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EFFECTS OF REPLECING CLOVER HAY BY CUCUMBER (*Cucumis sativus L.)* VINES STRAW WITHOUT OR WITH NATUZYME OR PREBIOTIC CONTANING MANAN OLIGOSACCHARIDE IN NZW RABBIT DIETS ON NUTRIENT DIGESTIBILITY, CAECAL, CARCASS CHARACTERISTIES AND SOME BLOOD CONSTITUENTS

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ABSTRACT

The present study was designed to investigate the effect of using cucumber vines straw (CVS) instead of clover hay in growing NZW rabbit diets without or with prebiotic (mannan oligosaccharide ,MOS) or multi-enzyme (Natuzyme, NZ) supplementation on nutrient digestibility, nutritive values, caecal microbial activity and its volatile fatty acids (VFAs) content, carcass traits and some blood constituents. A total number of 63 six-week old NZW rabbits were randomly divided into 7 groups; each group included 3 replicates of 3 rabbits each and reared in metallic batteries under similar conditions. Graded levels of cucumber vines straw were used to replace 0, 25, 50, 75 and 100% clover hay, 100% clover hay level without or with NZ or MOS at 1g/kg diet each, respectively, and to form 7 pelleted diets similar in all nutrients content and fed to rabbits from 6 to 12 weeks old. Results show that neither dietary CVS till 30% level (100% instead of clover hay) nor supplementation with NZ or MOS had significant effects on caecal VFA content (Acetate, propionate, Butyrate, Isobutyrate, Valerate, Isovalerate), carcass characteristics (skin+foot, liver, heart, kidneys and abdominal fat weights as percentages of live body weight) and plasma constituents (total lipids, total cholesterol, creatinine and enzymatic activities of alanine aminotransferase (ALT) and aspertate aminotransferase (AST)). Moreover, all other studied performance traits were not influenced with CVS-diets till 22.5% or 30% level supplemented with NZ or MOS. However feeding 30% CVS-diet without NZ or MOS significantly decreased nutrients digestibility coefficients, nutritive values (digestible crude protein, total digestible nutrients, and digestible energy, caecal pH value, relative carcass yield weights for carcass empty, total edible parts and plasma constituents (total proteins, albumin and globulin) and increased caecal ammonia (NH_3-N) concentration compared with those of control. Supplementing NZ or MOS into 30% CVS diet significantly negated (similar to control) all these adverse effects occurred by this level of CVS on studied traits. It could be concluded that CVS can be successfully used till 22.5% level (75% of clover hay) for feeding growing NZW rabbits without any healthy troubles or adverse effects, such level may be raised till 30% (100% instead of clover hay) in NZW rabbit diets supplemented with either NZ or MOS.

Keyword*:* Blood, caecal , carcass, cucumber vines, digestibility, enzymes, rabbit, mannan oligosaccharide, volatile fatty acids.

INTRODUCTION

Most of vegetable by-products are discarded in the field either as organic fertilizers or burned causing environmental pollution. Some are dried and stored as forage for ruminants or left in the field for livestock grazing

(Renard, 2001). In Egypt, although there has a great attention towards the use of hay of agricultural by-products, few attempts have been successfully performed on ensiled agricultural by-products and forage in rabbit feeding. The domestic rabbit is primarily a herbivorous animal that can consume most types of hay (roughages), Rabbits industry can play an essential role in overcoming the gab between demand and supply of animal protein, moreover, rabbits meat are more suitable than other types for human consumption. It is well known that the feeding cost represents about 60-70% of the total productive cost. Minimizing the feed cost could be achieved through the use of untraditional cheaper feed ingredients or improving utilization of common feeds by using some feed additives. The available amount of clover hay is usually insufficient for animal feeding leading to increasingly prices for diets. Cucumber crop cultivation has been increased in Egypt during the last three decades to be 1, 954,925 tones yearly. Egypt has now attained self sufficiency in cucumber production (Ministry of Agriculture, 2007), so there are many tones of cucumber crop wastes, that may participate in solving the feedstuffs shortage problem and reduce environmental pollution. Some studies have been carried out to determine the nutritional value of roughages (legumes; grasses; tree leaves; vegetable by-products) as either traditional or untraditional feedstuff for rabbits. Recently, many studies (Tag El-Din *et al.,* 2004; Omara, 2005; Sherif *et al*., 2010; Suliman, 2012) utilized some agricultural and agro-industrial by products in rabbit feeding, especially as alternatives to clover hay, which commonly represents about 30-40% of the complete pelleted diets of rabbits. Increasing dietary fiber level in rabbit diets reduced the rate of passage and digestive efficiency for energy in the small intestine, but fiber degradation was increased. It was indicated that adaptation of rabbits to a high fiber diets resulted in a higher digestive efficiency in volume for colon and caecum, digestive efficiency in the small intestine than those initially fed a low-fiber diets (Gidenne, 1992). Dietary fiber has an important role in the regulation of the intestinal transit, the gut flora and the intestinal mucosa integrity of rabbits (Fortun-Lamothe and boullier, 2007). Moreover, fiber sources were commonly related to digestion efficiency and feed intake in rabbits (Garcia *et al.,* 1999). Dietary fiber is necessary for rabbits to maintain a high rate of passage, avoiding an accumulation of digesta in the caecum that reduces feed intake and impairs growth (De Balas *et al.,* 1999). It also constitutes an energetic substrate for intestinal microbiota which supply an additional energy (volatile fatty acids), and high-quality microbial protein recycled through caecotrophy to the animal. In addition, type of fiber is also important, as chemical composition and physical structure of plant cell walls vary widely among fiber sources. Most of the VFA (acetate, propionate, butyrate) formed by gut bacteria are absorbed and metabolized by the animal thus contributing to host energy requirements (Fooks and Gibson, 2002), while some bacterial metabolites, such as ammonia, phenols and amines, resulting from the brocken and fermentation of proteins are toxic (Dommett *et al.,* 2005).

