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Risk of developing type 2 diabetes mellitus among cleaning staff in a Bolivian university

Riesgo de desarrollo de diabetes mellitus tipo 2 en personal de limpieza de una universidad boliviana

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ABSTRACT

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disease preventable through early detection and healthy habits, the risk of which can be assessed using the FINDRISC questionnaire. The objective of this research was to determine the risk of developing T2DM among cleaning staff at the Domingo Savio Private University in Bolivia. A descriptive, cross-sectional, and quantitative study was conducted. The FINDRISC questionnaire was administered to 22 workers during the first half of 2025. Anthropometric data, personal and family medical history, dietary habits, and physical activity were collected. The majority of participants were under 45 years of age (95.5%) and were either overweight (59.1%) or obese (9.1%). 68.2% did not consume fruits or vegetables daily, and 31.8% did not engage in regular physical activity. Abdominal circumference was elevated in 22.7% of participants. 68.2% presented a low risk, 13.6% a slightly elevated risk, another 13.6% a moderate risk, and 4.5% a high risk of developing T2DM in the next 10 years. Although the majority presented a low risk, factors such as abdominal obesity, sedentary lifestyle, and family history were identified as increasing the likelihood of developing T2DM. These results highlight the need to implement preventive strategies focused on healthy habits and regular check-ups in this study population.

Keywords: type 2 diabetes mellitus, abdominal obesity, sedentary lifestyle, primary prevention, dietary habits, metabolic risk.

RESUMEN

La diabetes mellitus tipo 2 (DM2) es una enfermedad metabólica crónica prevenible mediante detección temprana y hábitos saludables, cuyo riesgo puede evaluarse con el cuestionario FINDRISC. El objetivo de esta investigación fue determinar el riesgo de desarrollar DM2 en el personal de limpieza de la Universidad Privada Domingo Savio en Bolivia. Se realizó un estudio descriptivo, transversal y cuantitativo. Se aplicó el cuestionario FINDRISC a 22 trabajadores durante el primer semestre de 2025. Se recogieron datos antropométricos, antecedentes personales y familiares, hábitos alimentarios y actividad física. La mayoría de los participantes tuvo menos de 45 años (95,5 %) y presentó sobrepeso (59,1 %) u obesidad (9,1 %). Un 68,2 % no consumía frutas ni hortalizas diariamente y el 31,8 % no realizaba actividad física regular. La circunferencia abdominal estuvo elevada en un 22,7 %. El 68,2 % presentó un riesgo bajo, el 13,6 % riesgo ligeramente elevado, otro 13,6 % riesgo moderado y el 4,5 % riesgo alto de desarrollar DM2 en los próximos 10 años. Aunque la mayoría presentó riesgo bajo, se identificaron factores como obesidad abdominal, sedentarismo y antecedentes familiares que incrementan la probabilidad de desarrollar DM2. Estos resultados señalan la necesidad de implementar estrategias preventivas enfocadas en hábitos saludables y control periódico en esta población de estudio.

Palabras clave: diabetes mellitus tipo 2, obesidad abdominal, sedentarismo, prevención primaria, hábitos alimentarios, riesgo metabólico.

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INTRODUCTION

Diabetes is a metabolic disease characterized by hyperglycemia, which over time leads to serious micro- and macrovascular damage. The most common type is type 2 diabetes mellitus (T2DM), caused by insufficient insulin secretion or resistance to the action of insulin in the body (Galicia-Garcia et al., 2020). T2DM accounts for more than 90% of diabetes cases worldwide, and its prevalence continues to rise, especially in low- and middle-income countries, due to lifestyle changes and urbanization (Hoogeveen, 2022). Often, the likelihood of this disease being detected only in an advanced stage is high, due to its long latency period and a preclinical phase that is usually asymptomatic (Młynarska et al., 2025)

Lifelong diabetes management is essential due to its metabolic complications. These complications impair quality of life, generate high healthcare costs, and have a significant emotional impact on patients and their families (Losonczi et al., 2025). Therefore, prevention, along with early detection, is crucial to avoid the disease, its progression, and mitigate its numerous complications. In this context, disease prevention measures are vital. One tool developed to address this is the FINDRISC scale, based on eight variables related to lifestyle factors and anthropometric parameters, used to determine the risk of developing T2DM over 10 years (Pesaro et al., 2021). Since this is a validated tool that does not require blood samples, it is accessible, making it necessary to test its effectiveness in our population sample.

