Chamomile tea: Herbal hypoglycemic alternative for conventional medicine

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Abstract: Chamomile is considered as one of the oldest and also documented as medicinal plant. It has shown to be an anti-inflammatory, astringent and antioxidant especially in floral part since ancient times. Recent studies reported that chamomile has potential to lower blood sugar levels in hyperglycemia. In the present study we have investigated the pharmacological effects of chamomile tea on fasting and post prandial glucose levels and HbA1C in blood of diabetic rats (alloxan induced) and the results were compared with glibenclamide as standard. Statistical analysis was performed using SPSS. It has been observed in our study that it has reduced progressively the fasting and post prandial blood sugar levels, significantly in alloxan induced diabetic rats particularly on day 30and 60. It also reduced the level of HbA1C significantly at the end of the study and the effects were similar to that of the standard group. Chamomile tea administration has also controlled the reduction in weight in diabetic rats as compared to diabetic control and the results were not very much different from standard. Results from the present study indicate that chamomile tea have a glucose lowering effect in diabetic rats so its daily consumption can be potentially useful in hyperglycemia and it can be used as a substitute of conventional drug treatment. Further studies are necessary to elucidate the exact molecular mechanism involved in anti-diabetic action of chamomile.

Keywords: Chamomile, hyperglycemia, anti-diabetic, glibenclamide.

INTRODUCTION

One of the oldest, widely used, native of the old world and well documented medicinal plant is chamomile (Astin *et al.*, 2000). Chamomile belongs to daisy family (*Asteraceae* or *Compositae*). It is widely represented by two known varieties *Matricaria Chamomilla* known *as*wild chamomile and Roman chamomile considered as common specie. Both types of chamomiles are used in traditional medicine and herbalism (Hansen and Christensen, 2009). *Matricaria chamomilla* (author citation) is the most popular source of chamomile, a herbal product used for a variety of medical purposes and has been used since ancient times *(*Grieve, 1982; Petri and Lemberkovics, 1994). The active constituents of German chamomile are Terpenoids: a-bisabolol, a-bisabolol oxide A and B, chamazulene, sesquiterpenes; Flavonoids: apigenin, luteolin, quercetin; Coumarins: umbelliferone, herniarin, esculetin; Spiroethers: en-yndicycloether, Other constituents: anthemic acid, choline, tannin, polysaccharides (Newall *et al*., 1996; Paya *et al*., 1992; Kaneko *et al*., 2007).

Chamomile as whole plant is used as a lotion in toothache as an external application, in earache, neuralgia as well as in external swelling. It can also be used for making herb and beers (Hamon, 1989). Chamomile has been used as traditional medicine for centuries as an anti inflammatory, astringent, antioxidant and curing medicine (Weiss, 1988). It has shown effectiveness against wounds, sunburns, eczema, burns, ulcers, bruises, canker sores, neuralgia, sciatica, rheumatic pain, leg ulcers, hemorrhoids and mastitis when applied externally (Newall *et al*., 1996; Maday, 1999). Additionally, it is used externally to treat diaper rash, splintered nipples, chicken pox, poison ivy and conjunctivitis, and as a hair tint and conditioner (Merfort *et al*., 1994). For soothing ano-genital inflammations it can be used as bath additive (Kyokong *et al*., 2002) and for relaxing tired, achy muscles and feet and softening the skin (Merfort *et al*., 1994).Chamomile's one of the main role is as a multipurpose digestive aid. It can also be used to treat different gastrointestinal disturbances such as anorexia, flatulence, motion sickness, indigestion, nausea, vomiting and diarrhea. Chamomile is used as herbal bitter to stimulate the liver and also have tendency to heal ulcers (Mann and Staba, 1986).

Especially in children it is used for the management of summer diarrhea with purgatives to stop cramping. Flowers can be used alone or in combination with crushed poppy-heads, as a poultice for inflammatory pain or congestive neuralgia. It can also be used in inflammatory conditions associated with underlying infection or abscess such as facial swelling (Hamon, 1989).

