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Growth and Digestibility in Four Saudi Camel Breeds

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Abstract: The current study was conducted to investigate the breed effect on growth and digestibility coefficients in camel. Four young male camel breeds were used (Majaheem, Suffr, Sho'l and Wodoh) 6-9 months old with average weight 133.83±2.83 kg were used in 204 day trial. Animals were group fed of three animals in four replicates for each breed. A balanced energy/protein ration used to ensure that animals get their nutrient requirements using *ad lib* twice feeding system per day in order to satisfy their feeding intake. Average daily feed intake, average daily gain, feed conversion efficiency and digestibility coefficients were calculated. The results obtained from the growth trial indicated that the final weight of animals after 204 days was 292.33±6.65, 278.17±11.36, 284.35±21.89 and 270.35±10.69 kg for Majaheem, Wodoh, Suffr and Sho'l, respectively. The average daily gain was 770, 698, 734 and 690 g for Majaheem, Wodoh, Suffr and Sho'l, respectively. Feed intake was 4.73±0.10, 4.68±0.10, 5.24±0.84 and 4.53±0.26 kg for Majaheem, Wodoh, Suffr and Sho'l, respectively. Majaheem breed have the best feed conversion efficiency compared to other breeds.

Key words: Breeds, camel, Majaheem, Suffr, Sho'l, Wodoh, growth, digestibility

INTRODUCTION

There are no adequate studies on the nutrition requirements of camels or of energy, protein, vitamins and minerals need. The most of the information available is on the particular experimental study or observations. The research carried out on a camel compared with the research conducted on other types of ruminants and noted that the findings of many researchers, sometimes contradictory to the different situations of each study.

FAO indicated that total world population of camels was 19.2 million of which 11.8 in Arab world, representing approximately 76% of the global. Camels account for 14% of the total animal units in the Arab countries (Warda, 1989). The distribution of camels in the Arab world in most Arab countries but they are concentrated in Somalia (56%) and Sudan (24%) and Mauritania (7%) and Saudi Arabia (3.5%).

Saudi Arabia has many camel breeds, spreading all over region. Camels in Saudi Arabia classified according to their colors and used for milk and meat production. The main types of camels in Saudi Arabia are Majaheem camel (black, dark color and high-lactation milk), Wodoh camel (a medium-sized, moderate in milk production), Suffr camel (large to medium-size, color mixture between the white and red) and Sho'l camel (the colors overlap between red and blond).

There is no information on Saudi camel breeds that has ability to produce meat nor their growth requirement or nutrition and husbandry.

Therefore, the aim of this study was conducted to investigate the effect of Saudi camel breeds (Majaheem, Suffr, Sho'l and Wodoh) on growth performance and digestibility coefficients of Dry Matter (DM), Crude Protein (CP), Crude Fiber (CF), Ether Extract (EE) Nitrogen Free Extract (NFE), Neural Detergent Fiber (NDF) and Acid Detergent Fiber (ADF).

MATERIALS AND METHODS

Animals and diets: Four young male represent common Saudi camel breeds were used (Majaheem, Suffr, Sho'l and Wodoh) 6-9 months old with average live weight 133.83±2.83 kg. Animals are group fed of three animals in four replicates for each breed. Each breed was 12 animals and the total of all breeds were 48 animals. A balanced energy/protein ration consist of (Alfalfa hay and concentrate mixture, Table 1) were used to ensure that animals get their nutrient requirements using *ad lib* twice feeding system.

Growth trial: A total of 48 young camels were weighed and divided to four groups, each group contained 12 young camel allotted by weight to three animals in four

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replicates for each breed. The experiment lasted for 204 days (approximately 29 weeks). Feed intake and water intake for each group were weekly recorded and calculated daily feed and water intake. The animal's weights were recorded every 2 weeks, before morning meal. The daily gain weights and feed conversion ratio were calculated.

