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Abstract: *Diabetes prevalence is increasing all around the world, despite incredible efforts by the scientific associations and updated healthcare regulations by the governments. Year by year, growing number of medications with or without injection therapies (like insulin) which would be used not only for the management of high blood glucose (sugar), but also to avoid complications that may associate with a number of additional problems such as heart attack (myocardial infraction), kidney failure (hemodialysis, even kidney transplantation), eye disease (retinopathy), cerebral disease (stroke with or without cognitive dysfunction). During the management of diabetes, one of the fearful acute complication is low blood sugar (hypoglycaemia; hypo) that will also give rise to anxiety/anxiety-like symptoms. This chronic metabolic disorder may not only be associated with the development of anxiety later in life, but certain situations like disasters (earthquakes, floods, hurricanes, etc.) may trigger this psychological behaviour, as well. Over the last two decades, it has been observed that considerable number of muslim people with diabetes has been fasting Ramadan with an increasing trend despite both hypo and hyperglycaemia. Either fasting or prohibition of fasting may provoke anxiety for these people. Education is the key, starting from the diagnosis and at any step of life for those having diabetes in order to alleviate the anxiety symptoms.*

Introduction

Diabetes prevalence is increasing all around the world, despite incredible efforts by the scientific associations and updated healthcare regulations by the governments. According to the 10th Diabetes Atlas, published by International Diabetes Foundation (IDF), world population is having almost 600 million people with diabetes. Interestingly, among the countries that rank order -from 2021 towards year 2045- does not change for the first six countries: China, India, Pakistan, USA, Indonesia and Brasil. In two decades, according to the estimations, people with diabetes in Pakistan aged 20-79 will be rising from 33 million to 62.2 million which is an alarming increment rate. Also, Türkiye will appear as the 10th in the rank order in 2045 (IDF Diabetes Atlas, 2021).

Diabetes Management and Long-Term Complications

Year by year, growing number of medications with or without injection therapies (*like insulin*) which

would be used not only for the management of high blood glucose (*sugar*), but also to avoid complications that may associate with a number of additional problems such as heart attack (*myocardial infarction*), kidney failure (*hemodialysis, even kidney transplantation*), eye disease (*retinopathy*), cerebral disease (*stroke with or without cognitive dysfunction*). Unfortunately, diabetes mellitus or briefly diabetes is a complex entity; a vascular disorder that may affect all tissues, organs and systems due to the circulating high blood sugar. Even rather than saying '*diabetes mellitus*', better we use '*diabetes mellitus et lipidus et proteinus*' especially when teaching this metabolic condition since it is not only the problem of carbonhydrates but lipids (*cholesterols*) and proteins as well. Diabetes -*seen mostly in childhood where there is lack of insulin*- is called type 1 diabetes and insulin replacement is essential which is four times daily, usually. Type 2 diabetes is mostly diabetes of adults who have obesity, mostly with insulin resistance, meaning although body produces even more insulin to lower sugar numbers, there is less efficacy to its effect. For a better sugar control, increasing number of medications came into the market today; both pills (*tablets*) and injectables (*variety of insulins and anti-obesity drugs, namely glucagon-like peptide 1 receptor agonists 'GLP-1 RAs'*). Number of drugs being prescribed will be getting higher due to not only to control the sugar spikes but also to reduce the risk of small (*microvascular*) and large (*macrovascular*) vessel complications (*undesired consequences*). Microvascular complications are observed in the eye (*retina disease, called 'retinopathy' in medicine*) the kidney, (*'nephropathy'*) or the nerve (*'neuropathy' may present as tingling, numbness or burning sensation especially at the feet area, etc*). Macrovascular complications affect the heart (*heart attack, 'myocardial infarction'*), the brain (*'stroke' with or without cognitive decline*) or the feet (*'diabetic foot disease', with ulcer and/or gangrene formation at the toes*). Fear of having aforementioned complications may also provoke anxiety. Additionally, with or without daily injection therapies (*insulins, GLP-1Rs*), along with numerous medications associated with the needle use (*finger prick sugar tests, up to 7 or more times a day*) may cause anxiety as well. Moreover, among those people who developed end-stage kidney failure may go on hemodialysis programe 3 times weekly, 4hrs at each session with lines filled with one's own circulating blood. Some people with diabetes may not recover fully from the diabetic foot which may even end up with an amputation. In a nutshell, all of these possible scenarios may cause chronic anxiety.

