RESEARCH OPINIONS IN ANIMAL & VETERINARY SCIENCES

ISSN 2221-1896 (PRINT) www.roavs.com ISSN 2223-0343 (ONLINE)

Effect of feeding urea treated wheat straw and formaldehyde treated barley grains on milk composition and some blood metabolites of Meriz does

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Abstract

The study was conducted to examine the effect of feeding urea straw and formaldehyde treated barley grains on milk composition and blood biochemistry in Meriz does. Fifteen does aged 4 years of matching body weights and same lactation stage were randomly divided into 3 equal groups. All the animals were fed a ration contained 80% concentrate + 20% wheat straw. For the control group the wheat straw was untreated; for the T1 and T2 groups, the wheat straw was treated with urea but T2 had half of the barley grains of the concentrate portion was treated with formaldehyde. Feeding urea treated straw increased significantly ($P<0.05$) milk yield. Fat and protein percentages increased significantly ($P<0.05$) in treatment T2 in comparison with control group. A significant increase was noted in the concentration of blood urea in does fed either urea treated straw or formaldehyde treated barley grains as compared to control. It can be concluded that feeding urea treated straw and formaldehyde treated barley grains to Meriz does improved milk production and milk components.

Keywords: Meriz Goats, Urea, Straw, Milk Composition, Blood Metabolites

Introduction

It is well known that straw is poor quality roughages because of its low contents of protein and energy and high content of fibrous fractions, cellulose and hemicelullose which are associated with lignin and make it unavailable for microbes of the rumen leading to decrease its digestibility (Perdock and Leng, 1991). Many techniques have been used to improve the nutritive value of cereal straw by physical (Sarnklong et al., 2010), chemical (Hamad et al., 2010) and biological (Hassan et al., 2011) treatments. Moreover, urea treatment is one of the most important chemical methods. The addition of urea can be absorbed into the cell wall and break down the bonds between lignin and other fibrous fractions. This process enables the microorganisms to ferment the structural carbohydrate easily thus enhancing its digestibility (Chenost and Kagouli, 1997; Lam et al., 2001; Selim et al., 2004).

It was reported that the rapid fermentation of barley starch in the rumen caused a depression in rumen pH, lowered fiber digestion, feed efficiency and milk fat percentage (Stone, 2004). It was also reported that treatment of barley grain with formaldehyde reduced protein and starch degradability (Ortega-Cerrella et al., 1999) and improved digestion (Cabrita et al., 2006; Al-Mallah, 2007). Saleh (2009) and Al-Dabagh (2010) observed high response in milk production and composition with increasing urea level in ewes fed ration containing formaldehyde treated barley.

The objective of the current study was to investigate the effect of feeding urea-treated straw as roughage and formaldehyde treated barley grains on milk yield composition and some blood biochemical parameters of Meriz Does.

Materials and Methods

Fifteen Meriz does in third week of lactation were divided into 3 groups (5 animals each) of matching average body weight (31.6±0.38 Kg). The does were allotted randomly to three dietary treatments and fed *ad libitum* 80% of the concentrate mixture (Table 1), plus 20% of wheat straw. The first diet treatment (control)

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Table 1: Ingredient percentages and chemical composition of the experimental diets

Items	Control (%)	T1 (%)	T2 (%)
Treated Barley	-	-	38
Untreated Barley	76	76	38
Soy bean meal	7.5	7.5	7.5
Wheat bran	15	15	15
Urea	0.5	0.5	0.5
Salt	0.5	0.5	0.5
Limestone	0.5	0.5	0.5
Chemical analysis %	Concentrate	Untreated straw	Treated straw
Dry matter	94.33	95.38	92.60
Organic matter	95.40	88.61	91.50
Crude protein	15.80	3.5	9.69
Crude fiber	3.35	32.09	31.94
Ash	4.60	11.39	8.5
Ether extract	2.65	0.64	0.66
Metabolizable energy Kcal/kg **	2591	1375	1375

*Determined according to A.O.A.C (2000); **Determined according to Al-Khawaja et al. (1978)

had untreated wheat straw, the second diet (T1) had the wheat straw treated with urea, in the third diet (T2) the wheat straw was also treated with urea in addition half of barley grains of the concentrate portion was treated with formaldehyde (Kassem et al., 1987). In addition, does were allowed to grazing for 3 hour daily.

Milk samples were obtained on daily basis by hand milking. Milk samples (40 ml) were collected from both sides of the udder per does and were analyzed for fat, protein, and lactose using EKO-MILK, Ultrasonic Milk Analyzers. Blood samples from each animal were collected via jugular vein before morning feeding three times at the mid and the end of the experiment and centrifuged at 3000 rpm to harvest blood serum which was stored at -20°C until analysis. Serum samples were analyzed for urea, total protein, albumin and glucose using analytical kits. The concentration values of urea (mg/dl), total protein (g/dl) and albumin (g/dl) were determined by spectrophotometer using commercial kits (BIOLAB SA, France, and Plasmatic Laboratory Product, Unit 29 Dreadnough Trading estate Bridport Dorest DT6 5BU, UK). Globulin (g/dl) values were determined by subtracting albumin values from total protein values.

The data were statistically analyzed using ANOVA (SAS, 2001) as in the following animal model:

$$Yij = \mu + Ti + ANj + eij$$

Where Yijk is the observed value of the trait; μ is the overall mean; Ti is the effect of the ith diet treatment; ANj is the random effect of the jth animal and eij the residual.

