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Evaluation of the nutritive value of wild almond seed (*Amygdalus scoparia*) and its effect on performance, milk fatty acid composition and antioxidant activity in lactating goats

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Abstract A total of 21 dairy goats in mid lactation were randomly assigned to three experimental diets in a completely randomized design. The diets contained 0, 3, or 6% WAS, and consisted of 45% forage and 55% concentrates. Milk fat and the ratio of milk fat to milk protein were significantly lower in goats fed diets containing 6% WAS (P≤0.01). Digestibility of crude fat was higher, and that of neutral (NDF) and acid (ADF) detergent fiber was lower in the goats fed diets containing WAS (P≤0.05). Milk fatty acids C14: 1 and C18: 1 and C16: 1, C18: 2, CLA and C18: 3 were significantly higher in animals which received diets containing WAS. Total mono unsaturated fatty acid (MUFA) content, poly unsaturated FA (PUFA), and PUFA/saturated FA (SFA) ratio were significantly higher in the goats fed diet containing 6% WAS (27.04%, 3.94% and 0.05, respectively). Desaturation index for C16: 1 was significantly higher in WAS goats (P≤0.01). Concentration of plasma HDL in goats (38.14-39.28 mg/dL) was higher WAS goats (P≤0.05). In conclusion, supplementation of WAS to dairy goats at a level of 3 and 6% was an effective means of increasing concentrations of unsaturated FA, especially oleic, linoleic, CLA, linolenic, and PUFA in milk fat, and plasma HDL.

Keywords: unsaturated fatty acid, desaturation index, dairy goat, digestibility, milk fat

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Introduction

Milk is one of the essential products in the human diet, rich in nutritive components. The nutritive value of goat milk considered based on various factors (Andrade and Schmidely, 2006; Matsushita et al., 2007; Strzalkowska et al., 2008). Lipid composition is one of the most important components of the nutritional quality of milk. Different fatty acids (FAs) are involved as positive or negative predisposing factors for human health (Chilliard et al., 2003; Luna et al., 2008). Moreover, goat milk fat content and composition may be extensively modified by genetic and physiological factors as well as nutritional factors (Chilliard et al., 2003). Among nutritional factors, fat supplementation of the diet is an efficient means to modify milk FA composition in lactating ruminants (Palmquist et al., 1993; Chilliard et al., 2000), which can be used to improve the nutritional quality of milk fat. Concentrations of specific health-promoting fatty acids, such α-linolenic acid and rominic acid have been increased in milk fat of cows fed oilseed diets rich in C18:3 and C18:2, respectively. The almond nut (seed) is known as a source of nutritious food with high lipid content. It is also rich in esters of palmitic and linoleic acids (Nwosu et al., 2008). Almonds belonging to the Rosaceae family and Amygdaloideae or Prunoideae sub family are one of the most important perennial fruit crops of arid and semi-arid regions of Iran which is the fifth world producer of this crop (FAO STAT, 2013). *Prunus scoparia* is a wild almond found in Iran, Turkmenistan and Afghanistan. It is a xerophytic shrub and has been used as a grafting stock for domesticated almonds to provide drought resistance (Hanelt and IPK, 2001). The almond seed rich in essential amino acids, is a good source of dietary protein containing 25.81% crude protein (Ezeokonkwo and Dodson, 2004). Many authors demonstrated the antioxidant, cardioprotective, anti-cancer, anti-inflammatory, anti-aging and anti-microbial properties of linoleic acid in almonds (Arslan, 2007; Chen et al., 2006; Maguire et al., 2004). Almond consumption has been reported to decrease the risk of colonic cancer in rats (Davis and Iwahashi, 2001), increase HDL cholesterol, and reduce LDL cholesterol in humans (Hyson et al., 2002). These actions may be related to the presence of flavonoids and other phenolic compounds in nuts. Production of almond hulls, which

are mainly used in livestock feed, is estimated to exceed 6 million tons annually, thus being a potentially good source from which to extract antioxidants in high quantities (Siriwardhana et al., 2006; Shahidi et al., 2009). Few studies have examined the effects of feeding wild almond on milk composition, especially on fatty acid (FA) composition, in goat milk; however, some studies on medicinal properties of their leaves, roots and fruits have been reported (Venkatachalam and Shridhar, 2006; Sang et al., 2002). Therefore, this study aimed at determining the nutritive value of wild almond seed (WAS) and its effect on the performance, milk composition, blood metabolites and antioxidant activity in lactating goats.

Material and methods

Animals and diets

The experiment was conducted at the research station of Rezwan Institute of Agricultural Education in Kerman city, Kerman, Iran. A total of 21 primiparous hybrid dairy goats in mid lactation with mean weight of 27±2.5 kg and daily milk yield of 1.00 ± 0.2 kg were randomly assigned to three experimental diets (n=7 goats per diet) in a completely randomized design. The goats were kept in individual pens and had free access to water. The experimental periods lasted 42 days, with the first 14 days for dietary adaptation and 28 days for data collection. The goats were fed twice per day in two equal portions (at 0800 and 1600 h) and the amount of feed offered per animal was recorded and adjusted according to the feed refusals daily. The animals were maintained according to the guidelines set by the Iranian Council on Animal Care (1995). The WAS samples were collected in July-August from a mountain located in Baft city in Kerman province (56°19′E and 28°49′N), and dried in the sun. All WAS samples were then grounded through a 1mm screen 1- and analyzed for DM, CP, NDF, ADF, EE and ash. The total phenolic content of WAS was determined by the Folin–Ciocalteu method (Kaur and Kapoor, 2002). Tannin contents were determined by method of Broadhurst and Jones (1978) and condensed tannin content was measured using the vanillin assay (Price et al., 1978). Ingredients and chemical composition of diets and the fatty acid (FA) profile of oil supplements, are presented in Table 1. The compositions of diets, on a dry matter (DM) basis, were: (1) a diet without WAS as the control diet, (2) a diet with 3% WAS and (3) a diet with 6% WAS. Diets containing 55% concentrate and 45% forage (DM basis), were formulated to be isocaloric and isonitrogenous according to NRC (2007) requirements (Table 2).