Herbal teas are admired all around the globe and about a million cups of chamomile tea are used on a daily basis in which chamomile flower powder is either pure or blended

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with medicinal herbs popular for same use. As a tea in larger doses it can be used as sedative, to treat insomnia and in other nervous conditions (Jackson, 2000). For inflammatory conditions, it is used as wash or rinse for throat and mouth particularly and also to diminish oral mucositis due to chemotherapy (Fidler *et al*., 1996; Mazokopakis *et al*., 2005).

Recently unanimity has been developed that herbal tea and their principle components may have various beneficial effects by directly influencing the activities of certain important enzymes involved in various disorders, although the exact mechanism is not known. One of the interesting use of these herbal teas is their use in prevention of onset of diabetes (Paya *et al*., 1992; Kaneko *et al*., 2007). The recent studies recorded that chamomile has potential to lower blood sugar levels in hyperglycemia (Kato *et al*., 2008).

The aim of the present study is to explore the pharmacological effects of chamomile tea on blood glucose levels and HbA1C in diabetic rats (alloxan induced). The effects of chamomile tea are compared with glibenclamide (hypoglycemic drug).

MATERIALS AND METHOD

Plant material and preparation of tea

Chamomile tea bags were purchased from local market manufactured by R. T wining and Company Limited, South Way, Andover, Hampshire, England. Tea was prepared by adding 1gm (one tea bag) chamomile flowers in 150 ml boiling distilled water, covering and leaving to steep for 10-15 min and then allowed to cool for 15 min. The adult dose of chamomile tea is 1cup twice a day (Wang *et al*., 2005) and the dose for rats was calculated according to body weight by unitary method. Tea was prepared freshly just before administration.

Experimental design

The experiment was performed using healthy, adult male Wistar rats, age 6-8 weeks and weight 150 to 250 g (N=30). Animals were kept under standard environmental conditions (21±1°C, 55±5% humidity) and maintained with free access to water and regular rat pellet diet ad libitum. The plan followed for animal experiments were approved by BASR University of Karachi under resolution No.10 (66).

To induce diabetes, animals were injected with a single dose of freshly prepared solution of alloxan monohydrate (dissolved in ice-cold water) intra-peritoneally at a dose of 150mg/kg body weight (Rao *et al*., 1999, 2001). Since alloxan is able to produce hypoglycemia as a result of massive pancreatic insulin release, rats were given 20% glucose solution (15-20 ml) intra-peritoneally after 6 hours. The rats were then kept for the next 24 hours on 5% glucose solution. 5% Glucose containing water bottles were kept in the cages to prevent hypoglycemia (Gupta *et al*., 1984). Control group rats were treated identically and served as diabetic control.

After 48 hours, blood samples were drawn in order to ensure that hyperglycemia has been induced. The levels of blood glucose considered to be in normal ranges from 50-135mg/dl. Animals with fasting glucose levels>120mg/dl were considered as diabetic and chosen for experimental study (Pari and Maheswari, 1999).

Diabetic rats were indiscriminately assigned to three different groups (n = 10 in each group). The control group (n=10) was given distilled water; treated groups (n=10) received chamomile tea and the standard group (n=10) was given glibenclamide (Daonil, Sanofi-Aventis, Pakistan) (5mg/ 70kg). The experiments were performed in overnight fasted rats. Fasted animals were deprived of food for at least 16 h but allowed free access to water.

Determination of parameters

Weight of rats, fasting and postprandial blood glucose were determined in rats on day 7, 30 and 60 of treatment. Blood glucose levels were determined with a glucose analyzer (Abbott Medisense Optium Blood Glucose analyzer). On day 60the animals were sacrificed by cervical decapitation under mild anesthesia. According to the requirements of the test, specific tubes were arranged. The blood samples were collected in Bio Vac EDTA. K_3vacuum tubes for collection of pure blood to determine HbA1C in blood. Samples were then taken personally to Dr. Punjwani Center for Molecular Medicine and Drug Research (PCMD) diagnostic laboratory located in H.E.J Research Institute, University of Karachi within 1 hour after collection.

