

Challenges of Insulin Storage in Hot Climates

Amon Solomon Ghebrenege*

Department of Clinical Diabetes, Ghindae Zonal Referral Hospital, Ghindae, Eritrea

*Corresponding author: Amon Solomon Ghebrenege, Department of Clinical Diabetes, Ghindae Zonal Referral Hospital, Ghindae, Eritrea, E-mail: amonsgk89@gmail.com

Received date: October 06, 2021; Accepted date: October 20, 2021; Published date: October 27, 2021

Citation: Ghebrenege AS (2021) Challenges of Insulin Storage in Hot Climates, J Clin Diabetes 5: 126

Copyright: © 2021 Ghebrenege AS, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Abstract

Background: The treatment of Diabetes mellitus (DM) focuses on proper drug regimen and lifestyle management. The worldwide prevalence of DM has risen dramatically over the past two decades. In Eritrea, DM has shown a significant rise over the past 10 years becoming the 22nd most common incidence in Eritrea for ages over 5 years. Insulin is the recommended treatment for DM. Storage of insulin is key in maintaining appropriate functionality.

Cases: We report here two diabetic patients, where improper storage of insulin led to many challenges in controlling their blood sugar levels in Ghindae Zonal Referral Hospital. The first is a 50-year-old male who has been on insulin therapy since 2010. Because he had constantly reported high fasting blood sugar levels, his insulin regimen was increased constantly but there was no improvement. Once the patient started placing his medication in a refrigerator, he showed marked improvement. Our second patient is a 32-year-old male who has been on insulin therapy. The patient has been recurrently admitted to the hospital with high blood sugar levels and diabetic ketoacidosis. He reported that he places his medication on a small cloth satchel that he keeps wet and hangs in the wind. He was advised to place his medication in a refrigerator. Once, he was able to access a refrigerator, he too was able to record healthy fasting blood sugar levels.

Conclusion: Alternative ways of cooling are also as effective as modern techniques in maintaining the storage temperature within the recommended range. Healthcare professionals should intensely educate patients of the proper storage of insulin.

Key words:

Diabetes mellitus, insulin

Introduction

Diabetes mellitus (DM) is one of the most extensively researched diseases, yet its treatment remains to be a challenge. The treatment focuses not only on the drug regimen but also on dietary and lifestyle management. Even slight changes in any one of those can harm the patients. DM is classified on the basis of the pathogenic process in two broad categories designated type 1 and type 2 [1]. The worldwide prevalence of DM has risen dramatically over the past two decades, from an estimated 30 million cases in 1985 to 177 million in 2000. Based on current trends, >360 million individuals will have diabetes by the year 2030 [1]. In Eritrea, DM has shown a significant rise over the past 10 years [2]. Greater than 3500 new cases have been reported until July of 2017 [2]. According to the Health Management Information System of Eritrea, DM is the 22nd most common incidence in Eritrea for ages over 5 years. Insulin is the recommended treatment for DM. There are many types of insulin preparations. Insulin comes from drug manufacturers in three basic packages; vials, pens, and cartridges. Storage of insulin is key in maintaining appropriate functionality. Two diabetic patients, where improper storage of insulin led to many challenges in controlling their blood sugar levels in Ghindae Zonal Referral Hospital, are reported here.

The methods and importance of the storage duration and temperature of insulin are also discussed.

Case Report

Case 1

A 50-year-old male who was diagnosed with type I diabetes mellitus in early 2010, and has since been on insulin therapy. He started following in Ghindae Hospital in 2015 and had recurrently recorded fasting blood sugar levels as high as ~400mg/dl. Due to this rise in fasting blood sugar, his regimen of lente insulin and regular insulin had been increased from 37IU and 21IU per day to 50IU and 30IU per day respectively. Even though the regimen was raised, and the patient had been adhering to a strict diabetic diet, the patient still had high blood sugar. In the beginning of 2018, the patient reported that he carried the medicine in his pockets just in case he needed it. The patient was then informed on the importance of proper cooling of insulin. After the session, he started placing his medication in a refrigerator. Upon his coming follow ups, patient showed marked improvement with healthy fasting blood sugar levels of 68mg/dl, 86mg/dl and 91mg/dl over the past six months. After complaining of bouts of hypoglycemia, his insulin regimen has also been reduced to just lente insulin of 30IU per day.

Case 2

Our second patient is a 32-year-old male who has been diabetic since he was just 15 years old. He started following in our hospital in 2015 and was on lente and regular insulin of 45IU and 20IU respectively. But over the past three years, the patient has been recurrently admitted to the emergency room and many times to the medical ward for treatment of hyperglycemia and mild diabetic ketoacidosis. Moreover, the patient came for follow ups every two months due to personal reasons. What was peculiar about the patient was the remarkable recoveries he made once admitted. In January, 2018, the patient reported that he places his medication on a small cloth satchel that he hangs in the wind and wets it whenever his satchel starts to dry so that its contents may remain cool throughout the day. He was advised to place his medication in a refrigerator. Being from a very rural area, he was not able to gain access to a refrigerator for the next two months. But in April the same year, he informed us that he has a kind neighbor who had opened a small cafeteria in the vicinity. The neighbor had agreed to keep patient's drugs refrigerated. Since then, our patient has recorded fasting blood sugar levels of 91mg/dl in May and 98mg/dl in June.