Table 1. Chemical and fatty acid composition of wild almond seed (WAS)

Chemical composition	WAS
CP (%)	8.08
EE (%)	7.2
Ash (%)	6.89
NDF (%)	26.88
ADF (%)	19.74
ME (Mcal/kg DM)	2.19
Phenolic compounds	
Total tannin (%)	0.55
Total phenolic compounds (%)	0.988
Fatty acids composition (% of total fatty acids)	
C16:0 (Palmitic acid)	7.81
C16:1 (Palmitoleic acid)	0.51
C18:0 (Stearic acid)	2.29
C18:1 (Oleic acid)	69.05
C18:2 (Linoleic acid)	21.51
C18:3 (Linolenic acid)	0.68

Sampling

Individual goat feed intake was calculated using daily feed offered and feed refused averaged over the duration of performance phase. The apparent digestibility of the diets were determined in the last 5 days of the trial during which the feces were collected daily and stored at −20° C for the determination of apparent digestibility using acid insoluble ash (AIA) marker (Van Keulen and Young, 1977). Feed and feces were analyzed for dry matter (DM; cod 930.13), ash by ignition to 550 °C, crude protein (CP; cod. 954.01), and ether extract (EE; cod. 945.16) according to the AOAC (1990) method. Acid (ADF) and neutral (NDF) detergent fibers were determined using the method described by Van Soest et al. (1991). All analyses were performed in duplicate. On the last day of the trial (day 42), approximately 2 h prior to feeding, blood samples were collected from the jugular vein and transferred into the sterile tubes that containing EDTA as an anticoagulant. Blood samples were centrifuged (D-7200 tuttlingen) at 3,000×g for 15 min to obtain plasma. Plasma was separated and stored at -20ºC prior to analysis for glucose, cholesterol, triglyceride, HDL, LDL and malondialdehyde (MDA). The thiobarbituric acid method was used to quantitate MDA-reactive products (Plaser et al., 1966). Milk yield was recorded and milk samples were collected weekly and stored at 4°C with potassium bichromate (as a preservative) until analyzed for fat, protein, lactose, solids not fat (SNF) and total solid (MilkoScan, Foss Electric, Hillerød, Denmark). Milk FA composition was determined in samples (without preservative) collected in the last week of the experiment. Milk FAs were extracted and methylated according to Bouattour et al. (2008)

Table 2. Ingredients and chemical composition of the experimental diets containing wild almond seed (WAS)

Ingredient (% of dry matter)	Diets [a]		
	Control	3% WAS	6% WAS
Alfalfa hay	30	30	30
Corn silage	15	15	15
Barley grain, ground	25	23	21
Corn grain, ground	12	11	10
Soybean meal	10	10	10
Wheat bran	5.3	5.3	5.3
Wild almond seed (WAS)	0	3	6
Calcium carbonate	0.8	0.8	0.8
Vitamin A, D, and E premix 1	0.6	0.6	0.6
Trace-mineralized salt 2	0.6	0.6	0.6
Sodium bicarbonate	0.7	0.7	0.7
Chemical composition			
ME, (Mcal/kg of DM)	2.55	2.53	2.50
Dry matter (%)	89.51	89.26	88.55
Crude protein (%)	15.38	15.29	15.20
Ether extract (%)	2.65	4.12	6.23
NDF (%)	32.52	33.89	35.25
ADF (%)	19.85	21.17	22.49
Calcium (%)	0.88	0.92	0.93
Phosphorus (%)	0.41	0.45	0.45

[1]Contained 5,000,000 IU of Vitamin A; 5,000,000 IU of Vitamin D and 500,000 of Vitamin E per kg.
[2]Composition: 75.15% NaCl, 3.046% Mn, 1.025% Cu-sulfate, 0.253% Zn-sulfate, 0.015% EDDI-80 and 0.011% Na-selenide.

method. The samples were incubated at 100 °C for 60 min and extracted with 5 ml of hexane. The FA methylesters in the hexane layer were analyzed by a gas chromatograph (3400 Varian Star; Varian Inc., Palo Alto, CA) equipped with CP-SIL-88 capillary column (60 m×0.25 mm, Varian) and helium was the carrier gas. Column temperature was initially 50 °C for 1 min, increasing from 4 °C/min to 190 °C. Injector and detector temperatures were 280°C and 300°C, respectively. Goats' milk samples were collected in the last day of the trial and stored at -80°C without preservative until analyzed for MDA.

Statistical analysis

The GLM procedure (SAS, 2005) was used to detect statistical differences between treatments. The following model was employed: $Y_{ij} = \mu+T_i+\varepsilon_{ij}$.

Y_{ij} is the dependent variable, μ the overall mean for each parameter, T_i the effect of treatment and ε_{ij} the residual error. The Duncan's multiple range test was used to detect the differences between treatment means.

Results

Feed intake, milk yield, and milk composition

The results of this study indicated that feed intake, milk yield, and fat-corrected milk (FCM) of lactating goats were not affected by experimental diets (Table 3). Milk fat and milk fat to milk protein ratio were significantly lower in goats fed diets containing 6% WAS ($P\leq0.01$). No significant change was observed in milk protein, lactose, total solids, Solids not fat (SNF), and MDA between the treatment groups fed experimental diets. MDA is the end-product of lipid peroxidation and it can be considered as an indicator of antioxidant activity.

Digestibility

The results of apparent digestibility of the experimental diets are presented in Table 4. The results showed that apparent digestibility of dry matter, organic matter, and crude protein was not affected by the treatment groups fed experimental diets, but the digestibility of ether extract was significantly higher in treatment groups fed diets containing WAS ($P\leq0.05$). Also, apparent digestibility of NDF and ADF was decreased in the treatment groups fed diets containing WAS compared to the controls ($P\leq0.05$).

Fatty acid composition

The results of chemical composition of milk fatty acids (Table 5) indicted that both short-chain fatty acids and

Table 3. Dry matter intake, milk yield, and milk composition of goats fed diets containing different levels of wild almond seed (WAS)

	Diets			SEM[1]	*P* value
	Control	3% WAS	6% WAS		
Feed intake (g/d)	1729.28	1715.71	1716.42	9.313	NS[2]
Milk yield (g/d)	998.71	992.14	998.57	32.12	NS
FCM[3] (g/d)	1.02	1.02	1.03	0.454	NS
Composition					
Fat (g/100 g raw milk)	4.25[a]	4.19[ab]	4.13[b]	0.024	**
Protein (g/100 g raw milk)	3.63	3.64	3.56	0.023	NS
Fat/Protein	1.19[a]	1.15[b]	1.14[b]	0.009	**
Lactose (g/100 g raw milk)	5.22	5.22	5.24	0.350	NS
Total Solid (g/100 g raw milk)	15.62	15.68	15.16	0.513	NS
SNF[4] (g/100 g raw milk)	11.44	11.54	11.32	0.449	NS
MDA[5] (µmol/L)	4.87	4.79	4.65	0.214	NS

[1]SEM: Standard error of mean.
[2]Not significant
[3]FCM: 4% fat corrected milk (FCM= [(0.4×kg of milk) + (15×kg of milk fat)]).
[4]SNF: Solids not fat
[5]MDA: Malondialdehyde
[a,b]Within row, mean values with common superscript(s) are not significantly different (P>0.05).

