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A RESEARCH TO ASSESS AND ESTIMATE THE WORLDWIDE EPIDEMIOLOGY OF PREDIABETES WITH CURRENT AND FUTURISTIC PERSPECTIVE

[1]Dr. Ijaz Ahmad, [2]Dr. Zahoor ur Rehman, [3]Dr. Tariq Hassan
[1]PG Resident Internal Medicine, Hayatabad Medical Complex Peshawar
[2]PG Resident Internal Medicine, HMC Peshawar
[3]Medical Officer DHQ Hospital Dir Lower

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Abstract:
An intermediate condition of hyperglycemia refers to prediabetes which reflects the level of glucose more than normal range; whereas, these levels are under the maximum limit of diabetes. It is a well-known metabolic state as the prediabetes individuals are more prone to the development of overtly formed diabetes state along with related complications and disorders. Awareness about prediabetes may help to identify early diagnosis, timely medical intervention and reducing the total increase in the patients of diabetes. Different organizations present different screening guidelines for diabetes which result in the different estimation of diabetes prevalence. In the presence of such variations, different estimates present an increase in the diabetes cases who were classified as prediabetes all over the world. The objective of this research is to analyze the prediabetes diagnostic/ screening criteria, the relation between prevalence and glycemic measures and discuss present practice and futuristic perspective on the global burden of prediabetes.

Keywords: *Diabetes, Prediabetes, Prevalence, Global Burden and Screening Tools.*

Corresponding author:
Dr.Ijaz Ahmad,
PG Resident Internal Medicine, Hayatabad Medical Complex Peshawar

QR code

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INTRODUCTION:

Prediabetes is a vital metabolic condition which may lead or indicate to the future possible development of diabetes as prediabetes diagnosed individuals are more prone to the development of diabetes and its associated complications. Prediabetes is also at the risk of various pathogens development including macrovascular complications, nephropathy, neuropathy and retinopathy [1].

Different studies report 7.9% development of diabetes from a state of prediabetes [2]. Another series reported that peripheral neuropathy prevalence was more among prediabetes in comparison to the normal tolerance of glucose; whereas, it was the same among recently diagnosed patients of diabetes [3]. Chronic Kidney Disease and diabetes are also closely related [4]. Prediabetes individuals are also at an increased risk of CVD, stroke, coronary heart disease and higher mortality rates [5]. Moreover, increased levels of plasma glucose indicated prediabetes among early pregnancy cases which are also associated with increased risks of adverse outcomes during pregnancy and may also result in gestational diabetes [6]. International clinical modifications and disease classification put prediabetes as a separate billable state [7].

In the course of three to five years, prediabetes progresses to an overt state of diabetes (T2DM) among 25% individuals and 70% in the course of a lifetime [1, 8]. Due to its chronic features, it also poses long-term diabetes-related implications affecting life quality and increasing healthcare financial burden [9]. By modifying lifestyle, we may reverse prediabetes with physical activity and healthy diet pattern [10, 11]. In the absence of inefficacy of lifestyle modifications, individuals may take help from medical assistance such as acarbose and metformin [10 – 12]. The objective of this research is to analyze the prediabetes diagnostic/ screening criteria, the relation between prevalence and glycemic measures and discuss present practice and futuristic perspective on the global burden of prediabetes.

DEFINING PREDIABETES

An intermediate condition of hyperglycemia refers to prediabetes which reflects the level of glucose more than normal range; whereas, these levels are under the maximum limit of diabetes. It is a well-known metabolic state as the prediabetes individuals are more prone to the development of overtly formed diabetes state along with related complications and disorders [1, 8]. Different organizations present different screening guidelines for diabetes which result in the different estimation of diabetes prevalence. In the presence of such variations, different estimates present an increase in the diabetes cases who were classified as prediabetes all over the world (Table – I) [7, 9, 13].

Table – I: Prediabetes Diagnostic Criteria

Criterion	ADA [13]	WHO & IDF [7, 9]
Terminology	Prediabetes	Intermediate hyperglycemia Impaired glucose tolerance
IGT (Evaluated through 2-h PG during 75g OGTT)	7.8 – 11.0 mmol/L (140 – 199 mg/dL)	-
IFG (Evaluated through FPG)	5.6 – 6.9 mmol/L (100 – 125 mg/dL)	6.1 – 6.9 mmol/L (110 – 125 mg/dL)
HbA1C	5.7% – 6.4% (39 – 47 mmol/mol)	ND

Table – II: Abbreviations

Abbreviation	Stands For
ADA	American Diabetes Association
FPG	Fasting Plasma Glucose
HbA1C	Glycated Hemoglobin
IDF	International Diabetes Federation
IFG	Impaired Fasting Glucose
IGT	Impaired Glucose Tolerance
ND	Not Defined
OGTT	Oral Glucose Tolerance Test
PG	Plasma Glucose
WHO	World Health Organization

ADA recommended lower threshold levels than WHO guidelines for IFG [7, 13]. This was done to improve the prevalence concordance between IGT and IFG as the WHO threshold may differ from others in a considerable way. WHO criteria did not use an overall estimation of prevalence; whereas, it presents relative overt T2DM development. IFG reflects hepatic insulin resistance which is a more important diabetes marker in comparison to IGT defined skeletal muscle insulin resistance [14].