Results and Discussion

It appeared from the results presented in Table 2 that does fed urea treated wheat straw (T1) produced significantly (P<0.05) more milk per day compared to the control and T2 group. This finding could be due to the availability of more energy and protein resulted from the improved feed utilization (Walli, 2010). Although the three treatment groups had almost a similar amount of dry matter intake (Table 2) the treatments, however, increased the digestibility of the straw (Wayengo et al., 2004; Wanapat et al., 2009). The daily milk yield of T2 group does was lower than those of T1 might be the result of decreased barley degradation caused by formaldehyde treatment in T2. This could also be seen by their increased blood urea in this treatment compared to T1. Although, T1 and T2 treatments fed treated straw and their dry matter intake was similar, daily milk yield and feed conversion was lower in T2 group (Table 2). This result is in accordance with those reported by Djibrillou et al. (1998) in lactating goats and Mapato et al. (2010) in dairy cattle. However, Dosky, (2007), Saleh, (2009) and Al-Dabagh (2010) found that formaldehyde treated barley and wheat bran increased milk production in ewes.

Feeding urea treated straw and formaldehyde treated barley grains (T2) increased significantly (P<0.05) milk fat and milk protein compared to control and T1 (Table 2). Also, a non-significant increase of the percent of lactose was observed in T2 compared to control and T1. The high milk fat percentage of T2 does might be due to the improvement in the rumen pH and the acetic/propionic acid ratio resulted from the increase fiber digestibility (Al-Mallah, 2007). Whereas, the high milk protein percentage of the same group of does might be due to the high degree of rumen undegradable protein and available degradable protein (Kassem et al., 2005). It is in contrast to the finding of Al-Busadah (2008) who noticed a significant increase in milk constituents of Aradi goats fed urea treated straw. Moreover, several authors found that ewes fed formaldehyde treated barley resulted in a significant increase in milk fat and protein (Dosky, 2007; Saleh, 2009; Al-Dabagh, 2010).

Table 2: Daily milk yield and composition (means and standard error) of Meriz does fed the experimental diet treatments.

Over all mean	Feed conversion ratio (kg of feed/ kg of milk)	Dry matter intake (gm/day)	Daily milk yield (ml)	Milk composition %		
				Fat	Protein	Lactose
	-	-	509.92±15.01	3.52 ±0.07	4.88±0.06	4.53±0.02
Control	1.8±0.4	831±12.34	455.20±27.32^{b}	3.34 ± 0.14^{b}	4.69±0.07^{b}	4.49±0.01
T1	1.4±0.2	805±10.91	574.64±22.10^{a}	3.51 ± 0.11^{ab}	4.80±0.11^{b}	4.50±0.01
T2	1.6±0.2	807±9.88	499.92±23.38^{b}	3.70 ± 0.12^{a}	5.15±0.10^{a}	4.58±0.06

Control = group of does fed concentrate + untreated straw;;T1 = group of does fed concentrate + urea treated straw; T2 = group of does fed concentrate with formaldehyde treated barley grains + urea treated straw; ^{a,b}Means in the same column with different superscripts are significantly (P<0.05) different

Table 3: Some blood metabolites of Meriz does fed the experimental diets

Over all mean	Blood Biochemical				
	Urea (mg/100ml)	Total Protein (gm/100ml)	Albumin (gm/100ml)	Globulin (gm/100ml)	Glucose (mg/100ml)
	37.19 ± 0.79	8.27 ± 0.14	2.75 ± 0.03	5.52 ± 0.14	49.02 ± 0.89
Control	33.71 ± 0.86^{b}	8.51 ± 0.26	2.72 ± 0.05	5.78 ± 0.27	47.35 ± 1.69
T1	37.44 ± 1.34^{a}	8.16 ± 0.25	2.75 ± 0.04	5.41 ± 0.25	48.97 ± 1.44
T2	40.42 ± 1.29^{a}	8.14 ± 0.19	2.76 ± 0.04	5.38 ± 0.19	50.74 ± 1.46

Control = group of does fed concentrate + untreated straw; T1 = group of does fed concentrate + urea treated straw; T2 = group of does fed concentrate with formaldehyde treated barley grains + urea treated straw; Means on the same column with different superscripts are significantly (P<0.05) different.

With the exception of blood urea, the results of this study revealed that diet treatments had no significant (P<0.05) effect on total protein, albumin, globulin and glucose (Table 3). While an increase (11%) was noted in the concentration of urea in does fed urea treated straw as compared to control. Reduction of barley grains protein and starch degradation (T2) might have caused an increase of 8% in blood urea concentration compared to T1. This might be due to the reduction in starch degradability and energy available to the rumen microorganisms to utilize nitrogen causing an increase in ammonia absorption through the rumen wall and increase blood urea concentration. Helmer and Bartley (1971) observed that fiber was the least effective carbohydrate in promoting the use of ammonia released from urea and starch was the most effective. Similarly, Dutta et al. (2004) and Wanapat et al. (2009) found that feeding urea treated straw increased blood urea concentration in ruminants.

It can be concluded that the treated feed of Meriz does improved milk quality by increasing the percentages of fat and protein. The study also showed that blood urea concentration was also increased in the treated does.

Acknowledgment

We would like to thank prof. Dr. Jalal E. AlKass, School of Animal Production, Faculty of Agriculture and Forestry, University of Duhok for his valuable help in preparation of this manuscript.

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