

# Achievement of 3B goals among T2DM patients: An experience from Central Nepal

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## Abstract

**Background:** Management of type 2 diabetes mellitus (T2DM) requires comprehensive control of three metabolic parameters: blood glucose, blood pressure (BP), and blood lipid commonly known as 3B. We studied the prevalence of patients reaching the 3B goals in Nepalese context.

**Materials and Methods:** Patients aged 30 years or above who presented in Dhulikhel Hospital outpatient clinic of internal medicine department of Dhulikhel Hospital with a diagnosis of T2DM diagnosed at least for 6 months were enrolled in this cross-sectional, observational study. Patients with any major illness, surgery, or diabetic ketoacidosis in last 6 months, use of glucocorticoids, post-transplant diabetes, and gestational diabetes were excluded. The study was conducted during the period between January 2015 and June 2015. Chi-square test was used to compare qualitative variables. The nonparametric test (2 independent sample tests) was used for quantitative variables.

**Results:** One hundred and fifty study participants had a mean age of  $56 \pm 11.88$  years, body mass index of  $23.97 \pm 4.72$  kg/m<sup>2</sup>, and an HbA1c of  $8.02 \pm 1.78\%$ . The proportion of patients with good glycemic control (HbA1c <7%) was 30%. Only 26% patients had achieved targets for both systolic and diastolic BP (<130/80) and 35% patients had achieved the target of LDL less than 100. In this study, 32 (21.33%) patients had control of blood glucose and blood lipid, whereas 26 (17.33%) patients had control of blood glucose and BP. Likewise, only 19 (12.67%) patients met the target of blood glucose, BP, and blood lipid control.

**Conclusion:** Our data showed that only 13% of patients achieved the 3B goals. Our study highlights the urgent unmet need, to improve the quality of diabetes care in our center which may be a representative of the country.

**Keywords:** 3B goals, HbA1c goal, Nepal, T2DM

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## INTRODUCTION

Despite the global increase in the number of diabetic patients and medical advancement, the control of diabetes has been very difficult to achieve even at resource-rich setting which has directly impacted on an array of microvascular, macrovascular, and

neuropathic complications. Previous landmark studies have suggested that multifactorial intervention leads to a reduction in the complications and mortality in diabetic patients.<sup>[1]</sup> This has led to the formulation of guidelines for the management of diabetes by many scientific

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associations.<sup>[2]</sup> The comprehensive management of diabetes includes achieving an optimum control of 3 parameters viz. HbA1c (<7%), blood pressure (BP) (<130/80 mmHg), and cholesterol (low-density lipoprotein [LDL] <100 mg/dl). Glycemic control alone is insufficient, and the focus should be in the management of all three components in every diabetes patient. A survey from Norway showed that only 6% of patients with type 2 diabetes mellitus (T2DM) had HbA1c <6.5%, BP <140/85 mmHg and LDL cholesterol <3 mmol/L (116 mg/dl)<sup>[3]</sup> while Bernard M.Y. Cheung *et al.* studied changes in the prevalence, treatment, and management of diabetes in the United States from 1999 to 2006 using data from the National Health and Nutrition Examination Survey and revealed that the percentage of patients achieving all 3 targets increased from 7% to 12.2%.<sup>[4]</sup> Even higher rate of target achievement was revealed by a Canadian study showing 21% of T2DM patients achieving the combined targets for HbA1c, BP, and LDL-C.<sup>[5]</sup> In the study from China titled “Nationwide Assessment of Cardiovascular Risk Factors: Blood pressure, Blood lipid and Blood Glucose in Chinese Patients with Type 2 diabetes: 3B STUDY”, 47.7%, 28.4%, and 36.1% of the population achieved the appropriate target of blood glucose (HbA1c <7), BP (SBP/DBP <130/80 mmHg), and total cholesterol (<4.5 mmol/L) respectively; only 5.6% achieved all three targets.<sup>[6]</sup> Therefore, studies from different parts of the world have a varied result regarding the proportion of patients gaining the recommended target levels. There is no publication from Nepal stating the level of control of all three variables among our patients. The aim of the study was to study the clinical profile of T2DM patients visiting OPD of internal medicine department of Dhulikhel hospital and determine the proportion of patients achieving control of these parameters.