Prebiotics such as mannan oligosaccharide (MOS) and fructooligosaccharide (FOS) are alternatives to antibiotics. Prebiotics are non-digestable feed ingredients, which beneficially affect growth and activities of probiotics, and gut microflora by selective stimulating the growth or metabolic activity of a limited number of gut microflora, e.g. *Bifidobacteria* and *Lactobacillus sp*. (Gibson and Roberfroid, 1995). Prebiotics substrates like FOS and MOS derived from yeast and bacteria cells, which are neither hydrolysed by the endogenous digestive enzymes nor absorbed by the host have been identified as prebiotic agents (Gibson and Fuller, 2000; Zimmerman *et al*., 2001). The yeast cell wall has a powerful antigenic stimulating properties, and it is well established that this property is a characteristic for the mannan chain (Ballou, 1970).

The objective of the present study was to evaluate effects of using graded levels of cucumber vines straw without or with mult-enzyme (Natozyme, NZ) or prebiotics (mannan oligosaccharides, MOS) supplementation in growing NZW rabbits diets on the nutrients digestibility, nutritive values, caecal microbial activity and volatile fatty acids (VFAs) content, carcass characteristics and some blood constituents.

MATERIALS AND METHODS

The present experiment was carried out at the Poultry Station, Agriculture Research and Experimental Center, Faculty of Agriculture, Mansoura University during the period from January to february 2012, while the chemical analyses were completed at the Laboratories of Animal Production Research Institute, Agriculture Research Center. This research was designed to study the effects of using graded levels (0, 7.5, 15, 22.5 and 30%) of dietary cucumber vines straw (CVS) representing 0, 25, 50, 75 and 100% of clover hay, in the pelleted diets on the growth performance of NZW rabbits during the period from 6 to12 weeks old. In addition, the effects of supplementing either multi-enzyme (NZ) or prebiotic containing (MOS) to 30% CVS level of rabbit diet was also investigated.

Preparation and chemical analysis of tested materials:

Cucumber (*Cucumis Sativus L.)* belongs to *Cucurbitaceae* are grown in Egypt, during September-January and February-June, to get its fruits for human consumption. Cucumber vines were obtained from Dakahllia governorate fields. Following end of the fruits collection season of cucumber, the vines (stalks, leaves) were harvested, then left to dry in the air and ground for diet manufacturing. The chemical analysis of CVS was (16.17, 26.01, 1.77, 11.10, 44.95% of CP, CF, EE, Ash and NFE on DM) and DE (kcal/kg) = [7.1 (CP, g/kg) +12.0 (EE, g/kg) +5.59 (NFE, g/kg)]-1801 (Fekate, 1987; El-Kerdawy, 1996).Cucumber vines straw and clover hay (third cutting) using duplicate samples were determined according to AOAC (1995).

Animals, diets and management:

A total number of sixty three NZW rabbits of 6-week old were randomly divided into 7 groups (nearly similar in average body weight) of 3 replicates each. Three rabbits of each replicate were housed together in galvanized wire cages (50×50×45 cm). Seven experimental pelleted diets were formulated (Table 1) to cover the nutrient requirements for rabbits according to NRC (1977). The first one was considered as control (free 0f cucumber vines straw). The 2^{nd}, 3^{rd}, 4^{th}, and 5^{th} diets were formulated by using graded levels of 7.5, 15, 22.5 and 30% CVS of the diet as replaced 25, 50, 75, and 100% of clover hay, respectively, in the rabbit diets.

Table (1): Composition and chemical analysis of the experimental rabbit diets (6-12 wks old).

Ingredients	Cucumber vines straw replacement levels						
	0.0 Control	25 %	50 %	75 %	100 %	100% + NZ	100% +MOS
Soybean meal, 44%	11.3	11.5	11.7	11.9	12.1	12.1	12.1
Yellow corn	3.4	4.0	4.6	5.2	5.8	5.8	5.8
Wheat bran	30.0	29.2	28.4	27.6	26.8	26.7	26.7
Barley grain	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Clover hay	30.0	22.5	15.0	7.5	--	--	--
Cucumber vines straw	--	7.5	15.0	22.5	30.0	30.0	30.0
Natuzyme (NZ)	--	--	--	--	--	0.1	--
MOS(1)	--	--	--	--	--	--	0.1
Molasses	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Di-calcium phosphate	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Limestone	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Vit.+Min. Mix.(2)	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Sodium chloride	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Dl- Methionine	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total	100	100	100	100	100	100	100
Calculated values(3):							
Digestible energy, kcal/kg	2618.3	2619.0	2619.7	2620.7	2621.4	2618.8	2618.8
Lysine, %	0.82	0.82	0.81	.0.81	0.80	0.80	0.80
Meth.+ Cyst., %	0.53	0.53	0.53	0.52	0.52	0.52	0.52
Calcium, %	1.17	1.16	1.16	1.15	1.14	1.14	1.14
Total phosphorus, %	0.86	0.86	0.85	0.85	0.84	0.84	0.84
Determined analyses on DM basis (AOAC, 1995):							
Dry matter, %	89.55	89.61	89.57	89.68	89.59	89.63	89.61
Organic matter, %	83.21	83.19	83.14	83.17	83011	83.16	83.12
Crude protein, %	17.21	17.22	17.20	17.19	17.20	17.19	17.19
Crude fiber, %	13.52	13.49	13.50	13.48	13.47	13.46	13.46
NDF(4), %	79.02	79.28	79.51	79.83	80.11	80.11	80.11
ADF(4), %	17.51	17.98	18.38	18.76	19.58	19.58	19.58
ADL(4), %	4.26	4.83	5.32	5.84	6.55	6.55	6.55
Hemicellulose(4), %	61.51	61.30	61.13	61.07	60.53	60.53	60.53
Cellulose(4), %	13.25	13.15	13.06	12.92	13.03	13.03	13.03
Ether extract, %	3.19	3.18	3.16	3.14	3.12	3.12	3.12
Nitrogen free extract,%	49.29	49.30	49.28	49.36	49.32	49.39	49.35
Ash, %	16.79	16.81	16.86	16.83	16.89	16.84	16.88
Price, LE/kg(3)	1.9375	1.9059	1.8742	1.8426	1.8109	1.8893	1.9093

