International Journal of Biological Sciences and Applications
2017; 4(5): 43-55
http://www.aascit.org/journal/ijbsa
ISSN: 2375-3811

American Association for Science and Technology

Glucosinolates in Rabbit Nutrition: Biologically Detoxification, Growth Performance, Digestibility, Blood Constituents, and Carcass Characteristics

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Keywords
Rocket Seed Meal (RSM),
Solid Fermentation,
Glucosinolate (Gls),
Biologically Detoxification,
V-Line Rabbits,
Growth Performance,
Digestibility,
Blood Constituents,
Carcass Characteristics

Received: April 25, 2017
Accepted: September 1, 2017
Published: September 20, 2017

Citation
Husain Abd Allah El-Fadaly, Sherif Mohamed El-Kadi, Mostafa Maher El-Moghazy, Ahmed Ali Soliman, Mahmoud Salama Mahmoud El-Haysha. Glucosinolates in Rabbit Nutrition: Biologically Detoxification, Growth Performance, Digestibility, Blood Constituents, and Carcass Characteristics. *International Journal of Biological Sciences and Applications.* Vol. 4, No. 5, 2017, pp. 43-55.

Abstract
The aim of the study was to investigate the effects of partial and total substitution (25, 50, 75, and 100%) of soybean meal of control diet with agro-industrial by-products as the source for plant protein, rocket (*Eruca sativa*) seed meals (RSM) processor of solid state fermentation using *Aspergillus oryzae*, on growth performance, nutrients digestibility, blood constitutions, carcass characteristics and economic efficiency. The experiment was divided into five groups of modern male rabbits weaning, the V-line Spanish species, in each group of 5 animals, age 31 days, where we were weaned at 30 days. The five diets contain approximately 18% protein, 14% fiber, and their components are as follows: Soybean, barley, maize, yellow corn, mint and kernels, derris, hemp, limestone, and food salt; as well as seedling of watercress in one of the safe breeds. It could be concluded that substitution of rocket seed meals up to 50% of soybean meal in the diet of V-Line rabbits had good results without adverse effects on growth performance. At the end of the feeding period (10 weeks of age), all rabbits were fasted for 12 hrs. The trend of the antioxidant markers in the rabbits' blood stream was increasing as the watercress increased. The increase was gradual, with the control group 0% RSM (T1) being the lowest and the highest in the group where the replacement was 100% RSM (T5), using RSM in rabbit diets significantly ($P<0.05$) increased serum Glutathione reduced concentration (GSH), and Total Antioxidant Concentration (TAC) for 25, 50, 75, and 100% RSM-protein. Rabbit fed diets containing 25, 50, 75, and 100% RSM-protein significantly ($P<0.05$) showed higher concentrations of serum GSH and TAC than those fed the control diet. This reduction represented (40, 21.42, 54.28, and 70%) and (36.36, 15.15, 48.48, and 57.57%), respectively. Although the level of replacement of 75% and 100% gave insignificant results compared to the control group in terms of carcass

measurements, in addition to the fact that most levels of blood measurements came in all experimental treatments within the normal range of rabbit blood serum rates, Experimental in the control group Taking into account the economic cost, the substitution has a distinct production value.

1. Introduction

Due to the continuous increase in population and the consequent increase in food consumption, this led to a large food gap, especially in animal protein sources. The need for protein sources of plant origin, which is believed to be the main source of food protein, Especially in the countries of the world, which suffer from poverty and increased births. In spite of the benefits of these plant sources, we find that they contain substances with toxic or inhibitory properties that limit or hinder the use of these sources in nutrition (which is in their raw form). Therefore, these inhibitory substances must be studied and treated in order to maximize the utilization of protein sources Plant and plug part of the food gap.

These include growth inhibitors in plant protein sources: Protease inhibitors, Lectins, Cyanogens, Saponins, Gossypol, and Glucosinolates (Gls). Ruminants are less delicate to dietary glucosinolates. Pigs are more severely affected by dietary glucosinolate compared to rabbit, poultry, and fish. The tolerance level (mol./1g diet) of total glucosinolate (TGls) in ruminants, pig, rabbits, poultry and fish is 1.5–4.22, 0.78, 7.0, 5.4 and 3.6 mol., respectively.

1.1. Biologically Detoxification

Since rabbits will be fed on fodder containing glycosinolates (large group of sulphur-containing secondary plant metabolites in all the economically important varieties of Brassica), which will be removed until the removal method is safe and does not cause added toxicity to the feed. If a fungus is used to release fungus toxins, we will solve a problem with a larger problem than Leads to the death of rabbits. Instead of being a harmful substance that can be borne by rabbits fed and survived, the fungal toxins from the fungus used to remove or break down the antimicrobial and kill animals instead of being harmful substances cause poor and productive animals And Tens I turn into a deadly substance. From the above, we thought about the use of edible mushrooms isolated from cheese eaten by humans on a daily basis and does not produce toxins, and the choice came on an *Aspergillus oryzae*. Ando *et al*. (2012) isolated *Aspergillus oryzae* from Iranian commercial cheese (Caspian cheese). Sharma *et al*. (2013) isolated *A. oryzae* from spoiled cheese and used it for producing alkaline protease. Habib (2014) and El-Fadaly *et al.* (2015) isolating and identification of *A. oryzae* from Egyptian Ras cheese (Romy) during *repining* period and studying the biochemical properties. Results showing that, *Aspergillus oryzae* and *Rhizopus sp*. did not produce any fungal toxins on potato dextrose broth (PDB) medium.

1.2. Feed Intake

Prasad *et al.* (2000) evaluated six groups of 8 weaners (4 weeks old) broiler rabbits were sustained on pelleted diets (18% crude protein "CP" and 2500 kcal DE/kg) formulated using six locally available protein supplements (groundnut cake, mustard cake, soybean meal, cottonseed cake and guar meal) for 8 weeks. The total dry matter (TDM) intake through the experimental dated was highest for the cotton seed cake diet (6810 g) and lowest for the soybean meal diet (4990 g). Tripathi *et al.* (2003) mentioned that mustard meal (MM) was incorporated at the levels of 80, 160 and 245 g/kg of rabbit diets in replacement of soybean meal (SBM) and compared with an SBM-based diet. Rabbits fed MM diets reduced feed intake. Tripathi *et al.* (2008) fed high-glucosinolate mustard meal as supernumerary of the soya-bean meal (SBM) in weaning rabbits of Soviet Chinchilla and White Giant breed diets containing mustard meal (MM) 0, 80, 160 and 245 g/kg for two months. It is concluded that MM can replace up to 66% SBM protein in rabbit feeding, whereas complete replacement of SBM with MM reduced feed intake by 23%.

1.3. Measurements of Blood Characteristics

Zeweil *et al.* (2008) transported that, Serum total protein, albumin, and cholesterol were significantly exaggerated by different treatments; however, serum urea-N and GPT were not affected. It can be concluded that RSM at 10.5% level of the diet in New Zealand White (NZW) rabbits had the best results without adverse effects on growth performance, kidney function, and liver function. Tripathi *et al.* (2008) studied the effect of graded levels of high-glucosinolate mustard (*Brassica juncea*), TGLS, meal as a substitute for the soyabean meal (SBM) in broiler rabbit diets containing mustard meal (MM) 0, 80, 160 and 245 g/kg for 8 weeks. Diets had TGLS 3.8, 8.4 and 11.98 mg/g DM in 80, 160 and 245 g MSM diets, respectively. Serum aspartate aminotransferase increased linearly ($P<0.01$) while alanine aminotransferase and alkaline phosphatase activity and protein, were not affected by MM. Rabbits tolerated 8.4 mg TGLS per g diet (160 g MSM per kg) during active growth without any apparent effect on health and growth.

