Egyptian Journal of Rabbit Science, 30(2): 125- 145 (2020)

EFFECT OF USING BAGASSE AS A SOURCE OF NATURAL FIBER INGREDIENT AND ADSORBENT MATERIAL FOR AFLATOXIN IN GROWING RABBITS RATIONS ON GROWTH PERFORMANCE

H. A. Abo-Eid[1]; M. S. Abousekken[1]; Amal A. Abou Hagar [2] and T. S. Abdel-ghany[2]

[1]Sustainable development of Environment and its Project Management Department, Environmental Studies and Research Institute, University of Sadat City, Menofiya, Egypt.

2 Regional Center for Foods and feeds, Agricultural Research Center, Ministry of Agriculture. Egypt.

***Corresponding author**: H. A. Abo-Eid; Email: hosni.aboeid@esri.usc.edu.eg hosny_abo_eid@yahoo.com*

ABSTRACT : *This study was carried out to determine the effect of feeding dietary bagasse as a source of natural fiber ingredient and adsorbent for aflatoxins (AFs) in growing rabbits diets and to evaluate using dietary bagasse on growth performance, digestibility coefficients of nutrients, nutritive value, some blood constituents and economical efficiency of New Zealand White rabbits (NZW). The study involved fifty four NZW growing rabbits of aged 5 weeks with initial body weight mean of 751.8±35.62 g. Animals were divided into nine equal groups and fed treatment diets for 8 weeks. The experimental groups were: control or basal diet (T_1), basal diet supplemented with low dose of AFs (75µg total AFs/kg diet) (T_2), high dose of AFs (150µg total AFs/kg diet) (T_3), 3% of bagasse (T_4), 6% of bagasse (T_5), 3% of bagasse with low dose of aflatoxin (T_6), 6% of bagasse with low dose of aflatoxin (T_7), 3% of bagasse with high dose of aflatoxin (T_8) and 6% of bagasse with high dose of aflatoxin (T_9). Results of live body weight at 13 week of age of both T_7 and T_9 groups recorded numerical higher body weight value compared to control group (T_1), T_2 and T_3 groups. T_3 group recorded significantly ($P<0.05$) the highest daily feed consumption during periods; 5-9 and 5-13 weeks compared to control group (T_1) and other groups. The best significant ($P<0.05$) value of the feed conversion ratio was recorded with T_6 group at 9-13 weeks of age and the whole experiment period compared to T_2 group. While T_9 group recorded the best significant ($P<0.05$) value of the feed conversion ratio compared to T_3 group. Also, T_4 and T_5 groups achieved the significant ($P<0.05$) better value of feed conversion compared to control group (T_1). The values of DM, OM, CP, EE and NFE for T_5 group were higher compared to* *control (T_1) and T_4 group. Generally, T_6 group recorded significantly ($P<0.05$) higher values of nutrient digestibility, DCP and TDN compared to T_2 group. While, T_9 group recorded significantly ($P<0.05$) higher values of digestibility nutrients, DCP and TDN compared to T_3 group. Blood constituents results showed that changes in serum total protein (TP), and albumin (ALb) of rabbits treated with two doses low and high aflatoxins (T_2 and T_3) caused a significant decrease in both values when compared with control group (T_1) . Supplementation of 3% or 6% bagasse with low or high doses of aflatoxins (T_6 to T_9) showed a significant increase in both parameters when compared to groups treated with aflatoxins singly (T_2 and T_3). T_6 and T_9 groups showed a significant decrease in both parameters when compared to T_2 and T_3 groups. The results showed the lowest value of serum creatinine and urea obtained with T_7 group. T_7 and T_9 groups showed a significant decrease in serum ALT, AST, ALP activity and cholesterol comparing with T_2 and T_3 groups. The results showed that the highest value of total PI recorded for T_6 group followed by T_5 group.*

***Conclusively,** based on the results obtained in this study, it was established that using 6% of bagasse in the rations of growing rabbit's achieved improvements in growth performance parameters. At the same time, presence of bagasse alleviated the detrimental effect of aflatoxin.*

***Keywords:** Bagasse, Aflatoxin, performance, economic efficiency.*

INTRODUCTION

In Egypt, there is a broad gap between animal needs and the available fodder. Also, the fast increase in the cost of sources of animal protein is now an urgent need to increase the size of livestock. It has been observed that rabbits production is one of the best sources to mitigate the low consumption of animal protein prevalent in developing countries because of specific characteristics of rabbits meat (Maidala and Istifanus, 2012). Contamination of mycotoxins in feed is a global problem. Among mycotoxins, aflatoxins are one of the most dangerous toxins found in animal feeds (Williams *et al.,* 2004). One of the recent methods of detoxifying products contaminated with mycotoxins is to use non-nutrient adsorbents in the diet to reduce the mycotoxins absorption from the gastrointestinal tract. Several workers reported that the adsorbent in the feed could selectively bind mycotoxins during digestion and pass without harm from the gastrointestinal tract of the animals. The main advantages of adsorbents are the safety, low cost and ease of adding them to animal feed (Avantaggiato *et al.,* 2005 and Khadem *et al.,* 2012). Due to the increasing number of information about aflatoxin contamination in feeds, there is a high demand for practical, simple and cost-effective detoxification methods. (Zahoor and Khan, 2018).

Bagasse is the fibrous residue of a sugarcane stalk after crushing and extracting the juice (Almeida *et al.,* 2018). Bagasse is the main by-product of the sugarcane industry. It is one of the largest agricultural wastes in the world. Around 54 million tons of dry bagasse are produced annually worldwide and large amounts of it are burned in the fields, which creates a serious pollution problem. Hence, using this agricultural waste as an adsorbent material that had low cost could avoid the accumulation that leads to environmental problems (De Gisi *et al.,* 2016 and Siqueira *et al.,* 2020). One of the advantages of bagasse is that it is available during any time of fodder shortage and is less expensive compared to other traditional roughage sources. Thus, bagasse is the only viable alternative, in the short and medium-term, as roughage for animal feed (Barros *et al.,* 2010 and Almeida *et al.*, 2018).

Therefore, the objective of this research was to determine the effect of feeding dietary bagasse as a source of natural fiber ingredient and adsorbent for aflatoxins in growing rabbits diets and to evaluate using dietary bagasse on growth performance, digestibility coefficients of nutrients, nutritive value, some blood plasma constituents and economical efficiency of growing New Zealand White (NZW) rabbits.

MATERIALS AND METHODS

The present study was carried out at Farm of Sustainable Development Department, Environmental Studies and Research Institute, University of Sadat City, Menufiya Governorate, Egypt during January to March, 2017. The laboratory work was done at Regional Center for Food and Feeds, Agriculture Research Center. *Aspergillus flavus* NRRL (3145) was obtained from the National Research Center (Dokki, Giza). Aflatoxins (B1, B_2, G_1 and G_2) were obtained from Sigma Chemical Company (St Louis, MO, USA). Bagasse was obtained from local juice stores in Cairo, Egypt.

