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**Study the Effect of Ginger and Flaxseed on Rats Infected
With Obesity**

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Abstract

The purpose of this research to clarify the effect of both ginger and flaxseed, including all of the elements of the nutrients give a sense of satiety and work to burn fat in the body, which leads to get rid of obesity and excess body weight, and for this purpose the research was conducted on forty-four white mouse To eleven groups, each group contains four mice and the mice were fed a high percentage of fat to become obese. Then, the nutritional intervention was done by adding flaxseed and ginger to the daily food, a significant decrease in the rate of weight gain in mice from 43.5 g to 37.25 g respectively. At the same time, the best group was the group fed on 7% of the flax seeds, where the weight gain rate was 15 g.

a decrease in food intake in rats from 453.5 g to 433 g. The groups showed an increase in the indicators with a significant difference compared to the positive control group, and the best group was the group that fed 5% of the mixture of flax seeds and ginger roots where the rate of food eaten 443.5 grams.

decrease with a significant difference in the rate of utilization of food from 0.095 g to 0.085 g. At the same time the best group was the group fed on 7% of flaxseed, where the rate of utilization of food 0.033 g.

The group of infected mice fed on the basic meal in addition to 7% of the flaxseed the best treatment for liver weight

The total of infected rats fed on the main meal, in addition to 7% of the mixture of ginger and flax seeds, showed the best treatment for kidney weight

Keywords: Ginger, Flaxseed, Obesity, Liver, Kidney, Rats.

Introduction:

Obesity is the most prevalent health problem. It is also known to be a risk factor for the development of metabolic disorders such as type 2 diabetes, systemic hypertension, cardiovascular disease, dyslipidemia, and atherosclerosis. Obesity is a pathological condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problem (Cheng *et al.*, 2010).

Also, obesity is generally defined as the abnormal or excessive accumulation of fat in adipose tissue to the extent that health may be impaired. (Aronne and Segal, 2010)

Obesity results from an imbalance of energy homeostasis, over an extended period of time. Caused by the consumption of more calories than the body is able to burn. The cause of the imbalance is complex and is influenced by the convergence of various environmental, behavioral, and genetic factors. No single cause can account for obesity; instead, obesity is due to a combination of contributing factors. Obesity reflects the associations of genetic, metabolic, cultural, environmental, and behavioral factors.

(Morrill and Chin (2004).

Materials and Methods:

The used of herbs:

Flax seeds and ginger roots were purchased from the local market of Menoufia Shebin El Koum Center, and were ground and fed to rats.

Experimental animal

Rats forty four adult female albino rats, weighting (160 + 5g). from Medical Insects Research Institute, Doki, Cairo were used in this study. Rats were housed in wire cages under the normal laboratory condition and were fed on standard diet for a week as an adaptation period. Diet was offered to rats in special food cups to avoid looser conditions of food, water was provided to the rats by glass tubes supported to one side of the cage, food and water provided ad- libitum and checked daily.

Experimental design:

The experimental was done in the Faculty of Home Economics, Menoufia University, Shebin El-kom. Rats were housed in wire cages in a room temperature 25C and kept under normal healthy condition.

Biological evaluation:

During the experimental period (28days), the diet consumed was recorded every day and body weight was recorded every week. The body weight gain (B.W.G), feed efficiency ratio (F.E.R), and organ/ body

weight were determined according to (Chapman et al., 1959). Using the following equations

B.W.G = (Final weight - Initial weight)

$$\text{Relative organ weight (ROW)} = \frac{\text{Organ weight} \times 100}{\text{Body weight}}$$

$$\text{Feed efficiency ratio (FER)} = \frac{\text{Gain in body weight (g)}}{\text{food intake (g)}}$$

Estimation of serum lipids :

Triglycerides :

Enzymatic calorimetric determination of Triglycerides was carried out according to (**Fassati and prencipe 1982**) .

Total cholesterol:

The principle use of total cholesterol determination according to (**Allen, 1974**

HDL-cholesterol :

Phosphotungstic acid and magnesium ions selectivity precipitating all lipoproteins except the HDL fraction-cholesterol present in the supernatant can be determined by the same method used for total cholesterol, according to (**Lopez, 1977**)

VLDL and LDL- cholesterol :

The determination of VLDL (very low-density lipoproteins) and LDL were calculated according to the method of (**Lee and Nieman, 1996**) as follows :

$$\text{VLDL (mg/dl)} = \text{Triglycerides} / 5$$

$$\text{LDL (mg/dl)} = (\text{Total cholesterol} - \text{HDL}) - \text{VLDL}$$

Results and Discussion:

Table (1): Effect of ginger, flaxseed and their mixtures on BWG, FI & FER of rats

