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Effects of Feeding Prosopis Juliflora Pods on Growth Performance, Nutrient Intake, Digestibility, and Carcass Characteristics of Black Goat Kids Fed Finishing Diets

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ABSTRACT

Prosopis juliflora pods (PJP) are a source of raw energy and are a suitable meal for ruminants. The objective of this study is to assess the growth performance, nutrient intake, digestibility, and carcass characteristics of Black goat kids fed finishing diets replacing barley grains with PJP. For an 80-day feeding period, thirty-two weaned male kids (body weight = 16.8±0.91 kg; age = 110±3 days) were randomized to receive one of the four treatment diets. Experimental diets were 0 (CON), 10 (PJP10), 15 (PJP15), and 20 (PJP20), with all diets being similar in terms of metabolizable energy (ME) and crude protein (CP). Intake values were similar except for ether extract which was higher ($P<0.05$) for the PJP20 group and acid detergent fiber which was higher ($P<0.05$) for the PJP15 kids. Intakes of CP, organic matter (OM), dry matter (DM), and neutral detergent fiber were unaffected. The feed conversion ratio, average daily gain, and final live weight of the treatment groups were similar. With the ADF that was not different, results of digestibility were better ($P<0.05$) for the PJP20 group but mostly not different from the control group. Regarding meat dressing-out % and carcass cuts and linear dimensions, hot and cold carcass weight, and fasting live weight, no variations were found across the treatment diets. The total lean % in racks was greater ($P<0.05$) in the CON and PJP15 groups. The meat-to-bone ratio in racks and shoulders was the lowest ($P<0.05$) in the PJP20 group compared to the other groups. This study highlighted the impacts of PJP on the growth of Black goat kids without having adverse effects on growth performance, carcass characteristics, or meat quality.

Keywords: Black goat kids, Prosopis juliflora pods, Growth performance, Digestibility, Nutrient intake, Carcass characteristic

INTRODUCTION

Goat meat (Chevon) is characterized by low content of fat, harmful cholesterol, and saturated fatty acids, as well as its high percentage of protein (Mazhangara *et al.*, 2019; Allhyani *et al.*, 2021). This distinctive nutritional property makes it more attractive and consumable compared to other traditional meats such as beef and lamb (McMillin and Brock, 2005; Mazhangara *et al.*, 2019). In Jordan, the Black goat, also known as Baladi, accounts for 80% of all goats and produces 2,600 tons of red meat annually, rendering it a significant source of meat (MOA, 2007; Abdullah *et al.*, 2008).

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Jordan's climate is characterized by a semi-arid climate with an average rainfall of less than 200 mm/year (Al-Kharabsheh, 2020); as a result, the agricultural sector suffers from a severe shortage of fodder, which threatens livestock in Jordan. Bridging the feed shortage gap and creating alternative feeds such as olive cakes, tomato pomace, sesame hulls, and mesquite (*Prosopis juliflora* species) contribute to reducing the high cash cost that has become burdensome on the shoulders of livestock breeders (Awawdeh *et al.*, 2018; Obeidat *et al.*, 2008; Al Jassim *et al.*, 1998).

Prosopis juliflora (PJP) is a medium-sized, fast-growing, thorny tree characterized by curved pods with hardened pericarp and green-brown flexible branches (Shiferaw *et al.*, 2021; Pasieczink, 2001; Harris *et al.*, 2003; De Lemos *et al.*, 2023). Originating in the Americas, it has spread to semi-arid and arid regions such as Australia, Africa, and Asia. In numerous countries, PJP has been employed as an alternative feedstuff for livestock diets and has shown promising results with a variety of animal species (Abdullah *et al.*, 2011; De Lemos *et al.*, 2023).

Several authors have indicated that the substitution of wheat bran, barley grains, or corn with varying levels of PJP enhanced average daily gain (ADG), dry matter (DM) intake, and feed efficiency (Habit and Saavedra, 1988; Ravikala *et al.*, 1995; Abdullah and Abddel hafes, 2004; Obeidat *et al.*, 2008). According to Mahgoub *et al.* (2005a), substituting Rhodes grass hay with PJP up to 20% in goat diets improved feed intake, weight gain, feed conversion ratio (FCR), and hot and cold carcass weights, however, when PJP was increased to 30% of the diet, performance decreased. In the same line, Obeidat *et al.* (2008) indicated that using PJP up to 20% in lamb finishing diets did not affect weight gain, digestibility, carcass composition, or meat quality; however, they reported an improvement in DM intake and a reduction in the cost of gain. Also, Nagpal *et al.* (1995) showed an improvement in live weight, hot carcass weight and the dressing percentage in lambs fed a PJP diet. Despite that, little attention has been paid to the use of *Prosopis juliflora* pods in goat feeding.

