Feed and water intake, digestibility and nitrogen utilization by camels compared to sheep and goats fed low protein desert by-products

Gihad El-Sayed A., El Gallad T.T., Sooud A.E.O., Abou El-Nasr H.M., Farid M.F.A.

in

Tisserand J.-L. (ed.).
Séminaire sur la digestion, la nutrition et l'alimentation du dromadaire

Zaragoza : CIHEAM
Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 2

1989
pages 75-81

Feed and water intake, digestibility and nitrogen utilization by camels compared to sheep and goats fed low protein desert by-products

E. A. GIHAD
T. T. EL-GALLAD
FACULTY OF AGRICULTURE
GIZA (EGYPT)

A. E. SOOUD
H. M. ABOU EL-NASR
M. F. A. FARID
DESERT RESEARCH INSTITUTE
CAIRO (EGYPT)

RESUME - Après avoir fait le point des données bibliographiques en matière d'ingestibilité, de digestibilité et de rétention azotée chez les dromadaires, une étude est conduite sur 2 dromadaires femelles, 4 béliers et 4 boucs (race du désert).

Ce travail a pour objetif de mettre en évidence les effects sur l'ingestion d'eau de la matière sèche, la digestibilité et la rétention azotée de trois rations: foin seul, 75% de noyaux de dattes et 25% de foin, 75% de grignons d'olive et 25% de foin.

Les résultats montrent que les dromadaires dépensent moins d'eau que les petits ruminants pour leur thermorégulation s'il n'y a pas de différence d'ingestion de MS (par Kg $p^{q\ .71}$) lorsque les trois espèces consomment le jour seul. Les ovins mangent moins que les caprins et les camelins lorsque les régimes comprennent des noyaux de dattes ou des grignons d'olives. Les dromadaires digèrent mieux les glucides pariétaux mais moins bien les matières azotées que les petits ruminants. Toutefois, les camelins retiennent une quantité plus élevée d'azote (par Kg $p^{q\ .75}$) que les petits ruminants, sauf peut-être pour le régime contenant des déchets de dattes.

Mots-clés: Dromadaire, ingestion, aliment, abreuvement, digestion, rétention azotée.

SUMMARY - After having gathered data from bibliography about intake, digestibility and nitrogen retention in dromedaries, a study was carried out on 2 female dromedaries, 4 rams and 4 bucks (desert breed).

This work has as objetive to show the effects of digestibility and nitrogen retention on water intake in three rations: hay, 75% date pits and 25% hay, 75% olive cake and 25% hay.

The results show that dromedaries consume less water than small ruminants because of their thermo-regulation if there is no difference concerning dry matter intake (per Kg. $p^{q\ .71}$) when the three species eat only during the day. Sheep eat less than goats and dromedaries when the diets include date pits or olive cake. Dromedaries digest wall carbohydrates better than small ruminants but nitrogen matter worse than them. Still dromedaries retain higher quantities of nitrogen (per Kg. $p^{q\ .75}$) than small ruminants, except perhaps with the diet containing date wastes.

Key words: Dromedary, intake, feed, watering, digestion, nitrogen retention.

Introduction

Camels on natural range browse and graze. The nature and sparseness of feed available to camels make rapid feeding rates and, therefore, high levels of dry matter intake are difficult to achieve. The number of bites and the size of bite have an effect on feed intake. There are very great differences in feed intake and thus in the feeding time among camels. Therefore, very little is known about what governs the feeding habits of camels (WILSON, 1984). Camels consumed less feed than sheep, whereas goats consumed the most when grazing in semi-arid land (GAUTHIER-PILTERS, 1974 and EL-SHAER, 1981).

The New World Camelidae showed that camels are significantly more efficient in the digestion of dry matter, fiber, cellulose and crude protein than sheep (HINZ et al., 1978). It was suggested that the greater efficiency may be achieved because of the more rapid frequency of contractions in the forestomach and ruminating cycle as a whole. Similar results were reported by SOOUD (1980) and KANDIL

(1984). Nevertheless, FARID et al., (1979) found that camel digest dry matter and crude fiber better than sheep, but crude protein was less digested. GIHAD et al. (1980) reported that goats digest crude fiber better than sheep.

Camels consume less water than sheep and goats. Moreover, they tolerate water deprivation for a long period without any adverse effects on their performance (SCHMIT-NIELSON, 1964 and FARID et al., 1985). Certain types of desert sheep and goats also, possess the ability to abstain from water for sometime, but their resistance is nowhere near that of camels. Urinary water excretion was less in camels than in sheep (MACFARLANE et al., 1963). Water deprived camels excreted less urine than those watered daily (KANDIL, 1984).