Table 4. Apparent digestibility of nutrients in goats fed diets containing different levels of wild almond seed (WAS)

Digestibility	Diets			SEM[1]	*P* value
	Control	3% WAS	6% WAS		
DM (%)	75.39	74.20	73.61	0. 807	NS[2]
OM (%)	66.62	66.56	66.37	1.235	NS
CP (%)	62.06	62.49	62.89	0.845	NS
EE (%)	74.02[b]	76.51[a]	76.55[a]	0.738	*
NDF (%)	51.62[a]	49.04[b]	49.19[b]	0.635	*
ADF (%)	38.72[a]	36.47[b]	36.07[b]	0.700	*

[1]SEM: Standard error of mean.
[2]Not significant
[a,b]Within row, mean values with common superscript(s) are not significantly different (P>0.05).

saturated fatty acids in milk were not affected by experimental treatments. C14: 1 and C18: 1 (P≤0.05) and C16: 1, C18: 2, CLA and C18: 3 (P≤0.01) were significantly higher in treatments fed diets containing WAS.

Moreover, the total MUFA content (P≤0.05), PUFA (P≤0.01), and PUFA SFA ratio (P≤0.01) were significantly higher in the treatment group fed diets containing 6% WAS. Desaturation index for C16: 1 was significantly higher in the treatment groups fed diets containing WAS (P≤0.01). The Δ9 fatty acid desaturation index is a tremendous need for improved biomarkers that can be used in the clinical setting to aid in the early detection of metabolic diseases.

Blood parameters

Blood parameters measured in goats fed diets containing different levels of WAS were not affected by the experimental diets except for HDL (P≤0.05), which were significantly higher in the treatment groups fed diets containing WAS.

Discussion

The results of the present study showed that feed intake, milk yield, and FCM of lactating goats were not affected by experimental diets. Thus, these results were consistent with previous studies (Badiei et al., 2014; Dirandeh et al., 2013) that showed that feeding diets containing different sources of omega-3 and omega-6 fatty acids had no significant effect on feed intake and milk yield. Modaresi et al. (2011) also reported that the addition of 6 or 12% pomegranate seed pulp as a source of oil to diets of lactating goats did not affect dry matter intake, milk yield, and FCM.

Drackley et al. (1992) hypothesized that the amount of unsaturated FA reaching the small intestine of dairy cows could affect gastrointestinal motility and alter DMI. In current study, milk fat and milk fat to milk protein ratio were significantly lower in goats fed diets containing 6% WAS. It has been reported that approximately 50% of milk fat in the mammary gland is synthesized by acetate and butyrate, and the other 50% of

Table 5. Fatty acid composition of goat milk fed diets containing different levels of wild almond seed (WAS)

Fatty acid	Diets			SEM[1]	*P* value
	Control	3% WAS	6% WAS		
C4:0 (%)	1.01	1.04	1.04	0.029	NS[2]
C5:0 (%)	0.27	0.27	0.29	0.011	NS
C6:0 (%)	0.79	0.82	0.81	0.078	NS
C8:0 (%)	1.80	1.81	1.82	0.096	NS
C10:0 (%)	10.18	10.90	11.84	0.784	NS
C10:1 (%)	0.29	0.30	0.31	0.011	NS
C12:0 (%)	5.59	5.70	5.80	0.301	NS
C12:1 (%)	1.03	1.07	1.07	0.038	NS
C14:0 (%)	13.16	13.09	13.05	0.532	NS
C14:1 (%)	1.51^{b}	1.63^{ab}	1.72^{a}	0.052	*
C15:0 (%)	0.81	0.89	0.86	0.028	NS
C15:1 (%)	0.34	0.36	0.38	0.018	NS
C16:0 (%)	41.20	38.52	39.28	1.132	NS
C16:1 (%)	0.19^{b}	0.21^{a}	0.23^{a}	0.007	**
C17:0 (%)	0.97	0.92	0.94	0.029	NS
C17:1 (%)	0.58	0.63	0.65	0.026	NS
C17:2 (%)	0.18	0.21	0.21	0.008	NS
C18:0 (%)	4.38	4.23	4.23	0.261	NS
C18:1 (%)	20.43^{b}	21.92^{ab}	22.43^{a}	0.533	*
C18:2 (%)	1.41^{b}	1.54^{a}	1.62^{a}	0.032	**
C18:2 (CLA) (%)	0.50^{c}	0.66^{b}	0.71^{a}	0.014	**
C18:3 (%)	0.87^{c}	1.27^{b}	1.39^{a}	0.023	**
C20:0 (%)	0.48	0.43	0.42	0.020	NS
C20:1 (%)	0.20	0.22	0.22	0.007	NS
Sums of fatty acid					
SFA (%)	80.78	78.85	80.71	1.260	NS
MUFA (%)	24.58^{b}	26.37^{a}	27.04^{a}	0.547	*
PUFA (%)	2.98^{c}	3.69^{b}	3.94^{a}	0.053	**
PUFA/SFA	0.03^{b}	0.04^{a}	0.05^{a}	0.001	**
Desaturase index[3]					
inC14:1	0.10	0.11	0.11	0.005	NS
inC16:1	0.001^{b}	0.010^{a}	0.010^{a}	0.0008	**
inC18:1	0.82	0.83	0.84	0.007	NS

[1]SEM: Standard error of mean.
[2]Not significant
[3]14:1 desaturase index=C14:1/(C14:0+C14:1); 16:1 desaturase index=C16:1/(C16:0+C16:1); 18:1 desaturase index= C18:1/(C18:0+C18:1).
[a,b]Within row, mean values with common superscript(s) are not significantly different (P>0.05).

milk fat is directly provided by fat absorbed from the blood (Ackers, 2002). There are three theories of the effects of fatty acids with multiple double bonds on the reduction of milk fat. The first one is that changes in rumen fermentation result in an inadequate production of acetate and butyrate to support the production of milk fat. The second one is that ruminal propionate production and increased hepatic gluconeogenesis have resulted in a rise in blood insulin levels, leading to a shortage of milk fat precursors in the breast. The last one is that the unique fatty acids produced during rumen biohydrogenation inhibit milk fat synthesis (Bauman and Grinarri, 2001).

