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COMPREHENSIVE DISEASE ASSESSMENT – A INTEGRATED APPROACH TO ACCESS DIFFERENT ASPECTS OF DISEASE WITH FOCUS ON DIABETES – A SILENT INDIAN PANDEMIC

KALA K

Assistant Professor, SPS SGRRU Dehradun, UK, India

*Corresponding Author: Dr. Kanishk Kala: E Mail: kanishk.kala@gmail.com

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ABSTRACT

Diabetes is becoming a major public health problem at global level. It is prominent both in developing and developed nations. The asymptomatic and progressive nature of the disease it a silent threat. The macro and micro vascular complaints makes the aetiology complicated and treatment mandatory which is usually chronic and costly. The tests for diagnosis is usually assessment of blood sugar levels or OGTT which both are costly. So to enhance the screening apart from tests certain screening tools like Diabetes Knowledge Questionnaire (DKQ), IDRS, PSS etc. tools have been developed which are reviewed in an integrated manner in this article. The aim is not only to screen diabetes but to access the comorbid conditions also though use of tools or scales in an integrative manner to figure out not only disease but also the other etiological factors so that the actual clinical condition of patient could be accessed and based on the condition a rational and appropriate pharmaceutical care plan for patient could be framed and implemented. Further this integrated strategy could be implemented in other chronic diseases also.

Keywords: Diabetes, Metabolic Disturbances, Obesity, Physical Activity, Poor Nutrition

Background

Diabetes is chronic disorder which manifest as a metabolic disturbances in blood sugar level and has been increasing in India as a major non communicable disease within last decade. The major etiologists behind this are altered lifestyle. obesity, physical activity, poor nutrition, and

comorbidity which collectively contributed in rise of diabetes cases. Diabetes is becoming more and more prominent worldwide. The two biggest countries having a high burden of diabetes are China and the United States of America. This signifies that diabetes poses a risk to both developed and developing nations **[1]**.

INTRODUCTION

The non-communicable set of diseases referred as NCD are a cause of heart disorders, stroke events, malignancy, diabetes and respiratory disease, are collectively add up to for almost 70% of all global deaths. Almost three quarter of mortality cause is a NCD. The death in NCD is usually premature in which patient dies before reaching the age 70 years. This trend is prominent undeveloped and developing countries **[1, 2]**.

Age, gender, and family history are examples of non-modifiable risk variables that have contributed to the growth in NCDs. Modifiable risk factors include smoking, physical inactivity, alcohol consumption that can be dangerous, and poor dietary choices. Therefore, in order to discover risk factors early, primary prevention principles for NCDs must tools for risk assessment should be employed **[1, 2]**.

Over the past ten years, a number of diabetic risk scores have been developed for use in preventative initiatives in the United States, Scandinavia, and the United Kingdom. These ratings, which are based on population-based criteria from the individual countries, are all helpful mass screening methods **[3]**.

The alarming situation is present in India with every fifth Indian being a diabetic. This makes India the diabetic capital of the world. India has witnessed a rise in prevalence in diabetes among the youth above age group of 18 from 4.7% in 1980 to 8.7% in 2015 and is expected to be 11.4 % till 2045. The distribution of diabetes is both in rural and urban population of India **[1, 2]**.

Ironically in India, people with type 2 diabetes may remain undiagnosed for a long time which leads to development of micro and macro-vascular complications in these patients. Diabetes progression eventually becomes a etiological factor for complaints like blindness, renal failure, heart attacks, stroke and lower limb amputation. As per a estimation till 2030 diabetic subjects will rise to 366 million amongst which the large proportion of burden will be from developing countries also a total of 79.4 million diabetics will be contributed from India **[1, 2]**.

A nationwide initiative known as the "National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases & Stroke" (NPCDCS) has already been launched by the Indian government. Between 2010 and 2012, the suggested

solutions were put into practice in 700 Community Health Centers and 20,000 Sub centres spread over 100 Districts in 21 States. Opportunistic screening using the glucose strip method would be performed on a predetermined day by an ANM or health worker (M) as part of the national diabetes program **[1, 2]**.