Treatment/Parameter	BWG (g)	FI (g)	FER (g)
	Mean \pm SD	Mean \pm SD	Mean \pm SD
Control group (-)	43.50 ^a \pm 5.00	453.50 ^a \pm 10.63	0.095 ^a \pm 0.013
Control group (+)	37.25 ^a \pm 3.86	433.00 ^b \pm 6.38	0.085 ^a \pm 0.008
Ginger 2.5%	9.75 ^{bc} \pm 4.19	443.25 ^{ab} \pm 7.63	0.021 ^{bc} \pm 0.009
Ginger 5%	8.00 ^{bc} \pm 1.41	439.75 ^{ab} \pm 4.11	0.017 ^{bc} \pm 0.003
Ginger 7%	11.25 ^{bc} \pm 0.97	435.75 ^b \pm 7.13	0.025 ^{bc} \pm 0.001
Flaxseed 2.5%	5.50 ^c \pm 0.58	435.75 ^b \pm 2.63	0.012 ^c \pm 0.001
Flaxseed 5%	9.50 ^{bc} \pm 2.08	436.25 ^b \pm 2.87	0.021 ^{bc} \pm 0.004
Flaxseed 7%	15.00 ^b \pm 2.94	437.25 ^b \pm 5.91	0.033 ^b \pm 0.006
Ginger & Flaxseed 2.5%	10.25 ^{bc} \pm 5.96	436.25 ^b \pm 9.74	0.023 ^{bc} \pm 0.013
%Ginger & Flaxseed 5	8.25 ^{bc} \pm 2.50	443.50 ^{ab} \pm 4.43	0.018 ^{bc} \pm 0.005
%Ginger & Flaxseed 7	8.75 ^{bc} \pm 0.95	442.00 ^{ab} \pm 3.37	0.019 ^{bc} \pm 0.001

Means under the same column bearing different superscript letters are different significantly (p<0.05)