Changing the ingredients of animals' diet and using nutrients containing unsaturated fatty acids can easily change milk fat compounds (Chilliard et al, 2007). In this study, WAS is a major supplier of dietary fat, with fat rich in unsaturated fatty acids. On the contrary to our results, other studies found that milk fat in goats by adding pomegranate seed pulp (Modaresi et al., 2011) and flaxseed oil (Li et al., 2012) increased. No significant change was observed in milk protein, lactose, total solids, and nonfat milk solids between treatment groups fed experimental diets. It has been reported that lactose is less affected by dietary intake in animals as compared with other milk components (Bauman et al., 2006). There was no significant difference between goats fed diets containing WAS with respect to MDA content of milk. MDA is the metabolite of lipid peroxidation in the body used to assess oxidative damage to membranes

Table 6. Blood parameters of goats fed diets containing different levels of wild almond seed (WAS)

Parameters	Diets			SEM[1]	*P* value
	Control	3% WAS	6% WAS		
Blood sugar (mg/dL)	66.28	65.42	66.85	2.167	NS[2]
Cholesterol (mg/dL)	57.42	65.71	61.42	3.626	NS
TG (mg/dL)	19.14	17.14	21.42	1.551	NS
HDL (mg/dL)	33.28[b]	39.28[a]	38.14[a]	1.511	*
LDL (mg/dL)	20.31	23.00	19.00	2.568	NS
VLDL (mg/dL)	3.82	3.42	4.28	0.310	NS
MDA (µmol/L)	5.16	4.79	4.71	0.264	NS

[1]SEM: Standard error of mean.
[2]Not significant
[a,b]Within row, mean values with common superscript(s) are not significantly different (P>0.05).

and reflects free radical-mediated cell membrane damage (Ibrahim et al., 2008; Lykkesfeldt, 2007). No-preservative fats can be used to increase free radicals in the animal's body (Andrews et al., 2006). WAS is rich in polyphenolic compounds, having many antioxidant, and anti-inflammatory effects. It has been reported that the extracts of almond whole seed, including the brown skin, and green cover have a strong potential to inhibit free radicals (Siriwardhana and Shahidi, 2002). These activities may be related to the presence of flavonoids and other phenolic compounds in almonds (Ferreira et al., 2007).

Previous experimental studies have shown negative effects of linseed oil on total tract and forestomach OM, especially on fiber digestibility (Sutton et al,. 1983; Broudiscou et al., 1994), in sheep fed during maintenance receiving diet more than 50 g/kg of DM linseed oil. However, this is not consistent with results of Ueda et al. (2003) with a supplement of 30g/kg DM linseed oil in lactating cows, and Machmuller et al. (2000) who reported digestibility in steers and did not find any decrease in OM and NDF digestibility due to linseed supply. In this study, digestibilities of DM, OM, and CP were not affected by experimental diets, although the addition of WAS to diet led to an increase in EE digestibility. Similarly, adding 3% LSO to a hay-based diet of lactating cows (Ueda et al., 2003), 2.5% rolled or extruded linseed to diet of dairy cows (Doreau et al., 2009), 3% oil from linseed to diet of bulls (Sutter et al., 2000) and 2.5–4.8% oil from linseed to diet of lambs (Machmuller et al., 2000) and sheep (Wachira et al., 2000) did not affect nutrient digestibility. In the present study, an increase in EE digestibility in response to WAS might be due to better availability of FA in these sources as compared with those found in feed particles and microbial membranes (Bayourthe et al., 1993).An increase in the EE digestibility due to dietary fat was previously reported in lambs (Manso et al., 2006) and in dairy cattle (Weiss and Wyatt, 2004). It was suggested that the EE digestibility increased because digestibility of added fat was greater than that of the fatty acids in feed particles, and the endogenous fat losses were diluted by an increase in the dietary fat. Firkins et al., (2007) demonstrated that lipids may decrease both protozoal population in the rumen, and the rumen concentrations of cellulolytic bacteria (Jenkins and Palmquist, 1984). In their review, Devendra and Lewis (1974) reported that fat could depress cell wall degradation by four mechanisms: physical coating of fiber by lipids, shortage of cations (e.g. Ca) due to the formation of insoluble soaps, inhibition of the rumen microbial activity, and the modification of microbial population. The results of the present study revealed that dietary treatments could affect the fiber digestion in goats. Likewise, the amount of added oil is a major determinative factor of the negative effect of FA on nutrient digestibility (Doreau et al., 2009).The difference between studies might be partially due to composition of the basal diet (i.e., forage type), feeding strategy (i.e., maintenance vs. ad libitum), fat level, and type.

In concordance with the results of other studies, we observed no significant changes in C4:0 to C12:0 milk fat contents after WAS supplementation (Chilliard et al., 2003; Chilliard and Ferlay, 2004). However, Luna et al., (2008) reported that enzymes involved in pathways of de novo lipogenesis in goat mammary gland were less affected by lipid supplementation with polyunsaturated FA. Contrary to our results, feeding linseed oil (Nudda et al., 2006), and sunflower oil (Razzaghi et al., 2015) decreased the concentration of C16:0 and C16:1 in goat's milk fat. According to Mele et al. (2008), addition of 4% soybean oil to goat diet decreased the concentration of cis-C16:1 in milk fat. According to Chilliard et al., (2001), milk FA composition results from the production of FA by 2 distinct metabolic processes: de novo synthesis in the mammary gland of FA secreted in milk (40%) and extraction from the circulating plasma lipids (60%). It has been found that C4:0 to C12:0, most