(1) Natuzyme (NZ) is multifunctional feed enzyme mixture containing xylanase, 10000000 U/kg; cellulase, 4200000 U/kg; β-gluconase, 700000U/kg; phytase, 700000U/kg; α-amylase, 700000U/kg and pectinase, 50000 U/kg. It also contains hemicellulases, amyloglycosidases and pentosanases activities. The active MOS consists of (100% yeast cell wall) 4 main, covalently linked, components of which mannoproteins and β (1,3) glucans, which functions as the backbone of the cell wall, account for the largest protein (Lipke and Ovalle, 1998).

(2)Each 3 Kg vitamin and mineral mixture contained 12000000 IU Vit. A, 2500000 IU Vit. D_3, 10000 mg Vit. E, 2500 mg Vit K_3, 1000 mg Vit B_1, 4000 mg Vit. B_2, 1500 mg Vit. B_6, 10 mg Vit. B_{12}, 10000 mg Pantothenic acid, 20000 mg Nicotinic acid, 1000 gm Folic acid, 50 mg Biotin, 500 gm Choline chloride, 60 gm Manganese, 55 gm Zinc, 100 mg Selenium, 1000 mg Iodine, 35 gm Iron, 10 gm Copper, 250 mg Copalt, and Carrier $CaCo_3$ to 3 kg.

(3)Calculated (NRC (1977) except test materials (calculated according to its determined values, Table 1).

(4)NDF= Nutrient detergent fiber, ADF= Acid detergent fiber, ADL= Acid detergent lignin, Hemicellulose = NDF- ADF, Cellulose = ADF- ADL.

(5)Price of 1kg diet was calculated according to the prevailing prices of feed ingredients during the experimental period.

The 6th diet contained 30% CVS with multi-enzyme (Natuzyme, 1g/kg diet) while the 7th diet contained 30% CVS with prebiotic (mannan oligosaccharides, MOS, 1g/kg diet). These additives were added at the level recommended by the manufacturer. All diets contained similar values of protein, energy and other nutrients and fed to groups during the experimental periods (6-12 weeks old). Rabbits were reared under standard managerial hygiene conditions in a naturally ventilated building. All cages were provided with manual feeder, and fresh water was available continuously through an automatic system of nipple drinkers. Pelleted feed and fresh water were renewed daily and were available day long for *ad lib* voluntary intake . Vaccination and common managements were conducted for rearing rabbits.

Data Collection:

Digestibility trials: During the 12th week of age, the experimental rabbits using the same replicates for each treatment were gone under digestibility evaluation for diets using total collection method. Animals were fed their corresponding experimental diets for 5 days, in which feed intake and feces voided, were accurately weighed every 24 hr for each animal. Feces produced daily for each replicate were collected quantitatively in polyethylene bags and stored at -20°Ċ for five consecutive days (Perez *et al*., 1995).

Fecal samples were dried in a forced air oven at 70°Ċ for 72 hr (air-dried samples) then ground and placed in screw-top glass jars until chemical analyses. Dry matter (DM), crude protein (CP), ether extract (EE), crude fiber (CF) and ash content of the feces as well as those of feed were determined according to AOAC (1995) and expressed on a dry matter basis. Nitrogen free extract (NFE)= 100- (CP+ EE+ CF+ Ash). The apparent digestion coefficient for DM, OM, CP, EE, CF and NFE were calculated. The total digestible nutrients (TDN) were calculated according to the classic formula of Cheeke *et al.* (1982) as: TDN% =DCP% + DCF% + DNFE% + DEE% ×2.25. The digestible energy (DE, kcal/kg) was calculated by multiplying each of digestible crude protein (DCP, g/kg), digestible ether extract (DEE, g/kg), digestible crude fiber (DCF, g/kg), and digestible nitrogen free extract (DNFE, g/kg) by 5.28, 9.51, 4.20 and 4.20, respectively, according to Schiemann *et al.* (1972).

Slaughter test: At the end of the experimental period (12 weeks old), 3 rabbits were taken randomly from each treatment, weighed after being fasted overnight, and slaughtered to complete bleeding. Then, they were skinned, weighed and eviscerated to obtain carcass characteristics. Carcass Empty percentage was estimated by dividing the weight of hot eviscerated carcass without liver, heart, kidney, spleen, testes and lungs by the live body weight. The internal organs as well as abdominal fat were separated and weighed individually to estimate their relative weights of live body weight.

Caecal microbial activity and volatile fatty acids estimation: Caecum fluid samples were collected from each slaughtered rabbits (3 samples for each treatment) to estimate caecal microbial activity and volatile fatty acids (VFA's) content. About 20 ml of caecum fluid was collected at 8 hours post-feeding. The caecum fluid samples were filtered through two layers of surgical gauze and were used for determinations. The pH value of caecum fluid was estimated immediately using battery operated pH meter. The VFA's and ammonia-N (NH_3-N) concentrations were determined in wet samples of caecal content according to the method of Vernay and Marty (1984). After acidification of caecal fluid samples using concentrated orthophosphoric acid and hydrochloric acid (0.1 N), the VFA's were steamed-distilled from a known volume of sample using the micro-kjeldahl apparatus. Distillation rate was adjusted so that 100 ml distillate was collected within 7 to 10 minutes. The concentration of the VFA's was calculated by recording the amount of NaOH (0.01 N) needed to neutralize the VFA's in the distillate.

