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PLAUSIBLE EFFECT OF BOTTLE GOURD (*LAGENARIA SICERARIA*) PULP ON GLYCEMIC STATUS AND LIPID PROFILE OF THE SUBJECTS WITH TYPE II DIABETES

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ABSTRACT

The purpose of the study was to investigate the pulp waste obtained after juicing bottle gourd (*LagenariaSiceraria)* fruit belonging to cucurbitacae family, into a powdered product to be used into a dietary fibre supplement. It is reported that adequate dietary fibre is essential for proper functioning of the gut and has also been related to risk reduction for a number of chronic diseases including heart disease, certain cancers and diabetes. Therefore the study was undertaken to explore whether the pulp powder rich in fiber content exhibits any therapeutic properties when consumed by type II diabetic subjects. The study was begun with determination of acceptable dose of bottle gourd pulp powder (DBPP). Thereafter the pulp powder was administered to 25 diabetic subjects every day at fasted state for a month and baseline BMI, blood pressure of and fasting blood glucose (FBG) and serum lipids were recorded. Administration of pulp powder resulted in remarkable lowering of triglyceride and VLDL-c level ($p<0.01$) with a significant elevation ($p<0.01$) in HDL-c. A reduction in FBG and total cholesterol was also noticed though it was not statistically significant. There was significant improvement ($p<0.01$) in BMI of the subjects under study after a month with a decrease in systolic and diastolic blood pressure which was not statistically significant. These observations reveal that consumption of DBPP has therapeutic potential and may yield better results if consumed for longer duration.

KEYWORDS: *Lagenaria siceraria*, pulp powder, diabetes, glycemic status, lipid profile.

INTRODUCTION

The use of traditional medicine and medicinal plants in most developing countries, as a normative basis for the maintenance of good health, has been widely observed.[1] Vegetables reconsidered to be protective foods and highly beneficial for the maintenance of good health and prevention of diseases.[2,3] Cucurbits are vegetable crops, belonging to the family cucurbitaceae, which primarily comprised species consumed as food worldwide. Cucurbits are an excellent fruit in nature having composition of all the essential constituents required for good health of humans.[4,5] The *Lagenariasiceraria* fruit is used as immunosuppressant.[6], diuretic,[7] cardio-tonic, cardio-protective[8] and nutritive agent.[9] The fruit is also reported to be a good source of vitamin-B complex and choline as well as a fair source of vitamin-C and β-carotene.[10] It is also reported to contain Cucurbitacins, fibres, and polyphenol.[11]

Populations that consume more dietary fiber have a lower risk for chronic disease. Fiber also has beneficial effects on risk factors for several chronic diseases. Dietary fiber helps to protect against cardiovascular disease by improving blood lipid profiles, lowering blood pressure, and reducing indicators of inflammation.[12] High consumption of fiber-rich foods is one of the characteristic features of a healthy diet. The present study was carried out as a pilot study to explore whether bottle gourd pulp powder is acceptable on sensory parameters and exhibits therapeutic potential in subjects having diabetic dyslipidemia.

MATERIAL AND METHOD

Preparation of dry bottle gourd pulp powder (DBPP)

Bottle gourd pulp was procured as a by-product of bottle gourd juice extraction. The pulp remaining as leftover after bottle gourd juice extraction was collected. Following collection of the pulp it was examined whether it had any extractable water left in it and stored temporarily in refrigerator before dehydration. Bottle gourd pulp was dried in hot air oven at 40º – 50ºC for at least two days. The dried pulp was then ground to fine powder so that it may be stored in air tight containers.

