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THE INFLUENCE OF PARTIAL REPLACEMENT OF CONCENTRATE MIXTURE BY DRIED SUGAR FILTER CAKE BY- PRODUCT ON CONCENTRATIONS OF SOME TRACE ELEMENTS AND SOME WOOL CHARACTERISTICS IN GROWING LAMBS.

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ABSTRACT

A total number of 21 growing lambs rearing in Mallawy Research Station with an average of 4-5 months old and 17.30 kg. body weight an average were used in this study. Lambs were assigned randomly to three diets for 100 days. The experimental diets were manipulated to replace the concentrate feed mixture (CFM) by 0, 20, and 40 % of dried filter cake, DFC for treatments (D1, D2 and D3) respectively. The control diet (D1) was composed of CFM, berseem hay and wheat straw, whereas in the other 2 diets (D2 and D3), 20 % and 40 % of CM were replaced by DFC, respectively. At the end of the experiment blood samples were taken from each lamb and analyzed for estimation of metal content (Iron, Fe; copper, Cu, zinc, Zn; manganese, Mn; nickel, Ni; cadmium, Cd; chromium, Cr and lead, Pb) by using atomic absorption spectrophotometer. As well as physical measurements of the wool for its characteristics (greasy & clean fleece weight, stable length, fiber length and diameter) were studied. The obtained results revealed that addition of DFC to the rations did not significantly alter the concentrations of Fe, Cu, Zn, Mn, Ni, Cd, Cr, and Pb, except a significant effect ($p<0.05$) between D2 and D3 treatments in nickel concentrations. The corresponding figures for wool measurements also, were not significant.
Keywords: Sheep, dried sugar filter cake, trace elements, wool characteristics.

INTRODUCTION

Disposal of organic wastes as filter mud has become a serious problem facing all communities. In Egypt, tremendous amounts of sugar industry by -products as filter mud cake (500000 tons) accumulated yearly in the nearby of sugar cane factories, which represent an acute source of pollution for the environment (Hassanien, 1999). The produced amount of filter mud cake represents 3 - 4% of the manufactured cane (Vimal and Kale, 1982 and Hassanien, 1999).

The economical value of the filter mud is to be used as a soil conditioner or manure, which needs reevaluation under the Egyptian agricultural circumstances to prevent environmental pollution. In most cane sugar producing countries, several thousand tones of plant protein, rich in organic matter and containing also variable amounts of plant nutrients that were being dumped in the fields in the form of filter mud. The cake contains much of the colloidal organic matter that precipitate during clarification This led to suggest direct utilization of dried filter mud as an animal (oxen and sheep) feed (Parish, 1962 Staub and Darné, 1965 and Paturau, 1989).

This investigation was carried out in order to clarify the effect of feeding with dried filter cake (DFC) offered to the growing local Frafra lambs at different rates on some blood microelements and some wool characteristics.

MATERIALS AND METHODS

The present study was carried out at Mallawy Breeding Station, (El-Menia Governorate). Animal Production Research Institute, Agricultural Research Center during 1999 and 2000. Twenty-one growing Frafra lambs, aging about 4-5 months old and 17.3 kg. average body weight were used to study the effect of adding DFC on some blood minerals and wool characters. Lambs were divided into three similar groups with respect to their age and body weights (7 animals each).

The three groups were assigned at random to receive one of the three following experimental diets, group D_1 received concentrate feed mixture (CM), berseem hay (BH) and wheat straw (WS) as a control diet, whereas the second and third groups received the same control diet but CFM was replaced by 20 % or 40 % of DFC for D_2 and D_3 groups, respectively. All the experimental animals were group fed on CM with or without DFC supplementation with restricted amount of BH and WS *ad libitum*. The feeding requirement was calculated according to NRC (1992) recommendation for growing lambs and the experimental period lasted for 100 days. The drinking water was offered twice daily at 9 a.m. and 3 p.m.