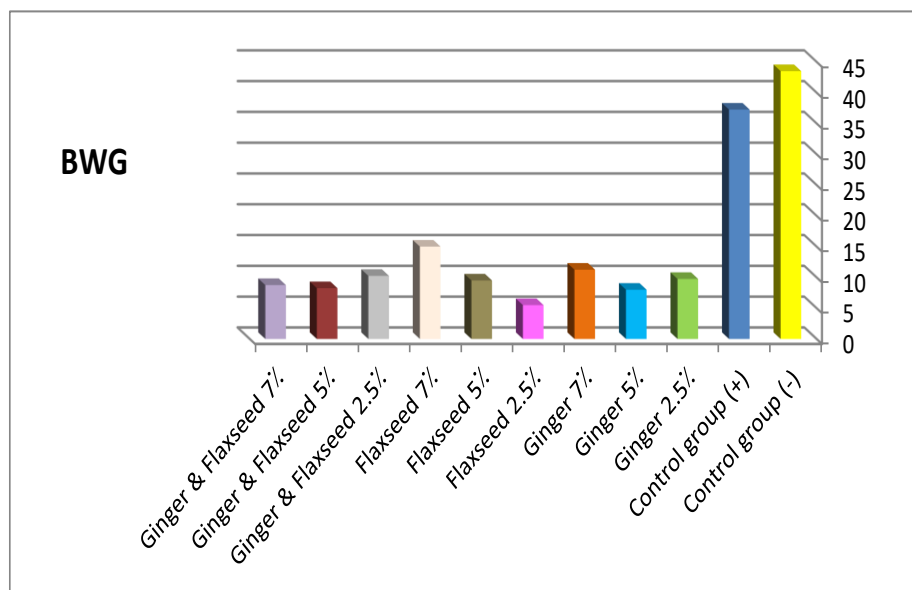


Fig. (1,A) Effect of ginger, flaxseed and their mixtures on BWG of rats

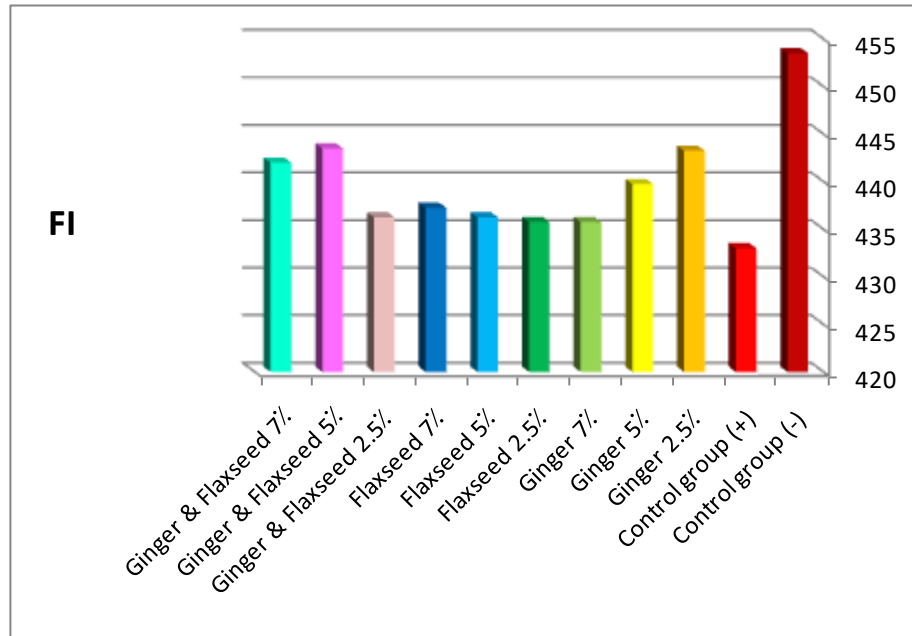


Fig. (1,B) Effect of ginger, flaxseed and their mixtures on FI of rats

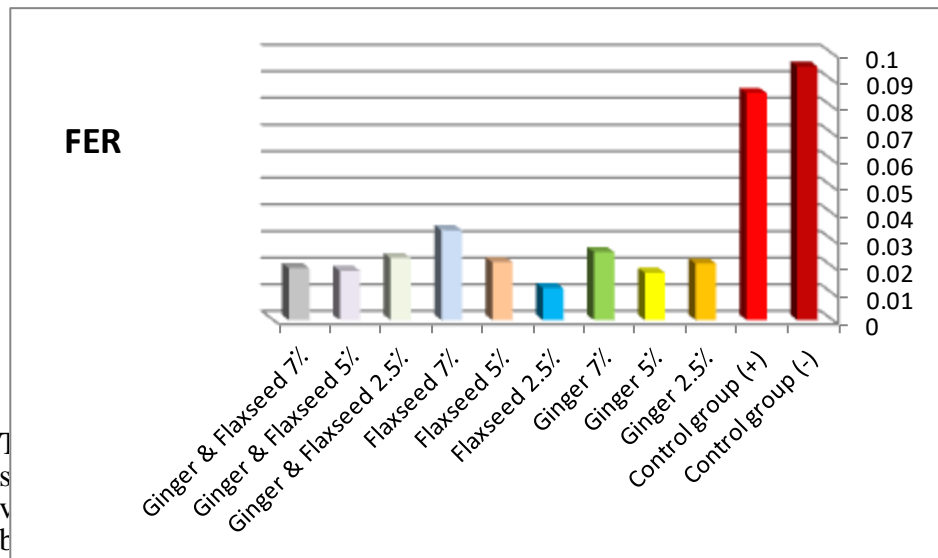


Fig. (1,C) Effect of ginger, flaxseed and their mixtures on FER of rats

diets indicated significant differences in mean value compared to control (+) group. The values were 9.75, 8.00, 11.25, 5.50, 9.50, 15.00, 10.25, 8.25 & 8.75 for 3, 4, 5, 6, 7, 8, 9, 10 & 11 groups, respectively.

The mean value of FI gain of rats fed on various diets was shown in **table (1) and Fig (1,B)**. It could be noticed that the mean value of (FI) of control (+) group was lower than control (-) group being 433.00 and 453.50, respectively. Which showing significant difference as compared to control () group. Rats fed on (2.5%& 5% Ginger, 5%&7% Ginger & Flaxseed) indicated significant differences in mean value compared to control (+) group. The values were 443.50,439.75, 443.50 &442.00, respectively.

The mean value of FER gain of rats fed on various diets was shown in **table (1) and Fig (1,C)**. It could be noticed that the mean value of (FER) of control (+) group was lower than control (-) group being 0.08525 and 0.09525, respectively. Which showing no significant difference as compared to control (-) group. All rats fed on different diets indicated significant differences in mean value compared to control (+) group. The values were 0.02125, 0.01775, 0.02550, 0.01200, 0.02175, 0.03375,0.02325,0.01850& 0.01950 for 3, 4, 5, 6, 7, 8, 9, 10 & 11 groups, respectively.

Table (2): Effect of ginger, flaxseed and their mixtures on Liver, Heart, Kidney, Lung & Spleen weights of rats

Treatment/Parameter	Liver Mean \pm SD	Kidney Mean \pm SD	Heart Mean \pm SD	Spleen Mean \pm SD	Lung Mean \pm SD
Control group (-)	4.24 ^a \pm 0.058	0.83 ^a \pm 0.05	0.48 ^{ab} \pm 0.02	0.46 ^a \pm 0.05	0.58 ^{ab} \pm 0.08
Control group (+)	4.19 ^a \pm 0.12	0.79 ^a \pm 0.08	0.44 ^{ab} \pm 0.04	0.43 ^a \pm 0.06	0.58 ^{ab} \pm 0.07
Ginger 2.5%	3.80 ^c \pm 0.04	0.82 ^a \pm 0.11	0.38 ^{ab} \pm 0.05	0.44 ^a \pm 0.09	0.45 ^b \pm 0.07
Ginger 5%	3.78 ^c \pm 0.11	0.81 ^a \pm 0.10	0.40 ^{ab} \pm 0.07	0.46 ^a \pm 0.08	0.59 ^{ab} \pm 0.06
Ginger 7%	3.73 ^c \pm 0.09	0.86 ^a \pm 0.11	0.37 ^{ab} \pm 0.05	0.46 ^a \pm 0.08	0.54 ^{ab} \pm 0.07
Flaxseed 2.5%	3.41 ^d \pm 0.12	0.79 ^a \pm 0.07	0.40 ^{ab} \pm 0.03	0.47 ^a \pm 0.06	0.58 ^{ab} \pm 0.04
Flaxseed 5%	3.87 ^{bc} \pm 0.15	0.86 ^a \pm 0.09	0.41 ^{ab} \pm 0.03	0.50 ^a \pm 0.06	0.61 ^{ab} \pm 0.04
Flaxseed 7%	4.09 ^{ab} \pm 0.11	0.86 ^a \pm 0.10	0.44 ^{ab} \pm 0.03	0.49 ^a \pm 0.05	0.67 ^a \pm 0.08
Ginger & Flaxseed 2.5%	3.71 ^c \pm 0.04	0.84 ^a \pm 0.07	0.38 ^{ab} \pm 0.05	0.45 ^a \pm 0.07	0.59 ^{ab} \pm 0.08
Ginger & Flaxseed 5%	3.85 ^{bc} \pm 0.03	0.86 ^a \pm 0.10	0.42 ^{ab} \pm 0.04	0.45 ^a \pm 0.07	0.70 ^a \pm 0.07
Ginger & Flaxseed 7%	3.83 ^c \pm 0.15	0.96 ^a \pm 0.11	0.42 ^{ab} \pm 0.04	0.47 ^a \pm 0.05	0.68 ^a \pm 0.06