Preparation of aflatoxins dose for rabbit experiment

The solution containing AFs consisted of a mixture of aflatoxin B_1, B_2, G_1 and G_2 at a total concentration of 7.5 µg AFs/ ml as a ratio of 8: 2: 4: 1, respectively used to prepare 2 final concentrations of AFs, 1µg AFs and 2µg AFs (St. Louis, Mo USA).

Preparation of dietary bagasse

Bagasse was obtained from local juice stores. Oven drying was done in a cabinet oven with air circulation at 60 C^{o} overnight whereas dried bagasse was milled by laboratory mill to pass a 2.0 mm- size mish pares to produce bagasse powder (Kamal, 2011).

Animals, housing and experimental design

The study involved fifty four growing New Zealand White rabbits (NZW) of aged 5 weeks with initial mean weight 751.8±35.62 g. Animals were divided into nine equal groups. The study lasted two months period (from January till March, 2017), All animals were individually housed in galvanized wire cages (50 x 55 x 39 cm) provided with a feeder and automatic nipple drinker, and were kept under the same managerial means and all animals were weighed weekly.

The experimental design used in vivo experiment

(T_1) Basal diet,
(T_2) Low dose of AFs (75µg total AFs/kg diet)
(T_3) High dose of AFs (150µg total AFs/kg diet)
(T_4) Received basal diet supplemented with bagasse at level 3%
(T_5) Received basal diet supplemented with bagasse at level 6%
(T_6) Low dose of AFs+ bagasse at level 3%
(T_7) Low dose of AFs+ bagasse at level 6%
(T_8) High dose of AFs+ bagasse at level 3%
(T_9) High dose of AFs+ bagasse at level 6%

Experimental diet

The ingredients of each diet which were assigned to each group are shown in Table 1. Prepared diets were kept in jute sack for offering to each animal group.

Growth performance

Live performance measurements for each feeding period were measured and/or calculated in terms of live body weight (LBW), body weight gain (BWG), feed intake (FI), feed conversion ratio (FCR), performance index (PI) and Mortality rate (MR).

Individual LBWG for each rabbit was calculated at 2, 4, 6, 8, 10 and 12 of experimental period by subtracting the initial LBW of a certain period from the final LBW of the same period, as follows:-

$$LBWG = W_2 - W_1$$

Table (1). Composition of ingredient feed rations for control and treated groups.

Ingredients	**Control**	**T_4**	**T_5**
Alfaalfa	25.00	23.00	20.00
Wheat bran	26.00	26.00	25.00
Barley grains ,Ground	20.00	20.00	20.00
Soybean meal (44% CP)	13.50	14.00	15.00
Yellow corn, ground	10.00	10.00	10.00
Wheat straw	1.50	-	-
Bagasse	0.0	3.00	6.00
L- Methionine	0.35	0.35	0.35
Lime stone	0.9	0.9	0.9
Di calcium phosphate	1.9	1.9	1.9
Premix*	0.50	0.50	0.50
Na Cl	0.35	0.35	0.35
Total (kg)	**100**	**100**	**100**
Calculated values**			
Crude protein %	17.11	17.24	16.93
DE, kcal/kg diet	2520	2513	2490
Crude fiber %	11.97	11.59	12.14
Ether extract %	2.54	2.50	2.41
Calcium %	1.17	1.15	1.11
Available phosphorus	0.36	0.36	0.36
Lysine %	0.87	0.87	0.86
Methionine	0.60	0.60	0.60
Cost/kg of diet in L.E. ***	2.73	2.38	2.31

*__The premix (Vit. & Min.)__ was added at a rate of 3 kg per ton of diet and supplied the following per kg of diet (as mg or I.U. per kg of diet): Vit. A 12000 I.U., Vit. D3 2000 I.U., Vit. E 40 mg, Vit. K3 4 mg, Vit. B1 3 mg, Vit. B2 6 mg, Vit. B6 4 mg, Vit. B12 0.03 mg, Niacine 30 mg, Biotine 0.08 mg, Pantothenic Acid 12 mg, Folicacid 1.5 mg, Choline chloride 700 mg, Mn 80 mg, Cu 10 mg, Se 0.2 mg, I 40 mg, Fe 40 mg, Zn 70 mg and Co 0.25mg.

**According to Feed Composition Tables for animal & poultry feedstuffs used in Egypt (2001) and NRC (1994).

***According to market prices of the year 2017.

Where: W_1= LBW at the onset of a certain period, W_2 = LBW at the end of the same period.

Feed intake for each replicate under each treatment was weekly calculated, on a group basis, by subtracting the residual feed from the offered one. Average daily feed intake per rabbit was then calculated by using the following equation:

FI/rabbit/day = FI / replicate/week / No. of rabbits consumed feed daily during the week period

Feed conversion ratio (FCR) (using the weight of mortality to correct FI data) weekly and whole experimental period was calculated for each replicate under each treatment and calculated as kg of feed used for producing one kg of body weight gain as follows:

FCR =Average feed intake (kg) per rabbit/ body weight gain (kg) per rabbit.

Daily mortality was recorded. Weekly mortality rate was calculated for each treatment group by subtracting the final number of live rabbits at the end of a certain period from the initial number of live rabbits at the beginning of the same period. Mortality rate percentage was calculated as a number of dead rabbits at the end of a certain period relative to the initial number of live rabbits at the onset of the same period.

Analytical methods

The proximate chemical analyses of experimental diets and dried feces were performed for moisture, dry matter (DM), organic matter (OM), crude protein (CP), crude fiber (CF), ether extract (EE) and Ash according to the Association of Official Analytical Chemists **(AOAC, 2016).** Nitrogen free extract (NFE) of both feed and feces was determined using the following equation:

$$NFE = 100 – (CP\% + EE\% + CF\% + Ash\ \%).$$

Digestibility trials

Digestion trials were conducted at the end of growth trial to determine the digestibility values and nutritive value of the experimental diets expressed as total digestible nutrients (TDN %) and digestible crude protein (DCP %). Three animals representing each group were individually housed in metabolic cages equipped with a stainless- steel screen and 4 mm mesh to retain feces but allow free passage of urine. Feed and water intake were offered to rabbits ad-libitum during the digestion trial. The digestion trial lasted for 10 days as preliminary period while the collection period lasted for 5 days in which feces was collected daily before the morning meal, weighed fresh and sprayed with 2% boric acid for trapping any ammonia released from feces and dried at 60 $^{\circ}$C for 24 hrs in an air drying oven. The feces were then ground and mixed, stored for subsequent chemical analysis. Samples of diets and feces were chemically analyzed to determine the digestibility coefficients and nutritive values of the experimental diets.