Camels are more efficient than sheep in utilizing their digested N. Moreover, they possess a high ability to reduce urea output, and consequently retained more N than sheep (SHAWKET, 1976; SOOUD, 1980, and FARID et al., 1985). The early work of READ (1925) showed that there was practically no urea in the urine of pregnant camels on low protein diet. Therefore, when grazing camels maintained on low N intake, the amount of urinary N fell to a very low level (LIVINGSTON et al., 1962). Camels under nutritional stress excreted a total of 1 g. urea in 24 hours (SCHMIDT-NIELSEN et al., 1957). This corresponds to a metabolism of 2.5 g. protein per day, which is obviously far too low. GIHAD (1976a) did not find any difference between sheep and goats in nitrogen utilization.

Nutritional studies on camels compared with sheep and goats as desert ruminant animals were conducted on the following topics:

1. Feed intake and digestion abilities.
2. Water intake and its utilization and,
3. Nitrogen utilization using N balance.

The nutritive values of date seeds and olive pulp as desert by-products, using a basal diet of hay, were also investigated.

Experimental procedure

This study was carried out at Maryout Desert Research Station, Desert Institute, Egypt. Three trials were conducted. Two female camels *(Camelus dromedarious),* four Barki rams and four desert bucks were used in each trial. Animals were taken from the dominant types in the desert area around the experimental station. The average initial weight of camels, sheep and goats was 594 ± 9.2; 47 ± 1.7 and 29 ± 1.0, respectively.

Three rations were fed to the three species of animals, one in each trial. These rations were chopped berseem hay *(Trifolum alexandrium)* fed alone (H), 75% crushed date seed mixed with 25% hay (DH) and 75% olive pulp mixed with 25% hay (OH). Chemical composition and average nutritive values of the experimental feeds are presented in table 1. Rations were formulated to cover the maintenance requirements of animals. Camels were fed according to cattle requirements (ARC, 1965) as described by SOOUD (1980) while sheep and goats were fed according (ARC, 1965) standards. Camels were housed in individual pens, while sheep and goats were confined in individual metabolism crates during the entire period of the experiment. Animals were fed twice daily and drinking water was voluntarily available for one hour at 11 a.m.

Daily water intake was recorded, meanwhile, dry matter intake was estimated during a 20-day preliminary period followed by a 10-day collection period. Faeces were collected in specially constructed bags attached to the animals with a harness. Urine was drained through a metal funnel fitted to the female geneitalia of camels or around the sheath of rams and bucks, into large bottles containing 20 ml. of 50% sulphuric acid solution. Procedures for sampling of feeds and collections, handling and sampling of faeces and urine were similar to those described by GIHAD (1976a). Proximate analyses of these samples were determined by standard A. O. A. C. (1965) methods.

Data obtained on water intake and excretion was related to the metabolic body mass ($W^{.82}$) as advised by MACFARLANE and HOWARD (1970). It should, however, be noted that the water intake was considered only as a sum of drinking water and feed combined water, while the water excretion was considered only as the amounts excreted in urine and faeces. The metabolic water intake and excreted evaporative cooling water were difficult to estimate with the practised procedure.

Data were statistically analysed by analysis of variance for a completely randomized design as described by Steel and Torrie (1960).

Results and discussion

Water utilization

The data of water utilization by camels, sheep and goats fed hay (H) alone, date seeds plus hay (DH) and olive pulp-hay (OH) rations are presented in tables 2, 3 and 4, respectively. Water intake as a sum of free drinking and feed combined water was expressed as ml. per kg. body weight, ml. per kg. metabolic body mass ($kg^{.82}$) and ml. per kg. dry matter intake. Camels fed H and DH rations showed lower ($P < .01$) water intake with the three parameters than sheep and goats. Camels fed OH ration only showed lower ($P < .01$) water consumption expressed as ml. per kg. body weight, while the other two parameters did not show any significant differences. Sheep and goats consumed comparable amounts of water. All the animals fed H ration showed high water consumption in contrast to OH ration. This result might be due to the fact that the first (H) was fed during summer while the second (OH) was fed during winter. These findings agree with those reported by SHAWKET (1976), FARID et al. (1979) and SOOUD (1980).

Faecal water ($ml/Kg^{.82}$) excreted by camels was almost higher than that excreted by sheep and goats. These results were significant ($P < .01$) among animals fed OH ration

and only between camels and sheep ($P < .05$) fed DH ration. Urinary water (ml/Kg$^{.82}$) excreted by camels was lower ($P < .01$) than that excreted by sheep and goats fed the same rations. Meanwhile, goats fed H and DH rations excreted more ($P < 0.5$ and $P < .01$) urinary water than sheep. Low urinary water excreted by camels was reflected on reducing ($P < .01$) the total water excretion compared to that excreted by sheep and goats fed H and DH rations. Goats fed DH and OH rations showed higher ($P < .01$) total water excretion than sheep. Moreover, those fed H ration showed a similar trend, but the difference was not significant. These results agree with the findings of MACFARLENE et al. (1963), SHAWKET (1976), FARID et al. (1979 and 1985) and SOOUD (1980) who studied water utilization by camels.

