

PLANTAGO AND MARIGOLD AS NATURAL GROWTH PROMOTERS AND AS DETOXIFICANTS AGAINST CADMIUM CHLORIDE IN GROWING RABBITS

By

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Abstract: *The role of plantago and marigold as natural growth promoters and as detoxifying agents against cadmium chloride was studied in 72 male growing rabbits. Rabbits were classified into 8 equal groups. The first and second groups were used as free and contaminated controls that received basal ration free or supplemented with 1/5 % LD₅₀ of cadmium chloride, respectively. Groups from three to six received basal diet supplemented with plantago or marigold at the level of 1.0 and 2.0%, respectively. Groups Seven and eight received contaminated ration plus 2.0% of plantago or marigold, respectively.*

Final live body weight in treatments of plantago at 1 and 2 % or marigold at 2 % levels significantly ($P<0.05$) increased by 4.7, 8.9 and 5.0 %, respectively compared to the free control group. Cadmium chloride treated rabbits group showed significant lower ($P<0.05$) final body weight by 15.0 % and daily gain by 22.4 % than the free control group. Supplementation 2 % of plantago or marigold to the contaminated diets as detoxicants significantly ($P<0.05$) improved the final body weight by (15.6 and 16.4) % and daily gain by (23.9 and 26.4 %), respectively compared to the contaminated control group.

Total cholesterol level significantly ($P<0.05$) decreased and the Packed cell volume PCV % significantly ($P<0.05$) increased in plantago or marigold supplemented at 1 and 2 % levels by (12, 16.2, 11.4 and 12 %) and by (15.5, 14.4, 16.3 and 23.6%), respectively compared to the free control group. PCV % significantly ($P<0.05$) increased in plantago or marigold supplemented at 2 % level to the contaminated diets by 25.8 and 28.3%, respectively compared to the contaminated control group. Urea and creatinin significantly ($P<0.05$) decreased by (18.4 and 15.8%) and by (22.6 and 26.3%), respectively compared to the contaminated control group. Total cholesterol, GOT and GPT significantly ($P<0.05$) decreased in plantago or marigold supplemented at 2 % level to the contaminated diets by (13.5 and 16.2%), (22.5 and 24.2%) and by (62.1 and 42.8 %), respectively compared to the contaminated control group. Rabbit groups

received plantago or marigold at the two levels used showed insignificant differences in digestibility coefficient. Plantago or marigold as feed additives showed lower economic efficiency % compared to the free control treatment while as detoxicants showed the best economic efficiency % compared to the contaminated control treatment. Adding plantago or marigold at the level of 2.0 % as detoxicants to the contaminated ration significantly ($P < 0.05$) decreased the average weights of spleen and total giblets.

INTRODUCTION

Recently, it has been found that some medicinal plants or herbs have some properties as growth enhancement. These additives are given to animals or birds to improve the physiological and productive performance as well as the general health.

Plantago used is the dried herb of *Plantago major* L. (plantain). Plantain is rich in polysaccharides (Heinrich *et al.*, 1998). The fatty acid composition of young leaves from plantago was rich in omega₃ and carotene (Guil and Rodriguez, 1999). The regulation of immune parameters induced by *Plantago major* may be clinical relevant in numerous diseases including chronic viral infections, tuberculosis, AIDS and cancer (Gomez *et al.*, 2000). Plantain solution provided effective for the treatment of dehydration due to acute diarrhea diseases and should be considered as an alternative when standard is not available (Arias *et al.*, 1997). Plantain herb mixture can therefore be safely used as an alternative growth promoter for the probiotic (Grela, 2000).

Marigold used is the dried flower of *Calendula officinalis*. Marigold oil is rich in myristic, palmitic, linoleic, linolenic, conjugated octadecatrienoic and stearic acid and carotenoids (Pintea *et al.*, 2003). Calendic acid is the effective components that represent approximately 60% of Calendula oil (Tisserand and Balacs 1995). Linoleic acid may have anticarcinogenic effects by inducing apoptosis through modification of signal transduction in colonic mucosal cells (Kim and Park 2003).