Determination of acceptability of DBPP

Sensory testing is often used to determine consumer acceptability of a food product. Ten (10) Professors and Postgraduate students of the Department of Home science, (Food and Nutrition) Govt. KRG PG College, Jiwaji University Gwalior, were the panellist to judge the beverage prepared using DBPP. The Sensory evaluation was carried out for various attributes like taste ,colour, flavour consistency and appearance to determine the total scores at stated

intervals by a trained taste panel using 9-point hedonic scale system[13] (B.Srilaxmi 2007). Two sets of samples of beverage were prepared and presented to the panellists. First set of sample contained 1, 3, 5 and 7g DBPP respectively in 200ml water (B1) and the second sample contained 1, 3, 5 and 7g DBPP in thin buttermilk (B2). Water was provided for the panellists to rinse their after tasting each set of samples. The tasting was done in triplicates and the mean scores for sensory attributes were computed (Table No.1).The scores obtained for sensory attributes determined acceptability of the beverage to be administered.

Selection of the subjects

25 subjects in the age group of 40-60 years were screened for diabetes. The criterion for screening was WHO 2006. All the subjects were given counselling about the foods to be taken and avoided during the course of the study; though no strict dietary guidelines were imposed. The subjects were also advised not to change their routine lifestyle and drug therapy during the study period. Thereafter study protocol was explained to the subjects and a written consent was obtained from each participant before registering for the study. Prior to administration of DBPP anthropometric and selected biochemical parameters of the subjects were measured.

The selected subjects were asked to remain devoid of food for 12 h or overnight before collecting the blood samples. Venous blood samples were drawn; the serum was separated and stored at -20° C for analysis of biochemical parameters.

Administration of DBPP beverage

On the basis of the scores obtained during sensory evaluation of DBPP beverage it was noted that addition of DBPP up to 5 g was acceptable whereas 7g was not much liked either with water or buttermilk by the testing panel. The acceptability scores for B2 were higher as compared to B1.Therefore each participating subject was administered with 5 g DBPP beverage in freshly prepared 200 ml buttermilk on empty stomach every day early in the morning, consecutively for 30 days. Daily attendance record was maintained throughout the study period to make sure that all the subjects were regularly taking the beverage.

Measurement of anthropometric and biochemical parameters

Anthropometric measurements included determination of body weight, Body Mass Index (BMI) and waist hip ratio. Blood pressure was monitored by Sphygmomanometer. Fasting blood glucose level and lipid profile were measured at baseline and after 30 days of the study

period. Blood glucose was assessed by Glucose Oxidase-Peroxidase method, [14].TG was estimated by Glycerol phosphate oxidase-peroxidase method,[15]total cholesterol by Cholesterol oxidase-peroxidase method,[16]and HDL-c by Phosphotungstate Method.[17] All the estimations were carried out by spectrophotometric assay employing commercially available kits (crest biosystems, India Pvt Ltd), LDL-c and VLDL-c were calculated from Freidewald'sformula.Risk factor for cardiovascular diseases was calculated before and after completion of one month supplementation.

RESULT

Table 1: Determination of acceptability of DBPP beverage

S.No.	Administration of DBPP with water (B1)	Acceptability Scores	Administration of DBPP with butter milk (B2)	Acceptability Scores
1	1g	7.6	1g	8.5
2	3g	7	3g	8
3	5g	6.5	5g	7.2
4	7g	5	7g	6.4

Table-2: Mean change in Anthropometric parameters& Blood Pressure on administration of DBPP beverage

Anthropometric parameters	Before administration of DBPP beverage		After administration of DBPP beverage for 30 days		Mean % change	T -value
	Mean ± SE	SD	Mean ± SE	SD		
Weight	69.28±2.258	11.29	68.78±2.19	10.97	0.721	3.623**
BMI	26.39±0.692	3.46	26.21±0.674	3.37	0.68	3.214**
Waist/hip ratio	0.97±0.008	0.04	0.98±0.006	0.03	↑-1.03	2.500
Blood Pressure						
Systolic	125.20±2.048	10.24	124.40±1.608	8.04	0.638	0.473
Distolic	79.60±1.198	5.99	78.80±1.176	5.88	1.005	1.020

Data collected before and after therapy was analysed by paired t-test. Levels of significance were represented in the form of (**) for 99 % ($P<0.001$) significance and (*) represented for 95 % ($P<0.05$) significance.

