

## Relationship between rs9939609 Polymorphism of FTO Gene, Diabetes Mellitus and Tuberculosis

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### Abstract

Tuberculosis and diabetes mellitus are the most important reasons in mortality all over the world. It's clear that reviewing of relationship between Tuberculosis (TB) and diabetes mellitus (DM) is necessary; on the other hand it's found that FTO gene has the positive relationship with metabolic issues. Therefore, it's necessary pay attention to the above and dangerous sicknesses, especially in field of genetic sciences. Hence, our purpose is investigation of relationship between polymorphism rs9939609 polymorphism of FTO gene, TB and DM. With regards to the findings, it was concluded that there was considerable relationship between FTO gene rs9939609 polymorphism and DM and also it was notable development of TB among diabetic people. It can be stated that there is an indirect relationship between FTO gene rs9939609 polymorphism and TB sickness.

**Keywords:** rs9939609 polymorphism, FTO gene, Tuberculosis.

### Introduction

Polymorphism of genes, nutritional methods and physical activity are indexes and important factors in field of serious sickness' occurrence (1-4). One of these sicknesses is diabetes mellitus (DM). DM is a metabolic disorder and it cause blood glucose level to higher than normal and this sickness is the common sicknesses in world (5). So, it's necessary pay attention to related cases in DM; especially in genetic sciences that they are sciences that review diseases in

view of structure and genes performance and rate of interference in their structure and normal performance in emergence of diseases. On the other hand, investigation about the infectious diseases and problems linked to them in order to obtain the health level promotion is necessary (6,7). Tuberculosis (TB), a severe infection that result from Mycobacterium tuberculosis bacteria, that 1.6 million people were died due to rate of outbreak of these contagious disease.

Unfortunately, 8.8 million people have suffered from active type of this infectious disease and TB is one of the most important reasons of mortality in developing countries (8,9). On the other hand, FTO gene has positive and significant relationship with metabolic sicknesses of body such as DM (10).

Therefore, it is necessary pay attention to dangerous sicknesses like DM and TB, especially in genetic sciences. Hence, our aim is reviewing relationship between rs9939609 polymorphism of FTO gene and DM and TB.

## Materials and Methods

Studies linked to our study goal were selected via search in databases such as PubMed, Google Scholar and Elsevier then were evaluated.

### 1. Relationship between FTO gene rs9939609 polymorphism and DM:

Researchers were conducted different studies about relationship between FTO gene rs9939609 polymorphism and DM. Li et al, in their papers about genetic FTO gene variation in related to type 2 diabetes mellitus (T2DM) and obesity, demonstrated their data on 96551 subjects from east and south of Asia: there is significant relationship between rs9939609 polymorphism and T2M (11). In other meta-analysis study that it was investigated three studies about relationship between rs9939609 polymorphism of FTO gene and DM among Scandinavian People (41504 subjects), its

conclusion was stated that above polymorphism has considerable influence on increasing the number of people suffering from diabetes (12). In large case-control study on Tunisia and Morocco, it was clear that rs9939609 polymorphism of FTO gene could play important role in development of DM (13). Also in other study, it was stated that this polymorphism is one of the most important risk factors for DM (14). Similarly, in Legry et al study, it was confirmed that two rs8050136 and rs9939609 alleles are dangerous alleles in outbreak of DM. Also this case was stated in other two studies (15-17).

### 2. Relationship between DM and TB:

About relationship between DM and TB, Stevenson et al stated that there is meaningful relationship between diabetic people and TB infection, so that TB infection prevalent in diabetic people (9). Also, other study was done by Mboussa et al and their aim was research about Pulmonary Tuberculosis prevalence in diabetic people. Their findings indicated that there is a considerable and important relationship between DM and outbreak TB (18). In a large-scale longitudinal cohort study, researchers were stated that TB outbreak among diabetic people is very high (19). Sola et al in their paper stated that DM could be an important risk factor for the reactivation of TB infection (20). Similarly, the other studies confirmed the previous results (21-25). Dyck et al stated in report about relationship between two sicknesses (above sicknesses)