The use of omega 3 fatty acids seemed not to influence the productive performance, the slaughter results or the percentage composition of fat, bone and lean in the principal cuts of meat. However, omega 3 fatty acids seemed to influence the belly and the bone percentage of the shoulder and jowl, as well as the carcass pH (Marsico *et al.*, 2003). Consequently, fatty acids that are essential for healthy are arachidonic acid and cervonic acid, derived from the diet, unless they are synthesized by the liver from linoleic acid and alpha-linolenic acid (Gomez *et al.*, 2003), and these can

prevent many diseases such as coronary heart disease, cancer, diabetes and hypertension. (Sarca, 2003).

The distribution of cadmium (Cd) on land is a consequence of emissions from industrial plants and waste of plant incineration. The production of Cd as anticorrosive for iron and other metals which used in the manufacture of batteries. The use of cadmium containing fertilizers, agriculture chemicals and pesticides might also contribute to contamination. Cadmium and numerous of its compounds are toxic. The accumulation of Cd in liver and kidneys is critical. Cadmium causes severe skeletal changes and often death. Zein el Dein et al., (2000) reported that the middle dose of cadmium chloride 40 (ppm) that induced reduction in performance and economic efficiency of broiler birds was about 16%.

The present study aimed to investigate the effects of marigold flowers plantago and as natural feed additives to diets either free or contaminated with cadmium chloride on rabbits performance and some physiological aspects

MATERIALS AND METHODS

A total number of 72 weaning male New Zealand White rabbits with an average body weight of 661.3 ± 39.3 g, were divided into eight equal groups of 9 each. The basal experimental ration (Table 1) was formulated and pelleted to cover the requirements of rabbits according to NRC (1977).The experimental groups were classified as follows;

Group 1 was fed the basal diet and served as free control,
Group 2 was fed the basal diet + 1/5 % LD₅₀ of cadmium chloride and served as contaminated control group,
Group 3 was fed the basal diet + 1.0% plantago,
Group 4 was fed the basal diet + 2.0 % plantago,
Group 5 was fed the basal diet + 1.0 % marigold,
Group 6 was fed the basal diet + 2.0% of marigold,
Group 7 was fed the basal contaminated diet + 2.0 % plantago and Group 8 was fed the basal contaminated diet + 2.0 % marigold.

Median Lethal dose LD₅₀ of cadmium chloride was determined and found to be 200ppm. according to Scharpf *et al.*, (1972).

New Zealand White rabbits were housed in galvanized cages provided with feeder and automatic drinkers. Rabbits of all groups were kept individually under the same managerial conditions. Live body weight was obtained and feed was offered *ad-libitum* and recorded biweekly during the experimental period lasted for 7 days.

At the end of the experimental feeding period, digestibility trials were conducted using (3 male rabbits from each treatment group) which were kept individually in metabolic cages. Faeces were collected separately without urine. Feed and water were offered *ad-libitum*. Feed intake and excreted faeces were recorded daily for 5 days. The total excreted faeces during the 5 – day's period were pooled, well mixed, weighed and sampled for analysis. Chemical composition of feed and dried excreta was determined according to A. O. A. C.(1990).

Blood samples at the end of the experiment were taken from the ear vein of three rabbits from each group for determination of plasma total protein (mg /dl), total lipids (mg / dl), cholesterol (mg / dl), packed cell volume (PCV)%, GOT and GPT(unit / l), urea (mg / dl), and creatinine (mg / dl) by using reagent commercial kits purchased from Bio- Merieux (France) following to the same procedure as described by manufactures.

At the end of the experiment, 3 males of each treatment were chosen randomly for slaughter test. Carcass and giblets weights were calculated as percentage of live body weight.

Economical efficiency % (Y) was calculated according to the following equation: $Y = [(A-B)/B] \times 100$, where A is the selling price of one kilogram live body weight gain (12.0 L.E.) and B is the feeding cost of this gain (0.95 L.E.) The cost of one kilogram of both plantago dried herb or marigold dried flower were (6.00 L.E).

Data were analyzed by using the complete randomized design according to Snedecor and Cochran (1982). Significant differences among means were detected by the method of Duncan (1955).

RESULTS AND DISCUSSION

Growth performance

Plantago and Marigold as growth promoters

Plantago at 1 and 2 % or marigold at 2 % levels significantly ($P < 0.05$) increased final body weight by 4.7, 8.9 and 5.0 % and daily feed intake by 7.3, 9.4 and 13.5 %, respectively compared to the control group (Table 3).