At the end of the feeding trial; blood samples were collected from each experimental lamb (21 animals) from the jugular vein before the morning diet The blood samples were kept at icebox and immediately transported to the laboratory then kept at 4 °C for 6 -12 h. After centrifugation (at 3000 rpm for 20 min.), serum samples were transferred to labeled vials and maintained at - 20 °C. Before determining the concentration of some serum metal content (Iron, Fe; copper, Cu; zinc, Zn; manganese, Mn; nickel, Ni; cadmium, Cd; chromium, Cr and lead, Pb) using atomic absorption spectrophotometer (GBC 300 AA), samples of serum, 1 ml each were digested using the sulfuric acid and hydrogen peroxide method (Parkinson and Allen, 1975) for metal analysis. As well as some physical characteristics of wool were recorded (greasy & % clean weight GFW, % CW, stable length SL, fiber length, FL and diameter, FD) where wool was taken from four lambs in each treatment.

At the end of the experiment, GFW for each animal was recorded at shearing and SL was measured to the nearest 0.5-cm in the three right- body - positions (neck, mid side and leg).

Samples of about 10 % from the shearing wool were collected from each animal, then send to analysis for FL, FD and % CW. Analysis of wool samples was done in the laboratory of Sakha Animal Production Research Station, Animal Production Research Institute, Ministry of Agriculture. Fibre length was measured to the nearest 2 mm using the Wool Industrial Research Association (W. I. R. A.) and according to International Wool

Textile Organization (I.W.T.O., 1952). Fibre diameter was measured in microns (μm) by a lanameter according to I. W. T. O. (1961).
Fleeces were soured using the normal soapsuds scouring process (Chapman, 1960), dried at 105° in a ventilated oven and the yield percentage on a stander basis was estimated (A. S. T. M., 1978).

Results were statistically analyzed using SAS (1987) applying the General Linear Models (GLM) producer. Statistical significant for the main effects was declared at ($p<0.05$) by using Duncan's New Multiple Range Test (1955).

RESULTS AND DISCUSSION

Serum minerals:

Data presented in Table (1) revealed that the addition of DFC at 20 and 40 % tended to induce insignificant increase in most of the minerals studied such as Fe, Cu, Mn, Zn, Cd and Pb. The increase of serum Fe, Cu, Mn and Zn concentrations in DFC diets may be due to that these diets contain such elements, where chemical constituents of the used DFC in the present study were 479, 82, 114, 221, 3, 0.50, 11 and 76 ppm. for Fe, Cu, Zn, Mn, Ni, Cd, Cr, and Pb, respectively. However, the chemical composition of another DFC was 2240, 239, 151 and 340 ppm, for Fe, Cu, Zn and Mn respectively (Arafat *et al.,* 1992). Variations may be due to nutrition differences.

Iron level was 2 folds or more in DFC diets than the control one (27.63, 31.99 vs. 13.98 ppm, Table 1).

The present results of Cu concentrations revealed higher levels than reported by Underwood (1971) who stated that, for sheep the normal range of Cu concentrations in the whole blood or plasma of healthy animals was 0.8 - 1.5 μg/ ml. Variations may be due to nutrition, age, breed, and environment or location differences.

Zinc concentration was slightly lower in D1 diet than both equal levels of D2 and D3 diets (Table 1). Zinc is relatively nontoxic to mammals and sheep exhibit considerable tolerance to high intakes of zinc (Underwood, 1971).

On the other hand, Ni concentration was significantly ($p< 0.05$) higher in D2 group compared with D3 group. These variations among the three groups may attributed to the individual variations that existed in Ni concentrations, where the range of Ni levels was 0.00 – 1.65, 0.00 – 4.60 and 0.00 – 1.20 ppm. in D1, D2 and D3, respectively. Atomic absorption spectrophotometer device was unable to detect any nickel content in some samples. Two lambs out of 7 in D2 group had higher values than average mean and two animals out of 7 in both D1 and D2 had zero levels of Ni concentrations, while 4 lambs out of 7 in D3 group had zero levels. Similarly Underwood (1971) found that the level of Ni in blood plasma had been investigated by several investigators with unusually uniform results, the levels reported were 0.01-0.06, mean; 0.04; 0.01 - 0.09, mean 0.03; 0.00-0.18, mean 0.02 and 0.00 - 0.27, mean 0.06 μg Ni/g blood. Underwood (1971) showed that although, blood analysis provides the most accurate assessment of the uptake of key macro & trace elements, but does not allude to the reason for their abundance or scarcity. He added that, Ni behaves like an essential trace metal because it is nontoxic to mammals orally, activates several enzyme systems; it is present in RNA and plays a role in pigmentation. Nickel like Zn, Mn and Cr is nontoxic and that Ni contamination does not present a serious health problems.