Therefore, the purpose of this study was to investigate whether the nutrient intake, performance, digestibility, carcass characteristics, and meat quality of Black goat kids fed finishing diets were affected by partially substituting *Prosopis juliflora* pods for barley grains.

Materials and methods

Animals, and Diets

Thirty-two weaned (110±3 days of age) intact male Black goats, having an initial weight of 16.8±0.91 kg, were bought from a local farm and transferred to the Jordan University of Science and Technology's Agricultural Center for Research and Production where the study was carried out. Kids were ear-tagged and vaccinated against internal and external parasites. Kids were randomly allocated to four treatment diet groups (8 kids/treatment) and housed individually in shaded, ventilated pens (1.5 m x 0.75 m).

After adopting the animals for a week, the kids were fed one of the four dietary treatments for a feeding period of 80 days. Diets, formulated to replace barley grains (Table 1), were: a control with no *Prosopis juliflora* pods (CON), a diet with 10 % PJP (PJP10), a diet with 15 % PJP (PJP15), and a diet with 20 % PJP (PJP20). All diets were isocaloric/ isonitrogenous containing 2.78 Mcal/kg ME and 17% of crude protein (CP) to meet the nutritional requirements for fattening male kids (NRC, 2007).

Prosopis juliflora pods were harvested near the Jordan Valley, allowed to air dry, and passed through a rotating forage chopper to reduce their size to 2-4 cm in length before mixing the diets to ensure thoroughness during the mixing process. Total mixed-ration diets were provided twice a day (two equal meals at 9:00 am and 3:00 pm) throughout the study allowing a refusal rate of 10% with free access to fresh water.

Table 1: Ingredients and chemical composition of the diet (% of DM) containing *Prosopis juliflora* pods (PJP).

Variable	Diet[a]			
	CON	PJP10	PJP15	PJP20
Ingredient (% of DM)				
Barley	59	49	44	39

Prosopis juliflora pods	0	10	15	20
Soybean meal	13	13	13	13
Wheat bran	15	15	15	15
Wheat hay	10	10	10	10
Salt	1.5	1.5	1.5	1.5
Limestone	1.4	1.4	1.4	1.4
Premix[b]	0.1	0.1	0.1	0.1
Feed cost /ton ($)	380	343	325	307
Nutrient composition				
ME (Mcal/kg)[c]	2.77	2.78	2.78	2.79
DM	94.3	93.8	94.1	93.9
OM (% of DM)	90.5	90.6	89.6	88.6
CP (% of DM)	17.4	17.0	17.5	17.4
EE (% of DM)	6.6	3.1	2.8	2.8
NDF (% of DM)	33.6	35.1	32.6	31.4
ADF (% of DM)	13.6	14.0	13.2	10.7

[a] Diets were: 0%PJP (CON), 10%PJP (PJP10), 15%PJP (PJP15), and 20%PJP (PJP20) of dietary DM.
[b] Composition per 1 kg contained (vitamin A, 450,000 IU; vitamin D3, 1,100,000 IU; vitamin E, 3.18 g, Mn, 10.9 g; I, 1.09 g; Zn, 22.73 g; Fe, 22.73 g; Cu, 2.73 g; Co, 0.635; Mg, 100 g; Se, 0.1 g).
[c] ME: metabolizable energy; calculated using tabular values NRC (2007).

All kids were weighed weekly before morning feeding and the feed offered was weighed daily, and at the end of the week, we calculated the total feed offered. All refusals of the week were collected daily before the feeding day to evaluate daily DM and other nutrient intake. Representative samples were also taken to be chemically analyzed.

Feed samples were analyzed for DM, organic matter (OM), ether extracts (EE), Neutral detergent fiber (NDF), and acid detergent fiber (ADF) as described by AOAC. (1990) and in our previous study by Abdullah *et al.* (2011).

