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EDITORIAL OPEN ACCESS

DIGITAL HEALTH SERVICES IN MANAGING PEOPLE LIVING WITH DIABETES

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In the recent world, more than 450 million people have diabetes. There are several types of diabetes and among them common are Type 1 DM in which the body cannot produce Insulin, Type 2 DM in which body cannot properly use insulin and Gestational Pregnancy related Diabetes. For diabetic patients, failure to treat or manage it can lead a serious complications like blindness, renal failure, heart attack and lower limb amputation. The burden of diabetes in patients are more acute in low middle income countries where nearly 80 % people lived with diabetes.

Digital health is a methodology that uses ICT to more efficiently personalize, and precisely address, the various problems people face with health[1]. In addition to healthcare, experts and stakeholders from various fields such as engineering, public health, and the economy are also involved in the digital health arena. In general, the provision of digital health services facilitates the collection of data related to an individual's condition, analyzes data to evaluate clinical or pre-clinical conditions, and provides the personalized intervention or monitoring for an area of interest[2]. These services not only include traditional interfaces such as e-mail, text messages, and web, but also new technology-based services such as smartphones, applications, and wearable devices[3]. Furthermore, the digital health field incorporates advanced and specialized services directly utilized by doctors and healthcare professionals.

Development of digital health implies that in dealing with diabetes there is a demand to establish a standard as guidance. Standard of digital health technology should fulfill aspects of functionality, contextually, effectiveness, and economic efficiency[4]. Level of evidence in functional aspects divided into three levels[4].

a. Level 1 is noticed when there is no direct user benefit such as electronic health records that can be connected to the wards and emergency room.
b. Level 2 is noticed when the information related to healthy living and illness prevention behaviors is provided. At this level, digital health service may provide information; do monitoring, and conduct two ways communication.
c. Level 3
   - 3A refers to the use of digital health service in preventing and managing diseases by self-management behavior with measurable patient's outcome.
   - 3B, which the most advanced medical device takes role in treating, activating, monitoring, calculating and diagnosing the patient.

The contextual and functional aspects have to be contemplated among the vulnerable populations who have limited digital literation. Adding to that, digital health service should provide factual information and clinical judgment to prevent misdiagnosis. This approach could support health

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care professional deliver their practical treatment5. In spite of the patient having low digital skill, the national government of the concerned countries should declared the legal and ethical consideration of digital health service which will be used. It also relates to economic consideration when the higher level functional digital health service the higher cost should be spent to cover the budget impact, cost utility, and cost consequences[6].

Validating digital health products requires a complex domain which is time-consuming during its development process. There are 4 domains to construct the rigor of digital health known as digital health scorecard[7].

a. 1st domain is technical to ensure the precision of the device of the digital product as valid as the gold standard of clinical examination. Technical validation was also constructed by security and interoperability aspects. The examples of technical validation of CGM in diabetes management that the device could check the blood glucose accurately, easily transfer to the health care provider, safely encrypted and provide data privacy for the patient[8].
b. 2nd domain is clinical aspect to make sure the digital health product feasible in real-world settings. In this stage, there will be critical appraisal of the simulation to determine a true clinical judgment9. An example of clinical validation in diabetes mobile apps using Mobile App Rating Scale (MARS) scoring to determine whether the application is good acceptable or poor acceptable[10].
c. 3rd domain is usability, to define when the feature of digital health met the needs of consumers (diabetes patients or health care providers). The best example of usability validation in CGM is calculation of high and low glucose scores, user's experiences, and patch attachment adherence[11].
d. 4th domain is about the cost or amount of price that consumers should pay to get access to a digital health service or product. In some diabetes apps, it is low cost and somehow it is free of charge. In the beginning, advanced technology such as CGM devices will be quite expensive. In future, this cost will be paid congruence with a better quality of care[12].

Fig 1. The main opportunities and obstacles implicated in the wider implementation of digitalization of diabetes health 13

Table 1: Representative digital health-related factors that can be used in diabetes and metabolic diseases

Classification	Example
Pre-clinical condition	
Assessment of daily activity	Activity tracker, heart rate, electrocardiogram, sleep quality
Evaluation of eating habits	Evaluation of meal time, frequency, total food intake, and calorie pursuing automation with the "food lens" function

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Weight reduction/diabetes prevention	Obesity management applications, online diabetes prevention program interventions
Digital health for people with diabetes mellitus	
Patient education	Evidence-based reference materials, Chatbot service
Advanced blood glucose measurement	Continuous glucose monitoring systems
Improvement of medication adherence	Oral medication with biosensor, insulin dose calculator, digital insulin pen
Evaluation and management of complications	Screening of retinopathy, and foot ulcer, detection and/or prediction of fall, hypertension management, home urinalysis
Direct involvement from healthcare professionals	Remote blood glucose monitoring, human coaching
Remote clinical trial	'ResearchKit', mSToPs study

Resource: Rhee SY, Kim C, Shin DW, Steinhubl SR. Present and Future of Digital Health in Diabetes and Metabolic Disease. Diabetes Metab J. 2020;44(6):819-827. doi:10.4093/dmj.2020.0088

Various successful activities already been running in many countries. The recent study shows a comprehensive diabetes healthcare center in south India has been efficiently exploiting the Diabetes Tele-Management System (DTMS®), a telemedicine-based intervention and follow-up program for diabetes management since 1998. The DTMS® team uses telephone/email/secure website to educate patients/caregivers on insulin injection technique, diet, exercise, use of a glucometer, hypoglycemia, and compliance to medications as well as to titrate insulin and oral drug dosages according to personalized glycemic targets. Telemedicine follow-up through DTMS® produced a significant reduction in HbA1c and hypoglycemia frequency in a cohort of 1000 patients with T2D. This approach ensures appropriate glycemic control, reduction in micro- and macrovascular complications, and multidrug compliance among the patients[14].

Digitally facilitated interactions between people living with Diabetes and healthcare professionals can allow enhanced access to care and prevent avoidable complications. This was demonstrated by the Be He@lthy Be Mobile (BHBM) initiative, run jointly by the WHO and the international Telecommunication Union (ITU), which works with governments and other partners to improve the prevention and control of NCD including diabetes with mobile technology. One BHBM program helped people living with diabetes in low- and middle-income countries to reduce diabetes-related complications through simple SMS interventions.

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Study of Biochemical Parameters in Diabetic Patients with and without Diabetic Retinopathy – A Hospital based study

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Abstract

Background: Diabetic Retinopathy (DR) is a common, potentially blinding and visually disabling complication of diabetes. Early detection of retinopathy and its progression to severity with routine referral for screening by Ophthalmologist can save vision by timely management. **Methods:** This was a hospital based cross-sectional study done to study the association of glycated hemoglobin (HbA1c), fasting and postprandial blood sugar, serum lipid profile, serum creatinine and urine albumin in diabetic patient with and without DR. A total of 50 patients with Diabetic retinopathy and 50 patients without diabetic retinopathy were enrolled in this study. All patients included were Type 2 DM aged 35 years and above. **Results:** The mean HbA1c was 8.62±1.5 and 5.54±1.2, total cholesterol was 228.9±63 and 184.9±39.8 mg/dl, serum triglyceride was 226.6±80.7 and 160.8±45.1 mg/dl, LDL-C was 152.3±49 and 127.2±37 mg/dl and serum creatinine was 1.15±0.45 and 0.66±0.27 mg/dl in diabetic retinopathy group and no diabetic retinopathy group respectively. There was significant association of elevated HbA1c, serum triglyceride, LDL- C and total cholesterol with diabetic retinopathy in patients with type 2 DM. The mean values of serum lipoproteins were higher in the diabetic retinopathy group. **Conclusion:** Elevated fasting and postprandial blood sugar, glycated hemoglobin, total cholesterol, serum triglyceride, LDL-C, serum creatinine and urine albumin were significantly associated with DR in our study. So, all patients with diabetes mellitus should be screened routinely for serum lipoproteins along with blood sugar profile, as it would help in early detection of diabetic retinopathy.

Keywords: Type 2 Diabetes mellitus, Diabetic Retinopathy, Serum Lipoproteins

Introduction:

Diabetic Retinopathy (DR) is a common, potentially blinding and visually disabling complication of diabetes where the cause of vision loss can be due to diabetic maculopathy or complications of proliferative diabetic retinopathy (PDR).[1] Diabetic patient are 25 times more likely than the general population to develop vision loss and blindness.[2] Diabetes has emerged as a major global concern. In 2040, the global diabetes prevalence in adults is predicted to rise to 10.4%.[3] In Nepal, the burden of diabetes is increasing rapidly due to increasing urbanization, aging population, rapid increase in obesity, and sedentary lifestyle. As per the recent meta-analysis, the prevalence of diabetes in Nepal was 8.5%.[4]

According to a hospital based study by Thapa et al[5] and Shrestha et al[6] in Nepal, the prevalence

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of diabetic retinopathy was 38% and 44.7% respectively. Long duration of diabetes, poor glycaemic control, high blood pressure, pregnancy and nephropathy are the known risk factors for diabetic DR.[7] Biochemical parameters being the reflection of the state of control of diabetes are valuable resources in identifying the progression of retinopathy. However, there are little conclusive evidence regarding the association of biochemical parameters especially serum lipid profile with retinopathy in this region. So, the objective of this study was to study the association of glycated hemoglobin (HbA1c), fasting and postprandial blood sugar, serum lipid profile, serum creatinine and urine albumin in diabetic patient with and without DR.

Methods:

This was a hospital based cross-sectional study conducted at B.P. Koirala Institute of Health Science, Dharan, Nepal. Written Informed consent was obtained from all the patients enrolled in the study. The research was approved by the ethics committee and institutional board of BPKIHS, Dharan, Nepal on 22nd July 2014(Ref. No.ACd/10/071/072), and has adhered to the tenets of the Declaration of Helsinki.

