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Napata College

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Department of Community Medicine

Adherence of diabetic patients to their respective Management Protocol at Ribat University Hospital in Khartoum – Sudan 2021

Submitted by:

Rudaina Ismail Osman

Rewa Ezzaldein

Nusaiba Bashir Osman

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Supervisor: Dr. Mawahib Salman Jubarah Rashid

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Public Health specialist

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قال الله تعالى:

(وَمَا تَوْفِيقِي إِلَّا بِاللَّهِ ۚ عَلَيْهِ تَوَكَّلْتُ وَإِلَيْهِ أُنِيبُ)

صدق الله العظيم

(هود من الآية:88)

Dedication

We would like to dedicate our research to our parents, and our siblings for always having confidence and faith in us.

To our family and close friends, we are exceptionally grateful for the constant prayers and support.

Acknowledgement

Praise be to Allah Almighty for his guidance, wisdom, and endless creativity in his creation.

Dr. Mawahib, our supervisor, it was a delight having you as our mentor, thank you for always guiding us, for constantly making time for us, and assisting us in making the best version of this research.

A special thanks to Ribat University Hospital for openheartedly welcoming us and allowing us to collect data despite unprecedented circumstances that have been bestowed upon our nation that manifested themselves in a plethora of difficulties regarding the instantiation progression and conduction of research projects throughout our beloved country, and to all the patients who consented and participated anonymously in this research.

We would also like to extend our gratitude to Napata Research and Innovation Center.

Abbreviations

DM – Diabetes Mellitus

DSF – Diabetic Septic Foot

Edu level – Educational level

FMoH – Federal Ministry of Health

IDDM – Insulin Dependent Diabetes Mellitus

IDF - International Diabetes Federation

NIDDM – Non-Insulin Dependent Diabetes Mellitus

OHA – Oral Hypoglycemic Agents

RUH – Ribat University Hospital

SPSS - Statistical Package for Social Sciences

T1DM – Type 1 Diabetes Mellitus

T1DM – Type 1 Diabetes Mellitus

T2D – Type 2 Diabetes

WHO – World Health Organization

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Abstract

Background: Despite diabetes being a well-known disease, many patients have diabetes-related complications, forexample: DSF, cataracts, macro – and micro vascular complications, etc.This research tries to understand diabetes from a patients' view-points, on whether they consider themselves adherent to not just medications, but to their overall treatment regimen and if they are aware of their treatment being much more than just medications to be taken, but an overall package of medication and life-style changing, and how well they are willing to change in their lives to decreases morbidity and mortality associated with diabetes.

Objectives: To determine the level of adherence of diabetic patients to their respective treatment protocol at Ribat University Hospital in Khartoum, Sudan 2021.

Materials and Methods: Cross sectional facility based study with total number of sample size 101, random systemic sampling was used to select the participants for this research, and the data was analyzed using SPSS v.26.

Results: The overall adherence rate in this study was 63%. Females were found to be statistically significant with adherence level (P value 0.043). Married individuals also had a better adherence rate (P value 0.043), there was a very statistically significant correlation between higher educational levels and adherence rate, as higher educational levels college education and above had a p value of 0.001.

Individuals with higher socio-economic statuses were also better adherent, middle and higher classes had higher adherence rates. Middle classes had a p value of 0.039, and wealthier classes had a p value 0.049 respectively.

Older age was also statistically significant in regards to adherence rates (p value 0.049). No significant correlation was found in regards to better adherence and co-morbidities.

Conclusion: Among the studied variables female gender, married couples, middle and higher socio-economic statuses, and college education level and above were found to be statistically significant with better adherence rates. Older age groups older than 66 years old were found to have astatistically significant to a highly significant correlation. The study recommended FMoH to develop unified evidence based management protocols with conduction of awareness raising campaign about the importance of patient's adherence to these protocols.

Key Words: Adherence, maladherence, type 1 diabetes, type 2 diabetes, and treatment protocol.

ملخص البحث

الخلفية: على الرغم من أن مرض السكري معروف جيدًا، إلا أن العديد من المرضى يعانو من مضاعفات مرتبطة بمرض السكري، على سبيل المثال: قدم السكري، وإعتام عدسة العين، مضاعفات الأوعية الدموية الكلية ولجزئية، وما إلى ذلك. يحاول هذا البحث فهم مرض السكري من وجهة نظر المرضى، على ما إذا كانوا يعتبرون أنفسهم ملتزمين ليس فقط بالأدوية، ولكن بنظام العلاج الشامل الخاص بهم وإذا كانوا على دراية بأن علاجهم أكثر بكثير من مجرد الأدوية التي يجب تناولها، بل مجموعة شاملة منا لأدوية وتغيير نمط الحياة، ومدى نجاحهم هم على استعداد للتغيير في حياتهم لتقليل معدلات لإصابة بالأمراض والوفيات المرتبطة بمرض السكري.

الأهداف: تحديد مستوى التزام مرضى السكري ببروتوكول العلاج الخاص بهم في مستشفى الرباط الجامعي بالخرطوم، السودان 2021.

المواد والطرق: دراسة مقطعية قائمة على المرافق مع العدد الإجمالي لحجم العينة 101، تم استخدام أخذ عينات منهجية عشوائية لاختيار المشاركين في هذا البحث، وتم تحليل البيانات باستخدام.SPSS v.26

النتائج: بلغ معدل الالتزام الكلي في هذه الدراسة 63٪. وجد ان الإناث ذات دلالة إحصائية مع مستوى الالتزام (P قيمة 0.043). كان لدى الأفراد المتزوجين أيضًا معدل التزام أفضل (قيمة (0.043 P، وكان هنا كارتباط ذو دلالة إحصائية جدًا بين مستويات التعليم العالي و معدل الالتزام، حيث كانت مستويات التعليم العالي في الكلية و مافوقها بقيمة.0.001 p

الأفراد ذوو الأوضاع الاجتماعية والاقتصادية على كانوا أيضاً أفضل تمسكًا، وكان لدى الطبقات المتوسطة والعليا معدلات التزام أعلى. كان لدى الطبقات الوسطى قيمة0.039 p، وكان للفئات الأكثر ثراء قيمة 0.049 pعلى التوالي. كان التقدم في السن ذو دلالة إحصائية أيضًا فيما يتعلق بمعدلات الالتزام (قيمة .(0.049 p لم يتم العثور على ارتباط كبير فيما يتعلق بالالتزام أفضل والمراضة المشتركة.

الخلاصة: من بين المتغيرات المدروسة جنس الإناث، والأزواج، والحالات الاجتماعية والاقتصادية المتوسطة والعليا، ومستوى التعليم الجامعي وما فوق وجد أنها ذات دلالة إحصائية مع معدل التزام أفضل. تم العثور على الفئات العمرية الأكبر من 66 عامًا ذات دلالة إحصائية لارتباط ذي دلالة إحصائية. أوصتا لدراسة FMoH بتطوير بروتوكولات إدارة موحدة قائمة على الأدلة مع إجراء حملة لزيادة الوعي حول أهمية التزام المريض بهذه البروتوكولات.

الكلمات المفتاحية: الالتزام، عدم الالتزام، السكري من النوع الأول، السكري من النوع الثاني، بروتوكول العلاج.

Chapter One

Introduction

Chapter One
Introduction

Background

The incidence and prevalence of diabetes mellitus (DM) has kept on expanding internationally, despite the continuous efforts in researches, with the subsequent weight resting more vigorously on tropical, developing countries [1,2].

Diabetes mellitus applies a huge burden bringing about expanded morbidity and mortality; this manifests itself in a plethora of aspects, but not limited to the financial sector in health and wellness as well as society as a whole. [3]

There are two main types of diabetes mellitus:

Type 1 diabetes, also called insulin dependent diabetes mellitus (IDDM) is brought about by absence of insulin secretion by beta cells of the pancreas.[4]

The second type, Type 2 diabetes, additionally called non-insulin subordinate diabetes mellitus (NIDDM), is brought about by diminished affectability of target tissues to insulin.[4]

Medication controlling blood glucose levels has been displayed to lessen the diabetes-related complications. [5]

Maintaining adequate treatment adherence and glycemic control in type 1 diabetes requires teamwork meaning that it requires the child and family to plan daily activities like exercise and constantly monitoring blood glucose, being aware of the signs and symptoms of hypoglycemia, and following a healthy diet. Effective completion of these steps is not as easy as it may seem and requires effort and organization, encouragement, and a good mindset [6] that encompasses a broad cognitive domain of skills [7].