WHO did not endorse the assessment of IFG on the basis of FPG and IGT with the help of OGTT (2-h plasma glucose) with oral intake of 75 g (OGTT). ADA also suggests prediabetes screening through HbA1c which is also not endorsed by WHO [15, 16]. Many consider HbA1C as a reliable diagnostic tool for IGT/IFG as it is easy to perform than OGTT or FPG because fasting is not necessarily required [13, 15]. However, it is scarcely available in underdeveloped countries [17]. DPP and DPPOS did not adopt the criteria of HbA1C [18 – 20].

It is difficult to nominate a certain or appropriate criterion for the diagnosis of prediabetes; whereas, reduced IFG threshold in ADA guidelines in comparison to the guidelines of WHO and IDF improve the parity between individuals diagnosed by IGT and IFG. Prediabetes diagnosis may vary in the presence of a variety of diagnosis criterion which is not surprising [17]. These variations may also lead to wrong diagnosis, unnecessary treatment or left cases along with delayed treatment initiation. We cannot accurately estimate the global prediabetes burden as well.

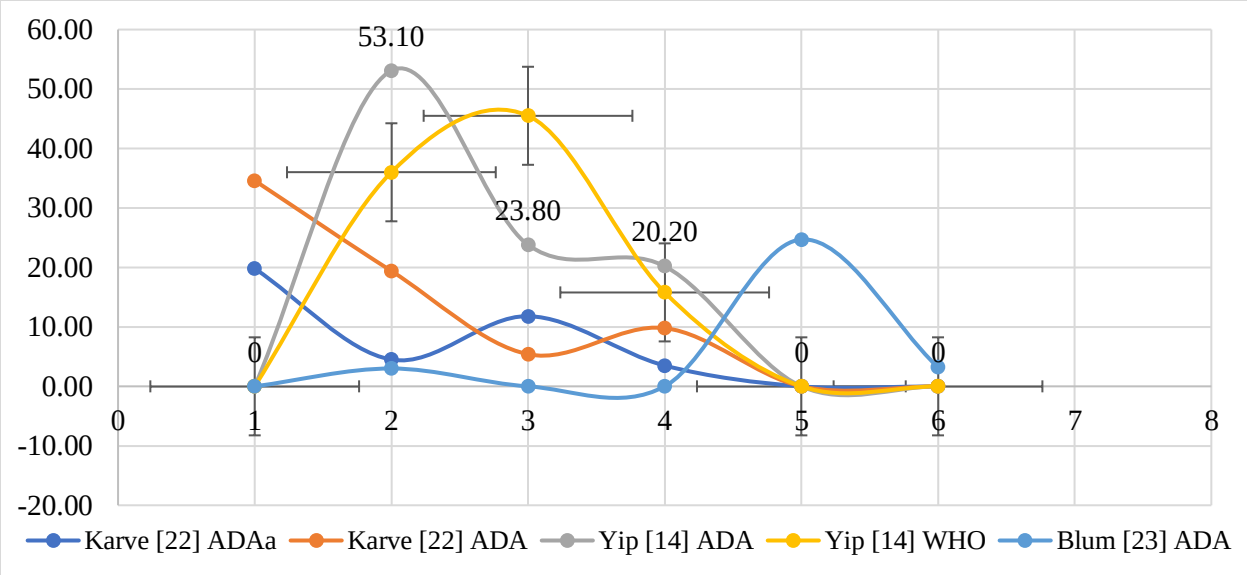
Different studies report 7.9% development of diabetes from a state of prediabetes. Another series reported that peripheral neuropathy prevalence was more among prediabetes in comparison to the normal tolerance of glucose; whereas, it was the same among recently diagnosed patients of diabetes. Chronic Kidney Disease and diabetes are also closely related. Prediabetes individuals are also at an increased risk of CVD, stroke, coronary heart disease and higher mortality rates. Moreover, increased levels of plasma glucose indicated prediabetes among early pregnancy cases which are also associated with increased risks of adverse outcomes during pregnancy and may also result in gestational diabetes. International clinical modifications and disease classification put prediabetes as a separate billable state.

