Der Tropenlandwirt, Zeitschrift für die Landwirtschaft in den Tropen und Subtropen.
85. Jahrgang, April 1984, S. 77–83

Evaluation of Dried Poultry Waste as a Feed Component in Sheep Diets in Subtropical Environment

Einsatz von getrocknetem Geflügelkot in der Fütterung von Schafen unter subtropischen Umweltbedingungen

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1. Introduction

Shortage of animal feedstuffs is a common problem in Egypt especially during summer. Finding out some new sources of feed ingredients has to be a policy to be able to meet the requirements of the animals and consequently the increasing human demands of animal products. Poultry waste could be considered as one of these new sources of feed ingredients. Analyses on pure excreta showed that it has a crude protein content similar to or higher than that of the cotton seed cake. Lowman and Knight (1970) found that uric acid nitrogen in the excreta. Oltjen and Dinius (1976) found that the digestibility of nitrogen from uric acid, sodium urate or processed poultry waste is equally good.

Statistically higher nitrogen retention was found with excreta when it was compared with urea as a sources of nitrogen (Galal et al. 1977). Similar results were found by Gihad (1976). Many workers (Lowman and Knight 1970, El-Sabban 1970, Tinnimit et al. 1972, Smith and Calvert 1972, 1976, Gihad 1976, Smith and Lindahl 1977 and Smith et al. 1979) evaluated poultry excreta and found that it could be used successively as a feed ingredient for ruminants. This work was conducted to evaluate such material in the subtropical environment of Egypt.

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2. **Materials and Methods**

Cage layer manure was used in this study and was defined as dried poultry waste (DPW). The fresh material was obtained from under cages in April 1978, spread in a 2 "layer on a concrete surface and was occasionally turned to be solar dried. In June, it was collected, ground and mixed thoroughly to obtain a finely dried and homogenous product.

Digestibility trials using DPW or cotton seed meal mixture (decorticated cotton seed meal + cotton seed hulls 5:4) were made to evaluate them as feed ingredients. The basal diet was formulated from coarsely ground yellow corn and bean straw at a ratio of 1:4.

Three digestibility trials were undertaken, one for each of the following:

1. Basal diet.
2. Basal diet + DPW (teested diet).
3. Basal diet + cotton seed meal mixture (tested diet).

Four adult Ossimi rams were used for every trial which lasted for 10 days preliminary and 7 days as a collection period. Representative samples from the diets and faeces were taken for analysis.

Four other digestibility trials were made using four concentrate mixtures including variable levels of DPW. The formula of these mixtures is in Table (1).

Table (1) : The formula of the used concentrate mixtures

Item	Mix.1 (control)	Mix.2	Mix.3	Mix.4
DPW	0.0	15	30	45
Decorticated cotton seed meal	25	16.7	8.3	0.0
Cotton seed hulls	20	13.3	6.7	0.0
Wheat bran	26	26	26	26
Rice bran	7	7	7	7
Yellow corn	19	19	19	19
Salt	1	1	1	1
Lime stone	2	2	2	2
Total	100	100	100	100

Four adult Ossimi rams were alloted to the four mixtures in a latin square design 4 × 4. Bean straw was used as a basal diet representing a constant ratio (25%) of the whole intake. The same technique for the digestion trial was followed as mentioned above.

The conventional methods of analysis were used for analyzing feeds and faeces. For statistical analysis, Snedecor and Cocuran (1967) were consulted. The multiple range test of Duncan (1955) was used to test the significant differences among means.

3. Results and Discussion

Data of the chemical analysis, digestibility coefficients and feeding value for basal diet, cotton seed meal mixture (CSM mix.) and DPW are presented in Table (2). CSM mix. and DPW were compared as protein supplements. Crude protein in CSM mix. was slightly higher than in DPW. As content of DPW is approximately 5 times that of CSM mix. This was reflected on the organic matter content of the DPW. The analysis of bean straw and yellow corn was within the published data of these ingredients.

Table (2) : Chemical analysis, digestion coefficients and feeding value of basal diet, DPW and CSM mix.

