

Original Research Article

Comparison and effectiveness of complementary and alternative medicine as against conventional medicine in the treatment and management of type 2 diabetes

Abstract

Aim: The main objective of the study was to compare, using laboratory data, the efficacy of herbal medicine against pharmaceutical drugs in treating and managing diabetes among type 2 diabetic patients.

Methodology: Patients were included in the study from an Herbal Clinic and the Diabetic Clinic at the Georgetown Public Hospital after giving their consent and satisfying the inclusion criteria. Laboratory analysis was done and analyzed using SPSS version 17 with a p-value of 0.05 is being used to determine statistical significance.

Results: Age, religion, ethnicity, education, marital status and monthly income were all found to have significant associations with the use of herbs. Persons using herbal medicine alone had normal HBA1C, FBS, and lipid profile. The most common herbs used were *Momordica charantia* and *Azadirachta indica*, which were used in combination or alone. Results showed a positive effect on coronary heart disease risk.

Conclusion: The information generated from the study indicated that a significant number of diabetic patients using herbs alone had normal results. However, a more controlled study is required to validate these results.

Key words: *herbal medicine, complementary medicine, type 2 diabetes, alternative medicine*

26 1. INTRODUCTION

27 Diabetes mellitus (DM) is a metabolic disorder that has become a significant and growing public health
28 problem worldwide. Wanchai & Phrompayak conveyed World Health Organization (WHO) statistics of 1.5
29 million deaths due to diabetes in 2012 with 80% occurring in low and middle-income countries. Moreover,
30 WHO had also reported that in 2014, 9% of adults aged 18 years and older had been diagnosed with DM.
31 DM has been predicted to become the seventh leading cause of death by 2030 with the International
32 Diabetes Federation envisaging a rise in prevalence of 642 million people by 2040 and a rise in the
33 annual global healthcare spending on DM to \$US 802 billion ^[1].

Comment [a1]: and

Comment [a2]: had instead of have

34
35 DM treatment can be broadly divided into two approaches: conventional medicine and alternative
36 medicine ^[1]. In diabetics patients, significant improvements can be achieved by treatment with
37 hypoglycemic or anti-hyperglycemic, insulin sensitizing, and insulin secretion enhancing drugs ^[2].
38 However, although many drugs improve glycemic control, studies have shown that side effects are still
39 frequently reported when using these therapeutic regimes. Meta-analyses from different studies have
40 showed that intensive glycemic control using metformin, sulfonylurea, and thiazolidinediones increased
41 cardiovascular and mortality risk whilst long-term thiazolidinedione use increased the risk of fracture,
42 lower respiratory tract infection, and bladder cancer among those with diabetes. These reports have
43 prompted the search for complementary and alternative medicine (CAM) for better management of
44 diabetes and its related complications ^[2, 3].

Comment [a3]: diabetics

45
46 Wanchai & Phrompayak categorized CAM into two categories: natural products and practices of the body
47 and mind. Natural products include herbs, vitamins, minerals and probiotics. Practices of the body and
48 mind include a diverse group of procedures or techniques administered or taught by a trained practitioner,
49 such as "yoga, chiropractic and osteopathic manipulation, meditation, massage, acupuncture, relaxation
50 techniques (*i.e.*, breathing exercises, guided imagery, and progressive muscle relaxation), Taichi, Qigong,
51 healing touch, hypnotherapy and movement therapy". In addition, other complementary health
52 approaches that may not neatly fit into either of these two groups such as the practices of healers from
53 the traditions of Ayurvedic medicine, Chinese medicine, homeopathy, and naturopathy ^[1]. Some studies
54 on CAM use showed inconsistent results. Prevalence of CAM use ranges from 34-38% ^[4, 5, 6]. In studies
55 related to CAM use by DM patients, the prevalence of CAM use varies from 17% to 80% ^[1, 7, 8]. These
56 studies have also reported that the most commonly used CAM therapies in patients with diabetes should
57 be nutritional advice and lifestyle diets, herbal remedies, supplements, spiritual healing, and massage
58 therapy and meditation training.