1.4. Daily Weight Gain Rates

Tripathi, *et al.* (2003) publicized that mustard was incorporated at the levels of 80, 160 and 245 g/kg of rabbit diets in alternative of soybean meal and compared with an SBM-based diet. Average daily gain of rabbits reduced linearly ($P<0.05$) on MM diets. It is resolved that partial replacement of SBM amounting to 80 g MM/kg diet could not have apparent adverse effects on the growth rate of growing rabbits. Tripathi *et al.* (2008) fed rabbits of Soviet Chinchilla and White Giant breed one of four experimental diets containing mustard seed meal (MM) 0, 80, 160 and 245 g/kg. Average daily gain (ADG) reduced ($P<0.05$) linearly with increasing MM levels in the diet, still 80 and 160 g MM diets had alike ADG compared to that of SBM diet. Though, partial replacement of SBM amounting to 80 g MM/kg diet could not have deceptive adverse effects on growth and health of growing rabbits. They also, established that MM can replace up to 66.0% SBM protein in rabbit feeding, whereas complete replacement of SBM with MM reduced ADG by 13.0%, respectively. Zeweil *et al.* (2008) estimate the effect of replacing three levels from rocket seed meal (RSM) as a partial or complete replacement of soybean meal (SBM) protein of the control diet of growing (NZW) rabbits. RSM contributed 0, 5, 10.5 and 21% of the diet. The consequences paraded that feeding rabbits 10.5% RSM in their diet compared to the control group during the whole experimental period occasioned in significant ($P<0.01$) improvement in total weight gain by 15.10% (1042 vs. 905 g). Ibrahim *et al.,* (2012) presented that supplementation Mustard seeds at 1.0% level significantly ($P<0.05$) increased average daily gain by 24.30% while at 0.5% level significantly ($P<0.05$) increased the average daily gain by 14.50% compared to the control group.

1.5. Carcasses Characteristics

Gowda *et al.* (1996) exposed that none of the carcass traits including percentage yield of edibles and in-edibles were affected by dietary treatments except for a higher ($P<0.05$) dressing percentage (65.10 vs. 59.90%) in rabbits fed on urea-ammoniated *deoiled* mustard meal diet. The chemical composition of fresh meat flaunted no variation. Bhatt *et al.* (1997) declared that Soviet Chinchilla kits were individually fed *ad libitum* for 42 days on a solvent-extracted mustard cake-based (24.0%) complete mash diet with 0 or 0.1% lysine or methionine. It is concluded that methionine supplementation results in dressing percentage in rabbits. Gowda *et al.* (1996) testified that New Zealand White rabbits fed for 18 weeks on isonitrogenous diets formulated with 100% *deoiled* mustard meal (DMM) and urea-ammoniated DMM. carcass traits and yield of edible cuts were not affected by dietary treatments. The fallouts advise that feeding DMM to broiler rabbits does not affect meat quality or carcass characteristics. Zanaty and Barakat (2000) communicated that concerning the carcass traits, the effect of animal protein source was higher in comparison with the effect of animal protein source. Tripathi, *et al.* (2003) quoted that, mustard meal (MM) was incorporated at the levels of 80, 160 and 245 g/kg of rabbit diets in replacement of soybean meal (SBM) and compared with an SBM-based diet. The MM amalgamation in growing rabbit diets linearly reduced protein and increased fat content in muscle. The liver weight increased due to MM incorporation. Instead, Abdo (2003) conveyed that carcass was decreased by increasing the *Eruca sativa* meal level from 25% to 50% substitution of soybean meal protein. Osman *et al.* (2004) defined that, 15% inclusion level of dietary rocket cake did not affect dressing, liver or heart percentages as compared with those of the control. Soliman *et al.* (2006) reported that, the no-significant effect of RSM on carcass traits at the substitution levels used (25 and 50%). Similarly, El-Shfei *et al.* (2007) directed that inclusion levels of 8, 16, and 32% of rocket meal protein to replace soybean meal protein in growing Japanese quail did not affect body weight, carcass weight, liver, heart and spleen percentages compared to control group.

1.6. Caecum Fermentation

Bacteria appear in rabbits during a week of birth, and within a few weeks they reach the fixed stage and can be ascertained by being detected. They are often anaerobic bacteria, a bacterium that produces B vitamins, so the biological fermentation occurring inside the cecum is an anaerobic fermentation that produces a group of acids, but butyric acid is the highest concentration of the rest, and through this fermentation occurs the digestion of fibers in rabbits, and for more information on the nature of the work of cecum rabbits can be found in Table 1.

Table 1. *Microflora and volatile fatty acids production in caecum rabbit.*

Volatile fatty acids (VFA's) production and microflora in caecum rabbit	Details	Author's
Psedomonous spp. and *Bacillus* sp.	- Bacteria were mainly anaerobic in rabbits. - Strains from cecum synthesized vitamin B_2.	Assem (2014)
In the rabbit butyric acid is usually produced in considerably higher quantity	- Cited that in contrast to ruminants, in which butyric acid is usually produced in much lower quantity than acetate and propionate, in the rabbit butyric acid is usually produced in considerably higher quantity than propionic acid. This may be blamed on the unusual microbial population of the rabbit caecum.	Cheeke (1987)
Subjugated by bacteroides species, which often are butyrate producing organisms.	The uncommon microbial population of the rabbit caecum.	Marty and Vernay (1984)
Increasing caecum VFA's concentration paralleled the reduction in pH values.	There is an inverse relationship between the rates of production of VFA's in rabbit rabbits and the degree of pH.	Musa (2008)
Indicated that caecal VFA's concentration was not increased in rabbits given medicinal plants.		El-Manylawi *et al.* (2005)
The VFA's are produced as end products of bacterial fermentation in the rabbit caecum.	Digestion of caecum in microbial digestion.	Cheeke (1987)
Noted that increasing dietary crude fiber, the butyrate propionate ratio increased so that as fiber level increased.	The proportion of butyrate acid produced as higher caecal butyrate level could help to explain the protective effect of fiber against enteritis.	Champe and Maurice (1983)

The aim of the study was to estimate the daily, weekly and monthly growth rates during the experiment of fattening to reach the male rabbits to the weight of commercial marketing (1750-2500) and to study the extent of differences between the experimental groups and the control group in terms of production economics, physiological and immunological effects and quality of carcass after slaughter. In order to ensure the efficacy of studying the effect of removing the toxicity of anti-nutrients by gaining watercress seeds to convert this gain from a substance that is harmful to animals to a plant fungus that competes with the other oxides currently used for soybeans. By earning watercress seeds from many different oxides.

2. Materials and Methods

2.1. Solid Fermentation

Solid fermentation was done on the experimental material (Rocket seed meal) studied using the strain *Aspergillus oryzae*, It has been obtained from the Department of Agricultural Microbiology, Faculty of Agriculture, Damietta University, Damietta, Egypt. Solid state fermentation of rapeseed meal or rocket meal (sterilized at 121°C, for 15 min) using *Aspergillus* sp. and *Rhizopus oligosporus* under solid state fermentation (1meal: 3water, at 25°C under aerobic condition, ten days) incapacitated myrosinase, reduced total glucosinolates by 431 mol/mmol and *thiooxalidone* by 340 mg/1g (Vig and Walia, 2001). The overall degradation of glucosinolates happened after 60–96 h fermentation at 25°C (Rakariyatham and Sakorn, 2002). However, in the current study, the fermentation duration was extended for 10 days to ensure the best results of Gls breakdown.

