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Investigating the Effects of Anti-hyper Lipidemic Mixture of Garlic, Sour Lemon and Ginger on Lipid Agents of Ratus Norvegicus Alluvia

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Abstract

Background: Cardiovascular disease is the first cause of death in Iran and the world due to the high level of blood lipids associated with it. The aim of this study was to investigate the effect of anti-hyper lipidemic mixture of garlic, sour lemon and ginger on the lipid agents of Ratus Norvegicus Alluvia.

Methods: This experimental study was performed on 23 specimens of Ratus norvegicus alluvia. They were randomly classified into four groups. For 60 days, two groups received food mixed with market oil, and then for three weeks the treatment groups received a mixture of garlic, sour lemon and ginger by gavage. Data were analyzed with SPSS-16 software. Due to the small sample size and non-linearity of parameters, non-parametric Mann–Whitney U-test was used for comparing groups in pairs. The significance level was set at 0.05.

Results: Comparing the control group with the group that received oil showed that injecting lipids was effective and caused significant increase in blood cholesterol level (P=0.006). Comparing two groups that received oil along with their diet, and the group receiving garlic, sour lemon and ginger, the cholesterol level and LDL were significantly lower than in control group (P≤0.008 and 0.008, respectively).

Conclusions: The results indicate that a mixture of garlic, sour lemon and ginger can reduce blood lipids in both Ratus with high blood lipids and rats with normal blood lipids.

Keywords: Garlic, Sour lemon, Ginger, Ratus.
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Introduction

Cardiovascular disease is one of the leading causes of mortality in the world and, according to ATPIII; the first outcome is metabolic syndrome.[1] Metabolic syndrome is a branch of metabolic disorders including metabolic disorders of glucose and insulin, lipid abnormality, obesity (especially abdominal obesity), and hypertension, all of which have been proven to be risk factors for heart disease, and its can increases the risk of cardiovascular disease.[2,3] One of the most important interventions for the correction of the dyslipidemia is the use of lipid-lowering drugs.[4] Drugs used for this purpose should be low in quantity because they should be used over a long time.[5]

One of the problems of modern medicine is the daily-increasing usage of chemical drugs that have many side effects, such as the gradual existence of self-defense phenomena which need increased consumption or usage of strong drugs.[6]

This has led researchers to turn to herbal therapy (medicine) without any interference of drugs. Herbal therapy is one of the oldest methods of therapy that has been reviewed in the past two decades.[7] The history of traditional medicine or experimental medicine and the use of herbals date back to the beginning of human life and civilization, because diseases were introduced with the creation of the human. That is why today all research centers at universities, industries and WHO have provided extensive programs for the use of herbals.[8] Using foodstuffs for the treatment of diseases and health promotion (prevention) is one of the most important strategies in Iranian traditional medicine.[9] Garlic, sour lemon and ginger are such foodstuffs as can affect our desired index.

Garlic is a kind of onion vegetable that is of great nutritional importance. It has been cultivated since ancient times as one medicinal herb and condiment, and nowadays it is used throughout the world as a famous medicinal herb.[9] The effects of garlic on the treatment of meningitis, parasitic diseases such as hymenolepis nana, trypanosome and leishmaniasis, platelet aggregation, thrombosis, lipid profiles and blood pressure have been confirmed.[10]

The lime tree (lemon) with the scientific name of citrus aurantifolia belongs to the citrus family.[11] Lemon is clinically considered to be anti-tumor, anti-inflammatory, anti-tetracyclic, anti-osteoporotic, antithrombotic and antiviral. The mechanism of action of flavonoids is through their effect on nitric acid levels, the direct removal of oxidative radicals, and their effect on the accumulation of leukocytes, oxides, and reactions with other enzymatic systems. Flavonoids in citrus also have a positive effect on the immune system.[12]

Ginger is a flowering plant with the binomial name of Zingier Official from the family of Zingiberaceae,[13] and is a part of food menus in most countries. From the rhizome of regular ginger root, a powder is prepared and is used as a spice from older days.[14] Galen, a Greek physician and used ginger as the body filter. He used ginger when the body was in imbalance. Ginger is a very common condiment on a global scale that has been used in Chinese traditional medicine for more than 2,500 years for curing flu, rheumatism, neurological disorders, gum swelling, toothache, asthma, stroke, constipation, diabetes,[15] indigestion, vomiting, cardiopathy,

high blood pressure and palpitations.[16] In vitro studies on rats have showed that ginger can significantly reduce the peroxidation of lipids and increase antioxidant enzymes such as glutathione. In addition, it has been observed that the ginger has antioxidant effects against ascorbic acid.[17]

Despite natural material (such as garlic, sour lemon and ginger) have less side-effects than chemicals and their easy access facilitates their consumption and due to the above-mentioned effects of garlic and sour lemon, various studies have been carried out for evaluation of the relationship between garlic and sour lemon consumption, separately, with their effects on the reduction of inflammatory biomarkers, lipid profile and insulin resistance in the cardiovascular patients, yet no study has been carried out regarding the effects of garlic, sour lemon and ginger mixture. The present study was undertaken with the aim of analyzing the effects of garlic, sour lemon and ginger mixture on preventing plasma lipids in various blood indicators of Ratus.

