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Original Article

A study on Anti-diabetic effect of peppermint in alloxan induced diabetic model of wistar rats

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Abstract

Background: Therapeutic agents like sulfonyl urea, biguanides etc are used to control blood glucose level in diabetic patients. However chronic usage of most of these agents produces adverse effects. The present study was undertaken with an objective to observe effectiveness of oral administration of Peppermint juice in alloxan induced diabetic wistar rats. ***Methods:*** Thirty adult male and female Wistar rats, weighing 150-200g, were selected for this study. Blood glucose was estimated by GOD-PAP method using diagnostic kit supplied by Agappe diagnostics, Maharashtra. Two Sample t- test, One way ANOVA are used to analyse the data. ***Results:*** The present experimental study provides further evidence that oral administration of Peppermint juice for 21 days produced a significant decrease ($p < 0.0010$) in the blood glucose level of alloxan induced diabetic rats. ***Conclusion***: From this study, we can conclude that the oral administration of Peppermint juice have beneficial effect on blood glucose levels. However further pharmacological and biochemical investigations will clearly elucidate the mechanism of action and helpful in projecting Peppermint juice as a therapeutic target in diabetes research.

Key words: Anti diabetic effect, Peppermint juice, Wistar rats.

Introduction

Diabetes mellitus is the most common endocrine disorder. More than 150 million people are suffering from it worldwide and it is likely to increase 300 million by year 2025. More than one fifth of them are Indians and the international diabetes federation declared India as diabetic capital of the world. More than 400 traditional plant treatments for diabetes mellitus have been recorded, but only a small number of these have received scientific and medical evaluation to assess their efficacy[1]. Herbal medicine has become a popular form of healthcare, though several differences have been reported between herbal and conventional pharmacological treatments. Herbal medicine can be tested for efficacy using conventional trial methodology[2]. Peppermint (*Mentha×piperita*,) also known as *M. balsamea* Willd. known to be hybrid mint, a cross between water mint and spearmint. *Mentha piperita L* (family Labiatae; genus *Mentha*) is reported to be commonly used in the treatments of loss of appetite, common cold, bronchitis, fever, nausea, vomiting [3], spasmodic responses [4], and antimicrobial and antioxidant activities[5]. It is also used for culinary purposes. There is evidence that it has a anti microbial and anti oxidant activities[6]. Peppermint is commonly used to soothe or treat symptoms. Examples would be nausea, vomiting, abdominal pain, indigestion, irritable bowel, and bloating [7,8]. It is also used in aroma therapy[9]. One animal study has suggested that Peppermint may have radio protective effects in patients undergoing cancer treatment [10] Cognitive performance is poorer in diabetic patients with peripheral neuropathy or elevated hemoglobin A_{1c} levels[17]. The aroma of peppermint has been found to enhance memory and alertness[11, 12]. The present study was undertaken with an objective to observe the anti diabetic effect of oral administration of Peppermint juice.

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Materials and methods

Thirty either sex Wistar rats, weighing 150-200g, were selected for this study. All rats were housed in polypropylene cages (30x22x14cm), fed with standard rat chow and water *ad-libitum.* The study was initiated after its approval by the Ethics Committee of Little Flower Medical Research Centre. Mentha piperita leaves were washed, weighed (100g/L), and triturated with water in a blender for 7 minutes. Peppermint juice was filtered and frozen in an amber flask by using refrigerator. Each flask was thawed daily at ambient temperature two hours prior to administration.

Rats were divided into three groups containing six animals each. All animals were fasted eight hours before treatment. Diabetes was induced in the rats by injecting alloxan intraperitonially (I.P) in a single dose of 150mg/kg of body weight. Peppermint juice was administered orally at a dose of 0.29 g/kg once a day. The dose administered to the animals was based on 100 g/L, which corresponds to the daily intake of 200 mL of juice by an adult man weighing 70.0 kg (such intake was based on population consultation). Served as normal control and did not receive either alloxan or Peppermint juice. Served as diabetic control and received alloxan only. Alloxan + peppermint juice will be administrated for test group.

After four hours of administration of alloxan, blood samples are collected from all the groups including control group for blood glucose estimation. This is considered as zero time. Blood glucose was estimated by GOD-PAP method Peppermint juice was orally administered every day for consecutive three weeks in test group. Blood samples were collected from all the groups at the end of every week for the estimation of blood glucose. Blood glucose levels were compared in all the groups. All the blood samples were collected from the caudal vein using butterfly needle to reduce the infection and hemorrhage. Two Sample t- test, One way ANOVA are used to analyze the data.