2.1.1. Maintenance of *A. oryzae*

The obtained *Aspergillus oryzae* was maintained on potato dextrose agar (PDA) slants at 5°C till use. Before use, the fungal isolates were sub-cultured on new slants of PDA and incubated at 25°C for 10 days (Habib, 2014 and El-Fadaly *et al.*, 2015).

2.1.2. Production of RSM Biological Treatment

A total of 55 kg of watercress seeds were prepared by fermentation to produce 4 experimental diets, 4 of which are 100 kg per feed.

2.2. Chemical Analysis

Chemical analysis of the raw materials, tested diets, and faces were carried out according to AOAC (2000). Digestible energy (DE) of the experimental diets was calculated according by the equation [DE*(kcal/kg DM) = 4253 – 32.6 (CF%) – 144.4 (Ash%)] described by Fekete and Gippert (1986).

2.3. Rabbits Growth Experience

2.3.1. Feeding and Caring for Experimental Animals

The rabbit experiment was conducted during the period from December 2016 to February 2017 at the Rashed Rabbit Farm in Agha, Dakahlia, Egypt. The experimental rations were manufactured and packed at the Rashed Rabbit Establishment.

The experiment was divided into five groups of modern male rabbits weaning, the V-line Spanish species, in each group of 5 animals, age 31 days, where we were weaned at 30 days (month):

1- Group (1): Control: Eat on the farm (100% soybean meal).

2. Group (2): 25% soy protein was replaced with taramira seed meal protein (25% watercress (RMS) + 75% soybean meal).

Group 3: 50% soy protein was substituted with taramira seed (50% watercress (RMS) + 50% soybean).

4- Group (4): 75% soy protein was replaced with Rocket seed meal protein (75% watercress (RMS) + 25% soybean gain).

5 - Group (5): 100% of soy protein was replaced with *Eruca sativa* seed meal protein (100% watercress meal).

Eruca sativa = taramira = watercress = Rocket seed meal (RMS) = Solid state fermentation of meal using *Aspergillus oryzae* (1meal: 3water, at 25°C under aerobic condition, 10 days).

The five diets contain approximately 18% protein, 14% fiber, and their components are as follows: Soybean, barley, maize, yellow corn, mint and kernels, derris, hemp, limestone, and food salt; as well as seedling of watercress in one of the safe breeds.

2.3.2. Feed Intake

NRC (1977) expressed that rabbits, like most animals, voluntarily adjust their feed intake to encounter their energy needs. While, NRC (1981) advised that, the total intake of feed by animals feeding *ad lib.,* is connected to their energy needs and the concentration of available fuels in the diet. Since all group in the present study fed almost a similar energy level it was not expected to have different feed intakes.

Each group of rabbits was fed one of the five experimental diets. Fresh water was automatically available at all times through stainless steel nipples for each cage. The experimental diets were offered to rabbits *ad libitum*. The rations were adjusted every week according to the average daily feed intake. Individual live body weight and feed intake were weekly recorded up to 10 weeks of age. Feed conversion ratio was calculated as g feed/g gain and as g TDN/g gain.

Five experimental diets were formulated to cover the nutrient requirements for breeding and mature rabbits according to (NRC, 1977) Table 2, recommendation as a standard commercial diet, containing 12.30 MJ ME/kg, and

17% CP. The control diet was without supplementation, while the second, third, fourth, and fifth diets contained 4.75, 9.90, 15.60 and 22.00% Rocket seed meal (RSM), as 25, 50, 75 and 100% of the crude protein level of the control diet was replaced by RSM, respectively. All experimental diets were in pelleted form and were nearly iso-caloric and iso-nitrogenous. A composition of the experimental diets used in this study are presented in Table 3.

Table 2. *Feed allowance according to NRC, (1977) of NZW rabbit during different stages.*

Nutrients	Growth	Maintenance	Gestation	Lactation
DE (Kcal)	2500	2100	2500	2500
TDN (%)	65	55	58	70
CF (%)	10-12	14	10-12	10-12
Fat (%)	2	2	2	2
CP (%)	13	12	15	17

Table 3. *Formulation and chemical analysis of the experimental diets.*

Ingredients	Control	Rocket seed meal (RSM)- treatment			
		T_1, 25%	T_2, 50%	T_3, 75%	T_4, 100%
Soybean meal (44% CP)	18	14.75	9.9	5.2	--
Rocket meal (36% CP)	--	4.75	9.90	15.60	22.00
Barley grain	21	21	20	20	20
Yellow corn grain	20	20	21.2	21.2	21.2
Alfalfa hay	30.0	29.38	29.38	29.38	29.38
Cannabis and mint straw	2.38	6	5	4	2.8
Common salt	0.3	0.3	0.3	0.3	0.3
Premix*	0.3	0.3	0.3	0.3	0.3
Anti-toxin	0.1	0.1	0.1	0.1	0.1
Coccidia	0.05	0.05	0.05	0.05	0.05
Clostridia	0.05	0.05	0.05	0.05	0.05
Dl-Methionine	0.07	0.07	0.07	0.07	0.07
L-Lysine	0.05	0.05	0.05	0.05	0.05
Di-calcium phosphate	2.5	2.5	2.5	2.5	2.5
Limestone	1	1	1	1	1
Total	100	100	100	100	100
Calculated analysis:					
Crude protein (%)	18	18	18	18	18
Crude fiber (%)	14-15	14-15	14-15	14-15	14-15
Calcium (%)	0.95	0.95	0.95	0.95	0.95
Phosphorus (%)	0.60	0.60	0.60	0.60	0.60

*Each one kilogram of premix contained: Vit. A 2000,000 IU, Vit. D3 150,000 IU, Vit. K 0.33 mg, Vit. B1 0.33 g, Vit. B2 1.0 g, Vit. B6 0.33 g, Vit. B12 1.7 mg, Pantathonic acid 3.33 g, Biotin 33 mg, Folic acid 0.83g, Choline chloride 200 mg, Cu 0.5 g, I 16.6 mg and Antioxidant 10.0 g.

2.3.3. Animal Performance

Performance index (PI%) was calculated according to North (1981) as below: PI = Live body weight (kg) x 100 / Feed conversion. The economical efficiency was calculated by the following equation: $Y = [(A - B) / B]$, where A is selling cost of obtained gain and B is the feeding cost for this gain (Abd El-Rahman *et al.*, 2012).

2.4. Carcass Traits

At the end of the feeding period (10 weeks of age), all rabbits were fasted for 12 hrs., weighted and slaughtered by severing the jugular vein with a sharp knife. The body weights slaughtering rendering to Blasco *et al.* (1993) to determine the carcass traits. The organ were left to drain for 15 min before being weighted.

After complete bleeding, the head, pelt, viscera, feet and tail were removed and the hot carcass was weighed. Giblets (liver, heart and kidney) were weighed and expressed as a percentage of pre-slaughter weight. The dressing percentage was calculated as the hot carcass weight in addition to giblets weight (dressed weight) divided by pre- slaughter weight. The carcass was separated into three primal cuts (for –limbs, trunk and hind-limbs). Each of three cuts was weighed and expressed as a percentage of carcass weight without the giblets.

