Original

Investigation of the effects of peppermint (*Mentha piperita*) on the biochemical and anthropometric profile of university students

Investigação dos efeitos do uso da hortelã (Mentha piperita) no perfil bioquímico e antropométrico de estudantes universitários

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Abstract

The hypolipidemic effects of several medicinal plants have already been demonstrated, but many plants commonly used to treat diseases still need to be studied. Peppermint (*Mentha piperita*) is widely consumed by the population for different purposes, but not for the treatment of dyslipidemias. The objective of this study was to examine the effects of this plant on human biochemical and anthropometric profiles and blood pressure, based on the administration of peppermint juice twice daily for 30 days. Blood samples were collected before and after the treatment in order to determine the glycemic and lipid profiles, and the Body Mass Index (BMI) analysis was performed. Results indicated that 41.5% of the subjects showed a reduction in glycemia, 66.9% in total cholesterol levels, 58.5% in triacylglycerides, 52.3% in LDL-c (low-density lipoproteins) indices, 70% in GOT (glutamic-oxaloacetic transaminase) levels, 74.5% in GPT (glutamic-pyruvic transaminase) levels, and that 52% presented an increase in HDL-c (high-density lipoprotein cholesterol) indices. Also, 52.5% showed a decrease in blood pressure and 48.7% in BMI. The use of peppermint by humans can be considered beneficial in the prevention and treatment of risk factors of chronic degenerative diseases.
Keywords: *mentha piperita; dyslipidemias; metabolic syndrome; blood pressure.*

Resumo

Os efeitos hipolipidêmicos de algumas plantas medicinais já foram demonstrados, mas muitas comumente utilizadas para o tratamento de doenças precisam ser estudadas. A hortelã (*Mentha piperita*) é requisitada pela população com diferentes finalidades, mas não no tratamento de dislipidemias. Objetivou-se verificar os efeitos desta planta no perfil bioquímico e antropométrico, e na pressão arterial de seres humanos, a partir da administração de suco de hortelã duas vezes ao dia, durante 30 dias. Antes e após tratamento, foram colhidas amostras de sangue para determinação do perfil glicêmico e lipídico, além de análise de Índice de Massa Corpórea. Os resultados mostraram que 41,5% das pessoas apresentaram redução na glicemia, 66,9% nos níveis de colesterol, 58,5% nas taxas de triacilglicerídeos, 52,3% nos índices de LDL-c (lipoproteínas de baixa densidade), 70% nos níveis de TGO (transaminase glutâmica oxalacética), 74,5% nos níveis de TGP (transaminase glutâmica pirúvica) e 52% apresentaram aumento nos índices de HDL-c (lipoproteína de alta densidade). Em 52,5% houve diminuição de pressão arterial e redução do IMC em 48,7%. A utilização da hortelã para humanos pode ser considerada benéfica na prevenção e tratamento de fatores de risco de doenças crônico-degenerativas.
Palavras-chave: *mentha piperita; dislipidemias; síndrome metabólica; pressão arterial.*

1 Introduction

The literature is rich in studies that demonstrate a relationship between high levels of blood lipids, insulin resistance and high blood pressure with increased risk of developing cardiovascular diseases. Many medicinal plants are effective in the treatment of risk factors for the development of these diseases. *Mentha piperita*, commonly known as peppermint, is a plant used extensively by people for the most diverse purposes, but not for the treatment of the aforementioned risk factors. Medicinal plants have also been applied in the treatment of several metabolic diseases, especially in the control of *Diabetes mellitus* and Hypercholesterolemia (PRAKASAM et al., 2003; WILLCOX et al., 2003; MOST et al., 2005; RUKKUMANI et al., 2003; HAN et al., 2008; KWON et al., 2009).

It is known that western diets, especially that of Brazilians, contain increasingly high concentrations of saturated fats, favoring increased levels of total cholesterol, triacylglycerides, low HDL-c, high blood pressure and altered fasting glycemia, which determine increased risks of developing heart diseases (SCHAAN et al., 2004; CAPUZZI; FREEMAN, 2007; MERCHANT et al., 2007). Besides these factors, there are the pharmaceutical cholesterol-lowering drugs, which are expensive and involve a possible long-term use of the drugs.

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Mentha piperita has numerous pharmacological, cosmetic and alimental applications due to its ability to produce terpene and terpenoid compounds. This plant produces oils rich in menthol and flavonoids, making it economically very important (MARTINS et al., 1998; CARDOSO et al., 2001; McKAY; BLUMBERG, 2006; SOUSA et al., 2007).

As previously mentioned, several plants have been evaluated for their potential to lower plasma lipid levels, but reports on the role of peppermint (*Mentha piperita*) are restricted to its antispasmodic, antimutagenic and antiflatulent effects, as well its antiemetic and analgesic effects on the mucous membranes (MEI et al., 2002; MIMICA-DUKIC et al., 2003; ROMERO-JIMENEZ et al., 2005).

The purpose of the present work was to examine the effects of peppermint juice on the biochemical and anthropometric profile and blood pressure of humans.

