

EFFECT OF FEEDING LETTUCE AND GARDEN ROCKET ON SOME BIOCHEMICAL PARAMETERS IN:

1- NORMAL RATS

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ABSTRACT

This study aimed to find out the effect of feeding some locally available and cheap plants as lettuce and garden rocket on some biochemical parameters in normal rats. After feeding normal rats the experimental diet for 28 days. The results obtained showed a gradual increase of relative liver, kidney and spleen weight. Rats fed the experimental diets presented a gradual decrease of total blood and liver cholesterol, triglycerides, phospholipids, free fatty acids and HDL-cholesterol, also a gradual decrease of AST, ALT and ALP levels was obtained. Blood creatinine, urea and glucose levels were also decreased.

A slight increase of serum calcium, phosphorus, magnesium, zinc, iron, ferritin, blood hemoglobin and hematocrit was observed in rats fed the experimental diets.

INTRODUCTION

Lettuce (*Lactuca Sativa*) and garden rocket (*Eurca sativa*), are considered important parts of human diets. They could have therapeutic and nutrient effect as they supply essential elements to human body. Vegetables are good sources of vitamins, minerals as well as fibers.

Lettuce is used mainly as an ingredient in green salads. Dark green leaves are good sources of vitamin A and C, iron, folic acid and calcium.

Garden rocket is a green vegetable which has a favorable flavor and a good nutritional value. Haag and Minami (1988), reported that garden rocket leaves contain phosphorus, potassium, calcium, magnesium, sulphur, copper, iron manganese and zinc.

MATERIALS AND METHODS

Materials:

Samples of lettuce and garden rocket leaves were obtained from local market in Cairo. They were washed and dried overnight at 63°C using a fan oven and powdered.

Methods:

1- Chemical analysis:

Moisture, protein, fat, ash were determined according to A.O.A.C. (1990), crude fiber by Pearson (1971), carbohydrate and energy value by F.A.O. (1982). Iron, calcium, sodium and potassium were determined by the

method of Jorhem (2000). Phosphorus and vitamin C were estimated by the method of Ronald and Ronald (1991). Extraction of liver lipids was done according to Bligh and Dyer (1959).

2- Biochemical analysis:

Cholesterol and HDL-cholesterol were determined according to Richmond (1973), triglycerides by method of Young and Pestaner (1975), phospholipids and free fatty acids by the method of Richard et al, (1974), AST and ALT were estimated by method of Reitman and Frankel (1957), ALP by Haussement, (1977). Creatinine was estimated by the method of Henry, (1974), urea by the method of Patton and Crouch (1977).

Serum ferritin was determined by Cook *et al.* (1974), hemoglobin by the method of Bernard (1965), hematocrit by the method of Mc-Inory (1954) and blood glucose by the method of Trinder, (1969).

Biological experiment:

50 weaning male albino rats (Sprague Dawley strain) of an average weight 40-50 gram and age 28 days. Rats were divided into 10 groups, 5 rats in each group and fed several diets for 28 days as follows:

- Group 1: Control, Fed control diet.
- Group 2: Fed control diet + 1 % lettuce powder.
- Group 3: Fed control diet + 2.5 % lettuce powder.
- Group 4: Fed control diet + 5 % lettuce powder.
- Group 5: Fed control diet + 1 % garden rocket powder.
- Group 6: Fed control diet + 2.5% garden rocket powder.
- Group 7: Fed control diet + 5% garden rocket powder.
- Group 8: Fed control diet + 1% of mixture powder.
- Group 9: Fed control diet + 2.5% of mixture powder .
- Group 10: Fed control diet + 5% of mixture powder .

* Mixture: consists of equal parts of lettuce and garden rocket powder.

The composition of the control diet.

Casein	11.9	gram (for 10% protein).
Corn oil	10	"
* Salt mix.	4	"
** Vit. Mix	1	"
Choline chloride	0.2	"
Corn starch	72.9	"

* Salt mixture was prepared according to Hegsted *et al.* (1941).

** Vitamin mixture was prepared according to Bunce and Bloomer, (1972).

N.B. Lettuce, garden rocket or their mixture were added to the control diet at the expense of starch.