Plasma constituents: Three blood samples per treatment were collected from slaughtered rabbits (at the end of the experimental period) in heparinized tubes for determination of some blood biochemical constituents. Plasma samples were obtained by centrifugation of blood samples at 3500 rpm for 20 minutes, and were stored at -20°Ċ for further analyses. `Colorimetric methods using commercial kits produced by Diamond diagnostics were used to estimate both plasma total protein (g/100 ml, Henry *et al.,* 1974), Albumin (g/100 ml, Doumas *et al.,* 1977), total lipids (g/l, Chabrol and Charonnat, 1973), total cholesterol (mg/100 ml, Watson, 1960), alanine aminotransferase (ALT) & aspertate aminotransferase (AST) enzymatic activities (IU/l, Reitman and Frankel, 1957) and creatinine (mg/100 ml, , Henry *et al.,* 1974). While, globulin concentration (g/100 ml) was calculated by subtraction of albumin values from the corresponding total protein values (Coles, 1974).

Statistical analyses: Data were statistically analyzed using one way ANOVA of SAS program (SAS Institute, 1994, Cry, NC, USA). Significant differences among means were ($P \leq 0.05$) separated using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DICUSSION

Nutrients digestibility and nutritive values:

Data of apparent digestibility for DM, CP, CF, EE, NFE, and nutritive values so DCP, TDN and DE of the experimental diets showed that there were no significant differences among groups fed control, CVS up to 22.5% level as well as those fed 30% CVS with either NZ or MOS (table 3). Growing rabbits fed diet containing 30% CVS without either NZ or MOS presented significantly lower digestibility of DM (5.0%), CP (4.44%), CF (8.48%), EE (4.72%), NFE (5.16%) and nutritive values as DCP (4.47%), TDN (5.13%) and DE (5.27%) compared with the control. However, supplementation of NZ or MOS into such diet containing 30% CVS significantly negated (similar to control) the adverse effects occurred by this level of CVS on all studied nutrient digestibility and nutritive values.

The present unaffected nutrients digestibility with dietary CVS up to 22.5% were similar with those observed with corn stalk diets up to 20% instead of clover (Afifi, 1999) and 20% peanut vines hay diets instead of clover hay (Omara, 2005) who found that apparent digestibility of DM, OM, CP, CF and NFE were not affected. Also, no significant change have been recorded in the DCP, TDN and DE values with CVS diets up to 22.5% level which agreed with those observed by Abd El-khalik (2002) and Tag El-Din *et al.* (2002) who reported that dietary 10 or 20% *phaseolus vulgaris* straw had no significant effects on DCP, TDN and DE of the diet. In the same manner, Sherif *et al*. (2010) observed that dietary parsley straw and caraway straw mixture (1:1) did not affect DCP, TDN or DE of the NZW rabbit diets. Moreover, the present results cited herein agreed with those of Perez *et al.* (1991), Hon *et al.* (2009), and Suliman (2012) who found that apparent digestibility of DM, CP and CF did not differ between the control diet and diets containing 70% replacement with different fiber sources.

Table (2): Nutrients digestibility and nutritive values of the experimental diets .

Dietary treatment	Nutrients digestibility (%)					DCP (%)	TDN (%)	DE (kcal/kg)
	DM	CP	CF	EE	NFE			
Control	68.43[a]	70.25[a]	50.11[a]	75.61[a]	73.49[a]	12.09[a]	60.36[a]	2667.2[a]
7.5% CVS	68.80[a]	69.63[a]	50.59[a]	75.75[a]	73.40[a]	11.99[a]	60.42[a]	2668.7[a]
15% CVS	67.81[a]	70.10[a]	49.68[a]	75.85[a]	73.52[a]	12.06[a]	60.39[a]	2668.0[a]
22.5% CVS	68.27[a]	70.53[a]	50.60[a]	75.85[a]	73.47[a]	12.13[a]	60.57[a]	2676.3[a]
30% CVS	65.01[b]	67.13[b]	45.86[b]	72.04[b]	69.70[b]	11.55[b]	57.16[b]	2526.6[b]
30% CVS+NZ	68.37[a]	70.68[a]	50.50[a]	75.51[a]	73.66[a]	12.15[a]	60.63[a]	2679.1[a]
30%CVS+MOS	68.38[a]	70.38[a]	50.42[a]	75.64[a]	73.58[a]	12.10[a]	60.51[a]	2673.2[a]
SEM	0.312	0.292	0.406	0.325	0.312	0.050	0.268	1.173
P value	0.002	0.001	0.001	0.001	0.0001	0.001	0.0001	0.0001

[a-b]Means in the same column having different superscripts are significantly different ($P \leq 0.05$) based on Duncan's test. n = 3 for each treatment

CVS= cucumber shoots straw, MOS= Mannan oligosaccharides (1g/kg diet), NZ=Natozyme (1g/kg diet), DM= dry matter, CP= crude protein, CF= crude fiber, EE= ether extract, NFE= nitrogen free extract, DCP= digestible crude protein, TDN= total digestible nutrients, DE= digestible energy.