Blood parameters

Blood samples were collected from each rabbit (3 rabbits /group) into dry clean tubes containing heparin and centrifuged at 3000 rpm for 15 min. The plasma was collected and stored at -20˚C to estimate some blood constituents as total protein (Armstrong and Corri, 1960), albumin (Doumas *et al.*, 1971), transaminase (aspartate aminotransferase (AST) and alanine aminotransferase (ALT)) (Reitman and Frankel, 1957), triglycerides (Royer and Ko, 1969), cholesterol (Zlatkis *et al.*, 1953), urea nitrogen and creatinine. The globulin values were obtained by subtracting the albumin values from the corresponding values of total proteins.

Organs weights:

Rabbits were scarified at the end of experiment and the liver and kidney were immediately removed and weighed.

Economic efficiency

Economic efficiency was calculated by the following equation:
Economic efficiency= (Selling price of one Kg live body weight - feeding cost of one Kg live body weight/ Feeding cost of one Kg live body weight)× 100.

Statistical analysis

The obtained data were statistically analyzed according to statistical analysis system (SAS, 2003). Data of live body weight, live body weight gain, feed intake, feed conversion and performance index were analyzed using one way analysis of variance according to the following model.

$$Y_{ij} = \mu + T_i + E_{ij},$$

Where, Y_{ijk} is the observation of the parameters measured, µ is the population mean, T_i is effect of adding levels of aflatoxin and bagasse and E_{ij}= experimental error and assumed to be independently and normally distributed with zero mean and σ^2_e.

Duncan’s Multiple Range Test (Duncan, 1955) distinguished the differences among means. Significant level was set at 5%.

RESULTS AND DISCUSSION

Chemical composition of experimental diets

The concentration of the active constituents of Bagasse

Results of proximate composition of bagasse used for preparation experimental diets (g/100 g dry matter) presented in Table 2. Cleared that ground bagasse used in the present study contains 2.1% CP; 34.4% CF

Table 2. Proximate composition of bagasse used for preparation of dietary fiber

Items	Proximate analysis (g/100 g on dry matter basis)
Protein	2.1
Fiber	34.4
Ash	1.38
Cellulose	37.08
Hemicelluloses	21.25
Lignin	6.42
Silica	1.0
NDF	65.97
ADF	44.72
ADL	7.64

and little concentration of ash (1.38%) meanwhile the main components in bagasse proximate analysis are cellulose (37.08%); Hemiclose (21.25%) and lignin (6.42%). Therefore, sugarcane bagasse has been successfully used as a fibre source for animal and rabbits diets. Also, bagasse is a good source of lignoceric and cerotic acids (Kamal, 2011).

Chemical composition of tested diets

Chemical compositions (Proximate Analysis) of experimental rations are presented in Table 3.

Table 3. Chemical compositions (Proximate Analysis) of Experimental rations.

Items	DM %	Moisture %	OM %	CP %	CF %	EE %	NFE %	Ash %	DE *(Mcal/kg)**
Ration1	89.27	10.73	80.82	16.94	10.94	2.65	50.29	8.45	2.59
Ration4	88.79	11.21	81.05	16.56	10.49	2.24	51.76	7.74	2.61
Ration5	89.82	10.18	82.09	16.49	11.46	1.54	52.6	7.73	2.57

*****DE *(Mcal/kg)* = 4.36 – 0.049 x NDF, NDF% = 28.924 +0.657 (CF %) according to Cheeke (1987).

Productive performance

Results in Table 4 showed that the initial body weight was in average of 751.8±35.62 g. Live body weight at 13 week of age of rabbits fed basal diet supplemented with bagasse at level 6% with low or high dose of aflatoxin (T7 and T9) recorded numerically higher body weight value (2220.8 and 2204 g) compared to control group (T1) (2087 g) and rabbits groups fed basal diet

Table 4. Effect of supplemented different levels of dietary bagasse and aflatoxin (Means±SE) on productive performance of growing rabbits.

Item	Treatment groups									Sig.
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	
No. of rabbits	6	6	6	6	6	6	6	6	6	
Live body weight (g)										
5 weeks	745.83±35.62	762.00±35.62	740.83±35.62	767.50±35.62	745.83±35.62	760.00±35.62	775.00±35.62	742.50±35.62	726.68±35.62	NS
9 weeks	1710± 77.57	1549±77.57	1642.5±77.57	1651.7±77.57	1558.3±77.57	1546.7±77.57	1582.5±77.57	1600±77.57	1510.8±77.57	NS
13 weeks	2087±118.38	2150±108.07	2194±118.38	2156.7±108.1	2279.2±108.07	2146±118.38	2220.8±108.07	2177.5±108.07	2204±118.38	NS
Daily weight gain (g)										
5-9 weeks	28.04±2.47	21.22±2.47	25.51±2.47	24.94±2.47	21.79±2.47	21.25±2.47	23.25±2.47	23.15±2.47	22.77±2.47	NS
9-13 weeks	14.00^{b}±3.02	21.46^{ab}±2.75	20.14^{ab}±3.02	18.04^{ab}±2.75	25.74^{a}±2.75	22.93^{ab}±3.02	22.80^{ab}±2.75	20.63^{ab}±2.75	21.96^{ab}±3.02	*
5-13 weeks	21.02±1.95	21.34±1.78	22.64±1.95	21.49±1.78	23.76±1.78	21.71±1.95	22.98±1.78	21.79±1.78	23.25±1.95	NS
Daily feed consumption (g)										
5-9 weeks	138.13^{b}±7.47	125.76^{bc}±7.47	176.19^{a}±7.47	121.76^{bc}±7.47	121.43^{bc}±7.47	118.24^{bc}±7.47	125.63^{bc}±7.47	125.71^{bc}±7.47	109.38^{c}±7.47	*
9-13 weeks	164.12^{ab}±10.49	143.45^{ab}±9.57	167.18^{a}±10.49	145.89^{ab}±9.57	164.45^{a}±10.49	120.25^{b}±10.49	175.89^{a}±9.57	156.82^{a}±9.57	155.64^{a}±10.49	*
5-13 weeks	141.62^{bc}±8.34	134.61^{bc}±7.62	170.48^{a}±8.34	133.82^{bc}±7.62	142.18^{bc}±8.34	117.61^{c}±8.34	150.76^{ab}±7.62	141.26^{bc}±7.62	135.46^{bc}±8.34	*
Feed conversion ratio (g feed/ g gain)										
5-9 weeks	2.80^{bC}±0.14	3.17^{b}±0.14	3.66^{a}±0.14	2.66^{c}±0.14	2.95^{bc}±0.14	3.01^{bc}±0.14	2.75^{bc}±0.14	2.91^{bc}±0.14	2.71^{c}±0.14	*
9-13 weeks	6.36^{A}±0.70	4.80^{ab}±0.64	5.29^{ab}±0.70	6.03^{a}±0.64	4.38^{ab}±0.70	3.42^{b}±0.70	4.89^{ab}±0.64	4.58^{ab}±0.64	4.68^{ab}±0.70	*
5-13 weeks	3.85^{b}±0.15	3.60^{bc}±0.14	4.26^{a}±0.15	3.55^{bc}±0.14	3.50^{bc}±0.15	3.18^{c}±0.15	3.62^{bc}±0.14	3.61^{bc}±0.14	3.39^{bc}±0.15	*
Mortality										
5-13 weeks	1	0	1	0	1	1	0	0	1	

NS = Not significant SE= Standard error.

