



Focus on The Effect of Dietary Pumpkin (*Cucurbita moschata*) Seed Oil Supplementation on Productive Performance of Growing Rabbits

Manal, R. Bakeer

Department of Physiology, Faculty of Veterinary Medicine, Cairo University, Giza – 12211, Egypt.

*Corresponding Author, Manal. R. Bakeer, E-mail: manalbaker36@yahoo.com

ABSTRACT

The present study was designed to investigate pumpkin seed oil's effect on body weight, digestive enzymes' activity, and the metabolic and antioxidant parameters of growing rabbits. This study was performed using two groups of 8-weeks old New Zealand White rabbits (NZW) (n=10/each group). The experiment lasted for eight weeks. The animals were divided randomly to either the control group and fed on a basal diet (C) or the experimental with a basal diet supplemented with 5 g pumpkin seed oil/kg diet (P). Results revealed a significant increase in body weight, blood glucos levels, total lipids and total protein, and serum amylase activities, lipase, and protease. Significant improvements in the antioxidative parameters of rabbits were also observed. In conclusion, the benefits shown in this study support further research into the use of dietary supplementation with pumpkin oil for increasing productivity in growing rabbits.

Keywords: Digestive enzyme, , glucose, New Zealand White rabbits, pumpkin seed oil.

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INTRODUCTION

Rabbit meat has long been recognized as a very important supply of animal protein to humans. Moreover, rabbits occupy a vital midway between ruminants and monogastric animals and can effectively utilize cellulose-rich feed with a ration containing less than 20% grain (Attia *et al.*, 2012). Simple biological characteristics, short breeding cycle, high prolificacy and better feed conversion efficiency (Hasanat *et al.*, 2006). The importance of rabbits as an economic animal especially for meat production means the development of the gastrointestinal tract is vitally more important especially the mucosa (villous for absorption) and sub-mucosa (glands) for enzymatic digestion (Elnasharty *et al.*, 2013).

Dietary antioxidant factors have special importance in maintaining growth, reproduction and immune competence in animal production by reducing the deleterious effects of free radicals and toxic metabolites on animals (Peter, 2007). One of the well-known natural antioxidants is pumpkin seed oil (Shaban and Sahu, 2017). Pumpkin seed oil is a rich natural source of proteins, phytosterols. Polyunsaturated fatty acids, antioxidant vitamins, such as carotenoids and tocopherol and trace elements, such as zinc (Makni *et al.*, 2008).

The Pumpkin plant has been frequently used as a functional food or medicine (Caili *et al.*, 2006). Pumpkin's consumption improves growth performance, milk yield and composition and reproductive performance of does as well as improving litter size and birth weight (Gaafar *et al.*, 2014). In addition, pumpkin stimulates enzymes of animal digestive systems (Jamroz and Kamel, 2002; Ramakrishna *et al.*, 2003).

There are few data available about the effect of Pumpkin Seed oil on productive performance of rabbit to our knowledge. We hypothesize that dietary Pumpkin Seed oil will enhance rabbit productive capacity. Therefore, this study's objective was to examine the effect of pumpkin seed oil on growing rabbits' productive performance.

MATERIALS AND METHODS

1. Animals and Experimental Design

The study was conducted in the Faculty of Veterinary Medicine, Cairo University. Twenty New Zealand white rabbits approximately eight weeks of age were divided randomly into two groups (n= 10/group); one group was considered as a control group and fed on a basal diet (C), while the second group was fed the same basal diet supplemented with 5 g pumpkin seed oil/kg diet (P). Pumpkin seed oil was

obtained from Arab Company for Pharmaceutical and Medicinal Plants, MEPACO", Egypt. The experiment lasted for 8 weeks. Rabbits were housed individually in commercial cages (55x60x34), equipped with automatic drinkers and j-feeders. Clean and fresh water was always available.

The whole rabbitry was well ventilated with both natural windows and electric fans and illuminated to 14:10 light-dark cycle through natural and fluorescent lighting. Average ambient temperature and relative humidity ranged from 20 - 30°C and 70-80%, respectively. Basal diet was formulated to meet rabbits' nutritional requirements as recommended in **NRC (1977)**. Diets were subjected to chemical analysis according to **AOAC (1997)** and offered for all animals ad libitum.; Tables (1) & (2).

