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Effect of pre- soaking of straw with water for different durations on the performance of Awassi lambs

K. Khazaal[1], K. Houcheymi[2], E. Abdallah[1], J. Abou Rjayli[1] and A. Harris[1]

[1]Faculty of Agriculture and Veterinary Science, Lebanese University, Beirut (Lebanon)
[2]Lebanese Agricultural Research Institute (LARI), Terbol, Bikaa (Lebanon)

Abstract. The experiment investigated the effect of pre soaking of straw with equal weight (1:1) of tap water for short durations (i.e. 12 (W12), 18 (W18) or 24 hr (W24)) on the performance of Awassi lambs (DM intake, LWG and feed conversion). Animals were divided into groups of 6 and fed as groups receiving equal amounts of concentrates (2.4 kg/group or 400 g/animal) (13.47 ME and 174.75 CP per Kg DM). Straw was given *ad libitum* (10% in excess of previous day intake) either untreated (Cont) or according to treatments. Daily intake and refusals of straw were recorded for each group. LWG was determined weekly. The daily DM intake was higher (P<0.05) (i.e.W12 (0.64 kg/d), W18 (0.66 kg/d) and W24 (0.71 kg/d)) as compared to Cont. (0.58 kg/d). However, the observed differences in average daily improvement in LWG (Cont. 107 g; W12 127 g; W18 143 g; W24 126 g) was not significant (P>0.05) as compared to control. Due to the improvement in daily intake and LWG, water soaking reduced the cost of LWG and this was most obvious for the W18 group. It was concluded that pre soaking of straw with ordinary tap water for a short duration (12 up to 18 hr) for 24 hr can have a positive effect on the straw intake and LWG. The technique is cheap and simple to apply with no apparent risk on the health of animals.

Keywords. Awassi lambs – Intake – LWG – Feed conversion – Straw – Water soaking.

L'éffet du pre-trempage de la paille avec de l'eau à différentes durations sur le rendemment des moutons Awassi

Résumé. *L'effet du pré trempage de la paille avec de l'eau ordinaire (1:1) pendant 12, 18, et 24 h sur l'ingestion de la matière sèche, le gain de poids vif (GMQ) et l'indice de consommation a été évalué sur 24 agneaux de race Awassi (24,9 ± 2,9 kg). Ces animaux ont été répartis en trois groupes égaux. Ces trois groupes ont reçu la même quantité de concentré (2,4 kg / groupe ou 400 g/ animal) (13,47 énergie métabolisable en MJ/kg MS, matières azotées totales (MAT) 175 g/kg MS) alors que la paille a été distribuée* ad libitum *(10% de refus), non trempée pour le groupe témoin (Cont), ou pré trempée pendant 12 h (W 12), 18 h (W18), ou 24 h (W 24). La consommation quotidienne ainsi que les refus de paille ont été enregistrés pour chaque groupe. Les animaux ont été pesés chaque semaine pour déterminer leurs GMQ. Les résultats ont montré une augmentation significative (P < 0,05) de la consommation alimentaire des groupes recevant la paille pré trempée (W12, W18 et W24) par comparaison au groupe témoin. Cependant, l'amélioration du GMQ (témoin 107 g ; W12 127 g ; W18 143 g ; W24 126 g) n'est pas significative (P>0,05). En raison de l'augmentation de la consommation alimentaire et du GMQ, le pré trempage de la paille a réduit le coût de production (gain de poids vif) surtout pour le groupe W18. Il s'agit d'une technique simple, non coûteuse, et sans risque sur la santé des animaux.*

Mots-clés. *Agneaux Awassi – Consommation alimentaire – Gain de poids vif – Indice de consommation – Paille pré trempée.*

I – Introduction

In Lebanon, and many developing countries population growth coupled with limited resources (agricultural land, water) have resulted in a large deficit in the national production of red meat and milk from ruminants. This deficit is mostly due to the shortage and high cost of high quality roughages such as hay and silages (Khazaal *et al*., 2001). As a result, most ruminant farmers depend to a large extent on cereal straws as the main source of forage and also on the extensive use of imported expensive concentrates to obtain moderate level of production. Furthermore, due to the expected increases in population and demands on animal protein, cereal straw is likely to play an increasingly important role as major source of roughages for ruminants in future. However, utilization and digestibility of cereal straws by ruminants are known to be low due to their low content of metabolizable energy (ME), crude protein (CP) and high content of lignified fiber.