STATISTICAL ANALYSIS

Statistical analysis was performed using SPSS version 16 (SPSS, Chicago, IL, USA). One-way ANOVA was used for data analysis. Post Hoc Tukey test was conducted and Multiple comparisons were observed between groups, p value = 0.05 was considered significant, p value=0.01 was considered more significant and p value=0.001 highly significant.

RESULTS

Table 1 shows the effect of chamomile tea on the blood glucose levels as compared to diabetic control and glibenclamide on fasting, postprandial glucose levels and HbA1C in diabetic rats. The fasting blood glucose level of chamomile treated rats was more significantly (p<0.05) reduced on day 7 and highly significantly (p<0.001) reduced on day 30as compared to diabetic control but the results were not better than glibenclamide. However on day 60 it reduced fasting blood glucose, highly significantly (*p*<0.001)as compared to diabetic control and not statistically significant from glibenclamide.

The postprandial glucose levels were highly significantly (p<0.001) reduced as compared to diabetic control on day 7, 30 and 60and was significantly lower (p<0.01) than glibenclamide on day 30 only. While the postprandial levels of chamomile treated rats were higher as compared to glibenclamide on day 7but were lower than glibenclamide on day 60, but not statistically significant.

The levels of HbA1Cwere measured at the end of study i.e on day 60 only and it was reduced highly significantly (*p*<0.001) as compared to diabetic control and the results were not statistically different from the glibenclamide treated group.

Fig. 1 shows the change in weight of the animals during experimental period. Alloxan administration induced diabetes in animals and therefore the reduction in weight was observed in all groups. There was gradual weight reduction in diabetic control during the experimental period. There was also weight reduction in the standard group on day 7 and 30 but further on day 60, the weight was maintained by glibenclamide. In chamomile treated group weight reduction was observed from day 7 till day 30 but afterwards the weight was maintained constant and the effect was not different from that of the standard group.

DISCUSSION

In spite of the accessibility of recognized antidiabetic drugs, remedies from the herbal plants are used with

Table 1: Changes in the blood sugar levels and HbA1c

	Day	Diabetic Control	Standard drug	Chamomile
Fasting Sugar levels (mg/dl)	7	246.2±60.80	152.0±56.64	161.1±14.48**
	30	265.2±77.31	96.50±25.86	103.4±37.98***
	60	290.8±57.05	74.70±4.800	65.40±17.59***
Post prandial Sugar level (mg/dl)	7	353.1±68.77	195.1±78.49	208.7±37.50***
	30	339.4±24.09	171.7±8.430	136.30±38.85##***
	60	367.9±5.660	142.0±40.26	122.2±35.29***
HbA1C (%)	60	8.890±0.410	3.560±0.201	3.610±0.206***

Data are Mean ± SD** *p*<0.01, *** *p*<0.001 compared with diabetic control: ## P<0.01 compared with diabetic rats treated with standard drug