2.5. Some Blood Constituents of Rabbits

Blood samples were individually collected at 12 weeks of age from each rabbit in non-heparinized glass tubes to estimate blood parameters. Blood serum was separated by centrifugation at 3000 rpm for 15 minutes. The collected serum was stored at Freezing temperature of the freezer until analysis. At 13 weeks of age, a digestibility trial was done using three male animals per group. Serum blood samples were kept at refrigerator under freezing conditions for the determination of the other parameters included total Bilirubin, Albumin, liver functions [ALT and AST (EC 2.6.1.1)], kidney functions (creatinine and urea), Atherogenic indices, lipid profile (triglycerides, total cholesterol, HDL, LDL and vLDL), Glutathione reduced (GSH) mmol./L, Lipid Peroxide, Malondialdehyde (MDA) mmol./L, and Total Antioxidant Concentration (TAC) mM./L were estimated using commercial kits [(Human and Diamond, Germany), (Spinreact, Spain)] according to the procedure outlined by the manufacturer.

Liver functions (ALT and AST) were determined as described in commercial kits by Randox (United Kingdom) according to the method of Reitman and Frankel (1957). Kidney functions (Serum creatinine and urea) were determined by a colorimetric method according to Larsen (1972); Fawcett and Scott (1960), respectively, as described in commercial kits by Human (Germany). The lipid profile, triglycerides (TG), total cholesterol (TC) and high density lipoprotein cholesterol (HDL−C) were determined by enzymatic colorimetric method of (Fossati and Prencipe, 1982; Richmond, 1973; Lopes−Virella *et al.*, 1977) described in a commercial kits by Human (Germany).

Serum low density lipoprotein cholesterol (LDL−C) and very low density lipoprotein cholesterol (VLDL−C) concentrations were calculated using the Friedewald *et al.* (1972) equations as follows:

$$VLDL–C = TG/5 \quad (1)$$

$$LDL–C = TC – (HDL–C + VLDL–C) \quad (2)$$

The atherogenic indices were calculated as reported by Ikewuchi and Ikewuchi (2009) using the following equations:

$$\text{Cardiac risk ratio} = TC / HDLc \quad (3)$$

$$\text{Atherogenic coefficient} = [TC−(HDLc)] / HDLc \quad (4)$$

$$\text{Atherogenic index of plasma} = \log TG / HDLc \quad (5)$$

2.6. Statistical Analysis

Statistical analysis of all experimental data was done using the statistical software package Costat (2005) with analysis of variance (one way randomized block, ANOVA) and significant differences between treatment means were determined using Duncan's multiple range test at p< 0.05 as the level of the significance (Duncan, 1955).

3. Results and Discussions

3.1. Rabbits Growth Experience Feed Intake

Omole (1982) interconnected that the range between 18.0 and 22.0% CP could be best for growing rabbits and 18% protein (optimum) diet was superior to 14.0% dietary protein level and slightly better than 22.0% protein diets in augmenting feed intake. Taie and Zanaty (1993) offered that feed intake (FI) as not exaggerated by either dietary protein level or energy-protein ratio. Feed intake was ranged between 96 and 101g/day. Gowda *et al.* (1996) gladdened 42 NZW rabbits, 6 weeks old, for 18 weeks on isonitrogenous diets formulated with *deoiled* groundnut meal and respectively, replaced at 50 or 100% with urea-ammoniated neem seed kernel meal or with 100% *deoiled* mustard meal and urea-ammoniated. Feed intake was not affected by dietary treatments. Bhatt (2001) spoiled German Angora for 225 days on 5 experimental diets using soya flakes, sunflower-cake, and mustard-cake as a source of protein. Lysine and methionine were supplemented at 100 g/d in sunflower-cake and mustard-cake based diets. Pooled dry matter intake/head/day was higher with the sunflower-cake-based diet (P<0.05) than other groups.

Table 4. *Chemical analysis of different experimental diets (% as DM basis).*

Ingredient	RSM-Crude	RSM-Treatment	Level of NSM (%)				
			Control (0%)	25%	50%	75%	100%
Dry matter (DM)	89.64	90.81	91.0	89.0	89.5	91.5	91.0
Chemical analysis (% as DM basis):							
Organic matter (OM)	92.9	93.0	95.00	93.5	91.5	91.5	88.5
Crude protein (CP)	31.83	36.5	18.04	17.03	17.79	19.03	18.04
Crude fiber (CF)	13.50	13.0	15.50	13.00	14.50	14.00	15.00
Ether extract (EE)	1.80	2.0	0.5	1.0	1.0	1.5	3.0
N-free extract (NFE)	45.77	41.5	41.96	51.47	43.71	48.47	43.46
Ash	7.10	7.0	5.0	6.5	8.5	8.5	11.5
Soluble carbohydrate	32.27	28.5	26.46	38.47	29.21	34.47	28.46
Energy	3347	3382	2506	2900	2613	2905	2797
Digestibility Energy (DE)**	2788	2818	3040	2891	2553	2569	2103

* Energy (Kcal/kg)= 1gm protein = 4.1kcal; 1gm carbohydrates = 4.1kcal; 1gm lipids = 9.2kcal.
** DE (Kcal/kg DM) = 4253 – 32.6 (CF%) – 144.4 (Ash%) according to Fekete and Gippert (1986).
% Soluble carbohydrate =% Total Carbohydrate -% Fiber.

3.2. Average Daily Gain

Results of live body weight and daily weight gain and the feeding trial are shown in (Table 5). Latest studies designated that natural medicinal plants and their by-products have favorable effects on live body gain, feed efficiency utilization and carcass characteristics in rabbits (Musa, 2008). Shemin *et al.* (1991) also indicated that the average daily gain of Angora rabbits increased when dietary CP was elevated from 12.45 to 17.0% but the increase was less or not significant when CP% was greater than 17.0% and cost of the gain increased sharply. Abou-Ela *et al.* (1993) institute that increasing crude protein level in the rabbit's ration achieved the highest (P<0.05) daily gain. Nasr *et al.* (1996) generate that body weight at two and a half months of age and gain weight from 6-10 weeks of age were lower significantly (P<0.05) with the substitution of 5 or 10% of the pelleted rabbit's diet by *Nigella sativa* meal than in the control. Bhatt *et al.* (1997) Twenty-eight Soviet Chinchilla kits, weaned at 42 days of age, were individually fed *ad libitum* for 42 days on a solvent-extracted mustard cake-based (24.0%) complete mash diet with 0 or 0.1% lysine or methionine. An increase of 28.33% in live weight gain. Gowda *et al.* (1996) Forty-two NZW rabbits, 6 weeks old, were assigned to 7 groups and fed for 18 weeks on 7 isonitrogenous diets formulated with *deoiled* groundnut meal (DGNM) and respectively, replaced at 50 or 100% with urea-ammoniated neem seed kernel meal and alkali-treated NKM or with 100% *deoiled* mustard meal and urea-ammoniated. The growth rate (GR) was not affected by dietary treatments. Bhatt (2001) fed German Angora for 225 days (About 32 weeks or 7.5 months). Five experimental diets were prepared using soya flakes, sunflower-cake and mustard-cake as a source of protein. Lysine and methionine were supplemented at 100 g/q in sunflower-cake- and mustard-cake based diets. Body weight decreased (P<0.05) with amino acid supplementation in the sunflower-cake-based diet through second and third shearing. The highest gain in weight (2198 g) was chronicled with the sunflower-cake-based diet. Prasad *et al.* (2000) assessed six groups of 8 weaners (4 weeks old) broiler rabbits were maintained on pelleted diets (18% CP and 2500 kcal DE/kg) formulated using six locally available protein supplements (groundnut cake, mustard cake, soybean meal, cottonseed cake and guar meal) for 8 weeks. The initial and final average weights ranged from 0.40 to 0.46 kg and 1.93 to 2.14 kg respectively. The total gain and average daily gain (ADG) ranged from 1.48 to 1.72 kg and 26.43 to 30.79 g respectively. The maximum total gain and ADG (1.72 kg; 30.79 g) were recorded for the cotton seed cake diet.

