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# EFFECTS OF PHARMACEUTICAL INTERVENTION ON THE CONTROL OF BLOOD GLUCOSE LEVELS IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

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ABSTRACT

**Introduction:** The role of a pharmacist in optimizing medication use and self-care education in chronic disease has been demonstrated in the literature, because patients with type 2 diabetes mellitus generally exhibit comorbidities and therefore have more difficulty adhering to their prescribed pharmacotherapy.Objective: To evaluate the effect of pharmaceutical interventions on the glycaemic control of ambulatory patients with type 2 diabetes mellitus.Methods: An interventional longitudinal study was performed from May 2011 to February 2012 in a private ambulatory endocrinology clinic with 100 volunteers. Pharmaceutical interventions were conducted in these participants and afterwards blood glucose results were checked.Results:We found that 45 of the participants had a significant reduction of at least 0.5% in their glycated haemoglobin levels and 38 mg/dL in their fasting glucose. Participants also demonstrated a 21% improvement in pharmacotherapeutic adherence.Conclusion: Pharmaceutical interventions contributed a positive effect on the control of glycated haemoglobin and blood glucose in patients with type 2 diabetes mellitus.

## INTRODUCTION

Diabetes mellitus (DM) is a chronic disease with serious social and economic impacts. Data show that there are about 371 million people worldwide with diabetes aged 20 to 79, and it is estimated that in 2030 the number of individuals will exceed 472 million [1–2]. About two thirds of these patients live in developing countries such as Brazil, where this epidemic is extremely intense.

Type 2 diabetes mellitus (T2DM) corresponds to 90% of all cases, and most carriers are overweight or have central fat deposition [3]. The assistance given to people with T2DM about their medication use is a growin g concern. However, promoting better health or a higher quality of life in these patients is not only limited to access to medication, since incorrect use can also result in ineffective or unsafe treatment [4].

A survey conducted in Brazil revealed that approximately 75% of subjects had poor glycaemic control [5]. In addition, patients with chronic conditions such as T2DM have greater difficulty adhering to the prescribed treatment, owing to several recommended lifestyle changes [6]. In short, only 33% to 50% of these patients fully adhere to their pharmacotherapy [7–8].

Pharmacists have been demonstrated to be critical in ensuring successful therapy in patients with chronic diseases, through guidance regarding the correct and safe use of their medications [9–10]. Additionally, an improved partnership with their doctor, changes in lifestyle, and increased self-care education has resulted in an improved quality of life for the patients [11–13].

## AIM OF THE STUDY

This study aimed to evaluate the effect of pharmaceutical interventions in controlling the clinical parameters (HbA1c and blood glucose) of ambulatory patients with T2DM in a private healthcare service.

## ETHICS APPROVAL

This study was approved by the Ethics Committee in Research of the Federal University of Sergipe (FUS), with number CAAE-0178.0.107.000–09. All individuals that agreed to participate in the study were previously elucidated on the goals and nature of the research; they further signed their informed consent in accordance with Resolution No. CNS. 196/96.

## METHODS

Study characterization. This is a longitudinal study conducted at

the endocrinology ambulatory clinic of a private hospital in the city of Aracaju (Sergipe), from May 2011 to February 2012. The research was divided into two stages. In the first stage, we recorded the fasting glucose and HbA1c results of the participants and gave them pharmaceutical guidance; a questionnaire was used to collect data. In the second phase, after three months, the results were measured again because HbA1c levels reflect the average endogenous exposure to glucose over 2 to 3 months [14].

Selection of patients. The study sample was selected by convenience, not randomly. The size was determined based on the frequency of visits for patients with T2DM. The sample was composed of subjects pre-diagnosed with T2DM in both genders above 40 years, who had fasting glucose and HbA1c tests measured using the same method at the same laboratory. Patients who presented with results above 110 mg/dL and 7.0% [15-16] were considered out of the normal range of values for fasting glucose and HbA1c, respectively. Although there remains some controversy about how glycemic control (based on HbA1c levels) reduces cardiovascular events, the guidelines from American and Brazilian societies still recommend a target HbA1c of 7% [15-16] for patients with diabetes.