A Total of 100 patients were enrolled in this study. Convenient sampling method was used. All patients with Type 2 DM with and without DR aged 35 years and above were included in the study. Patients were categorized as either presence or absence of DR. The patients with DR were classified as per ETDRS classification of Diabetic Retinopathy.8 Patients with Type 1 DM, Gestational diabetes mellitus, central corneal opacity, cataract obscuring detailed fundus evaluation, vitreous hemorrhage were excluded from the study. Detailed history was taken and all participants underwent a comprehensive ophthalmic examination. HbA1c, fasting and postprandial blood sugar, lipid profile, and serum creatinine and urine albumin were evaluated. All the biochemical parameters except urinary albumin were measure by using the standard commercial assay kits in CobasC311 auto-analyzer, closed system in the biochemistry laboratory of BPKIHS, Dharan.

Statistical analysis:

All the data were entered in Microsoft Excel spreadsheet 2013 and converted into SPSS (Statistical Package for Social Science) version 17.0 program for statistical analysis. For inferential statistics, X2 test was used for categorical data, for comparison of mean t test was used and for association between two continuous variable correlations was used.

Results:

A total of 50 patients with diabetic retinopathy and 50 patients without diabetic retinopathy were enrolled in the study. Out of 50 patients with DR, 28 had mild NPDR, 19 had moderate NPDR, 1 had severe NPDR with CSME and 1 had PDR with CSME.

The mean age was 59.56±10.9 and 54.30±9.7 years in patients with and without DR respectively. There was equal number of male and female in both groups. The mean duration of DM in DR group was 8.20±4.6 years and in no DR group were 4.08±2.7 years. Most of the patients in the DR group were housewives/retired and most of the patients in no DR group were businessmen. Forty two point nine percent of the patients on OHA 42.9% had DR whereas 57.1% had no DR. DR patients on insulin were 87.5% (P=0.002). In those patients with DR, only 22% had positive family history of diabetes while 78% had no family history of diabetes. In DR group, 74% were aware and 26% were not aware of DR as a complication of DM. The mean systolic blood pressure in DR group was 134.40±18.6 mm Hg and in no DR group was 126.60±15.8 mmHg. The mean diastolic blood pressure in DR group was 81.20±9.39 mm Hg and in no DR group was 76.60±10 mm Hg. The mean BMI in the DR group was 25.91±2.8 and in no DR group were 25.05±2.5. Best corrected visual acuity of ≥6/18 was present in 84% of the patients with DR and 16% had visual acuity of <6/18. In the patients without DR, right eye was considered for evaluation and 100% had visual acuity of ≥6/18. The mean CCT in the patients with DR was 533.7±17.9 and in those without DR was 513.9±29.

The mean fasting blood sugar was 120±1 mg/dl and 119.86±63.6 mg/dl in DR group and no DR group respectively (P<0.001). The mean postprandial blood sugar in the patients was 272.5±91.8 mg/dl and 192.6±63.6 mg/dl in DR group and no DR group respectively (P<0.001).The mean glycated hemoglobin in the patients with DR was 8.62±1.5% and in those without DR was 5.54±1.2% (P<0.001). (Table 1)

Table 1: Blood sugar

Fasting Blood sugar (mg/dl)	Diabetic retinopathy (N)			Odds ratio	95% Confidence Interval		P-value
	Yes	No	Total		Lower	Upper	
≤126	7 (18.9%)	30 (81.1%)	37 (100%)	0.109	0.041	0.289	<0.001
>126	43(68.3%)	20 (31.7%)	63 (100%)				
Postprandial blood sugar (mg/dl)							
≤200	8 (19.5%)	33 (80.5%)	41 (100%)	0.098	0.038	0.255	<0.001
>200	42 (71.2%)	17 (28.8%)	59 (100%)				
HbA1c (%)							
<7	5(10.6)	42 (89.4%)	47 (100%)	0.021	0.006	0.070	<0.001
≥7	45(84.9)	8 (15.1%)	53 (100%)				

The mean level of total cholesterol in the patients with DR was 228.9±63 mg/dl and in those without DR was 184.9±39.8 mg/dl. The mean HDL-C in the patients with DR was 40.6±8.0 mg/dl and in those without DR was 40.12±9.5 mg/dl. The mean serum triglyceride in the patients with DR was 226.6±80.7 mg/dl and in those without DR was 160.8±45.1 mg/dl. The mean LDL-C in the patients with DR was 152.3±49.1 mg/dl and in those without DR was 127.2±37.3 mg/dl.

The mean serum creatinine in the patients with DR was 1.56±0.43 mg/dl and in those without DR was 0.78±0.22 mg/dl. In the patients with serum creatinine level >1.2mg/dl (male) and >1md/dl (female), DR was seen in 91.8% of the patients (P<0.001). In the patients with albuminuria, 78.2% (43) had DR (P<0.001). (Table 2)

Table 2: Lipid profile, serum creatinine and urine albumin

Total Cholesterol (mg/dl)	Diabetic retinopathy (N)			Odds ratio	95% Confidence Interval		P-value
	Yes	No	Total		Lower	Upper	
≤200	13 (24.1%)	41 (75.9%)	54 (100%)	0.077	0.030	0.201	<0.001
>200	37 (80.4%)	9 (19.6%)	46 (100%)				
HDL-C (mg/dl)							
<40	27 (48.2%)	29 (51.8%)	56 (100%)	0.850	0.386	1.874	0.687
>40	23 (52.3%)	21 (47.7%)	44 (100%)				
Serum Triglyceride (mg/dl)							
≤150	7 (25.9%)	20 (74.1%)	27 (100%)	0.244	0.092	0.650	0.003
>150	43 (58.9%)	30 (41.1%)	73 (100%)				
LDL-C (mg/dl)							
<160	24 (38.1%)	39 (61.9%)	63 (100%)	0.260	0.109	0.621	0.002
≥160	26 (70.3%)	11 (29.7%)	37 (100%)				

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Serum creatinine (mg/dl)	Diabetic retinopathy (N)			Odds ratio	95% Confidence Interval		P-value
	Yes	No	Total		Lower	Upper	
≤ 1.2 (male); ≤ 1 (Female)	5 (9.8%)	46 (90.2%)	51 (100%)	0.010	0.002	0.038	<0.001
>1.2 (male); >1 (Female)	45 (91.8%)	4 (8.2%)	49 (100%)				
Urine Albumin							
No albuminuria	7 (15.6%)	38 (84.4%)	45 (100%)	0.051	0.018	0.144	<0.001
Albuminuria	43 (78.2%)	12 (21.8%)	55 (100%)				

Correlation:
In this study, 51.1% with poor HbA1c control had mild NPDR. (Table 3)

Table 3: Relation of Glycated Hemoglobin with Stages of Diabetic retinopathy

Stage of diabetic retinopathy	Glycated hemoglobin %	
	Good control <7%	Poor control ≥7%
Mild NPDR	5 (100%)	23 (51.1%)
Moderate NPDR	0	19 (42.2%)
Severe NPDR with CSME	0	1 (4.4%)
PDR with CSME	0	2 (2.2%)
Total	5 (100%)	45 (100%)

Serum triglyceride and serum creatinine showed low degree of positive correlations with abnormal HbA1c ≥7%. (Table 4)

Table 4: Correlation between abnormal HbA1C and serum lipoproteins in patients with Diabetic Retinopathy

Blood Parameters	karl-Pearson correlation coefficient r	P-value
S. Triglyceride	0.055	0.707
T.Cholesterol	- 0.041	0.779
HDL-C	- 0.132	0.361
LDL-C	- 0.163	0.259
S. creatinine	0.166	0.25

Discussion:
In our study, there was significant association of fasting blood sugar with DR (P<0.001). Among the patients with DR, 68.3% had fasting blood sugar of >126 mg/dl. El Hadd et.al[9] showed that a high fasting capillary glucose level was significantly related to occurrence of retinopathy (P=0.002). The fasting capillary glucose level in patients with DR was 9.8mmol/l and with no DR was 8.5mmol/l. Samatha et al[10] found that there was significant increase in fasting blood sugar in patients with DR (P<0.001).

There was significant association of postprandial blood sugar with DR in our study (P<0.001). Among the patients with DR, 71.2% had postprandial blood sugar of >200mg/dl. El Bab et al[11] showed that the patients with DR had significantly higher postprandial glucose.

Significant association of glycated hemoglobin with DR was shown in our study (P<0.001). Among the patients with DR, 84.9% had poor control (≥7%) of HbA1c. In a study by Shakya et al[12] the mean glycated hemoglobin was significantly higher in the DR group (7.7±1.5%) compared to no diabetic retinopathy group (6.9±1.1%) (P=0.004). Various other studies also showed significant association of poor glycemic control with DR.[13,14,15,16]

In our study, there was significant association of elevated total cholesterol with DR (P<0.001). Among the patients with DR, 80.4% had total cholesterol >200mg/dl. Samatha et al[10] showed

significance association of elevated total cholesterol with DR. The mean total cholesterol in patients with DR was 187.53±57 mg/dl and in those without DR was 167.79±29 mg/dl.

However, there was no significant association of HDL-C with DR in our study (P=0.687). However, El Bab et al11 found that there was significant change of HDL-C from 2.66±0.3mmol/L and 2.55±0.21mmol/L for no DR and DR patients, respectively (P<0.05).

Our study showed significant association of serum triglyceride with DR (P=0.003). Among the patients with DR, 58.9% had serum triglyceride > 150 mg/dl. Shakya et al[12] showed that the serum triglyceride value was higher in the group with DR but was statistically not significant (P=0.56). Serum triglyceride had low degree of positive correlation with HbA1c value. Similarly, Dayanand et al[17] and Mohan R et al[18] showed that hypertriglyceridemia was significantly associated with DR (P<0.05).