Hypoglycaemia as a Source of Anxiety

To our knowledge today, insulin is unique hormone which is responsible for reducing the blood sugar. Excessive amounts of insulin use like doubling the dose with forgetfulness or skipping the meal after injections or performing heavier exercise than usual will give rise to low blood sugar (*hypoglycemia; 'hypo'*), a blood sugar of less than 70mg. Symptoms of hypo will be trembling, headache, hunger, anxiety, sweating, irritability, fast pulse and palpitation. People with hypo will have activation of the stress hormones which are part of the contre-lateral hormone system like glucagone, cortisol and adrenaline and nor-adrenaline that especially the latter two have the capacity to increase the blood sugar in minutes. Low and high blood sugar curves then cause glucose variability, a concept that also does contribute to the development of complications. Converting their patients from pills into insulin are studied between Leicester (UK) and Kahramanmaraş Sutcu Imam (Türkiye) Universities revealed that not only for people with diabetes but for healthcare professionals -*HCPs*- (*primary care physicians, diabetes nurses and dietitians*) as well, fear, anxiety, worrisome became psychological elements making HCPs reluctant to prescribe insulin, even there was a necessity (Thaware et al., 2006). During the management of diabetes with insulin, hypo is one of the fearful acute complication that will give rise to anxiety/anxiety like symptoms. Also, certain tablets (*pills*) which are sulphonylure type anti-diabetic medications have higher hypo rate. Some countries cannot afford more convenient brand new

medications- *due to their costs*-, this makes those individuals further at risk of having hypo (*by using cheaper older sulphonylureas*), thus leading to anxiety.

Natural Disasters, Diabetes, and Psychological Distress

This chronic metabolic disorder may not only be associated with the development of anxiety later in life, but certain situations like disasters (*earthquakes & floods in Pakistan, hurricanes in USA, etc.*) may trigger this psychologic behaviour, as well. Although Japan is very well known with its earthquakes, almost now part of its life in the islands' country, recent terrible Kahramanmaras City earthquake happened in Türkiye on February 6, 2023 (*winter time*), causing more than fifty thousand death tolls and repeating day after (*with both magnitudes of 7.5 & 7.8*), destroying as well many buildings including healthcare facilities with an effect on 11 provinces with 15 million population including Gaziantep city, closer to Syria border (*Türkiye has 81 provinces by the way*) (Buyukbese, 2023 Dec 4-7). People with diabetes either type 1 (*mostly seen in children*) or type 2 (*adult diabetes, mostly*) could not reach out to their diabetes doctors, nurses and dietitians even their pharmacy in order to provide both their medications and supplies for checking their daily sugar numbers. The fear of death, getting wounded (*some even needed hemodialyses after having Crush syndrome*), having losses in their family members and loved ones, not reaching out to their medical supplies, accomodation problems (*especially in the early days, starting living under the ruins inside a tent or a container with limited sanity*), lack of basic (*food, clean water, heating, shelter, security*) and social needs (*finding jobs*) became burden for many, - *on top of*- already heaving anxiety before the disaster (Yilmaz et al., 2023; Jenat & Derivois, 2023). Meanwhile, Turkish Diabetes Foundation in collaboration with Turkish Ministry of Health provided numerous audit studies in the area in early years of the new millenium such as Southeastern Anatolia Diabetes (GAPDIAB) and Presidency of Türkiye Type 1 Diabetes Peer Projects which helped development of swift communication and necessary aid plans. Earthquakes are not new in Türkiye: In 1999, earthquake affected the Marmara Region including Istanbul revealed that people with type 1 diabetes living in the same house after the earthquake and not having enough food supply were reported to have lower quality of life (QOL) than people moving to another house and having enough food supply after the earthquake (Sengül et al., 2004). The Marmara Earthquake had a negative impact on the glycemic (*sugar*) control and QOL of the 88 subjects with type 1 diabetes -*investigated*- for the short term but pre-quake (*1-year before earthquake*) scores might be achieved after a long period (*1-year after earthquake*). Also, earthquake decreased the QOL of people with type 1 diabetes independent of deterioration of the glycemic control. HbA1c levels which is 3 month average sugar level and daily insulin requirements increased significantly at 3 months after earthquake period (Sengül et al., 2004). QoL questionnaire, gathered from Diabetes Control and Complications (DCCT) Trial was including (DCCT Research Group, 1998; Sengül et al., 2000):