Digestibility trial: At the end of growth trial, one animal from each replicate (four animals per breed) was used in digestibility trial. A metabolism study was conducted with 16 camels to determine digestibility. The animals were divided into 4 groups, each group contains 4 camels. The animals were housed in metabolic cages during the preliminary and collection periods. The experiment started with a 15 days preliminary period and followed by collection period which was 7 days. Feed and water were offered once a day at 8:00 am. Feces and residual feed were quantitatively collected from each animal. The feed offered and residual for each animal were weighed and recorded daily. Samples of feed and residual were taken daily and composted until the end of collection period, dried at 70°C for 24 h, ground through a 1 mm screen and used for chemical analysis. Daily fecal excretions were collected at 08:00 am weighed and recorded. Aliquots of (10%) of the sample from each animal were sampled daily; dried for 24 h at 70°C for DM determination. The remaining fecal sample was composted for each animal and stored at 4°C until further analysis.

Chemical analysis: Feed and feces were dried at 70°C for 24 h then ground through a 1 mm screen. Samples of feed and residual feed were analyzed for Dry Matter (DM), Crude Protein (CP), Ether Extract (EE), Crude Fiber (CF) and ash according to AOAC (2004). Neutral Detergent Fiber (NDF) and Acid Detergent Fiber (ADF) were determined according to Van Soest *et al.* (1991).

Statistical analysis: The data were analyzed according to SAS (2004). Duncan (1955)'s tests were used to compare the treatment means.

RESULTS AND DISCUSSION

The proximate analysis of the alfalfa hay and concentrate mixture which fed to experimental animals is shown in Table 1.

Growth trial: The initial weight of animals was 135.25±2.53, 135.77±1.92, 134.65±1.88 and 129.63±1.93 kg for Majaheem, Wodoh, Suffr and Sho'l, respectively with an average weight of 133.83 kg (Table 2). The final weight of animals after 204 days was 291.78±2.53, 278.17±5.68, 283.56±10.95 and 269.61±5.35 kg for Majaheem, Wodoh, Suffr and Sho'l, respectively with an average weight of 280.78 kg (Table 2). The average daily gain was 0.767, 0.698, 0.730 and 0.686 kg for Majaheem, Wodoh, Suffr and Sho'l, respectively. Feed intake was 4.73±0.05, 4.68±0.05 and 5.24±0.42 and 4.53±0.13 kg for Majaheem, Wodoh, Suffr and Sho'l, respectively (Table 2). Majaheem breed have the best feed conversion efficiency compared to other breeds. The vales of feed conversion were 6.18, 6.72, 7.43 and 6.61 kg feed kg^{-1} growth with no significant differences for Majaheem, Wodoh, Suffr and Sho'l, respectively (Table 2).

Table 1: The proximate analysis of the alfalfa hay and concentrate mixture

Items	DM	CP	EE	CF	NFE	Ash	NDF	ADF
Alfalfa hay	93.53	16.14	1.57	28.620	44.23	9.45	44.27	35.790
Concentrate mixture	93.54	21.01	2.90	3.470	65.36	7.26	17.70	6.870

DM: Dry Matter; CP: Crude Protein, EE: Ether Extract, CF: Crude Fiber, NFE: Nitrogen Free Extract, NDF: Neutral Detergent Fiber, ADF: Acid Detergent Fiber

Table 2: Effect of breeds of Majaheem, Wodoh, Suffr and Sho'l on growth, feed intake, Average Daily Gain (ADG), feed conversion and water intake (Mean±SE)

	Breed			
Items	Majaheem	Wodoh	Suffr	Sho'l
Period (day)	204	204	204	204
Initial weight (kg)	135.25±2.53^{a}	135.77±1.92^{a}	134.65±1.88^{a}	129.63±1.93^{a}
Final weight (kg)	291.78±3.32^{a}	278.17±5.68^{ac}	283.56±10.95^{bc}	269.61±5.35^{ac}
Gain weight (kg)	156.53±3.24^{a}	142.4±4.25^{a}	148.91±10.92^{a}	139.98±4.80^{a}
ADG (kg)	0.767±0.016^{a}	0.698±0.021^{a}	0.730±0.054^{a}	0.686±0.024^{a}
Feed intake (kg)				
Hay	1.80±0.04^{a}	1.72±0.04^{a}	1.91±0.14^{a}	1.68±0.06^{a}
concentrate	2.93±0.02^{ab}	2.95±0.01^{ab}	3.33±0.28^{a}	2.85±0.07^{b}
Total feed intake	4.73±0.05^{ab}	4.68±0.05^{ab}	5.24±0.42^{a}	4.53±0.13^{b}
Feed conversion	6.18±0.13^{a}	6.72±0.14^{a}	7.43±1.20^{a}	6.61±0.20^{a}
Water intake (L)	12.20±0.92^{a}	12.96±1.17^{a}	11.65±1.37^{a}	11.87±0.60^{a}