Digestibility and N balance trial

On day 68, 3 animals were randomly selected from each group and used to evaluate the digestibility and N balance. Animals were placed individually in metabolism cages. Animals were allowed an adaptation period of 7 days for the metabolism cages, followed by a collection period of 4 days. During the collection period, feed intake and refusals were recorded and sampled for further analysis. Daily fecal output was collected, weighed, and recorded, and then 10% was kept for subsequent analysis. Using a plastic container, urine was collected, weighed, and recorded, and then 5% was kept for evaluating the N retention. Feed, refusals, and feces were analyzed for DM, OM, CP, EE, NDF, and ADF according to the procedures described earlier. Urine samples were analyzed for N (Kjeldahl procedure; AOAC, 1990) to evaluate the N balance.

Slaughtering and carcass evaluation

Seven days after the end of the evaluating digestibility and N balance, all kids were weighed then fasted for 14 h (when only water was available) and weighed again before slaughter to get the fasting live body weight. All animals were slaughtered using the standard slaughter procedures (Abdullah *et al.*, 1998). The weights of the hot carcasses, non-carcass parts, and some visceral organs were recorded. After 24 h of cooling the carcasses at 4 °C, cold carcass weights were recorded to calculate the dressing percentage as cold carcass weight/fast live weight ratio.

The *Longissimus* muscles' pH and temperature were measured at 24 h of post-mortem through an incision in the *longissimus* (at the 12/13 rib site) using a portable pH meter. According to Abdullah *et al*. (1998), tissue depth (GR), rib fat depth (J), eye muscle width (A), eye muscle depth (B), eye muscle area, fat depth (C), and shoulder fat depth (S2) were performed on chilled carcasses and *longissimus* muscles. Carcasses were then cut into four parts (shoulder, rack, loin, and leg cuts) (Abdullah and Musallam, 2007). Upon cutting, loin cuts were dissected, and *longissimus* muscles excised from loin cuts were placed separately in vacuum packages and frozen at – 20 °C for 2 weeks, before meat quality assessment.

Meat quality measurements

The Warner-Bratzler shear force values on cooked meat samples, water holding capacity, cooking loss, and color coordinates (L*, a*, and b*) were among the metrics used to assess the quality of meat on Longissimus muscles. Each muscle was divided into slices of a specific thickness and each slice was used for a specified meat quality measurement (Abdullah and Musallam, 2007). Color was measured on 15 mm thick slices placed on a polystyrene plate covered with permeable film, and they were left to bloom for 2 h at 4 °C. Three measurements were taken from each slice. The average of the three measurements was recorded as the color coordinate value of the slice. Hue angle was calculated as $\tan^{-1}(b^*/a^*)$, whereas chroma was calculated as $(a^{*2} + b^{*2})^{1/2}$ (Abdullah and Musallam, 2007).

The water holding capacity was determined with samples of roughly 5 gm of raw meat (initial weight). Each sample was cut into small pieces, covered with two filter papers and two thin plates of quartz material, and then pressed with a weight of 2500 gm for 5 min. The meat samples were then removed from the filter paper, and their weight was recorded (final weight). The water holding capacity was reported as the weight lost during sample pressing divided by the initial sample weight and expressed as a percentage. Cooking loss was measured on slices of 25 mm thickness, where slices were placed in plastic bags and then cooked in a thermostatically controlled water bath at 75 °C for 90 min. Samples were cooled and weighed to calculate the percentage of water lost in cooking. The cooked slices were stored at 4 °C overnight, and then 6 cubes the size of 1x1x1 cm were cut parallel to the long axis of the muscle fiber. Shear force values were taken for the cubes using the Warner-Bratzler shear blade with the triangular slot cutting edge mounted on the Salter model 235 (Warner-Bratzler meat shear, G-R manufacturing co. 1317 Collins LN, Manhattan, Kansas, 66502, USA) to determine the peak force (kg) when shearing the samples (Abdullah and Musallam, 2007).