Patients diagnosed with type 2 diabetes mellitus are at first urged to keep a healthy and consistent eating and exercise routine, trailed by early medication that for the most part incorporates one or more oral hypoglycemic agents and later may incorporate an injectable treatment. [8]

The difference in the clinical presentation of type 1 and type 2 diabetes is presented in the following table:

Features	Type 1	Type 2
Age of onset	Usually less than 20 years	Usually greater than 30 years
Body mass	Low [wasted] to normal	Obese
Plasma insulin	Low or absent	Normal to high initially
Plasma glucagon	High, can be suppressed	High, resistant to suppression
Plasma glucose	Increased	Increased
Insulin sensitivity	Normal	Reduced
Therapy	Insulin	Weight loss, thiazolidinediones, metformin, sulfonylureas, insulin

Source: Guyton and Hall (2006). Table 1.1

Adherence to therapy is the degree to which a person's behavior in improving their overall lifestyle to control diabetes. This includes taking medication, following a diet, and/or executing lifestyle changes, and how consistent they are with the agreed recommendations from their healthcare provider. [8]

Studies have found that there's factors related to the overall adherence [9]including support from friends and family, the mental status of the patient, age, socio-economic status, and the patients' health beliefs are proven to be associated with the overall adherence. [10]

1.1 Statement of the Problem

It has been established that diabetes carries with it a plethora of possible complications, especially when patients do not adhere to the treatment plan set forth by their healthcare providers. For this reason, as well as for the rather grim prophecy by the IDF stating that number are bound to double by 2035. Mal-adherence will present a myriad issues related to the healthcare of these patients as well as an unnecessary economic burden that affects the patients as well as society in general. We

aim to assess the issue at hand so that recommendations regarding the necessity for immediate action (or possible lack thereof) are taken into account. It is also necessary that the necessary educational programs receive the support they need.

In Africa, diabetes mellitus is estimated to affect around 14 million individuals and this is expected to rise to about 28 million by 2030.

In Sudan, the national prevalence of diabetes in adults is 7.7% and is expected to reach 10.8% in 2035. [11]

1.2 Rationale / Justification

An evaluation of patient self-care behavior can show how successful the education and counseling has been achieved.

In spite of the importance of self-care activities in the management of DM, only few studies have been conducted in the country regarding adherence of diabetic's patients and it's related with quality of life. Studying and identifying the level of adherence is essential to plan the appropriate interventions to reduce complication related to poor control.

1.3 Research question

What is the level of adherence among diabetic patients in RUH diagnosed with type 1 and type 2 to their treatment protocol?

1.4 Research hypothesis

We are expecting a direct relationship in regards to the level of adherence of diabetic patients with sex, marital status, educational level, socio-economic factors, and presence of co-morbidities.

1.5 Research Objectives:

I. General

To determine the level of adherence of diabetic patients to their respective treatment protocol at Ribat University Hospital in Khartoum, Sudan 2021

II. Specific

- To assess adherence of patient to of diabetic patients to their respective treatment protocol at Ribat University Hospital in Khartoum, Sudan 2021
- To study factors related to adherence of diabetic patients to their respective treatment protocol at Ribat University Hospital in Khartoum, Sudan 2021
- To assess the effect of incompliance on hospitalization and disabilities among diabetic patients at Ribat University Hospital in Khartoum, Sudan 2021

Chapter Two

Literature review

Chapter Two

Literature review

2.1 Literature review

Diabetes mellitus is a condition due to a defect in insulin secretion, insulin action, or both. A major consequence of this disease ischronic hyperglycemia (that is elevated levels of plasma glucose)with disturbances of carbohydrate, fat and protein metabolism. [19]

Diabetes Mellitus has been increasing worldwide but specifically in tropical, and developing countries despite the research and efforts made. [13]

According to the International Diabetes Federation (IDF), 387 million people are living with diabetes in the world and of which more than 22 million are in the African region [8] which inspired us to consider this our research topic in our homeland Sudan.

Type 1 diabetes (T1D) is the second most common chronic illness in adolescence, the first being asthma, the major issue is it being associated with morbidity and premature mortality.[16]

Viable treatments are accessible yet require achieving a balance insulin dosing, diet and exercise alongside regular monitoring from blood glucose observing outcomes. Along these lines, execution of a steady adherence to such a perplexing and requesting treatment routine difficulties even the most roused juvenile. [16]

Central to dietary administration in T1DM is observingsugar admission and adjusting starch consumption as well as insulinlevels. Close adherence to sugaradmission is simultaneously associated witha better glycemiccontrol. It is worth mentioning that any disturbance between carbohydrate and insulin balancecan lead to not only immediate, but long-term complications of diabetes as well from hypo and hyperglycemia.A healthy diet is encouraged for all the patients with type 1 diabetes despite not having a disease-specific diet; they are more prone to develop dyslipidemia and cardiovascular diseases. Multiple researches have proven that patients with T1DM were found to have abnormal lipid levels increasing the risk factor for cardiovascular diseases. According to the 2005 Dietary Guidelines for Americans they recommend that patients with T1DM need to include in their diet fruits and vegetables, whole-grain foods, and foods that

have a lesser percentage of fats, in the guideline it is also stated that patients with T1DM have a limit of 7% of energy from saturated fat and should not exceed that number. (17)

With this in mind, studies have shown that patients diagnosed with T1DM were found to be consuming more fat than the recommended for them and even more than the non-diabetic people should consume according to the Healthy People 2010 recommendation. As mentioned above the limit of energy from saturated fat should not exceed 7, but their range was a lot higher being between 11 to 15 %. (17)

In order to encourage better eating habits and to motivate patients with T1DM, we need to consider the mental state of patients and how accepting they are towards being diagnosed with diabetes, as interventions that focus on direct, behavioral processes and don't pay attention towards the emotional, social, and family processes are less likely to have an effect on glycemic control; a more than one component intervention showed more robust effects on A1C.[18]
The rate of depression in teens with T1DM is around 15% this makes it almost double the rate in patients that are not diagnosed with diabetes type 1. (16)

A link between symptoms and higher HbA1c levels has been found and is mediated by declined adherence to blood glucose recording in a study of 276 teens with T1D. (16)

Type 2 diabetes mellitus is one of the most prevalent chronic diseases. Strict metabolic control (for microvascular related outcomes) and blood pressure control (for micro- and macrovascular related outcomes) plays a major roleinthe avoidance of vascular complications: macro- and microvascular disease being the most common diabetes-related causes of morbidity and mortality.(19)
Patients diagnosed with type 2 DM are considered vulnerable to the long-term complications of DM as well as the short term complications which leads to increase in morbidity as well as mortality(14)

Rapid uncontrolled urbanization and major changes in lifestyle could be driving this epidemic. This put high demands on the health care system and on society to keep up and work against this rapid increase. (14)

Appropriate diabetes programs in Sub-Saharan African countries are necessary to have in order to ensure the right treatment, to lower the risk of diabetes-related morbidity and mortality in the region. [14]

It is predicted that prevalence of DM in adults will increase in the next two decades and much of the increase will occur in developing countries where the majority of patients are aged between 45 and 64.[13], which is why our research was targeting the age group of 40-70.

The World Health Organization (WHO) has shown that adherence to long-term therapy for chronic illnesses in developed countries averages only around 50%[13].

Factors that are believed to play a major role in adjusting to chronic diseases include the age, how complex the treatment regimen, how long the patient has been diagnosed with the disease, as well as depression and the presence of any psychosocial issues.[22]

Adherence rates are usually reduced for patients with chronic conditions than those with acute conditions; this is associated with the long-term nature of chronic diseases because the decline in adherence is most rapid after the first 6 months of therapy. Such reduced adherence not only results in poor health outcomes but it also has a significant impact on healthcare costs. Thus, the overall management of type 2 diabetes should address adherence as well as appropriate medications. [8]

A literature search conducted in the years (1966–2003) was executed to single-out reports with quantitative data on adherence with oral hypoglycemic agents (OHAs) and insulin and interrelationship between adherence rates and glycemic control. Sufficient documentation of adherence was found in 15 retrospective studies of OHA prescription refill rates, 5 prospective electronic monitoring OHA studies, and 3 retrospective insulin studies.Retrospective studiesindicated that adherence to OHA therapy ranged from 36 to 93% in patients remaining on treatment for 6–24 months. Prospective electronic monitoringstudies documented that patients took 67–85% of OHA doses as prescribed. Electronic monitoring identified poor compliers for interventions that improved adherence (61–79%; P 0.05). Patients in the age of youth filled prescriptions for one-third of prescribed insulin doses. Insulin adherence among patients with type 2 diabetes was 62–64%. Thisstudy validates that many patients for whom diabetes medication was prescribed were poor compliers with treatment, including both OHAs and insulin. Despite that though, electronic monitoring systems were proven helpful in improving adherence for individual

patients. Similar electronic monitoring systems for insulin administration could be of benefit to healthcare providers determine patients needing additional support.[22]

With the current trend of transition from communicable to non-communicable diseases, it is projected that the latter will equal or even exceed the former in developing nations, thus culminating in double burden. Type 2 DM is the most prevalent form of diabetes mellitus and accounts for about 90% of cases of diabetes. [13]

Research based on large claim databases have pin-pointed key demographic factors, such as being of a more youthful age, lower education level, and lower socio-economic status, that are associated with poor medication adherence in T2D. The current body of data points to these important key factors: perceived treatment efficacy, hypoglycemia, treatment complexity and how convenient they are, cost of treatment, medication beliefs, and how much trust they put onto the physician, there's other factors (e.g. depression, forgetfulness, and limited diabetes knowledge) but the factors mentioned above are the most amenable to change.[20]

One way in which patients will be better able to manage their illnesses is by adhering to their medication regimens. Many patients, especially patients with a chronic illness, experience difficulties in following treatment recommendations.[13]

.Adherence to long-term therapy for chronic illnesses averages only 50%. As a result of poor adherence, patients do not receive optimal benefit from their drug therapy. Suboptimal treatment can lead to increased use of health care services (acute care and hospitalizations), reduction in patient's quality of life, and increased health care costs (drug costs and medical costs). The reports of World Health Organization have emphasized that “increasing the effectiveness of adherence interventions may have a far greater impact on the health of the population than any improvement in specific medical treatments. [13]

From these studies, it seems that the patient’s role in the process of adhering was to be passive and since the prescriber’s view was rational and based on scientific research, it may have been assumed to be superior to the patient’s beliefs and wishes. [13]

The data demonstrate that health beliefs, the quality of doctor/patient communication, and the quality of the information patients receive are important factors for patient adherence to treatment.