Discussion

Insulin was first isolated by Banting and Best in 1922. Due to its clinical importance, it is one of the most extensively studied molecules in modern medicine. Yet, in rural areas the storage duration and temperature of insulin for appropriate management of diabetes mellitus remains a challenge. When looking at the manufacturer's recommendation, unopened insulin must be stored at a temperature between 2 - 8°C. If opened and in use, it must be maintained at room temperature; i.e. between 15 – 30°C [3, 4]. Insulin shouldn't be used further from the date of expiration. If it has been opened, it cannot stay more than one month before its potency is compromised [5]. One study carried out in India used human insulin formulations of Eli Lilly, Novo Nordisk and Bicon, and stored them at temperatures of 5, 25, 26, 32 and 37°C for 28 days to simulate different environments of storage. Pharmaceutical analysis showed no drop in the concentration of insulin except in those stored at 32 and 37°C. There was also no significant change in blood sugar levels in animals injected with these formulations of insulin also stored different formulations under temperatures ranging from 5 to 50°C. They too came to the conclusion that insulin stored at temperatures greater than 30°C lost its potency.

Sanjay Kalra and Bharti Kalra discussed many ways of storing insulin while maintaining the temperature within the recommended range. Although the article dictates that a refrigerator is the most ideal place to store insulin, many other equipments such as a bowl of water, clay pots, thermocool boxes and a cool wet cloth are just as efficient. A study in Nigeria showed that most storage modes for insulin were unlikely to cause significant fluctuations in the storage temperature of insulin.

Ogle et al. also studied clay pots part-filled with water, and other evaporative cooling devices used in resource-limited countries. They studied thirteen devices that were used all over Asia and Africa as well as two commercially manufactured cooling wallets for comparison. The study revealed that all the cooling measures significantly reduced the temperature efficiently with the most efficacious being a goat skin, a clay pot and the commercial cooling wallets.

Conclusion

As mentioned above, many researches have come to the conclusion that opened insulin stored at less than 30°C is potent for 28 days. They also agree that alternative ways of cooling are as effective as modern techniques in maintaining the storage temperature within the recommended range.

Nevertheless, challenges are faced on a daily basis in areas with hot weather for most of the year such as parts of the Northern and Southern Red Sea regions of Eritrea. Further inquiry is necessary as to why cooling techniques which have previously been tried and proven aren't working in these areas. The cases reported here are just two of the many confronted in Ghindae Hospital. Thus, I believe that studies are necessary to quantify the real extent of the challenge of proper insulin storage. In addition, healthcare professionals should be aware of the proper storage and usage duration of injected insulin. They must also intensely educate the patients who are on insulin therapy about the proper storage of insulin. Moreover, patients ought to learn that any negligence in storage of insulin could lead to failure of therapy. They should be aware that irregularities in blood sugar control can lead to long and short-term detrimental effects like severe hypoglycemia, chronic cardiovascular, liver and kidney diseases, and even death. Furthermore, the Ministry of Health of Eritrea should implement symposiums that educate the public on the correct handling of insulin. The Ministry should also educate the patients on the potentially harmful end results of poorly controlled diabetes mellitus. There are many commercially available insulin storage devices which are affordable, portable, possess reliable cooling techniques, and do not require electricity. If such devices were available to people in resource lacking, hot climates and remote areas, the control of blood sugar in diabetic patients on insulin therapy could improve.

Acknowledgment

I would like to thank Mr. Mulgeta Russom of the Pharmacovigilance Division of the National Medicine and Food Administration of Eritrea for his support and contributions in writing this article.

Ethics Approval and Consent to Participate

Approval to conduct the study was obtained from the medical director of the hospital.

Author's Contributions

ASG designed the report, carried out the literature review and prepared the manuscript for submission.

References

1. Grajower MM, Fraser CG, Pharmd MS, Holcombe JH, Daugherty ML, et al. (2003) How Long Should Insulin Be Used Once a Vial Is Started. *Diabetes Care* 2003; 26: 2665-2669.
2. Vimalavathini R, Gitanjali B (2009) Effect of temperature on the potency & pharmacological action of insulin. *Indian J Med Res* 130: 166-169.
3. Storvick WO, and HenryHJ (1968) Effect of Storage Temperature on Stability of Commercial Insulin Preparations. *Diabetes* 17: 499-502.
4. Ogle GD, Abdullah M, Mason D, Januszewski AS, Besancon S, et al. (2016) Insulin storage in hot climates without refrigeration: temperature reduction efficacy of clay pots and other techniques. *Diabet Med* 33: 1544-1553.

5. Kalra S, Kalra B (2012) Storage of insulin in rural areas. J Academy Med Sci 2: 88-89.