T_1= Basal diet ;T_2 = low dose of AFs (75µg Total AFs/kg diet); T_3 = High dose of AFs (150µg Total AFs/kg diet) ; T_4 = basal Diet supplemented with bagasse at level 3%, T_5 = basal Diet supplemented with bagasse at level 6% ; T_6: low dose of AFs+ bagasse at level 3% ; T_7: low dose of AFs+ bagasse at level 6% ; T_8: High dose of AFs+ bagasse at level 3% ; T_9 : High dose of AFs+ bagasse at level 6%.

supplemented with low and high dose of aflatoxin (T2 and T3). Also, rabbits fed basal diet supplemented with bagasse at level 3% and 6% without aflatoxin recorded higher live body weight value but not significant compared to control group (T1). The same trend was observed for daily weight gain. These results are in close to Ismail et al. (2016) who reported that the final body weight and feed intake of rabbits increased with increasing levels of sugarcane bagasse. In this connection, SUN et al. (2018) found that during the first 3 wk. and week 7, the supplementation of aflatoxin B1 did not affect bucks' live body weight (LBW). Table 4 presented that rabbits fed high dose of aflatoxin (T3) recorded significantly (P<0.05) the highest daily feed consumption during 5-9 and 5-13 weeks compared to control and other groups. The best significant (P<0.05) value of the feed conversion ratio was recorded with rabbit fed basal diet supplemented with 3% bagasse and low dose of aflatoxin (T6) at 9-13 weeks of age and the whole experiment period compared to rabbits fed basal diet with low dose of aflatoxin (T2). While rabbits fed basal diet supplemented with 6% bagasse and high dose of aflatoxin (T9) recorded the best significant (P<0.05) value of the feed conversion ratio compared to rabbits fed basal diet with high dose of aflatoxin (T3). Also, rabbits fed basal diet with bagasse 3% or 6% (T4 and T5) showed significant (P<0.05) best value of feed conversion compared to control group (T1). Valchev *et al.* (2017) indicated that compound feed supplementation with increased amounts of aflatoxin B1 (0.2 mg/kg or 0.4 mg/kg) significantly reduced live weight, weight gain and feed intake and thus increased feed conversion. The same trend is observed by Zuo *et al.* (2013) and Chibanga *et al.* (2014) who stated that consumption of feed contaminated with low amount of aflatoxins in broiler chickens significantly degraded growth performance. Death losses during entire experimental period either for group fed on basal diet or the groups fed basal diet supplemented by bagasse with or without aflatoxin were observed (Table 4). Maidala *et al*. (2016) concluded that sugarcane bagasse can be used as a source of fiber in the diets of growing rabbits without deleterious effect with reduction in cost of production.

Nutrients digestibility, Nutritive values and nitrogen balance

Digestibility coefficients of nutrients and nutritive values are presented in Table 5. Results indicated a significant differences (P<0.05) among DM, OM, CP, CF, EE and NFE digestibility for all treatments. The values of DM, OM, CP, EE and NFE for rabbits group fed basal diet supplemented with bagasse at level 6% (T_5) were the highest ones; being 67.86, 68.43, 72.13, 53.01 and 76.54, respectively compared to control

Table 5. Effect of supplemented different levels of dietary bagasse and aflatoxin on digestion coefficients and nutritive values.

Items	Tested Diets										Sig.
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	± SE	
Digestibility %											
DM	63.66^{b}	62.31^{bcd}	59.69^{d}	59.69^{d}	67.86^{a}	63.14^{bc}	51.81^{e}	60.42^{cd}	60.86^{cd}	0.87	***
OM	63.92^{b}	62.04^{bc}	59.98^{c}	59.45^{c}	68.43^{a}	64.21^{b}	5140^{d}	60.28^{c}	61.49^{bc}	0.92	***
CP	69.97^{a}	63.72^{bc}	64.12^{b}	66.08^{b}	72.13^{a}	63.61^{bc}	60.51^{c}	66.60^{b}	70.98^{a}	1.10	***
CF	32.45^{a}	11.40^{d}	13.98^{cd}	16.02^{bc}	24.90^{a}	26.04^{a}	14.50^{bc}	16.63^{bc}	17.20^{b}	0.90	***
EE	45.59^{b}	25.31^{f}	25.56^{f}	48.26^{b}	53.01^{a}	33.20^{e}	33.91^{e}	41.26^{d}	25.90^{f}	0.92	***
NFE	71.65^{bc}	60.05^{d}	70.87^{c}	69.58^{c}	76.54^{a}	73.58^{b}	59.46^{d}	70.07^{c}	69.67^{c}	0.83	***
Nutritive values											
DCP	13.28^{a}	10.55^{d}	10.61^{d}	12.54^{b}	13.45^{a}	11.68^{c}	11.48^{c}	12.42^{ab}	13.03^{a}	0.22	***
TDN	59.56^{b}	40.05^{e}	56.04^{c}	56.92^{c}	64.02^{a}	59.37^{b}	49.02^{d}	57.58^{bc}	57.02^{c}	0.64	***

Sig. = Significance, SE= standard error, T_1= Basal diet ; T_2 = low dose of AFs (75µg Total AFs/kg diet); T_3 = High dose of AFs (150µg Total AFs/kg diet) ; T_4 = basal Diet supplemented with bagasse at level 3%, T_5 = basal Diet supplemented with bagasse at level 6% ; T_6: low dose of AFs+ bagasse at level 3% ; T_7: low dose of AFs+ bagasse at level 6% ; T_8 : High dose of AFs+ bagasse at level 3% ; T_9 : High dose of AFs+ bagasse at level 6%.

group (T_1) (63.66, 63.92, 69.97, 45.59 and 71.65, respectively) and rabbits group fed 3% bagasse (T_4). The CF value for control group was the highest compared to the other experimental groups. These results are consistent with Babiker *et al*. (2016) who found that, the digestibility of crude protein and organic matter of the sugarcane bagasse were improved ($P<0.05$) in experimental diets. in general, rabbits fed 3% bagasse with low dose of aflatoxin (T_6) recorded significantly ($P<0.05$) higher values of digestibility nutrients, DCP and TDN compared to rabbits fed basal diet with low dose of aflatoxin (T_2). While, rabbits fed 6% bagasse with high dose of aflatoxin (T_9) recorded significantly ($P<0.05$) higher values of digestibility nutrients, DCP and TDN compared to rabbits fed basal diet with high dose of aflatoxin (T_3) indicating positive influential effect of bagasse.

