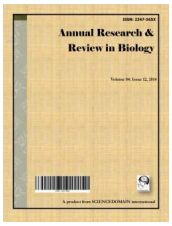

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Effects of Date Pits on Performance, Carcass Quality and Nutrient Digestibility of *Baladi* Goat Kids

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Authors' contributions

This work was carried out in collaboration between both authors. Author JMAO designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Author HAS managed the analyses of the study and managed the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

Aims: Effects of crushed date pits (DP) on growth performance, carcass traits and nutrient digestibility were studied on forty *Baladi* goat kids.
Methodology: All kids were male with an average body weight of 20 kg (S.D. = 0.27) at the beginning of the experiment. Animals were randomly divided into four groups of 10 kids each. Kids in each group received corn- soybean meal (SBM) total mixed rations (TMR). Rations were incorporated with DP at levels 0, 15, 30 and 45%, in the control and treatments from 2 to 4, respectively. All rations were isonitrogenous and isoenergetic. The growth experiment lasted 120 days. In the following week, 4 kids from each treatment were slaughtered.
Results: Kids fed DP at all levels consumed more (P<0.05) feed (0.81, 0.92, 0.91 and 0.92 kg for kids treatments one to four, respectively) but gained less (P<0.05) weight compared to those fed the control diet (33,117, 119,and 116 g/ day for treatments on to four, respectively). This same trend was found for the feed conversion (FC), carcass weight and dressing percentages. Feeding DP had

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no effects on external organs (hide, head and feet) (P=0.32) and thoracic organs (heart and lungs, HL) (P=0.36) and liver (P=0.45) weights when expressed as percent of empty body weight (EBW). Similarly, DP in kids' rations had no effects on carcass cuts: neck (P=0.39), shoulder (P=0.56), loin (P = 0.29) and legs (P = 0.51) average weights. However, DP decreased (P< 0.05) the abdomen fat of kids. Nutrients digestibility were depressed (P< 0.05) by DP feeding. For example, DM digestibility of control ration reduced from 71.1 to an average of 68.8%in rations incorporated with DP.

Conclusions: Inclusion of DP reduced the cost of rations by an average value of 11%. However, It can be concluded that feeding DP to fattening kids had no advantages in most of the tested parameters. Improving the nutritive value of DP through chemical or biological treatments could assure its value as a nonconventional feed ingredient in ruminant rations.

Keywords: Date seeds; Baladi goat kids; growth performance; carcass; digestibility.

1. INTRODUCTION

Livestock play an important role in the local Palestinian agriculture sector, which estimated as 38% of total agricultural sector income [1]. The animal production sector includes sheep, goat, dairy cattle and poultry. Fattening of lambs and kids represent an important activity among animal production enterprises in Palestine [2-4]. Fattening projects makes about 55% of the animal production income [1]. Cereal grains such as corn is a major feed ingredient in local fattening operation, where it is incorporated in formulated feeds at rate of about 45% [5]. In Palestine, the cost of feeding is more than 70% of the total production costs. In attempts to reduce feed costs as possible, several nonconventional feed ingredients were tested as potential feed ingredients. Date pits (DP) is a byproduct of date production and it is the second most available by products in Palestine, especially in Gaza Strip. Its annual amount is nearly 100,000 tons [6]. DP is characterized by its hard coat that limits its nutritive value where crushing and grinding is important to improve utilization of its nutrients [7]. It was reported by several research the importance of utilizing DP as part of animal rations [7-10]. The objective of the present study was to determine the effect of partially replacement of the expensive concentrate feed mixture (corn) with DP on growth performance, carcass traits and nutrient digestibility in *Baladi* goats (the native and most prevailing goat breed) fattening kids under Palestinian conditions.

2. MATERIALS AND METHODS

2.1 Processing of DS

A total of 1200 kg of DP was purchased from local date market in Gaza City, Palestine. Date pits were transported to the experiment site to be milled through a grinder. Other ration ingredients (soybean, wheat bran and vitamin and mineral premixes) were purchased from local feed factory and then mixed with DP by feed mixture of 800 kg capacity. The concentrate feeds were fed to kids in the form of pellets. The size of feed pellets was about 1.5 cm as length and 0.5-0.7 cm in diameter.