2 Materials and methods

2.1 Study site and population

This work was carried out at the "Estudante Rafael Almeida Camarinha" Faculty of Technology in Marilia, State of Sao Paulo, Brazil. The study population comprised 25 students between 18 and 45 years old, chosen randomly to participate in the project.

2.2 Anthropometric evaluation

Anthropometric measurements were taken and evaluated according to the methodology proposed by the World Health Organization (WHO, 1995). Weight and stature were measured, respectively, on an electronic scale (*Filizola*) with capacity for 180 kg and a stadiometer (SANNY) with millimetric precision.

The anthropometric measuring techniques presented below were based on Heyward and Stolazarczyk (2000).

- Stature. The subject must be barefoot, standing erect, feet together, with the heels, knees, buttocks, back and head flat against the wall, according to the Frankfort plane, with the lower limit of the orbit on the same horizontal line as the upper margin of the external auditory meatus, arms hanging freely against the trunk. The movable headboard of the stadiometer is positioned firmly on the upper part of the head, lightly pressing the hair;
- Weight. Measurements shall be in kilograms. People should be weighed wearing a minimum of clothing and no shoes. The subject must stand in the middle of the scale, with the arms relaxed along the trunk and the feet slightly apart. The weight is then read in grams.

2.3 Biochemical measurements

Glycemia, total cholesterol, HDL, triacylglycerides, GOT, GPT, and urea were measured before and after the treatment (30 days) with peppermint juice, according to the methodology adopted by the Marilia Municipal Foundation for Higher Education, at its Clinical Pathology Laboratory. The results were interpreted according to Mancini and Medeiros (2005), and the SBD – 'Sociedade Brasileira de Diabetes' (2010).

2.4 Statistical methodology

The data were described by Descriptive Statistics and analyzed by Student's *t*-test, comparing the two moments of the study.

2.5 Legal ethical aspects

Approval was given by the Research Ethics Committee of FAMEMA (Marilia Faculty of Medicine), under the Protocol No. 698 of November 5, 2007. Only individuals who had signed a consent form participated in the study (Resolution 196/October 10, 1996 – National Health Council).

2.6 Preparation of peppermint juice

Extracts were prepared in the form of juice (leaves blended with water and sieved), in a concentration of 20 g of peppermint leaves/200 mL of water distilled daily. The doses were also administered daily, including weekends, and consisted of the ingestion of one 200 mL glass of juice in the morning and another in the afternoon by a man weighing 70 kg.

3 Results and discussion

The results indicated that 41.5% of the study population showed a decrease in glycemia, 66.9% in total cholesterol levels, 58.5% in triacylglyceride rates, 52.3% in LDL-c indices, 70% in GOT levels, 74.5% in GPT levels, and 69.3% in urea levels, while 52% presented an increase in HDL-c indices. Among the studied group, 52.5% showed lowered blood pressure, 43.8% presented weight loss, and 48.7% showed reduced BMI.

The analysis of Table 1 reveals a statistically significant difference in maximum BP (decrease), LDL-c, GOT and urea levels. Total cholesterol and triacylglycerides were also lower, albeit not statistically significant.

Based on the results listed in Table 1, a parallel can be drawn between the genders (male and female) and the moment of measurement (pre- and post-treatment). The women showed a statistically significant difference in TC levels (decrease), GOT (decrease) and urea (decrease), and numerically, LDL-c and GPT were lower while HDL-c was increased. The men showed a statistically significant difference in GOT levels (decrease) and a non-significant decrease in total cholesterol, LDL-c and urea.

The results of this work are related to other studies that use vegetable foods for glycemic and lipid control, aiming at the prevention and treatment of chronic degenerative diseases (CAMACHO, 1996; JORGE et al., 1998; SONG; LEE, 2003; FIGUEIREDO; MODESTO-FILHO, 2008). These diseases are on the rise, for the globalized economy has led to new worldwide trends in the nutritional sector, contributing toward rapid changes in dietary patterns, with increasing consumption of foods rich in fats and sugars and a decline in the consumption of foods essential to health and in the practice of physical activities. This tendency is manifested by increased body weight and the

Table 1. Medium, standard deviation and results of the statistical analysis of the biochemical variables.

Variables	Moment		p-value
	Pre-treatment	Post-treatment	
Total cholesterol (mg.dL^{-1})	186.64 ± 40.95	175.21 ± 33.86	0.1785
LDL-c	167.36 ± 46.94	132.60 ± 49.87	0.0163
Glycemia (mg.dL^{-1})	89.41 ± 9.11	88.77 ± 7.54	0.1819
HDL-c (mg.dL^{-1})	47.10 ± 15.48	44.85 ± 16.60	0.4093
GOT (U.L^{-1})	25.32 ± 4.62	22.00 ± 6.44	0.0030
GPT (U.L^{-1})	38.73 ± 8.66	37.90 ± 12.43	0.3185
Triglycerides (mg.dL^{-1})	128.41 ± 72.02	111.65 ± 65.37	0.1955
Urea (mg.dL^{-1})	29.36 ± 8.94	27.10 ± 8.60	0.0123
Weight (Kg)	77.84 ± 17.90	79.79 ± 17.80	0.1365
BP max	121.90 ± 17.78	112.86 ± 8.95	0.0101
BP min	79.52 ± 12.44	79.05 ± 10.91	0.4265

development of dyslipidemias, diabetes, arterial hypertension, obesity, metabolic syndrome (MS) and vascular diseases (MANCO et al., 2004; MERCHANT et al., 2007; HOENIG, 2008; HSIEH et al., 2008; FRICK et al., 2008).