59
60 Thai diabetic patients relied mostly on a modified version of Taichi, Daode Xinxi technique were as
61 nutritional supplements were common among T2D patients in Taiwan, China, whilst Iranians with DM
62 used herbal remedies ^[1]. The possible reasons for these differences may be due to the differences in
63 culture, socioeconomic status and geographic contexts.

64 Herbal remedies in particular are quite popular in the management of diabetes as from the patient
65 perspective, it may be considered very acceptable to include plants as part of their medical intervention
66 based on the recognition that herbal intervention is considered to be natural and have been part of culture
67 and practices for many generations ^[9].

68
69 Guyana is a country steeped in culture and folklore due to its multiracial beginning. Consequently the use
70 of herbal remedies for ailments has been passed down from generation to generation and it is therefore
71 not surprising that with the upsurge of diabetes, Guyanese may take to herbs to combat this disease. This
72 study was done using laboratory studies, to compare the efficacy of herbal medicine used against
73 prescribed medicine among diabetic patients. It is stated that a high level of knowledge or awareness will
74 affect the outcome of the disease, regardless of race or the geographic location of the various sample
75 populations. Therefore, by providing knowledge on how effective herbal medicine is in managing diabetes
76 in Guyana, there can be better patient outcomes.

77
78 Since most of the studies concerning herbal remedies affects and use were done in other countries, the
79 results might not be applied for Guyanese patients appropriately due to differences in culture, behaviors,

socioeconomics and other factors. Using herbs that have no proven clinical benefit to patients, may lead to delays in seeking appropriate treatment, leading to severe diabetes related complications and associated disability and mortality. The authors are conducting this research to determine factors associated with the use of herbal medicine and quality of life affects for Guyanese diabetic patients. The aim of this study was to compare, using laboratory analyses, the efficacy of herbal medicine used against prescribed medicine among diabetic patients in Guyana.

2. METHOD

A total of sixty diabetic patients (diagnosed for at least six months) from both public medical clinics and a private herbal clinics were enrolled in the study. Patients attending medical clinic and using prescribed medication alone, for the past six months to manage their diabetes were enrolled. Patients attending herbal clinic using herbal medicine alone for the past six months to manage their diabetes. Healthy individuals from outpatient clinic were enrolled as controls.

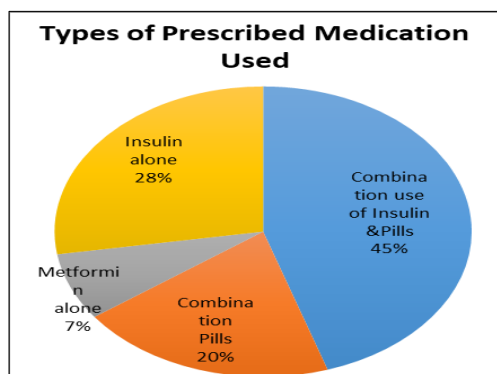
A semi-structured questionnaire was used to collect socioeconomic status of participants and other relevant data. Biochemistry and hematology reports of each participants were also collected for analyses. The study was a prospective convenience based study with mixed method approach. Data was analyzed using Statistical Package for Social Science (SPSS) version 20.0.

3. RESULTS AND DISCUSSION

3.1 Socio-demographic status

The study had a higher percentage of females than males ($p \leq 0.05$) and most participants were in the age group >60 . Significantly higher percentage of participants was in East Indian ethnic group ($p \leq 0.05$). Almost 43.8% participants had secondary education and most (47.5%) were married. Majority of the participants were unemployed (42.5%) with most having annual income between 50, 000-100, 000 ($p \leq 0.05$). Significantly higher percentage of patients were ≤ 45 years when diagnosed with Diabetes mellitus ($p \leq 0.05$) Figure 1.

Figure 1. Demonstrates types of prescribed medication used.



Most participants (45%) used combination of insulin and OHA (either Metformin, Daonil or both) for control of DM. Figure 2 shows the different types of herbal medicine used by the participants. Karela (27%) were used by majority of the participants followed by Karela and Neem combination (28%), followed by Karela and Cinnamon combination (22%).