As a result, several research studies with different approaches have been carried out to develop applicable and non-expensive techniques to improve the utilization of straw by ruminants. Chemical treatments namely sodium hydroxide, ammonia/ urea treatments were widely researched and applied. Such treatments improved digestion and intake and increased microbial activity resulting in improved live weight gain (LWG), milk production and feed conversion. However, adaptation of chemical treatments by farmers has varied from country to another (Makkar, 2011). In Lebanon and many developing countries, chemical treatments are still unfamiliar to farmers who rely heavily on cereal straws as the major source of roughage for their animals.

Additionally, unlike fresh or good quality roughages, when lignified cereal straws are fed, rumen microbes take a longer time (lag phase) to colonize the particles and begin the actual digestion of straw fiber (Orskov *et al.*, 1988). This initial process is believed to take several hours with lignified by-products.

Although water pre-soaking or hydrating of forages has been practiced by some farmers in India and Lebanon, the number of research studies is still very limited. The data available on the effects of water pre-soaking or hydration of animal feeds is contradicting (Chaturvedi *et al*., 1973; Devendra, 1983; Ndlovu and Manyame, 1987; Badurdeen *et al*., 1998). Theoretically, pre-soaking of straw should speed the process of colonization of the feed particles by the rumen microbes and enhance the process of digestion.

The present study aims to investigate the effect of pre- soaking of straw with equal weight of water for 12, 18 or 24 hr on the performance (intake, live weight gain LWG and feed conversion) of growing Awassi lambs.

II – Materials and methods

Twenty-four Awassi lambs (females and males) (average weight 24.9 ± 2.9 kg) were randomly divided into 4 similar groups (4 females and 2 males in each group) and allocated into 4 separated pens. During adaptation period (35 days) the groups were given the same ration which was composed of equal amounts of concentrates (400 g/head) as supplement in addition to *ad libitum* of straw. The feeds were offered in two meals. During the experimental period (49 days) the animals were fed 400 g of concentrate per head per day (as in adaptation phase). The untreated (control) or the water treated straw was offered in a separate feeder *ad libitum* (10% in excess of previous day straw intake). The treated straw was pre-soaked with 1:1 weight of tap water for either 12 hr W12, or 18 hr (W18) or 24 hr (W24). Daily refusals of straw were collected and weighed before offering the next morning meal. DM of refusals was determined daily. Subsamples of the refusals were dried and stored for further chemical analysis. The ME and CP content of concentrate were estimated according to AFRC (1993). The ME of straw was also estimated according to AFRC

(1993). Crude Protein CP and crude fiber were determined according to AOAC (2000). Daily DM intake of straw was determined per group and animal. Live weight gain (LWG) was determined weekly. The effects of treatments over the experimental period were analyzed using ANOVA.

III – Results and discussion

1. Composition of diet

The nutritive components of the concentrate mix were calculated according to AFRC (1993) and were assumed to provide 13.47 MJ/kg DM of ME and 174.5 g/kg DM of CP. Thus, at a level 400 g/day /animal this meant that daily concentrate was providing 5.39 MJ of ME and 69.9 g of CP which should cover the maintenance requirement of the animals and also the nutritive requirement of the rumen microbes. For straw, the low ME (7.4 MJ/kg DM and CP 48 g/kg DM) content will not provide alone the maintenance requirement to the animal and the rumen microbes.

2. Intake

As animals in all groups were given the same quantity of concentrate, so any effect on the treatment of straw would be basically reflected in the daily or weekly intake of straw. As shown in Fig. 1, there was a significant increase ($P<0.05$) in daily intake of the water treated groups (i.e.W12, W18 and W24) when compared to the Control group. The highest increase was for the W18 group (from 0.54 kg DM/animal/day to 0.66 kg DM/animal/day) and lowest increase for the Control group (from 0.54 kg DM/animal/day to 0.58 kg/animal/day). These findings on intake are in line with those obtained by Chatuverdi *et al* (1973) who used soaked wheat straw and Ndlovu and Manyame (1987) who soaked 1 kg maize stover with 1.5 l water for 24 hr prior to feeding.

