Incorporation *Jatropha Curcas* Meal on Lambs Ration and It's Effect on Lambs Performance

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Absract: This study was conducted to determine the effect of heat (HJM), or biologically with lactobacillus bacteria (BJM), treatments of Jatropha ***curcas*** meal with on concentrate ion of anti-nutritive compounds. In order to replacement of costly imported soybean meal and find out their effects on rumen fermentation characteristics degradability and consequently lambs performance. Seven concentrate feed mixtures (CFM), contained soybean meal was replaced with untreated Jatropha meal (UJM) by 0%, JMU (CFM^0), 25% JMU (CFM^1), 50% JMU (CFM^2), or heated Jatropha meal (JMH) by 25% (CFM^3) and 50% JMH (CFM^4) or biological Jatropha meal (JMB) by 25% (CFM^5) and 50% JMI (CFM^6), were formulated to study their degradation kinetics in the rumen, concentration of anti-nutritive compounds and performance of lambs fed tested rations. Biological treated (BJM) was more effective in decreasing anti-nutritive compounds than heat treatment. These were reflecting on the degradation kinetics, where DM and OM and their effective degradability (ED) were higher in (BJM) than (HJM). No significant differences were detected for daily gain of lambs fed rations contained basel or that contained 50% BJM. Economic cash return was more profit for BJM ration than the basel ration. Under the conditions of the present experiment, could be concluded that the bacterial treated JCMB could be replaced up to 50% JMB with Soybean meal at CFM.
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Keywords: *Jatropha curcas* meal, biological treated heated treated, degradability and daily gain.

INTRODUCTION

In Egypt sheep and goats industry is the least developed compared to other livestock industries. Feeds costs in sheep production the highest cost of the production requirements and may account 70-80% of costs. Nutrition is an important factor in sheep development, and a variety of nutrients are involved in proper growth and reproductive maturation. On contrast, it is well known that in Egypt, there is a serious shortage in rations and many oil crops had by-product which represent a real problem. Jatropha is oil crops belonged to family was known for its toxicity. The toxicity of jatropha was related to contain anti- nutritional compounds, which can effect on animal performance. Several study found that addition of 5% detoxified of castor meal in the diet has not been caused adverse effects or nutritive problems on lactating dairy cows, beef cattle and sheep (Alexander, 2008). Moreover, these authors found that calves fed milk from test cows showed neither apparent muscle residue accumulation nor abnormality organs. The heat treatment in combination with the chemical treatment of sodium hydroxide and sodium hypochlorite has also been reported to decrease the anti- nutritional compounds level in jatropha to 75% (Hass and Mittelbach, 2000). Egypt was planted jatropha curcas in different areas (luxor, ismailia, suez and giza). The hectare is yield up to 5 tons seed given about 1.85 tons of oil in the year (El-Gamassy, 2008). The protein quality of the meal obtained from shelled jatropha seeds is high with 1-2% residual oil has a crude protein (cp) content of between 58–64%. The available information on the toxic principles of jatropha is very scanty with feeding. The purpose of this study to investigate the effect of heat or biological treatments on degrading anti-nutritional compounds and their effects on lamb's performance.

MATERIALS AND METHODS

The present study was carried out at el-sero experimental station, belonging to the Animal Production Research Institute, Agricultural Research Center.

Detoxification methods

Heat treatment:

Jatropha curcas meal sample which left after extraction of oil, was heated in boiling water for 15 min to inactivate the anti-nutritional.

Lactic acid bacteria (LAB) treatment:

Jatropha meal was treated with lactobacillus acidophilus, at rate of 1g/100kg JM, stored in plastic containers for 21 days at room temperature, then dried to reach about 6% moisture and was ground to pass a 2 mm screen.

Anti-nutritional compounds analysis:

Trypsin inhibitor activity was determined essentially in untreated and treated Jatropha meal samples, according to Smith et al., (1980). Analysis of Lectin content was conducted by haemagglutination assay described by Gordon and Marqardt (1974). Total saponin (triepennid and steroidal) content was determined using a spectrophotometric method described by Hiai et al., (1976). Phytate content was determined by a colorimetric procedure described by Vairtrash and Laptera (1988). Seven concentrate feed mixtures (CFM's) were formulated to be iso-nitrogenous iso-energetic, by replacing soybean meal contained in the concentrate feed mixture (CFM*), with 25 or 50% of untreated Jatropha meal UJM, for CFMU[1], CFMU[2], respectively. Mixtures of (CFM*), where soybean meal was replaced with 25, or 50% of heated HJM, for CFM[3], CFM[4] mixtures, respectively, or 25 or 50% of treated meal with lacto bacillus bacteria BJM, for CFM[5] or CFM[6] mixtures, respectively. Representative samples of different concentrate feed mixtures, were analyzed according to A.O.A.C, (`1999). Chemical composition of UJM and BJM are shown in Table (1).