Table-3: Mean change in Fasting Blood Glucose & lipid Profile on administration of DBPP beverage

Blood glucose & lipid profile	Before administration of DBPP beverage		After administration of DBPP beverage for 30 days		Mean % change	T –value
	Mean ± SE	SD	Mean ± SE	SD		
Fasting Blood Glucose (mg/dl)	137.02 ±8.01	40.06	135.66±7.83	39.18	0.99	0.238
Total Cholesterol (mg/dl)	154.68 ± 4.97	24.86	153.44 ±4.11	20.59	0.80	0.331
Triglycerides (mg/dl)	193.04 ± 6.04	30.20	155.38 ±5.10	25.51	19.5	8.173**
HDL-c (mg/dl)	30.32 ± 1.50	7.51	32.94 ±1.54	7.74	7.9	3.680**
VLDL-c (mg/dl)	38.61 ± 1.20	6.03	31.08 ±1.02	5.10	19.50	8.184**
LDL-c (mg/dl)	85.79 ± 4.43	22.16	89.50 ±3.65	18.25	-4.32	1.052

Data collected before and after therapy was analysed by paired t-test. Levels of significance were represented in the form of (**) for 99 % (P<0.001) significance and (*) represented for 95 % (P<0.05) significance

Table-4: Mean change in Cardiac risk factor on administration of DBPP beverage

Cardiac risk factors	Before administration of DBPP beverage		After administration of DBPP beverage for 30 days		Mean % change	T –value
	Mean ± SE	SD	Mean ± SE	SD		
Cardiac Risk Ratio(CRR)	5.31 ± 0.23	1.15	4.87 ±0.21	1.07	8.28	2.903**
Atherogenic Coefficient(AC)	4.31 ± 0.23	1.15	3.87 ±0.21	1.07	10.20	3.333**
Atherogenicity Index of Plasma(AIP)	0.81 ± 0.02	0.12	0.68 ±0.02	0.11	16.04	13.000**

Data collected before and after therapy was analyzed by paired t-test. Levels of significance were represented in the form of (**) for 99 % (P<0.001) significance and (*) represented for 95 % (P<0.05) significance.

DISCUSSION

Hyperglycemia is a pathological condition associated with prediabetes and diabetes. Currently, management of hyperglycemia includes pharmacological interventions, physical exercise, and change of life style and diet. Food supplements have increasingly become attractive alternatives to prevent or treat hyperglycemia, especially for subjects with mild hyperglycemia.[18] Diet rich in dietary fiber is beneficial for the treatment of type 2 diabetes

mellitus[19], as dietary fiber ameliorates postprandial hyperglycemia by delaying digestion and absorption of carbohydrates and enhances satiety, which leads to a reduction in body weight.[20]

Most important risk factors for chronic diseases, such as hypertension, diabetes, obesity, and dyslipidemia, are also less common in individuals with the highest levels of fiber consumption.[21]The objective of the present study was to administer fiber in the form of DBPP and to determine the extent to which dried bottle gourd pulp powder (DBPP) intervention influences glycemic control and dyslipidemia in patients with type 2 diabetes mellitus whose metabolism is impaired despite receiving optimized drug therapy.

Effect of DBPP beverage on BMI, W/H Ratio, and Blood Pressure of diabetic subjects is shown in Table 1.A significant reduction (P<0.01) was found in body weight and BMI whereas slight increment in W/H ratio was seen in the subjects under study. Increasing consumption of dietary fiber with fruits, vegetables, whole grains, and legumes throughout one's lifetime is a critical step in restricting the epidemic of obesity found in developed countries. A study reported that in a 20-month period, every 1 g increase in total fiber consumed per day, decreased body weight by 0.25 kg.[22]Our findings are further supported by another study which reported that addition of functional fiber to weight loss diets should also be considered as a tool to improve success.[23] A marginal decrease was observed in systolic blood pressure (0.63%) and diastolic blood pressure (1.00%) in the subjects.