Results

The analysis of data is presented in Table no;1,2,3, Single intraperitoneal administration of alloxan 150mg/kg led to elevation of blood glucose level. The anti-diabetic effect of Peppermint juice on diabetic rats was significant.(p <0.001). The zero time, after 1 week, after 2 week and after 3 week of these three groups compared by using a one way ANOVA indicates a significant difference with p <0.001 is observed between the groups and within groups.

		Mean blood glucose (mg%)	P value
Pair 1	Zero time	88.00+4.77	.611
	After 1 week	87.16+6.40	
Pair t 2	Zero time	88.00+4.77	.829
	After 2 week	88.50+4.84	
Pair 3	Zero time	88.00+4.77	.749
	After 3 week	88.50+4.84	
Pair 4	After 1 week	87.16+6.40	.629
	After 2 week	88.50+4.84	
Pair 5	After 1 week	87.17+6.40	.249
	After 3 week	88.50+4.84	
Pair 6	After 2 week	88.50+4.84	1.000
	After 3 week	88.50+4.84	

Table :1 – Blood Glucose in control group rats (pair = Pair of blood glucose readings)

		Mean blood glucose (mg%)	P value
Pair 1	Zero time	211.33+6.95	.163
	After 1 week	205.83+8.38	
Pair 2	Zero time	211.33+6.95	<0.001
	After 2 week	173.16+3.43	
Pair 3	Zero time	211.33+6.95	<0.001
	After 3 week	161.00+5.51	
Pair 4	After 1 week	205.83+8.38	<0.001
	After 2 week	173.16+3.43	
Pair t 5	After 1 week	205.83+8.38	<0.001
	After 3 week	161.00+5.51	
Pair 6	After 2 week	173.16+3.43	.007
	After 3 week	161.00+5.51	

Table :2 – Blood Glucose level of Alloxan Induced Rats. (pair = Pair of blood glucose readings)

Discussion

Plants have evolved the ability to synthesize chemical compounds that help them defend against attack from a wide variety of predators such as

		Mean blood glucose (mg%)	P value
Pair 1	Zero time	209.16+5.84	<0.001
	After 1 week	187.83+5.07	
Pair 2	Zero time	209.16+5.84	<0.001
	After 2 week	164.00+3.46	
Pair 3	Zero time	209.16+5.84	<0.001
	After 3 week	138.83+4.21	
Pair 4	After 1 week	187.83+5.07	<0.001
	After 2 week	164.00+3.46	
Pair 5	After 1 week	187.83+5.07	<0.001
	After 3 week	138.83+4.21	
Pair 6	After 2 week	164.00+3.46	<0.001
	After 3 week	138.83+4.21	

Table :3 – Blood Glucose Alloxan induced diabetic rats treated with Peppermint (pair = Pair of blood glucose readings)

case-control studies [11]. Recently, a case- control study by Panwar R B et al. showed that the thrombotic (smoking, low fruit/vegetables intake, fibrinogen, homocysteine) as well as atherosclerotic (hypertension, high fat diet, dyslipidemia) risk factors were important in premature coronary heart disease[13].

Reviews of epidemiological studies suggest that all the major cardiovascular risk factors are increasing in India. In this study, most of young patients had risk factors like smoking, hypertension and dyslipidemia. Obesity noted to double the prevalence of cardiovascular disease in men and women under the age of 50 years, has been reported between 30% to 58% of younger patients [14, 15, 16]. Interestingly, a much higher percentage of young patients (almost 20%) were unaware of their hypertension, dyslipidemic status before the index MI and, thus, were not able to benefit from prior therapeutic interventions. Younger patients were more likely to have an MI as their first event (70.5%), whereas heart failure was a more common first event in older patients (60.5%). Importantly, the relative proportion of sudden death events was similar across age groups. We observed an age-dependent variation in hazard associated with smoking and hypertension, with greater relative hazard in the youngest cohort of patients. However Diabetes Mellitus and kidney disease were more prevalent in elderly patients in this study. The declining effect of individual risk factors with advancing age is likely because of the influence of competing risk factors. In contrast to their younger The individual risk factors contribute disproportionately to risk in younger patients underscores the importance of addressing modifiable risk factors in younger patients, as those risk factors present in younger patients appear to be associated with differentially greater risk[17-20].