Possible explanatory models for adherence emerged, relating to knowledge of the illness, body awareness and the doctor/patient relationship [15]

This shows the importance of proper doctor/patient communication to ensure the full education of the patient regarding diabetes and how lifestyle changes, diet, and medication all go hand in hand when it comes to living with a chronic illness like diabetes. [13].

With proper life-style changes and commitment to medication as well as an overall positive outlook these factors contribute dramatically to the life of the patient. [15].

A better regimen adherence may close the gap between the possible treatment benefits, and the benefits patients actually receive [21]

Possible ways to intervene and help improve adherence of diabetic patients to their treatment regimen include the recall and comprehension method in which the physician asks the patient to repeat the instructions being told, this should not make the patient feel as if he/she is being tested but rather to make sure that the patient has fully grasped the information and that a proper doctor-patient communication has been established. [21]

As well as ensuring that the patient is very well aware of all the advantages of being adherent in the entire regimen in the short and long run, another important thing is to ask the patient which medication they see themselves mostly forgetting and helping them remember it by creating a system that would help them remember all their medications, and informing the patient about the consequences of not being adherent. [21]

Another cause of maladherence is the price of medication. [21]

A study in USA showed that 34% of patients stated that paying for medications was a reason for the lack of adherence.[32] Yusuff et al.study in Nigeria [33]and Nasir *et al.* study in Ethiopia [34]specified lack of finance as major barrier for anti-diabetic drug adherence; which institute 51.9% and 37.1% respectively.

Price of medication is a major struggle in developing countries, In Sudan; the average annual squandering of diabetes care during childhood was USD 283, of which 36% was depleted on insulin. The direct average cost of diabetes care for type 2 adult diabetes patients was USD 175 per year. These costs represent 23% and 9% of incomes of the families of the children with diabetes

and of adult patients, sequentially. More than half of the income of adult patients was granted by the spouse or siblings. The average total annual medical expenditure was fourfold higher among people with diabetes, compared to those without diabetes (USD579 vs USD148, respectively). Nonetheless, those with diabetes were significantly more probable to suffer from serious comorbidities, and reported a higher proportion of personal adverse social effects, such as not being allowed from doing paid work or participation in education, both for themselves and their families. Looking back at the levels of blood glucose monitoring showed poor glycaemic control in 86% of children with T1DM. HbA1c was at unsatisfactory levels in 77% of adult patients. Patients attending private clinics had both higher income and higher costs in comparison to those attending public clinics. Nevertheless, both groups had poor glycaemic control, which could possibly mirror the low direct costs and the minimal care given to all patients with diabetes regardless of the socio-economic status. [(23)]

When asked why this isn't something that patients speak about with their clinicians is due to the fact that half of them did not believe that their healthcare provider would be of any help, while others felt embarrassed didn't find it easy to open up such matter, while some felt like there wasn't enough time in their hospital visits to speak about financial issues, which is why we encourage clinicians to ask about the presence of any cost-related problems as this is more common than we know.[(21)]

The aforementioned study in Sudan has highlighted the intensity of the economic burden on Sudanese patients with diabetes. This economic weight has generally not been translated into optimum diabetes care, and can be considered as an exhaustion of family resources and the consequences of a poor healthcare system. Patients with diabetes and their families pay a substantial part of their income to maintain health, and despite that they receive insufficient care. The indication for primary care services are that essential consideration administrations ought to be upheld so patients accomplish better diabetes control, and that the monetary weight on patients with diabetes should be reduced. Evidence-based programs for diabetes management and prevention in low-resource communities should be developed. Future research is needed to gain a greater understanding both of how families cope, and of efficient mechanisms to improve services in a cost-effective way. [(23)]

By providing these approaches it can make the process of taking medication not as stressful and in the same time the outcome will be favorable for both the short and long- term, and increasing the possibility that the patient could begin to weigh the risks of medications in comparison the benefits quite differently, making them more motivated and more willing to work on their adherence in regards to life-style and medication leading to a greater treatment efficacy.[20]

It is safe by now to say thatnon- adherence is a major factor that could lead to morbidity and mortality in diabetic patients. Overall improvement in adherence rate of 86.8 % was observed with a decline of non- adherence rate after interventions were made. Strategies to be employed during intervention that will ensure improvement in adherence should be centered on patient related issues, medication related issues, prescriber related issues and pharmacist related factors. [13]

2.2 Similar Studies

In Egypt, the adherence level to treatment was suboptimal as less than half the studied patients with diabetes mellitus were found to be disciplined to their medications. The marital status of the patient, the absence of comorbid illness and diabetes-related complications and beingpersistently educated and informed about the disease and treatment regimen were the most important indicators of medication adherence recognized by the study.[24]

In South Sudan, the proportions of "poor", "average", and "good" scores for knowledge were 58%, 18% and 24%, respectively. Less than half of the patients had had retinal check-ups (46.6%), HbA_1c tests (44.3%), lipid measurements (37.5%), dental assessments (20.5%) and renal function reviews (10.2%) in the last year;thisimplies that there was poor knowledge and low adherence to diabetes management guidelines. This highlights the impact of educational intervention and implementation of diabetes management guidelines in South Sudan.[25]

In Kenya, the prevalence of adherence was low for 28.3 % [95% CI: 23.1, 33.5], medium for 26.2% (95% CI: 21.1, 31.3) and high for 45.5% (95% CI: 39.6, 51.3) of study members. Glycemic control was good (HbA1c < 7%) for 107 (36.9 %) of study members. Dissatisfaction with family members support,patients with 2-10 years' duration of disease, consistently being admitted for diabetes mellitus, challenge in drug access and dissatisfaction with going to clinicians were factors that wererelated with poor medication adherence prompting the end that the mostof the patients

with diabetes mellitus patients have suboptimal medication adherence. Family support, affordability of medications and good healthcare provider-patient communication are very significant in guaranteeing medication adherence.[26]

In Saudi Arabia, they stated that Medication therapy management and better communication of the patients and healthcare providers are highly relevant for therapy optimization and reducing non-adherence and approaching the glycated hemoglobin targets.[35]

Even when free medicines were available with a high level of health care access through government PHCCs, studies demonstrated poor adherence.[27]

Poor adherence was found in rural areas, and in regards to educational levels and un-educated patients was found to be poorly adherent, and regions of lower income were also found to be poorly adherent in comparison to higher income regions. [27]

In Ghana, Adherence in diabetic patients was low. The findings stated that there was a clear significant association between the level of education and adherence. This wasfound to be consistent with other studies. Educated patients are more likely to know the consequences of diabetes and the diabetes-related complications and as such tend to adhere to their medications; Occupational status was on the other hand not associated with level of adherence. It was also found that patients who were better informed about their disease and medication from healthcare providers are more adherent. [28]

In India, the adherence level was observed to be poor,the socio-demographic factors that were viewed as altogether connected with better adherence to drugs among patients with Diabetes mellitus patients were over the age of long term and instructive status of secondary school or above.Among the clinical factors, those having longer duration of disease more than 5 years had higher medication adherence and this association was statistically significant. Among the treatment related elements, presence of glucometer was found to be significantly associated with good medication adherence. Some of the elements that are thought to influence compliance include social and psychological components like knowledge and understanding including communication, interaction and patient satisfaction, social isolation and social support including the effect of the family, health beliefs and attitudes and factors associated with the illness and the

treatment including the duration and the complexity of the regimen. In this study, it was found that a strong association exists between compliance to medications and educational levels.Illiteracy can disrupt how much you understand in regards to the disease and medication, Various studies show that the risk of non-adherence is exceptionally high when patients can't peruse and comprehend fundamental composed clinical instruction. [29]

A Chinese study stated "poor adherence and persistence were prevalent, Patients who had higher count of baseline HbA1c tests, higher count of baseline OAD classes, and presence of microvascular complications, including neuropathy and nephropathy, were more likely to be adherent and persistent to their insulin treatment., while n. Predictors of poor adherence/persistence with insulin included being elderly ($70 years), baseline claims-based hypoglycemic events, and presence of hypertension or dyslipidemia."[30]

Another study in China stated otherwise in which they had an adherence level of 89.6% stating that frequent follow-ups and better education were associated with a higher level of adherence. [36]

In Sudan, the country that we are currently doing our research in, has stated that the adherence rate was sub-optimal. [31]

In summary, the impact of mal-adherence is linked with an increased risk of morbidity and mortality in both type 1 and type 2 diabetics, and is not something that should be taken light-heartedly, especially due to the incidence of the disease increasing.