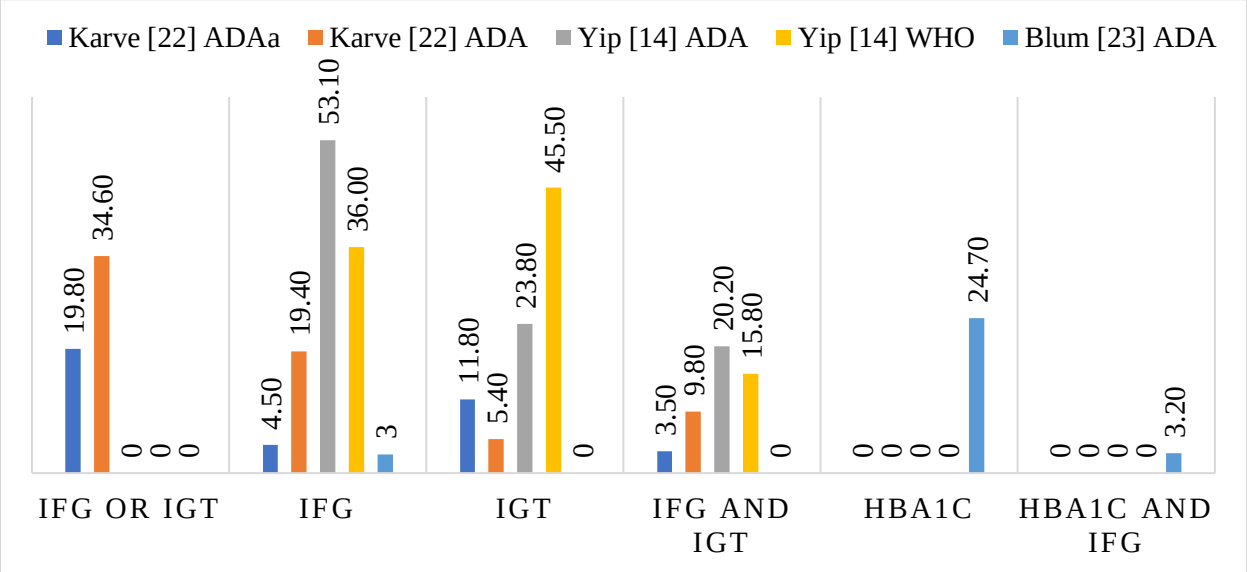
PREVALENCE OF PREDIABETES

There are great differences in the estimate of prediabetes prevalence with respect to different literary references as the diagnostic criterion employed differs from one another. ADA guidelines reduced the cut-off lead to increased prevalence among populations than WHO guidelines. A cohort included 1547 adults without an onset of diabetes; with a change in the lower threshold of IFG from (110 mg/dL) to (100 mg/dL) presented an increase in the prevalence of prediabetes from 19.8% to an increased proportion of 34.6% [21]. A large-scale analysis reported different prevalence rate with WHO and ADA guidelines respectively as 36% and 53.1% [22]. The IGT and IFG prevalence rates were almost similar for ADA and WHO guidelines respectively 20.2% and 15.8% [22].

Table – III: Varying Estimates of Diabetes

Author	Guideline Criteria Used	Estimated prevalence (%)					
		IFG or IGT	IFG	IGT	IFG and IGT	HbA1C	HbA_{1C} and IFG
Karve [22]	ADA[a]	19.80	4.50	11.80	3.50	0	0
	ADA	34.60	19.40	5.40	9.80	0	0
Yip [14]	ADA	0	53.10	23.80	20.20	0	0
	WHO	0	36.00	45.50	15.80	0	0
Blum [23]	ADA	0	3	0	0	24.70	3.20





We have already mentioned that HbA1C is a considerably reliable diagnosis for IGT. In a study, the sample population included 1542 healthy adults, among these adults 30.9% were diagnosed with prediabetes. In this prediabetes identified cases the diagnosis was made through HbA1C (79.9%), FPG (9.9%) and ADA (10.3%) guideline [23].

The prediabetes prevalence greatly depends on the used criterion for diagnosis such as IGT; whereas, others assess the outcomes for multiple tests. In the light of ADA guidelines, the abnormal outcomes of any of the criterion (IGT, IFG and HbA1C) is adequate for the confirmation of prediabetes [24]. We should not rely on single diagnosis criteria.

GLOBAL VARIABILITY IN PREDIABETES PREVALENCE

The abovementioned prediabetes identification complexities pose a challenge in the accurate estimation of prediabetes burden and relative global prevalence as mentioned in different literary references. However, present and future perspective are presented in IDF published review which is based on IGT among 20 years to 79 years old individuals [9]. Global IGT estimated prevalence reported in 2017 is 7.3% (352.1 million) which is anticipated to rise to 8.3% by 2045 (587 million). Male to female difference was not significant and fifty percent individuals with IGT were less than fifty years of age [9].

FACTORS THAT AFFECT PREVALENCE RATES OF PREDIABETES

Various epidemiological studies demonstrate a significant association between prediabetes likelihood and ethnicity; the as different rate of risk was found among prediabetes ethnic groups [14, 24]. An intricate process of factors including socioeconomic status, life expectancy, access to healthcare facilities, wealth, educational levels, disease exposure, healthcare awareness and obesity prevalence rates [25 – 26]. With more wealthy, urbanized, nutritional access, educated and healthcare facilitated populations, the chances of longevity are increased with increased rates of prediabetes.

CONCLUSIONS:

The literature presents varying rates of prevalence of prediabetes reflecting the heterogeneity of characteristics and approaches. It is clear that there is a rapid increase in prediabetes prevalence all over the world. Serious efforts are required to stop this increase in order to avoid possible conversion into diabetes which threats to global healthcare provisions.

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