## MATERIALS AND METHODS

### Study population

Patients aged 30 years or above who present in Dhulikhel Hospital outpatient clinic with a diagnosis of T2DM diagnosed at least for 6 months were enrolled in this cross-sectional, observational study. Patients with any major illness, surgery, or diabetic ketoacidosis in last 6 months, use of glucocorticoids, posttransplant diabetes, gestational diabetes were excluded. The study was conducted during the period between January 2015 and June 2015. This study was approved by Institutional Review Committee of Kathmandu University School of Medical Sciences/Dhulikhel Hospital.

### Study measures

A questionnaire form was made and patients were asked their demographic information including name, sex, age, marital status, educational level, smoking and alcohol history. Physical examination was done at the time of enrollment including measurement of height, weight, and BP. For BP measurement, patients were asked to do rest at least for 5 minutes and taken two BP measurements consecutively at 5 minutes interval and taken the mean value as patients BP. Information about diabetic history, diabetic complications, and medical treatments were assessed. Lastly, recent laboratory results of fasting plasma glucose (FPG), HbA1c, LDL level were recorded. Laboratory results of previous 30 days (fasting blood lipid and HbA1c results within 3 months) were accepted for the study.

### Data analysis

Chi-square test was used to compare qualitative variables if this was inappropriate then the nonparametric test was used. For quantitative variables, tests of normality was done and found that all such variables were not distributed normally. A nonparametric test (2 independent sample test) was used for such variables. The value of  $P < 0.05$  was considered statistically significant. All data were analyzed using SPSS 16.0.

## RESULTS

In this cross-sectional study, 150 T2DM patients were enrolled. The results were as follows: The mean age of the patient was 56 years (SD: 11.88). Fifty-three percent of the patients were female. The mean diabetes duration was found to be 5.56 years (SD: 4.33). The mean FBS level was  $137.88 \pm 49.56$  mg/dl. Variables are tabulated in Table 1.

### Blood glucose control

The mean HbA1c was  $8.02 (\pm 1.78\%)$ . The proportion of patients with tight glycemic control (HbA1c <7%) was 30% as shown in Figure 1.

**Table 1: Clinical parameters of study participants.**

Variables	Mean $\pm$ SD / Number(%)
Age	56 $\pm$ 11.88
DM duration	5.56 $\pm$ 4.33
BMI	23.97 $\pm$ 4.72
FBS	137.88 $\pm$ 4.56
HbA1C	8.02 $\pm$ 1.78
BP systolic	127.21 $\pm$ 15.92
BP diastolic	80.37 $\pm$ 9.79
LDL	111.73 $\pm$ 37.46
Female	80 (53.33%)
Smoking	73 (48.66%)
Alcohol history	61 (40.66%)
Known case of dyslipidemia	41 (27.33%)
Known case of hypertensive	61 (40.66%)

