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Prophylactic Effects of Tomato and Lemon Juices on Castrated Healthy Local Male Rabbits

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ABSTRACT

This study was performed to determine the Prophylactic effects of both lemon and tomato juices on some physiological and biochemical features of healthy castrated male rabbits. The study included 30 male rabbits divided into 6 groups with 5 rabbits/ group; the first group which is the control group were given physiological solution, the second were given (4ml/ kg of body weight) lemon juice, the third were given (3ml/kg of body weight) tomato juice, the fourth were castrated and given physiological solution, the fifth were castrated and given (4ml/ kg of body weight) lemon juice and the sixth were castrated and given (3ml/kg of body weight) tomato juice. The results showed positive effects in the groups treated with the juices regarding the Adiponectin hormone, T3, T4 and TSH, as well as a reduction in concentration of TC, LDL-c, atherogenesis index and an increase in HDL-c concentration. We concluded that castrated groups was the opposite where there was a reduction in the concentrations of the Adiponectin hormone, T3, T4 and TSH, and an increase in the concentrations of TC, LDL-c, the atherogenesis index and a reduction in concentration of HDL-c.

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INTRODUCTION

The connection between man and his search for drugs in nature dates from the far past, of which there is ample evidence from various sources: written documents, preserved monuments, and even original plant medicines. Awareness of medicinal plants usage is a result of the many years of struggles against illnesses due to which man learned to pursue drugs in barks, seeds, fruit bodies, and other parts of the plants. (Biljana, 2012)

Eating plants in their natural form is considered the best means to avoid any deficiency in the human body as they contain all items that secure the body against any deficiency as they comprise all the various active ingredients. One of the items widely used all over the world and in almost all types of meals is tomato, *Osolanum Lycopericum*.

Tomato belongs to *solananceae* species and is planted in the temperate and the hot zones and it is of the *solanum* species and was called tomato considering its name in English. Tomato was first known in South America and then spread all over the world after the colonization of the two Americas (Elwan *et al.*, 2018).

Lemon is one of the citruses and is considered as a complete pharmacy. Its scientific name is *Citrus Lemon* and its trees were first known in India. Lemon is among the low calories plants and its juice is characterized by having Flavonoids, Flavanones, Favones, Hesperidin, Citronin, Cetronetin, Naringin and Rutin, it also contains carotenoids and is rich with C vitamin in addition to Citric acid and Essen-

Table 1: The effect of treatment with lemon and tomato juices on the concentration of adiponectin hormone, T3, T4 and TSH in blood serums of castrated healthy rabbits

Criteria	Adiponectin hormone	TSH hormone	T4 hormone	T3 hormone
Control group	4.9±7.5 B	0.4±0.7 b	0.01± 9.8 b	0.06± 1.09
Lemon juice group	0.7±11.1 a	0.05± 0.9 A	0.7±12.6 A	0.02±1.89 a
Tomato juice group	0.04±10.2 a	0.04±0.85 a	0.6±11.0 A	0.03±1.66 a
The castrated group	0.43±4.01 c	0.06±0.48 c	0.9±7.06 c	0.04±0.5 c
Castrated+lemon juice	0.30±6.31 b	0.05±0.69 b	0.4±9.4 b	0.20±1.05 b
Castrated+tomato juice	0.92±5.20 b	0.03±0.68 b	0.4±8.5 b	0.20±1.10 b

- Values are expressed by arithmetic means ± standard deviation, and number of rabbits/group= 5
- Numbers followed by different letters vertically indicate the existence of significant difference at probability level ($p \leq 0.05$)

tial oils. Lemon juice is rich of Selenium, Manganese, Zinc, Ca+, Mg+, Pectin which is one of the plant fibres, Limonoid which is a type of Terpenes of which the most important are Limonin and Nomilin, in addition to B complex vitamins, B2, B3, B7 and Niacin. Lemon juice is used to reduce the level of the lipoproteins and the overall cholesterol and to raise the level of HDL-c which is anti- cancer (Al-Snafi, 2016).

Aim of the Study

The study aimed at identifying the prophylactic effects of lemon juice and tomato juice on the castrated local male rabbits regarding some hormones and some biochemical features.

MATERIALS AND METHODS

Animals

After the wounds were healed for the fourth, fifth and sixth groups, 5 rabbits were put in each group and they were put into cages specially made for this purpose.

The study was performed on male rabbits of weight between 1000-1500 gm. obtained from local markets, and were checked against diseases, put in cages specially prepared for this purpose and divided into 6 groups with 5 rabbits/group. The age of rabbits varied between 10-12 months and they were left for a week to adapt with the place and the fodder. 15 of the rabbits were castrated by a surgeon from the college of veterinary of Mosul University.

