Tuberculosis (TB) is a bacterial infection caused by *M. tuberculosis*, also known as *Mycobacterium Tuberculosis*. There is a bidirectional relationship between TB and diabetes, and they both impact the presentation of each other. Diabetes is being increasingly recognized as a risk factor for TB. The expected rise in diabetes cases in developing countries having the brunt of tuberculosis would increase the influence of diabetes on TB in the coming future. The impact and relationship between TB and diabetes will vary across different regions of the world depending on the incidence and prevalence of each condition. Patient education is so important in understanding the disease nature (both TB and diabetes), duration of treatment, side effects of drugs, and complications of disease as well as the promotion of healthy lifestyle choices.

The objective of this review is to determine the prevalence, diagnostic and prevention strategy between diabetes mellitus and tuberculosis. The selected studies were identified using Pub Med database. The identified studies define lifestyle as important risk factor that may worsen the progression of the disease. This article also discussed about the prevalence of tuberculosis-diabetes mellitus over a span of 8 years.

**Keywords:** Diabetes mellitus, risk factors, tuberculosis.
Table 1: Studies assessing the effect of diabetes mellitus on treatment failure and death in patients treated for TB

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Treatment Failure</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Egypt</td>
<td>Indonesia</td>
</tr>
<tr>
<td>Setting</td>
<td>TB treatment centres</td>
<td>Outpatient clinics</td>
</tr>
<tr>
<td>Type of study</td>
<td>Case-control study assessing risk factors for treatment failure, matched for sex and centre</td>
<td>Prospective cohort study of new pulmonary TB patients</td>
</tr>
<tr>
<td>Participants(n)</td>
<td>119 cases, 119 controls</td>
<td>634 cases</td>
</tr>
</tbody>
</table>

Table 2: Review on several characteristics comparing article 1 and article 2.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Article 1</th>
<th>Article 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalence of Diabetes Mellitus and TB</td>
<td>The global prevalence of Diabetes Mellitus: The number of diabetes patients was 171 million in 2000. It is predicted to increase 214.04% to 257.31% by 2030 which is 366 million to 440 million, with three-quarters of diabetes patients living in low-income countries</td>
<td>The global prevalence of Diabetes Mellitus: The number of people who are suffering from Diabetes Mellitus among adults has increased by 20% in less than 30 years, and Diabetes Mellitus is predicted to reach 642 million worldwide by 2040 with most (80%) of the patients living in low and middle-income countries where TB is also endemic.</td>
</tr>
<tr>
<td>Countries having high incidence of TB and Diabetes Mellitus</td>
<td>South Africa, Swaziland, Uganda, Kenya, Cabo Verde The Gambia, Nigeria, Zimbabwe, Western Sahara, Ethiopia, Cambodia, Taiwan.</td>
<td>China, India, Brazil, Bangladesh, Indonesia and Russia.</td>
</tr>
<tr>
<td>Type of study</td>
<td>Chest radiograph survey, retrospective cohort, cross-sectional study, longitudinal cohort study, case-control study, population-based cohort and matched case-control study.</td>
<td>Retrospective-based cohort</td>
</tr>
<tr>
<td>Diabetes Mellitus as a risk factor for TB</td>
<td>Diabetes Mellitus patients are more likely to develop multidrug-resistant TB than those without Diabetes Mellitus.</td>
<td>Diabetes Mellitus increases the risk of Tuberculosis by three-fold. Co-occurrence of Diabetes Mellitus with other host characteristics can further synergise TB risk among Diabetes Mellitus patients, as suggested for Diabetes Mellitus plus smoking, micro and macro vascular complications of DM, and even their social environment.</td>
</tr>
</tbody>
</table>

Therefore, the World Health Organization (WHO) defines diabetes as a risk factor for TB. The main reason for the prevalence of TB in diabetic patient is because the bacteria can grow and multiply easily in the high-sugar environment and often lack vitamins A and B, thus weaken the resistance of respiratory tract, which is conducive to the infection and development of the bacteria. Infected patients with TB, due to symptoms of poisoning and the consumption of nutrients, affect the normal play of islet, causing islet cell malnutrition and atrophy, leading to diabetes. Diabetes is closely related to TB. In recent years, diabetes has been significantly increased with TB, which has become a clinical concern. When the two diseases coexist, the TB is complicated and difficult to treat. As the incidence of diabetes and TB continues to increase, the prevalence of TB has gradually increased, and research on the correlation between the two has increased. Therefore, objective of this study was to better understand the relationship between diabetes and tuberculosis prevalence, diagnosis and prevention.