The significant improvement as a result of plantago supplementation may be due to it's contents of ascorbic acid and carotene. Similar results for plantago in dogs observed by (Kim *et al.*, 1996) and in rats by Guil *et al.*, (1997). While the improvedment arigold supplementation may be due to the calendic acid activity that based on measurements of products of

fermentation in rabbit caecum. Simillar results for marigold in sheep observed by (Pethick and Chapman 1991) and in calves by Stenzel *et al.*, (2000). On the other hand the increase in body weight was correlated with slightly higher digestibility of most nutrients except for crude fiber (Table 5), and that may be attributed to the positive effect of these additives on the enzymes activity system.

Economical efficiency (EE)%

The economic efficiency percent was higher by 16.8, 5.1, and 2.2 % for rabbit groups received plantago at 2 or 1 % levels and marigold at 1% level respectively as growth promoters compared to the control group (Table 3). The only reduction value of the economic efficiency was in marigold at 2% level by 2.5% compared to the control group (Table 3). The changes in economic efficiency % were controlled by the relationship between the feed conversion ratio and the cost of these additive. These results may be indicate that plantago at 1 % level can be used as an alternative growth promoters with favorite meat quality. On the other hand using plantago or marigold as detoxicants at 2 % level markedly improved the economic efficiency % by 32 and 31.5 %, respectively compared to the contaminated control group (Table 3). These improvements may highlight that plantago or marigold can be safely used as detoxicants against cadmium chloride through the improvement of the immune system of treated rabbits as shown in PCV% value (Table 4).

Plantago and marigold as detoxicants

Cadmium chloride significantly ($P<0.05$) decreased final body weight by 15.0 %, daily gain by 22.4 % and daily feed intake by 9.5% compared to the free control group (Table 3). These values may be attributed to the alternation in digestive enzymes secretion or to the inhibition of the hypothalamic appetite center. Similar results was observed in rabbits used garlic contaminated with mercury by Ibrahim *et al.*, (2000), and for cinnamon contaminated with cadmium chloride in rabbit by (Ibrahim 2000). However Abdelhamid (1988) reported heavier body weight, higher gain, better feed conversion and increased feed consumption in Baladi rabbits fed diets contaminated with traces of mercury.

Supplementation 2 % of plantago or marigold to the contaminated diets as detoxicants significantly ($P<0.05$) improved the final body weight by (15.6 and 16.4) % and daily gain by (23.9 and 26.4) %, respectively compared to the contaminated control group (Table 3). The enhancement values for plantago may be due to the properties of the polysaccharides and glycoside consisting against contamination. Similar results in rats were observed by Rezaeipoor *et al.*, (2000) and Paulsen *et al.*, (1994). The

significant values for marigold may be due to the resistance effect of calendic acid against diseases and developmental abnormalities. Similar results in calves was obtained by Stenzel *et al.*, (2000).

Blood parameters

Plantago and Marigold as growth promoters

Total cholesterol values were significantly ($P<0.05$) decreased and PCV % were significantly ($P<0.05$) increased due to plantago or marigold supplementation at 1 and 2 % levels by (12, 16.2, 11.4) and 12 % and by (15.5, 14.4, 16.3 and 23.6%), respectively compared to the control group (Table 4). These results were paralleled with the lower insignificant abdominal fat percentage (Table 6). The significant reduction in cholesterol and the significant increase in PCV % may be attributed to the content of plantago and marigold in linolenic acid. Similar results were observed in commercial layers by (Zang *et al.*, 2003) and (Chen and Yeh 2003). The total proteins and total lipids in all treatments were found to be in normal range. Adding plantago or marigold at any experimental level did not change liver and kidney function in blood plasma. Similar results were obtained in lambs by Deaker *et al.*, (1994).

Plantago and Marigold as detoxicants

Packed cell volume % was significantly increased ($P<0.05$) by (25.8 and 28.3%) due to plantago or marigold supplementation at 2 % level to the contaminated diets respectively compared to the contaminated control group (Table 4). Urea and creatinin were significantly ($P<0.05$) decreased by (18.4 and 15.8%) and by 22.6 and 26.3%, respectively compared to the contaminated control group (Table 4). Total cholesterol, GOT and GPT were significantly decreased ($P<0.05$) by (13.5 and 16.2%), (22.5 and 24.2%) and (62.1 and 42.8%), respectively in plantago or marigold supplemented with 2 % level to the contaminated diets compared to the contaminated control group (Table 4).