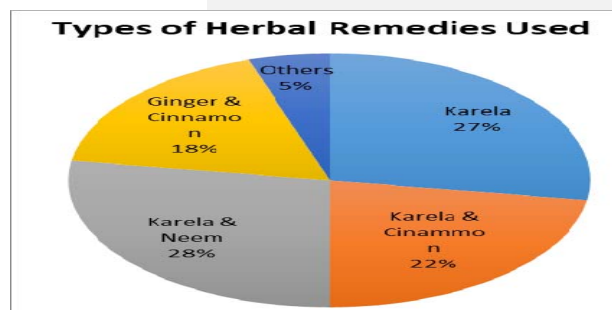


Figure 2 Types of herbal remedies used by participants.

3.2 Laboratory analysis

Table 1 shows laboratory values of study participants. Mean \pm SD and 95% CI of lab values were recorded for the study participants. Mean BMI was 27.4 ± 5.1 (95% CI 26.1-28.7) whereas higher mean HbA1c of 9.01 ± 3.2 (95% CI 8.2-9.8). Mean FBS was also recorded to be high with 143.9 ± 73.3 (95% CI 127.6-160.2).

Comment [a4]: Full meaning before abbreviation

Comment [a5]: Full Meaning before abbreviation

| Variable | Mean \pm SD | 95% CI |
|-------------|------------------|-------------|
| BMI | 27.4 ± 5.1 | 26.1-28.7 |
| DM duration | $0.32 \pm$ | |
| HbA1c | 9.01 ± 3.2 | 8.2-9.8 |
| Hb | 13.2 ± 1.4 | 12.9-13.6 |
| WBC | 7.2 ± 2.2 | 67-7.6 |
| | | |
| Platelet | 276.1 ± 78.8 | 258.6-293.6 |
| FBS | 143.9 ± 73.3 | 127.6-160.2 |
| CHOL | 193.4 ± 42.7 | 183.9-202.9 |
| TG | 114.7 ± 57.3 | 102.0-127.5 |
| HDL | 49.9 ± 16.8 | 46.2-53.7 |
| LDL | 129.2 ± 35.5 | 121.3-137.1 |
| VLDL | 24.8 ± 13.4 | 21.9-27.8 |
| CHD RISK | 4.7 ± 1.8 | 4.3-5.1 |
| BUN | 16.3 ± 6.2 | 14.9-17.7 |
| CREATININE | 1.3 ± 1.4 | 0.9-1.6 |
| Na | 138.5 ± 3.4 | 137.8-139.3 |
| K | 4.2 ± 0.5 | 4.1-4.3 |
| Cl | 102.6 ± 3.1 | 101.9-103.3 |
| GGT | 29.3 ± 39.7 | 20.4-38.1 |
| AST | 23.6 ± 7.2 | 22.0-25.2 |
| ALT | 24.7 ± 9.3 | 22.7-26.8 |
| ALP | 81.3 ± 53.9 | 64.1-98.5 |
| A/G/RATIO | 1.2 ± 0.5 | 1.1-1.4 |
| GLOB | 3.37 ± 0.9 | 3.1-3.7 |
| Uric Acid | 4.34 ± 1.7 | 3.8-4.9 |
| Albumin | 4.06 ± 0.7 | 3.8-4.3 |
| TP | 7.58 ± 1.1 | 7.2-7.9 |

Table 1. Showing laboratory values of study participants

Table 2 shows comparison of normal laboratory values of participants among the four groups using conventional medicine (CM), alternative medicine (AM), conventional and alternative medicine (CM+AM) and control. For HbA1c, significantly higher percentage (85.0%) of participants taking AM had normal value ($p=0.000$). For Hb normal value was reported among AM+CM group ($p=0.01$). Similarly significantly higher percentage of normal values were also observed among AM participants for FBS, AM, Cholesterol, TGL, HDL, LDL, VLDL and CHD.