2.2 Animals and Experimental Design

Forty weaned male *Baladi* black kids with an initial mean weight of 20 kg (SD = 0.27 kg) were used in the experiment. The experiment was conducted at Al Azhar University farm, Gaza city, Palestine after the approval of the Animal Care and Use Committee. Kids were treated with IVOMEC (Merial Limited, Luluth, GA, USA) and Cogla Vac (Cogla Laboratories, Libourne, France) against internal and external parasites and the enterotoxaemia, respectively. Both treatments were applied subcutaneously at 1 cm^3 dose. Kids were then assigned randomly to four experimental fattening diets (10 kids/treatment). Kids in each treatment were fed individually with TMR (Table 1), and each kid was considered as an experimental unit. Animals in treatment groups were fed corn–SBM based rations. DP was incorporated into diets at levels 0, 15, 30 and 45% in treatment 1 to 4 in a completely randomized design, for 120 days (Table 1). Rations fed were formulated to meet NRC [11] standards. Kids were housed in individual pens (1.4 m × 1.00 m) with constant illumination and fed the experimental diets twice daily at 0900 and 1700 h. Feed offered and refused was recorded daily. Clean drinking water was available in plastic buckets. Animal pens were cleaned weekly. Kids' weights were recorded weekly before the 0900 h feeding. Ingredient composition of the experimental diets is shown in Table 1.

Table 1. The ingredients and chemical composition of experimental feeds incorporated with date pits (DP) fed to *Baladi* goat kids, g/ kg DM

Ingredient	0DS	15DS	30DS	45DS
Yellow corn	560	360	210	30
Soybean meal	140	150	150	180
Wheat bran	150	190	190	190
DP	0	150	300	450
NaCl	10	10	10	10
DCP	10	10	10	10
Limestone	20	20	20	20
Premix[a]	10	10	10	10
Wheat straw	100	100	100	100
Chemical analysis: (DM basis)				
DM	926	937	930	933
OM	861	871	861	866
CP	140	141	139	142
TDN	631	630	629	628
NDF	403	411	420	419
aADF	231	240	238	241
Ash	68	69	70	71
Ca	12	12	13	13
P	6	7	6	6
ME[b], MJ/kg DM	6.0	6.1	6.1	6.2
Cost/kg ration ($)	0.33	0.31	0.29	0.28

[a] Composition per 1 kg contained, vitamin A, 2,000,000 IU; vitamin D3, 40,000 IU; vitamin E, 400 IU; Mn, 12.8 mg; Zn, 9.0 mg; I, 1.56 mg; Fe, 6.42 mg; Co, 50 mg; Se, 32 mg plus an antioxidant.
[b] Metabolizable energy; based on tabular values (NRC, 1985)

2.3 Chemical Analysis

Composited sample of feed, orts and feces were analyzed for DM (105℃ for 24 h). The crude protein (CP) was determined by macro-Kjeldahl procedure (method 955.04; AOAC, 1990). The crude fiber (CF) analysis was determined by filter bag technique (ANKOM Technology) (method 978.10; AOAC [12]. Ether extract (EE) was determined with ether as the solvent (method 920.39; AOAC [12]. The ash was determined according to AOAC procedures (AOAC, 1990 12. Samples were analyzed for neutral detergent fiber (aNDF; with heat stable-amylase and sodium sulfite) and acid detergent fiber (ADF; ANKOM2000 fiber analyzer, ANKOM Technology Corporation, Fairport, NY, USA) according to Van Soest and Rbertson [13]. Values for aNDF and ADF are expressed inclusive of residual ash. The total digestible nutrients values (TDN) of the experimental diets were calculated based on the TDN values of ingredients.

2.4 Digestibility Trial

After finishing the growth trial, four kids from each treatment were transferred to metabolic crates for digestibility trial. Kids were adapted to the metabolic crates for one week followed by an 8 days collection period. Feed was offered at 8:00 a.m. During the trial, the amount of feed offered and the orts were weighed and recorded on daily basis. The feed and the orts were sampled daily and approximately 200 g was piled until the end of the collection period for later analysis. Daily feces was collected at 7:00 a.m. and weighed. A 10% sample of daily feces were collected from each animal, dried in a forced air oven at 60℃ for 48 h, ground and passed through a 1 mm screen to determine the dry matter (DM) percentage. The remaining fecal samples were thoroughly and carefully mixed, placed in identified plastic containers and then stored at -4℃ for later analyses. The digestion coefficients were calculated for dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), crude fiber (CF), neutral detergent fiber (NDF) and acid detergent fiber (ADF) as a difference between nutrient intake and nutrient excreted in the feces divided by nutrient intake and then multiplied by 100.

