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# Overview of Glycemic Control in Workers with Diabetes at An Occupational Clinic in Jakarta

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## Abstract

**Introduction:** Based on Indonesia's population data in 2018 and International Diabetes Federation in 2019, an estimated 1 in every 10 Indonesian workers have type 2 diabetes mellitus (T2DM). Diabetes is a chronic illness with costly implications, especially in working population. Workers with diabetes experience 12% reduction in productivity adjusted life years (PALY) and additional $USD 467 monthly average healthcare cost. This study aims to determine glycaemic control in workers with diabetes.
**Methods**: Cross-sectional study utilizing laboratory medical records from 2015-2021 in an occupational clinic in Jakarta's Central Business District is performed. Data collected through accessing in-clinic laboratory and client lists' electronic medical records, is paired with their respective anthropometric parameters stored in paper archives. Criteria of Fasting Blood Glucose (FBG), lipid profile, HbA1c and Body Mass Index (BMI) are based on PERKENI 2019. Inclusion criteria are workers with prior history of T2DM who underwent HbA1c examination.
**Results:** 2,796 employees who underwent HbA1c examination were found; 65.8% normal, 29.6% pre-diabetic, and 4.6% exceeded T2DM cut-off. Amongst 2,796 employees, 1,322 had their FBG examined; 62% normal, 33.1% had increased fasting glucose and 5% exceeded T2DM cut-off; another 1,316 also had their lipid profile examined, in which 80.5% had dyslipidaemia. From 2015-2021, 160 employees had a history of T2DM, of which 86 had matching laboratory medical records, with 42 of those undergoing HbA1c examination. Of 42 respondents with diabetes who underwent HbA1c examinations, 54.8% had sub-optimal glycaemic control. FBG is the only risk factor significantly correlated to optimal glycaemic control ($p < 0.05$).
**Conclusion:** Health programs and policies in the workplace enacted by management and health institutions who offer medical services may play a vital role in the improvement of prevention and intervention of diabetes amongst workers.
**Keywords:** diabetes mellitus, prevalence, glycaemic control, occupational health

## *Abstrak*

***Pendahuluan:*** *Berdasarkan data Riskesdas tahun 2018 dan International Diabetes Federation tahun 2019, diperkirakan 1 dari setiap 10 pekerja Indonesia mengidap diabetes melitus tipe 2 (DMT2). Diabetes adalah penyakit kronis dengan implikasi mahal, terutama pada populasi pekerja. Pekerja dengan diabetes mengalami penurunan 12% dalam productivity adjusted life years (PALY) dan tambahan biaya perawatan kesehatan rata-rata bulanan sebesar $USD 467. Penelitian ini bertujuan untuk mengetahui kontrol glikemik pada pekerja dengan diabetes.*
***Metode:*** *Studi potong lintang menggunakan rekam medis laboratorium dari tahun 2015-2021 di sebuah klinik okupasi di Kuningan, Jakarta Selatan. Data yang dikumpulkan melalui akses rekam medis laboratorium beserta daftar klien di klinik, dipasangkan dengan parameter antropometri yang disimpan dalam arsip kertas. Kriteria Glukosa Darah Puasa (FBG), profil lipid, HbA1c dan Indeks Massa Tubuh (IMT) berdasarkan PERKENI 2019. Kriteria inklusi adalah pekerja dengan riwayat T2DM sebelumnya yang menjalani pemeriksaan HbA1c.*
***Hasil:*** *Didapatkan 2.796 pegawai yang menjalani pemeriksaan HbA1c; 65,8% normal, 29,6% pra-diabetes, dan 4,6% melebihi ambang batas DMT2. Dari 2.796 pegawai, 1.322 diantaranya menjalani pemeriksaan FBG; 62% normal, 33,1% mengalami peningkatan glukosa puasa dan 5% melebihi cut-off T2DM; 1.316 lainnya juga diperiksa profil lipidnya, di mana 80,5% menderita dislipidemia. Dari tahun 2015-2021, sebanyak 160 karyawan memiliki riwayat DMT2, 86 di antaranya memiliki kecocokan rekam medis laboratorium, dengan 42 di antaranya menjalani pemeriksaan HbA1c. Dari 42 responden penderita diabetes yang menjalani pemeriksaan HbA1c, 54,8% memiliki kontrol glikemik yang kurang optimal. FBG adalah satu-satunya faktor risiko yang berkorelasi signifikan dengan kontrol glikemik optimal ($p < 0,05$).*
***Kesimpulan:*** *Program dan kebijakan kesehatan di tempat kerja yang diberlakukan oleh manajemen dan institusi kesehatan yang menawarkan layanan medis dapat memainkan peran penting dalam peningkatan pencegahan dan intervensi diabetes di kalangan pekerja.*
***Kata kunci:*** *diabetes melitus, prevalensi, kontrol glikemik, kesehatan kerja.*