Urinary water excreted by camels fed the three rations was almost one half of the total water excretion, while it was two thirds by sheep and camels.

The average values of urinary water percent of total water excretion with the three tested rations were 49.77%, 69.39% and 73.16% by camels, sheep and goats, respectively. These results along with the above findings emphasize that the structure and function of the camel's kidney are of extreme importance in water conservation. Camel's kidney controls water loss in two ways: by the absolute concentration achieved and by the reduction in the flow of urine (MACFARLANE et al., 1963).

It is worthy to note that the difference between water intake and faecal plus urinary water loss considered as water loss was 5.42, 7.67 and 7.60 ml/Kg$^{.82}$ for camels, sheep and goats fed OH ration, respectively. Corresponding values were 26.49, 80.96 and 68.18 ml/kg$^{.82}$ when H ration was fed. These two rations were fed at maintenance level, therefore, the energy intake was almost similar (table 2 and 4). The OH ration was fed during winter while H ration was fed during summer, where the average ambient temperature was 16 and 38° C, respectively. The high ambient temperature in summer reflected on high water intake an insensible water loss (IWL). The differences in IWL among animals species in winter were narrow, while in summer the IWL by camels was almost one third that of sheep and goats. In other words, camels lose less evaporative cooling water in summer. These results along with the variation in body temperature during day and night might indicate that camels possess a sophisticated heat control mechanism (WILSON, 1984).

Feed intake

Daily intake of dry matter (DM), TDN and digestible crude protein (DCP) by the three animal species fed the different tested rations are shown in tables 2, 3 and 4. The DM intake expressed as g. per kg. body weight showed that camels consumed the lowest ($P < .01$) amounts, while goats showed the highest ($P < .01$) consumption. Expressing these results as percent of body weight also followed the same trend. Meanwhile, DM intake expressed as g. per kg$^{.75}$ showed that camels consumed similar amounts to those eaten by goats. Sheep showed similar results to those of camels and goats when fed hay alone, but their consumption was lower ($P < .01$) than others when fed DH and OH rations. These results were in line with the findings of GAUTH-PILTERS (1974), SHAWKET (1976), EL-SHAER (1981) and KANDIL (1984), who reported that camels consumed less feed than sheep and goats. However, FARID, et al. (1985) stated that camels can consume more DM from roughage feeds than sheep. Meanwhile, these results were in agreement with those of MAJUMDAR (1960), MACKENIZE (1967), DEVENDRA (1976) and GIHAD (1976 b), who found that goats can consume more DM than sheep.

The TDN and DCP intake followed a similar trend as to DM intake. The average, daily consumption of TDN and DCPT by camels was 34.59 and 2.49 g/kg$^{.75}$. The corresponding values for sheep were 28.32 and 2.58 g/kg$^{.75}$, while those values for goats were 31.67 and 2.59 g/kg$^{.75}$, respectively. The results of sheep fed OH ration were, only excluded, since this ration was less palatable to sheep (HATHOUT et al., 1977). The maintenance requirements of sheep as TDN and DCP are 29.26 and 2.55 g/kg$^{.75}$ (NRC, 1975). The corresponding values of goats are 28.24 and 2.73 g/kg$^{.75}$ (NRC, 1981). The herein results were in line with the nutrient requirement standards of sheep and goats. Therefore the camel results might be used as a scanty information and could be useful to serve as a guide for the maintenance needs of camels. These results merit some consideration, because of the lack of appropriate conclusive measures for camel nutrition. It is worthy to note that the maintenance requirements for cattle as TDN and DCP are 35.22 and 2.84 g/kg$^{.75}$ (NRC. 1978). Therefore, using the feeding standards of cattle for camels seems to be more appropriate.

Digestibility

The apparent digestion coefficients of H, DH and OH rations when evaluated by feeding to camels, sheep and goats are illustrated in tables 5, 6 and 7, respectively. Camels digested DM better ($P < .01$) than sheep and goats fed OH ration and only better than sheep ($P < .05$) when fed DH ration, otherwise, camels showed comparable results to sheep and goats. Camels showed lower ($P < .01$) digestive ability of crude protein than sheep and goats fed H and OH rations, meanwhile, the differences among the three species were not significant when DH ration was fed. Camels digested crude fiber better ($P < .01$) than sheep and goats fed DH and OH rations, and lower ($P < .01$) than only goats fed H ration. Camels digested ether extract less ($P < .01$) than sheep and goats fed DH ration, less ($P < 0,1$) than sheep and goats fed DH ration, and only better ($P < .01$) than sheep fed OH ration and goats fed H ration. Meanwhile, camels showed comparable results to sheep and goats. Camels digested N-free extract better ($P < .01$) than sheep and goats fed H and DH rations, while no significant differences were detected when OH ration was fed.