RESULTS AND DISCUSSION

Approximate chemical composition of lettuce (L), garden rocket (GR) and the mixture (M) consists of equal parts of (L) and (GR) is presented in table (1).

The obtained results approximately agree with those of Agriculture Handbook No. 8, 1963 and approximately parallel those investigated by pellet and Sossy, 1970, with few exceptions. Our results are more or less concordant to data of Nutrition Institute, Food composition Tables, (1996) and approximately like ASRT, (1997) data, except mineral variations.

The effect of lettuce (L), garden rocket (GR) and their mixture (M) on relative weight organs of experimental rats is illustrated in table (2). It could be noticed that there was gradual increase of liver weight, kidney weight and spleen weight with the increase of feeding supplement (L), (GR) or (M).

The data are in accordance with the results obtained by Abo-Shadie, (2002) who reported a significant increase of relative liver weight of rats fed diet containing 2% garlic. The results are also coinciding with those of El-Sayed, (2001) who reported a significant increase in relative liver weight of rats fed diet containing 5% p. *oleracea leouces* and he suggested that this may be due to the liver content of lipids.

Table (3) indicates the effect of feeding different levels of (L), (GR), or their (M), on blood lipids profile in normal rats. The data show a gradual decrease in the level of serum total cholesterol, triglycerides, phospholipids and free fatty acids, decreased gradually with the increase of feeding supplement of (L), (GR) or (M). HDL-cholesterol showed a gradual increase as the feeding supplement of (L), (GR) or (M) increased.

Liver lipids followed the same manner as serum lipids as shown in table (4).

These results are in good agreement with El-Adawi, (1997) who recorded highly significantly reduction in serum total cholesterol and phospholipids with dietary fiber sources. Thus the overall effect of fiber is to reduce the blood levels of cholesterol and triglycerides as reported by Ensminger *et al.*, (1995).

The data of the present work indicated that there was a gradual decrease of the AST, ALT and ALP levels with the increased level of (L), (GR) and (M) concentration in the diet, as reported in table (5). The results are supported by the hypothesis of El-Missiry and El-Gindy (2000) that ESS oil may have favorable effects on liver damage produced by the generation of free radicals.

Table (6) represents the effect of feeding different levels of (L), (GR) and (M) on kidney function. There is a gradual decrease of serum creatinine and serum urea accompanied with the increase of the feeding supplement of (L), (GR) and (M). Our results disagree with El-Adwi, (1997) who reported no significant difference in creatinine between (L) treatment at the two tested levels (5 and 10%) and control, on the other hand El-Sayed, (2001) found a significant decrease of creatinine in diabetic rats with the supplement of different levels p. *Oleracea leaves*.

The effect of feeding different levels of (L), (GR) or (M) on serum mineral profile is shown in table (7). Data obtained show a gradual increase of serum calcium and a slight increase of serum phosphorus, serum magnesium and serum zinc as the supplement level increased. Table (8)

illustrates the effect of feeding different levels of (L), (GR) or (M) on iron indices in normal rats.

Data showed a gradual elevation in iron and ferritin levels with the increase of supplement level. Hemoglobin and hematocrit levels ameliorated gradually with the increase of supplement level in the diet.

Contradicting our results Cook *et al.*, (1983) showed a lower iron absorption in normal human subjects fed high fiber meals than those fed low fiber meals.

Our data is in accordance with El-Adwi, (1997). He reported that tomatoes and (L) highly significantly increased hemoglobin and hematocrit values.

Table (9) shows the effect of feeding different levels of (L), (GR) or (M) on blood glucose level. After feeding 4 weeks, blood glucose decreased irregularly with the increase of experimental supplement level. Brighenti *et al.*, (1995) suggested that salad decreasing containing 100 g. of sliced (L) with liver oil and vinegar has a significant glycaemic effect in normal subjects which coincides with our findings. Roman *et al.*, (1995) reported a glycemic decrease caused by (L) lactuca sativa var. romana, prepared traditionally, but it was not significant.