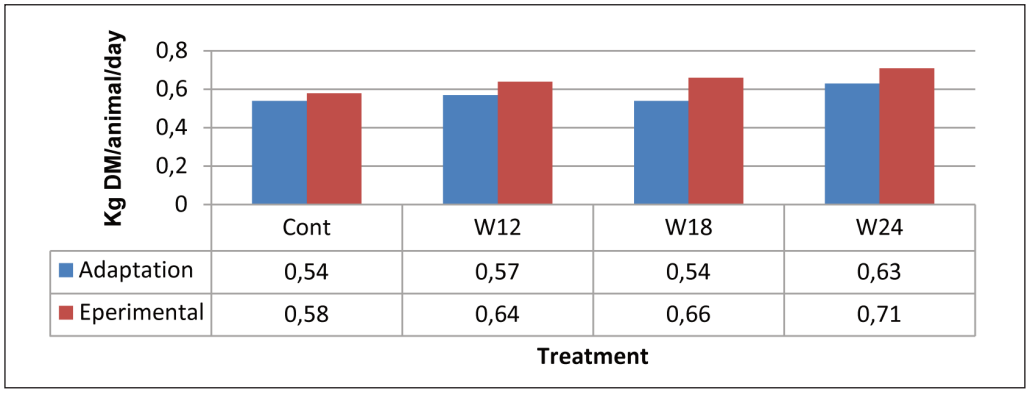

Fig. 1. Average daily DM intake of straw per animal (kg DM/animal/day).

However, the results are in disagreement with Devendra (1983) who reported negative effects on intake and digestion of wetted rice straw by sheep and also Abou Rjeily (2012) who reported a slight improvement in intake ($P>0.05$) after 24 hr soaking. Ndlovu and Manyame (1987) also reported that soaking did not affect ($P>0.05$) the apparent DM digestibility and rumen digestion kinetics. In the present study DM digestibility was not measured as animals were fed as groups. This discrepancy in research results may be due to differences in species of animals and the type of forages used.

3. Live weight gain

During the adaptation period (35 days), the variation between the groups slightly increased. Further examination of the results showed that all groups that were fed water pre soaked straw achieved higher LWG than the control group.

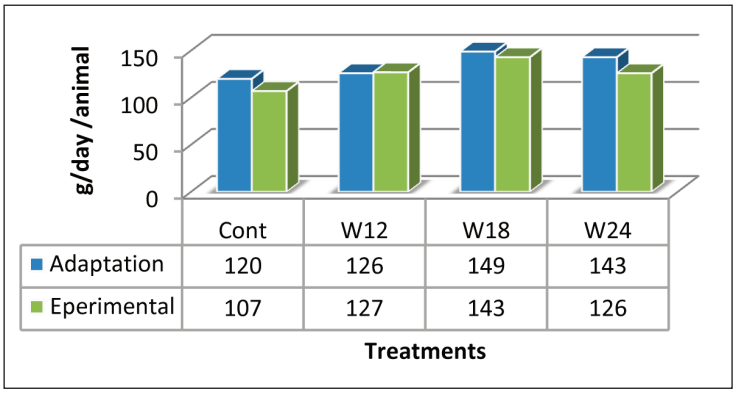

Fig. 2. The average daily live weight gain LWG during the adaptation and experimental periods.

However, this increase in LWG was not significant (P>0.05). As shown in Fig. 2, the highest LWG was achieved by the W18 group (143 g/animal/day during the experimental period). These results might be explained by the fact that as the lambs were growing, their maintenance requirements were also increasing. However, as concentrate was fed equally to all groups, any improvement in LWG must have been due to the increased and/or improved utilization of soaked straw.

