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Use of sawdust as a source of dietary fibre in rabbit diets

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SUMMARY. Twenty eight New Zealand White four weeks weaned rabbits were divided into four groups of seven. Dietary treatments were 5%, 10%, 15% and 20% sawdust. All diets were nearly isocaloric and isonitrogenous. The experiment lasted ten weeks and the chemical analysis of sawdust was: crude protein, 2.53%; ether extract, 0.76%; crude fibre, 60.26%; nitrogen-free extracts, 24.53%, and crude ash, 0.80%. The values for total digestible nutrients (TDN) were 75.7%, 66.0%, 75.0% and 74.7%; those for metabolizable energy (MEcal/kg) were 2.485, 2.150, 2.380, and 1.860; those for dry matter digestibility coefficients were 72.6%, 62.0%, 71.8% and 72.2; and those for organic matter were 73.8%, 63.8%, 72.4% and 72.0%, respectively. Sawdust incorporation had a decreasing effect on body weight gains. However, feed efficiency ratios were poor with increasing its levels. Feed intake significantly did not differ. Weight gains were only significantly low on 20% level (P< 0.01). Also, 20% group had a significant value for metabolizable energy (P< 0.01). Diet containing 10% sawdust showed a peculiar result which can not be explained. Apart from this peculiarity, it appears that the proportion of the other ingredients formulating this diet particularly cotton seed and bean meals.

The depressive effect of sawdust supplementation on growth performance mainly due to the apparent digestibility of gross energy which in turn affects metabolizables energy values. Using sawdust up to 15% as a source of fibre to rabbit diets gave adequate results. While utilizing sawdust at 20% failed to support growth compared to 5% level. Economical calculations should be taken in account to using chemically treated sawdust. A further research is necessary investigating optimum sawdust levels for breeding stock.

***Key words:** sawdust, growth performance, digestibility coefficients.*

Introduction

Rabbits are considered as herbivorous animals. They have relatively large caecum, though they can digest fibrous material more efficient than unruminants. In nature when diets contain less than 3-4% fibre rabbits have been eating edges of wooden hutches. In experimental diets, purified wood cellulose is often given as an attempt to reduce feed cost (King, 1984).

Sawdust can be added to diets in a purified diet as cellulose or to raise fibre levels. We have got many machinery systems which yield huge amount of sawdust every year. An attempt has been done to show the optimum level of sawdust when fed to rabbits. The alkaline treatment for sawdust resulted in a marked increase in the digestibility of all constituents except lignin and provided highly digestible products (Ferguson, 1942; Saarinen *et al.,* 1958). However, the chemical treatment of sawdust is costing (Millett *et al.,* 1970).

Although treating sawdust with sodium hydroxide, boiling or fermenting with poultry manure can increase the nutritive value for sawdust, it needs chemicals, effort and in addition to that needs special experience to run these treatments. It is so easy to rabbit keepers to know the proportion of sawdust that can be incorporated into diets. Hunter *et al.* (1981) stated that the main value of sawdust appears to be as a source of dietary fibre. This study was undertaken to investigate the optimum level of untreated sawdust in growing rabbit diets. Studying this effect on growth and digestibilities.

Material and methods

Sawdust was collected locally from wood-cutting machines at Fayoum Egypt. The material used directly by mixing it with other components to formulating the experimental diets. The proximate chemical analysis of the product is given in Table 1. The diets were four starting with 5% sawdust to 10%, 15% or 20% sawdust. The levels of other components were changed to keep protein and energy levels similar. No attempts were made to adjust the fibre levels. The composition of experimental diets is given in Table 2. The chemical analysis of diets is given in Table 3. Diets were prepared by mixing the dry ingredients thoroughly in a domestic food mixer. The diets were fed ad libitum in mash form.

Four weeks weaned of New Zealand White rabbits were obtainable from a private rabbitry in Giza, Egypt. Twenty eight animals were divided into four groups of seven. Animals located in wooden hutches of 20" x24" x24" which contains two rabbits each. Animals were fed a standard diet for a week prior to experiment commenced. The experiment carried out for ten weeks during which food was weighing in sufficient amount weekly and at the end of each week the residue weighed to give the food intake. Water was available every day in adequate amount to keep ad libitum condition.