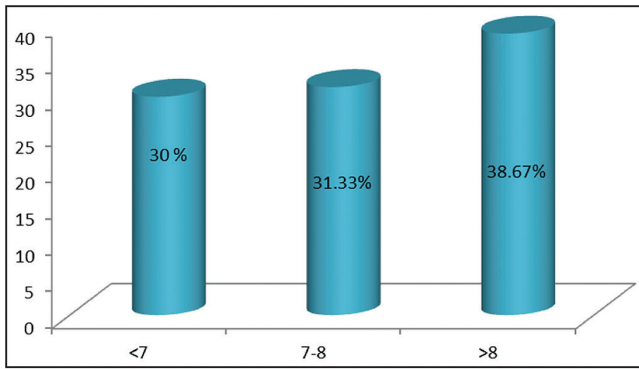


Figure 1: Bar diagram showing status of blood glucose control

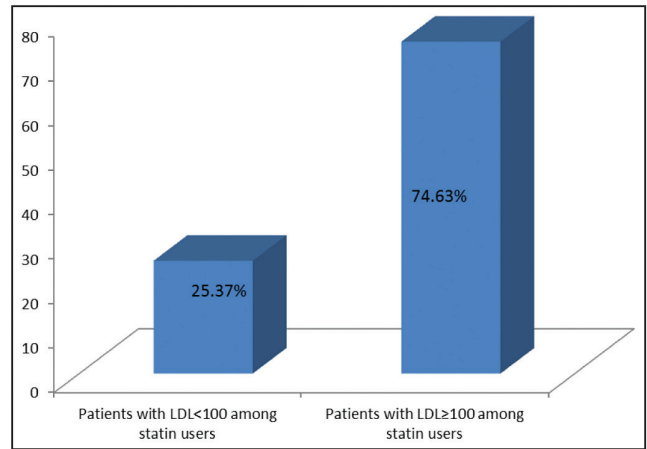


Figure 4: Bar diagram showing status of blood lipid control among statin users.

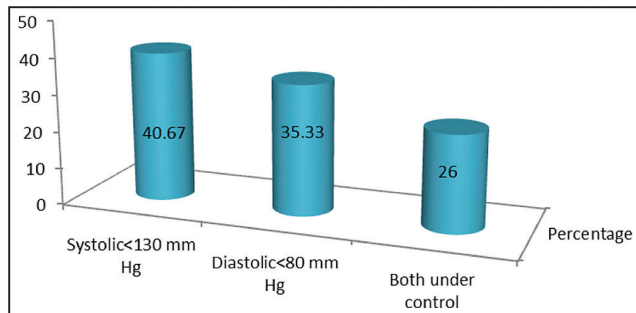


Figure 2: Bar diagram showing status of blood pressure Control

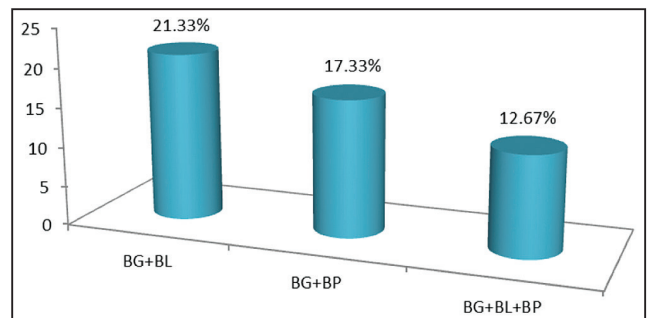


Figure 5: Bar diagram showing combined control of blood glucose, blood pressure and blood lipids

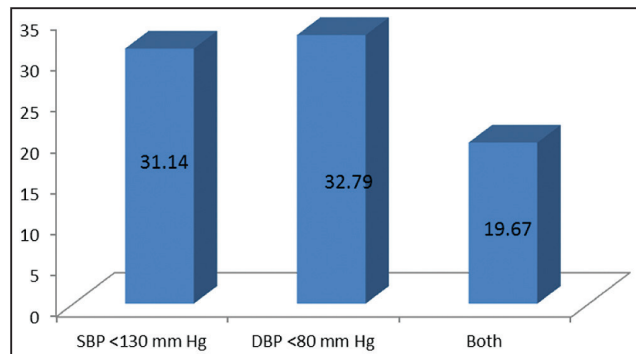


Figure 3: Bar diagram showing status of blood pressure control among patients taking antihypertensive drug

### Blood pressure control

Out of total 150 cases, 40.67% patients had achieved target systolic BP of less than 130 mmHg and 35.33% patients had achieved target diastolic BP of less than 80 mmHg. Only 26% patients had achieved targets for both systolic and diastolic BP [Figure 2].

Out of total 150 patients, 61 (41%) were already taking blood pressure lowering drugs. SBP target was met by 19 (31.14%) patients, DBP target was met by 20 (32.79%) patients, and both SBP and DBP was met by 12(19.67%) patients who were already under antihypertensive medication [Figure 3].

### Blood lipid control

In this study, 53 (35%) patients had achieved the target of LDL less than 100.

Among the total patients, 41(27%) were already taking lipid-lowering drug statin.