Table 5. *Performance of growing V-Line rabbits fed diets containing rocket seed meal.*

Items	Experimental Rations (%)					LSD (0.05)
	Control	Rocket meal				
		25	50	75	100	
No. of Animals	5	5	5	5	5	
Duration of trail, days	70	70	70	70	70	
Av. Initial weight, g	620 [a]	610 [a]	530 [a]	580 [a]	580 [a]	127.37
Av. Final weight, g	2745 [a]	2626 [a]	2640 [a]	2236 [a]	2323 [a]	351.69
Total gain, g	2125	2016	2110	1656	1743	
Av. Daily gain, g	30.35	28.8	30.14	23.65	24.9	
Av. DM intake, g (DM basis):	5000	3236	3048	4538	3850	

* The values are mean±SD of 5 rabbits in each group.
[a, b, c, d, and e]: Means within the same row with different superscripts are significantly different at (P<0.05).
T1 (Control, 100% Soybean), T2 (75% Soybean+25% Rocket), T3 (50% Soybean+50% Rocket), T4 (25% Soybean+75% Rocket), T5 (100% Rocket).

3.3. Feed Efficiency

Ibrahim *et al.*, (2012) presented that inclusion of mustard seeds in the rabbit diets at 0.5% or 1.0% significantly (P<0.05) better the final weight, total weight gain, and feed conversion compared to control diet. Soliman *et al.,* (2006) linked that an improvement in feed conversion by rabbits when they used commercial natural additives counting some medicinal herbage. Bhatt *et al.*, (1997) show that twenty-eight Soviet Chinchilla of rabbits kits, weaned at 42 days of age, were individually fed *ad libitum* for 42 days on a solvent-extracted mustard cake-based (24.0%) complete mash diet with 0.0 or 0.1% lysine or methionine. An increase of 20.30% in feed conversion ratio was experimental in the methionine-supplemented group. Prasad *et al.*, (2000) uttered an experiment in which Soviet chinchilla rabbits, weaned at 4 weeks (28 days), were fed for 8 weeks (56 days) on diets containing groundnut cake (control), mustard cake, soybean oil meal, til cake, cottonseed cake or guar meal on an is nitrogenous basis (26, 30, 23, 28.5, 40, and 22.5% of the diet, respectively). Results directed that mustard cake, til (*Sesamum indicum*) cake, cottonseed cake and guar meal could be used as substitutes for groundnut meal and soybean meal without an adverse effect on broiler rabbit performance. Prasad *et al.,* (2000) assessed six groups of 8 weaners (4 weeks old) broiler rabbits were preserved on pelleted diets (18% CP and 2500 kcal DE/kg) formulated using six locally available protein supplements (groundnut cake, mustard cake, soybean meal, til cake, cotton seed cake, and guar meal) for 8 weeks. The feed efficiency ratio ranged from 3.01 to 3.68 in different groups. Sesame (til) oil crops have been used since ancient times, the resulting oil contains a high proportion of proteins and fatty acids and antioxidant flavonoids, which contributes to the retention of natural properties Sesame oil is also used in cooking and is still used by many people in its food, adding to popular dishes and Many societies still rely on medical and therapeutic purposes as well as sweets and pies. Batt (2001) steered an experiment on 45 German Angora for 225 days. Five experimental diets were prepared using soya flakes (T1), sunflower-cake (T2) and *mustard-cake* (T4) as a source of protein. Feed efficiency decreased (*P*<0.05) with amino acid supplementation in the sunflower-cake-based diet (T3) during second and third shearing. Tripathi, *et al*., (2003) fed mustard (*Brassica juncea*) meal (MM) at the levels of 80, 160, and 245 g/kg of rabbit diets in replacement of soybean meal (SBM) and equated with an SBM-based diet. Feed conversion efficiency of rabbits fed MM diets was improved, which showed linear and quadratic effects. Nagadi (2008) appeared that feed conversion rate was significantly improved by decreasing the fiber levels (3.04 vs. 4.17, P<0.001) in rabbit diets. The mortality rate increased from 20.0% in the low fiber diet to 30% in the high fiber diet. Zeweil *et al.* (2008) stated that feed conversion ratio by 12.30% (3.84 vs. 4.38), total feed consumption increased by 1.30% (4004 vs. 3953 g) in NZW rabbits. The group fed 21.0% RSM-diet showed body weight gain and feed conversion ratio not significantly different from those of the control. Hamied *et al.* (2005) designated that feed conversion ratio was improved and mean values of daily feed consumption were decreased along with increasing dietary levels in the rabbit diets compared to the control diet. And presented that else a significant increase in apparent digestibility coefficient of DM, OM, CP, EE, CF and DCP% was detected while there was an insignificant increase in NFE apparent digestibility coefficient and TDN% with dietary barley *radicel* addition in the rabbit diets. Tripathi *et al.* (2008) fed rabbits of Soviet Chinchilla and White Giant breed one of four experimental diets containing mustard seed meal 0, 80, 160 and 245 g/kg. It is concluded that MM can replace up to 66% SBM protein in rabbit feeding, whereas complete replacement of SBM with MM reduced feed efficiency value.

3.4. Economical Efficiency

The effectiveness of using mustard seeds varies on upon the price of tried diets and the rabbit's growth performance. Prasad *et al.* (2000) measured six groups of 8 weaners (4 weeks old) broiler rabbits were preserved on pelleted diets (18% CP and 2500 kcal DE/kg) formulated using six nearby available protein enhancements (groundnut cake, mustard cake, soybean meal, cottonseed cake and guar meal) for 8 weeks. The cost of feed input/kg lives weight gain was Rs. 15.85, 12.64, 14.05, 19.16, 20.31, and 14.83 and corresponding net return per animal was Rs. 19.5, 29.1, 26.5, 18.5, 19.5 and 20.2 respectively, on diets with groundnut cake, mustard cake, soybean cake, *til* cake, cotton seed cake and guar meal. Soliman *et al.* (2006) itemized that the worst value of economical efficiency was for 25% changeover of RSM diet and the best for 50% pickled RSM (2% Copper sulfate "1kg meal/cake= 20g $CuSO_4$"), as compared to the control one. If net revenue, economical efficiency, and comparative economical efficiency, were taken into deliberation, integration of up to 10.50% treated RSM can be used to get better economical efficiency. Ibrahim *et al.* (2012) conveyed that rabbits fed on diet with 0.5 or 1% mustard seeds diet recorded the highest value of virtual economic efficiency and the lowest value of feed cost/ kg live body weight compared with control diets.