Overall results of nutrient digestibilities by the different animal species might indicate that camels showed high digestion of crude fiber and N-free extract, whereas, low digestion of crude protein when compared to sheep and goats. The three species of animals showed comparable digestive abilities for dry matter and ether extract. These results were in line with the findings of HINZ et al. (1973), SHAWKET (1976) and FARID et al. (1979).

Sheep and goats exhibited similar patterns in their ability to digest the various nutrients present in the different tested rations, except goats that exhibited a higher ($P < .01$) ability to digest crude fiber than sheep. These results were in agreement with the findings of JANG and MAJUMDAR (1962) and PANT et al. (1962), GIHAD (1976b) and GIHAD et al. (1980).

The digestion coefficients and nutritive values of date seeds and olive pulp as two agro-industrial by-products from desert crops were indirectly calculated from the foregoing results and presented in tables 8 and 9. These two by-products were palatable and their consumption in the formultated rations by the three animals species was comparable to that of berseem hay. Their digestible crude protein (DCP) contents were low. Nevertheless, olive pulp content (4.41%) was more than twice that of crushed date seed (1.38%). The energy value of these feeds was relatively high and could be used as energy supplementary feeds for browsing and/or grazing desert animals. The average TDN values of olive pulp and date seeds were 65.85% and 67.70%, respectively.

Date seeds should be crushed and supplemented with protein concentrate feeds. Olive pulp percent in formulated rations should not exceed 30-50% because of its high crude fiber and ether extract contents. Moreover, it is less palatable to sheep (HATHOUT et al., 1977). Using a high portion of these feed-stuffs in the experimental rations was for the sake of eliminating the digestion associative effect (EL-TALTY and ABOU-RAYA, 1977). The herein results were in line with the findings of EL-SHAZLY et al. (1963) and GHONEIM (1964).

Nitrogen utilization

The data of nitrogen intake and excrete N in faeces and urine are shown in tables 7, 8 and 9. Nitrogen utilization presented as nitrogen balance (NB) was also illustrated. Camels consumed more ($P < .05$) N ($mg/Kg^{.75}$) than sheep fed DH and OH rations. Meanwhile no significant difference was detected when H ration was fed. Camels consumed comparable amounts of N to those of goats.

Excreted faecal and urinary N was positively related to N intake. Moreover, faecal N was also affected by crude protein digestion. The kidney also possesses a specific mechanism in addition to the gastrointestinal tract to modify excretion or retention of urea according to metabolic needs of animals. Therefore, the data of these two parameters, as well as total excreted N, showed fluctuating results among the various animal species fed the different rations.

The average faecal N percent of total excreted N by camels, sheep and goats fed the three rations were 64.80%, 59.87% and 57.94%, respectively. Camels excreted more faecal N and consequently excreted less urinary N than sheep and goats. Moreover, the urinary N percent of digested N by camels was lower than that of sheep and goats. The average values were 57.55%, 65.67% and 72.24%, respectively. However, metabolic factors in N handling of kidneys by camels, as well as other ruminants, are poorly understood (HARMEYER and MARTENS, 1980), but the above results might indicate that camels possess the highest ability to modify the least urinary N losses compared to sheep and goats.

Camels retainted more ($P < .05$) N ($mg/Kg^{.75}$) than sheep and goats fed the three tested rations, except goats fed DH ration where that increase was not significant. Better retention by camels showed increasing percent values when related to N intake or digested N than sheep and goats. Regardless to the type of ration, the retained N percent of N intake by camels was higher than by sheep and goats. These values were 19.87% *vs* 15.14% and 12.68%, respectively. The retained N percent of digested N followed a similar trend. The corresponding values were 42.17% *vs* 32.63% and 27.98%, respectively. These two parameters showed that camels retained more N than sheep and goats. These results were in agreement with those of FARID et al. (1985), who found that camels in all dietary treatments were in a better status of N balance and retained more N than sheep, but sheep showed a distinct adaptation when fed the low protein diets.