Blood constituents

Blood plasma biochemical analysis values are used as indicators of the health status of rabbits. Table 6 represent the changes in serum total protein (TP), and albumin (ALb) of rabbits treated with two doses low and high aflatoxins (T_2 and T_3) caused a significant decrease in both values when compared with control group (T_1). Supplementation of 3% and 6% bagasse with low and high doses of aflatoxins (T_6 to T_9) showed a significant increase in both parameters when compared to groups treated with aflatoxins singly (T_2 and T_3). The highest value of serum protein and albumin were obtained on treatment with low aflatoxins dose and 6 % supplementation of bagasse (6.10, and 3.5 g/dl, respectively). These results are in agreement with Nwaogu (2016) and Barati *et al*. (2018) who found that total proteins were decreased in poultry as a result of feeding with aflatoxins contaminated diets. This led to damage in liver health and disturbance in metabolic pathways.

Regarding to creatinine and urea, Table 6 showed that significant increase in values of serum creatinine and urea of rabbits fed on low and high doses of aflatoxins (T_2 and T_3) when compared with control group (T_1). Supplementation of 3% and 6% bagasse in groups T_4 and T_5 showed no effects in both parameters when compared to control group (T_1). Groups of rabbits treated with low and high doses of aflatoxin and with 3% and 6% bagasse (T_6 to T_9) showed a significant decrease in both parameters when compared to groups treated with aflatoxins singly (T_2 and T_3). The results showed the lowest value of serum creatinine and urea obtained with low dose of aflatoxins and 6% bagasse supplementation (0.87, and 27.67 mg /dl, respectively).

Table 6. Effect of supplemented different levels of dietary bagasse and aflatoxin (Means±SE) on blood parameters of growing rabbits.

Groups / Parameters	Basal Diet	Controls				Treatments				Sig.
		Aflatoxin		Dietary bagasse		Low aflatoxin dose		High aflatoxin dose		
		Low dose	High dose	3%	6%	3% Bagasse	6% Bagasse	3% Bagasse	6% Bagasse	
	T1	T2	T3	T4	T5	T6	T7	T8	T9	
TP(g/dl)	$8.02^{a}\pm0.06$	$4.5^{g}\pm0.06$	$3.53^{h}\pm0.06$	$7.53^{b}\pm0.06$	$7.45^{b}\pm0.06$	$5.0^{e}\pm0.06$	$6.10^{c}\pm0.06$	$4.77^{f}\pm0.06$	$5.90^{d}\pm0.06$	*
Albu(g/dl)	$3.8^{a}\pm0.02$	$3.2^{g}\pm0.02$	$3.0\ 6^{h}\pm0.02$	$3.7^{b}\pm0.02$	$3.6^{c}\pm0.02$	$3.3\ ^{f}\pm0.02$	$3.5^{d}\pm0.02$	$3.20\ ^{g}\pm0.02$	$3.4^{e}\pm0.02$	*
Creat (mg/dl)	$0.7\ ^{f}\pm0.03$	$1.27^{d}\pm0.03$	$1.4^{a}\pm0.03$	$0.73\ ^{f}\pm0.03$	$0.75\ ^{f}\pm0.03$	$1.07^{dc}\pm0.03$	$0.87^{e}\pm0.03$	$1.13^{c}\pm0.03$	$1.0^{d}\pm0.03$	*
Urea(mg/dl)	$18.0^{f}\pm0.75$	$40.0^{a}\pm0.75$	$42.0^{a}\pm0.75$	$18.50^{f}\pm0.75$	$19.1^{f}\pm0.75$	$35.5^{c}\pm0.75$	$27.67^{e}\pm0.75$	$37.67^{d}\pm0.75$	$31.33^{d}\pm0.75$	*
ALT(U/L)	$17.67^{f}\pm0.7$	$42^{a}\pm0.7$	$43.67^{a}\pm0.7$	$18.00^{f}\pm0.7$	$18.18^{f}\pm0.7$	$35.33^{c}\pm0.7$	$25.67^{e}\pm0.7$	$39.00^{d}\pm0.7$	$29.00^{d}\pm0.7$	*
AST(U/L)	$21.00^{f}\pm1.1$	$54.00^{b}\pm1.1$	$58.33^{a}\pm1.1$	$21.80^{f}\pm1.1$	$22.00^{f}\pm1.1$	$44.00^{cd}\pm1.1$	$37.66^{e}\pm1.1$	$46.67^{c}\pm1.1$	$41.00^{d}\pm1.1$	*
ALPh(U/L)	$418.67^{g}\pm1.1$	$629^{d}\pm1.1$	$637.67^{a}\pm1.1$	$419.73^{g}\pm1.1$	$420.20^{g}\pm1.1$	$559.33^{d}\pm1.1$	$503.00^{f}\pm1.1$	$581.00^{c}\pm1.1$	$544.33^{e}\pm1.1$	*
Chol(mg/dl)	$32.27^{g}\pm1.0$	$78.6^{b}\pm1.0$	$85.23^{a}\pm1.0$	$33.7^{g}\pm1.0$	$34.77^{g}\pm1.0$	$65.67^{d}\pm1.0$	$51.73^{f}\pm1.0$	$74.10^{c}\pm1.0$	$57.67^{e}\pm1.0$	*

a, b .... Values within a row with different superscripts significantly different ($p<0.05$). SE= standard error.

T_1= Basal diet ; T_2 = low dose of AFs (75µg Total AFs/kg diet); T_3 = high dose of AFs (150µg Total AFs/kg diet) ; T_4 = basal diet supplemented with bagasse at level 3%, T_5 = basal diet supplemented with bagasse at level 6% ; T_6: low dose of AFs+ bagasse at level 3% ; T_7: low dose of AFs+ bagasse at level 6% ; T_8 : high dose of AFs+ bagasse at level 3% ; T_9 : high dose of AFs+ bagasse at level 6%. ALT: alanine amino transferase, AST: aspartate amino transferase, ALPh: Alkaline phosphatase and Cholesterol.

In this regard, increased creatinine and urea in the blood indicate inflammatory changes in the kidneys. These results are consistent with

In this regard, increased creatinine and urea in the blood indicate inflammatory changes in the kidneys. These results are consistent with El-Desouky *et al*. (2017) and Al-Masri (2017) who observed high levels of creatinine and uric acid when rats fed with wheat contaminated with AFB_1 as compared with the control group.

The results of Table 6 showed no significant ($P<0.05$) changes noticed in ALT, AST, ALP activities in rabbits treated with bagasse alone at level 3% and 6% for groups (T_4 and T_5) in all experiment period corresponding to control group (T_1). Rabbits fed on basal diet supplemented with %6 bagasse and aflatoxin with low and high concentration (T_7 and T_9) showed a significant decrease in serum ALT, AST, ALP activity and cholesterol comparing with basal diet supplemented with aflatoxin (low and high concentration) without bagasse (T_2 and T_3). These results almost were in agreement with Hasan (2014) who found an increase in serum levels of ALT, AST and ALP in rats treated with aflatoxins during storage of walnuts. This also agrees with Abdel-Wahhab *et al.* (2014) who reported that an increase in ALT and AST in aflatoxin-treated rats was an indication of changes in liver tissue.