Cardiovascular morbidity and death are predicted to decrease with early detection and treatment of type 2 diabetes. For people who already have diabetes, there is excellent medication available and the natural course of type 2 diabetes is well recognized. People with prediabetes who are at high risk of developing type 2 diabetes can avoid the disease with lifestyle changes, according to strong evidence **[4, 5]**.

Screening on large scale in usually in community for pre diabetes and type 2 diabetes with an oral glucose tolerance test (OGTT) is generally not suggested because this procedure is invasive, expensive, and inconvenient[5]. Though it was used previously for community screenings with positive results if proper procedure manual, training and knowledge in provided to participants as well as the researcher. Thus implementing mass screening drive is the most economical approach is to find out type 2 diabetes and pre diabetes concurrently within the community. The results of screening could help in treatment and management of diabetics in community which mostly goes unnoticed and indirectly increase the burden of diabetes. However in contrast to modern tools like diabetic screening scales the oral glucose tolerance test (OGTT) is comparatively costly, and is typically not advised for mass screening for pre diabetes and type 2 diabetes **[4, 5]**.

Indian Diabetes Risk Scoring (IDRS) which was developed based on the data of south Indians. The components considered in this tool are age, abdominal obesity, physical activity, and family history of diabetes and the possible score ranged from 0 to 100. Even in individuals with normal glucose tolerance, IDRS can be a useful marker of metabolic syndrome and cardiovascular risk, as demonstrated by Mohan *et al*.'s 2007 study. The Indian Diabetes Risk Score (IDRS) is arguably the strongest predictor of incident diabetes among Asian Indians, according to a 2008 study by Mohan *et al*. Diabetes and pre-diabetes incidence rates in India are greater than in other ethnic groups and western populations. Similar results were obtained by Nandeshwar *et al*. (2010) from a study conducted at Bhopal. Using the IDRS, 222 undergraduate students in Mumbai were studied (Bhatia *et al*., 2014). Of these, 1% had a high risk of getting diabetes, while 68% had a moderate risk. Similar findings were made by Gopalakrishnan *et al*. (2017) among Chennai medical students. Similar

results were obtained from rural Tamil Nadu by Gupta *et al*. in 2010 **[6, 7]**.

The majority of diabetics are in their 30s and 40s, which has a big influence on the nation's social and economic costs. The Indian Diabetes Risk Score (IDRS) scale is developed by Madras Diabetes Research Foundation (MDRF). It is an easy tool which aid in early detection of undiagnosed diabetes in the the patient and can also be utilized on large scale for the community. The tool has also shown good results in predicting other related aetiologies caused due to diabetes which includes incident diabetes6, metabolic syndrome, artery disease, non-alcoholic fatty liver disease, sleep disorders and diabetic complications, such as peripheral vascular disease, neuropathy, and help distinguish type 2 from non-type 2 diabetes. The MDRF-IDRS has also been validated in several other ethnic populations **[7]**.

In year 2022 a study involving screening of individuals through IDRS tool for early detection and identification of undiagnosed diabetic complications was conducted by ICMR in 30 states/union territories in India The outcome of study revealed that 32.4, 52.7 and 14.9 per cent of the general population were under high-, moderate- and low-risk category of diabetes. This study certifies the applicability of IDRS for mass screenings **[7]**.

According to the guidelines provided by the World Health Organization (WHO) and the American Diabetes Association (ADA), the oral glucose tolerance test (GTT) is currently the gold standard for diagnosing diabetes mellitus. Numerous diabetes risk scores, such as the Finnish Diabetes Risk Score, ADA Risk Test, and Danish Diabetes Risk Score, have been developed for screening and prevention initiatives. Even region-specific risk scores have been created, and diabetic scores of Indian descent have also been created. IDRS and Ramchandran have both demonstrated positive outcomes **[8, 9]**.