Our study also showed significant association of LDL-C with DR (p=0.002). Among the patients with DR, 70.3% had LDL-C ≥ 160 mg/dl. Samatha et al[10] however did not showed significant association of LDL-C with DR.

In our study, there was significant association of elevated serum creatinine with DR (P<0.001). Studies done by Cai et al[15] and EL Haddad et al[9] also showed significant association of elevated serum creatinine with DR.

There was significant association of urine albumin with DR in our study (P<0.001). Among the patients with DR, 78.2% had albuminuria. Cai et al[15] showed significant difference in urine albumin in patients with and without DR (P<0.001). Raman et al19, Klein et al[20] and Shammari et al[21] showed that microalbuminuria was significantly associated with DR.

In our study, serum triglyceride level and total cholesterol had a low degree of positive correlation with HbA1c level. Similar to our study, Shakya et al[12] showed a low degree of positive correlation of serum triglyceride with HbA1c.

Limitation and Recommendation:

The limitations of our study were convenient sampling method and small sample size. A study with large sample size would be more conclusive.
As our study showed positive association of higher serum lipoprotein with diabetic retinopathy, it is recommended that all patients with diabetes mellitus should be screened routinely for serum lipoproteins along with blood sugar profile, as it would help in early detection of diabetic retinopathy and thereby help in prevention of ocular complications.

Conclusion:

In our study, elevated fasting and postprandial blood sugar, glycated hemoglobin, total cholesterol, serum triglyceride, LDL-C, serum creatinine and urine albumin were significantly associated with DR.

List of abbreviations:

DM Diabetes Mellitus, DR Diabetic Retinopathy, LDL-C Low density lipoprotein cholesterol, HDL-C High density lipoprotein cholesterol, HbA1c Glycated hemoglobin
ETDRS Early Treatment Diabetic Retinopathy Study, PDR Proliferative diabetic retinopathy, NPDR Non-proliferative diabetic retinopathy, CSME Clinically significant macular edema, CCT Central corneal thickness.

Disclosure:

The authors declare no conflict of interest.

Authors' contributions:

IJ conceptualized, collected data, analyzed and wrote the manuscript. PL, BPB, RM, ML supervised and guided throughout from the beginning of the study and critically reviewed the manuscript. All authors read and approved the final manuscript.

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Correlation between Cytology and Histology of Solitary Thyroid Nodule: Our Institutional Experience

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Abstract

Introduction: Thyroid swelling is one of the most common disease presenting to otorhinolaryngology out patient. Fine needle aspiration cytology is key point in planning the surgical management. The discrepancy between cytology and histology reported in wide range depending upon centres. We planned to conduct this study with aim of knowing the sensitivity of cytology which can guide the need of surgical or observational treatment. **Methods:** Our study isprospective enrolling the patients with thyroid swelling who underwent surgical treatment between 1st October 2020 to 11th November 2021. Clinical, cytological and histological parameters were recorded. Accounting histology as gold standard, sensitivity, specificity and accuracy of fine needle cytology were calculated. The correlation was evaluated by chi square test. The p value of ≤0.05 was considered significant. **Results:** The most common age group reporting was 20-40 years accounting for 68.6% of cases with the female predominance (92.2%).The accuracy of fine needle cytology in detecting non neoplastic, neoplastic benign and neoplastic malignant lesion were 96.0%, 96.0% and 100.0 % respectively. **Conclusions:** Fine needle cytology is good tool for deciding surgical management for thyroid nodule and recommended for all cases.

Keywords: Thyroid, Cytology, Histology, Neoplasm, Benign, Thyroidectomy.

Introduction:

Thyroid swelling is one of the most common disease presenting to otorhinolaryngology out patient. The prevalence of thyroid nodule is approx. 4-10 % in general adult population[1,2]. Clinical history and examination, thyroid function test, ultrasonography of neck and fine needle aspiration cytology are commonly performed for evaluation of thyroid nodule[3,4]. Non neoplastic swelling is more common than neoplastic[5,6]. Nepal comes under endemic region for goitre due to iodine deficiency and so need to differentiate between malignant and non-malignant lesions. As per ATA guidelines, small neoplastic nodule can be kept on observation without surgical treatment and so avoidance of its potential complications[7].

FNAC is key point for surgical management. Since thyroid is highly vascular, small bore needle aspiration is preferred. Unstained smear is visualized for tissue fragments and colloid initially followed by stained examination. Papa¬nicolaou and H&E stains help in characterization of nuclear features whereas Romanowsky stains better define cytoplasmic charac¬teristics[8]. The discrepancy between cytology and histology reported in wide range depending upon centres. We planned to conduct this study with aim of knowing the sensitivity of cytology which can guide the need of surgical or observational treatment.

Methods:

Our study is prospective and conducted after

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obtaining institute ethical approval (IRC-NMCTH: 373/2020). We have enrolled the patients with thyroid swelling who underwent surgical treatment in our centreand had given consent for the study between1st October2020 to 11thNovember 2021. All patients were evaluated by history, clinical examination, thyroid function test, ultrasonography of neck and fine needle aspiration cytology. Clinical, cytological and histological parameters were recorded. Cytology and histological examination were performed from same pathology lab and by same consultant pathologist. Since all our patients have visible neck lump, conventional method of needle aspiration was performed except in 2 patients in which additional ultrasonic guided aspiration required in view of indeterminate cytology in first attempt. Final report of cytology was made after H&E staining. Accounting histology as gold standard, sensitivity, specificityand accuracy of fine needle cytology were calculated. The correlation was evaluated by chi square test. The statistical analysis was performed using SPSS version 16.0. The p value of ≤0.05 was considered significant.

Results:

The most common age group reporting was20-40 years accounting for 68.6% of cases with the majority being female (92.2%). Elderly age group above 60 years was confined to 5.9%. The majority of patients(51.0%) with the visible neck lump had consulted in the duration of 1 to 3 months.(Table 1)

Table 1: Clinical parameters

Parameters		Number (n)	Percentage (%)
Age group (in years)	20-30	17	33.3
	>30-40	18	35.6
	>40 -50	8	15.7
	>50 - 60	5	9.8
	>60	3	5.9
Sex	Male	4	7.8
	Female	47	92.2
Duration of neck swelling presentation (in months)	< 1	13	25.5
	1-3	26	51.0
	>3	12	23.5

One from each of non-neoplastic and benign lesion group, it turned out to be malignant. So,overall discrepancy was noted in 8% cases. Overall cytological and histological correlation was found to be significant by chi square test (p <0.001). (Table 2)

Table 2 :Cytological and histological parameters correlation

Parameters	Cytological	Histological	
Non neoplastic	25	24	Chi – square test P <0.001
Neoplastic – benign	25	24	
Neoplastic – malignant	1	3	

Accounting histopathology as gold standard, the accuracy of fine needle cytology in detecting non neoplastic, neoplastic benign and neoplastic malignant lesion were 96.0%, 96.0% and 100.0 % respectively. (Table 3)

Table 3: Sensitivity,specificity and Accuracy of Fine needle aspiration

Parameters	For non-neoplastic lesion	For neoplastic benign lesion	For neoplastic malignant lesion
Sensitivity	96.0%	96.0%	100.0%
Specificity	96.0%	96.0%	100.0%
Accuracy	96.0%	96.0%	100.0%

Discussion:

Cytological evaluation is the most commonly pursued for evaluation of thyroid nodule because it has many advantages being easy, safe, inexpensive and rapid procedure[9,10].Although uniform reporting system called as Bethesda system was incorporated, there is high chance of observer variation in reporting especially in the indeterminant cases[11].There is also some limitation of it because of possibility of false positive and negative result[12,13]. The main aim of fine needle cytology is to differentiate neoplastic versus non neoplastic nodule because the former

category requires surgical treatment while later category can be kept for observation[7].

Palpatory method is most commonly performed technique for FNAC. Since all patients had presented with visible neck swelling, the same technique was applied in our cases also. The most common age group noticed is 20-40 years of female (68.6%). Similar prevalence was seen in previously published literature from Nepal[14-16].

Neck lump is the most common manifestation of thyroid nodule due to which patients visit the concerned specialist with the fear of cancer. The time duration between onset of neck lump and visiting the doctor varies. In our cases, 51.0% reported between 1 to 3 months duration interval. The delay was because of ongoing COVID 19 pandemic and patient not having any other symptom apart from it.

Forty nine percentage of the cases reported by fine needle cytology as non-neoplastic underwent surgical management in view of cosmesis, fear of cancer and unsuitable for regular follow up. Rest 51% were neoplastic lesion and thus underwent surgical management. Accounting histopathology as gold standard, one from each of non-neoplastic and benign lesion group, turned out to be malignant. Thus, in our cases, accuracy of fine needle cytology in detecting non neoplastic , neoplastic benign and neoplastic malignant lesion were 96.0%, 96.0% and 100.0 % respectively which is comparable to the previous studies from Nepal and abroad 14-20. (Table 4)

Table 4 : Present study comparisons to published literatures

Literatures	Sensitivity	Specificity	Accuracy
Our study	96.0 %	96.0 %	96.0 %
Hirachand et al, 2013	96.4 %	94.4 %	95.7%
Bhatt et el , 2012	85.7 %	92.3%	90.0 %
Bista et al, 2011	70.0 %	97.5%	92.1%
Bagga et al, 2010	66.0 %	100%	96.2%
Sengupta et al, 2011	90.0 %	100%	98.8%
Sharma et al, 2017	84.0 %	100%	90.0%
Babu et al, 2016	90.0 %	100%	94.0%

Our institute is the referral tertiary care hospital in eastern Nepal and fulfils the criteria of high volume centre for thyroid surgery[21]. Since FNAC has limitation of inter- observer discrepancy, high volume centre is one of the measure to overcome this to some extent. We conducted this study with aim of knowing the sensitivity of cytology so that it can guide the need of surgical or observational treatment and thus avoidance of morbidities related to surgery. More number of samples with multicentric study will aid to our day to day practice in thyroid surgery.