of C14:0, and on average, 50% of C16:0 are produced by the de novo synthesis. All of C18 and longer-chain FA are extracted from blood (Givens and Shingfield, 2004; Palmquist and Griinari, 2006). In terms of human health, a decrease in C14:0 and C16:0 FA represents an improvement in the FA profile of milk because of the potential effects of the FA on cholesterol-raising activity (Kris-Etherton and Yu, 1997). Therefore, addition of WAS to the diet improved FA profile of milk for human consumption by reducing C14:0 and C16:0 content of milk fat, but this reduction was not significant. The content of C16:1 in milk originates from both de novo synthesis in the mammary gland and uptake of arterial blood (Nudda et al., 2006). The higher level of C16:1 in the treatment groups fed diets containing WAS was probably due to increased synthesis in the mammary gland because the index of Δ9-desaturase activity was higher in these groups. In the current study, C18:1, C18:2, and C18:3 in milk fat were significantly increased after supplementing the diet with WAS. Our results are in agreement with previous findings indicated that addition of oil source to diet of dairy goats (Modaresi et al., 2011; Razzaghi et al., 2015) increased concentrations of ruminic acid, punicic acid, and total CLA in milk fat. The high level of unsaturation in oil increases the value of oil for nutritional purposes (Kiani et al., 2015). It is well known that addition of vegetable oils to the diet of goats increases the concentration of trans-C18:1 FA in milk (Chilliard et al., 2003; Chilliard and Ferlay, 2004). Although the predominant biohydrogenation end-product of unsaturated FA in the rumen is stearic acid, several monounsaturated intermediates like vaccenic acid are often generated (Palmquist et al., 2005) and subsequently found in milk. C18:2 serve as precursors of C18:1 in the rumen (Nudda et al., 2006). C_9t_{11}CLA is produced in the rumen by anaerobic bacteria as an intermediate in biohydrogenation of linoleic acid and by desaturation of vaccenic acid (t_{11} C18:1) in the mammary gland via Δ9-desaturase (Bauman et al., 2001). According to Chilliard et al. (2003), the addition of either linseed oil or sunflower oil to the diet was significantly increased the concentrations of vaccenic acid and CLA in goat milk fat. Moreover, an increase in C18:1 in milk fat led to increased endogenous synthesis of the total CLA in the mammary gland (Modaresi et al., 2011); therefore,supplementation of WAS was also an effective means of increasing the concentration of CLA in milk fat of goats. Similarly, the addition of vegetable oils to the diet of dairy goats (Modaresi et al., 2011; Razzaghi et al., 2015; Emami et al., 2016) increased the concentration of C18:3n-3 FAs in milk. Dietary supplementation of WAS was significantly increased the concentrations of MUFA, PUFA, and the PUFA/SFA ratio as compared with the controls. Studies in sheep (Gallardo et al., 2015) and goats (Marin et al., 2011; Razzaghi et al., 2015) showed that diets containing herbal oil source were significantly increased the concentrations of MUFA and PUFA in milk. The stearoyl-CoA-desaturase index can be estimated as 16:1/16:0 or 18:1/18:0 and it has consistently been associated with metabolic complications (Vessby, 2003). The Δ9-desaturase index is an enzyme system which plays a key role in lipogenesis being responsible for Δ9-desaturation of methylene-interrupted fatty acyl-CoA substrates (Paton and Ntambi, 2009). In this study, the Δ9-desaturaseindex of C16:0 was increased after diet supplemented with WAS. Substantial increments in desaturase index of C16:0 have been associated with an increase in mammary palmitoyl-CoA desaturase mRNA abundance and activity (Bernard et al., 2009). Contrary to our results, the Δ9-desaturase index of C16:0 was decreased after feeding pomegranate seed pulp to dairy goats (Modaresi et al., 2011). Palmitic acid is synthesized de novo in the mammary gland, extracted from blood. Mosley and McGuire (2007) showed that 50% of the C16:1 cis-9 came from the Δ9-desaturation. Peterson et al. (2002) suggested that the variation in CLA content of milk fat among individuals was related to the rumen biohydrogenation and the Δ9-desaturase activity.

In the current study, the blood HDL increased, but no significant changes in other blood metabolites and MDA after WAS supplementation were observed. Modaresi et al. (2011) also found no effect on plasma glucose, triglyceride, HDL concentrations, or total cholesterol in dairy goat fed pomegranate seed pulp. Bernard et al. (2009), however, reported higher total plasma cholesterol in goats fed diets supplemented with sunflower seed oil or linseed oils. These differences could be attributed to the type of fat and FA composition in WAS and other fat sources.

Conclusion

The results of the present study suggested that, WAS could be used successfully as alternative to cereal grains and other sources of energy to dietary supplements. Supplementation of WAS at a level of 3 and 6% was an effective means of increasing concentrations of unsaturated FA, especially oleic, linoleic, CLA, linolenic, and PUFA in milk fat and plasms HDL.

References

Ackers, R.M., 2002. Lactation and the mammary gland. Iowa State Press, Ames, Iowa.

Andrade, P.V.D., Schmidely, P., 2006. Effect of duodenal infusion of trans10, cis12-CLA on milk performance and milk fatty acid profile in dairy goats fed high or low concentrate diet in combination with rolled canola seed. *Reproduction Nutrition Development* 46, 31-48.

Andrews, J., Vazquez-Anon, M., Bowman, G., 2006. Fat stability and preservation of fatty acids with AGRADO antioxidant in feed ingredients used in ruminant rations. *Journal of Dairy Science* 89, 60 (Abstract).

AOAC, 1990. Official Methods of Analysis. 15th Ed. *Association of Official Analytical Chemists*, Arlington, VA, USA.

Arslan, B., 2007. The determination of oil content and fatty acid composition of domestic and exotic safflower genotypes and their interaction. *Journal of Agronomy* 6, 415–420.

Badiei, A., Aliverdilou, A., Amanlou, H., Beheshti, M., Dirandeh, E., Masoumi, R., Moosakhani, F., Petit, H.V., 2014. Postpartum responses of dairy cows supplemented with n-3 fatty acids for different durations during the peripartal period. *Journal of Dairy Science* 97, 6391–6399.

Bauman, D.E., Griinari, J.M., 2001. Regulation and nutritional manipulation of milk fat: Low-fat milk syndrome. *Livestock Production Science* 70, 15–29.

Bauman, D.E., Lock, A.L., Corl, B.A., Ip, C., Salter, A.M., Parodi, P.W., 2006. Milk fatty acids and human health: Potential role of conjugated linoleic acid and trans fatty acids. In: Sejersen, K., Hvelplund, T., Nielsen, M.O. (Eds.) Ruminant Physiology: Digestion, Metabolism and Impact of Nutrition on Gene Expression, Immunology and Stress. Wageningen Academic Publishers, pp. 523- 555.