Additionally, when comparing weekly performance of individual animals within groups it was noticed that some animals turned a few days from a positive LWG to a negative or zero LWG. The occurrence of such cases was higher in the water treated straw (Table 1) and was highest for the W24 group. This might indicate some risk of the proliferation of unknown microorganisms on the soaked substrate. This may have contributed to the large variation of daily LWG differences observed during the experiment (from 143 g/day/animal to 126 g/day/animal). However, from the performance of animals, it was still possible to say that in general, the health of animals was good except for some animals that had diarrhea and foot infection and which recovered after appropriate treatments.

Table 1. Cases of still or negative LWG during the experiment amongst the groups during the experiment

Treatment	Cases of still or lose weight
Cont	8
W12	9
W18	10
W24	13

4. Feed conversion rate

The feed conversion was lower (i.e. requiring more nutrient) with the experimental phase as compared to the adaptation period. This is simply due to the increase of maintenance requirement for the animals as they increased in age and weight. The control group was the least efficient requiring 8.55 kg of feed/kg LWG whereas the W12 and W18 groups were most efficient requiring 7.97 and 6.99 kg feed/kg LWG.

IV – Conclusion

Pre soaking of straw with ordinary tap water for a short duration (12 to 18 hr) can have an overall positive effect on the straw intake and feed conversion. The technique is simple to apply and cheap with no apparent risk on the health of animals.

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References

Abou Rjeily J., 2012. *Effect of pre-soaking of straw with water on the performance of Awassi lambs*. MSc Thesis. Faculty of Agricultural and Veterinary Sciences. Lebanese university, Beirut, Lebanon.

AFRC, 1993. *Energy and Protein Requirements of Ruminants*. An advisory manual prepared by the AFRC Technical Committee on Responses to Nutrients. CAB INTERNATIONAL, Wallingford, UK.

AOAC, 2000. *American official method of analytical chemistry*. 17th edition, Gaithersburg, M., USA.

Badurdeen A.L., Ibrahim M.N.M. and Schiere J.B., 1998. Methods to improve utilization of rice straw effects of moistening, sodium chloride and chopping on intake and digestibility. P.5. Department of Animal science, University of Peradeniya, Peradeniya, Sri Lanka.

Chatuverdi M.L., Singh U.B. and Ranjham S.K., 1973. Effect of feeding water-soaked and dry wheat straw on feed intake, digestibility of nutrients and VFA production in growing zebu and buffalo calves. *Journal of Agricultural Science*, Cambridge, 80, p. 393-397.

Devendra C., 1983. Physical treatments of rice straw for goats and sheep and the response to substitution with variable levels of cassava, leucaena and gliciridia forages. In *MARDI, Research Bulletin*, 11(3), p. 372-290.

Khazaal K., Houcheimi K. and Mashlab H., 2001. The nutritive value of available varieties of barley straw in Lebanon: effects of feeding barley straw of three varieties on liveweight gain in Awassi lambs. In: Ben Salem H. , Nefzaoui A. and Morand-Fehr P. (eds), Nutrition and feeding strategies of sheep and goats under harsh climates. Proceedings of the 9th Seminar of the FAO – CIHEAM Sub-network on Sheep and Goat Nutrition, Tunisia. November 8-10,2001. *Options Méditerranéennes*, Series A, no. 59, p. 243-248.

Makkar P.S., 2011. Successes and failures with animal nutrition practices and technologies in developing countries. Proceedings of the FAO electronic conference, 1-30 September 2010, Rome Italy. *FAO Animal Production and Health Proceedings*, No 11. Rome, Italy.

Ndlovu L.R. and Manyame Z., 1987. Hydration as a mean of improving utilization of maize stover fed to steers. In: *African Forage Plant Genetic Resources, Evalulation of Forage Germplasm and extensive livestock production systems*. Proceedings of the 3rd workshop held at the International Conference Centre, Arusha, Tanzania, 27-30 April 1987. International Livestock Centre for Africa, Zimbabwe.

Orskov E.R., Reid G.W. and Kay M., 1988. Prediction of intake by cattle from degradation characteristics of roughages. *Animal production*, 46, p. 29-34.