Patient's awareness is a crucial part of seeing to it that patients are adherent to their medications; furthermore, ensuring a proper doctor-patient communication is a vital part and plays a major role in the outcome.

Diabetes, is more than simply taking medication, but it is an entire package of being adherent to the prescribed medication, exercise, avoiding bad habits, following a healthy diet, and having a good mental state, as well as being fully aware of the complications that would result due to poor adherence.

Chapter Three

Research Methodology

Chapter Three

Research Methodology

3.1 Study design:

Descriptive Hospital based Cross-sectional study

3.2 Study area\setting:

Hospitals & Diabetic Clinics:

- Ribat University Hospital

Ribat University Hospital, is a hospital owned by Ribat University, located in Burri.

It is a fairly crowded hospital, they have specialized unit for endocrinology at least once a week, most of the people there are part of the military, with an ICU unit for patients who develop DKA, although they are understaffed patients are adequately followed up.

3.3 Study Population:

Inclusion:

1) Any adult with Diabetes Mellitus

Exclusion:

1. Cognitively impaired
2. Gestational Diabetes

3.4 Sampling Technique:

Data collection tool:

Questionnaires. Self-administered, to be taken by the researchers

Technique: Random systemic sampling in Ribat University Hospital

In the referral clinic, the hospital admission list would be taken and our group would pick one and skip three, and for every ward we would decide on a new number to skip from.

3.5 Sample size:

Yamane's Formula

The calculation formula of Taro Yamane is presented as follows.

$$n = \frac{N}{1 + N(e)^2}$$

Where : n= sample size required

N = number of people in the population

e = allowable error (%)

$$\boldsymbol{n = \frac{480}{1 + 480\ (0.04)^{\ 2}} = 267 patients}$$

3.6 Study variables

Dependent:

- Adherence level

Independent:

- Age
- Gender
- Known co-morbidities
- Marital status
- Economic status
- Level of education

3.7 Data collection

Permission was granted from the hospital to collect the data, Google forum was used for the creation of questionnaires; data was collected using Statistical Package for Social Sciences (SPSS) version 26, data was collected by the researches after informing the patients of their right to withdraw anytime they decide, and analyzed using SPSS.

3.8 Ethical considerations

Ethically approved by the ethical committee of the community department at Napata College, and verbal consent was taken from all the participants. All the data collected from the participants remained confidential, and participation in this study was voluntary.

Chapter Four

Results

Chapter Four

Results

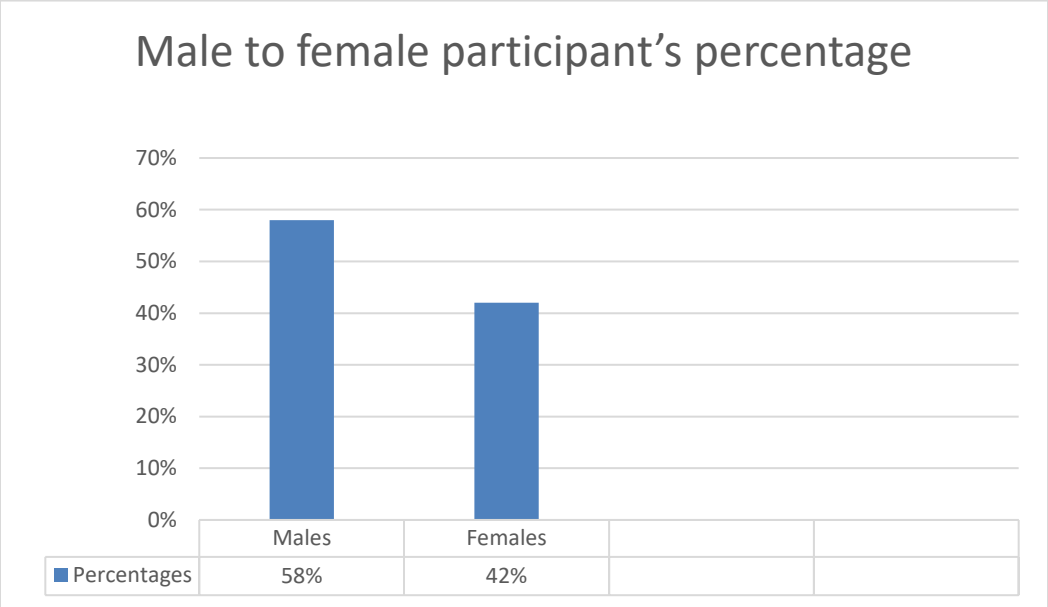


Figure 4.1 – Male to female participant's percentage in RUH in Khartoum- Sudan 2021

Our results stated that 58% of the participants were males, and 42% were females.

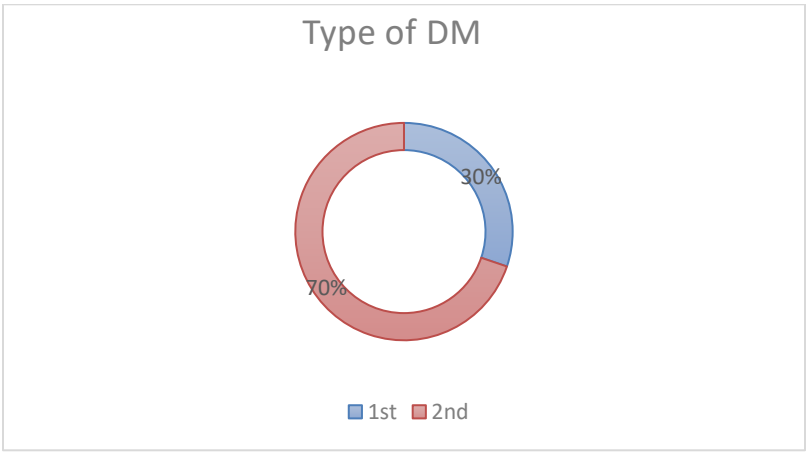


Figure 4.2 - Percentage between type 1 and type 2 diabetes in RUH in Khartoum- Sudan 2021

Majority of the patients were diagnosed with type 2 (70%)

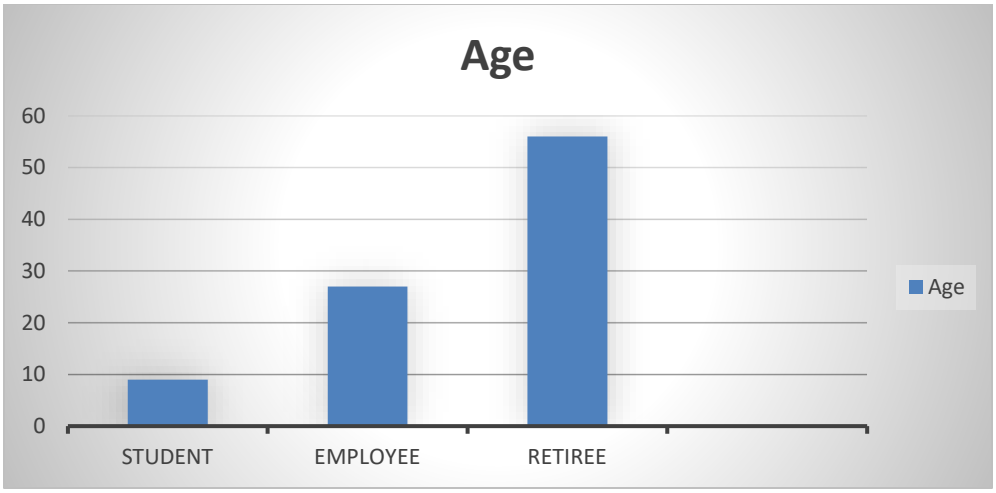


Figure 4.3– Ages of participantsin RUH in Khartoum- Sudan 2021

The participants ages ranged from 19-85 with a mean of 54.3 and a median of 57.