Materials and Methods

This experimental study was performed on 23 Ratus Norvegicus alluvia weighing 180–200 g. Ratus were kept in temperatures of 22 °C–25 °C. To adapt to environmental conditions, all experiments were carried out after two weeks of leaving them in nests.

Blood samples were taken directly from the heart. This led to increase in blood volume and mortality; so blood sampling was done only once to prevent possible mortality. We first divided Ratus into two groups randomly and then into two sub-groups randomly, as follows:

Group 1 (Control Group):

1- Ratus that received routine food (eight Ratus).

2- Ratus that received routine food plus garlic, sour lemon and ginger (four Ratus).

Group 2 (case Group): To increase the blood lipids of Ratus, market oil was added to their food and then they were divided into:

1- Ratus that received oil without additives (four Ratus)

2- Ratus that received oil-containing food plus garlic, sour lemon and ginger (seven Ratus).

To prepare the garlic and sour lemon mixture, we first peeled 30 cloves of garlic and five sour lemons. Then, we

mixed them with 20 g powder ginger in a blender. Then, we mixed the beaten ingredients and boiled them in 1 L water. After becoming cold, we passed the mixture from the filter and kept the ingredients in a glass in a refrigerator.

Based on their treatment class and sub-groups, we put Ratus in different cages (each group of four Ratus in one cage). For example, those Ratus that were in the group 1 received routine food plus garlic, sour lemon and ginger mixture. The Ratus that received routine food were kept in a separate cage. As mentioned above, food packages were prepared and then packed. To avoid information bias by the researcher, bar code method was used and sealed on each packet. The second digit from the right side indicated the type of treatment and the second digit from the left side indicated the cage number of Ratus. Two types of existent vials were coded as mentioned above. Ratus specimens received the prepared solutions for three weeks in gavage. In this study, observation of moral obligations was confirmed by the Ethics Committee of the Shahroud University of Medical Sciences. The person who analyzed the information was blinded. Data were analyzed by SPSS-16. Due to the small sample size and non-normality of parameters, non-parametric Mann-Whitney U-test was used for comparing groups in pairs. Significance level was set at 0.05.

Results

The studied Ratus were divided into six groups and their descriptive information is shown in table 1 (regarding the small sample size and non-normality of data, the mean and first and third quartiles are displayed).

Using Mann-Whitney U-test, the groups were compared in pairs. Comparing the control group with the group that received routine food plus garlic, sour lemon and ginger mixture, it was seen that garlic, sour lemon and ginger cause cholesterol reduction and LDL reduction (P=0.027) significantly (P=0.006 and 0.027, respectively). Other variables are shown in table 2.

Comparing the control group with a group that received oil, it was shown that injecting oil (lipid) was effective and caused significant increase in blood cholesterol level (P=0.006). Comparing both groups which received oil, it was shown that blood cholesterol level (P=0.008) and LDL (P=0.008) in the group that received garlic, sour lemon and ginger were significantly higher than in the group that only received oil (table 3).

Table 1. Description of research variables

	Cholesterol (mg/dl)	Tri glyceride (mg/dl)	Glucose (mg/dl)	HDL (mg/dl)	LDL (mg/dl)
Control	123.5 (121.50–126.0)*	103.5 (85.25–171.0)*	92.5 (77.0–108.0)*	59.5 (46.75–64.50)*	52.5 (43.50–56.75)*
Oil	146 (131.75–164.75)*	102 (95.75–117.25)*	113.5 (103.50–118.25)*	56 (44.75–62.0)*	64.5 (58.0–69.5)*
Control+garlic, sour lemon and ginger	111.5 (104.0–143.0)*	96.5 (87.25–129.0)*	96.5 (69.75–112.75)*	64.0 (58.0–70.0)*	34.0 (31.0–46.75)*
Oil+garlic, sour lemon and ginger	113.0 (112.0–116.0)*	76.0 (48.0–101.0)*	88.0 (81.0–97.0)*	67 (58.0–78.0)*	29.0 (27.0–35.0)*