Statistical analysis

Data was subjected to an analysis of variance in a completely randomized design using a MIXED procedure of SAS (2000). Animals were used as the experimental unit in the model. The initial BW of the kids was used as a covariate for the performance data. Cold carcass weight was used as a covariate in the analyses of carcass and non-carcass components and carcass cut weights. For shoulder, leg, loin, and rack characteristics, shoulder, leg, loin, and rack weights were used as covariates, respectively. The least square means were calculated for all variables in the study and the related LSD was calculated to determine significant differences.

Results and discussion

Nutrient intake and growth performance

No differences were observed among the treatment diets in the DM, OM, CP, and NDF intakes (Table 2). However, the intake of acid detergent fiber was significantly maximum (P<0.05) for the PJP15 group but not different from the PJP10 and PJP20 groups that were similar to the CON group. The best (P<0.05) EE intake was for the PJP20 group with similar intake among the other groups.

Table 2: Least-squares means of nutrient intake, and growth performance traits of Black goat kids fed diets containing *Prosopis juliflora* pods (PJP)

Variable	Diet[a]				SEM
	CON	PJP10	PJP15	PJP20	
Intake (g/d)					
DM	794.3	756.1	806.5	765.9	93.06
OM	727.7	695.4	741.1	701.4	83.70
CP	116.6	110.0	113.3	106.6	17.40
EE	22.6[b]	21.2[b]	24.7[b]	50.8[a]	4.09
NDF	257.0	253.9	294.8	270.4	31.62
ADF	77.8[b]	104.7[ab]	119.5[a]	110.8[ab]	13.77
Growth performance					
Initial weight (kg)	16.9	16.9	16.9	16.4	0.91
Final weight (kg)	26.5	24.3	25.8	24.4	1.23
ADG[b] (g)	121.7	94.1	111.9	95.5	15.40
FCR[c]	6.9	8.5	7.2	9.1	0.90

[a] Diets were: 0%PJP (CON), 10%PJP (PJP10), 15%PJP (PJP15), and 20%PJP (PJP20) of dietary DM.

[ab]Means within the same row with different superscripts differ ($P < 0.05$).

[b] ADG= average daily gain (final weight−initial weight)/80 days).

[c] Feed conversion ratio (FCR) = (g DM intake/g ADG).

These results are consistent with Abdullah and Abddel Hafes, (2004) who found that the inclusion of up to PJP25 in Awassi lamb diets did not affect the feed intake. Also, agreed with the results of Mahgoub *et al.* (2005a), where the feed intake was not affected in kids offered diets containing PJP10.

The lack of differences in nutrient intake among diet groups in present studies is mostly attributed to the lack of variation of ME in the treatment diets. Energy intake seems to have a greater influence on DM intake than physical fill (Lu and Potchoiba, 1990). The increase in ADF intake can be attributed to the fact that ADF content was higher in PJP compared to barley grains. However, this increase in the ADF contents in the diets did not impact DM intake (Table 2) (Obeidat and Shdaifat, 2013; Abdullah *et al.*, 2011). Mahgoub *et al.* (2005b) reported that the ADF content in PJP and barley grains was 317 and 37g/kg, respectively.

Results of initial and final body weights, ADG, and FCR are shown in Table 2. At the beginning of the study, average initial body weight was comparable among treatment groups. Likewise, final live weight, ADG, and FCR were also comparable among different treatment groups.

Mahgoub and Lu (1998) investigated the efficiency of growth of small-size breeds and found that the average daily gain for Batina and Dhofari kids was 119 and 91 g/d, respectively. Diets containing PJP at the levels of 0%, 15%, and 25% had no effects on the rate or efficiency of growth of Awassi lambs (Abdullah and Abddel hafes, 2004). Similarly, Obeidat *et al.*, (2008) reported that final weight and ADG were not affected in Awassi lambs that were fed diets containing 0, 10, and 20% PJP in replacement of barley grain. However, Mahgoub *et al.* (2005a) reported that kids fed rations containing 10% and 20% PJP had a higher BW compared to kids fed a diet free of PJP. In a current study, the lack of differences in performance is mainly related to the lack of variation in the DM intake among diet groups.

Digestibility and N balance

The apparent digestibility coefficients and N balance are presented in Table 3. The PJP20 group had the highest (P<0.05) digestibility coefficients for dry matter, organic matter, CP, and EE. Except for that of EE, all digestibility values were not different from the CON group. However, both DM and organic matter digestibility were lower (P<0.05) for kids fed the PJP15 diet. NDF digestibility tended to be higher for the PJP20 group while ADF digestibility was not affected by treatment diets.