In *Plantago major*, the significant improvement values could be attributed to the effect of polyphenolic complex as an inhibitor of the toxicity synthesis that reduced the toxic damage of the liver and other organs. Similar results were observed in rats by Ringbom *et al.*, (2001). Also, the polyunsaturated fatty acids in plantago may regulate the metabolic function of liver effectively by increasing glucose-6-phosphate dehydrogenase, 6-phosphogluconate dehydrogenase, lactate dehydrogenase, and malate dehydrogenase enzyme activities of rabbit liver. Similar results were observed in rats by Yilmaz *et al.*, (2004). In *Calendula officinalis*, the significant improvement values may be due to the linoleic and linolenic fatty acids that

inhibited new cyclooxygenase-2 -catalyzed prostaglandin biosynthesis. Similar results obtained by (Pintea et al.,2003). Or may be attributed to the linoleic acid of marigold as detoxificants agent by inducing apoptosis through modification of signal transduction in colonic mucosal cells. Kim and Park (2003) observed similar results on linoleic acid has anticarcinogenic effects.

Carcass traits

The insignificant decreased values of abdominal fat and dressing percent due to using plantago or marigold as growth promoters indicated that, plantago or marigold had no impact on the amount of abdominal fat. Grela (2000), obtained similar results for plantago. However, Deaker *et al.*, (1994) showed that dressing percentage, lumbar region weight and breast weight decreased ($P<0.05$) with 100% plantain peel in lambs.

Cadmium chloride treated rabbits group showed significant ($P<0.05$) lower weights of dressing percentage by (12.1 %), abdominal fat by (37.1 %), liver by (66.8%), kidney by (44.6%), heart by (26.3%) and spleen by (44.6%), respectively compared to the free control group (Table 6). These significant changes in organs weights may be due to the swollen mitochondria in the proximal tubule cells in these organs, or may be due to the subsequent cell damage, hepatic fibrosis and localization of cadmium in nucleus could be defined as the most characteristic ultra structural features for diagnosis of cadmium poisoning. Similar results were obtained for lead by Prasada et al.,(1989) and Birkhead et al., (1982).

Adding 2 % plantago or marigold to the contaminated diets significantly decreased the percentage weights of spleen with an equal value by 28% for the both two additives compared to the contaminated control group (Table 5). These results may be attributed to the promotion action of plantago or marigold that may give the sufficient protection against cadmium toxicity. Similar results obtained for clove contaminated with cadmium in rabbit by (Ibrahim, 2000).

Digestibility

There were slightly non-significant differences noticed in digestibilities of DM, OM, CP, CF, EE and NFE among the different experimental diets as shown in (Table 5). The slightly non-significant increase observed in digestibilities coefficients may be due to the major direct effects of plantago or marigold in European folk medicine as enhance of immune system. Plantago had no effect on internal parasite populations (Knight et al., 1996). Also, Fanimu and Odu (1996) observed that DM, CP and energy digestibility coefficients decreased ($P<0.05$) with 100 % plantain peel. Similar results were

obtained on clove and cinnamon by Ibrahim (2000), Zeweil (1992) on artichoke canning by-products and by Ali (1998) on corn stalk.

In conclusion, it appears that plantago at the level of 1 or 2 % and marigold at the level of 2% can be used as natural growth promoters as well as detoxicants against cadmium chloride through the improvement of the immune system of treated rabbits as shown at the percent of the packed cell volume .

Table 1. The constituents and calculated analysis of the basal ration.

Items	%
Yellow corn	14.2
Soy-bean meal (44%cp)	15.0
Wheat bran	29.0
Clover hay	36.7
Molasses	03.0
Lime stone	01.0
Sodium chloride	00.5
Meththionine	00.3
<i>Vit. & Min. Premix*</i>	00.3
Total	100.0
Chemical composition as fed basis	
OM	92.91
CP	18.95
EE	4.14
NFE	55.84
CF	13.98
Ash	7.09
DE(kcal/kg)**	2665

* Vitamins and Minerals per one kilogram :

Vit. A. 4000000 IU, Vit. D3 50000 IU; Vit. E 16.7 g, Vit. K 0.67 g, Vit. B1 0.67 g, Vit. D₃ 180000 IU, Coline chloride 400g, Pantothenic acid 6.67g, Niacin 1000 mg, Folic acid 1.67g, Biotin 0.07g, Manganese 10g, Zinc 23.3g, Iron: 25g, Calcium1.067g, Copper 600 mg, Selenium 0.033 g, Iodine 40 mg and Magnesium 133.4g.