Conclusions:

Fine needle cytology is good tool for deciding surgical management for thyroid nodule and recommended for all cases, although discrepancy exists to some extent. So, regular follow up is needed. Otherwise, surgical excision biopsy is alternative option to overcome it in clinically or radiologically suspected cases.

List of abbreviations

FNAC: Fine Needle Aspiration Cytology
HPE: Histo- Pathology Examination
ATA: American Thyroid Association

Ethics approval and consent to participate

Our study was conducted after obtaining institute ethical approval (IRC-NMCTH: 373/2020), Nobel Medical College and Teaching Hospital. Participants were explained about the research detail, its significance, the benefit and harm in Nepali language before obtaining the consent. A statement indicating that the participants has understood all the information and is willing to participate voluntarily was obtained. The confidentiality of participants were assured and not mentioned anywhere.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

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RT- Conceptualized, collected data, analyzed and wrote the manuscript. SKT-Involved in the study from the beginning and critically reviewed the manuscript.

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Prevalent Misconceptions and Determinants of Knowledge in Patients with Diabetes Mellitus in a Medical College

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Abstract

Background: Diabetes prevalence is high in South Asian countries. In Nepal, numbers are increasing every year. Many patients are aware that they have diabetes only when they develop one of its complications. This study was done to assess the knowledge and awareness of diabetes mellitus and the prevailing myths in outpatients of a tertiary care hospital. **Method:** It is a cross-sectional study conducted on diabetic patients attending the Department of Endocrine and Internal medicine, Nobel Medical College, over two months using questionnaires. **Results:** Among 200 diabetics, 67% believed that insulin is the medication of the last stage, 76% said insulin once started cannot be stopped.37% said medicine once started cannot be stopped. There was a misconception regarding the use of COVID-19 vaccines. 27% of the respondent opinioned that COVID-19 vaccines cause harm to diabetic patients. **Conclusion:** The survey showed many myths and misconceptions are prevailing in society regarding diabetes which needs to be addressed for better patient outcomes. The age of the participants, duration of illness, and their education status did not correlate with the total score for prevailing myths in the Nepalese population.

Keywords: Diabetes Mellitus, Diabetes Complications, Diet, Insulin, Knowledge, Prevention and Control

Introduction

Diabetes is a key challenging public health dilemma in the 21st century. It is the time to be aware and make aware to all people of the world. It is to be done for future human health development, early detection, and prevention of the bodily disorder concerned disease. This article has set the aim to assess the awareness and knowledge of diabetics in a tertiary care center in Nepal during the period of two months (2021 August to 2021 October). In Nepal, numbers are increasing every year. Many patients are aware that they have diabetes only when they develop one of its complications. This study was undertaken to assess the knowledge level in patients with diabetes. DM (Diabetes Mellitus) is one of the most prevalent metabolic diseases which can lead to enormous medical as well as socio-economic consequences[1]. It is currently the fastest-growing debilitating disease in the world. It is estimated that one out of five people aged 20 to 79 live with this disease, while a similar percentage of the population is at risk of developing it[2]. A major problem with diabetes is that if it is poorly controlled it leads to an increase in microvascular and macrovascular complications such as coronary artery disease, stroke, blindness, kidney failure, foot amputation, the poor blood supply to the limbs leading to increased morbidity. Patient education becomes a central component in the prevention and control of the disease.

Prevention is important because the burden of diabetes and its complications on health care and its

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economic implications are enormous, especially for a South Asian country. As DM is a chronic illness, optimal management requires motivated patients with proper awareness about the disease. DM is associated with significant rates of morbidity and mortality resulting from micro and macrovascular complications. It is one of the most prevailing disorders worldwide, the prevalence for which was estimated globally in 2013, 382 million people live with diabetes and this is expected to rise to 592 million by 2035[3]. The self-care practices of individuals are influenced by their knowledge about diabetes, the more they know about their illness, the more they would have self-management skills. Studies have consistently shown that improved glycemic control and strict metabolic control can delay or prevent the progression of complications associated with diabetes. Thus, it is indispensable to ensure that patients' knowledge, attitudes, and practices are adequate.

Methods:

This study has been approached by a prospective and observational study selecting randomly with 200 diabetics (out-patients). But the inpatients, pediatric patients, pregnant/lactating females have been excluded from the study. Participants were informed that participation was completely voluntary, written consent was obtained from each participant before research, no name was recorded on the questionnaires and all of the personal information of participants was kept confidential. This study was conducted after obtaining the ethical approval from the Institutional Review Committee of Nobel Medical College Teaching Hospital (Ref. No. IRC-NMCTH 556/2021). The participants were explained about the research, the involved benefit and harm in the languages they understood. Voluntary informed consent was taken from the participant for the study.

The required sample size was 120. Accounting for 20% partial or non-responders, the minimum sample size needed was 144. The total number of participants in our study was 200.

A total of 200 outpatients with diabetes mellitus were interviewed. The data collection form contains information about socio-demographic characteristics, questionnaires about patient awareness on illness, risk factors, symptoms, complications, myths, self-care practices, lifestyle modifications, and management. The myths selected were based on those encountered by the investigators during their clinical practices. Other experts in the field of endocrinology and internal medicine were also consulted in drafting the questionnaire for the knowledge and myth section. To prevent guessing by the participants, the option of don't know was also provided in the questionnaire. A correct score was rewarded 2 points, a wrong answer did not receive any point. The questionnaires were interpreted into local languages, to those who could not understand or read English and the relevant medical terms were explained, wherever required. The questionnaires comprised of:

- Eating sweets and sugary foods cause diabetes.
- People with diabetes always have symptoms attributed to it.
- Having a parent/sibling increases the risk of having diabetes.
- Insulin once started cannot be stopped.
- Insulin is the medicine of the last stage.
- Walking barefoot in the dew-covered lawn early in the morning improves glucose control.
- Alternative medicines (Ayurvedic/yoga) are better than modern medicine in controlling diabetes.
- Ayurvedic medicines do not have any side effects.
- Patients on medication need not be mindful of diet restriction/exercise.
- Eating bitter reduces sugar.
- Stored old rice/half-boiled rice does not increase blood sugar and can be consumed in sufficient quantity.
- Diabetics should not eat root vegetables.
- Removing maad (broth) from rice while cooking helps reduce blood sugar.
- COVID-19 vaccine causes harm to the diabetic patient.
- Protein doesn't raise blood sugar, can be taken in large quantities.

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The entered data were analyzed using IBM SPSS version 20. The Pearson's chi-square test and t-test were used to compare the data. The correlations between total score and baseline participants' characteristics were examined using Spearman's rank correlation. A p-value <0.05 was considered significant with a 95% confidence interval.

Results

The mean age of the participants was 49.7 years. 44% (88) of the participants were male. Most of the participants had BMI more than the recommended level for the Asian population- 42% of the participants were obese and 22% of the participants were overweight. Oral hypoglycemic agents (OHA) were most commonly prescribed, followed by both insulin and OHA. Only 12% of the respondents had used Ayurvedic medicine for diabetes. Hypertension and dyslipidemia were the most common concomitant illness in patients with diabetes. The other baseline characteristics are presented in Table 1

Table 1: Baseline characteristics of the participants

Variable	Frequency N (%)
Age	
Mean	49.7 years
Standard Deviation	11.4 years
Gender	
Male	88 (44%)
Female	112 (56%)
Body Mass Index	
Mean	24.7
Range	14-43.5mg/km2
Duration of Illness	
Mean	7.6 years
Range	0-26 years
Pharmacotherapy	
Oral hypoglycemic agents	144 (72%)
Insulin only	16 (8%)
Both	40 (20%)
History of Use of Ayurvedic Medicine	24 (12%)
Additional Risk Factors	
Smoking	20 (10%)
Alcohol intake	34 (17%)
Concomitant illness	
Hypertension	62 (31%)
Dyslipidemia	48 (24%)
Coronary Artery Disease	14 (7%)
Hypothyroidism	32 (16%)

A perfect score in the diabetes myths test section was 30. The mean score of the respondents was 11.8 with a standard deviation of 3.0. The response of the participants is shown below in table 2. In our study, 67% responded that insulin is the medication of the last stage, 76% said insulin once started cannot be stopped. 37% said medicine once started cannot be stopped. There was a misconception regarding the use of COVID-19 vaccines. 27% of the respondents considered that the COVID-19 vaccine causes harm to diabetic patients.

Our findings show that awareness and knowledge about diabetes were less among diabetic patients. 65% of the respondents said diabetics should not eat root vegetables. 74% of the respondents believed eating bitter reduces sugar. 67% of the respondents replied that ayurvedic medications do not have any side effects. (Table 2)

Table 2: Questionnaire about myths and misconceptions of diabetes mellitus

SN	Questions	Yes %	No %	Not sure %
1	Eating sweets and sugary foods cause diabetes.	60	30	10
2	People with diabetes always have symptoms attributed to it.	55	20	25
3	Having a parent/sibling increases the risk of having diabetes.	71	12	17
4	Insulin once started cannot be stopped.	76	9	15
5	Insulin is the medicine of the last stage.	67	12	21
6	Walking barefoot in the dew-covered lawn early in the morning improves glucose control.	55	23	22
7	Alternative medicines (Ayurvedic/yoga) are better than modern medicine in controlling diabetes.	47	36	17
8	Ayurvedic medicines do not have any side effects.	67	21	12
9	Patients on medication need not be mindful of diet restriction/exercise.	24	47	29
10	Eating bitter reduces sugar.	74	17	9
11	Stored old rice/half-boiled rice does not increase blood sugar and can be consumed in sufficient quantity.	67	18	15
12	Diabetics should not eat root vegetables.	65	17	18
13	Removing maad (broth) from rice while cooking helps reduce blood sugar.	54	20	26
14	COVID-19 vaccine causes harm to the diabetic patient	27	58	15
15	Protein doesn't raise blood sugar, can be taken in large quantity	29	43	28

The result showed that age of the participants (rs=0.10, p=0.52), education level (rs=0.03, p=0.82), and duration of illness (rs=0.15, p=0.32) had a positive association with total score. Similarly, the basal metabolic rate (rs=-0.10, p=0.45) had a negative association. However, none of the results were of statistical significance for the corresponding p-value.

