International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

The Escalating Genetic Predisposition to Type 2 Diabetes in the Global Population

Mr. Framcy T Mathew[1], Ms. Aminamol. H[2]

[1]Assistant Professor, Baselius College Kottayam
[2]Baselius College Kottayam

Abstract

The rising prevalence of Type 2 diabetes is a global health concern, with significant implications for public health systems worldwide. This article reviews recent research on the genetic predisposition to Type 2 diabetes, highlighting key genetic markers and their interactions with lifestyle and environmental factors. Studies have identified several single nucleotide polymorphisms (SNPs) associated with increased diabetes risk, with the TCF7L2 gene being particularly noteworthy. Moreover, certain ethnic groups, such as South Asians, exhibit higher genetic susceptibility due to specific genetic variations affecting insulin production and fat distribution. Familial patterns further underscore the hereditary nature of the disease, with individuals having a family history of diabetes at a higher risk. The interaction between genetic predisposition and modern lifestyle factors, including poor dietary habits, lack of physical activity, and increased obesity rates, exacerbates the risk of developing Type 2 diabetes. This review underscores the necessity for targeted research and personalized treatment approaches, considering both genetic and environmental factors to effectively address the escalating diabetes epidemic.

Introduction

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by insulin resistance and pancreatic beta-cell dysfunction, leading to hyperglycaemia. The prevalence of T2DM has been rising globally, with significant health and economic burdens. The genetic predisposition to T2DM plays a crucial role in its development and progression. This paper aims to review and synthesize current research on the genetic factors contributing to T2DM and their interactions with environmental and lifestyle factors.

Genetic Factors in Type 2 Diabetes

Single Nucleotide Polymorphisms (SNPs)

Research has identified numerous SNPs associated with T2DM risk. The TCF7L2 gene is one of the most significant genetic markers, influencing insulin secretion and beta-cell function (Grant et al., 2006). Other notable SNPs include variants in the FTO, SLC30A8, and CDKAL1 genes, which are linked to obesity and glucose metabolism (Frayling et al., 2007).

Ethnic Variations in Genetic Susceptibility

Certain ethnic groups, such as South Asians, African Americans, and Hispanics, have a higher genetic predisposition to T2DM. Genetic studies have shown that these populations possess specific genetic variations that affect insulin production and fat distribution, increasing their susceptibility to T2DM (Chambers et al., 2011).

Familial Patterns

T2DM often runs in families, indicating a strong hereditary component. Studies have shown that individuals with a family history of diabetes are at a higher risk of developing the disease (Meigs et al., 2000). Genetic linkage studies and genome-wide association studies (GWAS) have identified several loci associated with familial T2DM (Mahajan et al., 2018).

Interaction with Lifestyle and Environmental Factors

Diet and Physical Activity

The interaction between genetic predisposition and lifestyle factors such as diet and physical activity is critical in the development of T2DM. Poor dietary habits, including high intake of processed foods and sugary beverages, combined with a sedentary lifestyle, exacerbate genetic risks (Hu et al., 2001).

Obesity and Insulin Resistance

Obesity is a major risk factor for T2DM, and genetic factors influence fat distribution and insulin resistance. Genes such as FTO and MC4R are associated with obesity, and their variants can increase the risk of T2DM in obese individuals (Loos & Yeo, 2014).

Environmental Influences

Exposure to environmental pollutants and endocrine-disrupting chemicals (EDCs) can also affect insulin sensitivity and glucose metabolism. Research suggests that EDCs may interfere with hormonal regulation and contribute to the development of T2DM (Lee et al., 2014).

Conclusion

The escalating genetic predisposition to Type 2 diabetes in the global population underscores the need for a comprehensive approach to prevention and management. Understanding the interplay between genetic factors and lifestyle/environmental influences is crucial for developing effective strategies to combat the growing diabetes epidemic. Future research should focus on personalized treatment approaches and targeted interventions that consider both genetic and non-genetic factors.

References

1. Chambers, J. C., Zhang, W., Sehmi, J., Li, X., Wass, M. N., Van der Harst, P., ... & Kooner, J. S. (2011). Genome-wide association study identifies loci influencing concentrations of liver enzymes in plasma. Nature Genetics, 43(11), 1131-1138.
2. Frayling, T. M., Timpson, N. J., Weedon, M. N., Zeggini, E., Freathy, R. M., Lindgren, C. M., ... & McCarthy, M. I. (2007). A common variant in the FTO gene is associated with body mass index and predisposes to childhood and adult obesity. Science, 316(5826), 889-894.
3. Grant, S. F., Thorleifsson, G., Reynisdottir, I., Benediktsson, R., Manolescu, A., Sainz, J., ... & Stefansson, K. (2006). Variant of transcription factor 7-like 2 (TCF7L2) gene confers risk of type 2 diabetes. Nature Genetics, 38(3), 320-323.
4. Hu, F. B., Manson, J. E., Stampfer, M. J., Colditz, G., Liu, S., Solomon, C. G., & Willett, W. C. (2001). Diet, lifestyle, and the risk of type 2 diabetes mellitus in women. New England Journal of Medicine, 345(11), 790-797.
5. Lee, D. H., Steffes, M. W., Sjödin, A., Jones, R. S., Needham, L. L., & Jacobs, D. R. (2014). Low dose organochlorine pesticides and polychlorinated biphenyls predict obesity, dyslipidemia, and insulin resistance among people free of diabetes. Diabetes Care, 37(6), 1951-1958.

6. Loos, R. J., & Yeo, G. S. (2014). The genetic basis of eating behavior and food intake. Nature Reviews Endocrinology, 10(1), 30-44.
7. Mahajan, A., Taliun, D., Thurner, M., Robertson, N. R., Torres, J. M., Rayner, N. W., ... & Flannick, J. (2018). Fine-mapping type 2 diabetes loci to single-variant resolution using high-density imputation and islet-specific epigenome maps. Nature Genetics, 50(11), 1505-1513.
8. Meigs, J. B., Cupples, L. A., & Wilson, P. W. (2000). Parental transmission of type 2 diabetes: the Framingham Offspring Study. Diabetes, 49(12), 2201-2207.