Criteria for inclusion and exclusion. The criteria for exclusion included patients with suspected or confirmed presence of haemolytic disease or haemorrhage, since these complications alter levels of HbA1c [17].

Method for measuring fasting glucose and HbA1c. We used the amplified chemiluminescence methodology to measure levels of fasting blood glucose. For HbA1c measurement, we used a validated methodology from studies conducted by the Diabetes Control and Complications Trial Research Group (DCCT Research Group), which was based on the high performance liquid chromatography method (4% to 6% variance) [18–19].

Data collection and pharmaceutical interventions. All subjects included in the study answered a questionnaire to outline their socio-economic and demographic profile (gender, age, household income, and occupation), lifestyle habits (diet, physical exercise, alcohol consumption, and smoking), comorbidities, and medication use, as well as their fasting glucose and HbA1c values.

Interviews with patients were conducted individually for an average of 30 min by the researcher (J.M.D.M.) and a graduate student of Pharmacy (R.B.C.G.). Afterwards, an educational intervention in the form of a pharmaceutical orientation was given by the researcher, consisting of: an orientation related to chronic health condition (nature, causes, and treatment) and changes in lifestyle, identification of signs and symptoms caused by the drugs (effectiveness and safety), and encouragement to patients to actively participate in the proposed pharmacotherapy. The pharmacotherapeutic intervention consisted of an assessment of medication use (past and present), preventing and resolving drug-related problems (actual and potential), clarification regarding the storage of drugs, guidance on the correct use of medication, and strategies to improve adherence.

To complement the verbal guidance we provided patients with a manual from the Brazilian Diabetes Society (SBD) (2014) [15] and the American Diabetes Association (ADA) (2013) [16], which addressed the following aspects: healthy lifestyles (benefits of physical activity, alcohol consumption risks, cigarette smoking, and nutritional counselling); importance of cardiovascular risk factors; guidance on medications [importance of correct use, drug interactions (drug x drug and drug x food)] and contraindications; completing a timetable with the best times to take medication for the patient; specifying the best liquid to be taken with the medication. Additionally, the response criteria to pharmaceutical interventions for patients who had minimal reduction in HbA1c levels of 0.5% were established [12,20].

Evaluation of clinical parameters. The classification of obesity was done according to the body mass index (BMI) system determined by the Brazilian Association for the Study of Obesity and Metabolic Syndrome [21]. Systemic arterial hypertension (SAH) was considered for those patients who had a previous diagnosis consultation and/or were taking antihypertensive medication or had a systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg [22]. To identify the fitness enthusiasts, we used criteria from the IPAQ Research Committee (2005) [23], which considers individuals as such if they exercise vigorously at least three days a week for at least 20 minutes, or do moderate exercise at least five days a week for at least 30 minutes.

Our study had patients self-report their frequency of physical activity and knowledge about healthy eating habits. The patients interviewed that reported following a strict diet free of fats, sugars, and carbohydrates were considered to have healthy eating habits, since these habits help contribute to the maintenance of normal blood glucose levels (SBD) (2014) [15].

To outline the pharmacotherapeutic profiles of patients, the hypoglycaemic medications were selected, relating their subgroup with the mechanisms of action. Furthermore, to assess whether study participants had good adherence to pharmacotherapy, we applied the Morisky test, which consists of four questions, to assess the patient's behaviour in relation to their habitual use of medication [24].

Data analysis. Quantitative variables were described as mean and standard deviation (SD). The Shapiro-Wilk and Kolmogorov-Smirnov test was applied to assess the assumption of sample normality. Then, to compare these variables before and after intervention, we used the Student's t-test or the Mann-Whitney test according to standard sample normality. As for the categorical variables, absolute and percentage frequency were used. To compare characteristics of categorical variables at both time points, we used the McNemar test. To perform statistical calculations, we used the SPSS version 17.0 software. Statistical significance for all tests was considered to be a two-tailed $p < 0.05$.

## RESULTS

Characteristics of the study population. For this study, 100 individuals were approached. All agreed to participate. Observed ages ranged from 40 to 88 years, with females representing 59% of the sample. With respect to family income, 52% of all participants had an income above five times the minimum wage. The main source of income for 61% of the individuals was due to their own retirement.

The average BMI was 28.0 ± 5.3, and it was found that most of the selected patients were overweight.