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تأثير تغذية الخس والجرجير على بعض المؤشرات الحيوية:

١- الفئران الاصحاء

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- تهدف هذه الدراسة بيان تأثير تغذية بعض الخضروات رخيصة الثمن مثل الخس والجرجير وبيان تأثيرها على بعض المؤشرات الحيوية في الفئران الاصحاء. بعد تغذية الفئران بهذه الخضروات لمدة ٢٨ يوما أظهرت النتائج ما يلي:
- ١- زيادة تدريجية في اوزان الكبد والكلي والطحال.
 - ٢- انخفاض تدريجي في الكوليسترول الكلي والجلسيريدات الثلاثية والفسفوليبيدات والاحماض الدهنية الحرة بينما زاد الكوليسترول عال الكثافة في كل من الدم والكبد.
 - ٣- كما حدث انخفاض تدريجي في انزيمات الكبد AST, ALT, ALP.
 - ٤- بالنسبة للكرياتنين واليوريا وجلوكوز الدم فقد حدث انخفاض في مستواهم في نهاية التجربة.
 - ٥- أظهرت النتائج زيادة بسيطة في تركيز كل من الكالسيوم ، المغنسيوم ، الفسفور ، الزنك ، الحديد والفريتين في مصل الدم.
 - ٦- كما اظهرت النتائج زيادة تدريجية في نسب الهيموجلوبين ، والهيماتوكريت في دم الفئران.

Table(1): Approximate chemical composition of lettuce (L) , garden rocket(GR) and mixture of equal parts of lettuce and garden rocket (M) .

Sample (100 g)	Scientific Name	Water g%	Prot g%	Fat g%	Ash g%	Fiber g%	CHO g%	E Kcal	Na mg/100 g	K mg/100 g	Ca mg/100 g	Fe mg/100 g	P mg/100 g	V.C mg/100 g
L	Latuca Sativa	94.3	1.3	0.2	1.0	0.5	2.7	18	9.4	276.5	36.7	2.0	26.5	8.0
GR	Eruca Sativa	89.2	2.4	0.5	1.7	1.0	5.2	35	31.5	256	121.8	7.7	37.6	134
M	Mix. of equal parts of L &GR	92.1	1.9	0.4	1.3	0.7	3.6	26	21.2	270.4	80.2	4.9	31.8	72.3

Table (2) Effect of feeding different levels of lettuce , garden rocket or a mixture of equal parts of lettuce and garden rocket on relative weight of the organs in normal rats.

Parameter (g/100)	Control group	Lettuce feed level			Garden rocket feed level			Mixture feed level		
		1%	2.5%	5%	1%	2.5%	5%	1%	2.5%	5%
LW/BW	2.03 ±0.04 ^a	2.12± 0.01 ^b	2.24± 0.02 ^c	2.31± 0.02 ^c	2.22± 0.02 ^b	2.32± 0.02 ^c	2.43± 0.03 ^d	2.34 ±0.01 ^b	2.36± 0.01 ^b	2.47± 0.02 ^c
KW/BW	1.14 ±0.02 ^a	1.22± 0.03 ^b	1.30± 0.01 ^b	1.35 ±0.02 ^c	1.29± 0.02 ^b	1.36± 0.02 ^c	1.44± 0.03 ^c	1.35± 0.03 ^b	1.39± 0.01 ^b	1.48± 0.02 ^c
SW/BW	0.34± 0.02 ^a	0.37±0.01 ^a	0.41 ±0.01 ^b	0.44±0.03 ^b	0.41± 0.02 ^b	0.45 ±0.02 ^b	0.49± 0.02 ^c	0.44±0.02 ^{fa}	0.48± 0.03 ^b	0.53± 0.03 ^c

Mean ±SE. Different letters on the numbers mean significant difference at P <0.05

LW= Liver weight , KW= Kidney weight , SW= spleen weight , BW= body weight

Table (3) : Effect of feeding different levels of lettuce , garden rocket or a mixture of equal parts of lettuce and garden rocket on blood lipid profile in normal rats.