Degradability of different nutrients

Nylon bags technique was applied to determine degradability of DM, OM and CP for CFM's as described by Orskov and McDonald (1979). The degradability kinetics of DM, OM and CP were estimated (in each bag) by fitting the disappearance values to be equation $P= a+b\ (I-e^{c})$ as proposed by Orskov and McDonald (1979), were P represents the disappearance after time I least squares estimated of soluble fractions are defined as the rapidly degraded fraction (a), slowly degraded fraction (b) and the rate of degradation (c). The effective degradability (ED) for tested rations was estimated from equation of McDounald (1981).

Feeding trial was conducted by using twenty male growing male lambs, (18.9 ±1.20kg and 5–6 months). Animal were divided into two similar groups (10 animals each). Feeding trials lasted 150 days and animals were fed according to NRC (1994). The control group (R1) received basel ration composed concentrate fed mixture (CFM)50% and fresh berseem (FB)40% and rice straw 10%, respectively. Meanwhile tested group (R2) received CFM where soybean meal was replaced by 50% of (BJM). Animals were weighed (biweekly). Economical evaluation was calculated for the tested rations according to the prevailing prices of feeds during the time of the experiment. The data were statistically analyzed to test the significant using one way analysis of variance according to SAS, 2004, and Duncan's multiple range test was applied to test significant among means (Duncan, 1955).

ESULTS AND DISCUSSION

Chemical analysis of untreated and treated Jatropha meal.

Treatment of JM with lactobacillus (Lac) was resulted in a decrease in CF content by about 18.8%, meanwhile other treatments had quite similar for CF content.

Table (1): Chemical composition (%) of Jatropha meal and anti-nutritional compounds.

Ingredients	Untreated	Treated	
	JM	HJM	BJM
Chemical Composition (%)			
OM	92.76	92.87	92.48
CP	40.83	40.07	43.60
CF	10.77	11.24	8.25
EE	9.45	10.33	9.21
NFE	31.71	31.13	31.92
Ash	7.24	7.13	7.52
Anti-nutritional compounds			
Trypsin inhibitor mg/g	23.30	8.84	4.20
Lectin mg/ml^{-1}	55.41	12.17	7.35
Phytate g/100g	6.50	3.40	2.75
Saponnin %	4.50	3.50	2.40

*JM :untreated Jatropha meal
*HJM : Treated Jatropha meal with heat
*BJM : Treated Jatropha meal with Bacteria

On the other hand CP content was increased by about 6.8%, while other treatment was resulted in a decrease in CP content by about 1.63% and 1.84% (with heat) (Table 1). Ash content was increased by about 4% with biological treatment. Data in Table (1), showed that both treatments had a positive effect on decreasing concentration of anti-nutritional compounds, which consider as inhibitors and negative had effect on animals appetite (Ahmed and Adam, 1979 and Hajos et al., 1995). Bacteria treatment with lactobacillus (LB) decreased concentration of Trypsin inhibitors and lectin by about 82% and 86.7%, respectively. Meanwhile, heat treatment decreased the concentration of Trypsin inhibitor and lectin by about 75.54% and 83%, respectively. These results are in agreement with Haas and Mittelbach (2000) and Harinder et al., (2008) who reported that heat treatment has a positive effect on reducing Trypsin inhibitor and lectin concentration in JCM. On the meantime, phytic acid concentration was decreased. Saponins concentration of JCM was less affected by different treatment methods, these results agreed with those of Rakshit et al., (2008) who have reported that saponins was the lowest anti-nutritional compound affected with different treatment methods. So, lactobacillus (LB) treatment had higher effect on reducing anti-nutritional compounds as compared with heat treatment, which had lower effect. On the meantime, Martinez-Herrera et al., (2008) and Belewu et al.,(2010) observed that biological treatment was more effective on decreasing anti-nutritional compounds than heat treatment.