The rabbits were kept without feeding for 24 hours before surgery (Tapia-Araya *et al.*, 2015), and the castration were done for the fourth, fifth and sixth groups under general anaesthetic via a combination of ketamine 20 mg/kg of body weight, and Xylazine 3mg/kg of body weight (Al-Badrany, 2009), then the skin was stitched with thin silk thread. The study was performed after the wounds were completely healed and the rabbits were divided into groups under treatment (Al-Hadidy *et al.*, 2018).

The first group

The control group were given physiological solution via Gavage Needle to counterbalance the stress of catching the rabbits.

The second group

were given lemon juice 4 ml/kg of body weight.

The third group

were given tomato juice 3ml/kg of body weight.

The fourth group

were castrated and the rabbits were given daily physiological solution.

The fifth group

were castrated and given 4 ml of lemon juice/ kg of body weight.

The sixth group

were castrated and given 3ml of tomato juice/ kg of body weight.

Collection of Blood Samples

After one month of treatment, 5ml of blood were collected via intra cardiac blood sampling and put into special tubes with tight covers without any anticoagulant material and left in room temperature for 15

minutes till coagulation completed, then subjected to centrifugal process to obtain blood serum to perform the hormone and biochemical tests.

Hormone tests

Thyroid gland hormones T3, T4 and TSH as well as Adiponectin were estimated via using the ready analysis kit (MyBiosource) by USA, the kit depends

on analysing the competitive link by using the immune adsorption related to ELISA enzyme.

Biochemical tests

Lipoproteins and cholesterol concentration were estimated in blood serum via test strip of Reflotron based on the enzyme method, the atherogenesis index was calculated by applying the equation mentioned in (Tietz, 1987).

atherogenesis index= TC/HDL-c

Statistical Analysis

The results were statistically analysed according to the complete random design system (C.R.D) using Duncan multiple range test to check the differences among the groups at a probability level of ($p \leq 0.05$) using the statistical program SAS (SAS, 2001).

RESULTS AND DISCUSSION

From Table 1 we notice the occurrence of significant rise in the concentration of adeponectin hormone at a probability level ($p \leq 0.05$) in the groups treated with lemon juice and tomato juice compared to the control group, and as indicated by Table 1 there is significant reduction in the concentration of adeponectin hormone in the blood serums of castrated rabbits compared to the control group. We also note significant increase of the hormone in the castrated group treated with lemon juice and the castrated group treated with tomato juice to reach a concentration near to that of the control group. The table also indicates the occurrence of significant increase at a probability level ($p \leq 0.05$) in the concentration of TSH in the groups of lemon juice and of tomato juice compared to the control group, and we note a significant increase in the concentration of TSH in the castrated groups treated with the juices of lemon and tomato to reach its counterpart in the control group.

Table 1 indicates the occurrence of significant increase at the level ($p \leq 0.05$) in the concentration of T3 and T4 in the groups treated with lemon juice and tomato juice compared to the control group, while there were significant increase in the concentrations of the castrated + lemon juice and the castrated+ tomato juice compared to the castrated group without treatment with juice.

The treatment of the rabbits with the two types of juice led to a significant increase in the adeponectin hormone as both of them contain flavonoids, like Querciten, that works as antibiotics by inhibiting NFF-a (Nair *et al.*, 2006) or maybe they cause the increase of activity of insulin which affects the genetic expression of adeponectin and increases its secretion (Rivera *et al.*, 2008), or the reason might be that it contains B vitamins, especially B7, that increase the secretion of adeponectin and that is what (Salwa *et al.*, 2012) referred to. It works on stimulating the production of adeponectin hormone through stimulating receptors in the immunocytes like white blood cells, uninuclear and neutrocyte. The stimulation of these receptors leads to rapid increase in the production of adeponectin hormone, thus reduces the interior tissue (Plaisance *et al.*, 2009), additionally Lycopene is a non-provitami. A carotenoid that is responsible for the red to pink colors seen in tomatoes, pink grapefruit, and other foods. Processed tomato products are the primary dietary lycopene source. Unlike many other natural compounds, lycopene is generally stable to processing when present in the plant tissue matrix. Recently, lycopene has also been studied in relation to its potential health effects. Although promising data from epidemiological, as well as cell culture and animal, studies suggest that lycopene and the consumption of lycopene containing foods may affect cancer or cardiovascular disease risk, more clinical trial data is needed to support this hypothesis (Erica *et al.*, 2013).

The decrease of the hormone in the castrated male rabbits might be due to that the surgical castration is a form of oxidation stress where it causes the absence of testosterone hormone from the Lydig cells which is secreted in response to the ICSH and SSH hormones from the front lobe of the pituitary gland, the thing that causes obesity and increase in body mass, hence the reduction of adeponectin hormone.