** Calculated according to NRC (1977).

Table 2. The proximate analysis of Plantago and calendula(%)*

Item	OM	CP	EE	NFE	CF	Ash
plantago	95.24	22.26	7.70	57.47	7.81	4.76
calendula	92.55	21.44	9.09	49.74	12.28	7.45

*chemical analysis on DM basis

Table 3. Growth Performance of rabbits fed diets without or with Cd (40 ppm) supplemented with Plantago and marigold., (Means ±SD).

Item	Control		Plantago		Marigold		Cd+2%	
	free	contaminated	1 %	2%	1 %	2%	Plantago	Marigold
Initial live body weight (g)	640±49	659±27	640±49	632±51	672±57	692±21	663±34	643±29
Final live body weight (g)	2234±72 cd	1900±31 e	2339±66 ab	2432±67 a	2307±64 bc	2346±63 ab	2196±46 d	2211±46 cd
Daily body weight gain (g)	21.0±0.6 bc	16.3±0.7 d	22.4±0.4 b	23.7±0.7 a	21.5±0.5 b	21.8±0.6 b	20.2±1.0 c	20.6±0.8 bc
Daily feed intake (g)	97.0±1.6 a	87.8±1.1 c	94.5±7.5 ab	95.8±1.7 ab	95.3±0.9 ab	96.8±0.7 a	90.9±0.9 bc	90.0±3.7 bc
Feed conversion (ratio)	4.62±0.2 ab	5.39±0.2 a	4.22±0.4 b	4.05±0.1 b	4.44±0.1 b	4.45±0.2 b	4.52±0.2 b	4.37±0.2 b
Economic Efficiency %	55.3	37.2	58.1	64.6	56.5	53.9	49.1	48.9

a,b,c,d: Means in the same row bearing different letters, differ significantly (P<0.05).

Table 4. Blood parameters of rabbits fed diets without or with Cd (40 ppm) supplemented with Plantago and marigold., (Means ±SD).

Item	Control		Plantago		Marigold		Cd+1%	
	free	contaminated	½%	1%	½%	1%	Plantago	Marigold
Total protein (mg/dl)	7.7±0.4 a *	5.8±0.3 b	7.8±0.1 a	7.5±0.3 a	7.48±0.2 a	7.55±0.3 a	6.13±0.5 b	6.42±0.3 b
Total lipids (mg/dl)	207±14 b	287±59 a	198±9 b	189±10 b	186±6 b	182±11 b	210±3 b	215±7 b
Cholesterol (mg/dl)	167±5.6 b	185±6.7 a	147±5.6 cd	140±30.3 d	148±4.4 cd	147±20.2 cd	160±30.3 bc	155±6.7 abcd
GOT (unit /l)	89±6.8 b	120±3.3 a	88±1.9 b	86±1.7 b	86±3.1 b	84±4.2 b	93±1.3 b	91±0.8 b
CPT (unit /l)	28.5±1.9 b	53.8±3.2 a	28.5±0.6 b	26.6±1.4 b	29.8±0.5 b	28.3±1.8 b	32.8±4.5 b	33.6±1.6 b
PCV (%)	36.8±1.1 b	24.0±1.6 d	42.5±1.3 a	42.1±2.1 a	42.8±1.5 a	45.5±2.0 a	30.2±1.0 c	30.8±1.3 c
Urea (mg/dl)	36.3±2.7 bc	50.5±3.2 a	34.5±2.0 c	38.8±1.0 bc	36.2±2.2 bc	36.7±2.7 bc	41.2±0.8 bc	42.5±1.8 b
Creatinine (mg/dl)	4.1±0.3 b	5.3±0.2 a	3.8±0.2 b	3.4±0.2 b	3.4±0.2 b	3.9±0.2 b	4.1±0.4 b	3.9±0.6 b

a,b,c,d: Means in the same row bearing different letters, differ significantly (P<0.05).

Table 5. Digestibility coefficients of rabbits fed diets supplemented with plantago or marigold.