Table 1

CHEMICAL COMPOSITION AND NUTRITIVE VALUE OF FEEDSTUFFS AND EXPERIMENTAL RATIONS

Item	Hay	Date seeds	Olive pulp	Date seeds and hay ration	Olive pulp and hay ration
Moisture %	10.89	9.50	11.43	9.85	11.31
Dry matter composition: (DM basis %)					
Crude protein	11.38	6.81	8.68	7.95	9.35
Crude fiber	30.42	7.67	19.05	13.35	21.88
Ether extract	1.80	7.60	23.70	6.15	18.22
N-free extract	43.02	75.99	42.10	67.77	42.36
Ash	13.38	1.93	6.47	4.78	8.19
Nutritive value (DM basis %):					
Digestible crude protein (g)	6.36	1.38	4.41	3.10	4.91
TDN	49.11	67.70	65.85	64.25	62.05

Table 2

DAILY WATER AND FEED INTAKE AND EXCRETED WATER BY CAMELS, SHEEP AND GOATS FED A WHOLE HAY (H) RATION

Item	Camels	Sheep	Goats	SE ±
N.º of animals	2	4	4	
Initial body weight, kg.	610	50	31	
Water intake:				
ml/kg. wt.	27.11^{a}	86.07^{b}	88.28^{b}	8.35
ml/kg.$^{.82}$	86.00^{a}	174.00^{b}	166.00^{b}	12.50
ml/g. DM intake	2.72^{a}	4.64^{b}	4.30^{b}	0.25
Water excretion, ml/Kg.$^{.82}$:				
Faecal	30.89	29.87	25.49	1.11
Urinary	28.62^{a}	63.17^{be}	72.33^{bf}	5.73
Total	59.51^{a}	93.04^{b}	97.82^{b}	5.93
Urine, percent of excreted	48.06	67.90	73.94	
Insensible water loss	26.49	80.96	68.18	
Feed intake:				
Dry matter intake				
g/kg. wt.	9.96^{a}	18.53^{b}	20.52^{c}	1.31
g/kg.$^{.75}$	49.51	49.28	48.41	0.40
Kg/100 kg. wt	1.00	1.85	2.05	
TDN intake, g/kg.$^{.75}$	25.05	23.77	23.48	
DCP intake, g/kg.$^{.75}$	2.90	3.17	3.19	

a, b = Mean having different superscripts differ significantly (P < 0.1).
e, f = Means having different superscripts differ significantly (P < 0.5).

Table 3

DAILY WATER AND FEED INTAKE AND EXCRETED WATER BY CAMELS, SHEEP AND GOATS FED DATE SEED AND HAY (DH) RATION

Item	Camels	Sheep	Goats	SE ±
N.º of animals	2	4	4	
Initial body weight, kg.	595	45	28	
Water intake:				
ml/kg. wt.	26.24^{a}	57.78^{bf}	64.48^{be}	4.88
ml/kg.$^{.82}$	82.85^{a}	114.64^{b}	117.47^{b}	4.94
ml/g. DM intake	1.93^{a}	2.85^{be}	2.41^{bf}	0.13
Water excretion, ml/kg.$^{.82}$:				
Faecal	17.88^{e}	15.42^{f}	17.93^{be}	0.54
Urinary	19.25^{a}	36.84^{b}	64.10^{b}	5.86
Total	37.13^{a}	52.26^{b}	82.03^{c}	6.04
Urine, percent of excreted	51.85	70.49	78.14	
Insensible water loss	45.72	62.38	34.97	
Feed intake:				
Dry matter intake:				
g/kg. wt.	12.73^{a}	20.27^{b}	26.75^{c}	1.74
g/kg.$^{.75}$	62.87^{a}	52.51^{b}	61.54^{a}	1.54
kg/100 kg. wt	1.27	2.03	2.68	
TDN intake, g/kg.$^{.75}$	41.93	32.86	39.05	
DCP intake, g/kg.$^{.75}$	1.97	1.61	1.91	

a, b, c = Mean having different superscripts differ significantly (P < 0.1).
e, f = Means having different superscripts differ significantly (P < 0.5).

Table 4

DAILY WATER AND FEED INTAKE AND EXCRETED WATER BY CAMELS, SHEEP AND GOATS FED OLIVE PULP AND HAY (DH) RATION

Item	Camels	Sheep	Goats	SE ±
N.º of animals	2	4	4	
Initial body weight, kg.	578	45	28	
Water intake:				
ml/kg. wt.	15.12^{a}	23.57^{bf}	29.00^{b}	2.20
ml/kg.$^{.82}$	47.51	46.77	52.83	2.22
ml/g. DM intake	1.10	1.59	1.25	0.05
Water excretion, ml/kg.$^{.82}$:				
Faecal	21.30^{a}	11.82^{b}	14.75^{b}	1.30
Urinary	20.79^{a}	27.28^{b}	30.48^{b}	1.40
Total	42.09^{ab}	39.10^{b}	45.23^{a}	1.75
Urine, percent of excreted	49.39	69.77	67.39	
Insensible water loss	5.42	7.67	7.60	
Feed intake:				
Dry matter intake:				
g/kg. wt.	11.51^{a}	14.86^{b}	23.08^{c}	1.66
g/kg.$^{.75}$	56.41^{a}	38.51^{b}	53.07^{a}	2.68
kg/100 kg. wt	1.15	1.49	2.31	
TDN intake, g/kg.$^{.75}$	36.78	23.02	32.48	
DCP intake, g/kg.$^{.75}$	2.61	1.96	2.66	