## Introduction

Diabetes mellitus (DM) is currently a serious global health problem; in 2016, DM is the top 10 causes of death in the world, and WHO found that the prevalence of DM will continue to increase, especially in developing countries[1,2]. In 2019, the International DM Federation (IDF) estimates that 1 in 11 people of productive age (20-64 years) suffer from DM, and 79% of them live in developing countries.[3] Globally, health costs incurred due to DM in 2019 amounted to USD $ 760 billion.[4]

In Indonesia, the prevalence of DM according to Riskesdas in 2018 was 10.9% (1 out of 10 people).[5,6] In 2019, Indonesia is among the top 10 countries with DM sufferers in the world, and the IDF projects that Indonesia will continue to be in the top 10 until 2045.[3,7] Based on 2018 Riskesdas, 10.47% of Indonesian workers have DM.

In occupational health, DM is not only associated with work limitations/restrictions for affected workers (Tunceli et al, 2005), but also a decrease in work productivity; Magliano et al in 2018 found a decrease in productivity adjusted life years (PALY) of 12%. Productivity and performance will not be the only one affected; health costs will also increase and burden the country.[4,8,9] Tabano et al in 2018 also found that workers with DM require higher health costs at an average of USD $467 per month.[10]

For those who have been diagnosed with DM, ensuring optimum glycaemic control will maintain quality of life and work productivity, and prevent chronic complications from DM[11,12] especially those treated with insulin secretagogues such as sulfonylurea and glinide, or insulin. Hypoglycemia compromises driving performance, causes slower response times, and reduces cognitive function. A return-to-work assessment needs to be done after a history of severe hypoglycemia or intractable episodes requiring hospitalization before resuming driving.Case presentation: A-44-year-old man, a commercial vehicle driver with a history of Oral antidiabetic drugs (OAD.

This study aims to determine the overview of glycaemic control in diabetic workers who underwent MCU in an occupational clinic in Jakarta, Indonesia.

## Methods

This research is a cross-sectional study using secondary data by accessing medical record data from January 2015-November 2021. The research location is Ciputra Medical Center clinic located in Jl. Prof. Dr. Satrio Kav 3-5, Kuningan, Setiabudi, South Jakarta which has been operational since 2015. This clinic provides occupational MCU services as well as dermatology, ophthalmology and psychiatric for employees of companies around the Jabotabek (Jakarta, Bogor, Tangerang, Bekasi) area. Client companies include logistics, finance, mining, FMCG, governmental bodies and IT.

Due to the clinic's medical record system having yet to be integrated, data excavation involves first accessing laboratory data for employees who underwent HbA1c examinations during the sampling period and retrieving said data alongside any additional laboratory parameters. Afterwards, a client list of companies during the sampling period is retrieved, and employees from each company with a history of DM in their medical records is pooled and matched with the previous list of employees who underwent HbA1c examination. Should an employee underwent MCU more than once during the sampling period, their newest results will be the one analysed in this study. Inclusion criteria were workers with a history of diabetes who underwent HbA1c examination. HbA1c examination was performed via the ion-exchange High Performance Liquid Chromatography method.

The study was approved by the Research Ethics Committee of the Faculty of Medicine, Universitas Indonesia with letter number KET-1216/UN2.F1/ETIK/PPM.00.02/2021.