Abdullah and Abddel hafes (2004) reported an increase in DM and OM digestibility in Awassi lambs fed a diet containing PJP15 when compared to the control and other treatment diets that contained PJP at 25, 35 and 45% in the diets. However, present results are inconsistent with the study of Obeidat et al. (2008) reported that when PJP partially substituted barley grains with rations of 10% and 20% in Awassi lamb diets, there were no variations in the digestibility coefficient. Several previous studies have demonstrated that the presence of anti-nutritional components, such as tannins and phenolic compounds, could affect the digestibility of DM and nutrients when varying the levels of PJP fed (Horton *et al.*, 1993; Mahgoub *et al.*, 2004; Sarasvati *et al.*, 2014).

Nitrogen intake and the retained and retention percentages were similar among all treatment diets (Table 3). However, N lost in feces was lower (P<0.05) for kids fed a PJP20 than those fed the CON or PJP15 diet. Meanwhile, N loss in urine was lower (P<0.05) for the PJP15 group than the CON and PJP20 groups but similar to the PJP10 group. No differences were reported among groups in N retained neither as % nor as g/d.

Table 3: Least-squares means of nutrient digestibility coefficient and nitrogen balance of Black goat kids fed diets containing *Prosopis juliflora* pods (PJP)

Variable	Diets[a]				SEM
	CON	PJP10	JP15	PJP20	
Digestibility coefficients (%)					
DM	80.8^{ab}	77.2^{b}	75.5^{c}	83.8^{a}	2.52
OM	83.0^{ab}	80.4^{ab}	78.3^{b}	85.6^{a}	2.15
CP	72.8^{ab}	67.3^{b}	66.9^{b}	84.1^{a}	5.47
EE	83.3^{b}	82.8^{b}	80.6^{b}	94.0^{a}	2.20
NDF	69.5^{de}	66.2^{de}	64.8^{e}	74.5^{d}	3.91

ADF	61.2	62.5	60.0	68.8	4.56
N- Balance					
N-Intake (g/d)	22.3	18.3	23.3	22.7	3.72
N-feces (g/d)	6.0[a]	5.1[ab]	6.5[a]	3.4[b]	0.85
N-urine (g/d)	6.7[a]	5.5[ab]	3.4[b]	6.6[a]	1.10
Retained (g/d)	9.5	7.7	13.4	12.7	3.06
Retention %	43.6	33.9	44.2	54.7	10.7

[a] Diets were:0%PJP (CON), 10%PJP (PJP10), 15%PJP (PJP15), and 20%PJP (PJP20) of dietary DM.
[abc] Means within the same row with different superscripts differ ($P < 0.05$).
[de] Means within the same row with different superscripts differ ($P < 0.08$).

Our findings were inconsistent with results reported by Obeidat et al. (2008), who found no differences in N loss in feces and urine in Awassi lambs fed diets containing 0, 10, 15 and 20% PJP with no differences in N retention among treatment diets.

Carcass and non-carcass characteristics and meat quality

No variations were noticed across the treatment diets in fasting live weight, hot and cold carcass weights, dressing-out %, visceral organs, and mesenteric fat (Table 4).

Table 4: Least-squares means for fast live weight, hot and cold carcass weight, dressing-out % and non-carcass component weights of Black goat kids fed finishing diets containing *Prosopis juliflora* pods (PJP)

Variable	Diets[a]				SEM
	CON	PJP10	PJP15	PJP20	
Fast live weight (kg)	27.2	25.3	25.8	23.5	1.72
Hot carcass weight (kg)	12.7	11.3	11.9	10.1	0.99
Cold carcass weight (kg)	12.3	10.9	11.4	9.7	0.98
Dressing-out %	46.6	44.0	46.0	42.5	1.15
Mesenteric fat weight (g)	594	339	471	486	89.0
Lungs & trachea weight (g)	372	349	374	346	23.0
Heart weight (g)	116	116	124	102	10.0
Liver weight (g)	489	488	516	416	38.0
Spleen weight (g)	48	45	39	46	5.0
Kidney weight (g)	81	83	88	75	5.0
Kidney fat weight (g)	350	245	341	309	62.0
Testes weight (g)	203	153	212	200	32.0
Total offal weight[b] (kg)	2.24	1.80	2.15	2.03	0.21

[a] Diets were:0%PJP (CON), 10%PJP (PJP10), 15%PJP (PJP15), and 20%PJP (PJP20) of dietary DM.
[b] Total offal includes heart, spleen, liver, lungs and trachea, mesenteric fat, kidney fat, kidneys, and testes weights.