As for physical activity and the use of healthy eating habits, 75.6% of patients reported no physical activity, and 80% said they did not adopt healthy eating habits. The majority, 86% and 93%, respectively, revealed no use of alcoholic beverages and smoking. Fifty-eight percent (58%) of patients with T2DM also had hypertension, a cardiovascular risk factor.

The most prescribed medications for the control of T2DM were oral hypoglycaemic agents belonging to the following subgroups: biguanides (metformin) (51%), sulfonylureas (30.0%) (The majority represented by glibenclamide, 53%), gliptins (13%) and stimulator of non-sulfonylurea insulin secretion (6.0%). Addition to oral hypoglycaemic agents, insulin represented 24.0% of drug prescriptions.

In the beginning of the study, 75 individuals were observed to be hypoglycaemic among the participants. This number was later reduced to 63. Improper use related to the time of drug administration was the main problem detected during the initial monitoring of most counselled patients (80%), for example, the use of glibenclamide after meals, and metformin without a meal.

Comparison between the clinical variables and lifestyle habits of patients who responded to pharmaceutical interventions. In this study, we observed a frequency of 45% (n = 45) 95% CI of 35.0 to 55.0 in the selected sample that responded to pharmaceutical

interventions (minimal reduction of HbA1c levels of 0.5%). The response evaluations between females and males revealed that females (69%) had better results.

In patients that had a response to pharmaceutical interventions, we observed a statistically significant reduction in weight, fasting glucose, and BMI. A significant increase in the frequency of physical activity, knowledge about healthy eating habits, and adherence to pharmacotherapy (Table 1) were also observed.

## DISCUSSION

This study demonstrates that pharmaceutical interventions can contribute to ensuring that glycaemic goals in patients with T2DM are met. Research from various countries have shown that the involvement of a pharmacist in a multidisciplinary team brings positive results in controlling DM risk factors, improving drug prescriptions and adherence to treatment and patient safety, as well as reducing health costs [25–27].

The majority of patients in this study were female. The incidence and prevalence of T2DM is 1.4 to 1.8 times more common in women than in men [28]. However, this data could also be correlated to female predominance in seeking treatment [29]. Women are often more attentive to the symptoms of the disease and usually seek help earlier [28, 30].

Most T2DM participants in this research were elderly with hypertension. These data corroborate the study by Freitas and Garcia (2012), in which the prevalence of T2DM and hypertension increased significantly with age [31]. Furthermore, studies show that patients with DM had two to four times the incidence of coronary heart disease when compared to individuals without diabetes. This incidence is considered even greater in case of the elderly [32-33].

Regarding knowledge and practice of non-pharmacological measures, a few patients reported having knowledge about the importance of physical activity and healthy eating habits. According to Silva et al. (2006), DM is among the diseases that present greater difficulties for patients following pharmacotherapy, mainly because its chronic nature generates greater demands for self-care [34], which include behavioural changes related to diet and physical activity. Thus, it is necessary to ensure patient agency and make him/her co-responsible in controlling their DM [6]. Likewise, it is up to the pharmacist to establish a therapeutic relationship with the patient and check their understanding of the pharmacotherapy and the need to make changes in their lifestyle.

Treatment adherence increased significantly after drug interventions. Studies show that adherence to drug therapy for DM is higher in patients who reported having received information about the disease and the prescribed medication [35]. Therefore, pharmaceutical interventions can contribute to greater understanding by patients about their pharmacotherapy as well as help them get better control of the disease and possibly lower the risk for later development of diabetic complications.

The most common pharmaceutical interventions observed in this study were the guidelines on the appropriate times to use hypoglycaemic agents. This result was also observed in the review conducted by Machado et al. (2007) [36]. Accordingly, the guidance for pharmaceutical interventions in patients with T2DM has been considered clinically positive with statistical significance [37].

There were significant reductions in the HbA1c levels in 45% of the entire sample (considering a minimum value of 0.5%) and fasting glucose levels after interventions. These results were corroborated by other studies that conducted pharmaceutical interventions in patients with T2DM [36,38–40]. Epidemiological analysis indicate that a 0.5% reduction in HbA1c levels is equivalent to an estimated 7% reduction in the risk of developing myocardial infarction and a 12% reduction in the risk of developing cerebral stroke [18,41]. Improvements in HbA1c and fasting glucose levels also possibly occurred due to greater adherence to pharmacotherapy and changes in patient lifestyle.