Among patients using statin (41), only 17 (25.37%) achieved the target LDL [Figure 4].

### Control of 2B and 3B

In the study, 32 (21.33%) patients had control of blood glucose and blood lipid, whereas 26 (17.33%) patients had control of blood glucose and BP. Likewise, only 19 (12.67%) patients met the target of blood glucose, BP, and blood lipid control [Figure 5].

## DISCUSSION

### Blood glucose control

The HbA1c target should remain at or less than 7% because there is clear and consistent evidence of considerable benefit in microvascular outcomes.<sup>[7-9]</sup> The proportion of patients with tight glycemic control (HbA1c <7%) in this

study was 30%. Although the control rate is not satisfying, it is comparable or even superior to many such surveys carried out in a different part of the world. The proportion of individuals with diabetes reaching treatment targets for blood glucose, BP, and serum cholesterol was very low, ranging from 1% of male patients in Mexico to about 12% in the United States.<sup>[10]</sup>

The prevalence of inadequate glycaemic control was high in Brazil, a study carried out among 5,692 patients with T2DM in 2006–2007 found that 73% of them had HbA1c >7%.<sup>[11]</sup> A study in Asian countries including China revealed that only 21% of diabetes patients had HbA1c <7% and 55% had HbA1c >8%.<sup>[12]</sup> In 2004, a survey done among 493 T2DM inpatients in Guangdong province in China showed that 75% of them had HbA1c  $\geq$  6.5%.<sup>[13]</sup> A recent study in India showed only 20% of 1000 T2DM patients have HbA1c <7%.<sup>[14]</sup>

All these studies throughout the world showed poor glycaemic control among T2DM patients but there are few latest clinical trials which are showing improving control of glycemia. One of them is National health and nutrition examination survey (NHANES) in the United States of America. The logistic results indicated corresponding improvements over time: the predictive margin for having HbA1c <7% increased from 37.0% in 1999–2000 to 49.7% in 2001–2002 and to 55.7% in 2003–2004.<sup>[15]</sup> DIABCARE-CHINA Survey in 2006 revealed similar improvement in control of blood glucose, 26.8% and 41.1% of patients with T2DM reached HbA1c <6.5% and HbA1c <7% respectively, which was better compared to data achieved in 1998.<sup>[16]</sup>

A study published from Nepal in 2011 showed HbA1c control of 27.89% which is comparable to our study.<sup>[17]</sup> In this study, a total of 294 T2DM (180 males and 114 females) visiting the OPD of Civil Service Hospital, Kathmandu, Nepal from October 2009 to May 2010 were included. The mean HbA1c in the study among men was 7.2 and among women was 7.53, the difference being statistically insignificant. Similarly, mean FBS among men was 149.4 and among women was 159.4, the difference being statistically insignificant. The results in both these studies are comparable and better than many other studies around the world possibly because in both studies only OPD patients are included and inpatient subjects which are excluded might represent a higher proportion of patients without tight sugar control.

### Blood pressure control

Many guidelines<sup>[2,18]</sup> have focused on the importance of controlling BP. The BP goals in diabetes are controversial,

only 26% patients had achieved targets for systolic as well as diastolic BP in our study (<130/80). Among patients who were already hypertensive and taking medications, only 20% achieved target BP. BP control rate varies according to different surveys. Diab care 2006 survey in China revealed 77% of T2DM patients had BP >130/80 mmHg.<sup>[16]</sup> A nationwide French survey in 2001 showed only 16% of T2DM patients had BP <130/80 mmHg.<sup>[19]</sup> Similarly, such rate was 51.1% among patients in NHANES 2007–2010.<sup>[20]</sup>

Being specific to SBP and DBP, 41% patients had achieved target systolic BP of less than 130 mmHg and 35% patients had achieved target diastolic BP of less than 80 mmHg in our study. Other studies<sup>[21,22]</sup> showed only 25% of T2DM patients had SBP <130 mmHg whereas nearly 80% of patients had DBP <80 mmHg. The younger age and lower mean systolic blood pressure among patients in our survey may be the reason for the achievement of better SBP control.