2.5 Measurements at Slaughter

At the end of the 120 days feeding period, kids had a 12 h fasting period after which 4 kids from each treatment were slaughtered. The bodies were skinned; the head and feet were removed. The carcass was eviscerated and the hot carcass weight was determined. The internal organs (*i.e.* liver, kidneys, heart, skin) were weighed as well as carcass cuts (*i.e.* neck, shoulder, loin, flank, thigh) were taken and weighed and expressed as percent of hot carcass weight.

2.6 Statistical Analysis

Data were subjected to ANOVA for a completely randomized design using the general linear procedure of SAS [14]. Differences among treatment means for significant dietary effect were detected using the LSD procedure of SAS. Unless otherwise stated, significance was declared at $P<0.05$).

3. RESULTS

3.1 DS Chemical Composition

The DM, CP and EE values were relatively close among the experimental rations. Rations containing DP showed higher percentages of CF, ADF and NDF due to high concentration of fiber in DP. The nitrogen free extract (NFE) of the control and the experimental diets were within normal level (Table 1).

Chemical analyses of DP showed that it contains 65, 88, 150, 720, 10 g/kg CP, EE, CF, NFE and ash, respectively.

3.2 Kids Performance

Dry matter intake (DMI) was affected (P<0.05) by feeding DP. Feed intake was higher (P<0.05) by kids fed the different levels of DP compared to kids fed the control diets (Table 2).Body weight gain and average daily gain (ADG) were reduced (P<0.05) with incorporation of DP at different levels. DP decreased (P<0.05) feed conversion ratio (FCR) when fed to goat kids at different levels.

3.3 Empty Body Weight, Dressing Percentage and Offal Weights

Incorporation of DP in diets had significant effects on hot carcass weight (HCW) and dressing percentages. These parameters were (P<0.05) lower in kids fed the different levels of DP compared to control. However, offal (head, hide, feet (HHF), liver, heart and lung (HL), spleen and testis) proportions when expressed as percent of fasting body weight (FBW) were not affected by DS feeding to the goats fattening kids (Table 3).

3.4 Carcass Cuts

DP had no effects on carcass cuts (*i.e.* neck, shoulder, flank, legs) proportional to FBW (Table 4). DP when fed at different levels reduced (P<0.05) abdomen fat compared to that in control. However, DP had no effects on kidney fat.

3.5 Nutrients Digestibility

The DM digestibility was depressed (P<0.05) by feeding DP. However, organic matter (OM), crude protein (CP), ether extract (EE) and crude fiber digestibility were the same in control, 15 and 30% DP diets but higher (P<0.05) compared to the digestibility for diets containing 45% DP (Table 5). Total digestible nutrients (TDN) was reduced (P<0.05) by feeding DP at different levels.

4. DISCUSSION

Chemical analyses of DP showed comparable values to those reported by previous research [15].

Results of this study showed that feed intake was increased by feeding DP at different levels compared to control. Similar results were observed by El Gassim et al [16] where intake was increased in fattening lambs fed rations incorporated by 30% DP. In contrast, Al Shanti et al. [15] reported that feed intake was not affected by DP when fed to Assaf lambs. Similar results indicated lack of DP effects on feed intake in small ruminants [17-18] and in fattening Friesian calves [19]. It was reported that the increase intake of rations incorporated by DP might be due to the increased palatability of the rations of lactating ewes [20].

The inconsistent results concerning feed intake among different research might be attributed to type of date, species of animal and animal physiological stage.

Average daily gain (ADG) was lower in kids fed the different levels of DP. Al Suwaiegh [7] reported that DP at levels 15 and 20% caused similar ADG in Ardi goats as in control, but this gain was reduced at 10% DP level. However, Al Ani et al [21] reported that DP when replaced 30% of barley in Awassi lambs ration caused an increase in ADG. Final body weight was depressed by DP feeding. Different results were reported by previous research where DP at levels up to 10% resulted in lambs' final weight similar to control [22]. The DP growth promoting compounds effect to enhance animals' performance as reported by Ismail [20] was not clear in the present study.

This study showed that feeding DP to fattening kids reduced the feed conversion ratios. Different results were reported by previous research [7] who showed that DP improved FC when DP was fed fattening Ardi lambs at level up to 20% of ration. Animals' performance could be negatively affected if DP fed at levels higher than 20% [23].