**Table 1. Articles about relation between TB and DM**

Scholars	Population	Results
Stevenson et al.	Indian population	DM has a notable contribution in the TB occurrence.
Mboussa et al.	Congolese population	Occurrence of TB in diabetics is frequent than non-diabetics.
Leung et al.	Hong Kong population	TB is prevalent in patients with DM.
Solá et al.	Dominican population	DM can cause the reactivation of pulmonary TB.
Lee et al.	Taiwanese population	Poor glycemic control has association with TB occurrence.
Shetty et al.	Indian population	DM has a notable contribution in the TB occurrence.
Magee et al.	Georgian population	TB in patients with DM is frequent than those without.
Damtew et al.	Ethiopian population	DM prevalence in TB cases is notable.
Pealing et al.	British population	DM is a risk factor in TB risk increase.
Jabbar et al.	Pakistani population	TB in patients with DM is common than those without.
Dyck et al.	Saskatchewan population	DM is a TB risk factor and predictor for TB.

that T2DM is an important factor in prediction of TB suffering. Also they stated DM is as a risk factor in TB suffering (26). In other study, researchers indicated that it is important ages range between 40 and 70 in diabetic people in TB outbreak, because TB infection often occurs in these ages range in diabetic people (27).

## Conclusion

With regards to studies results, it can be concluded that there is a meaningful relationship between polymorphism rs9939609 polymorphism of FTO gene and DM. Also DM is an important risk factor for occurring TB infection and it is a factor for the

reactivation of TB infection. We can understand, there is an indirect relationship between polymorphism rs9939609 polymorphism of FTO gene and TB. Because this polymorphism is reason for one of the important risk factors in TB, i.e. DM. It's interesting that researchers stated that physical activity could overcome the efficacy of rs9939609 polymorphism of FTO on obesity linked properties (2). Probably, physical activity could have desirable impacts on DM and even it can be influence on improvement and reduction of TB occurrence, but this subject required to various studies to obtain exact, comprehensive, complete and clear results.

## References

- Mirsane SA, Shafagh S, Mirbagher Ajorpaz N. Efficacy of Pomegranate Ingredients in Treatment and Prevention of Diseases. *Avicenna J Med Biochem.* 2016;4(2):37992.
- Ruiz JR, Labayen I, Ortega FB, Legry V, Moreno LA, Dallongeville J, et al. Attenuation of the effect of the FTO rs9939609 polymorphism on total and central body fat by physical activity in adolescents: the HELENA study. *Archives of pediatrics & adolescent medicine.* 2010;164(4):328-33.
- Mirsane SA, Shafagh S. Remedial and beneficial effects of Calcium on colorectal cancer. *Arvand J Health Med Sci* 2016;1(2):121-2.
- Mirsane SA, Shafagh S. The Relationship Between XRCC1 Arg399Gln Polymorphism, Alcohol Consumption and Colorectal Cancer: One of the Alcohol Forbidding Reasons in Islam. *Gene Cell Tissue.* 2016;3(3):40607.
- Yang L, Shao J, Bian Y, Wu H, Shi L, Zeng L, et al. Prevalence of type 2 diabetes mellitus among inland residents in China (2000-2014): A meta-analysis. *J Diabetes Investig.* 2016;7(6):845-52.
- Mirsane SA, Mirsane SM, Oraei N. Islam and Neurocysticercosis. *Arch Neurosci.* 2016;3(4):38060.
- Mirsane SA, Shafagh S. Effects of Helicobacter pylori Infection and Western Diet on Migraine. *Gene Cell Tissue.* 2016;3(3):39212.
- Corbett EL, Watt CJ, Walker N, Maher D, Williams BG, Raviglion MC, et al. The growing burden of tuberculosis: global trends and interactions with the HIV epidemic. *Arch Intern Med.* 2003;163(9):1009-21.
- Stevenson CR, Forouhi NG, Roglic G, Williams BG, Lauer JA, Dye , et al. Diabetes and tuberculosis: the impact of the diabetes epidemic on tuberculosis incidence. *BMC Public Health.* 2007;7(1):234.
- Freathy RM, Timpson NJ, Lawlor DA, Pouta A, Ben-Shlomo Y, Ruokonen A, et al. Common Variation in the FTO Gene Alters Diabetes-Related Metabolic Traits to the Extent Expected Given Its Effect on BMI. *Diabetes.* 2008;57(5):1419-26.
- Li H, Kilpeläinen TO, Liu C, Zhu J, Liu Y, Hu C, et al. Association of genetic variation in FTO with risk of obesity and type 2 diabetes with data from 96,551 East and South Asians. *Diabetologia.* 2012;55(4):981-95.
- Hertel JK, Johansson S, Sonestedt E, Jonsson A, Lie RT, Platou CG, et al. type 2 diabetes, and weight gain throughout adult life: a meta-analysis of 41,504 subjects from the Scandinavian HUNT, MDC, and MPP studies. *Diabetes.* 2011;60(5):1637-44.
- Cauchi S, Ezzidi I, El Achhab Y, Mtiraoui N, Chaieb L, Salah D, et al. European genetic variants associated with type 2 diabetes in North African Arabs. *Diabetes Metab.* 2012;38(4):316-23.
- Rees SD, Islam M, Hydrie MZ, Chaudhary B, Bellary S, Hashmi S, et al. An FTO variant is associated with Type 2 diabetes in South Asian populations after accounting for body mass index and waist circumference. *Diabet Med.* 2011;28(6):673-80.
- Legry V, Cottel D, Ferrieres J, Arveiler D, Andrieux N, Bingham A, et al. Effect of an FTO polymorphism on fat mass, obesity, and type 2 diabetes mellitus in the French MONICA Study. *Metabolism.* 2009;58(7):971-5.