Item	Basal diet		DPW	CSM mix.
	Bean straw	Yellow corn		
A. Chemical analysis : %				
Dry matter	100	100	100	100
Organic matter	88.04	97.91	65.16	93.36
Crude protein	8.14	11.45	28.01	29.58
Ether extract	1.61	4.38	2.20	2.51
Crude fiber	44.11	2.39	16.11	36.17
NFE	34.18	79.69	18.84	25.10
Ash	11.96	2.09	34.84	6.64
B. Digestion coefficients : %				
Dry matter	52.53 ± 0.67		44.59 ± 1.34	62.12 ± 1.97**
Organic matter	52.02 ± 0.67		69.26 ± 3.01	63.95 ± 1.71**
Crude protein	44.29 ± 1.69		68.36 ± 1.02	74.57 ± 0.68*
Ether extract	65.17 ± 1.56		74.28 ± 4.37	87.48 ± 1.51
Crude fiber	28.91 ± 0.75		87.95 ± 3.93	45.33 ± 4.19**
NFE	72.04 ± 0.71		54.13 ± 1.55	73.90 ± 4.69*
C. Feeding value %				
TDN	43.72		42.92	56.66**
Starch value	24.72		37.52	45.90**
Digestible protein	3.89		19.15	22.06
* Significant($P<0.05$)				
** Significant($P<0.01$)				

3.1. Digestion coefficients and feeding value

The dry matter of the CSM mix. has a significant higher digestibility coefficient than that of the DPW. This is certainly due to the high ash content of the DPW. On organic matter basis, quite different figures are obtained, the organic matter of the DPW has a significant higher digestibility coefficient. Crude fiber of the DPW was well digested and exceeds significantly ($P < 0.01$) that of CSM mix. This was expected as the DPW fiber have been already subjected to the digestive enzymes through its passage within the alimentary tract of the birds. Moreover, perhaps the texture and kind of fiber in DPW may vary widely to that of the CSM mix. On the contrary, the NFE fraction of the DPW has a significant lower digestion coefficient. This was also expected as the most available part of this fraction is absent.

The TDN and starch value of DPW are significantly lower than those of CSM mix. If the comparison was made on the basis of one unit organic matter, the starch value of one unit organic matter from DPW will be 0.58 against 0.49 for that of the CSM mix. The corresponding figures for TDN are 0.66 against 0.61 and for digestible protein are 0.29 against 0.24. Nevertheless, the DPW could be considered a protein supplement than being a source of energy.

Table (3) : Chemical analysis, digestion coefficients and feeding value of feeds offered (straw + concentrate).

Item	Mix.1 (control)	Mix.2	Mix.3	Mix.4
A. Chemical analysis : %				
Dry matter	100	100	100	100
Organic matter	90.51	86.82	82.55	79.60
Crude protein	19.05	19.25	19.75	18.74
Ether extract	2.11	1.99	2.56	2.16
Crude fiber	27.18	24.01	21.27	19.01
NFE	42.16	41.56	38.96	39.68
Ash	9.49	13.18	17.45	20.40
B. Digestion coefficients : %				
Dry matter	62.07±0.48	63.23±3.27	63.12± 2.47	62.99±1.16
Organic matter	64.29±0.59	67.41±2.70	68.87± 1.95	69.94±0.64
Crude protein	72.29±0.81	74.23±2.79	75.12± 1.53	74.12±0.97
Ether extract	77.78±1.52	78.85±2.20	84.95± 0.85	80.36±1.44
Crude fiber	34.79±1.04	37.45±4.57	41.94± 2.50	45.65±1.39
NFE	79.03±0.45	81.19±1.69	79.39± 2.00	79.03±0.34
C. Feeding value as fed :				
TDN	54.01	54.46	53.62	52.27
Starch value	43.08	44.32	44.09	43.37
Digestible protein	12.35	12.85	13.38	12.57

3.2. Evaluation of the roughage/concentrate mixtures

Bean straw was used along with different feed mixtures in a rate of 1:3. The chemical composition, digestibility coefficients and feeding value of the four roughage/ concentrate mixtures are presented in Table (3).

