$\text{Net efficiency} = \frac{\text{productive S.E. intake (g)}}{\text{gain (kg)}}$$

The data presented in Table 6 show that the net efficiency followed the same trend of gross efficiency.

The overall averages were 2.602, 2.812 and 2.840 productive S.E. needed/ kg gain for the rice, wheat and bean straw groups respectively. The difference between groups was so small.

Finishing period

When the average body weight of each group reached about 360 kg the animals of different groups, received a finishing ration over a period of 70 days.

* Abou-Raya, A.K. (1967)

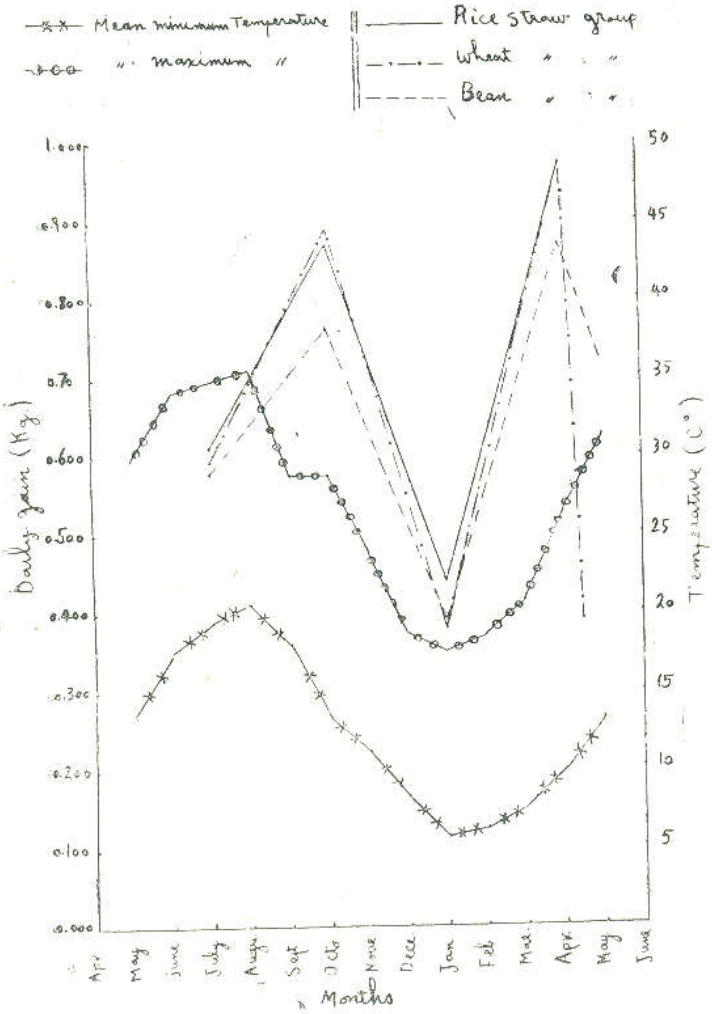

Fig. 2.—The effect of months of year on daily gain during the growth period.

Body weight changes

The average body weight at the beginning of the finishing period, body weights at different intervals of finishing are inserted in Table 7 and Fig. 3.

During the different intervals (14 days), the rice straw group had the highest body weigh while the bean straw group had the lowest body weight. At the end, the average final weight was 433.41 and 410.4 and 405.1 kg for the first, second and third groups respectively. The corresponding average age of the three groups was 581, 589, 606 days respectively.

TABLE 6. Mean net efficiency values different weight intervals during the first period (growing period).