1. *Satisfaction with treatment*
2. *Impact of treatment*
3. *Worry about the future effects of diabetes*
4. *Worry about social/vocational issues*

Earthquakes cause not only death but physical destruction and emotional trauma to people with diabetes living in the destruction area (Yildiz et al., 2023). Stress will negatively affect people with diabetes. Stress induced cortisol levels were found to the highest in people with post-traumatic stress disorders (PTSD) (Fukuda et al., 2000; Livanou et al., 2002). PTSD rate was 61% (*Recent Kahramanmaras earthquakes*) (Livanou et al., 2002; Sezgin et al, 2012). Even, depression and anxiety scores found to be increased in Türkiye's Marmara Earthquake (*type 1 diabetes*) (Salman et al., 2001).

Ramadan Fasting, Diabetes, and Anxiety

Over the last two decades, it has been observed that considerable number of people with diabetes has been fasting Ramadan with an increasing trend (Salti et al., 2004; Babineaux et al., 2010; Hassanein & Alamoudi et al., 2021; Hassanein & Hussein et al., 2021) even despite Covid-19 pandemic (Hassanein & Alamoudi et al., 2021; Hassanein & Hussein et al., 2021; Hassanein & Yousef et al., 2023; Alamoudi et al., 2023). Recent evaluations demonstrated that of the 150 million muslim diabetes population (IDF Diabetes Atlas, 2021), 120 million observe fast (Hanif et al., 2020). Fasting is mandatory for all muslims but 'healthy' adults during the holy month of Ramadan (Al Bakarah 2:185). Prolonged fasting especially during summer Ramadan will be challenging and increasing the risk of hypoglycaemia especially those who are on sulphonylureas and insulin (Hassanein & Ahmadani et al., 2024; Hassanein & Zauniddin et al., 2022; Hassanein & Abdallah et al., 2014; Hassanein & Buyukbese et al., 2020). Newer, diabetes drugs that recently came into market although have little or no hypo potential (Hassanein & Abdallah et al., 2014; Hassanein & Buyukbese et al., 2020; Hassanein & Malek et al., 2023; Hassanein & Malek et al., 2024), but few people and even few governments can only afford them in many countries (Hassanein & Ahmadani et al., 2024; Hassanein & Zauniddin et al., 2022). Apart from this, both fasting and prohibition of fasting may provoke anxiety, too in those who had the habit of fasting previously even from the childhood. The study named '*READ*' –*the first order in the holy book Quran revealed to the prophet Muhammad (peace be upon Him)*– was awarded by the Diabetes Education Study Group (DESG) committee at the meeting of the European Association for the Study of Diabetes (EASD), owing to the results obtained by the education of patients which decreased the risk of hypo and thus providing better sugar control during Ramadan intermittent fasting (Bravis et al., 2010). The psychosocial approach, and education are both important factors in everyday practice to better serve people with diabetes (Buyukbese & Konuk et al., 2006; Kalenderoglu et al., 2006; Celik et al., 2004; Buyukbese & Cetinkaya et al., 2002).

Conclusion

In conclusion, anxiety may appear at any stage of diabetes regardless of its types, starting at diagnosis towards the course of the disease. Management of diabetes with injections and blood sugar finger prick tests might act as instigators for the development of anxiety. Additionally, acute (*hypos*) and chronic complications (*amputations, kidney failures, etc*) may lead to fear and worry in many people. During disasters such as earthquakes, treatment of diabetes may become burdensome, indeed. Education may help alleviate symptoms and provide better glucose (*sugar*) control with further improving the prognosis.

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