The IDRS score has been developed by a renowned diabetiologist Dr V Mohan and his team through the outcome of their Chennai Rural Epidemiology Study (CURES). It is a user friendly diabetic risk assessing tool that predicts the risk for diabetes based on parameters of age obesity physical activity and the family history. (Raghav.,2017) Physical activity is also a parameter in diabetes which access the sedentary life styles. This component could also be accessed appropriately through a validated general physical activity questionnaire developed by the London School of Hygiene and Tropical Medicine. GPPAQ has been used in many primary care studies over the years **[8, 9]**.

KNOWLEDGE ASSESSMENT SCALES

The knowledge of disease is also important to frame the management plan and to achieve good outcomes. There are many scales developed which access the knowledge of disease. In terms of diabetes a scale has been developed by the knowledge of diabetes using a scale developed in the Indian Council of Medical Research–India Diabetes (ICMR-INDIAB) which has been utilized in studies. Several tools have been developed and put into use globally to determine information about various elements of diabetes. The Diabetic Knowledge Questionnaire (DKQ), Diabetes Knowledge Assessment (DKN) scale, the Ped-Carb Quiz (PCQ), the Diabetic Numeracy Test (DNT), and the Michigan Diabetes Knowledge Tool (MDKT) are a few well-known resources. These tools were created and approved in Australia and the United States. The goals of the assessments differed. The first tool created to evaluate general knowledge and insulin use was the MDKT. The PCQ evaluated the recognition of carbohydrates in food, the counting of carbohydrates in food, and the use of counting carbohydrates in insulin dosage calculations, whereas the DKQ evaluated overall knowledge on diabetes. In the meantime, the DNT assessed diabetes' numeracy abilities like Interpreting food labels, calculating insulin doses depending on blood glucose levels, and making adjustments for carbohydrates. The above tools have been adopted and implemented in many different countries **[10, 11]**.

IDRS Scale Scoring and Grading

The IDRS scale compromises of four components The IDRS scale is used with other scales also to access the different aspects of comorbidity to get a clear picture in a diabetic patients. IDRS can assist in prediction of metabolic syndrome and cardiovascular disorders. Th reason being the three common factors namely age, physical activity and waist circumference which affect both aetiologies metabolic syndrome and cardiovascular disease. IDRS works on factors in which two are modifiable and the two non modifiable. The modifiable factors could be intervened for management and control of diabetes. Subjects showing high IDRS values regardless of their blood sugar status, are ideal candidates for implementing the life style modification a management strategy for controlling diabetes **[12-14]**.

By raising awareness, an early diagnosis of DM risk can potentially aid in lowering the disease's prevalence. The Indian Diabetes Risk Score (IDRS) was created as a useful screening tool to identify the risk in order to alleviate this circumstance. The Madras Diabetes Research Foundation created 10 IDRS as a screening tool, and Mohan *et al*.'s 2005 Chennai Urban Rural Epidemiology Study (CURES) study validated it.11 Participants

can be grouped into low, moderate, and high risk groups for developing diabetes mellitus (DM) based on their IDRS score.

High sensitivity and specificity of IDRS to identify undiagnosed DM have been demonstrated in numerous studies **[12–14]**. In addition to aiding in the prevention of DM, doctors will be able to prevent the consequences listed above associated with DM if they are able to accurately forecast the risk of DM using basic scales like the IDRS with high sensitivity and specificity **[11-13]**.

Two modifiable risk factors—waist circumference and physical activity—and two nonmodifiable risk factors—age and family history—are used to create the IDRS score. Recurring links between modifiable risk factors and the incidence of diabetes mellitus include waist circumference and physical activity **[14]**.