145

146

| HbA1c | n (%) | p value |
|------------------|--------------|----------------|
| AM | 17 (85.0) | |
| AM+CM | 0 | |
| CM | 2 (10.0) | |
| C | 20 | p=0.000 |
| Hb | | |
| AM | 12 (60.0) | |
| AM+CM | 17 (85.0%) | |
| CM | 10 (50.0) | |
| C | 20 | p=0.01 |
| WBC | | |
| AM | 20 | |
| AM+CM | 16 (80.0) | |
| CM | 18 (90.0) | |
| C | 20 | p=0.10 |
| Platelets | | |
| AM | 20 | |
| AM+CM | 19 (95.0) | |
| CM | 18 (90.0) | |
| C | 20 | p =0.53 |
| FBS | | |
| AM | 17 (85.0) | |
| AM+CM | 1 (5.0) | |
| CM | 1 (5.0) | |
| C | 20 | p=0.00 |
| CHOLEST | | |
| AM | 19 (95.0) | |
| AM+CM | 8 (40.0) | |
| CM | 8 (40.0) | |
| C | 20 | p=0.00 |
| TGL | | |
| AM | 20 | |
| AM+CM | 10 (50.0) | |
| CM | 11 (55.0) | |
| C | 20 | p=0.00 |
| HDL | | |
| AM | 20 | |
| AM+CM | 17 (85.0) | |
| CM | 16 (80.0) | |
| C | 20 | p=0.06 |
| LDL | | |
| AM | 20 | |
| AM+CM | 15 (75.0) | |
| CM | 11 (55.0) | |
| C | 20 | p=0.002 |
| VLDL | | |
| AM | 20 | |
| AM+CM | 19 (95.0) | |
| CM | 19 (95.0) | |

| | | |
|-------------------|-----------|---------|
| C | 20 | p=0.56 |
| CHD | | |
| AM | 20 | |
| AM+CM | 12 (60.0) | |
| CM | 9 (45.0) | |
| C | 20 | p=0.00 |
| BUN | | |
| AM | 17 (85.0) | |
| AM+CM | 13 (65.0) | |
| CM | 11 (55.0) | |
| C | 20 | p=0.004 |
| CREATININE | | |
| AM | 18 (90.0) | |
| AM+CM | 15 (75.0) | |
| CM | 11 (55.0) | |
| C | 20 | p=0.002 |
| Na | | |
| AM | 19 (95.0) | |
| AM+CM | 18 (90.0) | |
| CM | 19 (90.0) | |
| C | 20 | p=0.34 |
| CHL | | |
| AM | 19 (95.0) | |
| AM+CM | 17 (85.0) | |
| CM | 16 (80.0) | |
| C | 20 | p=0.000 |
| GGT | | |
| AM | 18 (90.0) | |
| AM+CM | 1 (95.0) | |
| CM | 16 (80.0) | |
| C | 20 | p=0.000 |
| AST | | |
| AM | 19 (95.0) | |
| AM+CM | 18 (90.0) | |
| CM | 19 (95.0) | |
| C | 20 | p=0.000 |
| ALT | | |
| AM | 20 | |
| AM+CM | 16 (80.0) | |
| CM | 19 (90.0) | |
| C | 20 | p=0.000 |
| ALP | | |
| AM | 19 (95.0) | |
| AM+CM | 19 (95.0) | |
| CM | 18 (90.0) | |
| C | 20 | p=0.000 |

147 **Table 2 shows comparison of normal laboratory values of participants among the four groups**

148 The study was done to compare Hematology and Biochemistry values of diabetic patients using herbal
149 medicine and prescribed medicine, against Hematology and Biochemistry analyses of normal individuals.

Graphical representation on frequency of the different types of prescribed medications used by participants in the study indicated that combination use of Insulin and OHAs was the most popular treatment choice. Martin claims that dissatisfaction with results from orthodox pharmaceuticals as main reason among DM patients to use herbs^[10]. Frequency of the different types of herbal medicines used by the participants showed that majority used either Karela alone or combination of Karela and Neem. Studies have reported several herbs to have lowering effects on HbA1C and FBG, including Fenugreek, Gymnema and Karela which was found to lower both HbA1C and FBG and Green tea and Cinnamon which was found to lower FBG but have no effect on HbA1C^[3, 11, 12]. However even though these herbs among others were reported by various studies, no study was found that did a comparison of their effectiveness against the effectiveness of prescribed medications.