Limitations. Patient self-reporting may have led to an underestimation or overestimation of the frequency of physical activity, knowledge about healthy eating habits, and use of medication. However, future research is needed to evaluate and corroborate information from relatives, caregivers, and medical assistants, as well as to conduct pill counts in the assessment of treatment adherence.

## CONCLUSION

The results suggest that pharmaceutical interventions contributed to improvements in patient adherence to healthy lifestyles and pharmacotherapy, exerting a positive effect on the glycaemic control of patients with T2DM. Consequently, guidance provided to the patient should be continuously monitored and supervised by professional staff, especially the pharmacist. Moreover, it is necessary to develop collaboration among physicians, nurses, and pharmacists to provide specific care and foster patient co-responsibility regarding drug therapy and lifestyle changes.

## CONFLICT OF INTERESTS

The authors declare that they do not have conflict of interests.

## REFERENCES


1. International Diabetes Federation (IDF). Diabetes Atlas [internet].Brussels, Belgium: 5th Edition [atualizado em 2012 nov; citado em 2013 jul 9]. Disponível em: http://www.diabetes.org.br/ultimas/sao-13-4-milhoes-de-pessoas-portadoras-de-diabetes-no-brasil
2. Danaei, G., Finucane, M. M., Lu, Y., Singh GM, Cowan MJ, Paciorek CJ., et al. (2011) National, regional, and global trends in fasting plasma glucose and diabetes prevalence since 1980: systematic analysis of health examination surveys and epidemiological studies with 370 country-years and 2•7 million participants. Lancet, 378 (9785), 31–40.
3. Brasil. Ministério da Saúde. Secretaria de Atenção ŕ Saúde. Departamento de Atenção Básica. Diabetes Mellitus / Ministério da Saúde. Secretaria de Atenção ŕ Saúde. Departamento de Atenção Básica – Brasília: Ministério da Saúde, 2006.
4. Cunha, M. F. C. (2008) A racionalidade da mercantilização da doença [dissertação]. São Paulo: Faculdade de Saúde Pública, Universidade de São Paulo.
5. Mendes, A. B. V., Moreira, Jr. E. D., & Chacra, A. R. (2008) Evaluation of glycemic control in a population based sample of patients with diabetes in Brazil. San Francisco, CA: 68th Edition American Diabetes Association Scientific Session.
6. Espirito Santo, M. B. E., Souza, L. M. E., Souza, A. C. G., Ferreira, F. M. F.; Silva, C. N. M. R.., Taitson, P. F. (2012) Adesão dos portadores de diabetes mellitus ao tratamento farmacológico e não farmacológico na atenção primária ŕ saúde. Revista de Enfermagem, 15 (1), 88-101.
7. World Health Organization (WHO). Adherence to long-term therapies: evidence for action [internet]. Geneva, Switzerland: 110p [atualizado em 2003 jan; citado em 2003]. Disponível em: http:// whqlibdoc.who.int/ publications/ 2003/9241 545992.pdf
8. Smith, M., Bates, D. W., Bodenheimer, T., & Cleary, P. D. (2010) Why pharmacists belong in the medical home. Health Aff (Millwood), 29(5): 906–913.