## Result

From the 2015-2021 sampling period, accessing the laboratory medical records returned a total of 7,284 HbA1c examination data. After deleting duplicates, 2,796 employees were found, of which 1,322 underwent FBG examination and 1,316 underwent lipid profile examination. By accessing client record data from a separate system, 160 company employees were found to have prior history of diabetes mellitus, based on their medical records from 2015-2021. Of these 160 employees who had a history of previously diagnosed DM, 86 had matching laboratory medical records. Of 86 employees who had diabetes with available laboratory data, 42 underwent HbA1c examination. The following is a table that further elaborates data from the flowchart above;

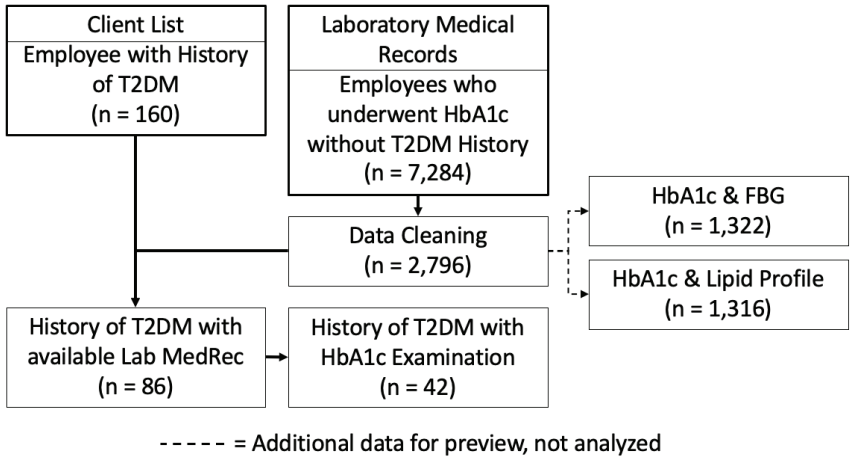


**Diagram 1.** Data Collection Flow. T2DM = Type 2 Diabetes Mellitus, FBG = Fasting Blood Glucose, Medrec = Medical Records

**Table 1.** Descriptive data of employees' metabolic profile

| Variable | Descriptive | Mean / Median |
|---|---|---|
| HbA1c (n = 2,796) | | 5.37 ± 0.67 |
| Normal | 1839 (65.8%) | |
| Impaired Glucose Tolerance | 829 (29.6%) | |
| Diabetes | 128 (4.6%) | |
| Fasting Blood Glucose (n = 1,322) | | 97 (70-471) |
| Normal | 819 (62%) | |
| Increased Fasting Glucose | 437 (33.1%) | |
| Diabetes | 66 (5%) | |
| Lipid Profile (n = 1,316) | | |
| Total Cholestrol | 199.6 ± 35.73 | |
| LDL | 121 (20-267) | |
| HDL | 51 (21-127) | |
| TG | 95 (26-814) | |
| Dyslipidemia (n = 1,316) | | |
| Yes | 1060 (80.5%) | |
| No | 256 (19.5%) | |
| HbA1c (n = 42) | | |
| Optimal | 19 (45.2%) | |
| Sub-optimal | 23 (54.8%) | |

Despite most of the 2,796 employees having normal HbA1c results, 29.6% were pre-diabetic, and 4.6% had HbA1c levels that exceeded the diabetes mellitus cut-off.

1,322 of the 2,796 employees also had their FBG examined, in which the distribution of normal, increased blood glucose and diabetes in the FBG group are also similar compared to that of the HbA1c group (65.8% with 62%, 29.6 with 33.1%, and 4.6% with 5% respectively).

Of the 1,316 employees who also had their lipid profile examined, in which a majority of them had dyslipidemia (80.5%), again emphasizing the

importance of lifestyle interventions, this time in order to prevent cardiovascular complications in the future.

For the 160 employees from 2015-2021 with a history of DM, 86 employees remained after matching their data with their respective laboratory examinations, of which 42 underwent HbA1c examinations; within this group, more than half had sub-optimal glycaemic control.

Based on the table above, men tend to have worse glycaemic control than women. All respondents who had normal FBG also had optimal glycaemic control. Of all the employees' risk factors, only FBG was significantly correlated with glycaemic control.