Economic efficiency

The effect of different levels of dietary bagasse on the average values of economical efficiency is presented in Table 7. Generally, among the most important factors involved in the achievement of maximum efficiency in meat production are feeding cost, length of growing period and the final body weight. Accordingly, the economic efficiency of any product could be calculated from input_output analysis based mainly up on the total feeding cost per total number of Kg LBW sold and the current selling price of LBW per Kg (Hala, 1998).

It should be pointed out that the calculation herein depended on the average price at 2017 (during which the experiment was executed). Results showed an improvement in the average values of net revenue, economical efficiency and relative economical efficiency due to feeding growing rabbits the diets with 6% bagasse without aflatoxin (T_5) (being 58.65; 2.30 and 122.34, respectively) compared to control group (T_1) and 3% bagasse group (T_4). It can be noticed that, low and high aflatoxin dose +6% of bagasse diet (T_7 and T_9) recorded the best relative economic efficiency % (120.21 and 119.04%) compared to T_2, T_3, T_6 and T_8 (105.85, 103.03, 110.77 and 109.09%). These decreasing in relative economic efficiency % may be due

Table 7. Economical efficiency of growing rabbits as affected by different levels of dietary bagasse and aflatoxin.

Items	Tested diets								
	Basal diet (T_1)	Low aflatoxin (T_2)	High aflatoxin (T_3)	3% Bagasse (T_4)	6% Bagasse (T_5)	low aflatoxin dose +3% bagasse (T_6)	low aflatoxin dose +6% bagasse (T_7)	High aflatoxin dose +3% bagasse (T_8)	High aflatoxin dose +6% bagasse (T_9)
Item									
Av. feed intake (Kg/rabbit) a	5.15	5.18	5.28	5.28	5.29	5.14	4.9	5.49	5.11
Price/ Kg feed (PT)* b	4.93	4.93	4.93	4.86	4.82	4.86	4.82	4.86	4.82
Total feed cost (LE) a x b = c	25.39	25.54	26.03	25.66	25.50	24.98	23.62	26.68	24.63
Av. Body weight gain (Kg/rabbit) d	1.33	1.39	1.39	1.46	1.53	1.4	1.4	1.48	1.45
Price/Kg live body weight (LE)** e	55	55	55	55	55	55	55	55	55
Total revenue (LE) (d x e = f)	73.15	76.45	76.45	80.30	84.15	77	77	81.4	79.75
Net revenue (LE) (f-c=g)	47.76	50.91	50.42	54.64	58.65	52.02	53.38	54.72	55.12
Economic efficiency *** (g/c)	1.88	1.99	1.94	2.13	2.30	2.08	2.26	2.05	2.24
Relative economic efficiency****	100	105.85	103.03	113.27	122.34	110.77	120.21	109.09	119.04
Performance index (PI)	54.21 ±3.46	59.72 ±3.16	51.50 ±3.46	60.76 ±3.16	65.11 ±3.46	67.48 ±3.46	61.35 ±3.16	60.33 ±3.16	65.01 ±3.46

* According to the price of different ingredients available in the market at the experimental time (2017).

** According to the local market price at the experimental period.

*** Net revenue per unit Cost.

**** Compared to the economical efficiency of the control group.

to bad effect of aflatoxin dose which caused increasing in feed intake and decreasing in final live body weight gain.

Results of performance index (PI) are presented in Table 7. The results indicated that the highest value of total PI recorded for rabbits group fed low dose of aflatoxin+ bagasse at level 3% (T_6) followed by rabbits group fed bagasse at level 6% (T_5) (67.48 and 65.11, respectively). While, the worst value was recorded by rabbits group fed high dose of AFs (T_3) (51.5%).

The results present in Table 8 show that, rabbits groups treated with low and high doses of aflatoxins (T_2 and T_3) achieved significant increase in liver, and kidney weight mainly at the end of the experimental period, compared with control group (T_1). That could be a result of inflammatory and biochemical changes due to the presence of aflatoxins in these organs.

Table 8. Liver and Kidney weight of growing rabbits as affected by different levels of dietary bagasse (Means ± SE).

Groups / Parameters	Basal Diet	Controls				Treatment				Sig.
		Aflatoxin		Bagasse		Low aflatoxin dose		High aflatoxin dose		
		Low dose	High dose	3%	6%	3% Bagasse	6% Bagasse	3% Vagasse	6% Bagasse	
	T1	T2	T3	T4	T5	T6	T7	T8	T9	
Liver weight	53.34^{f} ±3.73	94.85^{b} ±3.73	140.93^{a} ±3.73	57.26^{ef} ±3.73	65.25^{de} ±3.73	68.06^{cde} ±3.73	66.49^{cde} ±3.73	77.12^{c} ±3.73	77.07^{de} ±3.73	*
Kidney weight	8.71^{d} ±1.15	18.51^{ab} ±1.15	20.35^{a} ±1.15	12.69^{d} ±1.15	14.10^{cd} ±1.15	14.81^{bcd} ±1.15	14.38^{cd} ±1.15	17.03^{abc} ±1.15	15.45^{bcd} ±1.15	*

a, b ……. Values within a row with different superscripts significantly different (P<0.05).
SE= standard error.
T_1= Basal diet ;T_2 = low dose of AFs (75µg Total AFs/kg diet); T_3 = High dose of AFs (150µg Total AFs/kg diet) ; T_4 = basal diet supplemented with bagasse at level 3%, T_5 = basal diet supplemented with bagasse at level 6% ; T_6: low dose of AFs+ bagasse at level 3% ; T_7: low dose of AFs+ bagasse at level 6%; T_8: High dose of AFs+ bagasse at level 3% ; T_9 : High dose of AFs+ bagasse at level 6%.

Conclusively, based on the results obtained in this study, it was established that using 6% of bagasse only without aflatoxin in the rations of growing rabbit's achieved improvements in growth performance parameters, digestibility coefficients, biochemical parameters and economic efficiency. At the same time, presence of bagasse alleviated the detrimental effect of aflatoxin.

REFERENCES

Abdel-Wahhab, M.A.; E. S. El-Denshary; A. A. El-Nekeety, N. S. Hassan; F. M. Abu-Salem; N. A. Sarhan and B. H. Rhin (2014). Impact of Soy Isoflavones on Aflatoxin-induced Oxidative Stress and Hepatotoxicity in Rats. General Health and Medical Sciences, 1: 9-14.*Sciences Journal* 31 :1269-1277.

Al-Masri, S.A. (2017). Antioxidant activity of ascorbic acid against aflatoxin in contaminated nuts on rats. *The Journal of Animal & Plant Sciences*, 27: 389-397.