9. Lyra Junior D. P., Marcellini, P. S., Pelá, I. R. (2008) Effect of pharmaceutical care intervention on blood pressure of elderly outpatients with hypertension. Brazilian Journal of Pharmaceutical Sciences, 44 (3), 451-457.
10. Al Mazroui, N. R., Kamal, M. M., Ghabash, N. M., Yacout, T. A., Kole, P. L., & McElnay, J. C. (2009) Influence of pharmaceutical care on health outcomes in patients with Type 2 diabetes mellitus. British Journal of Clinical Pharmacology, 67(5), 547–557.
11. Funnell, M. M., Brown, T. L., Childs, B. P., Haas LB, Hosey GM, Jensen B., et al. (2010) National Standards for Diabetes Self-Management Education. Diabetes Care, 33, 89–96.
12. Machado, M., Bajcar, J., Guzzo, G. C., & Einarson, T. R. (2007) Sensitivity of Patient Outcomes to Pharmacist Interventions. Part I: Systematic Review and Meta-Analysis in Diabetes Management. The Annals of Pharmacotherapy, 41(10), 1569–1582.
13. Correr, C. J., Pontarolo, R., Wiens, A., Rossignoli, P., Melchiors, A. C., Radominski, R., Fernandez-Llimós, F. (2009) Economic evaluation of pharmacotherapeutic follow-up in type 2 diabetic mellitus patients in community pharmacies. Arquivos Brasileiros.de Endocrinologia e. Metabologia, 53, 825–833.
14. Selvin, E., Crainiceanu, C. M., Brancati, F. L., & Coresh, J. (2007) Short-term variability in measures of glycemia and implications for the classification of diabetes. Archives of Internal Medicine, 167, 1545–1551.
15. Sociedade Brasileira de Diabetes (SBD). Diretrizes da sociedade brasileira de diabetes. Princípios para orientação nutricional no diabetes mellitus [internet]. São Paulo, São Paulo: 2013/2014 Edition [citado em 2013 fev]. Disponivel em: http://www.nutritotal.com.br/diretrizes/files/342--diretrizessbd.pdf
16. American Diabetes Association (ADA) (2013) Standards of Medical Care in Diabetes. Diabetes Care, 36 (supplement 1), S11-S66.
17. Grupo Interdisciplinar de Padronização da Hemoglobina Glicada – A1C. Hemoglobina glicada. Posicionamento Oficial (2009) A importância da hemoglobina glicada (A1C) para a avaliação do controle glicęmico em pacientes com diabetes mellitus: aspectos clínicos e laboratoriais [internet]. [citado em 2013 Mai 5]. Disponível em: http:// www.labtestsonline.org.br/ understanding/ analytes/a1c/ tab/test/
18. Diabetes Control and Complications Trial Research Group - DCCT Research Group (1993) The effect of intensive treatment of diabetes on the development and progression of the long-term complications in insulin-dependent diabetes mellitus. New England Journal of Medicine, 329(14), 977–986.
19. Sumita, N. M., & Andriolo, A. (2006) Importância da determinação da hemoglobina glicada no monitoramento do paciente portador de diabetes mellitus. Jornal. Brasileiro de. Patologia e. Medicina Laboratorial, 42(3).
20. Clifford, R. M., Davis, W. A., Batty, K. T., & Davis, T. M. (2005) Effect of a