## Discussion

This study examines glycaemic control using HbA1c as an entry point for data collection, with GDP and Lipid Profile as additional tests. From 2,796 employees who underwent HbA1c examination, 29.6% have impaired glucose tolerance. Based on Riskesdas, a governmental population study in 2018, screening of Indonesia's general population with FBG and 2-hour post-prandial glucose examinations also found similar distributions for pre-diabetics (26.3% and 30.8% respectively). This is important to note, as it signifies that without lifestyle intervention, more than 1 in 4 of Indonesia's

**Table 2.** Relationship between risk factors of employees with diabetes on glycaemic control

| | Respondent (n = 42) | | Optimal Glycaemic Control (n = 19) | | Sub- Optimal Glycaemic Control (n = 23) | | p value |
|---|---|---|---|---|---|---|---|
| | Number | % | Number | % | Number | % | |
| Gender | | | | | | | [b]0.468 |
| Male | 32 | 76.2 | 13 | 68.4 | 19 | 82.6 | |
| Female | 10 | 23.8 | 6 | 31.6 | 4 | 17.4 | |
| Age (Mean) | 47.19 ± 7.87 | | | | | | |
| BMI | | | | | | | n/a |
| Normal | 6 | 14.3 | 2 | 10.5 | 4 | 17.4 | |
| Overweight | 8 | 19 | 3 | 15.8 | 5 | 21.7 | |
| Obese | 28 | 66.7 | 14 | 73.7 | 14 | 60.9 | |
| Underweight | - | 0 | - | 0 | - | 0 | |
| Abdominal Circumference | | | | | | | [a]0.661 |
| Normal | 28 | 66.7 | 12 | 63.2 | 16 | 69.6 | |
| Central Obesity | 14 | 33.3 | 7 | 36.8 | 7 | 30.4 | |
| Blood Pressure | | | | | | | n/a |
| Normal | 21 | 50 | 9 | 47.4 | 12 | 52.2 | |
| Pre-hypertension | 4 | 9.5 | 1 | 5,3 | 3 | 13 | |
| St. 1 Hypertension | 11 | 26.2 | 6 | 31.6 | 5 | 21.7 | |
| St. 2 Hypertension | 6 | 14.3 | 3 | 15.8 | 3 | 13 | |
| Dyslipidemia | | | | | | | [a]0.581 |
| No | 3 | 7.1 | 2 | 10.5 | 1 | 4.3 | |
| Yes | 39 | 92.9 | 17 | 89.5 | 22 | 95.7 | |
| FBG | | | | | | | [a]0.000 |
| Normal | 12 | 28.6 | 12 | 63.2 | 0 | 0 | |
| Sub-optimal | 30 | 71.4 | 7 | 36.8 | 23 | 100 | |

[a]Chi-square
[b]Fisher's Exact Test

general populace is on their way to become diabetics in the future. In occupational health, DM is not only associated with work limitations/restrictions for affected workers (Tunceli et al, 2005), but also a decrease in work productivity; Magliano et al in 2018 found a decrease in productivity adjusted life years (PALY) of 12%. Productivity and performance will not be the only one affected; health costs will also increase and burden the country.[4,8,9] In 2017, America recorded an indirect expenditure of workers with diabetes of USD $ 30.2 billion due to absenteeism and reduced productivity.[4]

Of the 1,322 employees who also underwent FBG examination, the distribution of employees with normal, increased blood glucose and diabetes are similar compared to that of the HbA1c group (65.8% with 62%, 29.6 with 33.1%, and 4.6% with 5% respectively).

This further accentuates the fact that roughly 3 out of 10 Indonesian have impaired glucose metabolism, requiring intervention in their lifestyle before eventually progressing to T2DM. It is also important to note that of 1,316 of employees who had their lipid profile examined, 80.5% were dyslipidemic, highlighting that intervention is urgent, not only to prevent progression to T2DM, but also for cardiovascular diseases.

Within our study, we also found that of 42 employees with history of T2DM, a little over half (54.8%) had sub-optimal glycaemic control. This shows that not only do those who are yet to have T2DM needed intervention; employees who already have diabetes also required further intervention to prevent complications that will further increase healthcare costs for the company. Tabano et al in 2018 also found that workers with DM require higher health costs at an average of USD $467 per month.[10]

Based on the age factor, the mean age of employees in this study was 46.7 years (SD 7.99; CI 95%). According to the National and Jakarta Riskesdas in 2018, 40% of the population with diabetes have never checked their blood glucose, while less than 10% of diabetics in the age range of 35-55 years routinely check their blood glucose. [13,14]causing the pole inequality relations between men and women. Therefore, in this study wanted to dismantle the detail view of some theories, both social and feminist about gender relations in the family. Each of these theories (structural functional, conflict and feminist This is where the workplace actually plays the biggest role in promoting employee health, especially through periodic medical check-up programs, because the "obligation at work" factor is a fairly effective motivating factor for someone to have a check-up related to health, apart from physical complaints.[15,16] and has proposed effective coverage (EC. One study in a company named Aetna found that implementing an employee health program (Wellness Program), reduces health costs by an average of USD$ 122 per worker with metabolic syndrome.[16]