Ruminal degradation kinetics contents (a,b and c) for DM, OM and CP of concentrate feed mixtures (CFM's) are presented in Table (2). It illustrated that washing loss fraction (a) degradable fraction (b) rate of degradation (c) and effective degradability (ED) of DM and OM were less (P<0.05) for untreated (UJM with 25% & 50%) levels as compared with the control mixture (CFM).

TABLE (2):Degradation kinetics of DM, OM and CP for experimental concentrate feed mixtures

Ingredients	Experienced concentrate feed mixtures							
	CFM^{0}	CFM^{1}	CFM^{2}	CFM^{3}	CFM^{4}	CFM^{5}	CFM^{6}	$\pm$
DM								
A	28.27^{a}	26.12^{b}	23.85^{c}	27.32^{a}	26.15^{ab}	28.13^{a}	27.32^{a}	1.07
B	55.28^{a}	52.15^{b}	49.82^{c}	54.42^{a}	53.48^{ab}	55.20^{a}	54.62^{ab}	1.36
C	0.045	0.042	0.038	0.041	0.038	0.040	0.038	0.004
EDDM	54.46^{a}	50.39^{b}	45.52^{c}	52.78^{ab}	50.16^{b}	53.84^{ab}	52.71^{b}	6.58
OM								
A	26.78^{a}	24.36^{b}	22.57^{c}	25.68^{a}	24.72^{b}	25.82^{a}	25.43^{a}	0.88
B	56.72^{a}	52.63^{b}	50.65^{c}	53.72^{b}	52.67^{b}	56.16^{a}	55.44^{a}	0.67
C	0.052	0.048	0.042	0.051	0.049	0.052	0.050	0.006
EDOM	56.90^{a}	52.21^{b}	47.74^{c}	53.72^{b}	52.67^{b}	56.24^{a}	54.94^{ab}	7.62
CP								
A	23.42^{a}	22.62^{ab}	21.53^{5}	23.18^{a}	22.92^{ab}	23.28^{a}	23.12^{a}	0.53
B	64.46^{a}	60.82^{b}	58.33^{b}	62.18^{ab}	60.18^{b}	64.32^{a}	63.63^{a}	0.65
C	0.054	0.051	0.046	0.053	0.052	0.054	0.053	0.005
EDCP	57.47^{a}	50.72^{b}	45.80^{c}	53.67^{ab}	52.35^{b}	55.83^{a}	54.68^{a}	1.43

A,b and c means in the same raw for each parameters with different superscripts are significantly different (P<0.05).

Also, washing loss fraction (a) degradable fraction (b) rate of degradation (c) and effective degradability (ED) of DM and OM were higher (P<0.05) for biological treatment as compared with untreated one. Lower soluble fraction (%) and rate of degradation were noticed with untreated JM ration for DM and OM degradation compared to the control. The treatment with bacteria increased DMD and OMD slightly higher than treatment with heat treatment. The decrease of degradability of CFMs containing untreated UJM may be due to the negative effect of Trypsin inhibitor and lectin on ruminal microorganisms. Ahmed and Adam (1979) and Rakshit et al., (2008) concluded that Trypsin inhibitor content of JM as well as other anti-nutritional compounds are affecting digestibility. The digestibility of CP for CFMs contained untreated UJM was lower than digestibility of CP for CFMs contained treated JM as a result to the high content of Trypsin inhibitor on UJM. On the mean time, the degradability of CP with bacteria treatment was higher than heat treatment, may be as a result to the over protection with heat treatment.

Average daily feed intake, daily gain and economic return for lambs fed experimental rations are shown in Table (3). There were no significant differences between experimental rations concerning the average daily feed intake. There were no significant differences between experimental rations among average daily gain. These results could be due to the positive effect of the biological treatment. These results are in agreement with Belewu, et al, (2010) who reported that treated Jatropha meal has not a negative effect on both daily gain and feed intake.

Results of economical evaluation are shown in Table (3). As a result of replacement 50% Soybean meal with BJM, the average daily feed cost in D2 was decreased by 17.24% than the control group. At the same time, both economic return and economic efficiency was improved by 4.11 and 19.32%, respectively for D2 as compared with control ration.

Under conditions of the present experiment, could be concluded that bacterial treated BJM could be replaced up to 50% of soybean meal in CFM without any adverse effect on lambs performance.