a, b, c = Mean having different superscripts differ significantly (P < 0.1).

Table 5

DIGESTIBILITY, NUTRITIVE VALUE AND NITROGEN UTILIZATION OF THE WHOLE HAY (H) RATION BY CAMELS, SHEEP AND GOATS

Item	Camels	Sheep	Goats	SE ±
Apparent digestibility %:				
Dry matter	53.98^{a}	55.55^{a}	54.77^{a}	0.41
Crude protein	51.53^{a}	56.51^{b}	57.85^{b}	0.85
Crude fiber	47.63^{a}	48.66^{a}	53.35^{b}	0.85
Ether extract	59.71^{a}	58.27^{a}	55.62^{b}	0.57
N-free extract	64.71^{a}	57.30^{b}	54.94^{b}	2.41
Nutritive value of DM %:				
Digestible crude protein	5.86	6.43	6.59	
TDN	50.61	48.24	48.50	
Daily N intake, mg/kg.$^{.75}$	870.00^{e}	869.00^{e}	848.00^{e}	17.95
Daily N excreted, mg/kg.$^{.75}$:				
Faecal	388.00^{e}	363.00^{e}	355.00^{a}	8.60
Urinary	287.00^{e}	413.00^{f}	399.00^{f}	18.16
Total	675.00	776.00	754.00	
Daily N retained, mg/kg.$^{.75}$	195.00^{e}	93.00^{f}	94.00^{f}	7.78
Percent of intake	22.41	10.70	11.08	
Percent of digested	40.46	18.38	19.07	
Urinary N, % of digested	50.54	81.62	80.99	

a, b = Mean having different superscripts differ significantly (P < 0.1).
e, f = Means having different superscripts differ significantly (P < 0.5).

Table 6

DIGESTIBILITY, NUTRITIVE VALUE AND NITROGEN UTILIZATION OF DATE SEEDS AND HAY (DH) RATION BY CAMELS, SHEEP AND GOATS

Item	Camels	Sheep	Goats	SE ±
Apparent digestibility %:				
Dry matter	60.70^{e}	56.93^{f}	58.25^{ef}	0.61
Crude protein	39.45^{a}	38.51^{a}	39.05^{a}	0.51
Crude fiber	59.94^{a}	51.21^{b}	55.52^{c}	1.19
Ether extract	67.35^{a}	81.41^{b}	81.28^{b}	1.92
N-free extract	66.72^{a}	61.08^{b}	61.52^{b}	0.88
Nutritive value of DM %:				
Digestible crude protein	3.14	3.06	3.11	
TDN	66.70	62.56	63.46	
Daily N intake, mg/kg$^{.75}$	963.00^{e}	807.00^{f}	926.00^{e}	22.70
Daily N excreted, mg/kg$^{.75}$:				
Faecal	582.00^{e}	498.00^{e}	564.00^{e}	13.30
Urinary	181.00^{e}	141.00^{f}	167.00^{e}	6.00
Total	763.00	639.00	731.00	
Daily N retained, mg/kg$^{.75}$	200.00^{e}	168.00^{f}	195.00^{e}	6.50
Percent of intake	20.77	20.82	21.06	
Percent of digested	52.49	54.37	53.86	
Urinary N, % of digested	47.51	45.63	46.14	

a, b, c = Mean having different superscripts differ significantly ($P < 0.1$).
e, f = Means having different superscripts differ significantly ($P < 0.5$).