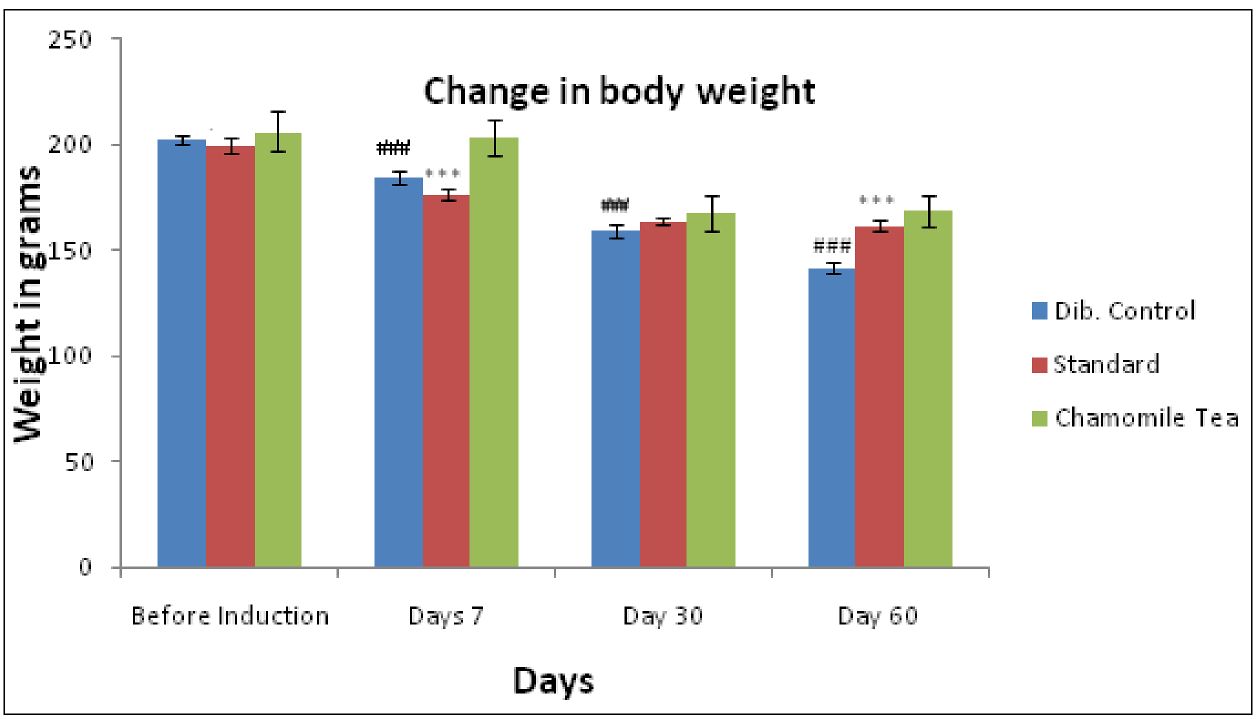

Fig. 1: Data are Mean ± SD ### *p*<0.001 compared with weight before induction control group (n=10):*** *p*<0.001 compared with weight before induction standard group (n=10).

increasing success to treat diabetes and to handle its complications (Bhattaram *et al*., 2002). It has also been observed that according to pharmacological effects reported, there may be certain examples where herbal medicine might produce synergistic effects when used with conventional medicines (Rodriguez-Fragoso *et al*., 2008). It has also been recommended that plant drugs and herbal formulations are comparably less harmful depending upon the dose and free from side-effects when compared with synthetic drugs and that is bringing more interest to wards traditional plants over synthetic drug (Saravanan and Pari, 2005). In the present study we have evaluated the anti-diabetic activity of chamomile tea and it has been observed that it has reduced progressively the fasting and post prandial blood sugar levels significantly in alloxan induced diabetic rats particularly on day 30 and 60 and also reduced the level of HbA1C in treated rats significantly when the blood samples were analyzed at the end of study. It was also observed that the reduction in the blood sugar levels and HbA1C was comparably similar to that of glibenclamide treated rats, which shows that it might have almost same potential as that of glibenclamide in lowering sugar levels. Large number of anti-hyperglycaemic and insulin-stimulatory effects containing plants as well as extracts have also been reported (Prince *et al*., 1998;Venkateswaran *et al*., 2002;Latha and Pari, 2003a,b; Akinmoladun and Akinloye, 2004). Glycosides, alkaloid and flavonoids are important metabolites responsible for hypoglycemic effect in various plants (Loew and Kaszkin, 2002). Chamomile tea contains high levels of polyphenolic compounds such as coumarins (herniarin, umbelliferone and esculetin) and flavanoids (apigenin, leuteolin and quercetin) (Paya *et al.*, 1992; Kaneko *et al.*, 2007) which may be one of the reasons for hypoglycemic effect of chamomile in the present study. This is also in agreement with the findings of Kato *et al.* (2008) in which he studied the inhibitory effect of chamomile hot water extract and its components luteolin and quercetin on rabbits Glycogen Phosphorylase. Inhibition of glycogen phosphorylase results in reduced glycogen degradation, suggesting that one of the hypoglycemic mechanisms of chamomile and quercitin is due to inhibition of glycogen degradation hyperglycemia.