Period of feeding (days)	I. Rice straw			II. Wheat Straw			III. bean straw		
	No. of animals : 18			No. of animals 20			No. of animals : 20		
	Productive energy intake (S.E. kg)	A.D.G.	Net effic. (kg) gain	Productive energy intake (S.E. kg)	A.D.G. (kg)	Net effici. (kg) gain	Productive energy intake (S.E. kg)	A.D.G. (kg)	Net. effici. (kg) gain
Start-90	1.210	0.609	1.987	1.198	0.594	2.017	1.185	0.581	2.040
91 — 176	1.745	0.868	2.010	1.912	0.878	2.178	1.918	0.762	2.517
177 — 274	1.915	0.444	4.313	1.970	0.355	5.549	1.870	0.376	4.975
275 — 358	2.534	0.960	2.649	2.418	0.971	2.490	2.129	0.867	2.465
359 — 372	—	—	—	2.606	0.375	6.949	—	—	—
373 — 386	—	—	—	—	—	—	2.504	0.723	3.463
From the start of the experiment to the end of growth blood	1.842	0.708	2.602	1.895	0.674	2.812	1.823	0.642	2.840

TABLE 7. Average body weight at different interval of finishing from weight about 360 kg till 70 day of finishing.

Finishing period days	Groups						Analysis of variance
	I. Rice straw		II. Wheat straw		III. bean straw		
	No. of anim:17		No. of anim.:20		No. of anim.: 20		
	A.b. wt (kg)	S.d.	A.b. wt (kg)	S.d.	A.b. wt, (kg)	S.d.	
0	364.28	36.7	361.00	36.9	356.80	40.00	N.S. 2.99
14	380.82	36.47	373.15	34.61	366.65	41.15	N.S. 0.65
28	399.41	36.89	378.76	35.64	372.90	45.14	N.S. 2.24
42	403.88	35.88	396.45	38.45	387.45	43.67	N.S, 0.71
56	420.88	35.43	405.40	38.48	396.05	44.36	N.S. 1.80
70	433.41	36.03	410.40	33.98	405.15	28.18	4.01*

* (P 0.05)
N.S. = not significant.

The final body weight obtained in this study is higher than that found by El-Ashry (1968) which was 378.6-381.1 kg in a fattening trial included 1.5-2 years old male buffaloes, receiving a ration of poor quality roughage and urea plus moderate amount of concetrates. Afifi *et al.* (1974) also reported an average body weight of 408.9 kg for old male buffalo calves at 24 months old and put on a fattening ration for six months. Yet, our results agree well with these stated by Ragab *et al.* (1966) who found that the average have body weight of male buffaloes were 359.33 and 449kg at the ages of 18 and 24 months, respectively.

Daily gain

Table 8 indicates that the average daily gain throughout the finishing period which extended for 70 days was 1.018, 0.708 and 0.691 kg for the rice straw, wheat and bean straw groups, respectively. The difference between groups in the daily gain was significant. Moreover, during the different weight intervals

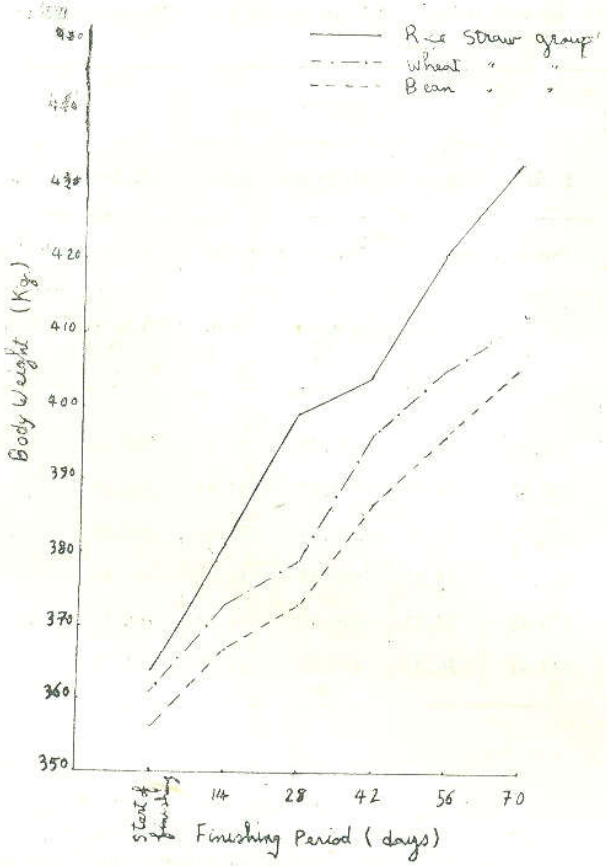

Fig. 3. Average body weight during the sec nd period (Finishing period).

of finishing, the group fed on rice straw was significantly higher in body gain over the other two groups (Fig.4). The results also revealed that an average daily gain as high as 1.3 kg/day was obtained by animals which received rice straw at most of the finishing intervals (Table 8).