Means under the same column bearing different superscript letters are different significantly (p<0.05)

Fig. (2,A) Effect of ginger, flaxseed and their mixtures on Liver weight of rats

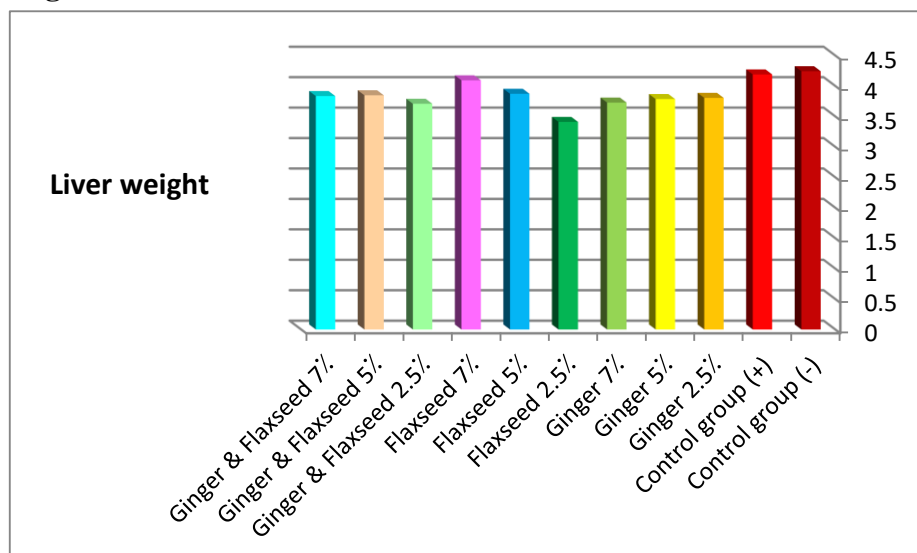


Fig. (2,B) Effect of ginger, flaxseed and their mixtures on Kidney weight of rats

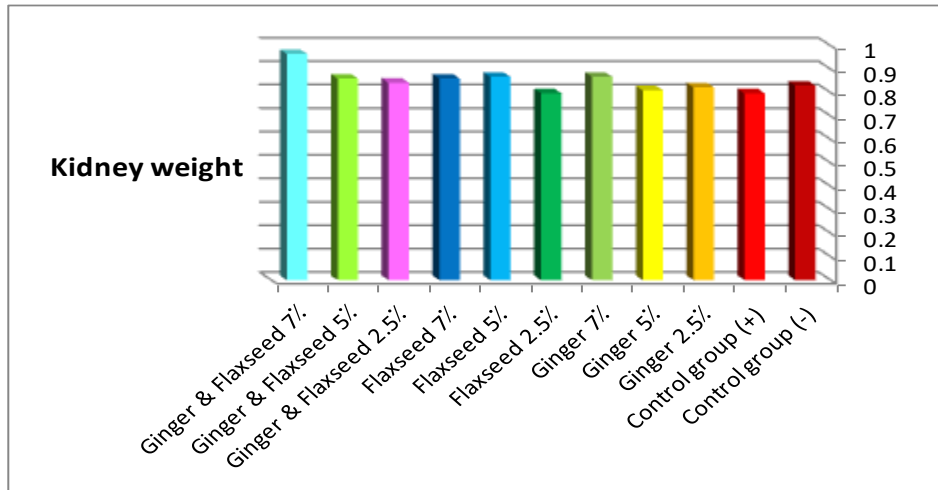


Fig. (2,C) Effect of ginger, flaxseed and their mixtures on Heart weight of rats

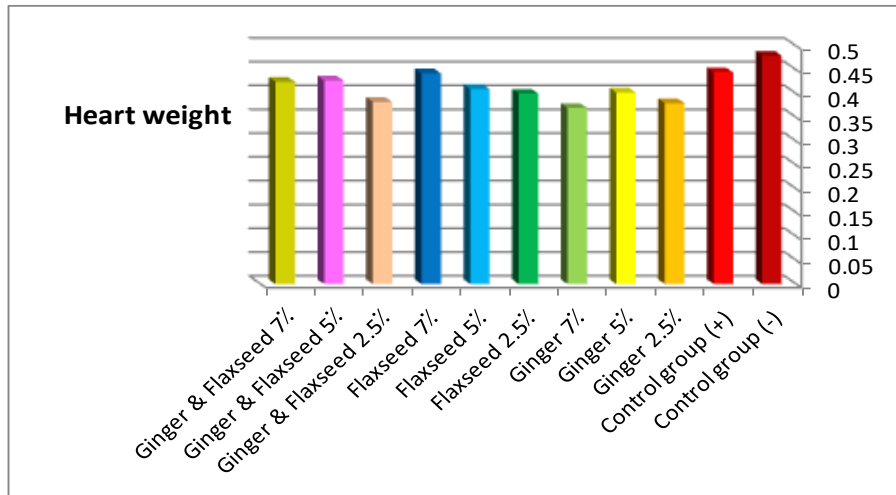


Fig. (2,D) Effect of ginger, flaxseed and their mixtures on Spleen weight of rats

