REVIEW ARTICLE

PREVALENCE OF RAMADAN AND FASTING RELATED DIABETIC COMPLICATIONS AMONG DIABETIC PATIENTS

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Summary:
The purpose of this article writing was to go through the prominent changes and associated safety in diabetic patients during the Islamic month of fasting. Various researches have been conducted upon physiological changes in a diabetic patient during the period of Islamic fasting, but still there is no variation perceived pathologically influencing the body weight, blood glucose, HbA1c, insulin, fructose amine, C-peptide, cholesterol or triglycerides ranges. In the suggestive portion of the following articles, the diabetic patients were advised to carry on with their regular routine. The pre-eminent point noted was that the patients adjusted their drug regimen especially by those with type I diabetes mellitus. Adjusting of drug regimen along with control over the diet and daily activities composed a Ramadan 3D Triangle through which a proper supervision and education came in to being concluding that few of the type I and most of the type II diabetes mellitus patients who wanted to fast could carefully manage it.

Key words: HbA1c, type I diabetes mellitus, type II diabetes mellitus, Ramadan 3D Triangle

1. INTRODUCTION :

The name vitamin is derived from a Latin word "vita" meaning life. Vitamins were also called vital amines because they were considered as amines on the basis of thiamin (vitamin B_1) and being essential component of diet. Vitamins usually act as catalysts or co-enzymes or often are essential parts of co-enzymes. These are organic molecules needed in small quantities for biochemical functions such as growth and repair of tissue. The structures of all the vitamins are known and synthetic vitamins are structurally similar to the natural vitamins. The sources of vitamins include dairy products, fish, rice, wheat, egg yolk, vegetables, fortified cereals, chicken and meat[1].

Vitamins have been considered to be necessary food factors. Humans either cannot synthesize vitamins or synthesize them in very small amounts and some amino acids which are characterized as dietary essentials[2]. The functions of vitamins are important for humans as they help in metabolism and vitamin deficiency

diseases. Avitaminosis leads to some form of disease which is associated with the type of the vitamin that is deficient[3]. Deficiency of vitamin D results in rickets and many other diseases of bones especially in children and new born. Anemia is caused by the deficiency of cyanocobalamin (vitamin B_{12}). Certain drugs required in some diseases may deplete some vitamins in the body which in turn must be supplied such as vitamin B_6 in Tuberculosis. Vitamin K deficiency leads to blood clotting problems and eye sight weakness and blindness is attributed to the deficiency of vitamin A. Vitamin E is known to be an antioxidant and its deficiency causes edema, thrombosis and hemolytic anemia[4]. Patients cannot

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INTRODUCTION:

Not only the religion of peace i.e. Islam recommends fasting of one month [1], but other recognized religions like Christianity, Hinduism, etc. also emphasizes on observing fast for a specific period of time.

Ramadan is one of the five pillars of Islam and the ninth month of Islamic calendar with varying days between 29 or 30 as it is based on lunar changes in which the Muslims observe daylight fasting [2]. It is also the month in which the Holy Prophet was granted with the blessing of the book, Quran. The duration and timings deviate as they depend on the geographical locations and seasons, usually ranging for 20 hours or less. Muslims who observe fast during this month are required to refrain from drinking, eating, administration of oral and parental medicaments, smoking beginning from predawn until sunset, whereas there is no abstaining from consumption between the period of sunset and dawn [3]. Ramadan is also considered as the month of spiritual progress as it reflects on the person's relationships and bonds with his family and friends. [4][5]

Fasting is not supposed to create unnecessary hardships upon any of the individual. "The Quran itself exempts the sick ones from this obligation" (Holy Quran, *Al-Baqarah*: 183-185). [6]

Fasting is obligatory only on healthy and adult individuals who preach Islam, whereas exemptions are still there for people who're sick with serious medical conditions including the diabetic patients. But a vast population with diabetes still observes fast during this month claiming it as an extremely significant and meaningful ritual with spiritual experience, therefore most of the people carry on fasting even against the medical suggestions. [7][8]

There was an EPIDIAR research conducted in 13 of the states with high population of Muslims, reporting that around 78% of the Muslims with type II DM observed fast in the following month [2].Even though fasting for a longer duration in diabetic patients can cause higher risks of experiencing the effects of poor glycemic control including hypoglycemia, hyperglycemia, Ketoacidosis and dehydration. [9-12]

Until now, there are various research works and guidelines published to facilitate the clinicians in accordance to managing the diabetic patients in the month of Ramadan. [8, 10, 11, 13-24] Nevertheless there is still a need of complementation of considering the patients point of view of fasting along with the behavioral changes in this duration.