Table 1: Composition percentage and analysis nutrients profile of the basal diet

Ingredients	%
Berseem hay	30.0
Barley grain	21.0
Yellow corn	5.0
Wheat bran	21.1
Soybean meal	17.5
Molasses	3.0
CaCl ₂	1.5
NaCl	0.4
Vit.&Min. Premix*	0.3
DL-Methionine	0.2
Chemical analysis (%)**	
Moisture	9.4
Crude protein	17.5
Crude fiber	14.0
Ether extract	2.70
Total Ash	7.10
Nitrogen free extract	49.30
Calculated digestible energy (kcal/kg)	2600

*The Rabbit's vitamin and mineral premix/kg contained the following IU/g for vitamins or minerals: A-4,000,000, D3-5000,000, E-16,7 g, K-0.67 g, B1-0.67 g, B2-2 g, B6-0.67 g, B12-0.004 g, B5-16.7 g, Pantothenic acid-6.67 g, Biotin-0.07 g, Folic acid-1.67 g, Choline chloride-400 g, Zn-23.3 g, Mn-10 g, Fe-25 g, Cu-1.67 g, I-0.25 g, Se-0.033 g, and Mg-133.4 g (Rabbit premix).

** Official methods of analysis of AOAC, international (1997).

Table 2: The chemical composition of pumpkin seeds oil

Ingredients	(%)*
Moisture	5.52
Protein	25.4
Fat (unsaturated fatty acid)	2
phytosterols	33.9
pectins	1.16
Minerals including zinc, iron, calcium, magnesium, sodium, copper, phosphorous and potassium.	30.0
	4.0

2. Samples Collection and Analysis

Blood samples were collected from the ear vein at the end of the experiment and immediately centrifuged at 1000g for 10 min at 4 °C. Serum was stored at -20 °C until assayed for amylase activity using the method of **Somogyi (1960)**. Lipase activity was assayed using the method described by **Tietz and Fiereck (1966)**. Protease activity was analyzed using the method of **Lynn and Clevette-Radford (1984)**. Blood glucose level was determined according to **Tietz and Fiereck (1966)**, total lipids according to **Allain (1974)**, and total protein according to **Doumas et al., (1981)**. Serum superoxide dismutase activity (SOD) (**Jewett and Rocklin, 1993**), total antioxidant capacity (TAC) (**koracevic et al., 2001**) and lipid peroxidation expressed in Malondialdehyde (**Yoshioka et al. 1979**) were assessed using kits purchased from Biodiagnostic Company, Dokki, Egypt.

3. Statistical Analysis

Data were statistically analyzed using general linear models (GLM) procedures adopted by SPSS (2008) for user's guide with one-way ANOVA according to **Snedecor and Cochran (1980)**.

RESULTS

The results summarized in table (3) show average bodyweight all over the experiment. Values indicate a significant increase in rabbits' average body weight fed the diet supplemented with pumpkin seed oil compared to controls.

At the end of the experiment, significant elevations were observed in blood glucose level, total lipids and total protein in rabbits supplemented with pumpkin seed oil compared to the control group (table 4). The results in table (5) indicate the activities of digestive enzymes in serum. The data show a significant increase in serum amylase activities, lipase and protease in rabbits fed the diet supplemented with pumpkin seed oil compared to controls.

Table 3: Effect of pumpkin seed oil supplementation on body weight of rabbit (g)

Parameters	Control group	Pumpkin group
8 weeks old	1150 ± 142.8	1120 ± 97.3
12 weeks old	1540 ^b ± 84.5	1780 ^a ± 105.2
16 weeks old	1930 ^b ± 186.2	2260 ^a ± 145.4

Values are means ± SE, (n: 10 rabbits / group).

Different superscript letters in the same raw denote P<0.05 between treatments.

Table 4: Blood glucose, total lipids and total protein levels of rabbits supplemented with pumpkin seed oil

Parameters	Control group	Pumpkin group
Glucose (mg/dl)	85.30 ^b ± 7.05	120.10 ^a ± 8.24
T. lipids (g/dl)	225.10 ^b ± 19.20	298.20 ^a ± 21.10
T. protein (g/dl)	4.72 ^b ± 0.67	6.13 ^a ± 0.92

Values are means ± SE, (n: 10 rabbits / group).

Different superscript letters in the same raw denote P<0.05 between treatments.