We have further confirmed these results by measuring both the fasting and postprandial glucose levels, which have been reduced significantly and also the levels of HbA1C and compared it with standard drug. In another study by Ramesh *et al* it has been reported that umbelliferone significantly elevated the plasma insulin levels as compared to diabetic control rats and reduced the blood glucose levels (Ramesh and Pugalendi, 2006). So we can say that a possible mechanism of chamomile tea may also be improvement in insulin secretion either from existing beta cells or its liberation from bounded form. This is related with the findings of Elbessoumy and Mahmoud (2013) where there was enhancement in the level of insulin in diabetic rats treated with chamomile and also reduction in the levels of HbA1C after 6 weeks treatment. To observe the long-term administration effects we have administered chamomile for two months and we have observed that chamomile have successfully controlled the transient hyperglycemia, which is usually seen after taking a meal as it has significantly decreased the random blood glucose levels in diabetic rats. However, hypoglycemic effect was also observed in normal rats when chamomile tea was administered to them. Therefore, it should be suggested that chamomile tea should be taken with sweetening agent such as sugar or honey. We have used alloxan instead of streptozotocin since the mechanism of alloxan is on pancreatic beta cells directly affecting the release of insulin (Jackson and Bressler, 1981). Our study revealed that chamomile tea can also reduce basal sugar level in non-diabetic rats but this requires further extensive study especially on humans. Chamomile tea is not only reducing the fasting and random blood glucose levels but also controlling the fluctuations in these levels as the levels of HbA1C is reduced significantly by chamomile tea indicating good control of diabetes.

Chamomile tea administration has also controlled the reduction in weight in diabetic rats as compared to diabetic control and the results were not very much different from standard. Weight reduction is normally observed in diabetes as insulin plays significant role in lipid metabolism. Insulin insufficiency leads to hypercholesterolaemia because of lipolysis in adipose tissues and protein breakdown resulting in muscle wasting and therefore weight loss (Loci *et al*., 1994; Agardh, 1999; Frayn, 1993; Brecher *et al*., 1983; Bopanna *et al*.,1997; Vasudevan and Sreekumari,2007). Thus we can say that reduction in weight was controlled probably by controlling the level of insulin.

CONCLUSION

Evidence from the present study shows that chamomile tea have a glucose lowering effects on alloxan induced diabetic rats and the effects were almost similar to that of glibenclamide so its daily consumption can be potentially useful in hyperglycemia and it can be used as a substitute of conventional drug treatment. The non-diabetic people can also consume chamomile with some sweetening agent and especially it should be taken after meals for better utilization of glucose. Further studies on molecular level are needed to reveal the mechanism involved in anti-diabetic action of chamomile.

REFERENCES

Agardh CD, Bjorgell P and Nilson EP (1999). The effect of tolbutamidein lipo-proteins and lipoprotein lipase and hormone sensitive lipase. *Diabetes Res. Clin. Pract*., **46**: 99-108.

Akinmoladun AC and Akinloye O (2004). Effect of *Aloe barbedensis* on the lipid profile and fasting blood sugar concentration of rabbits fed high cholesterol diet. *Global J. Pure Appl. Sci*., **10**(1): 139-142.

Astin JA, Pelletier KR, Marie A and Haskell WL (2000). Complementary and alternative medicine use among elderly persons: One-year analysis of Blue Shield medicare supplement. *J. Gerontol. A Biol. Sci. Med. Sci*, **55**(1): 4-9.

Bhattaram VA, Cercefe M, Cohlest C, Vest M and Deundo FH (2002). Pharmacokinetics bioavailability herbal medicinal products. *Phytomedicine*, **9**: 1-36.