Table 2. Effect of date pits (DP) on feed intake, body gain, slaughter body weight (BW), empty body weight (EBW) and dressing percentages (DP) of fattening black *Baladi* goat kids

Group	0DS	15DS	30DS	45DS	DS effect
DMI	810[b]	920[a]	910[a]	920[a]	0.05
Initial body weight, kg	19.96	20.55	20.00	20.20	0.22
Final body weight, kg	35.91[a]	34.55[b]	34.30[b]	34.10[b]	0.05
Average daily gain, g	133.00[a]	117.00[b]	119.00[b]	116.00[b]	0.05
CR	6.09[b]	7.88[a]	7.63[a]	7.94[a]	0.05
EBW, kg					
Carcass weight, kg	17.60[a]	16.23[b]	15.94[b]	15.8[b]	0.05
DP, %	49.00[a]	47.00[b]	46.50[b]	46.3[b]	0.05

Means in the same line with different alphabets (a, b) are significantly different (P<0.05). CR conversion rate.

Table 3. Offal proportions, % of empty body weight (EBW) in black goats fattening kids fed different levels of date pits (DP)

Group	0DS	15DS	30DS	45DS	DS effect
HHF	16.4	16.3	16.5	16.3	0.32
Liver	1.7	1.7	1.6	1.6	0.45
HL	1.6	1.6	1.6	1.6	0.36
Spleen	0.14	0.13	0.14	0.14	0.43
Testis	1.1	1.0	1.0	1.1	0.28

HHF, hide-head-feet; HL, heart and lungs

Table 4. Carcass cuts and body fat weights% of fasting body weight (FBW) in black goats fattening kids fed different levels of date pits (DP)

Group	0DS	15DS	30DS	45DS	DS effect
Neck	4.8	5.0	4.9	4.8	0.39
Shoulder	11.5	10.9	10.9	11.1	0.56
Loin	8.7	8.6	8.6	8.6	0.44
Flank	10.2	10.1	9.9	9.9	0.29
Legs	11.7	12.0	11.8	11.8	0.51
Abdominal fat	5.5[a]	2.8[b]	2.7[b]	2.8[b]	0.05
Kidney	1.7	1.7	1.7	1.7	0.69

Means in the same line with different alphabets (a, b) are significantly different (P<0.05)

Table 5. Nutrient digestibility of rations with different levels of date pits (DP) fed to fattening kids

Group	0DS	15DS	30DS	45DS	DS effect
Dry matter	71.1[a]	70.3[b]	68.4[b]	67.9[b]	0.05
Organic matter	70.9[a]	70.8[a]	70.9[a]	68.3[b]	0.05
Crude protein	70.3[a]	70.7[a]	70.0[a]	68.8[b]	0.05
Crude fiber	71.1[a]	70.1[a]	69.7[a]	67.4[b]	0.05
NFE	69.3[a]	71.3[a]	69.5[a]	68.1[b]	0.05
TDN, %	68.1[a]	60.7[b]	62.6[b]	58.7[b]	0.05

Means in the same line with different alphabets (a, b) are significantly different (P<0.05). NFE, nitrogen free extract; TDN, total digestible nutrients

Dry matter digestibility (DMD) was reduced in DP rations. Digestibility of DM and OM were 69.5 and 70%, respectively and comparable to digestibility values in Najdi lambs reported by Al Owaimer et al. [24]. DM digestibility was the same in both control and DP incorporated rations [7]. Al Kinani and Wash [25] reported an increase in digestibility with DP feeding to Awassi lambs.

The digestibility of crude fiber was decreased by DP inclusion in rations at the level of45%. Similar results were reported in nutrient digestibility

when DP fed to camels [26]. However, digestibility of NDF was improved in rations incorporated with DP at 20% level to Najdi goats. The reason for the increase in digestibility might be due to improved palatability and the energy content as DP increased in diets [7]. The digestibility values in Najdi goats were lower than those reported by previous research [27].

Similar to crude fiber, digestibility of CP was reduced at 45% DP level. Al Suwaiegh [7] and Al Dabeeb [28] reported lower CP digestibility when DP fed to goats at level of 30% of the goats and sheep rations, respectively. However, the CP digestibility was higher when same levels of date was fed to sheep [27].

The TDN percent (average of 63%) was similar among different dietary treatments and was more than the TDN requirement of goats at this body weight according to NRC [29] which indicated that the energy requirement of goats was met.

5. CONCLUSIONS

It can be concluded that feeding DP to fattening kids had no advantages to kids performance. Improving the nutritive value of DP through chemical or biological treatments could assure its value as a nonconventional feed ingredient in ruminant rations. However, inclusion of DP as in this study resulted on an average of 12% saving in rations cost.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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