Various researches overlooked at the biochemical alterations occurring during fasting in Ramadan in both,normoglycemic[25-31]and diabetics, [13, 32-40] in which, the majority had little change in the glycemic control, even though, some of the results showed a decrease in the body weight as well as blood lipid levels. [35, 37-40]

The objectives of the suggestions continued are three-fold:

1. Invitation for an open discussion over this topic;
2. Suggesting some medical opinions and advices;
3. Identification of topics of researches to answer the queries related to Ramadan fasting.

Going through this article, the usage of terms indication or contraindication is refrained as fasting is a religious matter upon which the patients are allowed to take decisions after seeking the suitable counseling from religious as well as medical centers. Although, still some emphasize is laid upon the type I DM patients with poor glycemic control as there are more associated risk factors. Not only the risks are accentuated, but advices are also given on how to manage the health if one is fasting.

The physiological state of diabetics during Ramadan:

Carbohydrate metabolism during Ramadan fasting in healthy persons:

There is an extensive analysis done on experimental short-term fasting effects on carbohydrate metabolism, [41] resulting that there is a slight decrease in serum glucose varying from 60-70 mg/dl in normal adults as soon as the start to fast. But this reduction stops as soon as the gluconeogenesis begins in the

liver due to decrease in insulin concentration and increase in the glucagon levels, sympathetic activity alongside. [41-42]

In age group of 1-9, 24 hours fasting caused a drop of blood glucose to half of the baseline as to that of normal levels. In 22% of this age group, blood glucose had dropped to less than 40 mg/dl. [43] Few studies also unveiled the effect of fasting on the serum glucose levels [25-29] while one of it showed a different pattern. During the first few days there was a decrease in the serum glucose, followed by regularizing until 20th day of fasting whereas by the 29th day, there was a slight increase. [26]18 m.mol/L i.e. 63 mg/dl is the least level of serum glucose level observed in this whole research. Others showed a slight increase [27] or different variation in the serum glucose concentration, [28-29] but all of them were within the normal physiological ranges. [26]From these researches, an evaluation can be made that the glycogen stores along with the gluconeogenesis up to some degree helped in the maintenance of normal serum glucose level in the fasting duration when followed by a large meal at predawn. This result can still vary from people to people depending on difference in eating habits and metabolism resulting in energy regulation. [1]

Body weight during Ramadan fasting:

i. In normal individuals:

Weight loss reported were of around 1.7 kg [44], 1.8 kg [45], 2.0 kg [46]and 3.8 kg[47] in normal healthy individuals when the observed fast in the month of Ramadan. In one of the researches done dominated by females, revealed no change in the body weight [48] where as it was also reported that overweight individuals tend to lose more weight as compared to the normal or underweight individuals. [46]

ii. In individuals with diabetics:

There is still a disputation over weight changes in diabetic people observing Ramadan fasting. [26, 37, 49-57] In one of the researches, there was an overall increase in the body weight of individuals [51, 55] while the other research concluded the decrease [26, 37, 50, 52, 54] or no change. [49, 53, 56, 57] Though there is refraining from food in fasting in Ramadan from dawn to sunset, there are no limitations on the quantity and quality of diet consumed at night [55, 25] It was also observed that most diabetic individuals decreased their daily activities to avoid risk of hypoglycemia [49, 57] through which it can be evaluated that, lack of activities in such patients caused an increased body weight. [56]

Variations in serum glucose level in Ramadan:

Diabetic individuals showed no prominent alteration in their glucose control. [37, 41,57-58] while in some individuals it may fall or rise [32-34] depending upon type of diet consumed at predawn as well as when breaking the fast, prevalence of medicine, and type of activities in routine. In majority medically, managed diabetic patient cases there was no observation of complications related to hypoglycemic or hyperglycemic state. [29, 47, 49, 50] Only countable cases were reported with hypoglycemia still free of clinical hazards. [38, 51, 53, 60]

Other factors of diabetes control during fasting in Ramadan:

Overall there was no change observed in values of HbA1c during whole month of Ramadan, not even and increase was countered.[32, 49-52, 54, 56, 57, 59, 60, 61]Only 3 researches came out with a conclusion of a slight increase in the HbA1c.[37, 53-61]Although one of the report laid emphasis on the similar increase in non-fasting patients as that of the fasting ones.[62]While the other declared a return to the initial level immediately as soon as the month ended [53]The levels of fructose amine [34, 37, 51, 56, 61], insulin and C-peptide [57] showed no variations throughout the whole month.