In addition to BMI and waist circumference of greater than 85 cm in men (as opposed to 90 cm in IDRS), the other diabetic risk score developed by Ramachandran also includes patient age beginning at 30 (as opposed to 35). Screening is done using the cut-off value of more than 21. Another scale named as FINDRISC was initially developed in Finland to predict the prevalence of diabetes in individuals aged 35 to 64. The eight comprehension questions in the FINDRISC tool include those on age, waist circumference, body mass index (BMI), degree of physical activity, consumption of fruits, vegetables, and berries, use of antihypertensive drugs, history of any hyperglycemia, and family history of diabetes. The tool doesn't require laboratory research and has numerous weighted values based on the associated risk. The ultimate score may vary between 0 and 26. The FINDRISC score has a maximum value of 26. A value of less than 7 is thought to indicate a very low risk of diabetes, value within 7–11 range reflects a low risk, 12–14 range denotes a moderate risk, 15–20 marks a a high risk, and 21 or more a reflects a very high risk. These values correlate to probabilities of 1%, 4%, 17%, 33%, and 50%, respectively, of developing diabetes over the next ten years **[11-14]**.

The three scores namely IDRS Ramachandran and FINDRISC access the occurrence of diabetes. Moreover, these have been compared also in previous studies conducted by jawahar etal which compared IDRS with ramachandran diabetic scores and the other Pawar, *et al* which compared IDRS with FINDRISC. Both the study results revealed positive correlations in between the scales **[11-13]**.

In addition the IDRS with FINDRISC also shows a positive link with diabetic complications. hence considering the fact this review is framed to access the secondary impacts through widely used accessing tools so that the comprehensive

picture of the impact of diabetes or any such chronic disease which fits in criteria of above scales can be accessed on comprehensive aspect. This will help to frame the management as well as the pharmaceutical care plan in a detail and more rational way **[11-14]**.

STRESS AND IDRS

Stress is the body's general reaction to any demands placed upon it. The negative impacts are communicated through negative changes in health-related behaviours as well as directly through neuroendocrine and autonomic reactions **[15]**.

The co-occurrence of mental health disorders with chronic medical illnesses appears to be either undetected or underdiagnosed in many cases. There is a significant odds ratio for anxiety among diabetics compared to other affective illnesses, and there is consistent evidence that these patients experience anxiety and depression at twice the rate of the general population **[15]**.

Furthermore, despite adjusting for other variables like socioeconomic status and demographic characteristics, the strong association between anxiety and diabetes persisted, in contrast to other affective disorders. However, the presence of these psychological distresses is not evaluated for in more than 45% of diabetic patients **[15]**.

A complex relationship is reported among anxiety states, dietary pattern and obesity. Diet consumed with higher free fatty acids contents can lead to anxiety. This is amplified by food craving behaviour to relive stress which may result in weight gain and can contribute to obesity. This complex shows a link between obesity parameters like BMI and Stress which often goes unnoticed in general practice and is a factor contributing in the poor clinical result among diabetics Therefore evaluating diabetics' psychological states appears to be a crucial first step in developing preventative and treatment plans **[16]**.

For stress assessment many tools have been employed amongst which the cohen perceived stress scale 10 and Spielberger State Trait Anxiety Inventory (STAI) are most widely used in diabetes related stress assessment. The Cohen Perceived Stress Scale–10 (PSS–10) is a self reporting questionnaire's which aims to access the extent of the stress perceived by persons in their life situations. The studies in diabetic patients using PSS are limited. Hence to figure out stress impact the analysis of stress though PSS could be done **[16]**.

The PSS is a commonly used tool that has been shown to be a valid psychometric measure of psychological stress over the preceding four weeks. Ten items total, each with a five-point Likert scale (0 = never, 1 = almost never). 2: sometimes; 3: quite frequently; and 4:

frequently. "General stressors" and "the ability to cope" are the first and second factors in the PSS construct, respectively. Since items 4, 5, 7, and 8 have positive statements, their scores are reverse coded, and the PSS score is calculated by adding up all of the item scores **[17]**.

The PSS score has a range of 0 to 40, where the highest perceived stress level is indicated by a score of 40. There is no diagnostic threshold in the PSS to distinguish between people who are stressed and those who are not. However in study by Garg etal. 2021 the categorization is based on value ranges. The range 0-13 is marked as low stress while 14-25 range is considerd as moderate stress range and finally the value above 27 denotes higher stress **[16-18]**.