A digestion trial was carried out on the eighth week, during that period food and faeces were recording daily as well as urine output. The rabbits were weighing weekly to the nearest gram on a top-pan balance. Sub-samples of food and dried faeces (dried at 6^{0}C overnight) were grounded in a food blender. Chemical analysis was carried out according to

Table 1. Composition of experimental diets.

Item	Sawdust levels (%)			
	5	10	15	20
Yellow corn	45	35	42	48
Barley grains	4	5	5	--
Wheat bran	6	3	--	--
Bean meal	12	20	5	--
Soyabean meal	15	10	21	25
Cottonseed meal	6	10	5	--
Cottonseed oil	2	2	2	2
Sawdust*	5	10	15	20
Fish meal	2	2	2	2
Limestone	2	2	2	2
Mineral mix.	0.5	0.5	0.5	0.5
Vitamin mix.	0.5	0.5	0.5	0.5
Salt	0.5	0.5	0.5	0.5

* This material was available locally at Fayoum, Egypt.

Table 2. Chemical Composition of experimental diets and sawdust.

Nutrient	Sawdust levels (%)				
	5	10	15	20	Sawdust
Moisture	13.5	14.3	16.6	12.7	11.1
	Analysis on dry matter basis				
Crude protein	20.1	19.6	20.4	18.9	2.9
Ether extract	7.5	7.0	7.3	6.9	0.9
Crude fibre	11.3	15.7	16.9	18.6	67.8
N.F.E.*	52.0	48.9	47.2	47.9	27.6
Gross energy	9.1	8.8	8.2	7.7	0.9
(Kcal/kg)	4011	4000	4037	4037	4063
Feed cost/ kg (P)	18.7	17.6	18.9	18.6	-- *

* It suggests that sawdust had no price (Zero price).

Table 3. Effect of sawdust incorporation on growth of rabbits.

Criteria	Sawdust levels (%)			
	5	10	15	20
Initial weight, g	526± 73.0	527±104.0	535±76.0	530±50.0
Final weight, g	1590±300.0 [a]	1514±296.0 [a]	1443±140.0 [a]	1202±216.0 [b]
Total gain, g	1064±163.0 [a]	987±163.0 [a]	908±200.0 [a]	672±917.0 [b]
Feed intake, g	4066±700.0	4876±716.0	4116±770.0	3908±917.0
Feed efficiency ratio (feed/gain)	3.8± 1.3	4.9±1.6	4.5±2.1	5.8±1.7
Grwth rate*	20.2±3.1 [a]	17.8±6.0 [a]	17.0±3.8 [a]	12.7±3.4 [a]

a,b: Means in each row with a common letter or with no letter are not significantly different at P<0.01.

$$\text{* Growth rate} = \frac{\text{weekly weight gain}}{\text{Initial body weight}} \times 100$$

the A. O. A. C. methods (1970). Nitrogen content was determined by Kegldahl methods. Gross energy of diets was calculated as 4kcal/g for protein, carbohydrates and fibre while fat is 9kcal/g. Statistical analyses for variance and least significant differences (LSD) were done according to Snedecor and Cochran (1980).

Results

The effect of sawdust incorporated on performance is shown in Table 3 and Fig. 1. Differences between initial weights were not significant. Rabbits fed on 5% sawdust showed the highest final weights. Body weights of animals decreased with raising sawdust levels. The 20% sawdust diet group showed a significant reduction (P< 0.01). Rabbits fluctuated in their feed intake, 20% SD group was the highest while 20% was the lowest. It was not clear why a 10% SD group did have a high food intake. Differences in feed intake were not significant which reflected on feed efficiency also.

Digestibility of crude protein,

ether extract and crude fibre increased with increasing sawdust levels (Table 4). Digestibilities of dry and organic matter and TDN values did not differ significantly between groups, with exception that 10% sawdust group was significantly low ($P < 0.01$). Regarding nitrogen free extracts (NFE), digestibility for 10% sawdust group was the lowest. 5% sawdust significantly had high value compared to other levels ($P < 0.01$). Metabolizable energy values significantly decreased with increasing sawdust levels.