Bopanna KN, Kannan J, Suchma G, Balaraman R and Ranthod SP (1997). Anti-diabetic and anti-hyperlipidemic effect of neem seed, kernal powder on alloxan diabetic rabbits. *Ind. J. Pharmacol*., **29**: 162-167.

Brecher P, Chobanian AV, Small DM, Van Sidde W, Tgercyak A and Baler J (1983). Relationship of an abnormal plasma lipoprotein to protect from atherosclerosis in the cholesterol fed diabetic rabbit. *J. Clin. Invest*, **5**: 1553-1562.

Elbessoumy AA and Mahmoud EA (2013). Biochemical and clinic opathological studies on some anti-hyperglycemic herbal preparations in alloxan induced diabetic rats. *Sch. J. App. Med. Sci*., **1**(2): 48-55.

Fidler P, Loprinzi CL, O'Fallon JR, Leitch JM, Lee JK, Hayes DL, Novotny P, Clemens-Schutjer D, Bartel J and Michalak JC (1996). Prospective evaluation of a chamomile mouthwash for prevention of 5-FU induced oral mucositis. *Cancer*, **77**: 522-525.

Frayn KN (1993). Insulin resistance and lipid metabolism. *Curr. Opin. Lipidol*., **4**: 197-204.

Grieve M (1996). A modern herbal. Dover Publications Inc. 1982. The Merck Index. 12th ed., Merck Research Labs. Division of Merck and Co. Whitehouse Station, New Jersey, p.4434.

Gupta NP, Solis NG, Avella ME and Sanchez E (1984). Hypoglycaemic activity of *Neuroleena lobata*. *J. Ethnopharmacol*., **10**: 323-327.

Hamon N (1989). Herbalmedicine. The chamomiles. *Can. Pharm. J.*, **13**: 612-612.

Hansen HV and Christensen KI (2009). The common chamomile and the scentless may weed revisited. *Taxon.*, **58**: 261-264.

Jackson JE and Bressler R (1981). Clinical Pharmacology of sulphonylurea as hypoglycemic agent: Part I. *Drugs*, **22**: 211-245.

Jackson D (2000). German Chamomile, *Matricaria chamomilla*.http://alnature.com/gallery/chamomile.htm

Kaneko T, Tahara S and Takabayashi F (2007). Inhibitory effect of natural coumarin compounds, esculetin and esculin, on oxidative DNA damage and formation of aberrant crypt foci and tumors induced by 1,2-dimethylhydrazine in rat colons. *Biol. Pharm. Bull*., **30**: 2052 -2057.

Kato A, Minoshima Y, Yamamoto J, Adachi I, Watson AA and Nash RJ (2008). Protective effects of dietary chamomile tea on diabetic complications. *J. Agric. Food Chem.*, **56**(17): 8206-8211.

Kyokong O, Charuluxananan S, Muangmingsuk V, Rodanant O, Subornsug K and Punyasang W (2002). Efficacy of chamomile-extract spray for prevention of post-operative sore throat. *J. Med. Assoc. Thai*., **85**:180-185

Latha M and Pari L (2003a). Preventive effects of Cassia auriculata L. flowers on brain lipid peroxidation in rats treated with streptozotocin. *Mol. Cell. Biochem*., **243**: 23-28.

Latha M and Pari L (2003b). Anti-hyperglycaemic effect of Cassia auriculata in experimental diabetes and its effects in key metabolic enzymes involved in carbohydrate metabolism. *Clin. Exp. Pharmacol. Physiol*., **30**: 38-43.

Loci AS, Shaabha M, Khazraji AL, Husain A and Twaija A (1994). Hypoglycemic effect of a valuable extract on some blood parameters in diabetic animals. *J. Ethnopharmacol.*, **43**: 167-171.

Loew S and Kaszkin M (2002). Approaching the problem of bioequivalence of herbal medicinal products. *Phytother. Res*., **16**: 705-711.