Fasting blood glucose level and lipid profile of the subjects administered with DBPP beverage has been presented in table no. 2, which indicates a remarkable improvement (P<0.01) in T G-c (mean reduction of19.5 %), HDL-c (mean increment of 7.9%),and VLDL-c levels (mean reduction of 19.5 %).Positive effects of fruits and vegetables have been attributed to dietary fibers, antioxidants, and especially phenolic compound.[24,25]Fibers and polyphenols are capable of improving the lipid profile in cardiovascular patients. Several dietary fiber sources lower LDL cholesterol levels. These include foods such as apples, barley, beans and other legumes, fruits and vegetables, oatmeal, oat bran and rice hulls, and purified sources such as beet fiber, guar gum, karaya gum, knojacmannan, locust bean gum, pectin, psyllium seed husk, soy polysaccharide and xanthan gum.[26]

Appreciable improvement was noticed in fasting blood glucose andTC and LDL level. However; the reduction of TC and LDL concentration observed in intervention group was not

significant compared to the concentration measured before the study. Several cohort studies support a strong inverse relationship between dietary fiber consumptions and development of type II diabetes. The mechanism by which dietary fibre exerts hypoglycaemic effect includes inhibiting amylase activity, glucose adsorption and glucose diffusion.[27] Apart from hypoglycemic effect, dietary fibre also exerts hypocholesterolemic effect by binding bile salts leading to their increased fecal excretion.[28,29] This in turn promotes utilization of endogenous cholesterol in bile salt synthesis leading to an overall hypocholesterolemic effect. Probably these effects of dietary fiber resulted in significant improvement in cardiac risk factors like CRR, AC and AIP of the subject in the present study. It is possible that intake of pulp powder for a longer duration could have exhibited more improvement in fasting blood glucose, TC and LDL.

CONCLUSION

On the basis of the encouraging results obtained in this study, a research work for longer duration may be planned and the pulp powder possibly be incorporated into food products so as to develop fiber rich food formulations with therapeutic implication. At the same time this approach will prevent fruit and vegetable waste generated after processing and probably be useful from health and nutrition point of view.

REFERENCES

1. UNESCO. Culture and Health, Orientation Texts -World Decade for Cultural Development 1988-1997, Document CLT/DEC/PRO - 1996, Paris, France: UNESCO; 1996; 29.
2. Sheela, K., Kamal, G.N., Vijayalakshmi, D., Geeta, M.Y., Roopa, B.P. Proximate analysis of underutilized green leafy vegetables in southern Karnataka. Journal of Human Ecology, 2004; 15: 227-229.
3. Nnamani CV, Oselebe HO, Okporie EO (2007). Ethnobotany of Indigenous Indigenous Leafy Vegetables of Izzi Clan, in Ebonyi State, Nigeria. In:Proceeding of 20th Annual National Conference of BiotechnologySociety of Nigeria. Abakaliki, November 14th - 17th, p. 111-114.
4. Rahman A.S.H. Bottle Gourd (Lagenariasiceraria)-a vegetable for good health.Natural Product Radiance, 2003; 2(5): 249-250.
5. Duke J.A., Handbook of Phytochemical and Constituents of GRASS herbs and other economic plants, Boca, Raton, CRC Press, FL, 1999; 98-119.