Discussion:

The mean age of our study population was 49.7 years, as age is one of the risk factors for the development of diabetes[5]. Similar findings are seen in previous studies where there is a high prevalence of diabetes among the elders[6,7]. Many patients are illiterate in our study group, as the educational level is positively associated with knowledge of the disease[8]. If the duration of diabetes is more, then awareness of DM would also be more due to positive association[9]. The majority of the diabetics in our study are not aware of the normal blood values and their significance and they do not know the type of diabetes they are suffering from, it might be because many of them were illiterate. So, proper education campaigns should be performed in simpler languages in which they can understand. More than half of the patients answered obesity as a risk factor for diabetes and it was also mentioned

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in other studies[10,11]. Many patients were taking two to three large meals compared to frequent small meals. A study done by Kahleova et al[12] suggests that eating two large meals a day is more beneficial than six smaller meals in type 2 diabetes. Further studies are needed before recommending the meal frequency, especially in the Nepalese population.

Around 10% of patients answered of taking a double dose if they forget the previous dose, and this idea of them should be discouraged to prevent the hypoglycemic condition. In the present study, many patients felt that diabetes is caused by high sugar intake but only a few patients were aware of the lack of insulin or failure of the body to use insulin could lead to diabetes. This finding agrees with that of a study conducted by Foma et al[13]. Only about 1/3rd of them knew that diabetes could be familial. It implies that most patients are unaware that diabetes runs in family. These patients should be provided with appropriate education regarding the causes of diabetes. Knowledge of complications such as loss of vision and poor wound healing was more compared to heart failure and kidney failure. This finding is similar to the study done by Foma et al[13].

In a study done by Alsous M et al[14], 16% of the participants reported that the use of complementary and alternative medicine (CAM) for better glycemic control, which is much lower than in our study. However, there are inter-country as well as intra-country variations that limit a direct comparison.

As a result of associated complications, diabetes intensifies the economic burdens both on health departments and patients themselves in developing countries like Nepal. According to Alanazi et al[15], 48.7% of the respondents thought that lack of exercise and obesity were the major risk factors of DM, 33.2% thought that it was a genetic disease when only 3.7% thought that it was through hypertension.

A sedentary lifestyle and bad eating habits have been blamed for the increasing prevalence of diabetes in developing countries like Nepal. The self-care practices of individuals are influenced by their knowledge about diabetes; the more they know about their illness, the more they would have self-management skills.

Many research works published have shown that the diabetic population doesn't have enough awareness of diabetes, the proper use of medications, lifestyle modifications, dietary plans, myths associated with insulin, and other educational programs on the health issue. As such DM is a key health problem globally. As it is a common metabolic disorder or problem with high prevalence so are myths and misconceptions. Thus, the myths and misconceptions can lead to poor glycemic control among diabetic people and may result in complications and then increase the incidence of morbidity and mortality. The study has shown low awareness of the population about various aspects of diabetes and motivating their diabetic family members to get their blood sugar test, blood pressure, urine test, and eye examination done as recommended by international guidelines. So, the authorities must take up mass education programs which would go a long way in the prevention and management of diabetes, especially in underdeveloped countries.

Awareness and knowledge about diabetes among diabetic patients were less in our study populations. All doctors, nurses, dietitians should help diabetic patients by providing the right information in a simpler language that they could understand and make them healthy. This can be done by issuing pamphlets of information about DM to diabetic patients with pictures showing the complication of diabetes and hypoglycemia, through public speaking sessions to address the general public.

The study highlighted the need of people in Nepal for better health information through large-scale awareness interventions regarding diabetes. In addition, diabetic patients' adherence to their anti-diabetic therapy can be achieved through patient counseling by a clinical pharmacist or health professional to improve diabetes care and can go

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a long way in the prevention and management of diabetes in Nepal. There is a big space for raising educational awareness about diabetes through formal, well-organized approaches by healthcare professionals in hospitals, clinics, and community-based healthcare centers. It is highly recommended that healthcare professionals both collaboratively and individually develop programs and projects.

There are some limitations to this study. The investigators noted that some of the responses to the questions on the diabetes myth section were due to guessing despite the availability of the 'do not know' option. The participants enrolled were from the outpatient department so their responses might not reflect the sicker admitted patients with diabetes mellitus. Furthermore, not all questions regarding the myths of diabetes were included in the study.

Conclusion:

The patients with diabetes exhibited poor knowledge and awareness regarding the disease and had significant myths and misconceptions about their illness. The level of knowledge regarding diabetes mellitus did not correlate with the age of the participant, duration of illness, education level, or body mass index.

List of abbreviations

COVID-19: Coronavirus Disease 2019, DM: Diabetes Mellitus, BMI: Body Mass Index, OHA: Oral Hypoglycemic Agent, CAM: Complementary and Alternative Medicine

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

SS conceptualized, collected data, analyzed and wrote the manuscript. PR and FA were involved in data collection and analysis of the data. All authors read and approved the final manuscript.

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Depression in Diabetes: A cross sectional survey among patients attending Diabetes Clinic in Kathmandu

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Abstract

Background: Depression, being a leading cause of disability, is a common illness affecting an estimated 350 million people affected worldwide and is a major contributor to the global burden of disease[3]. Depression is a significant comorbid condition prevalent in people with diabetes and adversely affects health outcomes. **Methods:** A cross sectional study was conducted on 434 patients in Metro Polyclinic situated in Kathmandu district of Nepal. Metro polyclinic was purposively selected as the sampling frame for this study as this polyclinic receives significant number of diabetes patients coming in from various regions of Nepal. **Results:** Among type -1 diabetes 55% had depression whereas 45% were normal. Among Type -2 diabetes 31% of them had depression whereas 69% had no depression. Among a total of 434 study sample, 425 were suffering from Type-2 diabetes while only nine of them were suffering from Type-1 diabetes. Of those who were suffering from Type-2 diabetes, 13 had severe depression, 27 had moderate depression, 85 had mild depression and 300 had normal range of depression. **Conclusion:** This study sheds the importance of looking for depression in Nepali diabetes patients. It has been shown that without identifying co-morbid depression and treating it, most of the patient will have poor prognosis.

Keywords: Depression, Diabetes, Disability

Background:

Diabetes is a chronic disease, that leads to an increased concentration of glucose in the blood (hyperglycemia)[1]. According to International Diabetes Federation in 2017, approximately 425 million adults (20-79 years) in the world were living with diabetes2. Depression, being a leading cause of disability, is a common illness affecting an estimated 350 million people affected worldwide and is a major contributor to the global burden of disease[3]. Depression is a significant comorbid condition prevalent in people with diabetes and adversely affects health outcomes. The combination of diabetes and depression is associated with decrease in functional abilities and self-care. The relationship between depression and diabetes appears to be bi-directional, i.e. those with diabetes are at increased risk for developing depression; and conversely, those with depression are at increased risk for developing diabetes[4]. A study showed that depression is associated with a 60% increased risk of type 2 diabetes[5]. Another meta-analysis showed depressed adults having 37% increased risk of developing type 2 diabetes mellitus[6]. Compared with non-diabetes patients controls, people with type 2 diabetes have a 24% increased risk of developing depression[7]. People with diabetes

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exhibit relatively high rates of diabetes specific distress, affective and anxiety disorders. For the people diagnosed with diabetes, the addition of depression serves to increase symptom burden, diabetes-related complications, unemployment, work-related disability, and healthcare costs[8]. Moreover, depression among individuals with diabetes has also been associated with potential socio-demographic, lifestyle, and clinical factors. The contributions of socioeconomic status, marital status, obesity, smoking habits, and physical limitations and inactivity have been extensively tested[9].

The Objective of this study was assess the prevalence of depression among patients with diabetes in outpatient clinic at Metro Polyclinic in Kathmandu:

Methods:

A cross sectional study was conducted on 434 patients in Metro Polyclinic situated in Kathmandu district of Nepal. Metro polyclinic was purposively selected as the sampling frame for this study as this polyclinic receives significant number of diabetes patients coming in from various regions of Nepal. This study used previously collected data from individual diabetes patients who came to Metro Polyclinic to receive treatment or counselling to manage their medical condition.

This study was conducted after the ethical approval from Nepal Health Research Council. Participants were explained about the research detail, its significance, the benefit and harm in Nepali language before obtaining the consent, their queries were answered.

Data were collected from diabetes patients within a certain point in time (approximately three months) by data collectors only after obtaining written and verbal consent from each patient. A structured questionnaire was prepared and pretested for collecting information regarding socio-demographic characteristics of the patients. Patient Health Questionnaire (PHQ)-9 scale was used to assess the prevalence of depression. All questions included in PHQ-9 scale were converted to Nepali language to maintain the external validity of the questionnaire. PHQ-9 scale has been used by many scholars to measure depression specifically in outpatient care[10] PHQ-9 scale has a sensitivity of 88% and a specificity of 88% for major depressive disorders and it has a high internal consistency[11]

Results:

This cross-sectional study showed that the prevalence of depression was 30% among diabetes patients coming in to receive treatment or counselling from Metro polyclinic.