Also, no differences were reported among linear dimensions and the carcass cut % of the shoulder, rack, loin, and leg cuts (Table 5). Further, no differences were observed in the leg fat depth (L3), tissue depth (GR), rib fat depth (J), eye muscle width (A) and depth (B), eye muscle area, fat depth (C) and shoulder fat depth (S2) among the treatment diets.

Table 5: Least-squares means for carcass cuts % and carcass linear dimensions of Black goat kids fed finishing diets containing *Prosopis juliflora* pods (PJP)

Variable	Diets[a]				SEM
	CON	PJP10	PJP15	PJP20	
Cold carcass weight (kg)	12.3	10.9	11.4	9.7	0.98
Shoulders (%)	47.3	46.5	47.8	45.4	1.37
Legs (%)	32.8	33.0	32.4	32.1	0.73
Racks (%)	9.8	9.8	10.0	9.2	0.30
Loins (%)	9.6	9.4	9.4	9.5	0.31
Shoulder fat depth (S2) (mm)	6.0	5.0	6.0	5.0	0.60
Leg fat depth (L3) (mm)	8.0	7.0	8.0	9.0	3.00
Fat depth (C) (mm)	2.6	2.5	2.7	2.6	0. 29
Tissue depth (GR) (mm)	16.0	16.0	15.0	13.0	1.50
Rib fat depth (J) (mm)	7.0	8.0	8.0	6.0	0.80

Eye muscle width (A) (mm)	49.0	46.0	49.0	46.0	1.90
Eye muscle depth (B) (mm)	22.0	21.0	22.0	18.0	1.90
Eye muscle area (cm^2)	6.82	6.36	7.74	6.22	0.72
A:B ratio	2.2	2.4	2.3	2.7	0.20

[a] Diets were:0%PJP (CON), 10%PJP (PJP10), 15%PJP (PJP15), and 20%PJP (PJP20) of dietary DM.

Results in the current study agreed with those observed no differences in hot and cold carcass weights, dressing%, non-carcass components, carcass cut, and linear carcass measurements when feeding PJP at a level up to 20% to growing Awassi lambs (Abdullah and Abddel hafes, 2004; Obeidat *et al.*, 2008). Likewise, Mahgoub *et al.* (2005a) reported that the proportion of body organs and fat depots in kids fed 0, 10, 20, and 30% PJP were similar for all treatments. However, the same authors found that the hot and cold carcass weights were higher for kids fed the PJP20 due to differences in the energy or protein percentages among fed diets, which could have an impact on the carcass's overall fat or moisture content.

Results for dissected legs and loins were not different (Table 6). The total lean % in legs and loins was lowest (P<0.05) in kids fed the PJP20 diet compared to that of kids fed other diets. The maximum meat-to-bone ratio in legs was greater (P<0.05) for the CON and PJP15 groups and lower (P<0.05) for the PJP20 than the PJP20 group while the PJP10 group was intermediate.

Table 6: Least-squares means for dissected leg and loin tissue of Black goat kids fed finishing diets containing *Prosopis juliflora* pods (PJP)