Impairment of the nutrients digestibility and nutritive values with raising CVS level till 30% (100% instead of clover hay) without MOS or NZ in rabbit diet may be due to increasing ADL level of such diet (Table 2). The difference in plant age may explain the difference in ADL content between CVS and clover hay. It is well known that insoluble fiber is the dietary fraction mostly related to digestive troubles in rabbits, as it is the most important factor in regulating rate of passage and microbial growth (De Blas *et al*., 1999; Garcia *et al*., 2000; Gidenne, 2003). Increasing ADL content in the diet altered caecum pH value (Gidenne and Perez, 1994; Nicodemus *et al*., 1999; Garcia *et al*. 2002) which might help to control pathogenic flora (De Blas *et al*., 2002). In addition, the presence of some anti-nutritional factors (ANF) in most vegetable by-products may reduce nutrient utilization as those showed with De Lange *et al*. (2000) who showed that many feedstuffs that are commonly fed to animals contain ANF that interfere with the utilization of dietary nutrients causing depression in growth and feed efficiency and affect animal health. In plants and seeds, these anti-nutritional factors primarily act as biopesticides, protecting them against moulds, bacteria and birds. The nutritional value of feeds depends upon its nutritional contents and their digestibility and the presence or absence of anti-nutrients and toxic factors (Lee, 1999), however we can improve the quality or reduce the ANF in crops by several ways, such as ensiling, chopping, wilting, drying, washing, boiling or using chemicals. As well as, Myrie *et al.* (2008) stated that most feedstuffs contain ANF such as insoluble fibers, lignins, tannins and lectins. Intake of these ANF has the ability to reduce nutrient digestibility and to increase endogenous protein losses, through increased intestinal mucus secretion. In this respect, Muzquiz *et al.* (1999) noted that the main toxic components in *phaseolus vulgaris* and its by-products are lectins, sugar-binding proteins which bind and agglutinate red blood cells. The toxicity of lectins is characterized by growth inhibition in experimental animals and diarrhea. In the same mannar, El-Tohamy and El-Kady (2007) found a decrease in CP digestibility by rabbits fed radish, rocket and their mixed diets compared with the control diet. The present results cited herein confirmed those obtained by Arafa (1999) and Abd El-hamed (2001) who found that the lowest TDN, DCP and DE values had been obtained by group of rabbits fed diet contained 30% pea by-product or cabbage leaves.

On the other hand, El-Tohamy and El-Kady (2007) reported that apparent digestibility of OM, EE, CF and NFE for rabbits were significantly increased with radish, rocket and their mixed diets compared with the control diet. Asar *et al.* (2010) observed that feeding corn-cob meal with Faba beans straw increased TDN, DCP and DE values and CP digestibility (10.51%) over the control. In this respect, Sherif *et al.* (2008) found that CP, EE, and NFE digestibility were not affected among 0, 10, 20, 25 and 30% banana leaves containing diets, while CF digestibility was improved, compared with the control diet. Also, Hussien (2009) observed that apparent digestibility of EE was not affected with either pea vines, green bean vines or squash vines from 0 to 35% of growing rabbit diets.

Caecal microbial activity and volatile fatty acid fractions:

Results presented in Table (3) showed different alterations for caecum microbial activity traits and volatile fatty acid (VFA's) content of 12 weeks old NZW rabbits. The present pH value and ammonia-N (NH_3-N) level showed that there were no significant differences among groups fed control, CVS till 22.5% level and 30% CVS supplemented with NZ or MOS diets. Feeding 30% CVS diet without NZ or MOS decreased pH value (3.1%) and increased NH_3-N concentration (38.5%) compared with control diet . However, these adverse effects were negated (similar to control) with NZ or MOS supplementation. (Table 3). Concerning present caecum VFA's as a total or their fractions, there were no significant differences among all rabbit groups fed experimental studied treatment diets. Total VFA's values averaged 8.27-8.58 mmol/100 ml, while their fractions recorded 42.03-42.72, 27.03-28.09, 25.56-26.12, 2.04-2.14, 1.11-1.16 and 1.06-1.13% for acetate, propionate, butyrate, isobutyrate, valerate and isovalerate, respectively (Table 4).

Caecum pH value is one of the most important factors which affect bacterial fermentation in the caecum. Caecum pH value depends on many factors of which the amount and composition of the diet. Fluctuations in pH value reflect the changes of organic acids quantity accumulated in the ingesta. However, it remains relatively constant, because produced acids are removed by absorption across the caecum wall. The present pH values and NH_3-N are similar with those obtained by Abd El-Lateif (2002). Also, Omara (2005) found that pH values in the caecum of NZW rabbits averaged 5.75-

6.15 and they were significantly decreased with groups fed diets containing peanut vines instead of 50-100% clover hay. He also observed that NH_3-N values averaged 23.3-44 mg/100 dL and they were increased with dietary peanut vines silage diets. The present results of caecum VFA's are similar with those observed by Shetifa (1999), Abd El-lateif (2002) and Omara (2005) who found that caecum VFA's of rabbits recorded similar values among different fiber sources. In the same manner, Champe and Maurice (1983) reported that source of fiber had no effect on total and individual caecal VFA's. Vollek *et al*. (2002) reported that caecum TVFA's ranged between 8.9 and 12.8 mmol/100 ml with rabbits fed diets containing wheat bran, sugar beet pulp and potato pulp.

Table (3): Caecal microbial activity and volatile fatty acid (VFA´s) content as affected by dietary treatments.