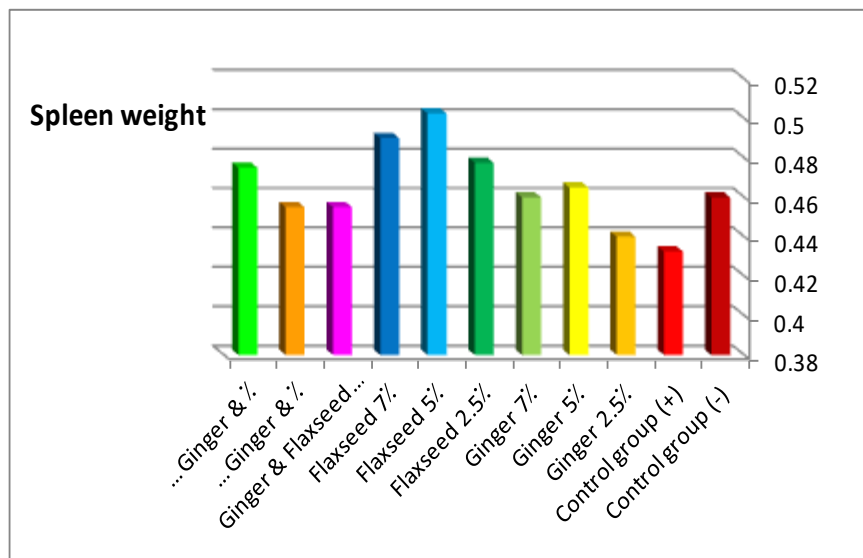
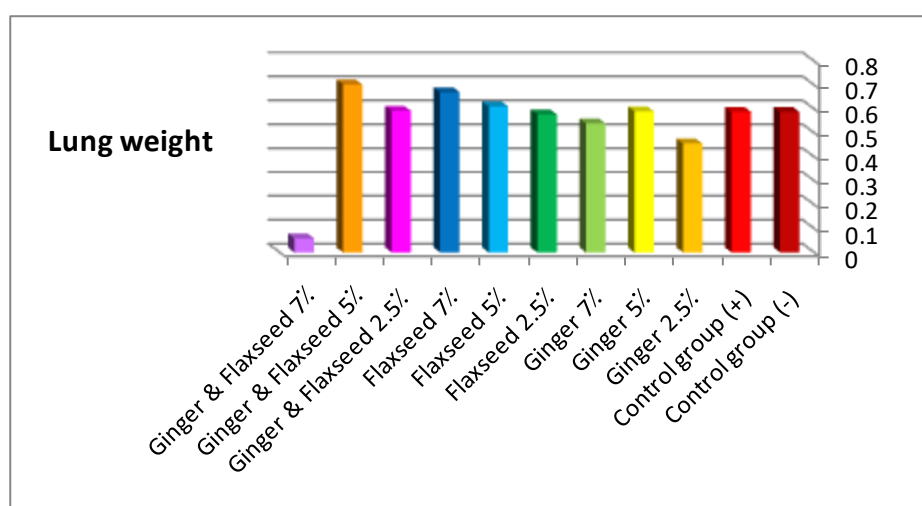


Fig. (2,E) Effect of ginger, flaxseed and their mixtures on Lung weight of rats



The mean value of Liver weight gain of rats fed on various diets was shown in **table (2) and Fig (2,A)**. It could be noticed that the mean value of (Liver weight) of control (+) group was lower than control (-) group being 4.1900 and 4.2425, respectively. Which showing no significant difference as compared to control (-) group. All rats fed on different diets indicated significant differences in mean value compared to control (+) group except 7% Flaxseed. The values were 3.8050, 3.7850, 3.7275, 3.4100, 3.8725, 3.7075, 3.8475 & 3.8350 for 3, 4, 5, 6, 7, 9, 10 & 11 groups, respectively.

The mean value of Kidney weight gain of rats fed on various diets was shown in **table (2) and Fig (2,B)**. It could be noticed that the mean value of (Kidney weight) of control (+) group was lower than control (-) group being 0.7975 and 0.8300, respectively. Which showing no significant difference as compared to control (-) group. All rats fed on different diets indicated no significant differences in mean value compared to control (+) group. The values were 0.8225, 0.8100, 0.8675, 0.7975, 0.8675, 0.8600, 0.8425, 0.8600 & 0.9650 for 3, 4, 5, 6, 7, 8, 9, 10 & 11 groups, respectively.

The mean value of Heart weight gain of rats fed on various diets was shown in **table (2) and Fig (2,C)**. It could be noticed that the mean value of (Heart weight) of control (+) group was lower than control (-) group being 0.4450 and 0.4800, respectively. Which showing no significant difference as compared to control (-) group. All rats fed on different diets indicated no significant differences in mean value

compared to control (+) group. The values were 0.3800, 0.4025, 0.3700, 0.4000, 0.4100, 0.4425, 0.3825, 0.4275 & 0.4250 for 3, 4, 5, 6, 7, 8, 9, 10 & 11 groups, respectively.