Variable	Diet[a]				SEM
	CON	PJP10	PJP15	PJP20	
Leg weight (g)	2046	1828	1927	1615	157
Subcutaneous fat (%)	4.8	4.7	4.9	4.6	0.68
Intermuscular fat (%)	4.5	4.2	5.2	4.5	0.47
Total lean (%)	59.8^{a}	57.9^{a}	59.0^{a}	55.0^{b}	1.41
Total bone (%)	22.8	25.3	23.3	27.2	1.25
Total fat (%)	9.5	9.1	10.3	9.3	0.95
Meat to bone ratio	2.7^{a}	2.4^{ab}	2.6^{a}	2.1^{b}	0.17
Meat to fat ratio	6.0	7.5	5.6	5.6	1.50
Loin Weight (g)	572	430	542	480	60.1
Subcutaneous fat (%)	8.4	7.9	9.0	7.3	0.88
Intermuscular fat (%)	9.1	6.8	8.8	6.8	1.49
Total lean (%)	53.2^{a}	51.8^{a}	53.9^{a}	46.3^{b}	1.70
Total bone (%)	21.4	26.2	23.8	30.3	2.28
Total fat (%)	17.1	14.2	17.3	13.7	1.68
Meat to bone ratio	1.5^{a}	1.3^{a}	1.2^{ab}	0.9^{b}	0.15
Meat to fat ratio	1.8	3.2	1.6	2.0	0.03

[a] Diets were:0%PJP (CON), 10%PJP (PJP10), 15%PJP (PJP15), and 20%PJP (PJP20) of dietary DM.
[ab] Means within the same row with different superscripts differ (*P* < 0.05).

No differences were observed between treatment diets in the subcutaneous fat%, intermuscular fat%, total bone%, total fat%, and meat-to-fat ratio for racks and shoulders and the total lean% for shoulders (Table 7). However, the total lean% in racks was higher (P<0.01) in the CON and PJP15 groups when compared to the PJP20 group. Meat to bone ratio in racks and shoulders was the lowest (P<0.05) in the 20% PJP group than the other groups.

Table 7: Least-squares means for dissected rack and shoulder tissue of Black goat kids fed finishing diets containing *Prosopis juliflora* pods (PJP)

Variable	Diets[a]				SEM
	CON	PJP10	PJP15	PJP20	
Rack weight (g)	604	546	601	466	62.2
Subcutaneous fat (%)	11.0	10.2	10.5	10.6	1.73
Intermuscular fat (%)	8.6	7.1	10.3	7.0	1.21
Total lean (%)	48.7^{d}	45.3^{de}	46.3^{d}	41.9^{e}	1.77
Total bone (%)	18.7	21.4	17.8	23.6	1.63
Total fat (%)	20.2	17.9	21.4	18.1	2.68
Meat to bone ratio	2.9^{a}	2.5^{b}	2.9^{a}	2.0^{c}	0.21
Meat to fat ratio	2.23	2.00	1.89	2.76	0.73
Shoulder weight (g)	2884	2588	2830	2390	234

Subcutaneous fat (%)	4.4	3.8	3.8	4.5	0.58
Intermuscular fat (%)	10.0	8.5	9.9	9.9	0.95
Total lean (%)	53.0	51.7	53.2	46.1	1.12
Total bone (%)	24.7	27.4	26.0	30.3	1.58
Total fat (%)	14.3	12.3	13.7	14.4	1.33
Meat to bone ratio	2.2[a]	2.0[a]	2.1[a]	1.6[b]	0.15
Meat to fat ratio	3.7	5.2	4.0	3.6	0.79

[a] Diets were:0%PJP (CON), 10%PJP (PJP10), 15%PJP (PJP15), and 20%PJP (PJP20) of dietary DM.
[abc]Means within the same row with different superscripts differ ($P < 0.05$).
[de]Means within the same row with different superscripts differ ($P < 0.08$).

No differences were among treatment diets observed in the quality characteristics of longissimus muscle in terms of weight, pH, temperature, Cooking loss, water holding capacity, lightness (L*), redness (a*), yellowness (b*), chroma, hue angle and the Warner-Bratzler shear force as shown in Table 8.

Table 8: Least-squares means for a range of quality characteristics of longissimus muscle for Black goat kids fed finishing diets containing *Prosopis juliflora* pods (PJP)

Variable	Treatments				SEM
	CON	PJP10	PJP15	PJP20	
Muscle weight (g)	101.6	87.8	102.9	84.1	13.20
pH 24	6.0	6.0	6.1	6.0	0.12
Temperature 24	3.3	3.6	3.6	3.8	0.34
Cooking loss%	37.9	39.2	33.7	35.6	2.54
Water holding capacity%	29.7	33.4	29.1	30.8	1.93
Warner-Bratzler shear force (kg)	3.9	3.8	5.2	3.7	0.62
Color					
L* value	38.5	40.5	38.3	40.3	1.87
a* value	2.3	2.3	2.6	2.7	0.42
b* value	19.0	20.0	19.8	21.5	1.72
Chroma value	19.2	20.1	20.1	21.7	1.68
Hue angle	82.0	83.5	81.8	83.1	1.65

[a] Diets were:0%PJP (CON), 10%PJP (PJP10), 15%PJP (PJP15), and 20%PJP (PJP20) of dietary DM.