Overall energy uptake and varying serum lipid levels during Ramadan fasting in diabetic individuals:

In some studies, the decreased amount of energy intake was reported [32, 37,56,58, 59] Most patients with type I and type II diabetes either showed no change or a slight decrease in the total serum cholesterol concentration and triglycerides [49-53, 58, 32, 38, 60] although increase in overall cholesterol level infrequently occurs. [57] Few researches have been reported unveiling the increase in HDL cholesterol in healthy

individuals [62-65] during the fasting month. [38, 52, 53,58] Still there is one research reported evaluating the increase in LDL cholesterol and decreased HDL cholesterol. [32]

Another study not only outlined an increase in APO A-1, APO A-1/APO B and APO A-1/HDL proportions but also in concentration of serum triglycerides and APO B [35]The beneficial or dangerous effects of Ramadan on the serum lipid concentration in diabetic individuals can't be cleared until there's no proper standardization of 3D Ramadan triangle.

Other biological factors during Ramadan fasting in diabetic patients:

There are no significant changes reported in the levels of serum creatinine, blood urea, uric acid, nitrogen, total protein, albumin, alanine, and aminotransferase and aspartate amino transferase in the fasting duration. [49, 51, 60] Any cases reported with changes in the following levels were either due to dehydration or metabolic adaptation irrespective of clinical importance.

Fasting guidelines for diabetic individuals:

These guidelines came into being after continuous research in the past two decades through the apprehensive approach of pathological along with physiological changes observed in the fasting diabetic patients.

Muslims who wish to fast are supposed to follow a criterion designed by the physicians working on them, which is helpful in making the desirable decision. [54, 66]

Fasting should be avoided in brittle T1DM, poor controlled T1DM AND T2DM patients, diabetic patients who can't follow the regime of 3D Ramadan triangle, diabetics with more complications including angina and uncontrolled hypertension, diabetics with history of diabetic ketoacidosis, pregnant diabetics or under current infections, elder patients with any degree of alertness problems and patients with two or more reports of hypoglycemia or hyperglycemia during the whole fasting month. [1]

Fasting is allowed if the above-mentioned conditions aren't observed in any individual and who follow the proper medical regime. [1]

Fasting is also encouraged for all overweight T2DM patients, excluding the pregnant or lactating females. Even when encouraged, diabetes should be stable with weight levels 20% above the ideal body weight or the BMI above 28 kg/m^2 [1]

Education of diabetics before Ramadan:

Type II NIDDM and Type I IDDM patients insisting over fasting should be given following advices to be followed compulsorily [50] i.e. not skipping meals in any condition, regular administration of medicines and consuming the meals as soon as the fast breaks. [56]

The basic fundamentals of pre-Ramadan deliberations are; assessment of physical wellbeing and metabolic control, reconciliation of diet and medicaments, balanced physical activities and identification of warning symptoms of dehydration, hypoglycemia, and other complicated possibilities.

Advices to follow during fasting period:

1. Dietary intake:

Weight gain has been observed in individuals when the diet is imprudent, or excessive gorging is done in non-fasting hours or rich carbohydrate and fatty food diet is taken which may contribute to hyperglycemia along with weight gain. [55, 57] It has been evidently observed that Ramadan in only beneficial for individual when a proper diet regime is maintained. [37, 66, 67] Through this a conclusion can be drawn that diabetic fasting individuals should consume healthy diet with refraining themselves from high calories and more refined food materials during this month. [67]

2. Physical activities:

Several researchers deduced that for NIDDM individuals, light to moderate physical activities are harmless [49] as fasting doesn't impedes with the persons tolerance to exercise [68] and it is recommended to continue the physical activities especially during non-fasting hours. [69]