Dietary Treatment	pH value	NH_3-N (mg/100 dL)	TVFA (mmol/ 100 ml)	VFA´s fractions (%)*					
				Acetat	Prop	Butyr	Isobut	Valer	Isoval
Control	6.46^a	27.67^b	8.33	42.53	27.13	26.05	2.10	1.12	1.06
7.5% CVS	6.43^a	28.67^b	8.27	42.27	27.38	25.95	2.11	1.16	1.13
15% CVS	6.44^a	24.33^b	8.35	42.72	27.37	25.65	2.04	1.12	1.10
22.5% CVS	6.44^a	26.67^b	8.34	42.62	27.03	25.99	2.12	1.14	1.09
30% CVS	6.26^b	38.33^a	8.58	42.50	27.36	25.84	2.05	1.13	1.11
30%CVS+NZ	6.51^a	25.33^b	8.30	42.47	27.05	26.12	2.14	1.11	1.10
30%CVS+MOS	6.52^a	27.00^b	8.36	42.03	28.09	25.56	2.11	1.12	1.09
SEM	0.234	0.134	0.031	0.155	0.167	0.108	0.020	0.011	0.072
P value	0.026	0.003	NS	NS	NS	NS	NS	NS	NS

a-b Means in the same column having different superscripts are significantly different(P≤0.05) based on Duncan's test. NS= Not significant n = 3 for each treatment

CVS= cucumber shoots straw, MOS= Mannan oligosaccharides (1g/kg diet), NZ= Natozyme (1g/kg diet),

***Acetat= Acetate, Prop= propionate, Butyr= Butyrate, Isobut= Isobutyrate, Valer= Valerate, Isoval= Isovalerate**

The present results cited herein confirmed those of Hussien (2009) who found that caecal NH_3-N concentrations were higher with growing rabbit diets containing 35% squash vines (100% instead of clover hay) than control diet. The present caecal acidity results agreed with those of Garcia *et al.* (1992) who reported that the substitution of sugar pulp by barley grains lucerne hay increased acidity of caecal contents.

However, Abou Ashour and Ahmed (1986) reported that high fiber diet caused higher production of TVFA's and lower NH_3-N concentration in caecal contents of rabbits. Also, Gracia *et al.* (2000) found that source of dietary fiber affected caecal fermentation pattern, but they found no correlation with dietary characteristics. Caecal total VFA values were higher with growing rabbit diets containing 7.75-35% pea vines, green bean vines or squash vines than control diet (Hussien, 2009). Similarly, Fraga *et al.* (1991) observed that caecal total VFA concentration of either beet pulp or rice hulls containing diets were higher than that of the control alfalfa hay diet. Also with acidity, Garcia *et al.* (1995) observed that neither type of Lucerne hay nor dietary fiber concentration has an effect on caecal pH value. Similarly, Hussien (2009) observed that neither dietary fiber sources (pea vines, green bean vines squash vines) nor their substitution level (0-35%) of clover hay in rabbit diets had significant effect on pH values for caecal contents.

Carcass characteristics:

Data for carcass characteristics (Table 4) of 12 weeks old rabbits showed that weights of both skin+foot, liver, heart, kidneys and abdominal fat as percentages of live body weight were not significantly affected among all groups of rabbits fed the experimental diets. Moreover, there were no significant differences in weights of both empty carcass and total edible parts as percentages of live weight among groups fed control, CVS till 22.5% and 30% CVS supplemented with NZ or MOS diets. Similarly, feeding some agriculture by-products for growing rabbits diets did not show any negative effects on carcass characteristics such as, artichoke caning by-products till 24% and pea processing up to 25% level (Zeweil, 1992a&b), tomato pomace (Ahmed *et al.*, 1994), cabbage leaves (Abd El-Hamed, 2001), peanut vines hay (Omara, 2005), and banana leaves (Sherif *et al.*, 2008). The present results cited herein confirmed those obtained by Tag El-Din *et al.* (2002) who found that dietary levels from 10 to 30% *phaseolus vulgaris* straw and kemzyme supplementation did not affect weights of liver, head, heart and abdominal fat as percentages of live weight. In the same manner, Al-Dobaib *et al*. (2007) observed that carcass traits of rabbits were not significantly affected by dietary discarded dates. Also, Aser *et al.* (2010) found that liver, heart and kidney weights of rabbits were not significantly affected by dietary mixtures of barley with berseem hay, corn-cob meal with berseem hay or corn-cob meal with faba beans straw.

Table (4): Carcass characteristics of NZW rabbits at 12 weeks-old as affected by dietary treatments.

Dietary Treatment	Live body Wt. (g)	Skin+ foot wt. (%)	empty carcass wt. (%)	Liver wt. (%)	Heart Wt. (%)	Kidneys wt. (%)	Abdom-inal fat wt. (%)	T. edible parts wt. (%)
Control	1955.6[a]	17.04	54.74[a]	4.02	0.293	1.017	0.280	60.34[a]
7.5% CVS	1960.4[a]	16.71	54.40[a]	3.98	0.297	1.043	0.277	59.99[a]
15% CVS	1961.3[a]	17.04	54.93[a]	4.01	0.293	1.050	0.277	60.55[a]
22.5% CVS	1963.1[a]	17.02	54.63[a]	4.04	0.293	1.023	0.293	60.28[a]
30% CVS	1755.7[b]	17.22	53.40[b]	3.87	0.300	0.973	0.267	58.81[b]
30% CVS+NZ	1956.4[a]	17.06	54.44[a]	4.00	0.303	1.050	0.293	60.09[a]
30%CVS+MOS	1960.0[a]	17.04	54.53[a]	3.96	0.310	1.033	0.290	60.13[a]
SEM	2.026	0.062	0.116	0.029	0.004	0.015	0.006	0.133
P value	0.011	NS	0.001	NS	NS	NS	NS	0.0001

[a-b]Means in the same column having differ rent superscripts are significantly different(P≤0.05) based on Duncan's test NS= Not significant n=3 for each treatment

CVS= cucumber shoots straw, MOS= Mannan oligosaccharides (1g/kg diet), NZ= Natozyme (1g/kg diet).