$^{a-c}$Means in the same row with different letters in their superscripts differ ($p<0.05$)

The camel is distinguished from other animals, it only needs small amounts of food to cover their requirements and also it can compensate for the loss quickly when feeding back to the normal level (Wilson, 1984). The present results are in agreement with the results of Basmaeil (1989) and Farid *et al.* (1990). Warda and Farid (1990) confirmed that the feed formulation of young camel should at least contained 2 mega calories kg^{-1} DM of metabolizable energy and feed intake in the range of 2.5% of body weight. Growth in body weight is the basis of meat production in domestic animals. There are many factors that influence growth rate including breed, nutrition, sex and health (El-Amin, 1979). No differences in body weight between sexes were observed up to 2 years by Ouda *et al.* (1992) or up to 4 years of age by Simpkin (1983). Average Daily Gain (ADG) for camels also vary widely between regions, breeds and within the same breed. Hammadi *et al.* (2001) reported camel body weights of 27, 48, 65 and 79 kg at birth 30, 60 and 90 days of age, respectively which indicates that ADG of 580 g day^{-1} between birth and 90 days of age. Bissa (1996) reported average body weights of 39, 119 and 171 kg at birth, 90 and 180 days, respectively for Indian camels indicating ADG of 733 g day^{-1} between birth and 180 days. The present results are in agreement with the results of Bissa (1996). These growth rate values are lower than those commonly reported for cattle but it should be noted that camels are normally raised under extensive systems depending mainly on rangeland grazing rather than on feedlots. The limited research carried out on improving camel nutrition demonstrated significant relationships between ADG and feed intake of concentrates for camels. Camels fed a diet with high dietary protein and energy gained more body weight (550 g day^{-1}) than non-supplemented camels fed only on mangroves (260 g day^{-1}) (Kamoun, 1995). Although, the present study formulated a balanced energy/protein ration used to ensure that animals get their nutrient requirements using *ad lib* twice feeding system but there is disagreement between the present study (686-767 g day^{-1}) and the study of Kamoun (1995) (550 g day^{-1}) in ADG. In general, the growth curve for camels follows a pattern more or less similar to that of other farm animal species. Tandon *et al.* (1988) showed that the ADG of Bikaneri camels in different age groups gradually increased from 400 g day^{-1} in the 0-1 year group to a maximum of 720 g day^{-1} in the 7-8 years group then declined to 300 g day^{-1} by 10-11 years of age. In Kenya, ADG of Tribal camel calves was 222 g day^{-1} to 6 months of age in dry years and 655 g day^{-1} in wet years (Field, 1979). Although, there are no differences of sex effected in live weight earlier in life, males get heavier than females at older ages. Mature male camels were heavier than females by 38% (Kurtu, 2004) and 8% (Wilson, 1978). The Australian mature camels weights ranged from 514-645 kg for males and 470-510 kg for females (Wilson, 1984). Khatami (1970) showed that Iranian camels at an age of 5 years were ranged in weight from 340-430 kg. Babiker and Yousif (1987) confirmed that the weight of mature well-finished male desert Saudi camels was an average of 475 kg.