It is of interest to note that within each group, the average daily gain fluctuated among the different weight intervals. Yet, it is observed that the severe drop in gain which occurred at any particular interval was compensated by a relatively higher rate of gain in the succeeding interval (Table 8). The lower daily gain at the third weight interval of the group and the second weight interval of the second and third groups may be attributed to the influence of high climatic temperature during this period as the maximum temperature ranged between 31.3-32.5°.

TABLE 8. Average daily gain ,relative growth rate for the groups during finishing period.

Finding period (days)	Groups												Analysis of variance	
	I.Rice straw				II.Wheat straw				III bean straw					
	$N_I = 17$				$N_2 = 2$				$N_3 = 20$					
	A.D.G.		R.G.R.		A.D.G.		R.G.R.,		A.G.D		R.G.R.		S.d.	
	$\bar{X}$	S.d.	$\bar{X}$	S.d.	$\bar{X}$	S.d.		S.d.	$\bar{X}$	S.d.	$\bar{X}$	S.d	D.G.	R.G.R.
0—14	1.307	0.486	7.5	11.21	0.869	0.373	3.5	1.7	0.668	0.667	3.0	2.9	7.53**	N.S. 2.85
15—28	1.328	0.515	4.8	1.9	0.396	0.425	1.5	1.6	0.439	0.598	1.9	2.8	18.48**	12.45**
29—42	0.412	0.498	1.4	1.8	1.232	0.526	4.5	1.8	0.975	0.746	3.9	2.5	8.69**	10.90*
43—56	1.214	0.543	4.2	1.8	0.639	0.576	2.7	2.7	0.664	0.618	2.6	1.8	5.34**	3.24*
57—70	0.937	0.561	3.1	1.8	0.379	0.867	1.2	3.0	0.700	0.569	2.3	2.1	3.10*	N.S
0—70	1.018	0.223	18.1	4.8	0.708	0.159	12.9	3.6	0.691	0.154	12.7	2.5	19.08**	2.72 12.4**

* : ($P < 0.05$) ** : ($P < 0.01$) N.S. = Not significant

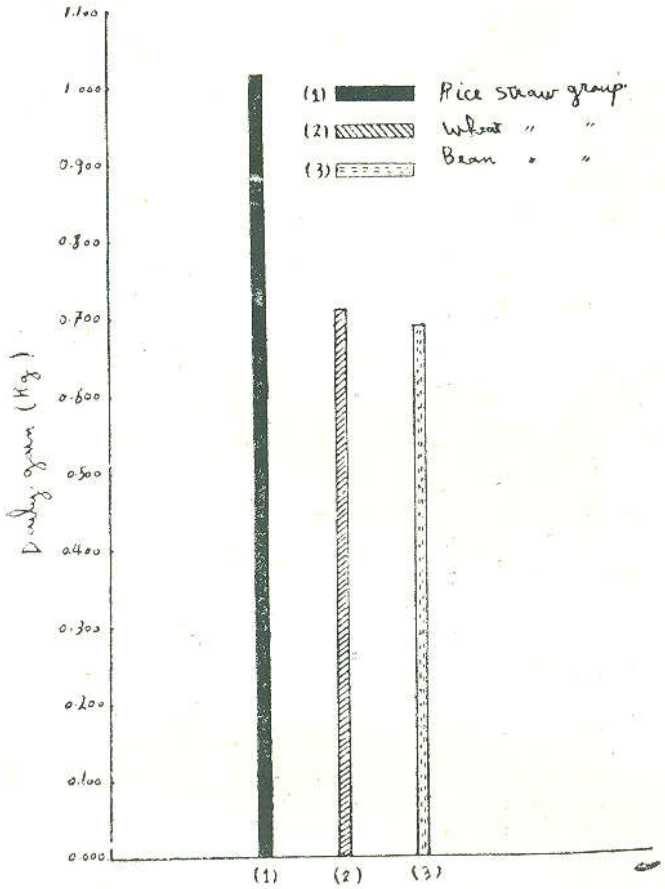

Fig. 4 . The average daily gain of the three groups during the finishing period.