Bayourthe, C., Moncoulon, R., Vernay, M., 1993. Effect of protein protected fat on ruminal and total nutrient digestibility of sheep diets. *Journal of Animal Science* 71, 1026-1031.

Bernard, L., Bonnet, M., Leroux, C., Shingfield, K., Chilliard, Y., 2009. Effect of sunflower-seed oil and linseed oil on tissue lipid metabolism, gene expression, and milk fatty acid secretion in alpine goats fed maize silage–based diets. *Journal of Dairy Science* 92, 6083–6094.

Bouattour, M., Casals, R., Albanell, E., Such, X., Caja, G., 2008. Feeding soybean oil to dairy goats' increases conjugated linoleic acid in milk. *Journal of Dairy Science* 91, 2399–2407.

Broadhurst, R.B., Jones, W.T., 1978. Analysis of condensed tannins using acidified vanillin. *Journal of the Science of Food and Agriculture* 29, 788-94.

Broudiscou, L., Pochet, S., Poncet, C., 1994. Effect of linseed oil supplementation on feed degradation and microbial synthesis in the rumen of ciliate-free and refaunated sheep. *Animal Feed Science and Technology* 49,189-202.

Chen, C.Y., Lapsley, K., Blumberg, J., 2006. A nutrition and health perspective on almonds. *Journal of Science and Food Agriculture* 86, 2245–2250.

Chilliard, Y., Ferlay, A., Mansbridge, R.M., 2000. Ruminant milk fat plasticity: nutritional control of saturated, polyunsaturated, trans and conjugated fatty acids. *Annales de Zootechnie*, 49, 181-205.

Chilliard, Y., Ferlay, A., Doreau, M., 2001. Effect of different types of forages, animal fat or marine oils in cow's diet on milk fat secretion and composition, especially conjugated linoleic acid (CLA) and polyunsaturated fatty acids. *Livestock Production Science* 70, 31–48.

Chilliard, Y., Ferlay, A., Rouel, J., Lamberet, G., 2003. A review of nutritional and physiological factors affecting goat milk lipid synthesis and lipolysis. *Journal of Dairy Science* 86, 1751–1770.

Chilliard, Y., Ferlay, A., 2004. Dietary lipids and forages interactions on cow and goat milk fatty acid composition and sensory properties. *Reproduction Nutrition Development* 45, 467-492.

Chilliard, Y., Glasser, F., Ferlay, A., Bernard, L., Rouel, J., Doreau, M., 2007. Diet, rumen biohydrogenation and nutritional quality of cow and goat milk fat. *European Journal of Lipid Science and Technology* 109, 828–855.

Davis, P.A., Iwahashi, C.K., 2001. Whole almonds and almond fractions reduce aberrant crypt foci in a rat model of colon carcinogenesis. *Cancer Letters* 165, 27–33.

Devendra, C., Lewis, D.D., 1974. Fat in ruminant's diets: a review. *International Journal of Animal Science* 44, 917-938.

Dirandeh, E., Towhidi, A., Zeinoaldini, S., Ganjkhanlou, M., Ansari Pirsaraei, Z., Fouladi-Nashta, A., 2013. Effects of different polyunsaturated fatty acid supplementations during the postpartum periods of early lactating dairy cows on milk yield, metabolic responses, and reproductive performances. *Journal of Animal Science* 91,713–721.

Doreau, M., Laverroux, S., Normand, J., Chesneau, G., Glasser, F., 2009. Effect of linseed fed as rolled seeds, extruded seeds or oil on fatty acid rumen metabolism and intestinal digestibility in cows. *Lipids* 44, 53-62.

Drackley, J.K., Klusmeyer, T.H., Trusk, A.M., Clark, J.H., 1992. Infusion of long-chain fatty acids varying in saturation and chain length into the abomasum of lactating dairy cows. *Journal of Dairy Science*, 75, 1517-1526.

Emami, A., Fathi-Nasri, M.H., Ganjkhanlou, M., Rashidi, L., Zali, A., 2016. Effect of pomegranate seed oil as a source of conjugated linolenic acid on performance and milk fatty acid profile of dairy goats. *Livestock Science* 193, 1–7.

Ezeokonkwo, C.A., Dodson, W.L., 2004. The potential of *Terminalia catappa* (Tropical almond) seed as a source of dietary protein. *Journal of Food Quality* 27, 207-219.

FAOSTAT, 2013. Food and Agriculture Organization – FAO. Available at: http://faostat3.fao.org/faostat-gateway/go/to/browse/Q/QC/E [accessed Oct. 14, 2013].

Ferreira, I.C.F.R., Baptista, P., Vilas-Boas, M., Barros, L., 2007. Free-radical scavenging capacity and reducing power of wild edible mushrooms from northeast Portugal: Individual cap and stipe activity. *Food Chemistry* 100, 1511-1516.

Firkins, J.L., Yu, Z., Morrison, M., 2007. Ruminal nitrogen metabolism: perspectives for integration of microbiology and nutrition for dairy. *Journal of Dairy Science* 90, 1-16.

Gallardo, B., Manca, M., Mantecon, A., Nudda, A., Manso, T., 2015. Effects of linseed oil and natural or synthetic vitamin E supplementation in lactating ewes' diets on meat fatty acid profile and lipid oxidation from their milk fed lambs. *Meat Science* 102, 79–89.

Givens, D.I., Shingfield, K.J., 2004. Foods derived from animals: the impact of animal nutrition on their nutritive value and ability to sustain long term health. *Nutrition Bulletin* 29, 325–332.

Hanelt P., (IPK) Institute of Plant Genetics and Crop Plant Research (eds), 2001. Mansfeld's Encyclopedia of Agricultural and Horticultural Crops (Except Ornamentals). 1th ed. Springer Berlin Heidelberg, pp. 532.

Hyson, D.A., Schneeman, B.O., Davis, P.A., 2002. Almonds and almond oil have similar effects on plasma lipids and LDL oxidation in healthy men and women. *Journal of Nutrition* 132, 703–707.

Ibrahim, G., Abdulmumin, S., Musa, K.Y., Yaro, A.H., 2008. Anticonvulsant activities of crude flavonoid fraction of the stem bark of *Ficus sycomorus* (Moraceae). *Journal of Pharmacology and Toxicology* 3, 351-356.

Iranian Council of Animal Care, 1995. Guide to the Care and Use of Experimental Animals, Vol. 1. Isfahan University of Technology, Isfahan, Iran.