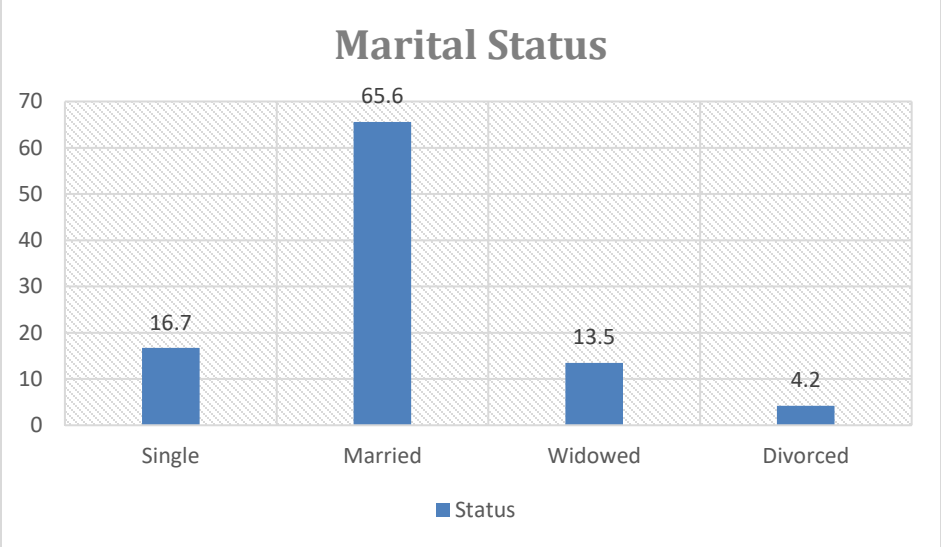


Figure 4.4 – Marital status of the participants in RUH in Khartoum- Sudan 2021

65.6% of the participants were married, and 4.2% were divorced.

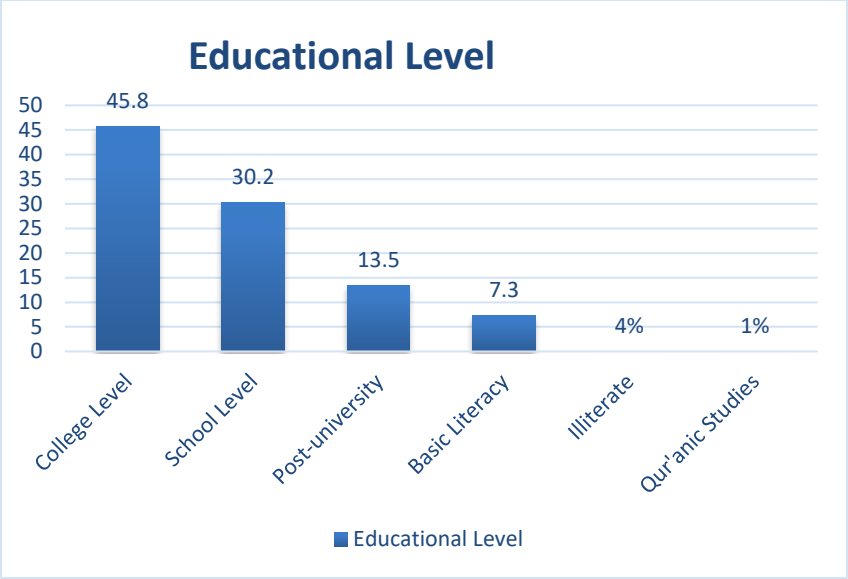


Figure 4.5 - Educational level of the participants in RUH in Khartoum- Sudan 2021

Majority of the participants had an educational level of school education and above (89.5%).

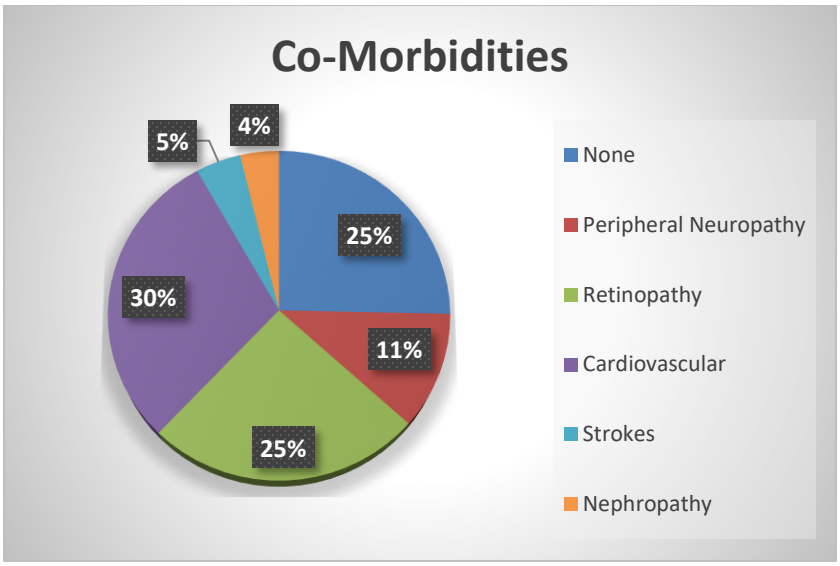


Figure 4.6 – Percentages of co-morbidities in RUH in Khartoum- Sudan 2021

75% of the patients had diabetes-related co-morbidities, while 25% of the patients stated that they did not have any complications related to diabetes.

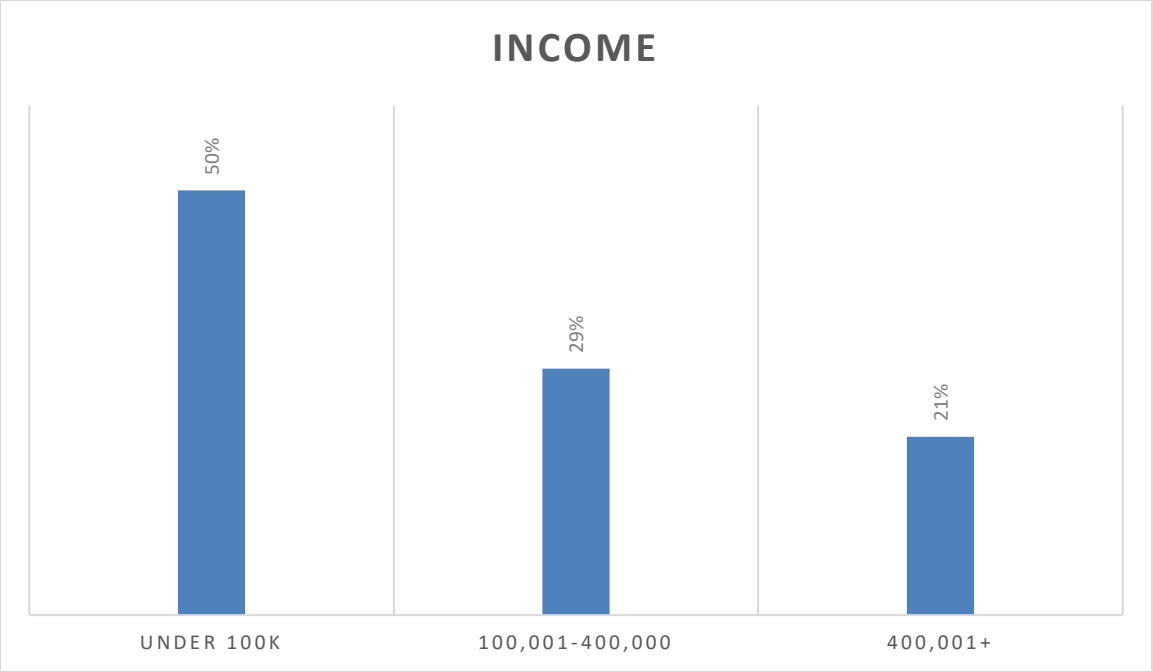


Figure 4.7– Socio-economic status of the participants in RUH in Khartoum- Sudan 2021

50% of the participants had a 'low' socio-economic status. 29% were classified as of 'moderate' socioeconomic status, while the remainder 21% were classified as of a 'high' socioeconomic status.

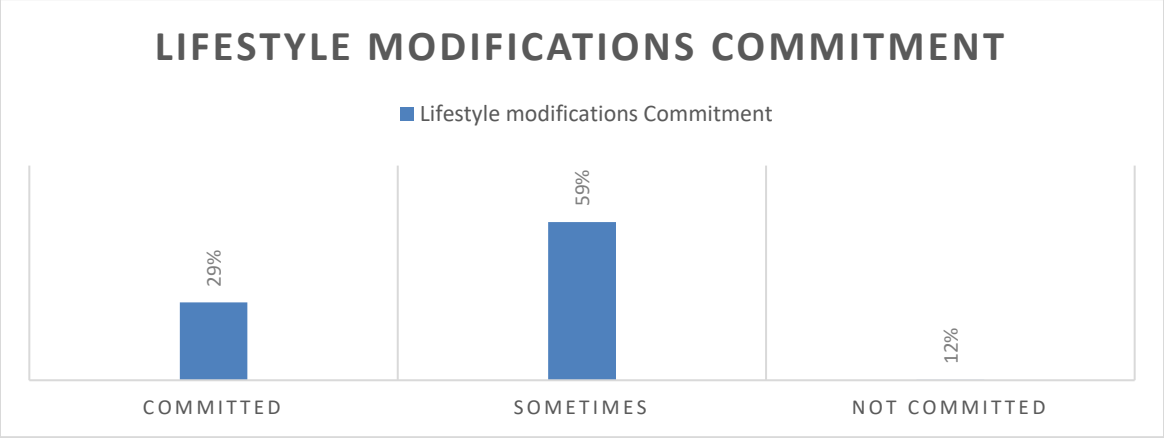


Figure 4.8 - Commitment towards life-style modifications in RUH in Khartoum- Sudan 2021

59% stated that they "try" committing to life-style modifications every now and then, while 12% have not committed to life-style modifications at all.