Table 5: Serum activity of digestive enzymes in rabbits supplemented with pumpkin seed oil

Parameters	Control group	Pumpkin group
Amylase (U/L)	118.30 ^b ± 9.04	220.10 ^a ± 15.17
Lipase (U/L)	165.10 ^b ± 14.20	228.50 ^a ± 11.10
Protease (U/L)	69.72 ^b ± 5.62	96.93 ^a ± 4.87

Values are means ± SE, (n: 10 rabbits / group).

Different superscript letters in the same raw denote P<0.05 between treatments.

Table 6: Impact of pumpkin seed oil supplementation on antioxidant parameters

Parameters	Control group	Pumpkin group
SOD (U/g)	515.30 ^b ± 15.24	660.10 ^a ± 16.35
TAC (µm/L)	2.05 ^b ± 0.12	2.98 ^a ± 0.31
MDA (nmol/g)	15.32 ^a ± 1.60	12.96 ^b ± 1.17

Values are means ± SE, (n: 10 rabbits / group).

Different superscript letters in the same raw denote P<0.05 between treatments.

SOD = superoxide Dismutase.

TAC = Total antioxidant capacity.

MDA= Malondialdehyde.

DISCUSSION

This study was designed to investigate the effect of pumpkin seed oil in improving rabbits' productive efficiency. The results revealed a significant increase in live body weight and blood glucose level, total protein and total lipid. These results agree with **Gaafar et al. (2014)** who reported that supplementation with pumpkin seed oil also increased rabbit body weight and some blood metabolic parameters. The results suggest that; these effects are possibly related to the high amount of protein and unsaturated fatty acids in pumpkin seed oil which important for animal body building (**Gossell-Williams et al., 2006**). Moreover, carbohydrate-rich pumpkin seed oil could have increased body weight by increasing blood glucose level and increasing metabolism (**Salman et al., 2008**). Furthermore, the amino acid arginine, a biochemical precursor in the synthesis of many body proteins, is highly concentrated in pumpkin seeds, which is essential for body building (**Abuelgassim, 2012**).

Nakiae et al., (2006) found that pumpkin seeds' nutritional value is based on high protein content and a high percentage of oil. These oils include the fatty acids oleic (up to 46.9%), linolenic (up to 40.5%), palmitic and stearic acid up to 17.4%. The pumpkin seed oil contains various minerals including selenium, zinc, calcium, copper, iron, manganese, phosphorous and potassium (4-5%); and carbohydrate pectin (30%). Pumpkin seed oil is rich in many potent antioxidants and beneficial nutritional supplements such as essential fatty acids and polyunsaturated fatty acids (PUFAs) including linoleic acid, oleic acid, palmitic acid, omega-3, omega-6 and omega-9, carotenes, lutein, gamma and P-tocopherols, phytosterols, chlorophyll, selenium and zinc and a reducer of heat stress that increases body weight and decrease animal mortality (**Hajati et al., 2011**).

According to the present study data, the activities of amylase, lipase and protease were significantly increased in serum of rabbits supplemented with pumpkin seed oil for 8 weeks. The results obtained by **Al-Dabbas et al. (2010)** suggest that pumpkin seed oil increases the production of digestive enzymes and improves digestion products through the enhanced liver of poly-carboxylic acids, phosphate salts, fiber and proteins.

Rabbits supplemented with pumpkin seed oil showed a significant increase in antioxidant parameters and decreased lipid peroxide. The reported results confer with those of **Xu (2000)**, who found that pumpkin polysaccharides could increase SOD and GSH-Px activity and reduce MDA content in tumor mice serum. Moreover, **Ahmed et al. (2009)** reported

that pumpkin seed oil administration resulted in a significant elevation in antioxidative adult male albino rats' antioxidative parameters. **Aghaei et al. (2014)** found that pumpkin seed oil improved antioxidant activity through increase serum TAC in the rat model, Similar to our findings but did not observe any effect on MDA in rats. However, **Rouag et al., (2020)** indicated that; pumpkin seeds (*Cucurbita pepo L.*) do decrease MDA in rats.

CONCLUSION

In conclusion, supplementation of growing rabbits with pumpkin seed oil was associated with improvements in live body weight through elevated blood glucose level, total protein and total lipid, and increased activity of the digestive enzymes. Additionally, pumpkin seed oil supplementation could be considered a beneficial tool for improving productive animal performance by increasing antioxidative parameters and decreasing animal stress. Therefore, the observed results suggest that pumpkin seed oil is a healthy addition to the rabbit diet, improving productivity.

Declaration of competing interest

There is no conflict of interest to declare

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