All employees in this study came from the formal sector, and 60% of the employees in this study were male. In 2021, the Central Bureau of Statistics reports that 43.49% of formal sector workers in Indonesia are male, and in DKI Jakarta, 61.74% of the workforce works in the formal sector.[6,14] The findings in this study are due to the fact that the sampling was carried out at medical check-up clinics that took contracts with companies located in one of Jakarta's Central Businees District Office Areas, so that no informal sector employees were screened. This requires special attention from the Department of Manpower, because the 2018 Riskesdas estimates that approximately 85% of people with DMT2 in Indonesia do not perform any regular glucose monitoring after they were diagnosed with diabetes; this figure is estimated to be even higher in informal sector workers who would rely on their own initiative and financing.[14]

In the lipid profile, as many as 92.9% of employees with diabetes have dyslipidemia. Based on Riskesdas data, 35.9% of the general population of Indonesia who are above 15 years of age have dyslipidemia, and 39.4% consume foods with high saturated fat more than once per day.[13,17] The prevalence of dyslipidemia in people with T2DM tends to be high (82.1% in the Riyadh population, 89% in the South African population), and is indeed higher than the general population; a cross-sectional study in a Chinese population found a dyslipidemia prevalence of 39.9% vs. 59.3% in the normal population compared to people with T2DM and 28.8% vs. 64% of the Indonesian population.[18–21] Based on the findings above, the workplace plays an important role in helping to monitor and control lipid profiles in employees with diabetes, especially because lipid profile is one of the factors that influence blood sugar control; In addition to periodic health checks, simple healthy lifestyle initiatives such as providing water dispensers, as well as consideration for providing healthier snacks/ catering during meetings/events at work, will greatly impact the health of said employee in the future.[16,22]

Our study had several notable strengths; firstly, we had a significant number of initial population sample

(2,796) with descriptive data similar to that of a national-scale governmental population study (Riskesdas). Secondly, the employees enrolled in our study originated from companies of various backgrounds (logistics, finance, mining, FMCG, governmental, IT, etc). However, we are also aware of several limitations; despite its large initial sample population, the requirement of having HbA1c examination performed on an employee with previous history of T2DM caused a significant decline in the final population of this study. Secondly, although this study took respondents within the last 5 years, it is cross-sectional in nature, where if employees undergo repeated annual check-ups, only their most recent data is used (no serial analysis). Furthermore, there is lack of integration of the system in which medical record data is kept, especially between that of the in-clinic laboratory and that of other divisions. Moreover, this study uses convenience sampling on secondary data, thus they may not accurately represent the condition of workers with diabetes throughout Indonesia, let alone Jakarta. Lastly, employees with diabetes whose fasting and 2-hour post-prandial blood glucose was examined but without HbA1c, were not included in this study population, so there is a possibility that this population were left out.

## Conclusion

This study pooled MCU results from 2015-2021, where 2,796 workers underwent HbA1c tests, of which more than one-fourth (29.6%) were pre-diabetic. Of those 2,796 respondents, 1,322 also underwent FBG examination in which almost a third (33.1%) were pre-diabetic, the results which aligns with a population-based governmental study. This highlights the importance of preventive efforts in the form of lifestyle and dietary changes in order to prevent further progression of this population to overt diabetes.

Of the respondents underwent Lipid Profile examination, 80.5% were dyslipidemic, with LDL being the worst component of the Lipid Profile (121 (20-267)). This further compounds the metabolic issue of the workers, emphasizing the importance of preventive efforts in the workplace to halt the progression to diabetes.

Of the workers with a history of Diabetes Mellitus from 2015-2021, less than half (45.2%) have optimal blood sugar control. This signifies that both healthy and diabetic workers require intervention; one to prevent progression to overt diabetes, and the other to better optimise their glycemic control. The workplace may hold a key role in optimising efforts in improving overall health of both healthy and diabetic workers.

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