3. Drug administration routine for IDDM patients:

Few professional physicians through researches deduced that fasting is safe for IDDM patients if proper self-monitoring is done supervised by an experienced physician [50] The only fundamental imposed is to keep a check and balance upon the insulin regimen so as to maintain the IDDM control during this month. Successfully three insulin methods have been studied:

i. Three dose insulin regimens; two doses of short acting insulin before sunset and dawn meal and one dose of intermediate acting insulin in the late evening. [50]
ii. Two dose insulin regimens; a dose of intermediate acting insulin in evening combined with short acting and medium acting insulin, equivalent to previous dawn dosage and a predawn insulin consisting of a regular dosage of 0.1-0.2 units/kg only [59]
iii. Using insulin lispro instead of regular insulin; according to studies, an observation was done that postprandial glycemic excursions are enhanced and chances of hypoglycemia decreases by the use of lispro insulin, both in T1DM [70] and T2DM [71]

Self-blood glucose monitoring must be done exactly before taking the meal after sunset and after 3hours too. The same should be done before and after predawn meal to adjust the insulin dose and regimen to prevent hypoglycemia and postprandial hyperglycemia.

4. Drug regimens for T2DM individuals:

Accessible studies indicates that fasting over weight NIDDM individuals don't encounter any major complications [41]If individuals adjust the hypoglycemic agents in their routine, they can control and reduce the risk of hypoglycemia and hyperglycemia. Investigators who dealt with a huge amount of patients, treated them with glibenclamide during Ramadan, concluded that diabetic could exchange the morning dose with any mid-day dose of this drug when taken at sunset [61] usage of repaglinide has also reported to give a better glycemic control.

5. Other suggestions and tips to minimize the chances of complications:

- Follow the Ramadan 3D triangle of drug routine for successful fast throughout the day.
- Self-monitoring of blood glucose and urine acetone (especially in T1DM)
- Measuring daily weight and reporting the reduction or gain below or above 2 kg. Weight reduction mostly occurs due to dehydration, polyuria or less dietary intake while weight gain is observed in the cases involving excessive dietary intake
- Recording daily dietary regime
- Seeking knowledge about warning symptoms of dehydration, hypoglycemia and hyperglycemia.
- Earning education about breaking or discontinuation of fast as any complications or harmful symptoms are observed
- Instantaneous medical care when complication occurs instead of waiting for availability of medical assistance
- Setting and managing the 3D Ramadan triangle as soon as the season or geographical location changes typically when fasting hours are prolonged

6. Fasting children with T1DM:

Even though fasting in diabetic children is not recommended, but still researches have shown that fasting is safe in diabetic adolescents. Another research study indicated that fasting doesn't alter short term metabolites controlling so fasting is sensible in older children who had diabetes since a longer time. However fasting should only be encouraged in children with good glycemic control with regular blood glucose home monitoring. [59]

Post-Ramadan management of fasting diabetics:

As soon as the month of fasting ends, the fasting therapeutic routine shall be replaced with the previous normal schedule. Patients shall also seek education about physiologic effect and changes that take place in their bodies during Ramadan. [66]

Basic research methodology on individuals fasting in diabetics:

Few relevant research papers are available on Ramadan fasting because of the mismanagement in routines before and after the Ramadan and absence of monitoring within weeks while observing fast, unbalanced dietary habits, caloric changes and unobserved weight changes in the individuals. It is necessary to take consideration of and control above mentioned factors. Still there is a requirement for more research papers to evaluate considerable physiological and pathological changes with proper research methods [72].

In the month of Ramadan, it is obligatory for healthy Muslims to observe fast, however, diabetic patients aren't bounded and can fast periodically in the whole month as its magnitude effects blood glucose levels and hepatic glucagon levels depending on the number of fasting days [73]. All this should be considered in all Ramadan research activities.

CONCLUSION

The greater part of literature search shows that Ramadan fasting is safe for the majority diabetic individuals with legitimate instruction and diabetic management. The majority of Type II diabetes patients can fast safely during Ramadan. Intermittent Type I diabetes individuals who demand Ramadan fasting can also fast if they are carefully managed. Strict consideration to dietary control, every day physicalactivity, and drug regimen amendment is necessary for successful Ramadan fasting. To shed more light on pathophysiological changes in Ramadan fasting, particularly in Muslim diabetics, it is recommended that a multicentric international controlled clinical trial be employed to assess the effect of differences in gender, race, physical activity, food habits, sleep patterns, and other important variables on the physiological and pathological conditions during Ramadan fasting.

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