Along with the current study, using PJP feeds did not have an impact on carcass characteristics and meat quality. For instance, Obeidat *et al.* (2008) studied the effect of feeding PJP to lambs and found that carcass characteristics and meat quality parameters (i.e., pH, color, water holding capacity, cooking loss, and shear force) were similar among diet treatments. According to Abdullah and Abddel Hafes, (2004) carcass characteristics were unaffected by the inclusion of PJP25 in lamb diets.

Conclusion

Prosopis juliflora pods are a source of raw energy and a suitable meal for Black goat kids. Previous studies and the current study have shown the possibility of using PJP in animal diets without causing problems with growth performance, carcass characteristics, and meat quality.

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تأثير تغذية قرون بروسوبس جوليفلورا Prosopis juliflora على أداء النمو، وتناول العناصر الغذائية، والهضم، وخصائص الذبيحة في العلائق النهائية لأطفال الماعز الأسود الذين يتغذون عليها

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ملخص

تعتبر قرون البروسوبيس جوليفلورا (PJP) مصدرًا للطاقة الخام وهي وجبة مناسبة للحيوانات المجترة. الهدف من هذه الدراسة هو تقييم أداء النمو، وتناول العناصر الغذائية، والهضم، وخصائص الذبيحة لصغار الماعز الأسود الذين تم تغذيتهم على وجبات نهائية مع استبدال حبوب الشعير بـ PJP لمدة 80 يومًا من التغذية. تم اختيار اثنين وثلاثين طفلًا مفطومًا من الذكور (وزن الجسم = 16.8 ± 0.91 كجم؛ والعمر = 110 ± 3 أيام) بشكل عشوائي لتلقي إحدى الأنظمة الغذائية العلاجية الأربعة. كانت الأنظمة الغذائية التجريبية 0(CON) ، (PJP15) 10،15(PJP10)، و 20(PJP20) ، مع تشابه جميع الأنظمة الغذائية من حيث الطاقة القابلة للاستقلاب (ME) والبروتين الخام (CP) . كانت قيم المدخول متشابهة باستثناء مستخلص الأثير الذي كان أعلى P) (0.05>لمجموعة PJP20 وألياف المنظفات الحمضية التي كانت أعلى (P <0.05) للأطفال على ال .PJP15 لم تتأثر تناول CP، والمواد العضوية(OM) ، والمادة الجافة(DM) ، وألياف المنظفات المحايدة. كانت نسبة تحويل الأعلاف ومتوسط الربح اليومي والوزن الحي النهائي لمجموعات العلاج متشابهة. مع عدم وجود اختلاف في وحدة تغذية المستندات التلقائية(ADF) ، كانت نتائج الهضم أفضل (P <0.05) لمجموعة PJP20 ولكنها في الغالب لم تختلف عن المجموعة الضابطة. وفيما يتعلق بنسبة صافي اللحم وقطع الذبيحة والأبعاد الخطية، ووزن الذبيحة الساخنة والباردة، والوزن الحي الصائم، فلم يتم العثور على اختلافات بين الأنظمة الغذائية المعالجة. كان إجمالي نسبة اللحم الصافي في الرفوف أكبر (P <0.05) في مجموعتي CON و . PJP15 كانت نسبة اللحم إلى العظام في الرفوف والكتفين هي الأدنى (P <0.05) في مجموعة PJP20 مقارنة بالمجموعات الأخرى. سلطت هذه الدراسة الضوء على تأثيرات PJP على نمو صغار الماعز الأسود دون أن يكون لها آثار سلبية على أداء النمو أو خصائص الذبيحة أو جودة اللحوم.

الكلمات الدالة: صغار الماعز الأسود، قرون Prosopis juliflora، أداء النمو، الهضم، تناول المغذيات، خصائص الذبيحة.

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