Hypoglycaemic Effect of Alcoholic Extracts of the Leaves of Abroma Augusta & Gymnema Sylvestre Plants in Type II Diabetes Mellitus Patients

H. Venkatesan[1], S. A. Karthi [2]

[1] Research Coordinator and Associate Professor, [2] Intern, Dept of Practice of Medicine, Vinayaka Mission's Homoeopathic Medical College & Hospital, A Constituent College of Vinayaka Mission's Research Foundation (Deemed to be University), NH 47, Sankari Main Road, Seeragapadi, Salem, Tamil Nadu, India

Abstract

Diabetes mellitus is the most common disease of the world causing much Morbidity. It is very evident that the incidence of this disease is rapidly increasing in both developed and developing countries. Also the mean age of acquiring the disease is lowering day by day. The Diabetes mellitus is classified into many types like, Type I / Juvenile, Type II / Non-insulin dependent, Gestational Diabetes, etc., But irrespective of the type affected, the patients suffer equally. India is having the largest Diabetic population of the world. So at this context the Natural Herbal Medicines which can have a Good Diabetic Control should be tested on the patients and reported effectively.

Leaves of *Abroma augusta* belonging to Malvaceae family is traditionally being used to treat Diabetes mellitus in India and Southern Asia. Thin-layer chromatography studies revealed the presence of Abromine (betaine), Triterpenoids, Flavonoids and Phenolic compounds in *Abroma augusta* L which are found to be Anti-diabetic. *Gymnema sylvestre* belonging to Asclepiadaceae family found in central and peninsular India is a potent Anti-diabetic plant used in folk, Ayurvedic and Homeopathic systems of medicine. *Gymnema sylvestre* leaves contain Gymnemic acids that have Anti-diabetic, Anti-sweetener and Anti-inflammatory activities.

These details intended us to carry out an Experimental Study on Type II Diabetes mellitus patients. The alcoholic extracts of *Abroma augusta* and *Gymnema sylvestre* were compared for their Hypoglycaemic effects by means of a Randomized Control Trial on Type II Diabetes mellitus patients which was executed with a Placebo control group for higher significance. Pre & Post Treatment Fasting Blood Glucose Levels were analyzed statistically. By the end of the study both the extracts showed Statistically good Hypoglycaemic effect with a P Value < 0.00001. *Gymnema sylvestre* (Mean lowering modulation – 29.03 mg/dL) has proved to be slightly more effective than *Abroma augusta* (Mean lowering modulation – 26.00 mg/dL).

Key Words: *Abroma.augusta, Abromine, Betaine, Gymnemic acids, Gymnema sylvestre, Type II Diabetes Mellitus, Hypoglycaemic.*

Introduction

Diabetes mellitus is the World's leading Non-Communicable disease and India is having the largest Diabetic population of the world.[1,2] Diabetes mellitus is a group of metabolic disorder involving carbohydrate, lipid and protein metabolism characterized by chronic hyperglycaemia, as a result of defects in insulin secretion from β – cells of pancreas or peripheral action of insulin or both.[3] The Diabetes mellitus is classified into many types like, Type I / Juvenile, Type II / Non-insulin dependent, Gestational Diabetes, etc., But irrespective

Corresponding Author:
Email: venkathompath@gmail.com
Mobile: +91 98651 34561; +91 86678 53212

of the type affected, the patients suffer equally.[4] This is often associated with other disorders like central obesity, hypertension and dyslipidaemia. [5]

The economic burden of diabetes mellitus and its complications are very high and increasingly affecting the lives of urban poor.[6,7] Number of people with diabetes across the world has risen from 108 million in 1980 to 422 million in 2014. WHO projects that diabetes will be 3rd leading cause of death in 2030.[8] It was estimated that India had 65.1 million adults with diabetes in 2013, and had the 2nd position among the top 10 countries with the largest number of diabetes. This number is predicted to increase to 109 million by 2035 unless steps are taken to prevent new cases of diabetes.[9] Prevalence of impaired glucose tolerance is also high in the urban population. Subjects under 40 years of age have a higher prevalence of impaired glucose tolerance than diabetes. The important risk factors for high prevalence of diabetes include: High familial aggregation, obesity specially central one, insulin resistance and lifestyle changes due to rapid urbanization.[10]

Young-onset Type II Diabetes mellitus seems to be an aggressive disease owing to the rapid deterioration of metabolic function. This deterioration coincides with high levels of other risk factors for CVD and disease progression frequently leads to the development of microvascular and macrovascular complications at an early age, with associated premature mortality. These adverse outcomes occur at higher rates than in Type I Diabetes mellitus and late-onset Type II Diabetes mellitus.[11]