6. Sankari M., Chitra V., Jubilee R., SilambuJanaki P., and Raju D., Der Pharmacia Lettre, 2010; 2(1): 291-296.
7. Ghule B.V., Ghante M.H., Yeole P.G., and Sauji A.N., Ind. J. Pharm. Sci., 2007; 69(6): 817-819.
8. Fard M.H., Bodhankar S.L., and Dikshit M., Cardioprotective activity of fruit of Lagenariasiceraria (Molina) Standley on Doxorubicin induced cardiotoxicity in rats. Int. J. Pharmacol, 2008; 4(6): 466-471.
9. Rahman A.H.M.M., Anisuzzaman M., Ahmed F., Rafiul Islam A.K.M. and Naderuzzaman A.T.M, J. of Applied Sci. Res, 2008; 4(5): 555-558.
10. Kirtikar K.R., and Basu B.D., Indian Medicinal Plants.2nd Edition, Dehradun, Oriental Enterprises, 2001.
11. Nadkarni A.K., Indian Material Medica, 3rd Edition, Vol.1, Bombay Popular Book Depot, India, 1954; 181.
12. Position of the American Dietetic Association: Health Implications of Dietary Fiber. J Am Diet Assoc, 2008; 108: 1716-1731.
13. B.Srilakshmi "food Science" Sensory evaluation, New Age International (p) Ltd, 2007; 4: 297-298.
14. Raabo E, Terkildsen TC. On the enzymatic determination of blood glucose. Scandinavian Journal of Clinical and Laboratory Investigation, 1960; 12: 402–7.
15. Fossati P, Prencipe L. Serum triglycerides determined colorimetric ally with an enzyme that produces hydrogen peroxide. Journal of Clinical Chemistry, 1982; 28(10): 2077-2080.
16. Stockbridge H,HardyRI, GlueckCJ. Public cholesterol screening: motivation for participation, follow-up outcome, self-knowledge, and coronary heart disease risk factor intervention. Journal of Laboratory of clinical medicine, 1989; 114(2): 142-151.
17. Lopes-Virella MF, Stone P, Ellis S, Colwell JA. Cholesterol determination in high-density lipoproteins separated by three different methods. Journal of Clinical Chemistry, 1977; 23(5): 882-884
18. Deng R.A review of the hypoglycemic effects of five commonly used herbal food supplements.Recent Pat Food Nutr Agric, Apr 2012; 4(1): 50-60.
19. American Diabetes Association: Standards of medical care in diabetes-2013**.**Diabetes Care, 2013; 36(1): S11-S66.
20. Post RE, Mainous AG III, King DE, Simpson KN**:** Dietary fiber for the treatment of type 2 diabetes mellitus: a meta-analysis.*J Am Board Fam Med* 2012; 25: 16-23.

21. LaironD,ArnaultN,Bertrais S. Dietary fiber intake and risk factors for cardiovascular disease in French adults. AmJ. clinNutri Rev, 2005; 82: 1185-1194.
22. Tucker, L.A.; Thomas, K.S. Increasing total fiber intake reduces risk of weight and fat gains in women. J. Nutr, 2009; 139: 576–581.
23. Joanne L. Slavin, Dietary fiber and body weight Nutrition, 2005; 21(3): 411-418.
24. Leontowicz H, Gorinstein S, Lojek A, Leontowicz M, Ci, z M, et al. Comparative content of some bioactive compounds in apples, peaches and pears and their influence on lipids and antioxidant capacity in rats. J NutrBiochem, 2002; 13(10): 603-10.
25. Alvarez-Parrilla E, De La Rosa LA, LegarretaP,Saenz L, Rodrigo-Garcia J, Gonzalez-Aguilar GA. Daily consumption of apple, pear and orange juice differently affects plasma lipids and antioxidant capacity of smoking and non-smoking adults. Int J Food Sci Nutr, 2010; 61(4): 369-80.
26. American Diabetes Association. Standards of medical care in diabetes. Diabetes Care 2008; 31(1): 54.
27. Ou, S., Kwok, K., Li, Y. and Fu, l., "*In vitro* study of possible role of dietary fiber in lowering postprandial serum glucose," *The Journal of Agricultural and Food Chemistry*, 2001; 49: 1026-1029.
28. Wang, W., Onnagawa, M., Yoshie, Y. andSuzuki, T., "Binding of bile salts to soluble and insoluble dietary fibers of seaweeds", *Fisheries science*, 2001; 67: 1169-1173.
29. Dongowski, G., "Interactions between dietary fibre-rich preparations and glycoconjugated bile acids*in vitro*", *Food Chemistry*, 2006; 104(1): 390-397.