Table 7

DIGESTIBILITY, NUTRITIVE VALUE AND NITROGEN UTILIZATION OF OLIVE PULP AND HAY (OH) RATION BY CAMELS, SHEEP AND GOATS

Item	Camels	Sheep	Goats	SE ±
Apparent digestibility %:				
Dry matter	53.08^{a}	50.34^{b}	50.74^{b}	0.45
Crude protein	49.50^{a}	54.40^{b}	53.57^{b}	0.68
Crude fiber	44.02^{a}	31.52^{b}	32.20^{b}	1.65
Ether extract	71.80^{a}	68.63^{b}	71.68^{a}	0.51
N-free extract	50.70^{a}	46.36^{a}	46.68^{a}	0.67
Nutritive value of DM %:				
Digestible crude protein	4.63	5.09	5.01	
TDN	65.17	59.76	61.21	
Daily N intake, mg/kg$^{.75}$	935.00^{e}	658.00^{f}	897.00^{e}	44.30
Daily N excreted, mg/kg$^{.75}$:				
Faecal	470.00^{e}	302.00^{f}	407.00^{e}	26.50
Urinary	305.00^{e}	259.00^{f}	439.00^{d}	25.20
Total	775.00	561.00	846.00	
Daily N retained, mg/kg$^{.75}$	156.00^{e}	97.00^{f}	51.00^{d}	14.00
Percent of intake	16.68	14.74	5.69	
Percent of digested	33.55	27.25	10.41	
Urinary N, % of digested	65.59	72.75	89.59	

a, b, c = Mean having different superscripts differ significantly ($P < 0.1$).
d, e, f = Means having different superscripts differ significantly ($P < 0.5$).

Table 8

DIGESTIBILITY AND NUTRITIVE VALUE OF DATE SEEDS BY CAMELS, SHEEP AND GOATS

Item	Camels	Sheep	Goats	Av.
Digestion coefficients %:				
Dry matter	63.68	57.55	60.27	60.50
Crude protein	21.11	19.68	19.96	20.25
Crude fiber	84.17	55.83	60.94	66.98
Ether extract	68.67	84.23	84.81	79.24
N-free extract	67.88	60.67	59.51	62.69
Nutritive value (DM basis) %:				
Digestible crude protein	1.44	1.34	1.36	1.38
TDN	71.23	66.12	65.76	67.70
Starch equivalent	68.84	63.74	63.36	65.31

Table 9

DIGESTIBILITY AND NUTRITIVE VALUE OF OLIVE PULP BY CAMELS, SHEEP AND GOATS

Item	Camels	Sheep	Goats	Av.
Digestion coefficients %:				
Dry matter	52.65	49.03	49.17	50.28
Crude protein	48.45	52.39	51.23	50.69
Crude fiber	38.42	19.95	21.58	26.65
Ether extract	72.40	68.28	74.01	71.56
N-free extract	44.85	41.48	43.41	43.25
Nutritive value (DM basis) %:				
Digestible crude protein	4.21	4.55	4.47	4.41
TDN	69.01	62.22	66.32	65.85
Starch equivalent	63.04	56.23	60.34	59.87

Retained N percent of N intake indicated that DH ration showed better values with all animal species than H and OH rations. The average values, regardless of the animal species were 20.81% *vs* 14.76% and 12.14%, respectively. The retained N percent of digested N followed a similar trend. The corresponding values were 53.57% *vs* 26.01% and 23.24%, respectively. The DH ration was the highest in its TDN content and consequently showed the highest energy intake by all animal species. The results might indicate that N utilization was influenced by energy intake, whereas, they aligned with the findings of EL-HAG and MUKTAR (1978) and HARMEYER and MARTES (1980).

Bibliography

A. R. C. (1965): Nutrient requirements of farm livestock. N.º 2, *Ruminants.* Agricultural Research Council, London.

A. O. A. C., Association of Official Agricultural Chemists (1965): *Official methods of analyses* 10th ed. Agric. Chem., Washington, D. C.

DEVENDRA, C. (1967): Studies in the nutrition of the indigenous goat of malaya. III. *The requirements of live-weight gains. Malaysia Agric. 46:98.*

EL-HAG, G. A. and A. M. S. MUKHTAR (1978): Varing levels of concentrates in the rations of Sudan desert sheep. World Rev. Anim. Prod. 12 (4):73.

EL-SHAER, H. M. (1981): A comparative nutrition study on sheep and goats grazing Southern Sinai desert range with supplements. Ph. D. Thesis, Fac. Agric. Ain-Shams Univ.

EL-SHAZLY, K.; IBRAHIM, E. A., and KARAM, H. A. (1963): Nutritional value of date seeds for sheep. *J. Anim. Sci.* 20:268.

EL-TALTY, Y. I. and ABOU-RAYA, A. K. (1977). Critical study of the associative effect of direct and indirect feeding in metabolism trials with sheep using flax products, clover hay and barley grains. *Egyptian J. Anim. Prod.*, 17:131.

FARID, M. F. A.; SHAWKET, S. M., and ABD EL-RAHMAN, M. H. A. (1979): Observations on nutrition of camels and sheep under stress. *Proc. IFS.* Workshop on camels, Khartom, Sudan, Dec. 1979. IFC provisional report 6:125.