The average daily gain of the group fed on rice straw higher than that recorded by Ragab *et al.* (1966) namely 0.50 kg for male buffalo calves fattened at the age interval of 18-24 months old was very similar to those reported by Afifi *et al.* (1974), namely 0.963 kg at nearly the same age. Yet, the daily gain attained by the wheat straw and bean straw groups were lower than those reported by the authors mentioned above.

The results reported by different authors about feeding the cattle partly on rice straw were similar to those obtained by buffaloes. White and Reynolds (1970) concluded that Angus and Hereford steers fed 20% ground rice straw had the highest average daily gain. Moreover Roverso *et al*. (1969) found that the average daily gain was 1.30 and 0.74 kg for the Nellore bulls when fed on rations containing 15 or 75% rice straw, respectively.

TABLE 9. Average S.E. / kg gain (kg) during the second experimental period (finishing period).

Finishing period (days)	Groups								
	I Rice straw			II Wheat straw			III Bean straw		
	No_1 : 17			$No._2$: 20			$No._3$: 20		
	Total intake of S.E. (kg)	Absolute gain (kg)	Feed efficiency (kg)	Total intake of S.E. (kg)	Absolute gain (kg)	feed efficiency (kg)	Total intake of S.E. (kg)	Absolute gain (kg)	Feed efficiency (kg)
Start—14.	1377.362	307	4.487	1540.395	243	6.339	1416.370	197	7.190
15—28	1334.927	316	4.224	1514.985	111	13.649	1453.095	123	11.814
29—42	1295.319	76	17.044	1551.370	355	4 370	1464.030	293	4.997
43—56	1360.094	289	4.706	1560.235	179	8.716	1469.717	172	8.545
57—70	1360.709	213	6.388	1588.916	100	15.889	1379.404	182	7.579
From the start till the end of finishing. . .	6728.411	1201	5.602	7755.9010	988	7.850	7182.616	967	7.428

TABLE 10. Mean net efficiency values at different weight intervals during the second period (finishing period).

Finishing period (days)	Groups								
	I. Rice straw			II. Wheat straw			III. Bean straw		
	No. of animals : 17			No. of animals : 20			No. of animals : 20		
	Productive energy intake (S.E. kg)	A.D.G (kg)	Net. effic. (kg) gain	Productive energy intake (S.E.kg)	A.D.G. (kg)	Net effic. (kg) gain	Productive energy intake (S.E. kg)	A.D.G. (kg)	Net effic. (kg) gain
Start—14.	3.700	1.307	2.831	3.445	0.869	3.964	3.033	0.668	4.540
15—28	3.424	1.328	2.578	3.305	0.396	8.346	3.119	0.439	7.105
29—42	3.193	0.412	7.750	3.370	1.232	2.735	3.100	0.975	3.179
43—56	3.406	1.214	2.806	3.326	0.639	5.205	3.055	0.664	4.601
57—70	3.325	0.937	3.549	3.391	0.279	8.947	2.682	0.700	3.831
start—70 (days) .	3.410	1.040	3.270	3.367	0.703	4.789	2.998	0.689	4.351

Feed efficiency

1·*Gross efficiency*:Table 9 indicates that feed efficiency of the three groups were 5.602, 7.850 and 7.428 S.E/kg gain. Comparing these figures it is self evident that rice straw group was by far the best, followed by the bean and wheat straw groups.

The average feed efficiency obtained in this work was greater better than those reported by Ragab *et al.* (1966) namely 11.65 kg S. E/ kg gain during the age period 18-24 months, but was higher than that reported by Afifi *et al.* (1974) namely 5.11 *kg* S.E/ k g gain for animals of the same age. However, our results are within the range reported by El-Hakim *et al.* (1971), who found that feed efficiency averaged 5.73 and 7.30 kg S.E./kg gain for male buffalo calves fedon 50% and 80% concentrates respectively.