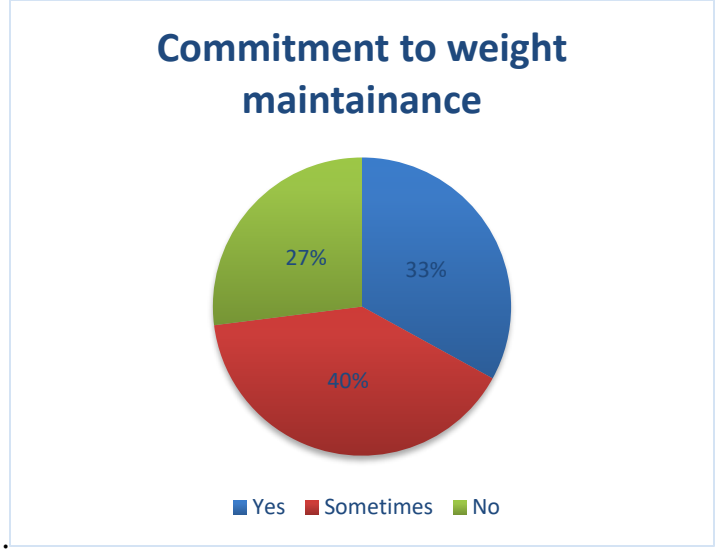


Figure 4.9–Commitment towards maintaining a healthy weight in RUH in Khartoum-Sudan 2021

40% of the patients try exercising every once in a while and 27% of the patients do not exercise or try maintaining a healthy weight.

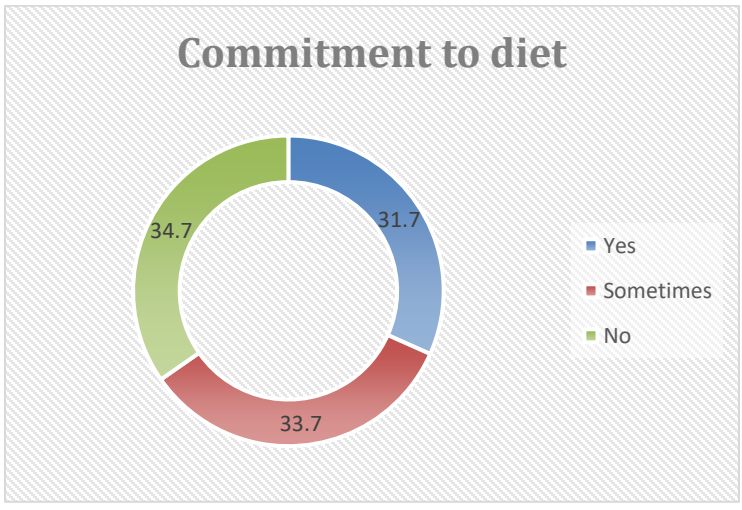


Figure 4.10 – Commitment towards diet in RUH in Khartoum- Sudan 2021

34.7% are not committed to diet while 31.7% are committed to diet.

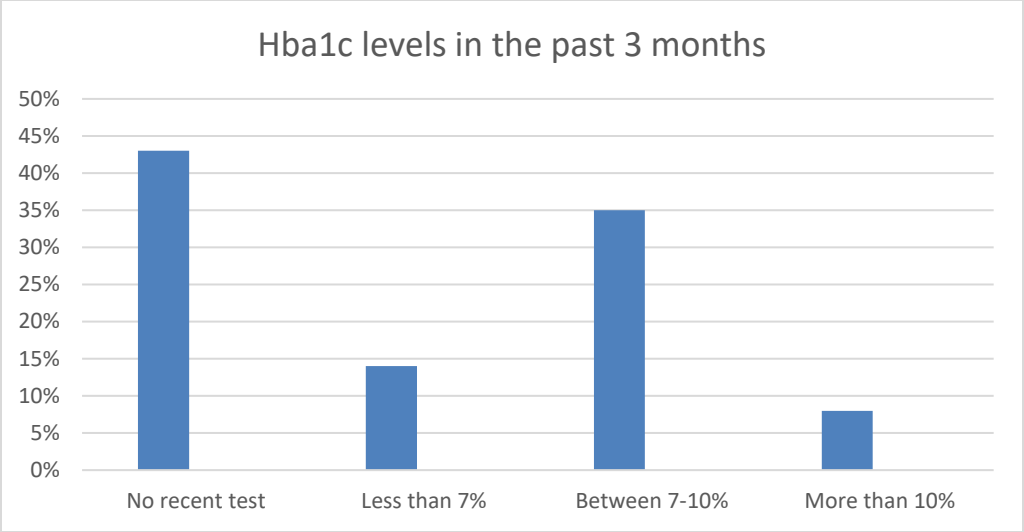


Figure 4.11– Hba1c testing results in the last 3 months of the participants in RUH in Khartoum- Sudan 2021

43% of the participants did not test their Hba1C levels in the past 3 months.

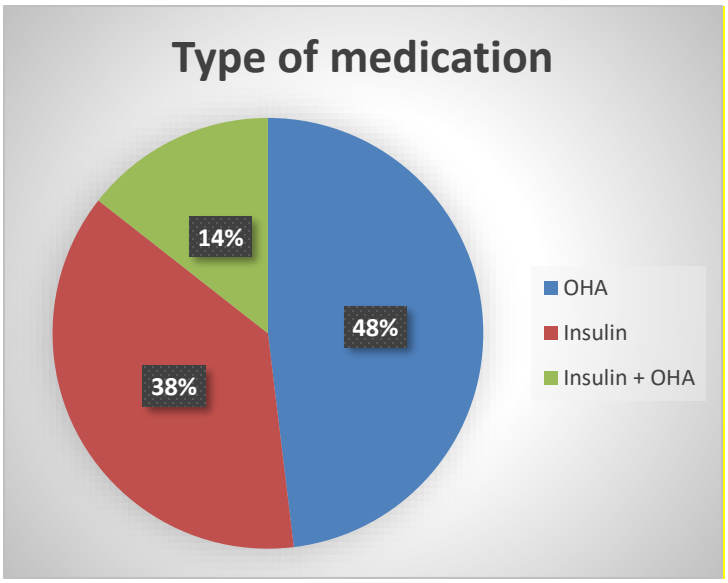


Figure 4.12 – Type of medication used in RUH in Khartoum- Sudan 2021

48% of the participants are using OHA while 38% are using insulin as a medication, and 14% are using both.

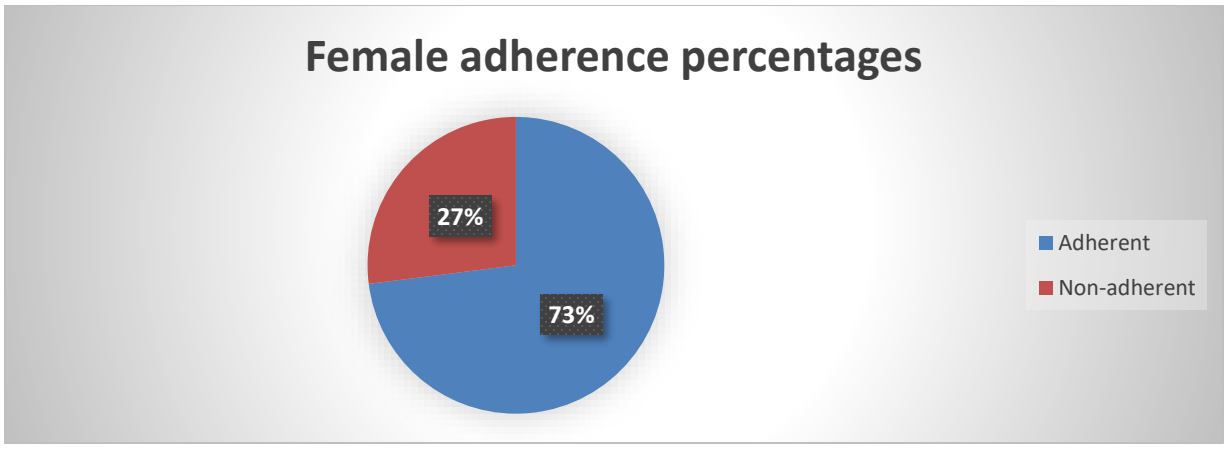


Figure 4.13 – Female adherence percentages in RUH in Khartoum- Sudan 2021

The majority of the females were found to be adherent.