Jenkins, T.C., Palmquist, D.L., 1984. Effect of fatty acids or calcium soaps on rumen and total nutrient digestibility of dairy rations. *Journal of Dairy Science* 67, 978–986.

Kaur, C. Kapoor, H.C., 2002. Antioxidant activity and total phenolic content of some Asian vegetables. *International Journal of Food Science and Technology* 37, 153-161.

Kiani, S., Rajabpoor, S.H., Sorkheh, K., Ercisli, S., 2015. Evaluation of seed quality and oil parameters in native Iranian almond (*Prunus L.*) species. *Journal of Forestry Research* 26, 115–122.

Kris-Etherton, P.M., Yu, S., 1997. Individual fatty acid effects on plasma lipids and lipoproteins: human studies. *American Journal of Clinical Nutrition* 65, 1628–1644.

Li, X., Yan, C., Lee, H., Choi, C., Song, M., 2012. Influence of dietary plant oils on mammary lipogenic enzymes and the conjugated linoleic acid content of plasma and milk fat of lactating goats. *Animal Feed Science and Technology* 174, 26–35.

Luna, P., Bach, A., Juarez, M., dela-Fuente, M.A., 2008. Influence of diets rich in flax seed and sunflower oil on the fatty acid composition of ewes' milk fat especially on the level of conjugated linoleic acid, n-3 and n-6 fatty acids. *International Dairy Journal* 18, 99-107.

Lykkesfeldt, J., 2007. Malondialdehyde as biomarker of oxidative damage to lipids caused by smoking. *Clinica Chimica Acta* 380, 50–58.

Maguire, L.S., O'Sullivan, S.M., Galvin, K., O'Connor, T.P., O'Brien, N.M., 2004. Fatty acid profile, tocopherol, squalene and phytosterol content of walnuts, almonds, peanuts, hazelnuts and the macadamia nut. *International Journal of Food Science and Nutrition*, 55, 171–178.

Marin, A.M., Gomez-Cortes, P., Castro, A.G., Juarez, M., Alba, L.P., Hernandez, M.P., De la Fuente, M., 2011. Animal performance and milk fatty acid profile of dairy goats fed diets with different unsaturated plant oils. *Journal of Dairy Science* 94, 5359–5368.

Matsushita, M., Tazinafo, N.M., Padre, R.G., Oliveira, C.C., Souza, N.E., Visentainer, J.V., Macedo, F.A.F., Ribas, N.P., 2007. Fatty acid profile of milk from Saanen goats fed a diet enriched with three vegetable oils. *Small Ruminant Research* 72, 127–132.

Machmuller, A., Ossowski, D.A., Kreuzer, M., 2000. Comparative evaluation of the effects of coconut oil, oilseeds and crystalline fat on methane release, digestion and energy balance in lambs. *Animal Feed Science and Technology* 85, 41–60.

Manso, T., Castro, T., Mantecon, A.R., Jimeno, V., 2006. Effects of palm oil and calcium soaps of palm oil fatty acids in fattening diets on digestibility, performance and chemical body composition of lambs. *Animal Feed Science and Technology* 127, 175–186.

Mele, M., Serra, A., Buccioni, A., Conte, G., Pollicardo, A., Secchiari, P., 2008. Effect of soybean oil supplementation on milk fatty acid composition from Saanen goats fed diets with different forage: concentrate ratios. *Italian Journal of Animal Science* 7, 297–312.

Modaresi, J., Fathi-Nasri, M.H., Rashidi, L., Dayani, O., Kebreab, E., 2011. Effects of supplementation with pomegranate seed pulp on concentrations of conjugated linoleic acid and punicic acid in goat milk. *Journal of Dairy Science* 94, 4075–4080.

Mosley, E.E., McGuire, M.A., 2007. Methodology for the in vivo measurement of the Δ9- desaturation of myristic, palmitic, and stearic acids in lactating dairy cattle. *Lipids* 42, 939- 945.

NRC, 2007. Nutrient Requirements of Small Ruminants: Sheep, Goats, Cervids, and New World Camelids. National Academy Press, Washington, DC.

Nudda, A., Battacone, G., Usai, M.G., Fancellu, S., Pulina, G., 2006. Supplementation with extruded linseed cake affects concentrations of conjugated linoleic acid and vaccenic acid in goat milk. *Journal of Dairy Science* 89, 277–282.

Nwosu, F.O., Dosumu, O.O., Okocha, J.O.C., 2008. The potential of *Terminalia catappa* (Almond) and *Hyphaene thebaica* (Dum palm) fruits as raw materials for livestock feed. *African Journal of Biotechnology* 7, 4576-4580.

Palmquist, D.L., Weisbjerg, M.R., Hvelplund, T., 1993. Ruminal, intestinal, and total digestibility of nutrients in cows fed diets high in fat and undegradable protein. *Journal of Dairy Science* 76, 1353-1364.

Palmquist, D.L., Lock, A.L., Shingfield, K.J., 2005. Biosynthesis of conjugated linoleic acid in ruminants and humans. *Advances in Food and Nutrition Research* 50, 179-217.

Palmquist, D.L., Griinari, J.M., 2006. Milk fatty acid composition in response to reciprocal combinations of sunflower and fish oil in the diet. *Animal Feed Science and Technology* 131, 358–369.

Paton, C.M., Ntambi, J.M., 2009. Biochemical and physiological function of stearoyl-CoA desaturase. *American Journal of Physiology-Endocrinology and Metabolism* 297, 28–37.

Peterson, D.G., Baumgard, L.H., Bauman, D.E., 2002. Dose dependent reduction in milk fat secretion with abomasal infusion of trans-10, cis-12 conjugated linoleic acid (CLA) and comparison to diet-induced milk fat depression. *Journal of Dairy Science* 85, 1703.

Plaser, Z.A., Cushman, L.L., Johnson, B.C., 1966. Estimation of product of lipid peroxidation (malonyl dialdehyde) in biochemical systems. *Analytical Biochemistry* 16, 359−364.

Price, M.L., Van-Scoyoc, S., Butler, L.G., 1978. A critical evaluation of the vanillin reaction as an assay for tannin in sorghum grain. *Journal of Agricultural and Food Chemistry* 26, 1214-1218.

Razzaghi, A., Naserian, A., Valizadeh, R., Ebrahimi, S., Khorrami, B., Malekkhahi, M., Khiaosa-ard, R., 2015. Pomegranate seed pulp, pistachio hulls, and tomato pomace as replacement of wheat bran increased milk conjugated linoleic acid concentrations without adverse effects on ruminal fermentation and performance of Saanen dairy goats. *Animal Feed Science and Technology* 210, 46–55.