Recent researches explore the effectiveness of many traditional herbs in treatment of Lifestyle disorders. 'Abroma agusta - Devil's cotton' and 'Gymnema sylvestre - Australian cowplant' are such herbs which are traditionally used in treating Diabetes mellitus.[12-15] But only few researches have been carried out with these herbs in justifying their judicious use. These details intended us to do a comparative study of the effectiveness of the Alcoholic extracts of these plants in controlling serum glucose levels of Type II Diabetes mellitus patients with a placebo control arm.

Materials & Method

Methodology used was Single Blind Comparative Experimental Study design of two parallel groups with a placebo control group. Patient Selection (Sampling) was made according to the following inclusion, exclusion criteria 30 patients were selected by Random Sampling Method. Both male & female Type II Diabetes Mellitus Patients belonging to the age group of 35 - 65 yrs [3] with Fasting Blood Glucose levels more than or equal to 126 mg/dL[3] were included in this study. Type II Diabetes Mellitus Patients with systemic complications & other systemic diseases were excluded. 'Systematic Random Sampling' method was adopted to assign patients in 3 Treatment Groups. Data collection was made by Case taking, Investigatory findings, Past history, Medical Reports & Diabetic Risk Screening Questionnaire.

Operational Design: [16]

As per the study protocol 30 Type II Diabetes Mellitus patients were selected randomly from Medical Unit IV of Vinayaka Mission's Homoeopathic Medical College Hospital, Salem, Tamilnadu in the period between 01.11.2016 to 31.12.2016. The Institutional Ethics Committee approval for this study was ordered on 26.10.2016. This Study was registered under Clinical Trial Registry of India with Reg. No: CTRI/2017/11/010528. The selection of cases was made on careful consideration of the Inclusion and Exclusion Criteria. The 'Case History' of each patient was recorded in a Standardized Case Format to evaluate and to rule out any co-morbid diseases or complications. 'Informed Patient Consent' in their local language was obtained from each patient. Then these selected patients were allotted equally in the 3 Treatment Groups by 'Systematic Random Sampling Procedure' such that each group carried 10 patients. Considered Treatment Groups were, **Group-A**: Alcoholic extract of Abroma. augusta; **Group-B**: Alcoholic extract of Gymnema sylvestre & **Group-C**: Dispensing alcohol as Placebo. The Pre treatment Fasting Blood Glucose Levels of each patient were tested and recorded. Few patients were found already under other Medications for Diabetes mellitus; they were prescribed with placebo for a month and then included in the study.

Each patient was given their respective Treatment for at least 2 months i.e, 60 days. They were prescribed with 10 drops of their respective alcoholic plant extracts / Dispensing alcohol mixed with 10 ml of water orally

in morning and night every day after food. The Patients were blinded to know the name of the medicines they were prescribed with, by coding the medicines as A / B / C. Also the placebo was prescribed in the form of "Dispensing Alcohol" so as to make it similar to other extracts. All the patients were explained about 'Diabetic Diet' and advised to follow, which was closely monitored. The Fasting Blood Glucose Levels of each patient were tested at 3rd, 6th and 9th Weeks of Treatment. Some Sample Characters like Age Distribution, Gender Distribution, etc., were analyzed. This study was carried out during November 2016 to March 2017 at Medical Unit IV of Vinayaka Mission's Homoeopathic Medical College Hospital, NH 47, Sakari Main Road, Seeragapadi, Salem, Tamilnadu, Pincode - 636308.

Statistical Analysis of Outcome:

The Pre Treatment and Post Treatment (Average of 3rd, 6th and 9th Week Values) Fasting Blood Glucose Levels were considered for Statistical Analysis using "Analysis of Variance - ANOVA".[17] The Statistical Analysis was prepared both manually and with the 'Statistical Package for Social Sciences.22 – SPSS' software.

Laboratory Investigatory Method / Procedure:

Fasting Blood Glucose Measurements were made by 'Glucose Oxidase - Peroxidase (GOD / POD) Method'. The Diagnostic Kit of 'Beacon Diagnostics Pvt. Ltd' was used for this. The Standard Normal Fasting Blood Glucose Value for this kit / method is ranging between 70 to 110 mg / dl.