Table (3): Effect of experimental diets on feed intake, daily gain and economic efficiency

Items	Experimental Rations	
	R1	R2
No of animals	10	10
Days of Experiment	150	150
Av. Initial B.W. kg	19.10	18.70
Av. Final B.W. kg	49.5	48.5
Total B.W. gain kg	30.4	29.8
Av. Daily gain g	203	199
Av. feed intake g	1234	1206
Av. Daily Feed cost (LE)	1.45	1.20
Price of daily gain LE	5.10	5.00
Economic Return	3.65	3.80
Economic Efficiency	3.52	4.20

LE= Egyptian

a, b ,c Means in the same raw having different significantly differ ($P<0.05$)

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REFERENCES

1. Ahmed, O.M.M. and Adam, S.E.I (1979). Toxicity of jatropha curcas in sheep and goat. Res. Vt. Sci.,27:89-96
2. Association of Official Analytical Chemists. (1999) :Official Methods of Analysis .16th eds. Association of Official Analytical Chemists. Washington. DC.
3. Alexander, J. (2008). Ricinus communis EFSA Journal* Jatropha curcas of goat. Agric. Biol.B .J. N. Am., 1(2): 135-138.
4. Belewu, M. A., Belewu, K.Y and Ogunsola, F.O. (2010). Nutritive value of dietary fungi treated Jatropha curcas kernel cake: Voluntary intake.
5. growth and digestibility coefficient of goat. Agric. Biol. J. N. Am., 1(2): 135-138.
6. Duncan, D. B. (1955). Multiple Ranges and Multiple F-Test. Biometrics, 11: 1-42.
7. El- Gamassy, I. (2008). Improved wastewater reuse practices feasibility study on growing Jatropha utilizing treated wastewater in Luxor,Report No. 57, September 2008, Cairo, Egypt.
8. Gordan, I. and Marquard, K. (1974): Determination of lectin content by haemagglutination Analysis Academic :press, New York.
9. Haas, W. and Mittelbach, M. (2000). Detoxification experiments with seed oil from Jatropha curcas L. Inds. Crop Prod., 12, 111–118.
10. Hajos. G., Gelencser, E., Pasattai, A. Grant, G., Sakhri, M. and Barbacs, S. (1995). Biological effects and survival of trypsin inhibitors and agglutinin from soybean in the small intestine of the rate. I. Agric. Food Chem. 43:165:170.
11. Harinder, P. S., Makkar, G. F. and Klaus, B. (2008). Protein concentrate from Jatropha curcas screw-pressed seed cake and toxic and antinutritional factors in protein concentrate. J. Sci. Food Agric. 88:1542–1548.
12. Hiai, K. Ferrel, R.E. and Muck, P. J.(1976). A method for saponin determination in Jatropha curcas. Cereai Chem, 46:312.
13. Martı´nez-Herrera, J., Siddhuraju, P., Francis, G., Da´vila-Ortı´z,G. and Becker, K. (2008). Chemical composition, toxic/antimetabolic constituents, and effects of different treatments on their levels, in four provenances of Jatropha curcas L. from Mexico. Food Chemistry 96: 80-89.
14. McDonald, I. (1981). A revised model for estimation of protein degradability in the rumen. J. Agric. Sci. Camb., 96:251
15. NRC. (1994). National Research Council, Nutrients Requirements of sheep National and Academy Press 17th.
16. Orskov, E.R. and McDonald I. (1979). The estimation of protein degradability in the rumen from incubation measurements weighed according to rate of passage. J. Agric. Sci. Camb., 92:499.
17. Rakshit, K.D., Darukeshwara, J., Rathina Raj,K., Narasimhamurthy, K., Saibaba, P. and Bhagya, S. (2008). Toxicity studies of detoxified Jatropha meal (Jatropha curcas) in rats. Food Chem Toxicol:46(12): 3621-3625.
18. SAS (2004). SAS/STAT, User's Guide Version 6. Statistical Analysis System institute Inc. Cary North USA
19. Smith, C., VanMegen, W., Twaalhoven L. and Hitckcock, C. (1980). The determination of trypsin inhibitor levels in foodstuffs. J. Sci., Food Agric. 3:341-350.
20. Vairtrash, L. A. and Laptera, N. A. (1988). Colorimetric determination of phytate in unpurified extracts of seeds and the products of their processing. Anal Biochem., 175:227-230.

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