Serum Lipids (mmol/l)	Control group	Lettuce feed level			Garden rocket feed level			Mixture feed level		
		1%	2.5%	5%	1%	2.5%	5%	1%	2.5%	5%
Total cholesterol	2.81±0.02 ^a	2.66± 0.01 ^b	2.55±0.02 ^c	2.40± 0.02 ^d	2.54± 0.02 ^c	2.39 ±0.01 ^d	2.20± 0.01 ^c	2.44± 0.01 ^b	2.32± 0.01 ^c	2.14± 0.02 ^d
Triglyceride	1.43± 0.01 ^a	1.39± 0.01 ^a	1.31± 0.01 ^b	1.18± 0.01 ^c	1.33± 0.03 ^b	1.19 ±0.03 ^c	1.11± 0.01 ^c	1.30± 0.02 ^b	1.12± 0.02 ^c	1.07± 0.01 ^d
Phospholipids	1.35± 0.02 ^a	1.29± 0.02 ^a	1.18 ±0.02 ^b	1.05± 0.01 ^b	1.27± 0.01 ^a	1.18± 0.01 ^b	1.09± 0.03 ^b	1.21± 0.01 ^b	1.15 ± 0.02 ^c	1.04 ±0.02 ^d
Free fatty acids	1.56± 0.02 ^a	1.43± 0.01 ^a	1.32 ±0.01 ^b	1.21 ±0.01 ^c	1.44± 0.01 ^a	1.31± 0.02 ^b	1.19 ±0.02 ^a	1.37± 0.02 ^b	1.25± 0.03 ^b	1.12 ±0.01 ^c
HDL cholesterol	0.91±0.01 ^a	0.92± 0.01 ^a	0.94± 0.02 ^a	0.97± 0.02 ^b	0.93± 0.02 ^a	0.95± 0.03 ^a	0.98± 0.03 ^b	0.95 ±0.01 ^a	0.96 ±0.01 ^b	0.99± 0.01 ^b

Mean ± SE Different letters on the numbers mean significant differences at P < 0.05

Table (4): Effect of feeding different levels of lettuce , garden rocket or a mixture of equal parts of lettuce and garden

rocket on liver lipid profile in normal rats.

Serum Lipids (mmol/l)	Control group	Lettuce feed level			Garden rocket feed level			Mixture feed level		
		1%	2.5%	5%	1%	2.5%	5%	1%	2.5%	5%
Total cholesterol	7.5±0.02 ^a	7.2± 0.01 ^a	6.8±0.03 ^b	6.6± 0.01 ^b	7.1± 0.01 ^a	6.7 ±0.02 ^b	6.3± 0.02 ^b	6.8± 0.01 ^b	6.4± 0.02 ^b	6.0± 0.04 ^b
Triglyceride	10.2± 0.02 ^a	10.0± 0.01 ^a	9.8± 0.03 ^b	9.7± 0.02 ^b	10.0± 0.01 ^a	9.8 ±0.02 ^b	9.6± 0.01 ^b	10.0± 0.03 ^a	9.5± 0.03 ^b	9.3± 0.01 ^b
Phospholipids	14.3± 0.04 ^a	14.1± 0.02 ^a	13.8 ±0.01 ^b	13.6± 0.01 ^b	14.0± 0.01 ^a	13.8± 0.02 ^b	13.3± 0.02 ^b	13.8± 0.01 ^a	13.6 ± 0.04 ^b	13.1 ±0.02 ^b
Free fatty acids	4.8± 0.01 ^a	4.5± 0.02 ^a	4.3 ±0.01 ^b	4.0 ±0.01 ^b	4.6± 0.01 ^a	4.5± 0.03 ^a	4.3 ±0.02 ^b	4.4± 0.02 ^a	4.2± 0.03 ^b	4.0 ±0.02 ^b
HDL cholesterol	0.72±0.01 ^a	0.73± 0.02 ^a	0.74± 0.03 ^a	0.74± 0.01 ^a	0.74± 0.02 ^a	0.75± 0.02 ^a	0.75± 0.01 ^a	0.75 ±0.01 ^a	0.76 ±0.02 ^a	0.77± 0.02 ^b

Mean ± SE

Different letters on the numbers mean significant differences at P < 0.05

Table (5) : Effect of feeding different levels of lettuce , garden rocket or a mixture of equal parts of lettuce and garden rocket on liver fun ctions in normal rats.