Properties of the Plants:

Abroma augusta belonging to Malvaceae family, an evergreen shrub, is found throughout the hot and humid parts of India. Leaves and seeds of *Abroma augusta* are considered to be edible in India, South Asia and New Guinea. Its Leaves are used as a remedy for diabetes, inflammation, rheumatic pain of joints, uterine disorders, and headache. Thin-layer chromatography studies revealed the presence of Abromine (betaine), Triterpenoids, alkaloids, steroids, triterpenes, flavonoids, megastigmanes, and phenylethanoid glycosides which are found to be Anti-diabetic.[18-20]

Gymnema sylvestre belonging to Asclepiadaceae family found in central and peninsular India is a potent Anti-diabetic plant used in folk, Ayurvedic and Homeopathic systems of medicine. *Gymnema sylvestre* leaves contain Gymnemic acids that have Anti-diabetic, Anti-sweetener and Anti-inflammatory activities. It renders glucose lowering activity due to the presence of phytochemicals, such as gurmarin, gymnemic acid as well as gymnemasaponins. Its leaves are known to have anti-oxidant, antibiotic, anti-inflammatory, antiviral, gastro & hepato-protective, anticancer & lipid-lowering activities.[21-23]

Alcoholic Extracts of the Plants:

The preparation of the alcoholic extract of leaves of Abroma agusta is to be done by macerating 1 part of freshly collected moist magma of its leaves with 10 parts of 95 v/v % alcohol for 14 to 28 days. The alcoholic extract of Gymnema sylvestre should be prepared by macerating 1 part of coarse powder of its leaves with 10 parts of 95 v/v % alcohol for 14 to 28 days. It should be shaken occasionally, and filtered. So obtained alcoholic extracts will be having the drug strength of 1/10 and this will be called as Homoeopathic Mother Tincture. Such prepared extracts should be standardized by using various physical, chemical and chromatographic parameters.[24] For this study the alcoholic extracts manufactured by Sharda Boiron Laboratories Ltd, SBL House, Commercial Complex, Shrestha Vihar, Delhi-110092, India were used. Sharda Boiron Laboratories Ltd is an ISO 9001:2000 certified company and the products produced by it are GMP certified.[25]

Results

Observations:

Study showed a Maximum Prevalence of Type II Diabetes mellitus in the Age Group between 46 & 55 Years (56.67%) and in Males (66.67%).

Fasting Blood Glucose Levels of the Patients:

The Fasting glucose levels of the patients & their modulations before, during and after treatment in the 3 groups are shown in the Figure 1.