Conversely, the BP control among already diagnosed hypertensive patients is not satisfactory. SBP target was met by 31% patients; DBP target was met by 33% patients and both were met by 20% of patients who were already under antihypertensive medication. REGARDS study revealed that 43% and 30% of European American and African American diabetic hypertensive participants respectively demonstrated a target BP of <130/80 mmHg.<sup>[23]</sup>

Overall, the BP control in this survey is satisfactory compared to other studies, but there are still more things to be done to increase the patient's awareness on the advantage of controlling BP.

### Blood lipid control

According to the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III [ATP III]), diabetes is considered a CHD risk equivalent because it confers a high risk of new CHD developing within 10 years.<sup>[24]</sup> In addition to the NCEP–ATP III guidelines, the ADA and the AACE have set target levels for lipids in patients with T2DM.<sup>[4,25]</sup>

Among 150 T2DM patients in this survey, only 35% had LDL cholesterol less than 100 mg/dl. Proportion of T2DM patients achieving blood lipid control is very low in other studies too<sup>[19,22,26]</sup> Whereas ECODIA survey<sup>[27]</sup> showed the higher rate of patients (64%) with blood lipid control.

The higher proportion of patients with poor lipid control may represent either the poor compliance of patients or the



medical inertia of treating physicians on initiating and/or titrating the dose of pharmacotherapy. These both parties may have their own difficulties in achieving target level. Overall the most propounding or profounding cause behind the poor blood lipid control in this survey may be due to many causes; such as poor drug compliance, economic burden, the inefficiency of health sectors on the screening of such patients, lack of patients as well as physicians awareness on understanding the benefit of controlling blood lipid level etc.

#### *Combined control of Blood Glucose, Blood Pressure and Blood Lipids (3B)*

In this study, 19 (12.67%) patients met the target of blood glucose, BP, and blood lipid control. A survey from Norway showed only 6% had HbA1c <6.5%, BP <140/85 mmHg and LDL cholesterol <3mmol/L(116 mg/dl)<sup>[3]</sup> while Bernard M.Y. Cheung *et al.* studied changes in the prevalence, treatment, and management of diabetes in the United States from 1999 to 2006 using data from the National Health and Nutrition Examination Survey and revealed that the percentage of patients achieving all 3 targets increased from 7% to 12.2%.<sup>[4]</sup> This improvement has been attributed to increasing in overall awareness about diabetes and its complications, incorporation of medical nutrition therapy and lifestyle modification as integral part of therapy and advances in medications. Even higher rate of target achievement was revealed by a Canadian study showing 21% of T2DM patients achieved the combined targets for HbA1c, BP, and LDL-C.<sup>[5]</sup> In the study from China titled “Nationwide Assessment of Cardiovascular Risk Factors: Blood pressure, Blood lipid and Blood Glucose in Chinese Patients with Type 2 diabetes:3B STUDY”, 47.7%, 28.4% and 36.1% of the population achieved the appropriate target of blood sugar (HbA1c<7),BP (SBP/DBP<130/80 mmHg) and total cholesterol(<4.5 mmol/L) respectively; only 5.6% achieved all three target.<sup>[6]</sup> A similar study from India showed only 9% of the study participants achieved the similar target goals of blood glucose, BP, and blood lipid.<sup>[14]</sup>

#### CONCLUSIONS

Despite the increase in the number of patients and medical advancement, the control of diabetes has been very difficult to achieve even at resource-rich setting which has directly impacted on an array of microvascular and macrovascular complications. Various studies have shown a significant benefit regarding all these complications with control of blood sugar levels and also control of BP and blood lipid levels. The results of this study underline that only a minor proportion of patients with T2DM achieves the recommended goals in terms of blood glucose, BP, and blood lipid. There is much space for improvement in

achieving individual target goal by increasing awareness, adherence among diabetic people as well implementing individualized focused treatment facilities from healthcare provider and government sector.

#### LIMITATIONS

The sample size was small.

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#### Conflicts of interest

There are no conflicts of interest.

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