Discussion

Addition of sawdust to rabbit diets up to 15% had no significant detrimental effect on growth. This effect may refer to energy concentration. It can be found from this study that ME, KCalkg ranges from 2500 to 2200 is adequate to give 13-15g gains a day. The low values of growth rate could be attributed to various factors: environmental temperatures (ranges 34-37^{o}C) which clearly affected food intake. The breed used another factor growth results. Effect of dietary energy levels on animals performance has been studied, and showed that the lower energy levels the lower growth rates and the higher feed consumption and vice verse (Szepesi and Oney, 1977; Sastry and Mahajan, 1981; Butcher *et al.*, 1983; Bedekar *et al.*, 1984 and Hale and Utley, 1986). This could be the reason for high feed consumption on 20% sawdust group, it had lowest energy level.

Sawdust incorporating did not affect feed intake when added up to 15%, while beyond that food intake decreased. This decrease in food intake can be explained by two reasons: palatability of diet and the high fibre levels (Table 2). Dietary fibre affects the density of diets and hence its energy concentration. These results are in agreement with those found by Sastry and Mahajan (1981) and Hale and Utley (1986) who showed that the high energy diets resulted in a better feed efficiency ratios.

The depressive effect of sawdust incorporation on weight gains might be due to dietary fibre levels. The higher the fibre levels the lower the body weight gains. This result support that of Hoover and Heitmann (1972). Also, it is possible that the amount of crude fibre could not be easily handled by the rabbits (Omole and Onwudike, 1981). Comparing our results with those recorded by Omole and Onwudike (1981) who used 4% sodium hydroxide treated sawdust, there was an agreement that using sawdust either treated or untreated up to 15% had no significant effect on both daily gain or feed efficiency ratio. The higher values of weight gains for Omole than ours were explained earlier.

Table 4.Digestibility coefficients of sawdust incorporated diets .

Criteria	Sawdust levels (%)			
	5	10	15	20
Dry matter	72.6 ± 1.1^{a}	62.0 ± 1.3^{b}	71.8 ± 2.7^{a}	72.8 ± 1.9^{a}
Organic matter	73.8 ± 1.2^{a}	63.8 ± 1.3^{b}	72.4 ± 1.5^{a}	72.0 ± 1.4^{a}
Crude protein	70.4 ± 2.1^{a}	64.7 ± 1.3^{b}	75.0 ± 1.2^{c}	76.4 ± 1.6^{c}
Ether extract	91.9±0.7	90.0±0.9	93.4±1.0	93.6±1.1
Crude fibre (feed/gain)	8.4 ± 1.2^{a}	18.2 ± 3.0^{b}	35.3 ± 4.2^{c}	25.4 ± 2.2^{d}
N.F.E. *	86.7 ± 2.3^{a}	74.2 ± 2.4^{b}	81.3 ± 4.6^{c}	85.4 ± 502^{a}
Gross energy	62.0 ± 1.2^{a}	54.0 ± 1.5^{b}	59.1 ± 1.7^{ab}	46.1 ± 1.3^{c}
TDN	75.7 ± 2.2^{a}	66.0 ± 3.0^{b}	75.0 ± 3.6^{a}	74.6 ± 3.7^{a}
ME,Kcl / Kg	2485 ± 150^{a}	2150 ± 130^{b}	2380 ± 90^{ab}	1860 ± 110^{c}

a,b,c,d: Values on lines that vary significantly have different superscript letters ($P<0.01$)

*NFE Nitrogen- free extrctives..

Digestibility coefficients of nutrients showed a different trend than growth performance. Addition of sawdust had improvement effect on digestibility of protein, ether extract and crude fibre and this is up to 15%. This result could be related to other components in diets or to an associated effect between ingredients composing diets. The 10% sawdust supplemented group gave peculiar results which can not be explained. A part from this peculiarity, it appears that the proportions of ingredients composing this diet particularly cotton seed and bean meal). Sawdust had no significant effect on dry, organic matter and total digestible nutrients.

Digestibility of gross energy decreased with increasing sawdust levels (P< 0.05). This potentially can be explained to a high significant effect of neutral detergent fibre (NDF) levels on the apparent digestibility of dietary energy. Stanogias and Pearce (1985) found that the extent and the rate of decrease in apparent 11 and metabolizable of energy with levels of intake was related to the source of NDF in diets. An equation between levels of sawdust and digestible energy replacement values was calculated by Harpster (1980). The higher the sawdust levels, the lower the digestible energy replacement values. Increasing sawdust levels than 15% significantly decreased the digestibility of both gross and metabolizable energy. Beyond this level it may be there is an adversely effect on nutrients balance, though animals are not able to obtain enough supply for optimum performance (Omole and Onwudike, 1981).

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