Sang, S., Cheng, X., Fu, H.Y., Shieh, D.E., Bai, N., Lapsley, K., Stark, R.E., Rosen, R.T., Ho, C. T., 2002. New type sesquiterpene lactone from almond hulls (*Prunus amygdalus* Batsch). *Tetrahedron Letters* 43, 2547–2549.

SAS Institute, 2005. SAS®/STAT Software, Release 6.08. SAS Institute, Inc., Cary, NC. USA.

Shahidi, F., Zhong, Y., Wijeratne, S.S.K., Ho, C.T., 2009. Almond and almond products: Nutraceutical components and health effects. In Alasalvar, C., Shahidi, F., (Eds.), Tree Nuts: Nutraceuticals, Phytochemicals, and Health Effects. CRC Press, Taylor & Francis Group, Boca Raton, FL, pp. 127–141.

Siriwardhana, S.S.K.W., Shahidi, F., 2002. Antiradical activity of extracts of almond and its by-products. *Journal of the American Oil Chemists' Society* 79, 903–908.

Siriwardhana, S.S.K.W., Amarowicz, R., Shahidi, F., 2006. Antioxidant activity of almonds and their by-products in food model systems. *Journal of American Oil Chemistry Society* 83, 223–230.

Strzalkowska, N., Bagnicka, E., Jozeik, A., Krzyzewski, J., 2008. Macro and microelements concentration in goat milk during lactation. *Zuchtungskunde* 80, 404-411.

Sutter, F., Casutt, M.M., Ossowski, D.A., Scheeder, M.R., Kreuzer, M., 2000. Comparative evaluation of rumen-protected fat, coconut oil and various oilseeds supplemented to fattening bulls. *Archiv für Tierernaehrung* 53, 1-23.

Sutton, J.D., Knoght, R., McAllan, A.B. Smith, R.H., 1983. Digestion and synthesis in the rumen of sheep given diets supplemented with free and protected oils. *British Journal of Nutrition* 49, 419-432.

Ueda, E.K.M., Goutb, P.W., Morgantia, L., 2003. Current and prospective applications of metal ion–protein binding. *Journal of Chromatography* 988, 1–23.

Van Soest, P.J., Robertson, J.B., Lewis, B.A., 1991. Methods for dietary fiber, neutral detergent fiber, and nonstarch polysaccharides in relation to animal nutrition. *Journal of Dairy Science* 74, 3583–3597.

Van Keulen, J.V., Young, B.A., 1977. Evaluation of acid insoluble ash as a natural marker in ruminant digestibility studies. *Journal of Animal Science* 44, 282-287.

Venkatachalam, M., Shridhar, K.S., 2006. Chemical composition of selected edible nut seeds. *Journal of Agriculture and Food Chemistry* 54, 4705–4714.

Vessby, B., 2003. Dietary fat, fatty acid composition in plasma and the metabolic syndrome. *Current Opinion in Lipidology*, 14, 15-19.

Wachira, A.M., Sinclair, L.A., Wilkinson, R.G., Hallett, K., Enser, M., Wood, J.D., 2000. Rumen biohydrogenation of n-3 polyunsaturated fatty acids and their effects on microbial efficiency and nutrient digestibility in sheep. *Journal of Agricultural Science* 135, 419-428.

Weiss, W.P., Wyatt, D.J., 2004. Digestible energy values of diets with different fat supplements fed to lactating dairy cows. *Journal of Dairy Science* 87, 1446-1454.

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ارزش غذایی دانه بادام وحشی (*Amygdalus scoparia*) و اثر آن بر عملکرد، ترکیب اسیدهای چرب شیر و فعالیت آنتی اکسیدانی در بزهای شیرده

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چکیده هدف از انجام این آزمایش برآورد ارزش غذایی دانه بادام وحشی و تاثیر آن بر عملکرد، ترکیب اسیدهای چرب شیر و فعالیت آنتی اکسیدانی در بزهای شیرده بود. شمار ۲۱ راس بز شیری که در میانه دوره شیردهی بودند، بر پایه یک طرح کاملا تصادفی به سه گروه دسته بندی شدند. جیره‌ها دارای ۳ سطح صفر، ۳ و ۶ درصد دانه بادام تلخ، و ۴۵ درصد علوفه و ۵۵ درصد کنسانتره بودند. چربی شیر و نسبت چربی به پروتئین شیر در بزهای تغذیه شده با جیره دارای ۶ درصد دانه بادام وحشی کمتر بود ($P\leq0.01$). گوارش پذیری ظاهری چربی خام در بزهای تغذیه شده با دانه بادام وحشی بیشتر بود. گوارش پذیری ظاهری فیبر نامحلول در شوینده خنثی و اسیدی با تغذیه جیره‌های دارای دانه بادام وحشی کاهش یافت ($P\leq0.05$). اسیدهای چرب C14: 1 و C18: 1 وهمچنین C16: 1، C18: 2، CLA و C18: 3 به طور معنی داری در تیمارهای تغذیه شده با دانه بادام وحشی بالاتر بود. فزون بر این، اسیدهای چرب دارای یک پیوند دوگانه، اسیدهای چرب دارای چند پیوند دوگانه و نسبت اسیدهای چرب دارای چند پیوند دوگانه به اسیدهای چرب اشباع در تیمارهای تغذیه شده با ۶ درصد دانه بادام وحشی بیشتر بود (به ترتیب ۲۷/۰۴، ۳/۹۴ و ۰/۰۵ در صد). شاخص غیر اشباعیت (Desaturase index) برای C16: 1 در تیمارهای تغذیه شده با دانه بادام وحشی بیشتر بود ($P\leq0.01$). همچنین غلظت HDL خون (۳۸/۱۴ تا ۳۹/۲۸ میلی گرم در دسی لیتر) در بزهای تغذیه شده با دانه بادام وحشی بالاتر بود ($P\leq0.05$). به طور کلی افزودن دانه بادام وحشی به جیره بزهای شیرده در سطح ۳ و ۶ درصد، روش موثری برای افزایش غلظت اسیدهای چرب غیر اشباع بویژه اولئیک، لینولئیک، CLA، لینولنیک و اسیدهای چرب دارای چند پیوند دوگانه در چربی شیر و افزایش HDL خون بزها بود.