Gupta et al indicated that several of these herbs when used in concordance with prescribed medications had better glucose lowering results than when either was used alone^[13], contrarily our results showed that almost all the patients in the combination group had elevated HbA1C and FBG. Possible reason for this could have been non-compliance to therapy as was reported by Shams et al who conducted a study on predictors for non-adherence to therapy in T2DM patients and found that there was 73.7% non-compliance to therapy when drugs were being used with other modes of therapy^[14]. It was reported that most persons stopped therapy when they felt healthy. Non-adherence could also be the reason for the drastically large number of persons with elevated HbA1C and FBG in the prescribed alone group. According to WHO recommended glycemic levels are achieved by less than 50% of patients, which is usually associated with decreased adherence to long-term therapies^[15].

Similarly studies have reported that some herbs used to treat diabetes may also have anti-lipid effects, namely Cinnamon, Karela, Fenugreek, Green Tea, Ginseng and Ginger^[16, 17]. Even though there were significant number of persons with elevated LDL and TRIG values in the prescribed alone and combination groups, most had either low or normal CHOL values. All three groups had mostly normal HDL. However so, there were notable findings with regards to the CHD Risk. All patients in the HM group had normal CHD risk values whilst almost half in the PM group had elevated values. Only 5 out of 20 persons in the HM+PM group (half of that in the PM group) had elevated values, which can conclude that herbal remedies used did have a positive effect on CHD risk.

Like cardiovascular disease, diabetes is a precursor for renal damage, also called Diabetic Nephropathy, which usually occurs due to uncontrolled diabetes, and results in raised kidney function values^[18]. From our analysis considerable relationships were found with the Kidney Function Tests and herbal medicine with BUN, CREAT and electrolytes (with the exception of Na) having highly significant p-values. There were very few persons (3) in the HM patient group with elevated BUN levels whilst there were 7 and 9 with high values in the HM+PM and PM patient groups respectively. Similar results were seen with CREAT. As there is a link between uncontrolled glycaemia and raised BUN and CREAT, it can be reasoned that since the herbs were better at controlling glucose levels, they were indirectly responsible for positively affecting BUN and CREAT levels. However, even when diabetes is controlled, the disease can lead to chronic kidney disease and kidney failure with prolonged existence^[18].

Although there may be relationships between elevated liver enzymes and diabetes, these are multifactorial in origin and are mostly associated with features of metabolic syndrome rather than glycaemic control^[19]. Results from our study indicate that all the tests in the Liver Function Panel (GGT, ALP, AST, ALT) had highly significant associations. However, most of the patients in all three groups had normal liver enzymes with very few being elevated; therefore these associations remain inconclusive, as many other factors have to be considered.

4. CONCLUSION

Elevated liver enzymes and diabetes are related and have multifactorial origin. Results from our study indicated that all the tests in the Liver Function Panel (GGT, ALP, AST, ALT) had highly significant associations. However, most of the patients in all three groups had normal liver enzymes with very few

203 being elevated; therefore these associations remain inconclusive, as many other factors have to be
204 considered.
205

206 ETHICAL APPROVAL

207 Ethical approval was sought from the Institutional Review Board (IRB) before commencement of
208 research. Informed consent was also obtained from the respondents before questionnaire was issued.
209