The inclusion of DPW in the mixtures was reflected on their composition. Organic matter and crude fiber were decreasing while ash was increasing by increasing the level of DPW in the mixture.

Surprisingly, the digestibility of dry matter in the four mixtures was approximately similar, ranging from 62.07 $\pm$ 0.48 to 63.25 $\pm$ 3.27, without any significant difference. As mentioned above, dry matter digestibility of the DPW indirectly estimated was low (44.59%). This was expected to lower the digestibility of mixtures including high levels of such waste. The inclusion of many other ingredients with the waste in the mixture may have an associative effect improving the digestibility of the whole mixture.

The organic matter and crude fiber digestibility increased successively with increasing the DPW ratio but no significant difference was observed. It should be born in mind that the organic matter and fiber content of the DPW estimated indirectly have higher digestion coefficients than those of CSM mix. The crude protein differed significantly ($P < 0.05$) in a narrow range. The nitrogen free extractives were well and similarly digested.

It is worthy to notice that the feed mixture including no Waste (mix. 1) has the lowest digestibility coefficients for all nutrients when compared with those mixtures including DPW. Perhaps, the waste has an unidentified stimulating factor which encourages the process of digestion. Such a point may need further investigation.

For feeding value, similarity in the TDN figures of the roughage/concentrate mixtures used and also in their starch equivalent was observed. This would encourage the idea of using DPW as a protein supplement for ruminant animals beside CSM. In this case the problem of the shortage of CSM will be partially solved. With intensive poultry production, increased amounts of waste may cover a great part from the shortage of the supplemental protein sources.

4. **Summary**

Dried poultry waste (DPW) obtained from under cages was evaluated and compared with cotton seed meal mixture (CSM mix.) as a feed ingredient. Chemical composition showed approximately similar crude protein but ash content exceeded 5 times that of the CSM mix. Digestion coefficients indirectly obtained by sheep revealed that DPW was lower digested ($P < 0.01$) than the CSM mix. On ash free basis, DPW organic matter has higher significant ($P < 0.05$) digestibility than CSM mix. The TDN per unit organic matter was 0.66 and 0.61 for DPW and CSM mix. respectively. The corresponding figures for digestible protein were 0.29 and 0.24.

Four concentrate mixtures including 0, 15, 30 and 45% DPW replacing similar proportions of CSM mix. were formulated. Those were evaluated along with bean

straw in a roughage concentrate ratio of 1:3. The successive feeding value of these mixtures as TDN was 54.01, 54.46, 53.62 and 52.27 and as starch value was 43.08, 44.32, 44.09 and 43.37. The digestible protein was 12.35, 12.85, 13.38 and 12.57 respectively.

Zusammenfassung

Der Einsatz von getrocknetem Geflügelkot (DPW) bei Käfighaltung wurde untersucht und mit Mehlmischung der Baumwollsamen (CSM mix.) als Bestandteil der Tierfütterung verglichen. Die chemische Zusammensetzung zeigte den gleichen Gehalt an Rohprotein bei beiden Komponenten während der Gehalt an Asche bei DPW höher als bei CSM mix. war (34,83% gegenüber 6,64%).

Die ermittelten Verdauungskoeffizienten beim Schaf zeigten signifikant niedrigeren Koeffizienten bei DPW als bei CSM mix. ($P < 0,01$). Die organische Substanz bei DPW wies höhere Verdauungskoeffizienten als bei CSM mix. ($P < 0,05$) auf. Das TDN in Einheiten der organischen Substanz war 0,66 für DPW bzw. 0,61 für CSM mix. und bei verdaulichem Protein 0,29 bzw. 0,24.
Vier Kraftfuttermischungen mit 0, 15, 20 bzw. 45% DPW in einer Mischung mit Bohnen-Stroh im Verhältnis 1:3 wurden untersucht. Der Ernährungswert der 4 Mischungen als TDN war 54,01; 54,46; 53,62 bzw. 52,27 und als Stärke-Wert war 43,08; 44,32; 44,09 bzw. 43,37. Das verdauliche Protein war 12,35; 12,85; 13,38 bzw. 12,57 für die vier Mischungen.

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