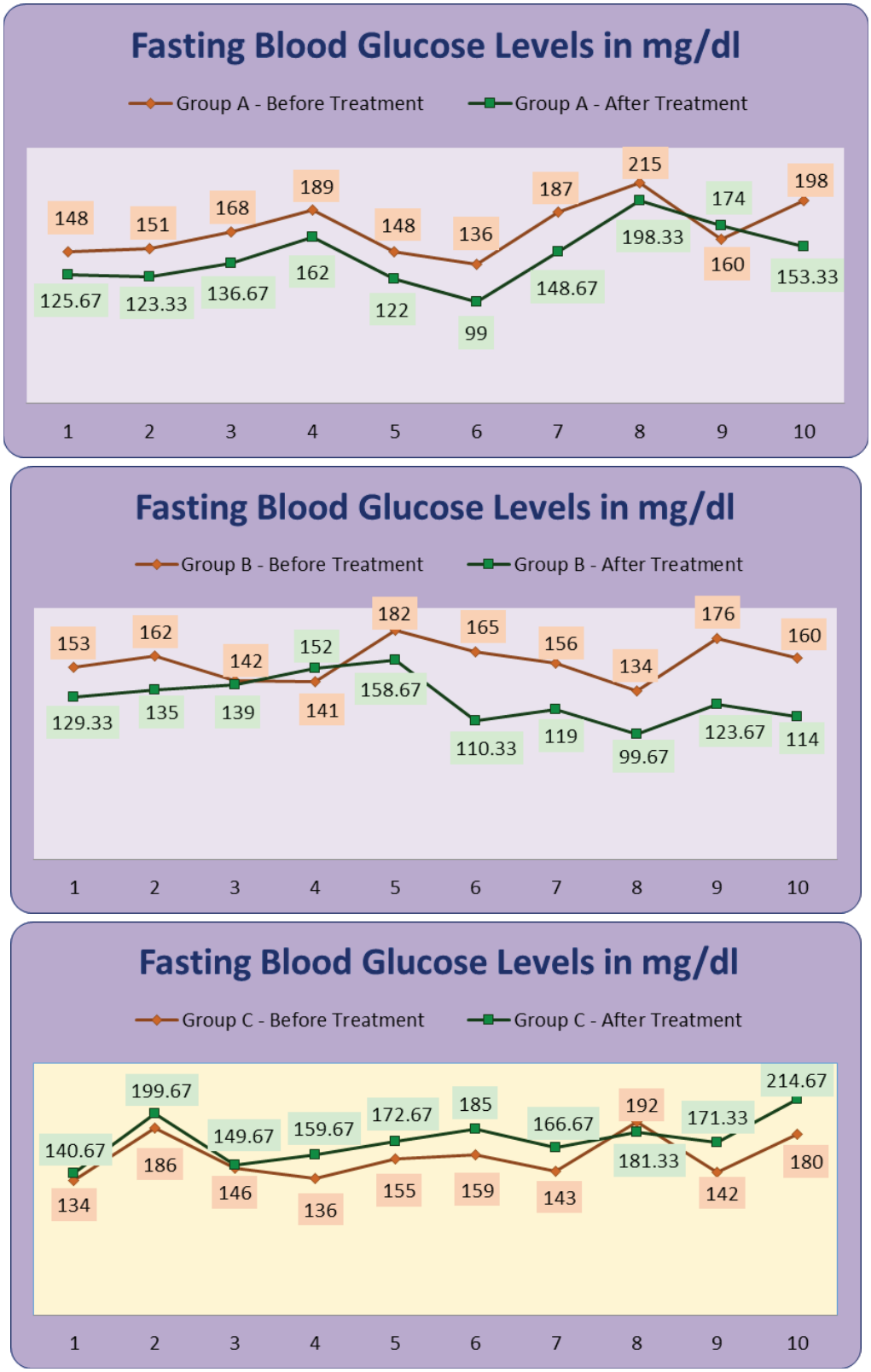

Figure 1. Fasting Blood Glucose Levels of Patients Before & After treatment

Descriptive Statistics:

Descriptive Statistics of Modulation of Fasting Blood Glucose Levels in mg/dL before and after Treatment is shown in Table 1 and Figure 2.

Table 1. Descriptive Statistics of Modulation of

Fasting Blood Glucose Levels in mg/dL before and after Treatment

	Minimum	**Maximum**	**Median**	**Mean**	**Std. Deviation**	**Confidence Interval @ 95% LOS**
Group A Before treatment	136.00	215.00	164.00	170.0000	25.92296	170.0000 ± 16.05
Group A After treatment	99.00	198.33	142.67	144.3000	29.07781	144.3000 ± 17.97
Group B Before treatment	134.00	182.00	158.00	157.1000	15.31484	157.1000 ± 09.48
Group B After treatment	99.67	158.67	126.50	128.0670	18.55604	128.0670 ± 11.46
Group C Before treatment	134.00	192.00	150.50	157.3000	21.38042	157.3000 ± 13.26
Group C After treatment	140.67	214.67	172.00	174.1350	22.25698	174.1350 ± 13.82