Table 3: Effect of breeds of Majaheem, Wodoh, Suffr and Sho'l on digestibility coefficients (Mean±SE)

	Breed			
Items (%)	Majaheem	Wodoh	Suffr	Sho'l
DM	67.29±3.50^{a}	46.29±0.12^{c}	58.61±3.05^{b}	50.97±1.94^{b}
CP	68.33±2.83^{a}	42.41±1.48^{c}	56.71±3.93^{b}	53.16±2.14^{b}
EE	65.22±3.45^{a}	22.99±2.49^{d}	59.10±2.77^{b}	48.74±3.67^{c}
CF	28.85±3.60^{cb}	30.07±2.39^{b}	34.75±1.20^{ab}	22.35±1.18^{c}
NFE	79.37±2.10^{a}	71.03±5.27^{ab}	74.03±2.35^{ab}	68.81±1.27^{b}
NDF	44.84±7.34^{a}	34.81±4.25^{a}	32.70±3.14^{a}	35.04±1.53^{a}
ADF	41.75±7.40^{a}	32.16±2.26^{ab}	30.87±.034^{ab}	24.31±1.54^{c}

$^{a-c}$Means in the same row with different letters in their superscripts differ ($p<0.05$); DM: Dry Matter, CP: Crude Protein, EE: Ether Extract, CF: Crude Fiber, NFE: Nitrogen Free Extract, NDF: Neutral Detergent Fiber and ADF: Acid Detergent Fiber

The water intake ranged from 11.65-12.96 L day^{-1} and these results show that the amount of water consumed has no effect on the quantities of feed intake by the camels in this study. Hermas (1990) found that the average daily consumption of water per head of camels through the seasons of the year was around 23 L in the Spring, 55 L in Summer and 40 L in Autumn and 16 L in Winter and these results are disagreement with the results of this study which ranged from 11.65-12.96 L day^{-1} and this difference may be due to the quality of breed, pasture, type of diet or feeding system.

Digestibility trial: Table 3 shows the effect breeds on the digestibility coefficients where the results indicate the superiority of Majaheem significantly ($p<0.05$) in dry matter, protein, crude fat and crude compared to the other breeds and the values of dry matter 67.29, 46, 29, 58.61 and 50.97% for Majaheem, Wodoh, Suffr and Sho'l, respectively. Farid *et al.* (1979) demonstrated that camels digest dry matter more than sheep. The values of the digestibility of protein which surpassed the Majaheem compared to other breeds under study were 68.33, 42.41, 56.71 and 53.16% for Majaheem, Wodoh, Suffr and Sho'l, respectively (Table 3).

Farid *et al.* (1979) noted that the camels, especially under insensitive conditions maintain protein and increase the rate of benefit from it more than sheep and the use of nitrogen in the camel is better than sheep.

The Majaheem breed had the best digestibility of dry matter and crude protein, crude fat and soluble carbohydrates compared to other breeds but Suffr breed

was recorded the best digestibility of crude fiber compared to other breeds (Table 3). The highest value of crude fiber digestibility was recorded with Suffr breed (34.75%) and the lowest value was recorded with Sho'l breed (22.35%). The digestibility of soluble carbohydrates ranged from 68.81-79.37% (Table 3) and the highest value with Majaheem breed and the lowest value with Sho'l breed ($p<0.05$). El-Ashry and Sooud (1983) reported that the digestibility of dry matter, crude fiber and Nitrogen Free Extract (NFE) of the camel is more efficient than sheep when fed a low concentration of energy in the diet. The digestibility of Neutral Detergent Fiber (NDF) and Acid Detergent Fiber (ADF) on the superiority of Majaheem breed compared to other breeds without significant differences ($p>0.05$), especially for NDF (Table 3).

The difference significant was only between Majaheem and Sho'l breeds in the coefficient of digestibility of ADF (Table 3). Hintz *et al.* (1973) noted that the New World camels were significantly more efficient in the digestion of DM, NDF, ADF and cellulose than the sheep or ponies. Hedi and Khemais (1990) reported that camels did not appear more digestion coefficient of DM, OM or CF of poor quality roughage diets when compared with corresponding values for sheep and cattle.

The present study demonstrated that the breed of camels affected the digestibility coefficients. It is clear that breed of Majaheem had the highest value in average daily gain, feed conversion and digestibility followed by Wodoh, Suffr and Sho'l and thus have the ability to utilize the protein and energy food which would increase the growth and hence carcass weight and quality of meat.

CONCLUSION

The results of the digestibility of the Majaheem breed had the best digestibility of dry matter and crude protein, crude fat and soluble carbohydrates compared to other breeds (67.3, 68.3, 65.2 and 79.4%, respectively) but Suffr breed was recorded the best digestibility of crude fiber compared to other breeds.

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