The insignificant increase of Cd in D3 group than both similar D1 and D2 groups (Table 1) is difficult to explain since little information is available on the normal Cd content of animal tissues.

Chromium concentration reverses the behavior of the other minerals where the concentrations lowered with increasing DFC percentage in the diet. This may be due to that replacing processes with DFC lowered the proportion of concentrates and hence cereal grains in D2 or D3 diets compared with the D1 group that fed with diets contained 100 % CM, which in turn decreased Cr concentrations, or may be due to the industrial process of sugar cane, and hence DFC decrease Cr concentrations. In this respect, Underwood (1971) illustrated that, Cr resembles most trace elements in being concentrated in the branny layers and gerrn of cereal grains as well as Cr may be lost in the process of sugar refining so that white sugar contain very little, compared with the amounts in brown or raw sugar. He added that, Cr has a low order of toxicity because of wide margin of safety exists between the amounts ordinarily ingested and those likely to induce deleterious effects.

The increase of Pb with increasing DFC percentage in the diets may come in the same order like Cd. In this regard Sharkawy (1991) attributed the elevation of Pb and Cd in blood samples of cattle to foodstuffs or drinking water and/ or exists in the breathing air.

Data illustrated in Table 1 indicated the similarity of increasing both Fe and Pb with increasing DFC in the diets. In this respect, Sharkawy (1991) found a positive correlation between Pb and Fe, and this Fe increase was attributed to the inhibition of delta aminolevulinic acid dehydrates and ferrochelatase enzymes of the heme synthesis pathway, so that inhibition of these enzymes by Pb resulted in accumulation of Fe in blood and other tissues.

Concentrations of Pb were very high in the three groups possibly because of high environmental contamination as pointed by Sharkawy, 1991. The mean blood Pb levels for normal sheep was $0.14\pm0.01\mu g/ml$. Very much higher levels occur in the tissues of sheep consuming excessive amounts of Pb (Underwood, 1971). Heavy metals supplied to an organism through organs and skin and with food through the alimentary canal (Sharkawy, 1991 and Rashed and Soltan, 2002).

Wool Characteristics:

The figures for wool measurements reflected a minor increase in D2 and D3 diet groups concerning GFW, SL at leg, nearly at neck and mid-side positions as well as FD (Table 2).

Results of GFW were in accordance with Hassan (1984) who found that average GFW of Ossimi sheep was 0.575 Kg., although there was a difference in age and breed between the two experiments.

Similarly, the present result of FL, irrespective of the variations in age, breed, nutrition and location agreed with that of El-Sherbiny *et al.* (1979) who found that FL was 8.80 cm for Ossimi.

Moreover, the result of SL in different body positions agreed with that of Ahmed (2002) who estimated values of SL as 7.9, 7.6, and 7.9 cm in Ossimi ewes in shoulder, mid - side and british positions, respectively. He attributed these insignificant body position variations to skin growth rate, which can be related to the growth of the wool. He indicated that a proof was lacking that different nutritional regimes caused a certain skin region to grow as the expense of another. On the other hand, El-Gabbas (1998) reported that an inherent factor associated with either the skin or its follicle population was proposed to be involved in determination of the amount of wool grown on particular position. Results of FD were higher than those reported by Ahmed (1992) in Ossimi sheep (ranging from 31.04 to 37.20 μm) and by El-Gabbas (1998) in Barki sheep (ranging from 31.40 to 48.13 μm). These differences were due to breed, age and location variations among the experiments. In accordance with the present study, Investigators showed that GFW was correlated significantly and positively with FD (Malik and Chaudhary, 1975) as well as with SL (Gurgis and Galal, 1972). Moreover, Reyneke and Fair (1972) found a significant positive correlation between wool production and both of FD (0.74) and SL (0.73). Decrease of GFW in D1 group which depend on whole concentrate ration may came in accordance with the explanation that Lambs on high concentrate diets could lack adequate sulfur, which may in turn reduce wool growth, since wool is high in sulfur, thus, this element is closely related to production as well as signs of sulfur deficiency are reduced wool growth and shedding of wool ((NRC, 1985). Or may came in accordance with the explanation that Zinc deficiency is characterized by a para keratosis and wool loss (Underwood, 1971), where Zn concentration in the present study was the least in D1 diet (Table 2).