In this study, the price of one ton of watercress/rocket seeds meal was between 3000-3500LE Egyptian pounds, ie, the kilogram of 3-3.5 pounds. If an extra half of the value of biological treatment was added to the fungi, the cost of the kilogram would be between 3.5 -4 LE, While the price of soybean is 44% protein at LE 6450, and the price of soybean is 47% 6850 LE. If the price of watercress is compared with the price of soybeans meal, soy will increase by 75-80%. Its proportion of soybeans with rabbits and other farm animals is of high economic value under constant price increases.

3.5. Blood Biochemistry in Blood Serum

This section displays the results for the effect of feeding diets containing levels of the experimental diets on some blood parameters of growing V-Line rabbits. Determination of serum creatinine and urea were used as indicators for kidney functions. The effect of *E. sativa* seed meal treatment on serum creatinine and urea levels in V-line rabbits is illustrated in Table 6.

Results of El-Shfei *et al.* (2007) exposed that total plasma protein was not significantly affected by replacing any ratio of rocket meal with soybean meal. While, replacing 8% rocket meal had a significantly (P<0.05) lower albumin compared with other groups, while globulin was significantly (P<0.05) increase. However, blood cholesterol and triglycerides were decreased significantly compared to control group. El-Shfei *et al.* (2007) marched insignificant effect on both AST and ALT (liver function) or plasma creatinine and uric acid.

Rabbit fed diets containing 25, 50, 75, and 100% RSM-protein significantly (P<0.05) showed lower concentrations of serum creatinine than those fed the control diet (Table 6). This reduction represented 10.67, 19.41, 24.27, and 23.3%, respectively.

While the concentrations of urea in the blood serum of rabbits fed on diets containing RSM-protein by 25, 75, 100% increased significantly (P<0.05) compared to the control group. This reduction represented 12.66, 4.09, and 26.10%, respectively (Table 1).

Table 6. *Analysis of Kidney functions (mg/dL) of blood serum parameters of V-line rabbits as affected by the experimental diets. *.*

TRT	Creatinine	Urea
1 (control)	1.03[a]	34.97[d]
2 (25% RSM)	0.92[b]	39.40[b]
3 (50% RSM)	0.83[c]	33.10[e]
4 (75% RSM)	0.78[d]	36.40[c]
5 (100% RSM)	0.79[d]	44.10[a]
LSD (0.05)	0.0103	0.4861

* The values are mean±SD of 3 rabbits in each group.

[a, b, c, d, and e]: Means within the same column with different superscripts are significantly different at (P<0.05).

T1 (Control, 100% Soybean), T2 (75% Soybean+25% Rocket), T3 (50% Soybean+50% Rocket), T4 (25% Soybean+75% Rocket), T5 (100% Rocket).

Activity of aspartate transaminase (AST) and alanine transaminase (ALT) in blood serum of rabbits as affected by experimental diets are presented in Table 7.

All our results within normal range (AST (SGOT) 20 – 120 IU\dl) and (ALT (SGPT) 25 - 65 IU\dl) (Woolford *et al.*, 1986., and Loeb and Quimby, 1989).

Concentration of albumin (ALb) and total Bilirubin (T. Bil) in blood serum of rabbits as affected by experimental diets are presented in Table 7.

The obtained results were within normal range Albumin 2.7- 5.0 g/dl (Fox, 1989., Woolford *et al.*, 1986., and Loeb and Quimby,. 1989).

These results were agreement with the outcome of Soliman *et al.* (2006) revealed that liver function data insignificant effect on alanine transaminase enzyme. It means that no venomous exhibited the effect on liver weight and non-pathologically or toxic effect practical between treated groups that reflect no adverse effect for tested materials on the quail health. Also, Zeweil *et al.* (2008) informed that GPT was not affected and can be settled that rocket seed meal at 10.50% level of the diet in NZW rabbits had the best results without hostile effects on growth performance, kidney or liver function. On their conflicting, Osman *et al.* (2004) located that adding rocket meal with the level of 5, 10 or 15% in broiler diets reduced the ALT value with any adverse effect on the liver function.

Table 7. *Analysis of Liver functions of blood serum parameters of V-line rabbits as affected by the experimental diets. *.*

TRT	ALT (GPT), (IU/dl)	AST (GOT), (IU/dl)	AST/ALT ratio	Albumin (ALb), g/dl	Total Bilirubin (T. Bil), mg/dl
1 (control)	40.67[b]	55.67[a]	1.36	4.25[b]	0.32[d]
2 (25% RSM)	51.00[a]	38.00[c]	0.74	4.39[a b]	0.31[e]
3 (50% RSM)	52.00[a]	40.00[b]	0.76	4.30[b]	0.34[c]
4 (75% RSM)	57.00[a]	36.00[c]	0.63	4.40[a b]	0.43[a]
5 (100% RSM)	36.00[b]	37.00[c]	1.02	4.49[a]	0.41[b]
LSD (0.05)	4.8614	1.7528	--	0.1101	6.5757

* The values are mean±SD of 3 rabbits in each group.
[a, b, c, d, and e]: Means within the same column with different superscripts are significantly different at (P<0.05).
T1 (Control, 100% Soybean), T2 (75% Soybean+25% Rocket), T3 (50% Soybean+50% Rocket), T4 (25% Soybean+75% Rocket), T5 (100% Rocket).

Concentration of Triglycerides (TG), Total Cholesterol (TC), high density lipoprotein (HDL-C), low density lipoprotein (LDL−C), and very low density lipoprotein (VLDL-C) in blood serum of V-Line rabbits as affected by experimental diets are presented in Table 8.

In this study, increasing level of RSM-protein increased total cholesterol (TC). The level of TC increased by 53.12, 53.12, and 15.62% with diets containing 50, 75 and 100% RSM-protein compared to the control diet, respectively. The highest percentage of total cholesterol was in the third and fourth groups (T3 and T4=49 mg/dl), followed by the fifth (T5=37 mg/dl), there are no significant differences between the groups 50 and 75%, but there is significant (P<0.05) difference between them and the other groups. It was noted that the high density lipoprotein (HDL) ratio in the control group (T1=16 mg/dl) and the last group containing 100% RSM (T5=16 mg/dl) are equal and therefore there is no significant difference between them (Table 8). On the other side, Zeweil *et al.* (2008) conveyed that, Serum cholesterol were significantly affected by the present of rocket seed meal in rabbit diets. Also, Omar (2003) exhibited that plasma concentration of cholesterol, total lipids and triglycerides of rabbits decreased by (6.6 and 19.2%), (19.1 and 24.6%) and (32.9 and 39.6%) in diets containing 25 and 50% NSM-protein compared with the control one, respectively.

The corresponding results were within normal range (Total lipids 150 - 400 mg\dl), (Triglycerides 50 - 200 mg\dl) and (Total cholesterol 10 - 100 mg\dl) (Woolford *et al.*, 1986., and Loeb and Quimby, 1989).

Table 8. *Analysis of Lipid profile (mg/dl) of blood serum parameters of V-line rabbits as affected by the experimental diets. *.*

TRT	Triglycerides (TG)	Total Cholesterol (TC)	HDL-C	LDL-C	VLDL-C
1 (control)	74.00[d]	32.00[c]	16.00[c]	1.20[d]	14.80[d]
2 (25% RSM)	135.00[a]	31.00[d]	14.00[d]	0.00[e]	17.00[c]
3 (50% RSM)	107.00[b]	49.00[a]	22.00[b]	5.60[b]	21.40[a]
4 (75% RSM)	106.00[c]	49.00[a]	24.00[a]	3.80[c]	21.20[b]
5 (100% RSM)	56.00[e]	37.00[b]	16.00[c]	9.80[a]	11.20[e]
LSD (0.05)	4.48733	1.9438	7.9355	1.7744	1.7744

* The values are mean±SD of 3 rabbits in each group.
[a, b, c, d, and e]: Means within the same column with different superscripts are significantly different at (P<0.05).
T1 (Control, 100% Soybean), T2 (75% Soybean+25% Rocket), T3 (50% Soybean+50% Rocket), T4 (25% Soybean+75% Rocket), T5 (100% Rocket).