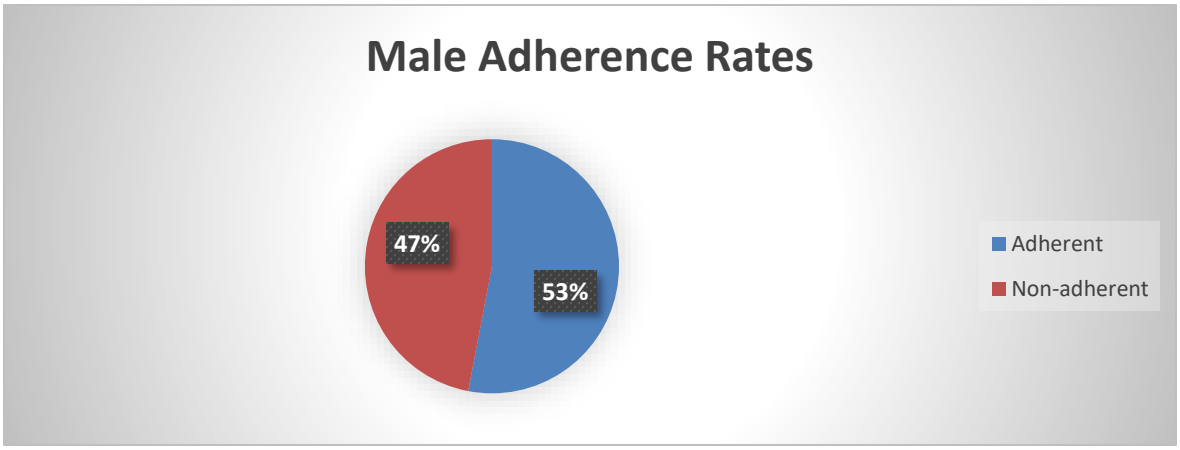


Figure 4.14 – Male adherence percentages in RUH in Khartoum- Sudan 2021

Poor adherence is found in 47% of the males.

Table 4.1 – List of correlations for adherents

Adherence level		B	Std. Error	Wald	df	P value	Odd Ratio	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
Adherent	Intercept	-1.612	4539.576	.000	1	1.000			
	Male	1.152	.565	4.159	1	.083	3.165	1.046	9.575
	Female	1.152	.564	4.161	1	.043	3.164	1.044	9.577
	Age: Under 40 years	1.810	1.298	1.947	1	.163	6.113	.481	77.760
	40-55 years	1.513	.847	3.193	1	.074	4.541	.864	23.875
	56-65 years	.679	.675	1.012	1	.314	1.972	.525	7.405
	66+ years	.626	.589	1.021	1	.049	1.965	.497	.
	Marital Status: Married	18.337	4539.576	1.032	1	.043	4.251	1.294	9.689
	Widowed	1.445	4539.576	1.022	1	.081	4.362	1.157	9.568
	Single	1.301	4539.576	1.040	1	.093	4.147	.926	9.598
	Single	1.301	4539.576	1.040	1	.093	4.147	.926	9.598
	Divorced	1.810	4539.576	1.032	1	.122	1.200	.259	5.553
	Socio-economic status: Low income	.183	.781	.055	1	.065	1.200	.259	5.553
	Middle class	.077	.761	.010	1	.039	2.073	.243	4.797
	Wealthy	.077	.761	.010	1	.049	2.080	.243	4.797
	College/University	18.572	1.000	345.177	1	.001	116312550.083	16396564.675	825088033.702
	Uneducated	19.481	1.738	125.640	1	.069	288785394.820	9575959.860	8708996850.575
	Post-graduate	20.153	1.448	193.679	1	.001	565344553.748	33089568.150	9659070284.632
	Secondary	18.652	.992	353.408	1	.065	126035134.997	18028099.804	881116447.463
	Literate	18.260	.000	.	1	.092	85121580.971	85121580.971	85121580.971
	Quranic studies	0[b]	.	.	0	.096	.	.	.

Female gender was found to be statistically significant in regards to adherence levels, as females were found to be more adherent (P value 0.043) in comparison to males.Individuals that were married were also more adherent (P value 0.043) in comparison to other marital statuses, there was a very statistically significant correlation between the socio-economic status and educational level,

as those that had a lower socio-economic status or lower educational levels were found to be less adherent in comparison to the individuals that had a higher socio-economic status or higher educational levels, as individuals that had an educational level of university and above had a p value of .001,and those of a higher socio-economic status were found to be more adherent as well, middle classes had a p value of .039 , and wealthier classes had a p value of .049 respectively.

Older age groups above the age 66 years, were found to alsobe statistically significant in regards to overall adherence rates. (P value .049)

No significant correlation was found when comparing adherence levels to the presence of co-morbidities.

Chapter Five

Discussion

Chapter Five

Discussion

5.1 Discussion

In our present study, women were found to be more adherent towards medication and life-style modification 71% (figure 4.13),supporting a study in China which also had a female dominance in regards to adherence, with a percentage of 91%[36], and a study in Saudi Arabia their findings showed males adherence was 37%, and a female adherence of 63% [27], and in India [29] these findings support our study also linked a better adherence in females who participated in this research. (Figure 5.1/Table 5.1)

Table 5.1

		Commitment to Lifestyle Changes	Sex
Commitment to Lifestyle Changes	Pearson Correlation	1	.194
	Sig. (2-tailed)		.057
	N	98	97
Sex	Pearson Correlation	.194	1
	Sig. (2-tailed)	.057	
	N	97	100

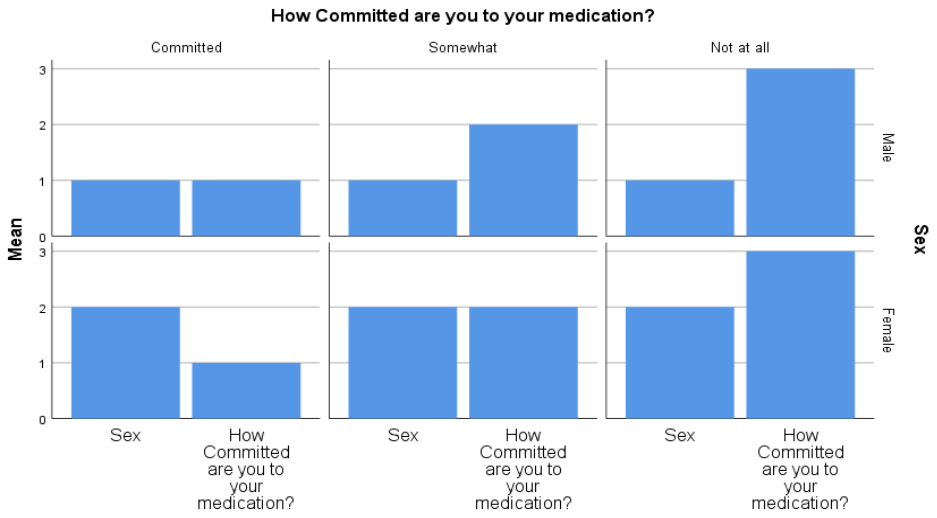


Figure 5.1

In our present study, married individuals have been found to be more adherent (P value.043) in comparison to individuals that are single, windowed, or divorced. A study in Ghana concluded a similar finding in which the adherence in married people are (62.4%) more than the single persons (42.4%), [28] a similar study in Egypt found that 56.8% of the adherent patients were married. [24] The link between marital status and adherence level is still not clear but implies the possibility of having a supportive partner could play a motivational role to the patient.

The study in China also found that older age groups were believed to be more adherent [36], due to this finding in China they encouraged more intensive medication adherence monitoring among younger, male diabetic patients who are newly prescribed antidiabetic medications. Physicians should spend more time and effort in explaining the importance of optimal medication adherence to these patients during their consultations, a finding opposing ours was how adherent they found their participants to be with an adherence level of 89.6%. [36]

A study in Saudi Arabia stated that there was a better adherence in the older age groups by a percentage of 61% [27], as well as a study in Ghana has also stated that older age groups were found to be more adherent. [28] .