With a different set of questions for assessing state anxiety and trait anxiety, the Spielberger State Trait Anxiety Inventory (STAI) is a reliable and validated self-report measure. The STAI makes a distinction between trait anxiety, which measures an individual's typical tendency to experience anxiety regardless of the circumstances, and state anxiety, which denotes the degree of anxiety experienced in a particular condition. Each subset consists of twenty questions, and the subject must answer each one, ranging from 1 (not at all) to 4 (very much so) for the state and 1 (almost never) to 4 (nearly always) **[19]**.

SLEEP AND IDRS

Sleep deprivation is linked with associated with factors like, such as mood swings, impaired memory, diabetes, obesity, and hypertension. There are many tools to access the sleep deprivations which could reflect disorders in sleep prominent amongst them include Pittsburg sleep quality index (PSQI), Morningness and Eveningness Questionnaire, Insomnia Severity Index and Fatigue Severity Scale by using these tools one can access sleep and its related impacts on patint or community so that the results could guide in proper diagnosis and management of disease **[19, 20]**.

The subjective sleep pattern and quality were measured using the Pittsburg Sleep Quality Index (PSQI) questionnaire. The seven domains of the self-rating questionnaire are: medicine use, sleep disruptions, daytime dysfunction, duration, quality, latency, and efficiency of sleep. Every domain has a value between 0 and 3, with the maximum score on the Likert scale indicating the negative extreme. A PSQI of five or higher is regarded as poor sleep quality. The PSQI produces a global score that is the total of the scores for seven domains **[19, 20]**.

A self-assessment tool called the Morningness and Eveningness Questionnaire was created to examine circadian sleep pattern. The questioner has 19 questions about things like weariness and sleeping

patterns. Ostberg devised a basic questionnaire pattern from which the scores are calculated. Of the 19 questions, 11 are of the choice variety and are rated from 1 to 4. There are two choice-based questions with response options of 0, 2, 4, and 6. There was one choice question with a possible score of 0, 2, 3, or 5 depending on the answer. The last five questions were rated from 1 to 5 and offered a choice of time scales. The interpretation is based on the 16–86 score range that was achieved. A score of 41 or lower denotes "eveningness," while a score of 59 or higher denotes morningness **[19, 20]**.

CLASSICAL SYMPTOMS AND IDRS

The population of India is more prone to developing diabetes mellitus. Adult illness prevalence was reported to be 2.4% in rural and 4%–11.6% in metropolitan settings. Some studies have reported high frequencies of impaired glucose tolerance ranging from 3.6% to 9.1%, which suggests that the prevalence of diabetes may climb even more in the next ten years. In Indian settings the majority of population is below poverty line and can't afford costly tests. Thus to access the strategy to use the three classical symptoms in collaboration of IDRS can help to access diabetes burden in an economical and rational manner. A study conducted by panwar etal 2017 showed that the classical symptoms of poly uria polydipsia and poly phagia were had a positive correlation with the IDRS scoring. Thus integrating the three classical symptom analogy and IDRS scoring along with clinical knowledge and experience of clinician better management of diabetes can be accomplished **[21]**.

CONCLUSION

The diabetes is a chronic disease and is a threat for developing India as it is a silent epidemic emerging due to altering lifestyle, dietary habits and related socioeconomically and genetic factor. The management of diabetes through the utilization of timely screening methods as well as proper pharmacological and non pharmacological measures is need of hour. For rational use of resources the integration of various tools like IDRS, dietary sales knowledge scales and primary symptoms along with tools measuring associated disturbances like stress and sleep can kelp to predict the clinical condition with precision. This could help in framing better patient management plan which could show positive outcomes. In addition to daibeties these scales and tools can be used to access other chronic diseases like respiratory cancer and others that affect quality of life of patient.

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