Table 1.1 Socio-demographic characteristics of the patients

S.N	Domain	Sub- Domain	Frequency	Percentile
1	Religion	Hindu	400	92.2
		Buddhist	25	5.8
		Muslim	1	.2
		Christian	3	.7
		Others	5	1
2	Ethnicity	Dalit	6	1.4
		Janajaati	122	28.1
		Madhisi	31	7.1
		Muslim	1	.2
		Brahmin/Chhetri	272	62.7
		Others	2	.5
3	Marital Status	Unmarried	10	2.3
		Married	401	92.4
		Separated	6	1.4
		Widow	17	3.9
4	Diabetes Type	type- 1	9	2.1
		type- 2	425	97.9
5	Occupation	Housewife	126	29.0
		Unemployed	6	1.4
		Government service	68	15.7
		Non-government	33	7.6
		Agriculture	31	7.1
		Business	104	24.0
		Labor	8	1.8
		Studying	4	0.9
		Others	54	12.4
6	Gender	Female	182	41.9
		Male	252	58.1

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Table 1.2 Range of depression amongst patients

Range of Depression	Frequency	Percentage (%)
Normal	304	70.0
Mild level	89	20.5
Moderate level	28	6.5
Severe level	13	3.0
Total	434	100

Table 1.3 Range of depression among diabetes patient according to type of diabetes

Type of Diabetes	Range of Depression				Total number of patient
	Normal	Mild	Moderate	Severe	
Type-1	4	4	1	0	9
Type-2	300	85	27	13	425
Total	304	89	28	13	434

Among type -1 diabetes 55% had depression where as 45% were normal. Among Type -2 diabetes 31% of them had depression where as 69% had no depression.

Among a total of 434 study sample, 425 were suffering from Type-2 diabetes while only nine of them were suffering from Type-1 diabetes. Of those who were suffering from Type-2 diabetes, 13 had severe depression, 27 had moderate depression, 85 had mild depression and 300 had normal range of depression. In contrary, of those suffering from Type-1 diabetes, none of them had severe depression, only one of them had moderate depression, four of them had mild depression and four of them had normal depression.

Discussion:

In this study, the prevalence of depression among diabetes patients was 30%. In other studies conducted in similar setting in other countries, prevalence of depression was found to be similar. For instance, in a study conducted in Vietnam, prevalence of depression among diabetes patient was 23.2%[12] In addition in another study conducted in Saudi Arabia which used PHQ-9 scale, the prevalence of depression was 37 percent[13] Of those, 23% had mild, 9% had moderate and 5% had severe depression which is similar to this study. In this study, 19.6% had mild, 6.2% had moderate and 3% had severe depression.

There is significant gap on research concerning depression among diabetes patients in Nepal. The study aims to add on to the evidence and initiate further research on this topic. However, there are several limitations of this study. First, this study purposively selected Metro Polyclinic as its sampling frame which might affect the generalisability of this study. Second, a cross-sectional method was used in this study which only considers a certain segment of population at certain point in time. Either cohort or experimental studies which assess diabetes patients for a longer a period of time has better external validity than cross-sectional study to study the prevalence of depression among diabetes patients. Third, this study undermined the association of depression according to socio-demographic characteristics of patients. Certain confounding variables mainly related with socio-demographic characteristics might skew the findings of the study.

Conclusion:

This study sheds the importance of looking for depression in Nepali diabetes patients. It has been shown that without identifying co-morbid depression and treating it, most of the patient will have poor prognosis. This cross sectional study highlights the important correlation between diabetes and depression in Nepali population. Further controlled prospective studies are needed for future direction.

Abbreviations:

Diabetes Mellitus: DMT2DM: Type 2 Diabetes Mellitus OPD: Outpatient department, PHQ: Patient Health Questionnaire

Competing Interests

The authors declare no competing interests.

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Author's Contribution
JB, AK, PS were involved in concept and design; acquisition of data was done by JB, AK, PS, SA, RS; JB, AK, PS, SA, RS were involved in analysis and interpretation; JB and RS drafted the article; Final approval of the manuscript was done by all authors.

End Note
PHQ-9 is a depression module which scores each of the 9 DSM-IV criteria as "0" (not at all) to "3" (nearly every day). Depression severity is given as 0-4 none, 5-9 mild, 10-14 moderate, 15-19 moderately severe, 20-27 severe

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Relationship between Body Fat Percentages by Bioelectrical Impedance Analysis and Body Mass Index (BMI) And other metabolic Parameters among Filipino Adults At Emilio Aguinaldo College Medical Center-Cavite

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Abstract

Background: Obesity posing burgeoning risk for mortality, diabetes mellitus, cardiovascular diseases and cancer among fast ageing Filipino population must be accurately measured by the use of rapid, non-invasive, digitally precise tool, Body Fat percentage and segmental body composition obesity predictors in Bioelectrical Impedance Analysis where overseas studies established significant but limited results. Our study focused on Filipino group with the correlation of its body fat percentage and other obesity predictors set in BIA therein like Free Fat Mass, Fat, Bone and Muscle masses, visceral fat amongst others, with Body Mass Index and other conventional obesity measurements. **Method:** This cross-sectional, correlational study included 363 Filipinos, patients and employees of Emilio Aguinaldo College Medical Center-Cavite and nearby health center, 18-80 years of age, BMI of 16-34, excluded those pregnant and bearing metallic body implants, have imparted their History, level of activity. Installed Standardized protocol for Physical Examination, measurements of height, weight, Body mass index waist and hip circumferences, waist-hip ratio, systolic blood pressure and diastolic blood pressure. **Results:** All BIA measurements used Tanita MC980. The Pearson correlation coefficients, Binary logistic regression analysis, two tailed test, Shapiro-Wilk tests analyzed 137 Males, 226 females with mean age of 34.64, p-value of 0.29, showed strong, significant correlation between BFP and BMI, and other measurements, where BMI had strongest correlation to women than men with synonymous correlation with other metabolic variables and predictors, and no significant difference between genders. **Conclusion:** Our research reflected that Body Fat Percentage have strong significant correlation with BMI, metabolic variables and obesity predictors measured, established a better estimate for obesity as compared to the conventional measurements.

Keywords: Bioelectrical Impedance Analysis, Percent Body Fat, Metabolic variables

Indroduction:

Obesity is defined as body mass index (BMI) 30 kg/m2 or more which is obtained by dividing a person's weight by the square of the person's height, has emerged as one of the most common health concern in the world. In Asia, approximately 17% of population is considered obese by World Health Organization (WHO)[1]. In the Philippines, the prevalence of obesity on 2003 was 4.9% by body mass index (BMI), and 10.2% and 65.6% by waist-hip ratio (WHR) in men and women respectively.[2]

Obesity is associated with an increased risk of mortality[3], type 2 diabetes[4], cardiovascular diseases and cancer[5]. Moreover, obese individuals have 7 times higher the risk of developing diabetes than individuals of a normal BMI[6]. Since obesity is

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increased with advancing age, the on-going rapid aging of the population will further impose a greater burden on the society. Indeed, it has been estimated that by 2030 nearly one-third of the world population is overweight or obese[7].

Bioelectrical Impedance Analysis (BIA) is known to provide a rapid, non-invasive and relatively accurate measurement of body composition with the possibility of utilizing at field settings. At present, there are studies conducted in various ethnic groups in other countries to determine the effect of age and gender in the Body Mass Index (BMI) - Body Fat Percentage (BMI-BF%) relationship, and there are uncertainties about the final conclusion. At present, relationship between Body Mass Index (BMI) and Body Fat Percentage estimated By Bioelectrical Impedance is not widely known in Philippines.

The objective of this study is to determine the relationship between Body Fat Percentage estimated By Bioelectrical Impedance and Body Mass Index (BMI) among Groups of Filipino Adults in Emilio Aguinaldo Medical Center.

Methods:

This is a cross-sectional analytic study that will include Filipino adult patients and individuals in Emilio Aguinaldo Medical center for a duration of 6 months. A cross sectional study to be conducted where height, weight and body composition measurements of adult patients will be carried out by a group of medical graduates.

The study was approved and reviewed by the EACMCC Medical Research Technical Review Committee (EMRTRC) and submitted to DLSHI C Independent Ethics Board (DLSHI-IEC) Panel for ethics review and approval. The study was conducted only upon approval from Panel.

The Inclusion Criteria was to include adult Filipino patients' age 18-80 years old with BMI 16-34 kg/m2 in this study. Subjects who were having metallic implants in the body like cardiac pacemaker, metallic prosthetics were excluded. Pregnant women were likewise excluded.

BF% will be estimated from bioelectrical impedance analysis. Pearson's' correlation coefficient(r) will be used to calculate and to see the relationship between BMI-BF% in the different age groups. Multiple regression analysis will be performed to determine the effect of age and gender in the relationship and polynomial regression will be carried out to see its' linearity.

Results:

The Table 1.0 showed that a total of 363 subjects were included in the analysis, Males with 137 subjects and females with 226 subjects, with a mean age of 34.64 and p-value of 0.29.