The slight decrease (2.5%) in the present empty carcass and total edible parts with raising CVS up to 30% level of the diet (100% instead of clover hay) without NZ or MOS confirmed those observed by Amber *et al.* (2002) who reported that dressing percentage values were significantly lower for rabbits fed diets contained sugar beet pulp, sweet potato tops or mung bean hay than those received the control diet. In the same manner, Gad-Alla, (1997) found negative effects on some carcass characteristics of rabbits with using sundried crops and vegetable residues in the diets. Supplementing NZ or MOS into 30% CVS diet negated the adverse effects occurred by this level of CVS because these additives may increase caecum microbial activities as those explained by (Gibson and Roberfroid, 1995). However, different results were observed by Sarhan (2005) found that dressing percentages of rabbits fed pea vines hay or pea pods hulls containing diets were higher than that of the control group. In the same manner, Safwat (2010) found that carcass and dressing percentages were higher for rabbits fed diets contained barley+ berseem hay or corn-cob+ berseem hay than those fed control diet.

Plasma constituents:

Results in Table (5) showed that neither dietary levels of 7.5-30% CVS nor supplementation with NZ or MOS had significant effects on plasma total lipids, cholesterol, creatinine and enzymatic activities of alanine aminotransferees (ALT) & aspertate aminotransferase (AST). Moreover, except group fed 30% CVS diet without studied additives, rabbits fed studied experimental dietary treatments were not significantly influenced in their plasma total proteins, albumin and globulin compared with those of control group. Rabbits fed diet containing 30% CVS without NZ or MOS recorded significantly lower total proteins (10.5%), albumin (12.4%) and globulin (8.6%) compared with those of control group. Supplementing NZ or MOS into such diet significantly negated the adverse effects occurred by this level of CVS. Similar results were observed by Tag El-Din *et al.* (2002) who found that dietary levels from 10 to 30% *phaseolus vulgaris* straw and kemzyme supplementation did not alter serum contents of total lipids, cholesterol and the activity of ALT. Also, Sherif *et al*. (2008) reported that blood parameters were not affected by feeding growing rabbits with different levels of banana leaves. In the same manner, inclusion of taro leaf in the growing rabbit diets had no effect on the serum AST and ALT activities (Abd El-Rahim *et al*., 1992). The present values for plasma constituents are within the normal values reported by many studies (Omara, 2000; Abd El-lateif, 2002; Adu *et al.,* 2010). The present values of ALT and AST indicated the normal activity of liver cells and healthy liver function.

The present decreasing of plasma proteins with higher dietary CVS level may be due to the decrease of caecum pH value which affects bacterial fermentation in the caecum, these alterations in the caecum impaired protein and other nutrient utilization with this level of CVS. Similarly, reducing blood proteins level was found in rabbits fed diets containing some agriculture by-products such as taro leaf (Abd El-Rahim *et al*., 1992), acacia leaves (El-Gendy, 1999), sunflower cake (Ismail and Gippert, 1999), fahle clover, fahle+ barley or fahly+ oats (El-Mahdy, 2000) and peanut vines hay (Omara, 2005).

However, different results were observed by El-Kerdawy *et al*. (1992) who found that the serum total proteins did not affected by feeding level of carrot tops hay in the diet from 0 up to 60%. Also, plasma total cholesterol level of growing rabbits was significantly decreased in rabbits fed diets contained hot pepper and fenugreek seeds (El-Ghamry *et al.*, 2004). In the same manner, El-Nattat and El-Kady (2007) found that addition of different medical plant seeds residues in adult rabbit diets decreased enzymatic activities of ALT and AST. The differences in the age of rabbits, management and diets composition may explain the difference between these results and those obtained herein.

Table (5): Plasma constituents of NZW rabbits at 12 weeks-old as affected by dietary treatments.

Dietary Treatment	Total protein (g/100ml)	Albu-min, (g/100ml)	Glubu-lin, (g/100ml)	Total lipids (g/l)	Choles-terol (mg /100ml)	ALT (IU/l)	AST (IU/l)	Creatin-ine (mg /100ml)
Control	4.76[a]	2.42[a]	2.34[a]	7.63	87.24	20.11	29.31	1.617
7.5% CVS	4.73[a]	2.34[a]	2.39[a]	7.71	84.50	19.08	29.52	1.643
15% CVS	4.75[a]	2.36[a]	2.39[a]	7.65	87.76	19.95	29.37	1.580
22.5% CVS	4.78[a]	2.34[a]	2.44[a]	7.63	88.90	20.72	29.99	1.601
30% CVS	4.26[b]	2.12[b]	2.14[b]	7.32	84.71	20.00	30.50	1.612
30% CVS+NZ	4.70[a]	2.35[a]	2.35[a]	7.67	88.80	20.41	29.58	1.567
30%CVS+MOS	4.66[a]	2.32[a]	2.34[a]	7.69	88.52	20.53	29.46	1.603
SEM	0.045	0.023	0.024	0.038	0.975	0.318	0.327	0.013
P value	0.005	0.007	0.007	NS	NS	NS	NS	NS

[a-b]Means in the same column having different superscripts are significantly different($P \leq 0.05$) based on Duncan's test. NS= Not significant n=3 for each treatment

CVS= cucumber shoots straw, MOS= Mannan oligosaccharides (1g/kg diet), NZ= Natozyme (1g/kg diet).

Conclusion: From the present nutritional results, it could be concluded that CVS can be successfully used till 22.5% level for feeding rabbits without any healthy troubles or adverse effect on nutrients digestibility, carcass traits and liver enzymatic activities, such level may be raised till 30% (100% instead of clover hay) in diets supplemented with either NZ or MOS.