Table 9. *Analysis of Atherogenic indices of blood serum parameters of V-line rabbits as affected by the experimental diets. *.*

TRT	Cardiac risk ratio	Atherogenic coefficient	Atherogenic index of serum
1 (control)	2.00[e]	1.00[e]	0.66[a]
2 (25% RSM)	2.21[c]	1.21[c]	0.98[a]
3 (50% RSM)	2.22[b]	1.22[b]	0.68[a]
4 (75% RSM)	2.04[d]	1.04[d]	0.64[a]
5 (100% RSM)	2.31[a]	1.31[a]	0.54[a]
LSD (0.05)	4.2952	6.0719	0.4407

* The values are mean±SD of 3 rabbits in each group.
[a, b, c, d, and e]: Means within the same column with different superscripts are significantly different at (P<0.05).
T1 (Control, 100% Soybean), T2 (75% Soybean+25% Rocket), T3 (50% Soybean+50% Rocket), T4 (25% Soybean+75% Rocket), T5 (100% Rocket).

Average concentration of serum Atherogenic indices (Cardiac risk ratio, Atherogenic coefficient, and Atherogenic index of serum) as affected by different levels of RSM-protein in the diets of rabbits are shown in Table 9.

In this study, increasing level of RSM-protein Increased and then decreased, but there were no significant (P<0.05) differences between them atherogenic index of serum. The level of atherogenic index of serum increased by 48.5 and 3% with diets containing 25 and 50% RSM-protein compared to the control diet, respectively. While, The level of atherogenic index of serum decreased by 3 and 18% with diets containing 75 and 100% RSM-protein compared to the control diet, respectively.

Atherogenic indices are powerful needles of the risk of heart disease. The higher values of atherogenic indices are a sign of the higher risk of developing cardiovascular diseases (Dobiasova, 2004). On the other hand, low atherogenic indices barbed to the protection against coronary heart diseases. Our data testified that a decrease in atherogenic index is due to an increase in HDL−C levels after the management with plant extract (Usoro *et al.*, 2006).

As long as the production of watercress seeds (RSM-protein) is rich in antioxidants, it was necessary to measure many measurements that indicate the levels of antioxidants in the blood of rabbits, compared with control animals, and Table 10, presents the levels of Lipid Peroxide "Malondialdehyde" (MDA), Glutathione reduced (GSH), and Total Antioxidant Capacity (TAC). Rabbit fed diets containing 25, 50, 75, and 100% RSM-protein significantly (P<0.05) showed lower concentrations of plasma Lipid Peroxide than those fed the control diet (Table 10). This is a very good indication that the higher the percentage of watercress (RSM) in rabbits, the higher the proportion of antioxidants in the blood, which prevents the oxidation of fat in the body of animals, and thus reduce the proportion of oxidizing fat in blood serum. The proportion of (MDA) in the control group that did not contain watercress (T1=3.14 mmol./L) while in the fifth group, which was replaced by 100% soybean meal of RSM (T5=2.56 mmol/L), a decrease of up to (18.47%).

In contrast, the trend of the antioxidant markers in the rabbits' blood stream was increasing as the watercress increased. The increase was gradual, with the control group 0% RSM (T1) being the lowest and the highest in the group where the replacement was 100% RSM (T5), using RSM in rabbit diets significantly (P<0.05) increased serum GSH and TAC concentration for 25, 50, 75, and 100% RSM-protein (Table 10). Rabbit fed diets containing 25, 50, 75, and 100% RSM-protein significantly (P<0.05) showed higher concentrations of serum GSH and TAC than those fed the control diet (Table 10). This reduction represented (40, 21.42, 54.28, and 70%) and (36.36, 15.15, 48.48, and 57.57%), respectively.

Table 10. *Analysis of different measurements of the anti-oxidation of blood of V-line rabbits as affected by the experimental diets. *.*

TRT	(MDA) mmol/L	(GSH) mmol/L	(TAC) mM/L
1 (control)	3.14 [a]	0.70 [e]	0.33 [e]
2 (25% RSM)	2.84 [c]	0.98 [c]	0.45 [c]
3 (50% RSM)	2.96 [b]	0.85 [d]	0.38 [d]
4 (75% RSM)	2.71 [d]	1.08 [b]	0.49 [b]
5 (100% RSM)	2.56 [e]	1.19 [a]	0.52 [a]
LSD (0.05)	0.00486	0.00972	0.01140

* The values are mean±SD of 3 rabbits in each group.

[a, b, c, d, and e]: Means within the same column with different superscripts are significantly different at (P<0.05).

T1 (Control, 100% Soybean), T2 (75% Soybean+25% Rocket), T3 (50% Soybean+50% Rocket), T4 (25% Soybean+75% Rocket), T5 (100% Rocket).

Recently, El-Fadaly *et al.* (2017 a, b) extracted meal and oli of *E. sativa* using Methanol and Hexane. The extracts showed to contain total polyphenols (TPs), total flavonoids (TFs), Reducing power (FRAP) as absorbency at 700 nm concentrations 80 mg/ml, and Antioxidant capacity of Transactions determined by (ABTS+, 2,2'-azino-bis (3-ethyl benzothiazoline-6-sulfonic acid) assay) and (DPPH, 2.2 Diphenyl-1-picryl hydroxyl assay) action radical contents of Transactions. The highest values were in all measurements of crude methanolic extract and watercress oil while the lowest values in all estimates were obtained with methanolic extract of Rocket seed meal (RSM) before thermal extraction, TPs (49.77, 44.22, 31.44, 26.11 mg GAE/g, respectively), TFs (11.82, 9.70, 7.77, 4.59 mg QE/g, respectively), FRAP (2.0191, 1.4765, 1.1719, 0.9409 mg/ml, respectively), ABTS+ radical (72.19, 59.67, 41.49, 65.23%, respectively), and DPPH radical (0.059, 0.047, 0.031, 0.012 µg/mL, respectively).

3.6. Carcasses Characteristics

Table 11, showed the carcass characteristics of slaughtered rabbits at 10 weeks of age. The differences in relative carcass traits as a results to the effect of feeding treatments were significantly (P<0.05). Tripathi *et al.* (2008) fed rabbits of Soviet Chinchilla and White Giant breed one of four experimental diets surrounding mustard seed meal 0, 80, 160 and 245 g/kg. It is decided that MM can replace up to 66% SBM protein in rabbit feeding, whereas complete replacement of SBM with MM affecting the muscle nutrient accretion pattern. The high weight of carcass and growth performance values as the reflexes the high nutritional value of mustard seeds levels of beta-carotene, a precursor to vitamin A as conveyed by Chow *et al.,* (2010). Ibrahim *et al.* (2012) inclusion mustard seeds in rabbit diets clearly decreased the dressing percentages by increasing the level of mustard seeds in rabbit diets. This result may be due to the occurrence of some fatty acids in mustard oil that are not usually present in edible oils and fats that reduced calorie fats as stated by Sengupta and Ghosh (2010) reported that mustard oil had beneficial effects on energy balance. Eskin *et al.* (2007) and Misra *et al.* (2010) notified that, rabbits that received 90% protein with 1% mustard seeds recorded the best values of carcass weight, this result may be due to the mustard seed content of monounsaturated fatty acids that contribute to decelerating obesity and the metabolic syndrome by or may be due to the high resistance of mustard to trypsin digestion (González De La Peña *et al.,* 1996). Measles capacities in the experimental groups and comparison with the control group showed no statistically significant (P<0.05) differences bar in the weight of the kidneys and stomach. The higher the percentage of replacement in the diet, the lower the weight of the kidneys and the weight of the stomach (Table 11).