**METHODOLOGY**

By using PubMed database, the author has found 3842 articles with the keywords of Tuberculosis and Diabetes which is ("tuberculosis"[MeSH Terms] OR\textit{...})
DISCUSSION
In the introduction, we mentioned that the existence of diabetes and TB is mutual. From the literature reviews that we choose, we also found that the TB rate in patients with diabetes was 23.5%, while the incidence of diabetes in patients with tuberculosis was 12.4%\textsuperscript{11,12}. However, there was a low uptake of a diagnostic evaluation for TB and confined to the patients that had evident symptoms of TB. So, only diabetic patients suspected of TB will be actively referred. Several programs have also been proposed to screen early TB-diabetes mellitus\textsuperscript{13}. Doctors must be well-trained that the diabetic patients receive routine TB screening to carry out other diabetes-associated complications. Moreover, user-fees for the X-ray limit the number of screenings. Based on this problem, cost-free or subsidised will reduce the financial burden, encourage patients to undergo screening and increase the uptake of TB testing. Screening for diabetes in TB patients is best done at the start of TB treatment and registration. Low-cost diabetes testing is recommended, although the results may be slightly skewed, patients are more likely to agree that it is cheap. The laboratories or at the provider clinics provide these tests with the assurance of interventions to obtain data on diabetes screening as part of the TB surveillance system\textsuperscript{14,15}. Integrated delivery units provide a solution for diabetes screening, TB diagnosis and TB-diabetes mellitus treatment in a facility that can capture data with supporting systems and monitoring results. The results of the study indicate that patients with TB-diabetes mellitus have a higher risk of adverse diabetes mellitus outcomes, including delayed mycobacterial clearance, relapse and re infection, treatment failure, and even death\textsuperscript{16}. Two factors are prime suspects, poor glucose control and differences in antibiotic levels of plasma anti-mycobacteria bacteria. Based on the problems stated, we can bring out another question: How to prevent the development of diabetes mellitus in a patient with diabetes\textsuperscript{17}. Therefore, for patients diagnosed with diabetic TB, the control of blood glucose and effective anti-tuberculosis drugs are the key points and difficulties in the treatment of this disease, as well as the key to prevent the emergence of drug-resistant diabetes mellitus\textsuperscript{18}. Active control of blood glucose is the key to the treatment of diabetic TB\textsuperscript{18}. Meanwhile, early diagnosis of TB, early adequate and reasonable anti- TB treatment, strengthens blood glucose monitoring during treatment, and timely evaluation of the treatment effect by reviewing chest radiographs and sputum bacteria. For people with poor glycaemic control, they should consider an appropriate extension of course to 1 year or more. If it progresses to multidrug-resistant TB (Mdr-tb), it is more contagious, more difficult to treat, and the failure rate and mortality are higher. It is essential to develop an appropriate and effective treatment plans for Mdr-tb, and also strengthen the management of patients. These methods are essential to interrupt its transmission\textsuperscript{19}.

CONCLUSION
The high prevalence of diabetes mellitus in low- and middle-income countries where TB is endemic has become one of the issues that should be targeted by the related department. Prevalence, diagnostics and prevention of TB and diabetes mellitus are the topics that needed to be emphasized. Upon the high prevalence of diabetes mellitus and TB, the author has mentioned some actions which are necessary for preventing the occurrence of TB and diabetes mellitus that will be stated below\textsuperscript{15}. Those actions need to be paid attention by related department so that the prevention for TB-diabetes mellitus can be controlled in well-manner. Furthermore, the author has also stated the relationship between diabetes mellitus and TB. People who are suffering from chronic diseases such as diabetes mellitus will have a weaker immune system\textsuperscript{6}. Therefore, they are more likely to progress from latent to active TB. In the research, it was found that the risk of TB is related to the severity of diabetes mellitus. Patients who needed more than 40 units of insulin per day have a double chance to develop TB than those with lower doses\textsuperscript{21}. There are several precautions that are needed to be taken note by TB-diabetes mellitus patients. Poorly controlled diabetes can lead to several complications, including increased susceptibility to infection. For example, infection caused by Mycobacterium Tuberculosis (Mtb). Therefore, diabetes patients need to have regular diabetes control\textsuperscript{12}, including strict control on their diet and carry out a healthy lifestyle such as exercise regularly and sleep according to time. Besides, the author has also mentioned that diabetes mellitus can increase the risk of successful LTBI in close contacts which can facilitate the progression from LTBI to TB\textsuperscript{22}. In the article, the author has also mentioned that DM-diabetes mellitus patients have a higher frequency of lower lung lobe infiltrates where Mtb would implant during inhalation. One should further themselves from high infection area where Mtb are endemic. As the fact infections are the cause of worsening diabetic control, but the drugs taken by diabetes patients to treat TB may also weaken the glycaemic control of the patients. In the article, the author has also brought up some facts that need to be taken serious. First, overlapping toxicities when treating TB and diabetes mellitus must be handled carefully to avoid subsequent action to the patients\textsuperscript{3}. As an example, isoniazid is a drug which is used to treat active TB infections. However, it might cause peripheral neuropathy. Therefore, pyridoxine should be given at the same time to avoid such
incidence. In addition, rifampicin is a potent inducer, which is a host of metabolising enzymes can accelerate the metabolism of drugs given with rifampicin. It can cause hyperglycaemia when treated with oral hypoglycaemic drugs directly or indirectly and leading to reduced treatment effects. For example, sulfonyl ureas are oral hypoglycaemic drugs which is usually used for Type 2 diabetic patients. Other treatment such as rosiglitazone and repaglinide should also be paid more attention when treating with rifampicin. This is because rifampicin can reduce the plasma concentrations of the mentioned drugs by 54% and 31% respectively. TB is an infectious disease which can be transmitted through the air. Thus, one needs to be cautious when exposing to a high risk area. Wearing a mask would be an ideal way to prevent infection. However, the best preventing way is to avoid an area with the high spreading of TB, especially diabetes patients. They need to have full protection from TB in order to prevent any infection.

As a conclusion, TB-diabetic patients need to pay more attention to their lifestyle. All the risk factors should be avoided to prevent any incidences or to worsening of the disease. The associated department should also educate the public on the prevention of diseases. Campaign and social media are the easiest and effective way of reducing the prevalence of TB and diabetes mellitus.

**AUTHOR’S CONTRIBUTION**

All authors have worked equally for this work.

**REFERENCES**