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تـأثير إحـلال دريـس البرسـيم بعـروش الخيـار بـدون او مـع مخلـوط الإنزيمـات أو البريبيوتـك المحتـوى على المانـان أوليجوسكرايد فـى علائـق الأرانـب النيوزيلانـدى على معاملات الهضم، خصائص الأعور وجودة الذبائح وبعض مقاييس الدم

السمرة حسن على أبـو عجلـة ، هيـام محمد عبده أبـو المعاطى ، الشحات محمد قوطـة، شرين محمد الدسوقى.
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اجريت هذه الدراسه بهدف تقييم اثر تغذيه الارانب الناميه على علائق تحتوى مستويات مختلفه من تبن عروش الخيار بدون او مع اضافه مخلوط الانزيمات او البريبيوتك (المنان اوليجوسكرايد) بدلا من دريس البرسيم على معاملات الهضم والنشاط الميكروبى فى الأعور ومحتواه من الأحماض الدهنيه الطيارة وصفات الذبائح وبعض القياسات فى الدم. تم اختيار ثلاثه وستون ارنبا نيوزيلندى ابيض متماثلة عند عمر ٦ اسابيع وقسمت الى سبعه مجاميع متساويه ومتقاربه فى وزن الجسم وكل مجموعه تحتوى على تسعه ارانب تم توزيعها الى ثلاثه مكررات متساويه وكل مكرره تشمل ثلاثه ارانب ورببيت فى بطاريات معدنيه تحت ظروف بيئيه موحده خلال فتره التجربه حتى عمر ١٢ اسبوع. تم تكوين سبعه علائق تجريبيه باستخدام تبن عروش الخيار بمستويات متدرجه هى صفر و ٢٥ و ٥٠ و ٧٥ و ١٠٠ % إحلالا من محل دريس البرسيم مع إضافة مخلوط الإنزيمات اوالبريبيوتك بمعدل ١ جم/كجم علف لكل منهما الى العليقه المحتويه على ١٠٠% عروش الخيار وكانت العلائق جميعها متساويه فى محتواها من العناصر الغذائيه وتفى بالاحتياجات الغذائيه للارانب فى مرحله النمو. قدمت العلائق فى صوره محببه خلال الفتره ٦-١٢ اسبوع من العمر. كما اجريت تجارب هضم على المكررات ذاتها خلال الاسبوع الثانى عشر من العمر وكانت فتره جمع الروث خمسه ايام. وفى نهايه التجربه تم ذبح عدد ثلاثه ارانب لكل معامله لقياس خواص الذبائح واخذ عينات لكل من سائل الاعور والدم لاجراء التحليلات المعمليه.

ويمكن إيجاز النتائج المتحصل عليها فيما يلى:

١- لـم تسـجل المعـاملات الغذائيـة باسـتخدام تـبن عـروش الخيـار حتـى مسـتوى ٣٠% (١٠٠% محـل دريس البرسيم) او اضـافه البريبيوتك أو مخلوط الانزيمات فى علائق الارانب خـلال فتره التجربـة أي تأثير معنوي على كل من محتوى سـائل الأعـور مـن الاحمـاض الدهنيـه الطيـاره ككـل اوفـرادى (اسيتك ، بروبيونيك ، بيوتريك ، ايزوبيوتريك ، ڤاليريك ، ايزوڤاليريك) وكذا بعض صفات الذبائح مثل اوزان الفرو+الارجل والكبد والقلب والكلى ودهون البطن كنسبه مئويـه مـن وزن الجسم وكذا تركيز بعض المكونـات فـى الـدم مثـل الدهون الكليـه والكلوليسترول والكريـاتينين ونشـاط انزيمـات الكبد (ALT&AST).

٢- لم يؤثر استخدام تبن عروش الخيار حتى مستوى ٢٢,٥% من العليقه (٧٥ % من دريس البرسيم) وأيضا مستوى ٣٠% من العليقه (١٠٠% من دريس البرسيم)مع إضـافة النـاتوزيم أو MOS فـى العلائق تأثيرا معنويا على جميع صفات أداء الأرانب المدروسة خلال فتره التجربة.

٣- اظهرت مجموعه الأرانب المغذاه على ٣٠% تبن عروش الخيار تاثرا معنويا (مقارنـه بـالكنترول) يشمل تدهورا فى معاملات هضم المركبـات الغذائيـة المختلفـة وانخفاضـا فـي كـل مـن القـيم الغذائيـة (البـروتين المهضـوم، مجمـوع العناصـر الغذائيـة المهضـومة الكليـة، الطاقـة المهضـومة ودرجـة الحموضة لسائل الأعور وأوزان كل من الذبيحة الجوفاء ومجموع الأجزاء المأكولة عند عمـر ١٢ أسبوع وانخفاضـا ايضـا فـى مستوى بعض مكونـات بلازمـا الـدم مثـل البـروتين الكلـى والالبيـومين والجلوبيولين وزياده فى تركيز الامونيا فى سائل الاعور.

٤- لوحظ تاثيرا ايجابيا جوهريا واقيا نتيجه لاضافه البريبيوتك او مخلـوط الانزيمـات علـى السـواء الـى علـف الارانـب المحتـوى علـى ٣٠% تـبن عـروش الخيـار حيـث ازالـت (مسـاويه للكنتـرول) الاثـار الضـاره علـى جميـع صـفات الاداء المدروسـه نتيجـه لاحـلال عـروش الخيـار بنسـبه ١٠٠% محـل دريس البرسيم فى علف الارانب خلال فتره التجربه.

التوصه: يمكن استخدام تبن عروش الخيار بنجاح فى تغذيـه الارانـب الناميـه حتـى مسـتوى ٢٢,٥% من العليقه كإحلال محل ٧٥ % من دريس البرسيم وبـدون اى اثـار ضـاره علـى معـاملات الهضـم والقيم الغذائيـه وخـواص الـذبائح ونشـاط انزيمـات الكبـد ويمكـن زيـاده هـذا المسـتوى الـى ٣٠% فـى العلـف (محـل ١٠٠% مـن دريـس البرسـيم) باضـافه المنـان اوليجوسـكرايد اومخلـوط الانزيمـات (الناتوزيم) بمعدل ١ جم□كجم علف.

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