Fibre length exhibited highest value in D3 group followed by D1 then D2 group. The same trend was occurred in SL in neck position and the DFC diet had no constant effect on such trait.

Generally, from the previous results it seems that DFC can be utilized successfully by growing lambs, which consequently can contribute to feed cost savings and to solve environmental problems of the sugar cane industry.

It can be concluded that superior; cheaper, alternative sources of animal feed could probably be developed locally. However, the main difficulty for the industrial utilization of filter mud as an animal feed ingredient is the drying operation (Paturau, 1989).

Differences in micro elements and wool characteristics were within tolerable level and normal physiological limits, indicating the economic use and safety effect for feeding the growing lambs with DFC up to 40 % as replacement from the CFM.

Table (1): Least squares mean ± standard errors for some trace minerals and heavy metals (ppm).

Group	L.S.M. ± S.E.							
	Fe	Cu	Zn	Mn	Ni	Cd	Cr	Pb
D1	13.98	2.12	5.12	1.09	0.53^{ab}	0.09	0.21	7.97
D2	27.63	3.16	6.04	1.09	1.77^{a}	0.09	0.18	9.55
D3	31.99	3.29	5.93	2.06	0.38^{b}	0.24	0.01	10.53
± SE	6.49	0.38	0.81	0.48	0.42	0.10	0.14	1.99

a, b means within each column bearing different superscripts differ ($p < 0.05$).

Table (2): Least squares means ± standared error for some wool characteristics.

Group	Grease fleece weight (gm)	Clean wool %	Stable length (cm)			Fibre Length (cm)	Fibre Diameter (µm)
			Neck	Mid side	Leg		
D1	515	87.16	7.93	6.00	6.88	7.33	19.90
D2	550	86.74	7.75	8.00	7.00	6.94	21.98
D3	573	83.87	8.75	7.13	8.75	7.60	20.52
± S.E	63	3.44	0.62	0.67	0.70	0.42	1.48

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تأثير الإحلال الجزئي للعلف المركز باستخدام مخلفات مرشحات السكر الجافة علي تركيز بعض المعادن النادرة وبعض صفات الصوف للحملان النامية

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تم إجراء هذه الدراسة علي ٢١ من ذكور حملان نامية مرباة بمحطة بحوث ملوي تراوح عمرها من ٤ إلي ٥ شهور ووزنها ١٧,٣٠ كجم . تم تقسيم الحملان عشوائيا إلي ثلاث مجاميع تغذية لمدة ١٠٠ يوم . تم معالجة هذه التغذية التجريبية ليتم استبدال مخلوط العلف المركز بنسبة صفر ، ٢٠ ، ٤٠ % بمرشحات السكر الجافة للمعاملات د١ ، د٢ ، د٣ علي التوالي . العليقة د١ (الضابطة) تكونت من مخلوط العلف المركز ، دريس البرسيم وتبن القمح . عليقة المعاملة د٢ كانت مشابهة للعليقة د١ و ٢٠ % من مخلوط العلف المركز، بينما المعاملة د٣ كانت استبدال ٤٠ % من مخلوط العلف المركز بمرشحات السكر الجافة . بعد مرور ١٠٠ يوم من التغذية التجريبية تم أخذ عينة دم من كل حمل وتم تحليله لتقدير معادن الحديد والمنجنيز والنحاس والزنك والكادميوم والنيكل والكرميوم والرصاص بها باستخدام جهاز الامتصاص الذري .

كذلك تم دراسة الصوف وصفاته (وزن الجزة الخام والنظيفة) وطول الخصلة وطول الليفة وقطرها حيث تم أخذ عينات صوف من ٤ حملان من كل معاملة وتم تسجيل الصفات الطبيعية للصوف .

وقد أظهرت النتائج أن تركيز معادن الحديد والمنجنيز والنحاس والزنك والكادميوم والنيكل والكرميوم والرصاص في الدم لم تتأثر معنويا بإضافة مرشحات السكر الجافة ما عدا اختلاف معنوي ($P< 0.05$) في عنصر النيكل .

الصورة المناظرة لقياسات الصوف كانت عدم معنوية الاختلافات في جميع صفات الصوف المدروسة .