These findings in regards to age are similar to ours as older age groupswere found to be more adherent than younger groups (Table 4.1) while more researches should be made in trying to understand why older age groups are more adherent, it is safe to assume that older age groups

receive better care and can be constantly reminded by people in their households, which is a hypothesis supported by a study in Kenya, where the majority of participants in their study were over fifty-five years of age and would likely be living with children or relatives; the protective effect of family noted above is likely to facilitate adherence with medication. In contrast younger patients who are professionally active have been shown to be more likely skip or forget their medication [39] hence poorer adherence. [26]

These findings oppose a study in Egypt where patients who were younger than the age of 40 were found to be adherent by 66.7 % and the age group of 40-60 were adherent by 53% and patients older than the age of 60 had an adherent rate of 20.8%. [24]

Our present study has found a significant correlation between socio-economic status and adherence levels, as a lower socio-economic status has been linked with a decreased adherence level. This supports other studies that have found a significant relation between poor adherence and financial problems. A study in USA showed that 34% of patients stated that paying for medications was a reason for the lack of adherence [32]. Yusuff et al. study in Nigeria [33] and Nasir et al. study in Ethiopia [34] specified lack of finance as major barrier for anti-diabetic drug adherence; which institute 51.9% and 37.1% respectively. [31]

In China, they also stated that there was a relationship between district of residence and the odds of better medication adherence, as patients living in Taipo (a region more urbanized than the North district but less urbanized than Shatin) were found to be more adherent. [36] as well as Saudi Arabia, which linked those of a higher socioeconomic class are more adherent to their medications by (45.5 %). [27] Similar statement was made in Ghana, the socioeconomic status that had the highest adherence rate to their medications where of a high socio-economic status [28], as well as India which stated that upper socio-economic classes are more adherent. [29]

This could be due to the fact that higher socio-economic status is able to afford better health-care facilities, even if they are living in a developing country, they have the privilege of travelling to countries that could provide a better healthcare to them, while those of a lower socio-economic status or those living in countries dealing with financial crisis will not be able to afford medication, this statement has been supported in a study in Kenya which states that "Cost of treatment has been implicated as a barrier in achieving medication adherence and glycemic control among Type 2 diabetes mellitus patients [37]. Almost half of diabetic patients recruited reported cost as their main

challenge to medication access. In Kenya, where the bulk of health care costs are paid out of pocket (OOP); this increased expenditure can result in catastrophic impoverisation of individuals and their families especially if the breadwinner is affected [38].

At the public or national health level; increased resources need to be invested"[26]

A similar statement has been made in Sudan, the country in which this research is currently being made which has highlighted the impact of economic burdens among patients with diabetes in regards to affording medication. [23]

In our present study, a very significant correlation (P value .001/Table 4.1)between better education and better adherence levels, 89.5% of our participant's responses had an educational level of complete school education or above, In South Sudan 58% of the responses showed poor knowledge. This was associated with a low level of education among participants [25] while compared to India which they were illiterate by 30% it was found that a strong association between compliance to medications and literacy levels [29]

This implies the importance of education among all age groups to have a better understanding about the disease complications, and importance of adherence.

In our current study when asked about commitment to life-style changes, exercise and diet 59% stated that they "sometimes" commit to their life-style modifications, and only 29% are always committed, in regards to weight and exercise 33% are fully committed in incorporating exercise to their everyday routine, while 40% sometimes try to commit. When finally asked about their diet 31.7% are committed fully in adjusting their diet to being diabetic while 33.7% stated that they sometimes adjust their eating habits, but it is usually on and off.

In South Sudan, when they were asked about diet almost 50% of respondents were not following diet recommendations [25] stating that physical activity has the greatest effect to minimize diabetes complications and reducing weight They suggested some barriers to exercise adherence such as lack of motivation and convenience and weather, which our respondents stated is why they aren't able to commit as well.

A finding in our study was that 43% of the participants did not test their Hba1C levels in the past 3 months (figure 4.11), which is a similar finding in South Sudan were they stated that only (44.3%) patients had been tested for HbA1C within last four months. [25]

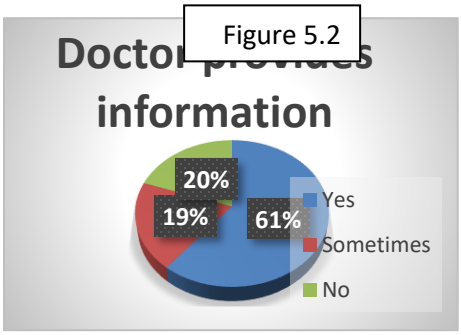
Although it isn't the scope of this research, we as a whole need to find ways to help patients encouraged to test their HbA1C levels every 3-4 months.

Our study has found that a good doctor-patient relationship in which a doctor properly educates the patient about the side-effects of medication and importance of adherence is linked with an increased motivation to adhere which has been stated by 61% of our participants (Figure 5.2),

This supportsa study in Saudi Arabia which states that "Medication therapy management and better communication of the patients and healthcare providers are highly relevant for therapy optimization and reducing non-adherence and approaching the glycated hemoglobin targets" [35]

Although our research has not found a significant link between co-morbidities and the level of adherence of diabetics towards their management protocol, the presence of co-morbidities is common in diabetics, our current study has found that 30% of patients with diabetes have cardiovascular complications,25% have retinopathy, 11% have peripheral neuropathy, 4% of the participants had strokes and nephropathy, while 25% stated that they do not have complications.

Figure 5.2



5.2 Limitations

Due to the political instabilities that were taking place in Sudan, and the limited time allocated to the conduction of this project, we were unable to reach the requested sample size.

Chapter Six

Conclusion and Recommendations

Chapter Six

Conclusion and Recommendations

6.1 Conclusion

- Among the studied variables female gender, married couples, middle and higher socio-economic statuses, and college education and above were found to be statically significant with better adherence rates.
- Older age groups (above the age of 66 years old) were found to have a statically significant to a highly significant correlation
- The study recommended FMoH to develop unified evidence based management protocols with conduction of awareness raising campaigns about the important of patient's adherence to these protocols
- The overall adherence rate in RUH was sub-optimal with a percentage of 63%

6.2 Recommendations

Federal Ministry of Health for Non-Communicable diseases directorate:

- Develop unified evidence based management protocols with clear updating mechanism.
- Establishment of comprehensive Diabetic management centers with

Federal Ministry of Health promotion directorate:

- To conduct awareness raising campaigns, among diabetes patients in regard of importance of adherence to management protocol,
- Further studies are recommended by reaching the representative sample size.

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Annexes:

- Questionnaire

مدىالتزاممرضىالسكريبالعلاج

بياناتشخصية

الجنس

ذكر

انثى

العمر

الحالة الاجتماعية

أعزب\عزباء

متزوج\ة

أرمل\ة

مطلق\ة

الحالة التعليمية

غير متعلم

محو أمية

(تعليم متوسط (اعدادي\متوسط\جامعي

جامعي

دراسات عليا

الوظيفة

? **ماقيمة مرتبك الشهري**

اقل من ١٠٠ ألف في الشهر

أم ١٠٠ _ ٤٠٠ ألف في الشهر

أم أكثر من ٤٠٠ ألف في الشهر

بيانات داء السكري

ما هو نوع السكر الذى اصبت به؟

النوع الاول
النوع الثاني

في اخر 3 شهور ما هى نتيجة آخر تحليل تراكمى للسكر ؟

% أقل من 7
% من 7 الى 10
% اكثر من 10
لا يوجد تحليل حديث

في اى عمر تم التشخيص؟

ما هو عدد سنوات الاصابة بمرض السكرى؟

هل يوجد تاريخ مرضي للسكري في العائلة؟

نعم
لا

ما هو التزامك في تعديلات نمط الحياة

ملتزم
احاول الاتزام
غير ملتزم

ما هو العلاج الذى تستخدمة حاليا لمرض السكر؟

أدوية مخفضة للسكر
انسولين
أدوية مخفضة للسكر + انسولين

ما مقدار التزامك بالعلاج ؟

ملتزم جدا
ملتزم الى حد ما

ملتزم قليلا

غير ملتزم

(هل لديكم أمراض مزمنة أخرى أو مضاعفات لمرض السكر؟ (يمكن اختيار أكثر من اجابة

لا يوجد مضاعفات

التهاب الأعصاب الطرفية

مضاعفات فى العين

أمراض شرايين القلب و الاوعية الدموية

ارتفاع فى ضغط الدم

جلطات دماغية

قصور فى وظائف الكلى

أحرص على زيارة المستشفى بانتظام

نعم

لا

انا افحص سكر الدم ذاتيًا حسب توصيات الطبيب

نعم

لا

احمل طعامًا مثل مشروب محلى أو حلوى أو شوكولاتة فقط فى حالة نقص السكر فى الدم

نعم

لا

أحاول الحفاظ على وزنى المثالى عن طريق قياس وزنى بانتظام

نعم

لا

أحاول الحصول على معلومات حول التحكم على مرض السكرى من خلال حضور المناسبات المختلفه او تصفح الإنترنت

نعم

لا

هل تعدل جرعة العلاج من دون استشارة طبيب؟

نعم

لا

* **هل يعطيك الطبيب معلومات عن الأثار الجانبية للعلاج؟**

نعم

لا

* **هل تتبع حمية غذائية للسكري؟**

نعم

لا

ما مدى تأثير حالتك النفسية و الاجتماعية و الاقتصادية بلسكري؟

لم يأثر

أثر بشكل بسيط

كان له تأثير كبير

- Informed consent

  A verbal consent was given by all the participants before filling the questionnaire

- Map