The mean value of Spleen weight gain of rats fed on various diets was shown in **table (2) and Fig (2,D)**. It could be noticed that the mean value of (Spleen weight) of control (+) group was lower than control (-) group being 0.4325 and 0.4600, respectively. Which showing no significant difference as compared to control (-) group. All rats fed on different diets indicated no significant differences in mean value compared to control (+) group. The values were 0.4400, 0.4650, 0.4600, 0.4775, 0.5025, 0.4900, 0.4550, 0.4550 & 0.4750 for 3, 4, 5, 6, 7, 8, 9, 10 & 11 groups, respectively.

The mean value of Lung weight gain of rats fed on various diets was shown in **table (2) and Fig (2,E)**. It could be noticed that the mean value of (Lung weight) of control (+) & control (-) groups were being 0.5875. Which showing no significant difference as compared to control (-) group. Rats fed on Ginger 2.5% indicated significant differences in mean value compared to control (+) group. The value was 0.4550 for 3 groups.

Table (3): Effect of Flaxseed on Lipid Profile of rats

Treatment/Parameter	CHOL Mean ±SD	TRI Mean ±SD	HDL Mean ±SD	LDL Mean ±SD	VLDL Mean ±SD
Control group (+)	159.00 ^a ±21.66	176.00 ^a ±8.19	41.33 ^a ±4.93	86.57 ^a ±8.50	35.27 ^a ±3.83
Rats feed on Ginger&Flaxseed 2.5%	99.33 ^b ±13.65	102.33 ^b ±25.89	39.67 ^a ±2.31	38.33 ^b ±9.16	20.40 ^b ±5.55
Rats feed on Ginger&Flaxseed d 5%	91.00 ^b ±14.71	89.67 ^b ±11.93	33.67 ^a ±10.69	35.43 ^b ±6.27	17.93 ^b ±0.64
Rats feed on Ginger&Flaxseed 7%	78.00 ^b ±13.00	86.33 ^b ±19.86	24.00 ^a ±6.25	31.60 ^b ±4.33	17.23 ^b ±5.30

Means under the same column bearing different superscript letters are different significantly (p<0.05)

Fig. (3,A): Effect of Ginger&Flaxseed levels on Cholesterol of rats

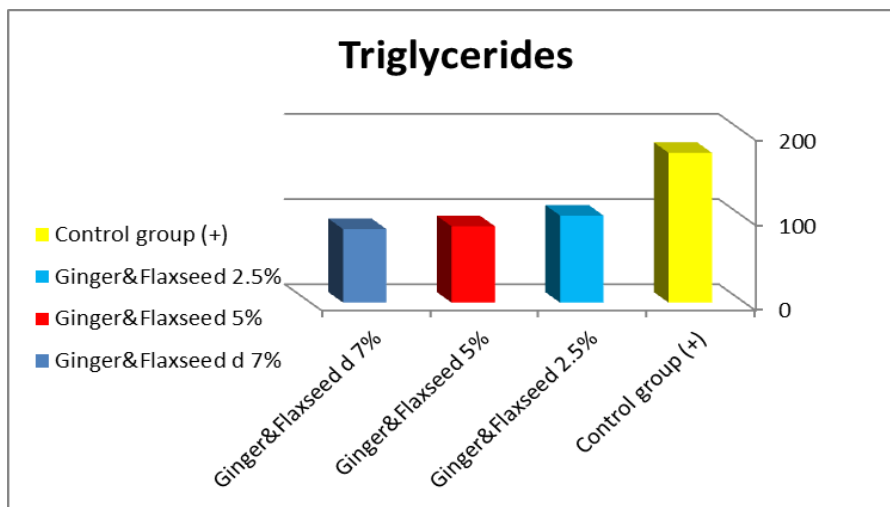
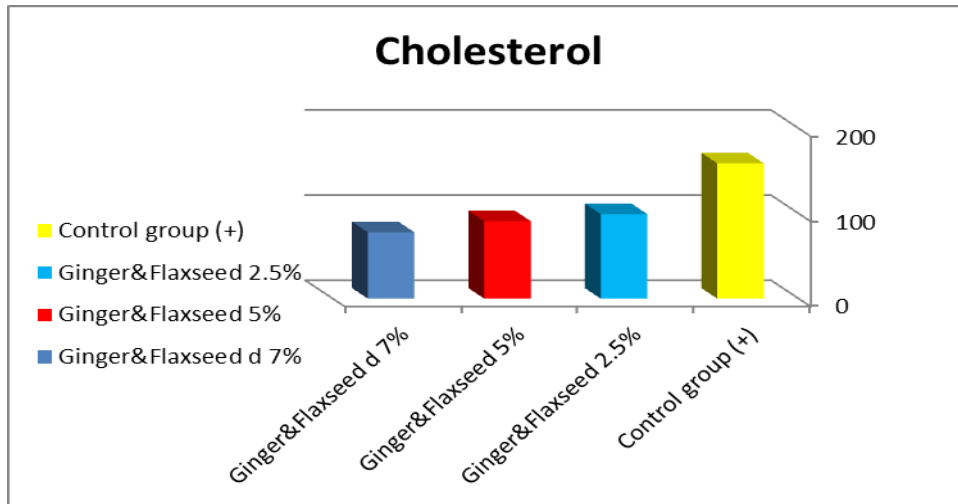