Table 11. *Dressing percentage and carcass offal's of slaughtered growing V-Line rabbits fed rations containing rocket seed meals. *.*

Carcass Traits	Treatments/Groups					LSD (0.05)
	T1	T2	T3	T4	T5	
Pre-slaughter weight (Animal weight) (g)	2618.33 ᵃ	2601.67 ᵃ	2700.00 ᵃ	2236.67 ᵃ	2323.33 ᵃ	596.29
Dressed weight (g)	2526.67 ᵃ	2513.33 ᵃ	2620.00 ᵃ	2153.33 ᵃ	2260.00 ᵃ	568.28
Carcass weight head (g)	1930.00 ᵃ	2005.00 ᵃ	2100.00 ᵃ	1725.00 ᵃ	1791.67 ᵃ	568.28
Carcass weight without head (g)	1791.67 ᵃ	1871.67 ᵃ	1960.00 ᵃ	1596.67 ᵃ	1656.67 ᵃ	461.75
Net carcass weight (g):	1205.00 ᵃ	1276.67 ᵃ	1243.33 ᵃ	1085.00 ᵃ	1141.67 ᵃ	333.26
a-Head	138.33 ᵃ	133.33 ᵃ	140.00 ᵃ	128.33 ᵃ	135.00 ᵃ	26.95
b-Heart	8.59 ᵃ	8.47 ᵃ	8.24 ᵃ	8.70 ᵃ	7.14 ᵃ	1.27
c-Liver	85.00 ᵃ	88.33 ᵃ	95.00 ᵃ	80.00 ᵃ	71.67 ᵃ	19.67
d-Kidneys	21.54 ab	23.18 ab	24.88 ᵃ	21.22 ab	18.96 b	3.19
e-Testes	4.39 ᵃ	4.39 ᵃ	3.87 ᵃ	3.87 ᵃ	4.12 ᵃ	1.74
Total weight of edible organs (g): = (a+b+c+d+e)	258.12 ᵃ	257.69 ᵃ	271.98 ᵃ	242.13 ᵃ	236.89 ᵃ	47.01
Total weight of edible organs (g%)	9.85 ᵃ	9.88 ᵃ	10.07 ᵃ	11.04 ᵃ	10.24 ᵃ	1.69
1-Skin, legs, and Tail	478.33 ᵃ	481.67 ᵃ	488.33 ᵃ	403.33 ᵃ	423.33 ᵃ	116.85
2-lungs	23.79 ᵃ	23.66 ᵃ	19.85 ᵃ	23.27 ᵃ	18.04 ᵃ	10.59
3-Blood	91.67 ᵃ	88.33 ᵃ	80.00 ᵃ	83.33 ᵃ	63.33 ᵃ	53.93
4-Cecum	138.33 ᵃ	110.00 ᵃ	133.33 ᵃ	103.33 ᵃ	121.67 ᵃ	41.05
5- Stomach	143.33 ᵃ	111.67 ab	123.33 ab	90.00 b	90.00 b	32.52
6-Intesten	223.33 ᵃ	173.33 ᵃ	225.00 ᵃ	150.00 ᵃ	148.33 ᵃ	66.46
Digestive tract (full) = 4+5+6	505.00 ᵃ	395.00 ᵃ	481.67 ᵃ	343.33 ᵃ	360.00 ᵃ	113.31
Total waste weight (g)= 1+2+3+4+5+6	1098.79 ᵃ	1021.99 ᵃ	1069.85 ᵃ	853.27 ᵃ	864.70 ᵃ	264.03
Total waste weight (%)	41.95 ᵃ	38.03 ᵃ	39.61 ᵃ	38.07 ᵃ	37.17 ᵃ	3.88
The length of the testis (cm)	2.90 ᵃ	3.07 ᵃ	2.83 ᵃ	2.67 ᵃ	2.67 ᵃ	0.64
Showing testis (cm)	0.60 ᵃ	0.57 ᵃ	0.90 ᵃ	1.00 ᵃ	0.97 ᵃ	0.34

* The values are mean±SD of 3 rabbits in each group.

a, b, c, d, and e: Means within the same row with different superscripts are significantly different at (P<0.05).

T1 (Control, 100% Soybean), T2 (75% Soybean+25% Rocket), T3 (50% Soybean+50% Rocket), T4 (25% Soybean+75% Rocket), T5 (100% Rocket).

3.7. Caecum Activity

Through the current study can be summarized activities of the rabbits caecum in the following points:

a. Bacteria can be detected and isolated from rabbits from the first week of age. The microbial load is increased gradually and rapidly during the following weeks to achieve stability by reaching the age of weaning and to be finally adopted on plant rations after stopping breastfeeding. The cactus bacteria in rabbits play an important role in the synthesis of the vitamins that rabbits need to feed, in the self-manufacturing of vitamins.
b. The percentages of volatile fatty acids (VFA'S) produced by rabbits are different from those produced by ruminants. Volatile fatty acids known as three types, acetatic and propionatic and butyric acids, are ruminants acetates (2 carbon atoms) and propionates (3 carbon atoms), butyric (4 carbon atoms) is very small, whereas in rabbits the opposite is true, with butyric acid coming first, and this is due to the proliferation of bacterial strains producing this acid in abundance.
c. Depends on an increase in VFA'S production in the caecum on diet composition. The higher the production of VFA'S in caecum rabbits, the higher the pH value, ie, the alkaline tendencies, This indicates that the rabbit is either hungry or has a long period of feeding and digestion, whereas if the concentration of volatile fatty acids is higher, the pH value is lower, Inside the cecum is acidic, indicating that the rabbit has been sown or has eaten its food not long ago.
d. Digestion of caecum in microbial digestion. The final product of the fermentation process is based on what the bacteria possess from an enzyme system.
e. Increasing crude fiber in the diet of rabbits leads to an increase in the proportion of butyrate produced caecum, and this explains the role of protective fiber within the intestine.

4. Conclusions

A 100 g Rocket meal/1 kg diet can be comprised in broiler rabbits feeding and the Gls should not exceed to 7.0 mol./1g diet. The impact of Gls metabolites present in animal produce on human health also needs to be investigated. From the present review, it appears that adopting a suitable Gls biologically detoxification technology Using the edible and palatable fungi of rabbits, All Brassica-originated feeds and fodders can effectively use in rabbit feed formulations.

In conclusion, from the previous results, watercress seed meals treatment by *Aspergillus oryzae* can be used up to 50% instead of soybean meal in the growing V-Line rabbit diets improved the digestibility, daily weight gain, feed and Economical efficiency, hot carcass weight and dressing percentage without any adverse effects on growth performance or kidney or liver function.

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