1.1.1 Table 1. Demographic and clinical characteristics of the study participants

	Total (n=363)	Male (n=137)	Female (n=226)	P-value
	Frequency (%); Mean + SD; Median (IQR)			
Age	34.64 + 12.47	35.53 + 12.0	34.10 + 12.74	0.292
Weight (kg)	63.64 + 14.0	72.12 + 12.93	58.49 + 11.99	<0.001
Height (m)	1.60 + 0.09	1.68 + 0.08	1.55 + 0.06	<0.001
BMI	24.67 + 4.43	25.59 + 4.16	24.12 + 4.51	0.002
Obese	67 (18.46)	29 (21.17)	38 (16.81)	0.300
Body fat %	29.86 + 8.94	22.67 + 6.51	34.22 + 7.24	<0.001
FFM (Fat free mass)	41 (36.6─52.6)	55.2 (51.2─59.5)	37.3 (34.9─40.1)	<0.001

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Fat mass (kg)	17.6 (13.3–23.4)	15.5 (11.9–20.3)	19.05(15–24.3)	<0.001
Bone mass (kg)	2.4 (2–2.8)	2.9 (2.7–3.1)	2.1 (1.9–2.3)	<0.001
Muscle mass	38.6 (24.6–49.9)	52.3 (48.5–56.4)	35.2 (33–37.8)	<0.001
Protein (kg)	9.1 (8.1–13.9)	15.5 (13.2–17.2)	8.3 (7.5–9)	<0.001
ECW (kg)	12.4 (10.9–14.6)	14.7 (13.8–15.8)	11.4 (10.1–12.4)	<0.001
ICW (kg)	17.2 (15–21.1)	22.1 (20–23.7)	15.7 (14.2–17.2)	<0.001
BMR KJ	5234 (4632–6272)	6523 (5870–7079)	4780 (4464–5201)	<0.001
BMR kcal	1251 (1107–1499)	1559 (1403–1692)	1142.5 (1067–1243)	<0.001
Visceral fat	7 (4–10)	10 (8–13)	5 (3–8)	<0.001
TBW (kg)	29.5 (25.9–35.4)	36.8 (33.9–39.3)	26.75 (24.5–29.4)	<0.001
TBW %	48.7 (45.7–51.7)	51.3 (48–55.3)	47.4 (44.3–49.9)	<0.001
ECW/TBW%	41.3 (39.8–42.7)	40.3 (39.2–41.6)	41.8 (40.4–43.6)	<0.001
Waist circ.	85 (77–93.7)	90 (81–97)	82 (75–91)	<0.001
Hip circ.	95 (89.4–102)	97 (91–104)	94 (88–100)	<0.001
Waist-hip-ratio	0.9 (0.86–0.93	0.92 (0.89–0.95)	0.89 (0.83–92)	<0.001
Systolic blood pressure	119.12 + 15.13	124.89 + 14.76	115.62 + 14.29	<0.001
Diastolic blood pressure	80.41 + 11.48	84.60 + 11.82	77.87 + 10.52	<0.001
METS				
7 to 10	35 (9.64)	17 (12.41)	18 (7.96)	0.164
> 10	328 (90.36)	120 (87.59)	208 (92.04)	

Abbreviations: METS (metabolic equivalents), ECW(extracellular water), ICW(intracellular water), TBW (total body water), BMR (basal metabolic rate), BMI (body mass index)

The mean Body Fat percentage (BF%) was 29.86 + 8.94, with higher value for women at 34.22 + 7.24 as compared to 22.67 + 6.51 for men , has no significant difference. The Waist Circumference has mean value of 85 (77–93.7), higher with males at 90 (81–97) as compared with females at 82 (75–91) with no significant difference. The Hip Circumference has mean value of 95 (89.4–102), higher with males at 97 (91–104) as compared with females at 94 (88–100), which has no significant difference. Waist-Hip Ratio mean value is 0.9 (0.86–0.93, with no significant difference between male and females.

1.1.2 Table 2.0 Correlation coefficient of Body fat percentage, WC, WHR, and Blood pressure to BMI

	Total	Male	Female
Body fat percentage	0.6133	0.8959	0.9457
Waist circumference	0.7312	0.7537	0.7088
Waist-hip-ratio	0.4494	0.5180	0.3771
Systolic blood pressure	0.3940	0.3463	0.3802
Diastolic blood pressure	0.4294	0.3883	0.4169
All P-value were <0.001			

The Table 2.0 showed the correlation of BMI to BF% which is higher in females (r=0.9457)

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as compared to Males (r=0.8959. There is higher correlation of Body fat percentage to BMI (r=0.6133) as compared to, Waist-hip ratio(r=0.44), and to systolic(r=0.39) and diastolic BP(r=0.42) but lower as compared to waist circumference(r=0.73).

1.1.3 Table 3.0 Correlation coefficient of BMI, WC, WHR, and Blood pressure to Body fat percentage

	Total	Male	Female
Body mass index	0.6133*	0.8959*	0.9457*
Waist circumference	0.3356*	0.6888*	0.6857*
Waist-hip-ratio	0.0841	0.4719*	0.3542*
Systolic blood pressure	0.0702	0.3013*	0.3707*
Diastolic blood pressure	0.0874	0.2904*	0.3994*

** - P-value = <0.001*

The Table 3.0 showed the correlation of Body Fat Percentage (BF %) to BMI, WC, WHR and Blood Pressure. The correlation is more significant with BMI (r=0.61) as compared to WC (r=0.33), WHR (r=0.08) and Systolic Blood Pressure(r=0.07) and diastolic BP (r=0.08).

1.1.4 Table 4.0 Predictors of obesity

	Crude odds ratio	95% CI	P-value
Age	0.9992	0.9781 to 1.0276	0.941
Weight (kg)	1.2144	1.1604 to 1.2710	<0.001
Height (m)	4.6888	0.2715 to 80.9862	0.288
Body fat percentage	1.2211	1.1614 to 1.2840	<0.001
FFM	1.0786	1.0496 to 1.1083	<0.001
Fat mass (kg)	1.6777	1.4567 to 1.9322	<0.001
Bone mass (kg)	9.8700	5.0534 to 19.2776	<0.001
Muscle mass	1.0808	1.0505 to 1.1119	<0.001
Protein (kg)	1.0279	0.9635 to 1.0966	0.405
ECW (kg)	2.0786	1.7229 to 2.4984	<0.001
ICW (kg)	1.2466	1.1618 to 1.3377	<0.001
BMR KJ	1.0010	1.0001 to 1.0013	<0.001
BMR kcal	1.0043	1.0032 to 1.0055	<0.001
Visceral fat	1.6639	1.4777 to 1.8735	<0.001
TBW (kg)	1.2017	1.1418 to 1.2648	<0.001
TBW %	0.6862	0.6234 to 0.7552	<0.001
ECW/TBW%	1.2320	1.0957 to 1.3853	<0.001
Waist circumference	1.2003	1.1483 to 1.2546	<0.001
Hip circumference	1.2151	1.1577 to 1.2753	<0.001
Waist-hip-ratio	3254559	15615 to 6.78x108	<0.001
Systolic blood pressure	1.0486	1.0288 to 1.0688	<0.001
Diastolic blood pressure	1.0711	1.0448 to 1.0982	<0.001
METS >10	0.3335	0.1583 to 0.7026	0.004

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Abbreviations: METS (metabolic equivalents), ECW(extracellular water), ICW(intracellular water), TBW (total body water), BMR (basal metabolic rate), BMI (body mass index), FFM(fat free mass)

Weight: for every kg increase in weight, the odds of being obese also increases by 21.44%, **BF%:** for every percentage increase in body fat, the odds of being obese also increases by 22.11%, **FFM:** for every unit increase in FFM, the odds of being obese also increases by 7.86%, **Fat mass:** for every kg increase in fat mas, the odds of being obese also increases by 67.77%, Bone mass: for every kg increase in bone mass, the odds of being obese also increases by 9.87 times., **ECW:** for every kg increase in ECW, the odds of being obese also increases by 107.86%, **ICW:** for every kg increase in ICW, the odds of being obese also increases by 24.66%, **BMR KJ:** for every unit increase in BMR KJ, the odds of being obese also increases by 0.10%, **BMR KJ:** for every unit increase in BMR kcal, the odds of being obese also increases by 0.43%, **Visceral fat:** for every unit increase in visceral fat, the odds of being obese also increases by 66.39%, **TBW:** for every kg increase in TBW, the odds of being obese also increases by 20.17%, **TBW%:** for every percentage increase in TBW, the odds of being obese also decreases by 31.38%, **ECW/TBW%:** for every percentage increase in ECW/TBW, the odds of being obese also increases by 23.20%, **WC:** for every cm increase in waist circumference, the odds of being obese also increases by 20.03%, **HC:** for every cm increase in hip circumference, the odds of being obese also increases by 21.51%, **WHR:** for every unit increase in waist-hip-ratio, the odds of being obese also increases by over 3 million folds., **SBP:** for every unit increase in SBP, the odds of being obese also increases by 4.86%, **DBP:** for every unit increase in DBP, the odds of being obese also increases by 7.11%

Discussion:

In this study, we analyzed the correlation between BFP measured by BIA, with BMI and other anthropometric and metabolic variables in 363 patients at Emilio Aguinaldo College Medical Center-Cavite. The results of our study showed that BFP has a significant correlation with BMI and other anthropometric variables (WC and WHR). However simple anthropometric measurements (WC, and WHR) had also better correlation with BMI. We limited the inclusion criteria to subjects with age 18-80 years old. Changes in body composition occur as part of the normal aging process. In elderly, the amount of lean body mass decreases with age, a process called sarcopenia. Data from the Rosetta Study show that older adults have, on average, more fat than younger adults at any given BMI[8].The predictive equations which may have been derived in populations of younger ages, might be less valid in elderly individuals[9]. Hence, we included the subjects with maximum age of 80 year-old.

We only included patients with BMI 16-34 kg/m2 in this study. Clinical use of BIA in subjects at extremes BMI ranges cannot be recommended for routine assessment and it should be interpreted with caution. BIA results are affected by tissue hydration in severely malnourished patients. The overall effect of severely obese state is overestimation of fat-free mass, and thus an underestimation of BFP(10). The result of current study demonstrated that BFP had strong and significant correlation with BMI (r=0.902 for men; r=0.933 for women) and WC (r=0.822 for men; r=0.787 for women) among adult Filipino(11). Among the three anthropometric measurements (BMI, WC, and WHR), BMI had the strongest correlation with PBF. In addition, it is noteworthy that these degrees of correlation differed between the sexes. This agrees with the study by Kobayashi et al., who demonstrated the strong correlation of BFP and BMI among Japanese population (r=0.813 for men; r=0.888 for women). On the other hand, a previous study by Ozenoglu et al showed only moderately strong correlation between PBF with BMI (r=0.584) & WC (r=0.598) among female subjects(12). Study by Lemos-Santos et al (12)., PBF was less correlated with WHR (r=0.55) compared with WC (r=0.90) among Brazilian men (13). We use Binary logistic regression analysis

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was used to determine the significant predictors of obesity among study participants. Our findings showed significant correlation between BFP and BMI.