B.2.Net efficiency :Net efficiency over the 70 days finishing was 3.279, 4.789 and 4.351 kg productive S.E. intake kg gain for the rice straw, wheat straw and bean straw group respectively (Table 10). The difference between groups in net efficiency during finishing period was much higher than that obtained for the growing period.

Thus, it can safely recommended to use the rice straw as we have been able to show through the present study that buffalo male calves thrived better on rice straw than those fed on wheat and bean straws, especially at the finishing stages.

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انتاج اللحم من الجاموس المصرى

١ — تأثير استخدام مواد العلف الخشنة على معدل الزيادة اليومية وكفاءة الغذاء الكلية والصافية أثناء فترتى النمو والتسمين

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تهدف هذه الدراسة الى معرفة كفاءة تسمين العجول الجاموسى على علائق تحتوى على مواد علف خشنة مختلفة . وقد أجريت هذه الدراسة فى محطة بحوث الانتاج الحيوانى بمحلة موسى — التابعة لوزارة الزراعة وشملت التجربة على ٥٨ عجل جاموسى مقسمة الى ٣ مجموعات . الأولى : ١٨ حيوان وكانت تغذى على قش الأرز بينما غذيت المجموعة الثانية والثالثة على تبن القمح وتبن الفول على التوالى وشملت كل منها ٢٠ حيوان وكان وزن الحيوانات عند بدء التجربة هو ١٧ر١١٠ و ٨٥ر١٠٧ و ١٧ر١١٠ كيلو جرام للمجاميع الثلاث على التوالى بينما كان متوسط أعمارها هو ١٥٣ر١٤٧ و ١٥٠ يوم بنفس الترتيب .

وقد استخدم نظامين فى التغذية الأول : وهو أثناء فترة النمو ويبدأ من بداية التجربة حتى يصل متوسط وزن الحيوانات الى ٣١٠ كيلو جرام . والثانى : أثناء فترة التسمين والتى تلى فترة النمو وتستمر لمدة ٧٠ يوم وتتلخص أهم نتائج هذه الدراسة فيما يلى :

١ — كان معدل الزيادة اليومية للعجول أثناء فترة النمو هو ٧١٠ر٠ ، ٦٨٠ر٠ ، ٦٤٤ر٠ كيلو جرام لمجموعات قش الأرز ، وتبن القمح وتبن الفول على الترتيب بينما الأرقام المقابلة أثناء فترة التسمين (٧٠ يوم) كانت ١٨ر١٠ ، ٧٠٨ر٠ ، ٦٩١ر٠ كيلو جرام . هذا وان الفروق بين المجاميع كانت معنوية جدا .

٢ — تبين أن شهور السنة لها تأثير على معدل الزيادة اليومية حيث بلغ الحد الأدنى للنمو خلال شهرى يناير وأغسطس .

٣ — أثناء فترة النمو كانت كفاءة الغذاء الكلية هى ٤١٨ر٤ ، ٦٨٢ر٤ ، ٨٠٤ر٤ كيلو جرام معادل نشا لكل كيلو جرام نمو لمجاميع الحيوانات التى تغذى على قش الأرز وتبن القمح وتبن الفول على التوالى بينما كانت ٦٠٢ر٥ ، ٨٥٠ر٧ ، ٤٢٨ر٧ كيلو جرام معادل نشا لكل كيلو جرام نمو وذلك أثناء فترة التسمين (٧٠ يوم) .

٤ — كانت كفاءة الغذاء الصافية أثناء فترة النمو ٦٠٢ر٢ ، ٨١٢ر٢ ، ٨٤٠ر٢ كيلو جرام معادل نشا فتنتج لكل كيلو جرام نمو وذلك لمجاميع قش الأرز وتبن القمح وتبن الفول على الترتيب بينما كانت ٢٧٩ر٣ ، ٧٨٩ر٤ ، ٣٥١ر٤ كيلو جرام أثناء مرحلة التسمين .