The current study showed a significant increase in the concentrations of T3, T4 and TSH in the serums of male rabbits treated with lemon juice and tomato juice compared to the control group and the castrated group as the lemon juice and the tomato juice contain flavonoids and C vitamin and the existence of Rutin (Martin *et al.*, 2002), which works on enhancing the genetic expression of TSH and increasing its secretion from the pituitary gland and it also is characterized by its influence on Sodium Iodide symporter by way of taking Iodide from the thyroid gland to make its hormones and also it stimulates Thyroperoxidase which is the key enzyme for the formation of the Thyroid gland hormones, also

Table 2: The effect of treatment with lemon and tomato juices on the tracing of lipids and atherogenesis index inserums of castrated healthy male rabbits.

Criteria Treatment	TC concentration mg/100ml	LDL-c concentration mg/100ml	HDL-c concentration mg/100ml	atherogenesis index
Control group	3.1≤120.2	3.3±69.5	0.5±25.9	2.3±4.6
Lemon juice group	5.9±110.3 c	5.1±55.1 c	1.3±27.4 a	3.1±4.02 c
Tomato juice group	4.3±115.4 c	5.0±56.2 c	1.2±26.3 a	2.9±4.38 c
The castrated group	3.9±200 a	6.3±180.1 a	0.5±20.4 c	4.5±9.80 a
Castrated+lemon juice	3.5± 119.3	0.61±23.1	0.61±23.1	5.13±5.16
Castrated+tomato juice	4.0±121.3	6.11±72.1	0.71±26.1	5.19±4.64

- values are expressed byarithmetic means ± standard deviation, and number of rabbits/ group= 5
- Numbers followed by different letters vertically indicate the existence of significant difference at aprobability level (p≤0.05)

the Lycopene in tomatoes and the Rutin in the lemon juice have a counter effect against the growth of cancer cells in the thyroid gland (Gonçalves *et al.*, 2013).

The decrease in T3, T4 and TSH hormones in the castrated group might be due to the absence of testosterone hormone which leads to body weight increase and the accumulation of fatty tissue. There is a close link between the weight increase and the decrease of these hormones; obesity increases oxidation stress and the free roots and this condition stops the oxidation of the iodide ion by way of preventing the formation of Thyroperoxidase enzyme, then to prevent the formation of the Thyroid gland's hormones (Poncin *et al.*, 2007).

The results of Table 2 showed a significant decrease at probability level (p≤0.05) in the concentrations of TC and LDL-c and the atherogenesis index, and a significant decrease in the concentration of HDL-c in the two groups treated with lemon and tomato juices respectively compared to the control group each. The level of lipoproteins LDL-c, HDL-c, the atherogenesis and TC in the castrated groups treated with lemon juice and tomato juice returned to a level near to that of the control group, whereas in the castrated group without treatment there was a significant increase in TC, LDL-c and the atherogenesis index, and a decrease in the level of HDL-c compared to the rest of groups at a probability (p≤0.05).

The reason behind that, might be the existence of C vitamin in both juices and the existence of flavonoids which are characterized by its effectiveness in eliminating free roots. Tomato also contains the antioxidant, Lycopene and then reducing the oxidization of LDL-c and the production of VLDL-c in the liver and its concentration in the blood serum reduces (Priya *et al.*, 2011). Also the V.C which already exists in the two juices reduces the resistance of the fatty tissues to the free fatty acids from the fatty tissues used in building VLDL-c (Codoñer-Franch *et al.*, 2010) and the reduction in the LDL-c is ascribed to its containing Hesperidin which is one of the most important flavonoids compounds that eliminate the LDL-c through enhancing the receptors of LDL-c in the liver and increasing its efficiency (Morin *et al.*, 2008).

Flavonoids in the juices of lemon and tomato are considered of the antioxidants which are characterized by their ability to lower the overall cholesterol level and to promote its metabolism. It also enhances the efficiency of SOD, increases the concentration of TC, LDL-c and VLDL-c, and reduces the HDL-c in the castrated groups, or the castration might cause the accumulation of fat and the increase of weight due to the lack of testosterone the thing that leads to increasing the Triglyceride since there are big connection between TC and the level of low density lipoproteins, and the reason of the VLDL-c increase is due to the big amounts of fatty acids in the blood stream as the weight increase causes the lack for the insulin receptors and a considerable increase in Beta3 adrenergic receptors and that is why the fatty acids flow increases. These fatty acids are taken from the liver and they increase the making of VLDL-c (Eteng *et al.*, 2010).

CONCLUSIONS

We concluded that each tomatoes and lemon juice had a beneficial effects which represented below.

1. **First** - Stimulate the secretion of the adiponectin hormone
2. **Second** - Stimulate the secretion of T.S.H hormone and thyroxine hormone and thyronine
3. **Third** - Low total cholesterol and atherogenic index and improvement of lipids profile.

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Conflict of interest

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