pharmaceutical care program on vascular risk factors in type 2 diabetes: the Fremantle Diabetes Study. Diabetes Care, 28, 771–776.
21. ASSOCIAÇÃO BRASILEIRA PARA ESTUDOS DA OBESIDADE E DA SÍNDROME METABÓLICA (ABESO) (2014). Disponível em: http://www.abeso.org.br/imc/calcule-seu-imc.shtml
22. Sociedade Brasileira de Cardiologia (SBC) (2007) V Diretrizes Brasileiras de Hipertensão Arterial. Arquivos Brasileiros de. Cardiologia, 89 (3), 24-79.
23. IPAQ Research Committee. Guidelines for the data processing and analysis of the International Physical Activity Questionnaire [internet]. [atualizado em 2005 nov; citado 2013 Mai 6]. Disponível em: http://www.ipaq.ki.se/scoring.pdf
24. Morisky, D. E., Gren, L. W., & Levine, D. M. (1986) Concurrent and predictive validity of self-reported measure of medication adherence. Medical Care, 24, 67–74.
25. Elnour, A. A., El Mugammar, I. T., Jaber, T., Revel, T., & McElnay, J. C. (2008) Pharmaceutical care of patients with gestational diabetes mellitus. Journal of Evaluation in Clinical Practice, 14(1), 131–140.
26. Lyra, D. P. Jr, Rocha, C. E., Abriata, J. P., Gimenes, F. R., Gonzalez, M. M., & Pelá, I. R. (2007) Influence of Pharmaceutical Care intervention and communication skills on the improvement of pharmacotherapeutic outcomes with elderly Brazilian outpatients. Patient Education and Counselling, 68(2), 186–192.
27. Lee, J. K., Grace, K. A., & Taylor, A. J. (2006) Effect of a pharmacy care program on medication adherence and persistence, blood pressure, and low-density lipoprotein cholesterol: a randomized controlled trial. The Journal of the American Medical Association, 296(21), 2563–2571.
28. Carolino, I. D. R., Molena-Fernandes, C. A., Tasca, R. S., Marcon, S. S., Cuman, R. K. N. (2008) Fatores de risco em pacientes com diabetes mellitus tipo 2. Revista Latino Americana de Enfermagem, 16(2), 238-44.
29. Pires, C. F., Costa, M. M., Angonesi, D. B., Borges, F. P. (2006) Demanda del servicio de atención farmaceutica en una farmacia comunitaria privada. Pharmacy Practice, 4 (1), 34–37.
30. Tavares, D. M. S., Rodrigues, F. R., Silva, C. G. C., & Miranzi, S. S. C. (2007) Caracterização de idosos diabéticos atendidos na atenção secundária. Ciencia e Saúde Coletiva, 12 (5), 1341–1352.
31. Freitas, L. R. S., & Garcia, L. P. (2012) Evolution of prevalence of diabetes and associated hypertension in Brazil: analysis of National Household Sample Survey, 1998, 2003 and 2008. Epidemiologia e Serviços de Saúde, 21(1), 7–19.
32. Camargo, E. G., Gross, J. L., Weinert, L. S., Lavinsky, J., Silveiro, P. S. (2007) Aspirina em baixa dosagem em pacientes com diabete melito: Riscos e benefícios em relação ŕs complicações macro e microvasculares. Arquivos. Brasileiros de. Endocrinologia &. Metabologia, 51(3), 457–465.
33. Leitão, C. B., Krahe, A. L., Nabinger, G. B., Picon, P. X. ; Pecis, M. ; Zaslavsky, L. M. A., et al. (2006) Aspirin Therapy is Still Underutilized Among Patients With Type 2 Diabetes. Arquivos Brasileiros. Endocrinologia & Metabologia, 50(6), 1014–1018.
34. Silva, I., Pais-Ribeiro, J., Cardoso, H. (2006) Adesão ao tratamento do Diabetes Mellitus: a importância das características demográficas e clínicas. Revista Referencia, 2 (2), 34–41.
35. Gimenes, H. T., Zanetti, M. L., Haas, V. J. (2009) Fatores relacionados ŕ adesão do paciente diabético ŕ terapeutica medicamentosa. Revista Latino-americana de Enfermagem,17, 201–209.
36. Machado, M., Bajcar, J., Guzzo, G. C., Einarson, T. R. (2007) Sensitivity of Patient Outcomes to Pharmacist Interventions. Part I: Systematic Review and Meta-Analysis in Diabetes Management. The Annals of Pharmacotherapy, 41(10), 1569–1582.
37. Glazier, R. H., Bajcar, J., Kennie, N. R., & Willson, K. (2006) A systematic review of interventions to improve diabetes care in socially disadvantaged populations. Diabetes Care, 29 (7), 1675–1688.
38. Machado-Alba, J. E., Torres-Rodríguez, S., & Vallejos-Narváez, A. (2011) Effectiveness the pharmaceutical care in diabetic patients. Colombia Médica, 42(1), 72–80.
39. Correr, J. C., Pontarolo, R., Wiens, A., Rossignoli, P., Melchiors, A. C., Radominski, R., & Fernandez-Llimós, F. (2009) Economic evaluation of pharmacotherapeutic follow-up in type 2 diabetic mellitus patients in community pharmacies. Arquivos. Brasileiros de Endocrinologia & Metabologia, 53 (7), 825–833.
40. Al Mazroui, N. R., Kamal, M. M., Ghabash, N. M., Yacout, T. A., Kole, P. L., & Mcelnay, J. C. (2009) Influence of pharmaceutical care on health outcomes in patients with Type 2 diabetes mellitus. British Journal of Clinical Pharmacology, 67 (5), 547–557.
41. UNITED KINGDOM PROSPECTIVE DIABETES STUDY - UKPDS 33 (1998) Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes. Lancet, 352 (9131), 837–853.