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Comparing the Effectiveness of a Low Carbohydrate Diet and Metformin On Glycosylated Hemoglobin Reduction in Type Two Diabetes Mellitus

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Abstract

In this study, a low carbohydrate diet and metformin pharmacotherapy were compared to determine their effect on HbA1c in the type two diabetic patient. Several high quality studies were examined along with evidence from three new recent studies (n=5). Metformin is a drug that is often used as initial pharmacologic therapy due to its documented effectiveness in lowering HbA1c (HbA1c). Literature from the last 15 years was reviewed. The most recent research study done by Yamada et al. (2014) also showed a decrease in HbA1c of 0.63 in the type two diabetic patient. The disadvantage of using metformin for type two diabetes mellitus is that it can increase the risk of lactic acidosis with other comorbidities such as heart failure, renal insufficiency, hypoxia, or sepsis. The study showed that both the low carbohydrate diet and metformin pharmacotherapy were effective at lowering HbA1c in the type two diabetic patient. The low carbohydrate diet showed a 3.0% decrease (Kashi et al., 2017) of HbA1c all the way to a 0.51 decrease in baseline HbA1c in the studies that were examined. The metformin pharmacotherapy showed a decrease of 0.51 decrease up to a greater than 1.0 decrease from baseline HbA1c in the studies examined within this project. After looking at all the parameters that were affected, it was concluded that choosing treatment between the two options studied will be highly dependent on each individual patient and their readiness and willingness to implement lifestyle changes. Both methods of treatment are equally as effective and can benefit to different patients.

Introduction

The research shown is comparing the effectiveness of a low carbohydrate diet and pharmacotherapy in reducing a type two diabetic’s HbA1c. Random trials for T2DM can include, but are not limited to, lifestyle changes and/or metformin. A patient who wishes to use lifestyle intervention will likely use a mix of dietary changes facilitated by a registered dietitian (Dietary A recommendation), increased physical activity to improve cardiovascular function (Dietary B recommendation), and education from a diabetic educator (Dietary C recommendation). Current evidence also supports initial pharmacologic therapy (Dietary A recommendation) for T2DM (Dyban Plsu, 2017). Metformin lowers blood and circulating blood glucose levels by decreasing the production of glucose in the liver and decreasing intestinal absorption of glucose in the distal small intestine as described by Dyban Plsu (2017).

Statement of the Problem

The number of people diagnosed with T2DM continues to rise each year. Medical providers face the challenge of treating type two diabetes on a daily basis and there are numerous possibilities available as treatment options. Medical providers and patients need to be able to choose their first line treatment based on scientific evidence, effectiveness, and how that treatment will fit in with the patient’s personal lifestyle. The low carbohydrate diet and metformin need to be compared in terms of effectiveness on HbA1c as the solo first line treatment of diabetes mellitus.

Research Questions

• In newly diagnosed type two diabetes presenting for initial treatment, does a low carbohydrate diet or metformin have a greater effect on lowering glycosylated hemoglobin?
• What are the advantages of a low carbohydrate diet on lowering glycosylated hemoglobin?
• What are the disadvantages of a low carbohydrate diet on lowering glycosylated hemoglobin?
• What are the advantages of metformin pharmacotherapy on lowering glycosylated hemoglobin?
• What are the disadvantages of metformin pharmacotherapy on lowering glycosylated hemoglobin?

Literature Review

In newly diagnosed type two diabetes presenting for initial treatment, does a low carbohydrate diet or metformin have a greater effect on lowering HbA1c?

What are the advantages of using diet management as first line treatment of type two diabetes mellitus? The study done by Kirby et al. (2008) showed that the low carbohydrate diet groups were even more effective at lowering blood glucose levels. Another study done by Mantzoros et al. (2017) showed that the low carbohydrate diet decreased HbA1c by an average of 0.26 in comparison to the control diets within each group. A critical review of carbohydrate restriction in diabetes management that was done by Feig et al. (2015) showed that low carbohydrate diet decreased HbA1c by an average of 0.6. This study was particularly interesting because the low carbohydrate diet was done as a first line treatment for managing diabetes. The study done by Tjy et al. (2015) showed that the HbA1c was decreased the same amount in both the low carbohydrate diets and high carbohydrate groups that were being studied. Kudoma et al. (2009) compared a high carbohydrate low fat diet with a low carbohydrate high fat diet. The analysis showed that there was no significant difference in the HbA1c outcomes. Jung and Choi (2017) showed there was no difference in HbA1c between the low carbohydrate and high carbohydrate diet groups.