Item	Control	Plantago		Marigold	
		1%	2%	1%	2%
DM	63.3±1.6	64.6±1.2	65.1±1.6	66.6±0.6	67.3±0.9
OM	60.7±1.8	63.4±1.4	64.6±2.3	64.3±2.0	65.3±2.1
CP	72.1±2.3	75.5±2.0	74.1±2.3	73.1±1.8	74.5±2.6
CF	35.2±0.7	34.4±0.6	35.2±1.8	35.6±0.9	35.8±1.1
E.E	70.7±1.0	73.0±1.6	73.3±1.7	75.2±0.7	76.3±0.5
NFE	69.5±0.7	71.6±1.0	72.7±0.2	72.8±1.6	73.2±2.2

Table 6. Carcass traits of rabbits fed diets without or with Cd (40 ppm) supplemented with plantago or marigold (%).

Item %	Control		Plantago		Marigold		Cd+2%	
	free	contaminated	1%	2%	1%	2%	Plantago	Marigold
Dressing	58±1 abc	51±2 d	56±2 bc	55±2 bod	59±2 ab	62±1.4 a	53±1.2 cd	54±1.1 cd
Abdominal fat	13.3±1.0 a	8.3±0.9 b	11.5±1ab	10.4±1.0ab	10.5±0.6ab	11.7±1.2ab	9.4±1.2 b	9.8±1.0 b
Liver	2.65±0.3 c	4.42±0.4a	2.58±0.2 c	2.67±0.2bc	2.56±0.3bc	2.85±0.2bc	3.58±0.4ab	3.88±0.11a
Kidney	1.21±0.1bcd	1.75±0.1a	0.92±0.2cd	0.88±0.03d	0.98±0.2cd	1.03±0.1bcd	1.45±0.7ab	1.26±0.1bc
Heart	0.38±0.01b	0.48±0.03a	0.39±0.02b	0.38±0.02b	0.41±0.02b	0.39±0.02b	0.41±0.02b	0.42±0.1ab
Spleen	1.21±0.01bcd	1.75±0.2 a	0.92±0.2cd	0.88±0.03d	0.98±0.1bcd	1.45±0.7 ab	1.26±0.1bc	1.26±0.1bc
Total giblets	6.49 ±2.3	9.27±2.9	6.57±2.3	6.79±2.4	7.12±2.4	7.52±2.6	8.09±2.7	8.46±2.7
Fur	14.9±1.8	12.4±0.8	15.4±1.7	16.0±1.7	13.3±0.6	14.0±1.8	13.0±1.2	13.9±1.0

abc,d. Means in the same row bearing different letters differ significantly (P<0.05).

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الملخص العربي

لسان الحمل والأقحوان كمنشطات نمو طبيعية وكمضادات سموم لكلوريد الكاديوم في الأرانب النامية.

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قسم الإنتاج الحيواني - المركز القومي للبحوث - الدقى - جيزة .

أجريت هذه الدراسة لبيان التأثيرات الناجمة عن تغذية أرانب النمو على علائق مضاف إليها كل من لسان الحمل أو الأقحوان بغرض إثراء العلائق بمحتوى أى منهما من السكريات العديدة أو الأحماض الدهنية الغير مشبعة أو من العناصر المعدنية مما يكسب الخلية الحية خاصية مقاومة الإجهاد لمواجهة ما يتعرض له الأرنب في حالة تناوله علف ملوث بكلوريد الكاديوم كأحد السموم واسعة الانتشار إما عند استخدامها كمبيدات زراعية أو كمخصبات للتربة أو ناتج أبخرة المصانع أو كونها تدخل في جلفنة بطاريات الأرانب وأثر ذلك على مظاهر النمو وبعض التغيرات الفسيولوجية.

استخدم في هذا البحث 72 أرنب نيوزلندى مقسمة إلى 8 مجموعات متساوية. تمت التغذية على عليقه متوازنة واختلفت المجموعات باختلاف الإضافات حيث اعتبرت المجموعة الأولى هي القياسية الحرة والثانية هي القياسية الملوثة بكلوريد الكاديوم بنسبة 40مليجرام/كجم علف. المجموعات من الثالثة إلى السادسة غذيت بإضافة لسان الحمل أو الأقحوان بنسبة 1، 2% إلى العليقة الأساسية على الترتيب. أما المجموعتان السابعة والثامنة فغذيتهما بإضافة لسان الحمل أو الأقحوان بنسبة 2% إلى العليقة الأساسية الملوثة بكلوريد الكاديوم على الترتيب.