Almeida G. A. P.; M. A. Ferreira; J. L. Silva; J. C. C. Chagas; A. S. C. Véras; L. J. A. Barros and G. L. P. Almeida (2018). Sugarcane bagasse as exclusive roughage for dairy cows in smallholder livestock system. Asian-Australas. *J. Anim. Sci.* 31:379–385. doi: 10. 5713 / ajas.17.0205.

AOAC. (2016). *Official Methods of Analysis International*. 20th Ed. Association of Official Agricultural Chemists, Washington, D.C., U.S.A.

Armstrong, W. D. and C. W. Corri (1960). *Physiological Chemistry*. Laboratory Diction, 3rd Edition, P. 75 Punges publishing Co., Minneapolis, USA.

Avantaggiato, G., M. Solfrizzo and A. Visconti (2005). Recent advances on the use of adsorbent materials for detoxification of Fusarium mycotoxins. *Food Addit. Contam.* 22, 379–388.

Barati, M.; M. Chamani; S. N. Mousavi; S. A. Hoseini and M. T. A. Ebrahimi (2018). Effects of biological and mineral compounds in aflatoxin-contaminated diets on blood parameters and immune response of broiler chickens. *Journal Of Applied Animal Research*, 46:707–713.

Barros, R. C. D.; V. R. R. Júnior; A. S. D. Souza; M. Franco; T. D. S. Oliveira; Gustavo Almeida Mendes; D. A. D. A. Pires; E. Sales; L. A. Caldeira (2010). Economic viability of substitution of sorghum silage by sugarcane or sugarcane bagasse ammoniated with urea for cattle in feedlot. *Rev Bras Saude Prod Anim.*,11:555–69.

Chibanga, J. F.; D. B. Nyirenda and J. Simbaya (2014). Effects of supplementing different levels Vitamin A Aflatoxin B1 contaminated diets on the performance of broiler chickens. *Asian Journal of Natural & Applied Sciences*, 3: 35-46.

De Gisi, S.; G. Lofrano; M. Grassi and M. Notarnicola (2016). Characteristics and adsorption capacities of low-cost sorbents for wastewater treatment: *A review. Sustain. Mater. Technol*., 9, 10–40.

Doumas, B. T.; W. A. Watson and H. G. Biggs (1971). Albumin standards and the measurement of serum albumin with bromcresol green. *Clinica Chimica Acta*, 31(1), 87-96.

Duncan, D. B. (1955). Multiple range and multiple F tests. *Biometrics, 11:*1–42.

El-Desouky, T.A.; A. M. A. Sharoba; A. I. El-Desouky; H. A. El-Mansy and K. Naguib (2017). Biological and Histopathological Evaluations of Using Ozone Gas in Decontamination of Aflatoxin B_1 in Wheat Grains. MOJ Toxicol, 3:57,1-7.

HÁLA, Jiří (1998). Radioaktivita, ionizující záření, jaderná energie. 1. vyd. Brno: Konvoj, 311 s. ISBN 80-85615-56-8.

Hasan, R. H. G. (2014). Acute and Chronic Effects of Aflatoxin on the Liver of Rats During the Storage of Walnuts, *World Applied Sciences Journal,* 31 :1269-1277.

Ismail F.S.A.; M. R. Elgogry; W. A. Morsy and H. M. EL-Tahan (2016). Effect of using sugarcane bagasse with or without enzymes in rabbit diets on growth performance of growing rabbits. *World Rabbit Science Association Proceedings 11th World Rabbit Congress,* June 15-18.

Babiker, I. A.; A. M. S. Mukhtar; O. A. E. Khidir (2016). Digestibility and rumen degradability of bagasse based diets (bbd) fed to beef cattle. *J Dairy Vet Anim Res*., 3(1):15-18, DOI: 10.15406/jdvar.2016.03.00065.

Kamal, G. Nath (2011). Utilization of sugarcane bagasse fiber in functional food formulations. Master of Science. University of Agricultural Sciences, Bengaluru.

Khadem, A.A.; S. D. Sharifi; M. Barati and M. Borji (2012). Evaluation of the effectiveness of yeast, zeolite and active charcoal as aflatoxin absorbents in broiler diets. *Global Vet*. 4: 426–432.

Maidala, A. and J. A. Istifanus (2012). The role of micro livestock in alleviating protein deficiency and poverty reduction in Nigeria being a paper presented at the second school of vocational and technical education. *National Conference Held at College of Education Azare from* 4-8th June.

Maidala, A.; T. N. Dahuwa and J. Haruna (2016). Nutritional Evaluation of Human Used Sugar Cane Bagasse as a Source of Fibre on Growth Performance and Carcass Characteristics of Rabbits. *International Journal of Geography and Environmental Management, ISSN 2504-8821* Vol. 2 No.1rabbits. *Ind. J. Exp. Biol*., 34: 592-593.

NRC (1994). National Research Council.Nutrient Requirements of Poultry.9th Ed. National Academy of Sciences. Washington, D.C., USA.

Nwaogu, L. A. (2016). Toxico-pathological evaluation of Citrulluscolocynthis seed and Pulp aqueous extracts on albino rats. *World J. Biol. Med. Sci.* 3: 76–85.

Reitman, S. and S. A. Frankel (1957). Colorimetric method for the determination of sGOT and sGPT. *Amr. J. Clin. Pathol*., 28: 56-63.

Royer, M. E. and H. A. Ko (1969). Simplified semi-automated assay for plasma triglycerides. *Ann. Biochem*. 29:405.

SAS (2003). SAS/STAT User's Guide (Version 9.2). *Statistical Analysis System Inst*, Cary, NC.

Siqueira, T.C.A.; I. Z. Da Silva; A. J. Rubio; R. Bergamasco; F. Gasparotto; E. A. De Souza Paccola and N. U. Yamaguchi (2020). Sugarcane Bagasse as an Efficient Biosorbent for Methylene Blue Removal: Kinetics, Isotherms and Thermodynamics. *Int. J. Environ. Res. Public Health* , 17:526; doi:10.3390/ijerph17020526.

Sun, Y.; G. Dong; E. Guangxin; M. Liao; L. Tao and J. Lv (2018). The effects of low levels of aflatoxin B1 on health, growth performance and reproductivity in male rabbits. *World Rabbit Science*, *26* (2): 123.

Valchev, I.; V. Marutsova; I. Zarkov; A. Ganchev and Y. Nikolov (2017). Effects of aflatoxin B1 alone or co-administered with Mycotox NG on performance and humoral immunity of turkey broilers. *Bulgarian Journal of Veterinary Medicine*, *20* (1).

Williams, J. H.; T. D. Phillips; P. E. Jolly; J. K. Stiles; C. M. Jolly and D. Aggarwal, (2004). Human aflatoxicosis in developing countries: a review of toxicology, exposure, potential health consequences, and interventions. *The American Journal of Clinical Nutrition*, 80 (5):1106–1122, https://doi.org/10.1093/ajcn/80.5.1106.