FARID, M. F. A.; SOOUD, A. E. O., and SHAWKET, S. M. (1985): Water intake and excretion of camels and sheep in relation to diet characteristics and water deprivation. *3rd. AAP. Anim. Sci. Cong.* May, 1985, Seoul, Korea. pp. 799-857.

GAUTHER-PILTERS, H. (1974). The behaviour and ecology of camels in the Sahara with special reference to nomadism and water management. In: Geist, V. and Walter, F. (eds.). *The behaviour of ungulates and its relation to management.* IUCN Publ. N.º 24, pp. 542-557.

GHONEIM, A. (1964): Animal Nutrition. *Fundamentals and common feedstuffs Anglo-Egyptian Lib.* Cairo.

GIHAD, E. A. (1976a): Value of dried poultry manure and urea as protein supplements for sheep consuming low quality tropical hay. *J. Anim. Sci.* 42 (3):706.

GIHAD, E. A. (1976b): Intake, digestibility and nitrogen utilization of tropical natural grass hay by goats and sheep. *J. Anim. Sci.* 43 (4):879.

GIHAD, E. A.; MEHREZ, A. Z., and EL-BEDAWY, T. M. (1980): Fiber digestibility by goats and sheep. *J. Dairy Sci.* 63:1701

HARMEYER, J., and MARTENS, H. (1980): Aspects of urea metabolism in ruminants with references to the goat. *J. Dairy Sci.* 63:1707.

HATHOUT, M. K.; SOLIMAN, I. M.; A. AL-BELAAZI and ATALLAH, S. M. (1977): Use of sheep concentrate mixtures containing olive pulp (Fittura) for fattening of lambs. *Agriculture Research Review.* 55, 197.

HINTZ, H. F.; SCHRYVER, H. F., and HALBERT, M. (1973): A note on the comparison of digestion by new world camels, sheep and ponies. *Anim. Prod.* 16:303.

JANG, S. and, MAJUMDAR, N. (1962): A study of comparative digestibilities in different species of ruminants. *Annu. Biochem. Exp. Med.* 22:303.

KANDIL, H. M. (1984): Studies on camel nutrition. Ph. D. Thesis, Fac. Agric. Ain-Shams Univ.

LIVINGSTON, H. G.; PAYNE, W. J. A., and FRIEND, M. T. (1962): Urea excretion in ruminants. *Nature*, 194:1057.

MACFARLANE, W. V.; MORRIS, R. J. H., and HOWARD, B. (1963): Turnover and distribution of water in desert camels, sheep, cattle and kangaroos, *Nature.* London, 197:270.

MACFARLANE, W. V., and HOWARD, B. (1970): Water in physiological ecology of ruminants. In: *Physiology of digestion and metabolism in the ruminant.* A. T. Phillipson, editor. Griel Press, England.

MACKENZIE, D. (1967): *Goat Husbandry.* Faber and Faber Ltd. 2nd. ed. London.

MAJUMDAR, B. N. (1960): Studies on goat nutrition. II. Digestible protein requirements for maintenance from balance studies. *J. Agr. Sci.* 54:335.

N.R.C., National Research Council (1975): Nutrient Requirements of sheep. 5th ed. National Academy of Sciences. Washington, D. C.

N.R.C., National Research Council (1978): Nutrient Requirements of Dairy Cattle. 5th ed. National Academy of Sciences. Washington, D. C.

N.R.C., National Research Council (1981): Nutrient Requirements of goats. National Academy of Sciences. Washington, D. C.

PANT, H. C.; RAWAT, J. S., and ROY, A. (1962): Studies on rumen physiology I. Growth of fistulated and standardisation of methods. *Indian J. Dairy Sci.* 15:167.

READ, B. E. (1925): Chemical constituents of camel's urine. *J. Biol. Chem.* 64:615.

SCHMIDT-NIELSEN, B. K.; HOUPT, T. R. and JARNUM, S. A. (1957). Urea excretion in camel. *American J. Physiol.* 188:477.

SCHMIDT-NIELSEN, K. (1964): The Camel. In: *Desert Animals: Physiological problems of heat and water.* Clarendon Press, Oxford, p. 277.

SHAWKET, S. M. (1976): Studies on rumen micro-organism. M. Sc. Thesis, Fac. Agric. Alexandria Univ.

SOOUD, A. E. O. (1980): Comparative studies on digestion and food utilization in camels and sheep. Ph. D. Thesis. Fac. Agric. Ain-Shams Univ.

STEEL, R. G. and TORRIE, J. H. (1960): Priniciples and procedures of statistics. McGraw-Hill Book Co. New York, N. Y.

WILSON, R. T. (1984): The camel. Longman. Group Limited, U. K. p. 223.