A major limitation of this study is Subjects who were having metallic implants in the body like cardiac pacemaker, metallic prosthetics were excluded. Pregnant women were likewise excluded. They could be classified as having metabolic syndrome. Exclusion of these subjects may cause underestimation of the PBF measurement ability.

Conclusion:

The Body Fat Percentage (BFP) measured by BIA has a strong and significant correlation with the BMI, the other anthropometric measurements like Waist and Hip Circumference and its ratio, the metabolic variables like systolic and diastolic blood pressure, and those that are useful for predicting obesity measured by BIA like Free Fat Mass, Fat mass (kg) Bone mass (kg) Muscle mass Protein (kg) ECW (kg) ICW (kg) BMR KJ BMR kcal Visceral fat TBW (kg) TBW % ECW/TBW%.

With the principles set in the Bioelectrical Impedance Analysis, where electric current passes through the body at a differential rate depending on body compositions of water and different ions measures digitally at Ionic level, we can therefore conclude that Body Fat Percentage measured by BIA is an better gauge of level of Obesity as compared to manual BMI using height and weight, and other anthropometric measurements like waist and hip circumference.

Recommendations:

This study recommends the use of BIA (Tanita MC980) as an epidemiological tool for the assessment of obesity in the different age groups and subgroups of metabolically challenged age groups.

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REVIEW ARTICLE OPEN ACCESS

Clinical Laboratorial Perspective on Screening of Prediabetes and need for Standardization of Post Prandial Blood Glucose Testing in Nepal

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Abstract
This study explores the differences in categorization of prediabetes based on fasting blood glucose by the World Health Organization and the American Diabetes Association from a laboratory perspective and the associated implications. As the diagnostic thresholds for prediabetes are based on the likelihood of developing overt diabetes, the criteria for this collective representation of dysglycemic states, including Impaired Fasting Glucose and Impaired Glucose Tolerance needs to be clearly established in the face of a society that grows increasingly concerned about diabetes and its associated complications over time. The authors intend to delve into different published points of view and recommend a categorization in Nepal's context.

Keywords: fasting blood glucose; post-prandial blood glucose; prediabetes; 75 grams oral glucose tolerance test

Introduction:
Existing norms of diagnosing prediabetes are based on measurements of glycated hemoglobin (HbA1c), fasting blood glucose or blood glucose concentration two hours following a 75 grams oral glucose load. The term prediabetes has been accepted to represent either of two states, the first – where an individual cannot maintain baseline blood sugar levels over periods of fasting (at least eight[r[1]] hours), thus aptly labeled Impaired Fasting Glucose (IFG) and / or a second state where an individual cannot handle glucose loads as efficiently, indicated by the term, Impaired Glucose Tolerance (IGT). The American Diabetes Association (ADA) and the World Health Organization (WHO) have defined different thresholds for the categorization for prediabetes. According to the ADA, a fasting blood glucose level of at least 100 mg/dL (5.6 mmol/L) but less than 126 mg/dL (7.0 mmol/L) is categorized as IFG, while a blood glucose level in between 140 mg/dL (7.8 mmol/L) and 200 mg/dl (11.1 mmol/L) 2 hours following an oral glucose load of 75-grams qualifies as IGT.[1] The WHO, however, defines IFG as a state where fasting blood glucose levels are between 110 mg/dl (6.1 mmol/L) and 126 mg/dL (7.0mmol/L), whereas the WHO's definition for IGT uses the same thresholds as that of the ADA.[2] In this regard, a person with a fasting blood sugar level of 105 mg/dl would be regarded as prediabetic by ADA standards, while he would be dismissed as normal when using the WHO definitions. It is interesting to note that the ADA also uses HbA1c values ranging from 5.7% to 6.4% in the categorization of pre-diabetes, regardless of blood sugar values.

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The progression from prediabetes to overt hyperglycemic symptoms of type 2 diabetes arguably occurs over a period of many years.[3] The likelihood of progression to overt diabetes is significantly more in patients with both IFG

and IGT, as compared to patients with a single impairment of either IFG or IGT.[4] Insulin resistance and other lifestyle related factors also contribute to an elevation of this risk in susceptible individuals.

Controversies:

To start with, the term prediabetes can be misleading – because many people diagnosed with IFG or IGT do not ever develop overt diabetes. Up to 70% of prediabetic, figures have shown, will develop diabetes at some point in their lifetime.[5] In contrast to a normoglycemic state, this prediabetic state has been established to be associated with an increased occurrence of micro- and macrovascular complications – when long term glycemic control is taken into account –regardless of whether an individual progresses to overt type 2 diabetes.[6] The importance of screening for prediabetes cannot be overemphasized here, given that Nepal has been witnessing an alarming rise in the number of diabetes cases over the past decade along with a population that grows increasingly concerned with the complications related to diabetes.

The WHO has recommended using the term intermediate hyperglycemia to indicate glycemic levels varying between normal glucose tolerance and overt diabetes.[2] The cut-offs defined by ADA and WHO for establishing prediabetes do not equate, owing to the fact that the reference levels for prediabetes were most likely established by these organizations using different groups of individuals with their unique lifestyle differences and ethnic origins. The primary concern here is that these threshold values should be sensitive enough to correctly identify individuals at an increased risk. It is blatantly clear that using the ADA recommendations, a larger fraction of the population would be diagnosed as prediabetic as compared to when using the WHO cut-offs. In a meta-analysis published in 2017, 27% of the population studied was identified as pre-diabetics when WHO guidelines were used, compared to a whopping 48% if ADA criteria were to be used in the same population.[7] It is interesting to note that the substitution of the ADA criteria in place of the WHO criteria for the screening and diagnosis of type 2 diabetes thus potentially doubles the estimated prevalence of prediabetes. It should be noted that this labeling people as prediabetes has implications which include periodic and frequent blood testing, a social stigma associated with the diagnosis, some forced lifestyle changes and the use of certain medications.

To put it bluntly, the usefulness of IFG and IGT in evaluating glycemic control has long been criticized due to the variability in threshold values and in their prognostic worth in reference to probability of developing diabetes or the likelihood and severity of related complications.[8] Also, these threshold values for diagnosis of prediabetes are limited in application – owing to poor reproducibility.[9] Nevertheless, the presence of IFG and / or IGT in an individual identifies him or her with having different pathological abnormalities in their glucose homeostasis which needs to be addressed; there is no argument to that.

Nepalese Context:

The prevalence of type 2 diabetes reported in a recent study in Nepal is 8.5%.[10] Similarly, the prevalence of prediabetes in a community-based study done in Nepal, is reported to be 7.14%. [11] In our experience, prediabetes is often an incidental diagnosis in people who undergo a routine physical workup or perhaps a screening for diabetes.

Most of the clinical laboratories in Nepal use an established reference range for fasting and postprandial blood glucose, as recommended by the WHO. The cut off value established by both the ADA and the WHO for post prandial blood glucose levels is based on the premise that the patient undergoing the test has consumed carbohydrates equivalent to 75 grams of an oral anhydrous glucose solution. Our practice of measuring post prandial blood sugar is via a blood sample taken two hours following lunch and this is based on the assumption that the major portion of our diet comprises carbohydrates.

Given that the established reference ranges are based on the oral 75 grams anhydrous glucose load, it is quite valid to argue that in our settings, the established diagnostic sensitivity of post prandial blood glucose tests are greatly contended, at best. This emphasizes the need for standardization of post prandial blood glucose testing. Save for a few laboratories in Nepal that routinely perform the 75 grams oral glucose tolerance test in screening gestational diabetes, very few organizations have the concept of a standardized oral glucose load prior to evaluating post prandial glucose. Again, the fact that this concept of oral glucose loading has additional implications associated with it, because it is definitely more time consuming, may incite malingering and decrease compliance on part of the patients, owing to the hassle involved and there is the possibility that subsequent results may advocate additional confirmatory tests.

With the advent of HbA1c as a standardized marker of long term glycemic control as well as of patient compliance, the ADA eventually advocated its use in the screening and diagnosis of prediabetes, based on widespread studies on reference intervals. The WHO, too has included the use of HbA1c in the diagnosis of diabetes recently. The catch is that we do not have enough evidence to justify using HbA1c in the evaluation of prediabetes (IFG and/or IGT states). Also, with the costs of laboratory estimation of HbA1c amounting to roughly ten times that of the cost of estimating blood sugar, it is a no-brainer that blood glucose investigation is the better option for Nepal, which still relies on a cash-based healthcare delivery system. It is also imperative that the ADA recommendations for fasting blood glucose thresholds be implemented in Nepal in the face of the growing number of cases of diabetes and related complications in the urban population.

Recommendation:

For patients that undergo a routine health workup or in patients that are screened for type-2 diabetes, a fasting blood glucose measurement between 100 and 126 mg/dL on two or more occasions should advocate a standardized 75 grams oral anhydrous glucose (82.5 grams of monohydrate glucose available in Nepal) tolerance test to establish prediabetes in our context.

Conclusion:

Testing for blood glucose following 75gm oral glucose load using the diagnostic thresholds advocated by the ADA standardizes both the diagnostic testing for prediabetes, as well as the evaluation of long-term glycemic control in diabetic patients, in terms of reporting accuracy, value for money, as well as predictive values from a clinician's perspective.

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Conflict of Interest- None

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