Preventive measures such as nutritional assistance and education, as well as the fight against physical inactivity, are extremely important factors to prevent the rise in the incidence of MS and its chronic complications (MIGGIANO; PETRAROLI, 2005). However, alternatives may be important aids in the prevention and even minimization of risk factors of future diseases. These alternatives include medicinal plants. Figueiredo and Modesto-Filho (2008) determined the effects of defatted sesame (*Sesamum indicum* L.) flour on the glycemic levels and weight control of diabetes type 2 patients. Soy (SONG; LEE, 2003) and eggplant (CAMACHO, 1996; JORGE et al., 1998) have been widely studied and their consumption has been associated with beneficial effects on dyslipidemias.

Other examples are *Cassia esculenta*, *Curcuma* sp., *Ananas comosus*, green tea and others (PRAKASAN et al., 2003; RUKKUMANI et al., 2003). Sousa et al. (2007) determined and quantified the antioxidant effects of phenolic compounds of the bark and leaves of several medicinal species, among them *T. brasiliensis, T. fagifolia, Q. grandiflora* and *C. macrophyllum*. Similarly to this work, there are reports in the literature that demonstrate that the use of plants may be related with reduced BMI. Maskarinec et al. (2008) made this association with the use of soybean in adult women, and Ortega and co-workers et al. (2006) reported this relationship with the consumption of vegetables and cereals.

Mentha piperita is one of ten plants most widely consumed by the population for therapeutic purposed and the consumption of its juice in the present study showed that it can be efficient in controlling glycemia, total cholesterol, triacylglycerides and LDL-c, as well as in increasing HDL-c (BARBALHO et al., 2009) without interfering with hepatic enzymes (GOT and GPT), which could indicate attack on the liver. Moreover, no increase was observed in urea levels, indicating that it does not promote renal alterations.

Several studies have focused on examining the beneficial effects of *Mentha* species. These effects may be related with the presence of substances such as menthol, eugenol, thymol, flavonoids, terpenoids, eriotricin, luteolin and hesperidin rosmarinic, cinnamic and caffecic acids and other compounds that demonstrate antioxidant activity (McKAY; BLUMBERG, 2006; SAMARTH et al., 2007; DORMAN et al., 2009; SCHMIDT et al., 2009; YANG et al., 2010). López et al. (2009) determined the effects of the genus *Mentha* (*Mentha piperita* and *Mentha aquatica*) extracts and observed protection of the PC12 cells against oxidative hydrogen-peroxide-induced stress.

Many studies indicate that the consumption of foods and beverages with polyphenol is related to protection against cardiovascular diseases. This is related to their antioxidant potential and it is also because of its action on the nitric oxide (NO) metabolism - that improves the vascular tone control, and it is also due to its action on the hypertension (SCHINI-KERTH et al., 2010).

The antioxidants also contribute to the reduction of oxidative stress in obese and diabetic persons (BEN SLAMA et al., 2009; MAHFOUZ et al., 2009; BENZIE; WACHTEL-GALOR, 2010). Flavonoids may act in distinct ways on various components of plasma lipid (DOYAMA et al., 2005), but the available literature still does not suffice to explain the exact mechanisms whereby phenolic acids, flavonoids and terpenoids exert these beneficial effects. Nor does it explain the reasons why they may have positive effects on the reduction of BMI. Raederstorff (2009) showed that olive polyphenols can decrease oxidized LDL-c levels in plasma and reduce oxidative damage.

In view of the need to find inexpensive alternatives to conventional medications, studies are necessary to confirm the effects of medicinal plants and the ideal therapeutic schemes of benefits and the reduction of the occurrence of adverse effects, since in Brazil's poorest regions and even in its largest cities, medicinal plants are sold in open street markets and municipal markets and are grown in people's backyards (MACIEL et al., 2002).

The results obtained in this work are important because they indicate that *Mentha piperita* can be used for therapeutic and preventive purposes on the biochemical profile, blood pressure and BMI.

4 Conclusions

The use of peppermint in the form of juice for humans can be considered beneficial in the prevention and treatment of risk factors of diseases that rank among the main causes of death in the globalized world. Therefore, it is possible to suggest that this plant can be used as a functional ingredient to the food processing industry such as snacks, cereal bars, drinks and blends. This can be attractive to the consumers who are interested in meals with more benefits than the usual.

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