16. Price RA, Li WD, Zhao H. FTO gene SNPs associated with extreme obesity in cases, controls and extremely discordant sister pairs. *BMC Med Genet.* 2008;9:4.
17. Hunt SC, Stone S, Xin Y, Scherer CA, Magness CL, Iadonato SP, et al. Association of the FTO gene with BMI. *Obesity (Silver Spring)* 2008;16(4):902-4.
18. Mboussa J, Monabeka H, Kombo M, Yokolo D, Yoka-Mbio A, Yala F. Course of pulmonary tuberculosis in diabetics. *Rev Pneumol Clin.* 2003;59(1):39-44.
19. Leung CC, Lam TH, Chan WM, Yew WW, Ho KS, Leung GM, et al. Diabetic control and risk of tuberculosis: a cohort study. *Am J Epidemiol.* 2008;167(12):1486-94.
20. Solá E, Rivera C, Mangual M, Martinez J, Rivera K, Fernandez R. Diabetes mellitus: an important risk factor for reactivation of tuberculosis. *Endocrinology, Diabetes & Metabolism Case Reports.* 2016.
21. Lee PH, Fu H, Lai TC, Chiang CY, Chan CC. Glycemic Control and the Risk of Tuberculosis: A Cohort Study. *PLoS Med.* 2016;13(8):1002072.
22. Shetty N, Shemko M, Vaz M, D'souza G. An epidemiological evaluation of risk factors for tuberculosis in South India: a matched case control study. *Int J Tuberc Lung Dis.* 2006;10(1):80-6.
23. Magee MJ, Foote M, Maggio DM, Howards PP, Narayan KV, Blumberg HM, et al. Diabetes mellitus and risk of all-cause mortality among patients with tuberculosis in the state of Georgia, 2009–2012. *Annals of epidemiology.* 2014;24(5):369-75.
24. Damtew E, Ali I, Meressa D. Prevalence of diabetes mellitus among active pulmonary tuberculosis patients at St. Peter specialized hospital. Addis Ababa, Ethiopia. *World J Med Sci.* 2014;11(3):389-96.
25. Pealing L, Wing K, Mathur R, Prieto-Merino D, Smeeth L, Moore DA. Risk of tuberculosis in patients with diabetes: population based cohort study using the UK Clinical Practice Research Datalink. *BMC medicine.* 2015;13:135.
26. Dyck RF, Klomp H, Marciniuk DD, Tan L, Stang MR, Ward HA, et al. The relationship between diabetes and tuberculosis in Saskatchewan: comparison of registered Indians and other Saskatchewan people. *Can J Public Health.* 2007;98(1):55-9.
27. Jabbar A, Hussain SF, Khan AA. Clinical characteristics of pulmonary tuberculosis in adult Pakistani patients with coexisting diabetes mellitus. *East Mediterr Health J.* 2006;12(5):522-7.