Fig. (3,B): Effect of Ginger&Flaxseed levels on Triglycerides of rats

Fig. (3,C): Effect of Ginger&Flaxseed levels on High density lipoprotein of rats

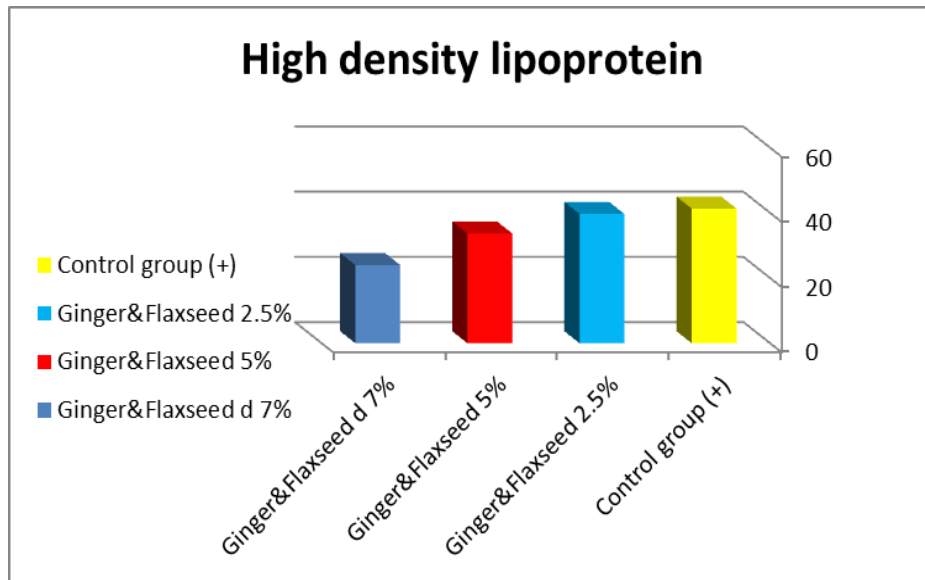


Fig. (3,D): Effect of Ginger&Flaxseed levels on Low density lipoprotein of rats

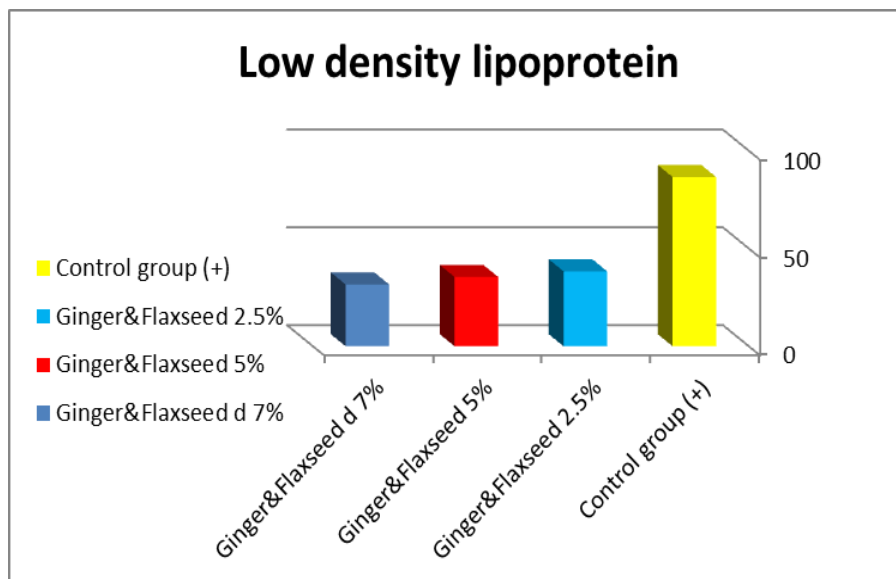
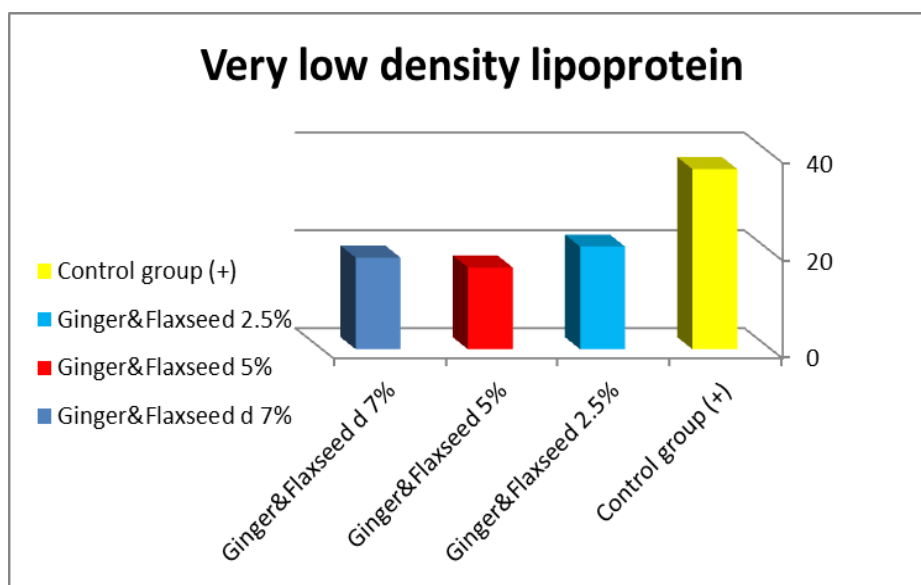


Fig. (3,E): Effect of Ginger&Flaxseed levels on Very low density lipoprotein of rats



Data presented in table (3) and illustrated in figs show the effect of Ginger & Flaxseed on Lipid Profile (Cholesterol, Triglycerides, High density lipoprotein, Low density lipoprotein, Very low density lipoprotein) of rats.