What are the disadvantages of using diet management as first line treatment of type two diabetes mellitus? The most prominent disadvantage of using a low carbohydrate diet as a first line treatment for T2DM is its adherence. One thing that Feig et al. (2015) noted was that the low carbohydrate diet group had unlimited access to food, but they had to restrict their carbohydrate intake which they thought was easier to adhere to than other types of diet that had a strict restriction to add into a lower blood glucose level. Many of these studies showed that the low carbohydrate diet was beneficial for several health parameters, Kirby et al. (2008) discussed their concern about the sustainability of the results achieved by the low carbohydrate diet once the patient goes back to a higher carbohydrate intake. Another disadvantage of using a low carbohydrate diet as a first line treatment of T2DM is that, as stated above in several studies, the low carbohydrate diet is not improving diabetic parameters significantly more than any other type of diet. Another important thing seems to be a reduction in the patient’s weight which can be obtained by any type of diet that causes a person to decrease their weight.

What are the advantages of using metformin as first line treatment of type two diabetes mellitus? The study done by Gonzalez-Ortiz et al. (2012) showed a greater than one percent drop in HbA1c in more than 50% of the participants at the completion of the study. Kashi, Mahrous, Kanemety, and Azadeh (2016) found that over a three-month period, the patients undergoing metformin therapy had a decrease in HbA1c. The study done by Nichols et al. (2015) was broken down into adherence groups. Adherence below 51% showed a statistical difference of 0.71% and 23% showed a further decrease of 0.45% in HbA1c, and the adherence group of 80% or greater was associated with a decrease of 2.3% in their HbA1c. Ramanevik et al. (2011) studied two groups that initiated metformin therapy at different times. During this study, the researchers found that the early initiation of metformin therapy resulted in a 0.51 greater decrease in HbA1c and were also more likely to reach a HbA1c target value of less than 7%. William et al. (2015) found that the patients that were on the maximum dose of metformin had a 0.51 greater decrease in their HbA1c compared to the untreated group.

What are the disadvantages of using metformin as first line treatment of type two diabetes mellitus? The disadvantages of using metformin include, but are not limited to, possible hypoglycemic events, lactic acidosis, cost, and also the risk of not making any lifestyle changes to reverse the disease itself. Since metformin prevents the formation of glucose, this can decrease the amount of glucose in the bloodstream and cause hypoglycemia. (Dyban Plsu, 2017) This can also be caused by a patient missing or skipping a meal, excessively exercising, or drinking alcohol. This is risk increased if the patient moves from sole metformin pharmacotherapy to combination therapy using metformin and another antihyperglycemic drug. According to Buse et al. (2016) the accumulation of metformin can cause lactic acidosis. The use of metformin with other comeditudes such as heart failure, renal insufficiency, hypoxia, or sepsis can increase the risk of lactic acidosis. (Dyban Plsu, 2017). With the amount of people diagnosed with T2DM, there is potentially 43 billion dollars being spent on metformin alone every year as reported by Stabler & Croft (2017). The final disadvantage of using metformin as initial therapy for T2DM is not actually treating the underlying cause of T2DM. As described by Roumie et al. (2016), once patients are on metformin pharmacotherapy without initiating lifestyle changes (such as dietary management, physical activity, or smoking cessation) there is a significantly increased chance of intensifying their pharmacotherapy to combination therapy within four years.

Applicability to Clinical Practice

Almost one tenth of the population of the United States of America is currently diagnosed with T2DM according to the American Diabetes Association (2017). The research done for this project, it has become evident that there is another way to treat T2DM. The two treatments that have been compared in depth are metformin pharmacotherapy and a low carbohydrate diet. While a low carbohydrate diet, a patient is able to lower their body weight and BMI, raise their high density lipoprotein cholesterol, lower their triglycerides, and decrease their HbA1c. The problem that is not every patient is going to be ready and willing to adhere to a strict diet to treat their type two diabetes. This is where education comes in. It is important to educate these patients and even involve the registered dietitian and diabetic educator. The low carbohydrate diet is effective at treating T2DM only in the patients who are ready and willing to adhere to the diet and make a lifestyle change to improve their health.

The author, on the other hand, has been used as a first line treatment for T2DM for centuries (Bardal et al., 2011). It has been proven to be effective and a oral drug that is not difficult to add into a person every day routine. It is believed that patient begins metformin pharmacotherapy immediately at diagnosis, there must be consultation with a diabetic educator and registered dietitian with frequent follow ups.

It was not found that either the low carbohydrate diet or metformin pharmacotherapy was more effective. They were both proven to be effective at lowering a patient’s HbA1c, but the main thing that was found was that each patient is different and a treatment that fits well in one patient might not be advantageous in another patient’s life. Each patient is diagnosed with T2DM must be educated on the treatment options and provided the support they need to both decide on a treatment option and alter it.

References


Bardal, S. M., Friesen, W. G., Jeffcoate, R., Fitzgerald, S., & Hebert, J. (2011). Cost of metformin can be a huge expense which could be up to 54 billion dollars per year being spent on T2DM metformin pharmacotherapy in the United States alone (Economist, 2011). Final drafted: January 27, 2011. (2011). It is noted that most diabetic drugs were shown to lower HbA1c to approximately the same level. This means that there are different pharmacotherapies that can decrease HbA1c and possibly improve other health parameters as well.

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