210 REFERENCE

- 211 1. Wanchai, A., & Phrompayak, D. Use of complementary and alternative medicine among Thai patients
212 with type 2 diabetes mellitus. *Journal of Integrative Medicine*. 2016; 14(4), 297-305.
- 213 2. Lin, Y., Ho, T., Yeh, Y., Cheng, C., Shiao, Y., Wang, C., . . . Liang, W. Chinese Herbal Medicine
214 Treatment Improves the Overall Survival Rate of Individuals with Hypertension among Type 2
215 Diabetes Patients and Modulates In Vitro, Smooth Muscle Cell Contractility. *Plos One*. 2015;1-18.
- 216 3. Nahas, R., & Moher, M. Complementary and alternative medicine for the treatment of type 2 diabetes.
217 *Canadian Family Physician*. 2009; 55, 591-6.
- 218 4. Eisenberg, D., Kessler, R., Foster, C., Norlock, F., Calkkin, D., & Delbanco, T. Unconventional
219 medicine in the United States. *N Engl J Med*. 1993; 246-252.
- 220 5. Astin, J. Why patients use alternative medicine:results of a national study. *JAMA*. 1998; 1548-1553.
- 221 6. Oldendick R, C. A. Population-based survey of complementary and alternative medicine usage,patient
222 satisfaction, and physician involvement. *South Med*. 2000; 375-381.
- 223 7. Chang, H. A., Wallis, M., Tiralongo, E., & Wang, H. L. Decision-making related to complementary and
224 alternative medicine use by people with Type 2 diabetes: a qualitative study. *Journal of Clinical*
225 *Nursing*. 2012; 3205-15.
- 226 8. Moolasarn, S., Sripa, S., Kuessirikiet, V., Sutawee, K., Huasary, J., Chaisila, C., . . . Sankan, S. Usage
227 of and Cost of Complementary/Alternative Medicine in Diabetic Patients. *Journal of the Medical*
228 *Association of Thailand*. 2005; 88(11), 1630-36.
- 229 9. Cefalu WT, Stephens JM, Ribnick DM. Diabetes and Herbal (Botanical) Medicine. In: Benzie
230 IFF, Wachtel-Galor S, editors. *Herbal Medicine: Biomolecular and Clinical Aspects*. 2nd edition. Boca
231 Raton (FL): CRC Press/Taylor & Francis. Chapter 19. 2011
232
- 233 10. Martins, E. The growing use of herbal medicines: issues realting to adverse reactions and
234 challenges in monitoring safety. *Front Pharmacol*. 2013; 4: 177
- 235 11. Neelakantan, N., Narayan, M., de Souza, R. J., & van Dam, R. M. Effect of fenugreek (*Trigonella*
236 *foenum-graecum* L.) intake on glycemia: a meta-analysis of clinical trials. *Nutrition Journal*.
237 2014;13(7).
- 238 12. Rahman, I. U., Khan, R. U., Rhaman, K. U., & Bashir, M. Lower hypoglycemic but higher
239 antiatherogenic effects of bitter melon than glibenclamide in type 2 diabetic patients. *Nutrition*
240 *Journal*. 2015;14(23).
- 241 13. Gupta PD, De A. Diabetes mellitus and its herbal treatment. *Int J Res. Pharm Biomed Sci* 2012;
242 3(2):706-21.

- 243 14. Shams N, Amjad S, Kumar N, Ahmed W, Saleem F. Drug Non-Adherence In Type 2 Diabetes
244 Mellitus; Predictors And Associations. J Ayub Med Coll Abbottabad. 2016; 28(2):302-307.
- 245 15. García-Pérez LE, Alvarez M, Dilla T, Gil-Guillén V, Orozco-Beltrán D. Adherence to therapies in
246 patients with type 2 diabetes. Diabetes Ther. 2013; 4(2): 175-94
- 247 16. Vafa M, Mohammadi F, Shidfar F, Sormaghi MS, Heidari I, Golestan B, Amiri F. Effects of cinnamon
248 consumption on glycemic status, lipid profile and body composition in type 2 diabetic patients. Int J
249 Prev Med. 2012; 3(8): 531-6.
- 250 17. Wang, J., Ryu, HK. The effects of *Momordica charantia* on obesity and lipid profiles of mice fed a
251 high-fat diet. Nutr Res Pract. 2015; 9(5): 489–495.
- 252 18. Dabla, P.K. Renal Function in Diabetic Nephropathy. World Journal of Diabetes. 2010; 1, 48-56.
- 253 19. Saligram S, Williams EJ, Masding MG. Raised liver enzymes in newly diagnosed Type 2 diabetes
254 are associated with weight and lipids, but not glycaemic control. Indian J Endocrinol Metab. 2012;
255 16(6): 1012-4.

256
257

258

259

260