Parameter	Control group	Lettuce feed level			Garden rocket feed level			Mixture feed level		
		1%	2.5%	5%	1%	2.5%	5%	1%	2.5%	5%
AST (U/L)	24.1±0.21 ^a	23.1± 0.15 ^a	21.1±0.11 ^b	20.1± 0.35 ^b	23.1± 0.50 ^a	21.1 ±0.40 ^b	20.1± 0.52 ^b	22.3± 0.50 ^a	20.3± 0.20 ^b	19.1± 0.25 ^b
ALT (U/L)	19.8±1.00 ^a	19.2± 1.22 ^a	18.8± 2.20 ^b	18.6± 3.25 ^b	19.1± 2.20 ^a	18.8 ±1.12 ^b	18.4± 2.11 ^b	19.2± 2.20 ^a	18.7± 1.25 ^b	18.2± 2.10 ^b
ALP (U/L)	80.1± 3.31 ^a	80.1±3.22 ^a	77.1 ±1.17 ^b	74.1± 3.43 ^c	80.1± 3.33 ^a	78.1± 2.30 ^a	73.1± 4.37 ^b	79.5± 3.33 ^a	76.2 ± 1.45 ^b	72.3 ±3.25 ^c

Mean ± SE

Different letters on the numbers mean significant differences at P < 0.05

Table (6): Effect of feeding different levels of lettuce , garden rocket or a mixture of equal parts of lettuce and garden rocket on kidney functions in normal rats.

Parameter (mg/100 mL)	Control group	Lettuce feed level			Garden rocket feed level			Mixture feed level		
		1%	2.5%	5%	1%	2.5%	5%	1%	2.5%	5%
Creatinine	0.65±0.03 ^a	0.64± 0.1 ^b	0.62±0.20 ^a	0.60± 0.1 ^b	0.65± 0.1 ^a	0.62 ±0.3 ^a	0.59± 0.2 ^b	0.62± 0.2 ^a	0.60± 0.1 ^b	0.56± 0.1 ^b
Urea	36.20 ±0.2 ^a	35.12 ±0.2 ^a	33.20 ±0.2 ^a	31.31 ±0.1 ^b	36.10 ±0.2 ^a	33.10±0.2 ^a	30.10 ±0.4 ^b	34.20±0.3 ^a	31.20± 0.1 ^b	30.20± 0.2 ^b

Mean ± SE

Different letters on the numbers mean significant differences at P < 0.05

Table (7) : Effect of feeding different levels of lettuce , garden rocket or a mixture of equal parts of lettuce and garden rocket on liver functions in normal rats.

Serum mineral	Control group	Lettuce feed level			Garden rocket feed level			Mixture feed level		
		1%	2.5%	5%	1%	2.5%	5%	1%	2.5%	5%
Ca (mmol/L)	1.9±0.01 ^a	2.1± 0.03 ^a	2.2±0.01 ^b	2.3± 0.02 ^b	2.2± 0.01 ^b	2.3 ±0.01 ^b	2.4± 0.03 ^c	2.3± 0.01 ^a	2.3± 0.01 ^b	2.5± 0.03 ^c
P(mmol/L)	0.71±0.02 ^a	0.72± 0.3 ^a	0.74± 0.1 ^a	0.78± 0.03 ^b	0.73± 0.4 ^a	0.76 ±0.2 ^b	0.79±0.3 ^b	0.76± 0.4 ^b	0.79± 0.2 ^b	0.82± 0.3 ^c
Mg(mmol/L)	0.71± 0.02 ^a	0.73±0.03 ^a	0.74± 0.01 ^a	0.78± 0.03 ^b	0.72± 0.02 ^a	0.74± 0.01 ^a	0.78± 0.02 ^b	0.76± 0.02 ^a	0.77 ± 0.01 ^b	0.80 ±0.02 ^c
Zn(umol/L)	13.4± 0.2 ^a	13.6 ±0.1 ^a	13.8 ± 0.2 ^a	14.2 ±0.01 ^b	13.8± 0.2 ^a	13.7 ± 1.01 ^a	14.3 ±1.3 ^b	14.2 ±0.3 ^b	14.5±1.01 ^b	14.8 ±1.0 ^c