This male preponderance is remarkably consistent across 52 countries with hugely divergent rates of CAD mortality and lifestyles [21-22]. This study concur with previous finding that overall risk factors are more likely in males compared to females. Our study showed that smoking is a major risk factor for CAD in both groups. The effect of cigarette smoking on coronary risk factors is pervasive. Unfavorable effects include enhancement of platelet function. Platelet activation by cigarette smoking is linked to thrombosis formation, including onset of myocardial infarction [23]. Smoking is increasing among young subjects (20-35 years), according to second and third National Family Health Surveys (NFHS) [24]. There were significant state-level and regional variations in smoking [24, 25]. The smoking rates were the highest in eastern Indian states and the lowest in Punjab [26]. In urban populations, smoking is increasing among the low educational status subjects [27]. This study also supports the claim that smoking rate is highly prevalent in central Indian subjects.

High Prevalence of hypertension (20% and 14% in young and elderly patients respectively was seen among the both study population. This agrees with the previous studies by Sofia and EUROSPIRE, hypertension has been seen as a major risk factor for CAD [28]. The prevalence of hypertension has increased in both urban and rural subjects and presently is 25%-40% in urban adults and 10%-15% among rural adults [29]. A high incidence of diabetes was seen among the elderly population. Indians are genetically prone to develop type II diabetes mellitus due to insulin resistance. The hyperinsulinimia in these patients accelerates the atherosclerotic process in the coronary arteries. Diabetes is second only to CAD as a health burden in India. During the past decade, the number of people with diabetes in India increased from 32 million to 50 million, and the projected Figure may reach 87 million by 2030 [30]. Hyperinsulinemia, insulin resistance, and the higher rate of prevalence of metabolic syndrome in people with type 2 diabetes were attributed to high coronary risk in south Asians [31,32] . Although there are large regional variations in the prevalence of diabetes it has more than quadrupled in the last 20 years from < 1%-3% to 10%-15% in urban areas and 3%-5% in rural areas [33].

such as insects, fungi and herbivorous mammals. By chance, some of these compounds, whilst being toxic to plant predators, turn out to have beneficial effects when used to treat human diseases. It is vital that people understand that all herbs are plant-derived drugs, without exception. While there are some that are – in the correct dose, with the correct processing, and the correct usage are very beneficial [21]. 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. The hypolipidemic effects of several medicinal plants have already been demonstrated, but many plants commonly used to treat diseases still need to be studied. It was reported that plant extracts causes anti diabetic effect by promoting regeneration of beta cells or by protecting these cells from destruction. Plant extracts may activate insulin receptors or affects beta cells to release insulin[15].

Mentha piperita (peppermint) is one of the plants most frequently used by the Brazilian population for therapeutic purposes[22]. *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[19]. *Mentha piperita* can be used for therapeutic and preventive purposes on the biochemical profile, blood pressure and BMI.[20] Oral administration of pepper mint showed anti diabetic property.[16] Phenolic compounds and antioxidant activities of peppermint may be useful for meal planning in type 2 diabetes[18].

As medicines used to regulate glycemia and dyslipidemia are costly, the use of peppermint juice may be an alternative low-cost strategy to treat non-communicable diseases associated with the insulin dysfunction. It can also be used to prevent the complications of gestational DM, thus preventing fetal hyperglycemia and hyperinsulinemia, metabolic abnormalities, and the metabolic syndrome in the offspring from mothers with DM. As peppermint also shows antioxidant and antiperoxidant effects, it also can prevent oxidative damages [23-26].

The present experimental study provides further evidence that oral administration of Peppermint juice for 21 days produced a significant decrease in the blood glucose level in the model of alloxan induced diabetes in rats. Species of Mentha are aromatic plants traditionally used as medicinal remedies and culinary herbs but this study suggests that the use of the *M. piperita* juice has potential as a culturally appropriate strategy to aid in the prevention of DM. Despite the promising results concerning the use of peppermint, it is fundamentally important to perform further studies in order to evaluate its effects on human beings and the ideal doses to be used.

Conclusion

From this study, we can conclude that the oral administration of Peppermint juice have beneficial effects on blood glucose levels. However further pharmacological and biochemical investigations will clearly elucidate the mechanism of action and helpful in projecting Peppermint juice as a therapeutic target in diabetes research**.**

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