* تم الحصول على النتائج الآتية عند استخدام لسان الحمل أو الأقحوان كمنشط للنمو :-

- 1- أدت إضافة لسان الحمل عند مستوى أي من 1 أو 2% أو الأقحوان عند مستوى 2% إلى زيادة معنوية في متوسط الوزن الحي النهائي بمقدار 4.7، 8.9، 0.5% على الترتيب مقارنة بالمجموعة القياسية.
- 2- أحدثت إضافة لسان الحمل عند مستوى 2% زيادة معنوية في متوسط معدل الزيادة اليومية في الوزن الحي قدرها 12.9% مقارنة بالمجموعة القياسية.
- 3- أدى تلوين العليقة بكلوريد الكاديوم إلى إنخفاض معنوي في كل من متوسط الوزن الحي النهائي قدرها 6% وفي معدل الزيادة اليومية للوزن الحي قدرها 9.5% وكذلك إنخفاض في استهلاك العلف اليومي قدرها 6.7% على الترتيب مقارنة بالمجموعة القياسية.
- 4- أدت إضافة كل من لسان الحمل والأقحوان عند مستوى 2% للعليقة الملوثة بكلوريد الكاديوم إلى تحسن معنوي لكل من متوسط الوزن النهائي بنسبة 4.6 و 5.3% ومعدل الزيادة اليومية في الوزن بنسبة 6.3 و 8.4% على الترتيب مقارنة بالمجموعة القياسية.
- 5- أدت إضافة لسان الحمل أو الأقحوان عند مستوى أي من 1 أو 2% إلى العلف إلى إنخفاض معنوي في الكوليسترول بنسبة 12، 16.2، 11.4 و 12% وإلى زيادة معنوية في حجم كرات الدم المضغوطة بنسبة 15.5، 14.4، 16.3، 23.6% على الترتيب مقارنة بالمجموعة القياسية.
- 6- أدت إضافة لسان الحمل أو الأقحوان عند مستوى أي من 1 أو 2% إلى إنخفاض في قيمة الكفاءة الإقتصادية بمقدار 13.6، 7.3، 22.6، 34.6% على الترتيب مقارنة بالمجموعة القياسية.

- * تم الحصول على النتائج الآتية عند استخدام لسان الحمل أو الأبقوان كمضاد للتلوث بكلوريد الكاديوم :-
- 7- أدت إضافة لسان الحمل أو الأبقوان عند مستوى 2% إلى العلف الملوث بكلوريد الكاديوم إلى زيادة معنوية في حجم كرات الدم المضغوطة بنسبة 25.8 ، 28.3 % وانخفاض معنوي في مستوى كل من اليوريا بمقدار 18.4 ، 15.8% والكرياتينين بمقدار 22.6 ، 26.3% والكوليسترول بنسبة 13.5 ، 16.2 بالإضافة إلى التحسن المعنوي في نشاط إنزيمات الكبد GOT بنسبة 22.5 ، 24.2 % و GPT بنسبة 62.1 ، 42.8 % على الترتيب مقارنة بالمجموعة القياسية الملوثة بكلوريد الكاديوم.
- 8- إضافة لسان الحمل أو الأبقوان عند مستوى أي من 1 أو 2% إلى العلف لم يظهر تغيير ملحوظ على نسبة دهن البطن أو على باقى أجزاء الذبيحة.
- 9- أدى تلويث العليقة بكلوريد الكاديوم إلى انخفاض معنوي في نسبة التصافى بمقدار 12.1 % وإلى زيادة معنوية في وزن كل من كمية دهن البطن بنسبة قدرها 31.7 % والقلب بنسبة 26.3 % والطحال بنسبة 44.6% وكذلك لمجموع الأجزاء المأكولة بنسبة 58.1% على الترتيب مقارنة بالعليقة القياسية الحرة ، بينما أدت إضافة لسان الحمل أو الأبقوان عند مستوى 2% للعلف الملوث إلى تصحيح معنوي في خفض وزن كل من الطحال بنسبة 28 ، 28 % والأجزاء المأكولة بنسبة 18.1 ، 16.7 % على الترتيب مقارنة بالعليقة القياسية الملوثة بكلوريد الكاديوم.
- 10- أدت إضافة لسان الحمل أو الأبقوان عند مستوى 2% إلى تحسن ملحوظ للكفاءة الإقتصادية بنسبة 20.9 ، 6.6% على الترتيب مقارنة بالمجموعة الملوثة القياسية.