Mean ± SE

Different letters on the numbers mean significant differences at P < 0.05

Table (8): Effect of feeding different levels of lettuce , garden rocket or a mixture of equal parts of lettuce and garden rocket on iron indices in normal rats.

Iron Indices	Control group	Lettuce feed level			Garden rocket feed level			Mixture feed level		
		1%	2.5%	5%	1%	2.5%	5%	1%	2.5%	5%
Serum Fe (Ug/dl)	60.2±3.3 ^a	62.15±2.0 ^a	64.10±4.5 ^b	67.29±1.5 ^c	63.30± 2.3 ^a	66.4 ±2.3 ^b	69.14± 2.5	64.15± 2.3 ^b	67.3± 2.33 ^b	71.25± 1.1 ^c
Serum ferritin(Ug/l)	50.6±4.8 ^a	51.8± 2.3 ^a	52.2±1.5 ^b	52.8± 2.0 ^b	52.3± 2.2 ^a	52.9 ±1.1 ^b	53.1± 2.7	53.8± 2.6 ^a	54.3± 1.0 ^b	54.9± 1.5
Hemoglobin (g/L)	11.6± 0.2 ^a	11.6± 0.1 ^a	11.8 ±0.2 ^a	11.9± 0.1 ^a	11.9± 0.3 ^a	12.1± 0.2 ^b	12.4± 0.4	11.8± 0.3 ^a	12.2 ± 0.2 ^b	12.6 ±0.4 ^b
Hematocrit (%)	38.5±1.2 ^a	38.8±1.1 ^a	38.9 ±1.7 ^a	39.0 ±1.0 ^b	38.8±2.2 ^a	38.9± 1.0 ^a	39.3 ±2.20	38.9± 3.13 ^a	38.9±2.0 ^a	39.7 ±1.0 ^b

Mean ± SE

Different letters on the numbers mean significant differences at P < 0.05

Table (9): Effect of feeding different levels of lettuce , garden rocket or a mixture of equal parts of lettuce and garden rocket on blood glucose level (mg/dl) in normal rats.

Intervals (week)	Control group	Lettuce feed level			Garden rocket feed level			Mixture feed level		
		1%	2.5%	5%	1%	2.5%	5%	1%	2.5%	5%
1 st week	98.5±3.5 ^a	98.4± 2.1 ^a	92.5±3.5 ^a	90.4±2.4 ^a	95.4± 3.2 ^a	89.5 ±3.0 ^a	84.2± 2.1	93.2± 1.3 ^a	87.4± 2.5 ^a	80.3± 1.5 ^a
2 nd week	92.2±1.8 ^a	91.4± 3.7 ^a	90.4±2.4 ^a	92.4±2.5 ^a	90.1± 2.4 ^a	90.3 ±2.5 ^a	90.1±2.3 ^a	88.1± 3.2 ^a	88.2± 1.0 ^a	87.2± 1.5 ^a
3 rd week	88.5± 2.6 ^a	85.5± 1.5 ^a	86.3 ±1.5 ^a	84.3± 2.5 ^a	84.2± 3.2 ^a	80.5± 1.2 ^a	84.2±1.5 ^a	81.4±3.5 ^a	78..5± 1.5 ^a	81.2 ±3.6 ^a
4 th week	86.9±3.3 ^a	84.3±2.4 ^a	84.4 ±2.6 ^a	80.2 ±1.2 ^a	85.7± 1.5 ^a	80.2± 2.5 ^a	78.2 ±2.0 ^a	80.4± 1.0 ^a	77.1±3.3 ^a	75.5 ±3.5 ^a

Mean ± SE

Different letters on the numbers mean significant differences at P < 0.05