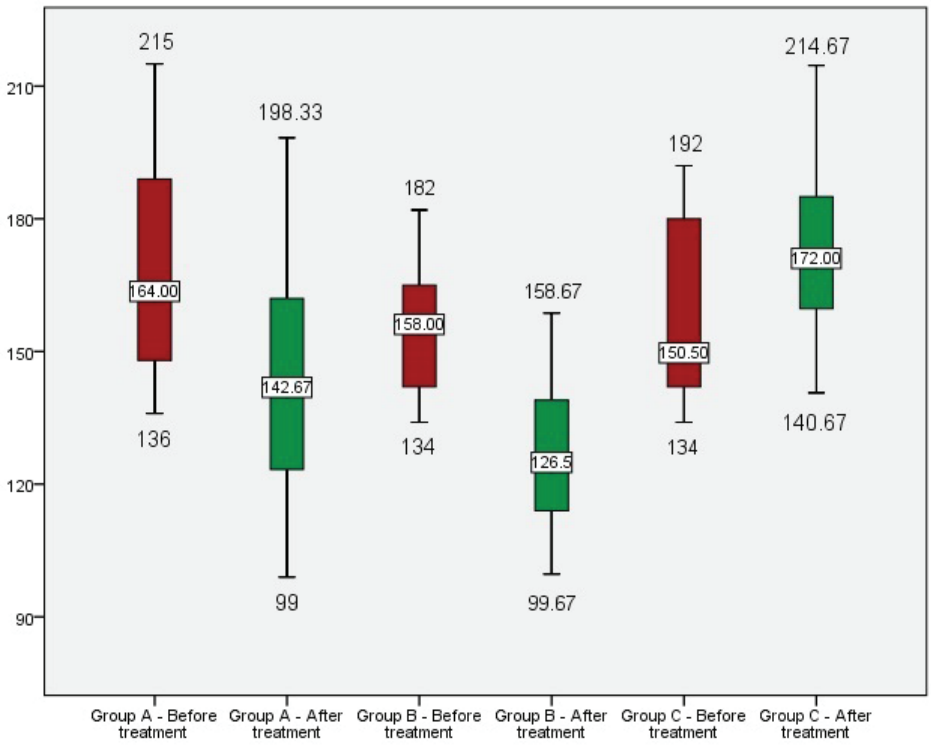

Figure 2. Box plot of Fasting Blood Glucose Levels in mg/dL

ANOVA Results:

'Analysis of Variance' of before & after treatment modulations in Fasting Blood Glucose levels between the groups is highly statistically significant both at 95% and 99% Confidence Levels with a P Value < 0.00001. Since the p Value calculated is < 0.00001, the modulation is highly significant and this is not due to any chance.

Discussion

Both the alcoholic extracts of leaves of Abroma agusta (26 mg/dL) & Gymnema sylvestre (29 mg/dL) have marked Hypoglycaemic effect. When compared Gymnema sylvestre had shown a slight more lowering effect than the Abroma agusta. The effectives of the Hypoglycaemic effects are graded as shown in the Figure 3. The Placebo Control Group C does not show any such effects.

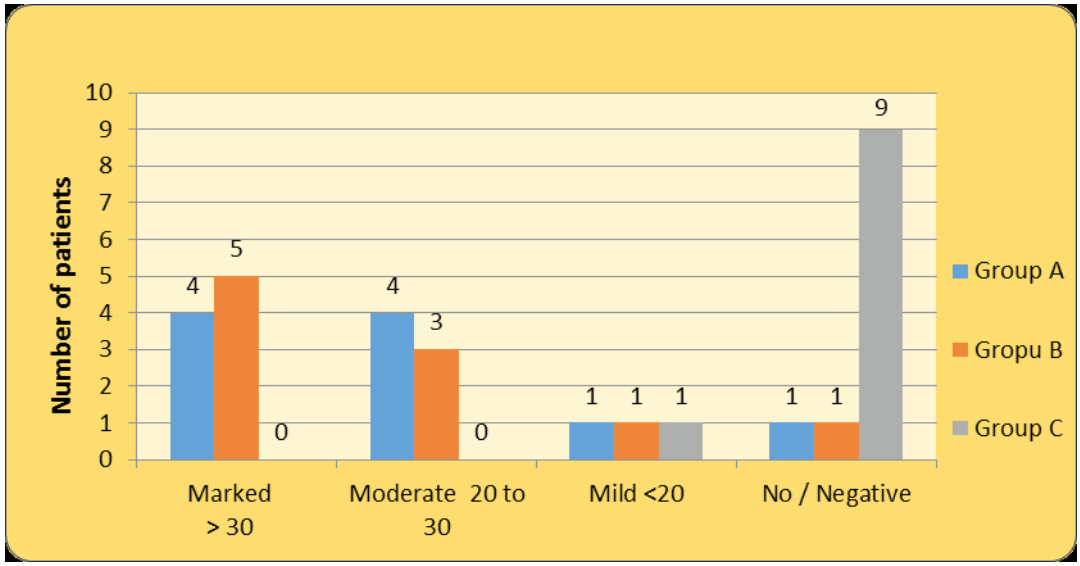

Figure 3. Grand Modulation of Fasting Blood Glucose Levels of the Patients

Conclusion

This 'Single Blind Placebo Controlled Comparative Experimental Study' proved that both the alcoholic extracts of the leaves of Abroma agusta and Gymnema sylvestre had a Good Hypoglycaemic effect on Type II Diabetes mellitus patients. Such that both the plant extracts can widely be used in the treatment of Type II Diabetes mellitus patients to maintain their blood glucose levels within normal range.

Ethical Clearance: Has been taken from the 'Institutional Ethics Committee' of Vinayaka Mission's Homoeopathic Medical College and Hospital, Salem, Tamilnadu, India. (Ref.No: VMHMC/IEC/01/2016 dated 26.10.2016)

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Conflict of Interest: Nil.

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