Maday E (1999). A study of the production of essential oils in chamomile root hair cultures. *Eur. J. Drug Metab. Pharmacokin*., **24**: 303-308.

Mann C and Staba E (1986). The chemistry, pharmacology and commercial formulations of chamomile. In Herbs, spices and medicinal plants. Recent advances in Botany, Horticulture and Pharmacology; L.E. Craker and J.E. Simon Eds; Food products Press, **1**: 235-280.

Martens D (1995). Chamomile: The herb and the Remedy. *Prover, J. Chiro. Acad. Homeo*, **6**: 15-18.

Mazokopakis EE, Vrentzos GE, Papadakis JA, Babalis DE and Ganotakis ES (2005). Wild chamomile (*Matricaria recutita L.*) mouthwashes in methotrexate-induced oral mucositis. *Phytomedicine.*,**12**: 25-27.

Merfort I, Heilmann J, Hagedorn-Leweke U and Lippold BC (1994). *In vivo* skin penetration studies of camomile flavones. *Pharmazie.*, **49**: 509-511.

Newall CA, Anderson LA and Phillipson JD (1996). Herbal medicines: A guide for health-care professionals. London: Pharmaceutical Press: pp.296.

Paya M, Halliwell B and Hoult JR (1992). Interactions of a series of coumarins with reactive oxygen species. Scavenging of superoxide, hypochlorous acid and hydroxyl radicals. *Biochem. Pharmacol*., **44**: 205-214.

Petri G and Lemberkovics E (1994). Gyogynovenyek es drogjaik muszeres vizsgalatanak lehetosegei. *Acta. Pharmaceutica Hungarica*, **64**: 87-93.

Prince P, Stanely M, Menon PV and Pari L (1998). Hypoglycaemic activity of Syzigiumcumini seeds: Effect on lipid peroxidation in alloxan diabetic rats. *J. Ethnopharmacol*., **61**: 1-7.

Ramesh B and Pugalendi KV (2006). Anti-hyperglycemic effect of umbelliferone in streptozotocin-diabetic rats. *J. Med. Food.*, **9**: 562-566.

Rao BK, Kesavulu MM and Apparao CH (2001). Antihyperglycemic activity of momordicacymbalaria in alloxan diabetic rats. *J. Ethnopharmacol*., **78**: 67-71.

Rao BK, Kesavulu MM, Giri MM and Apparao CH (1999). Anti-diabetic and hypolipidemic effects of Momordicacymbalaria Hook. fruit powder in alloxan-diabetic rats. *J. Ethnopharmacol*., **67**: 103-109.

Rodriguez-Fragoso L, Reyes-Esparza J, Burchiel SW, Herrera-Ruiz D andTorres E (2008). Risks and benefits of commonly used herbal medicines in Mexico. *Toxicol. Appl. Pharmacol.*, **227**(1): 125-135.

Saravanan R and Pari L (2005). Anti-hyperlipidemic and anti-peroxidative effect of circulatory antioxidants and lipids in diasulin, a polyherbal formulation in alloxan induced hyperglycemic rats. *BMC Complement. Alternative Med*., **5**: 14-34

Vasudevan DM and Sreekumari S (2007). Text book of biochemistry for medical student. Japee brothers medical publishers Ltd, New Delhi, pp.151-160.

Venkateswaran S, Pari L and Saravanan G (2002). Effect of Phaseolus vulgaris on streptozotocin-induced diabetic rats. *J. Med. Food*, **5**: 97-104.

Wang Y, Tang H, Nicholson JK, Hylands PJ, Sampson J and Holmes E (2005). A metabonomic strategy for the detection of the metabolic effects of chamomile (Matricariarecutita L.) ingestion. *J. Agric. Food Chem*., **53**(2): 191-196.

Weiss RF (1988). *In*: Herbal Medicine. Arcanum AB, (editor). Beaconsfield, Beaconsfield Publishers, U.K., pp.22-28.