*Mean of studied variables

Table 2. Comparison of Control Group with Garlic, Sour Lemon and Ginger Control

	Cholesterol (mg/dl)	Tri glyceride (mg/dl)	Glucose (mg/dl)	HDL (mg/dl)	LDL (mg/dl)
Control	123.5 (121.50–126.0)[*]	103.5 (85.25–171.0)[*]	92.5 (77.0–108.0)[*]	59.5 (46.75–64.50)[*]	52.5 (43.50–56.75)[*]
Control+garlic, sour lemon and ginger	111.5 (104.0–143.0)[*]	96.5 (87.25–129.0)[*]	96.5 (69.75–112.75)[*]	64.0 (58.0–70.0)[*]	34.0 (31.0–46.75)[*]
P-value comparison of two groups	0.01[*]	0.86[*]	0.09[*]	0.73[*]	0.03[*]

[*]Mean of studied variables

Table 3. Comparing Oil Group with Oil Group+Garlic, Sour Lemon and Ginger

	Cholesterol (mg/dl)	Tri glyceride (mg/dl)	Glucose (mg/dl)	HDL (mg/dl)	LDL (mg/dl)
Oil	146 (131.75–164.75)[*]	102 (95.75–117.25)[*]	113.5 (103.50–118.25)[*]	56 (44.75–62.0)[*]	64.5 (58.0–69.5)[*]
Oil+garlic, sour lemon and ginger	113.0 (112.0–116.0)[*]	76.0 (48.0–101.0)[*]	88.0 (81.0–97.0)[*]	67 (58.0–78.0)[*]	29.0 (27.0–35.0)[*]
P-value comparison of two groups	0.008[*]	0.089[*]	0.011[*]	0.059[*]	0.008[*]

[*]Mean of studied variables

Discussion

The results of this study show that the blood lipids of Ratus that received routine food with market oil for 60 days were significantly higher than for the group that did not receive routine food with market oil. After three weeks of treatment, the Ratus group with high blood lipids showed significant decrease in cholesterol and LDL as a result of the given treatment. In the groups with normal blood lipids and high blood lipids, it was observed that garlic, sour lemon and ginger reduced cholesterol, Glucose and LDL. A meta-analysis study investigated the effect of garlic on blood lipids of people who were under treatments of 4–24 week in contrast with a group receiving placebo. It was shown that garlic causes reduction in total extent of blood cholesterol, which is consistent with the results of the present study.[18] Bok et al. showed that cholesterol level in liver and plasma in Ratus that received sour lemon was lower than to Ratus was not received sour lemon, and they concluded that this reduction related to flavonoids of sour lemon.[19] Hertog proved that flavonoids in lemon skin can react with active oxygen because of flavonoids in lemon skin anti-oxidant characteristics and can avoid the reaction of oxidizing LDL.[20] The current additives in lemon skin reduce significantly cholesterol and triglyceride levels, reduce blood pressure and prevent atherosclerosis.[21] A study that investigated the effect of allicin in garlic powder and its effects on blood lipids, triglycerides and blood pressure reported that allicin in garlic reduces the blood lipid level in Ratus.[22] Also, garlic and thyme mixture reduces the lipid parameters in guinea pigs.[23] Animal studies have shown that garlic decreases blood lipid parameters in rabbits. Another study on rabbits revealed that garlic reduces blood lipids in rabbits with high cholesterol,[24] which is consistent with the results of the present study. Studying the effect of garlic cloves on the blood sugar and blood lipid levels in diabetics, Parastouei et al. showed that in diabetics garlic causes reduction in cholesterol and LDL.[25] For the animal models, consumption of garlic powder causes accumulation of lipids in liver and increase in the bile acids.[23] Fiber-rich diet can reduce the triglyceride levels by controlling lipogenesis in liver. Fiber can reduce lipid parameters and cholesterol and plasma LDL by preventing the absorption of bile acids and

cholesterol and increasing the activity of the LDL receptor.[26] Shirdel et al. concluded that ginger can reduce significantly the triglyceride and cholesterol levels in diabetic Ratus in contrast with the diabetic control group, and can increase the cholesterol LDL. The effect of ginger on cholesterol levels was not significant.[27]

The protective effect of ethanolic extract of ginger on metabolic syndrome was significantly reduced after six weeks, in contrast with the groups receiving the full-fatty diet. HDL changes were significant in none of the groups.[28]

Allicin in garlic and ethanol in ginger and lemon skin extract can each reduce the cholesterol in blood lipids and triglycerides. Using these materials simultaneously for Ratus that received full-fat diet for 60 days and for Ratus that had routine diet caused reduction in some blood indicators mentioned in the study. So, the garlic, lemon and ginger mixture can reduce blood lipids for both Ratus with high blood lipids and Ratus with regular blood lipids.

Acknowledgement

Conflict of Interest

The authors declared that they have no conflict of interest.

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