The highest Cholesterol of treated group recorded for rats fed on Ginger & Flaxseed 2.5%. While, the lowest value recorded for rats fed on Ginger & Flaxseed 7% with no significant differences, the mean values were 99.33 and 78.00, respectively.

Data obtained from Cholesterol indicated that there are differences between positive control group and the highest treated group with Ginger & Flaxseed 2.5% with significant ($P < 0.05$). The mean values were 159.00 and 99.33, respectively.

The highest Triglycerides of treated group recorded for rats fed on Ginger & Flaxseed 2.5%. While, the lowest value recorded for rats fed on Ginger & Flaxseed 7% with no significant differences, the mean values were 102.33 and 86.33, respectively.

Data obtained from Triglycerides indicated that there are differences between positive control group and the highest treated group with Ginger & Flaxseed 2.5% with significant ($P < 0.05$). The mean values were 176.00 and 102.33, respectively.

The highest High density lipoprotein of treated group recorded for rats fed on Ginger & Flaxseed 2.5%. While, the lowest value recorded for rats fed on Ginger & Flaxseed 7% with no significant differences, the mean values were 39.67 and 24.00, respectively.

Data obtained from High density lipoprotein indicated that there are no significant differences between positive control group and the highest treated group with Ginger & Flaxseed 2.5%. The mean values were 41.33 and 39.67, respectively.

The highest Low density lipoprotein of treated group recorded for rats fed on Ginger & Flaxseed 2.5%. While, the lowest value recorded for rats fed on Ginger & Flaxseed 7% with no significant differences, the mean values were 38.33 and 31.60, respectively.

Data obtained from Low density lipoprotein indicated that there are differences between positive control group and the highest treated group with Ginger & Flaxseed 2.5% with significant ($P < 0.05$). The mean values were 86.57 and 38.33, respectively.

The highest Very low density lipoprotein of treated group recorded for rats fed on Ginger & Flaxseed 2.5%. While, the lowest value recorded for rats fed on Ginger & Flaxseed 5% with no significant differences, the mean values were 21.00 and 16.73, respectively.

Data obtained from Very low density lipoprotein indicated that there are differences between positive control group and the highest treated group with Ginger & Flaxseed 2.5% with significant ($P < 0.05$). The mean values were 36.87 and 21.00, respectively.

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دراسة تأثير الزنجبيل وبذور الكتان على فئران التجارب المصابة بالسمنة

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الملخص العربي

1- الغرض من هذا البحث استيضاح تأثير كل من الزنجبيل وبذور الكتان بما يحتويه كل منهم من عناصر غذائية تعطى الاحساس بالشبع وتعمل على حرق الدهون فى الجسم مما يؤدي الى التخلص من السمنة والوزن الزائد للجسم، ولهذا الغرض اجرى البحث على اربعة واربعون فار ابيض من فصيلة الالبيينو قسمت الى احدى عشر مجموعه كل مجموعه تحتوى على اربعة فئران وتم تغذية الفئران على نسبة عالية من الدهون لاصابتها بالسمنة ثم بعد ذلك تم التدخل الغذائى عن طريق اضافة الزنجبيل و بذور الكتان الى الطعام اليومى مما ادى الى حدوث انخفاض بدرجة معنوية فى معدل اكتساب الوزن فى الفئران من 43.5 جرام الى 37.25 جرام على التوالى ، وفى الوقت نفسه كانت المجموعة الافضل هى المجموعة التى تغذت على 7% من بذور الكتان حيث كان معدل اكتساب الوزن 15 جرام. حدث انخفاض فى الغذاء المتناول فى الفئران من 453.5 جرام الى 433 جرام ، وظهرت المجموعات ارتفاع فى المؤشرات مع وجود فرق معنوى بالمقارنة بالمجموعة الضابطة الموجب، وكانت المجموعة الافضل هى المجموعة التى تغذت على 5% من خليط بذور الكتان وجذور الزنجبيل حيث كان معدل الغذاء المتناول 443.5 جرام . حدث انخفاض مع وجود فرق معنوى فى معدل الاستفاده من الغذاء من 0.095 جرام الى 0.085 جرام وفى الوقت نفسه كانت المجموعة الافضل هى المجموعة التى تغذت على 7% من بذور الكتان حيث كان معدل الاستفاده من الغذاء 0.033 جرام . اظهرت مجموعة الفئران المصابة التى تغذت على الوجبه الاساسيه بالاضافه الى 7% من بذور الكتان افضل المعاملات بالنسبه لوزن الكبد اظهرت مجموعه الفئران المصابه التى تغذت على الوجبه الاساسيه بالاضافه الى 7% من مخلوط الزنجبيل وبذور الكتان افضل المعاملات بالنسبه لوزن الكلى.

البحث: الزنجبيل ، بذور الكتان، حرق الدهون ، السمنة الكبد ، الكلى ،الفئران