Zahoor, M. and F. A. Khan (2018). Adsorption of aflatoxin B1 on magnetic carbon nanocomposites prepared from bagasse. *Arabian Journal of Chemistry*, 11:729–738.

Zlatkis, A.; B. Zak and A. J. Boyle (1953). A new method for the direct determination of serum cholesterol. *J. Lab. Clin. Med. 41:486-92, [Depts. Chem., Pathol., and Med., Wayne Univ., and City of Detroit,* Receiving Hosp., Detroit, MI].

Zuo, R. Y., J. Chang, Q. Q. Yin, P. Wang, Y. R. Yang, X. Wang, G. Q. Wang and Q. H. Zheng (2013). Effect of the combined probiotics with aflatoxin B2-degrading enzyme on aflatoxins detoxification, broiler production performance and hepatic enzyme gene expression. *Food and Chemical Toxicology*, 59, 470–475.

تأثير إستخدام مصاصة القصب كمصدر طبيعى للالياف وكمادة ماصة للأفلاتوكسين في علائق الأرانب النامية على الأداء

حسنى السيد أحمد أبو عيد* - محمود سعد أبو سكين* - أمل عبد العزيز أبو حجر** - تامر سيد عبد الغنى**

*قسم التنمية المتواصلة للبيئة وإدارة مشروعاتها – معهد الدراسات والبحوث البيئية – جامعة مدينة السادات – مدينة السادات – المنوفية – مصر.
**المركز الإقليمى للتغذية والأعلاف – مركز البحوث الزراعية – وزارة الزراعة – الدقى – الجيزة – مصر.

أجريت الدراسة لتحديد أثر إضافة مصاصة القصب كمصدر للألياف الطبيعية ولادمصاص الأفلاتوكسين في علائق الأرانب النامية ولتقييم استخدام مصاصة قصب السكر على أداء النمو ومعاملات هضم العناصر الغذائية والقيمة الغذائية وبعض مكونات الدم والكفاءة الاقتصادية للأرانب النيوزيلندية البيضاء النامية. اشتملت الدراسة على أربعة وخمسين أرنبًا بعمر 5 أسابيع بمتوسط وزن 751.8 ± 35.62 جم. تم تقسيم الحيوانات إلى تسع مجموعات متساوية وتم تغذيتها لمدة 8 أسابيع. كانت المجموعات التجريبية على النحو التالى: عليقة الكنترول (عليقة أساسية T_1) ، عليقة أساسية مضاف لها جرعة منخفضة من الأفلاتوكسين (75 ميكروغرام من الأفلاتوكسين / كجم عليقة) (T_2) و جرعة عالية من الأفلاتوكسين (150 ميكروغرام من الأفلاتوكسين / كجم عليقة) (T_3) و 3 ٪ من مصاصة القصب (T_4) و 6٪ من مصاصة القصب (T_5) و 3٪ من مصاصة القصب مع جرعة منخفضة من الأفلاتوكسين (T_6) و 6٪ من مصاصة القصب مع جرعة منخفضة من الأفلاتوكسين (T_7) و 3٪ من مصاصة القصب مع جرعة عالية من الأفلاتوكسين (T_8) و 6٪ من مصاصة القصب مع جرعة عالية من الأفلاتوكسين (T_9). سجلت نتائج وزن الجسم الحي عند عمر 13 أسبوع أعلى قيم لكل من المجموعتان T_7 و T_9 مقارنة بمجموعة الكنترول والمجموعتين T_2 و T_3. كما سجلت المجموعة T_3 أعلى استهلاك يومي للعلف بصورة معنويةً ($P < 0.05$) خلال الفترات 5-9 و5-13 أسبوع مقارنة بمجموعة الكنترول والمجموعات الأخرى. تم تسجيل أفضل قيمة معنوية ($P<0.05$) لكفاءة التحويل الغذائي للمجموعة T_6 في عمر 9-13 أسبوع وكذلك طول فترة التجربة مقارنة بالمجموعة T_2. بينما سجلت المجموعة T_9 أفضل قيمة معنوية ($P < 0.05$) لكفاءة التحويل الغذائي مقارنة

بالمجموعة T_3. كما حققت المجموعتان T_4 و T_5 أفضل قيمة معنوية ($P<0.05$) لكفاءة التحويل الغذائى مقارنة بمجموعة الكنترول (T_1). كانت قيم DM و OM و CP و EE و NFE للمجموعة T_5 هي الأعلى مقارنة بمجموعة الكنترول والمجموعتين T_1 و T_4. بشكل عام ، سجلت المجموعة T_6 قيماً أعلى معنوياً ($P<0.05$) للمركبات المهضومة و DCP و TDN مقارنة بالمجموعة T_2. بينما سجلت المجموعة T_9 قيماً أعلى معنوياً ($P <0.05$) للمركبات المهضومة و DCP و TDN مقارنة بالمجموعة T_3. أيضا أظهرت نتائج مكونات الدم أن التغيرات في البروتين الكلي (TP) والألبومين (ALb) للأرانب المعاملة بجرعتين منخفضتين وعاليتين من الأفلاتوكسين (T_2 و T_3) أدت إلى انخفاض معنوي في كلا القيمتين عند المقارنة مع مجموعة الكنترول (T_1). أظهرت النتائج أن إضافة 3٪ أو 6٪ من مصاصة القصب مع جرعات منخفضة أوعالية من الأفلاتوكسين (T6 إلى T9) أدت إلى زيادة معنوية في كل من البروتين الكلى والألبيومين عند مقارنتها بالمجموعات المضاف لها أفلاتوكسين فقط (T_2 و T_3). كما أظهرت المجموعتان T_6 و T_9 انخفاضًا معنويًا في قيم كل من البروتين الكلى والألبيومين عند مقارنتها بالمجموعتين T_2 و T_3. أيضا أظهرت النتائج أقل قيمة للكرياتينين واليوريا في الدم تم الحصول عليها مع المجموعة T_7. كما أظهرت المجموعات T_7 و T_9 انخفاضًا معنويًا في قيم ALT و AST و ALP والكوليسترول في الدم مقارنة بالمجموعات T_2 و T_3. أيضا أظهرت النتائج أن أعلى قيمة للـ PI سجلت للمجموعة T_6 تليها المجموعة T_5.

التوصية ، بناءً على النتائج المتحصل عليها من هذه الدراسة ، تم إثبات أن استخدام 6٪ من مصاصة القصب في علائق الأرانب النامية حقق تحسنًا في أداء النمو. وفي الوقت نفسه، خفف وجود مصاصة القصب من التأثير الضار للأفلاتوكسين.

الكلمات الدالة: مصاصة القصب – الأفلاتوكسين – الأرانب – أداء الأرانب – الكفاءة الإقتصادية.