The prevalence of T2DM in relation to occupation is widely studied. Several studies have shown that occupations with less physical activity, such as office work or prolonged cleaning, are associated with a higher risk of developing insulin resistance and T2DM (Ramírez et al., 2025). In a study conducted in Sweden with more than 4.5 million employed individuals between 2001 and 2013 (Carlsson et al., 2020), the prevalence of T2DM was 5.2% in men and 3.2% in women. When analyzed by occupation, motor vehicle drivers had the highest prevalence among men (8.8%), while among women, it was highest in the manufacturing sector (7.20%) and cleaning staff (6.18%). These findings demonstrate significant differences between professions, suggesting that certain work environments may be associated with a higher risk of developing T2DM.

The consumption of junk food among cleaning staff at the university, coupled with the inflexible work schedules, significantly limits their ability to access and prepare healthy meals.

These factors contribute to poor dietary habits that may increase the risk of T2DM, highlighting the need for workplace interventions promoting healthier eating options and more flexible meal times (Gallardo & García, 2024). T2DM and hypertension (HTA) are often linked to the consumption of processed meats, such as sausages, which are high in nitrites. Nitrites, used as preservatives, are associated with increased risks of cardiovascular disease and insulin resistance, key contributors to T2DM and HTA. In response, the food industry is exploring alternatives to nitrites in meat processing to reduce their negative impact (García et al., 2011). However, limited access to healthier food options among cleaning staff may exacerbate these health risks, emphasizing the need for targeted interventions. The present work aimed to analyze the risk of developing T2DM by applying the FINDRISC questionnaire to the cleaning staff of the Domingo Savio Private University in Bolivia, a vulnerable population due to their irregular eating habits and lack of flexibility in their work schedules.

METHODOLOGY

This study was framed within an applied, quantitative, observational, descriptive, and analytical cross-sectional investigation. The validated FINDRISC (Finnish Diabetes Risk Score) questionnaire was used, a widely employed tool for estimating the risk of developing T2DM in the next 10 years (Pesaro et al., 2021), recommended by the International Diabetes Federation. The study population consisted of 22 cleaning staff members from the Domingo Savio Private University in Bolivia. Sampling was non-probabilistic and purposive, considering all available workers during the study period.

The inclusion criteria for the study were: being an active cleaning staff member at the institution; demonstrating voluntary willingness to participate by providing informed consent before the administration of the questionnaires; being willing to effectively complete the FINDRISC questionnaire; and being available for anthropometric measurements. The exclusion criteria included: individuals already diagnosed with T2DM by their physician; pregnant or breastfeeding women at the time of the study; individuals with pathologies that affect glucose metabolism; cleaning staff using medications that alter glucose metabolism; and participants who did not complete the questionnaires or refused any of the measurements required for the study.

The FINDRISC questionnaire consists of eight questions about factors such as age, BMI,

waist circumference, physical activity, diet, use of antihypertensive medications, history of elevated blood glucose, and family history of diabetes. Its score classifies the risk of developing T2DM as mild (7-12 points), moderate (13-19 points), and high (>20 points).

RESULTS AND DISCUSSION

A total of 22 cleaning staff members of the Domingo Savio Private University in Santa Cruz were surveyed during the first half of 2025. The collected information was organized and analyzed considering the variables of age, body mass index, abdominal circumference, level of physical activity, eating habits, family history of T2DM, and personal history of high blood glucose, to determine the level of risk according to the FINDRISC scale.

The study population was predominantly young, with 95.5% of participants under 45 years of age (Table 1). However, despite their youth, a high prevalence of excess weight was observed, with 59.1% being overweight and 9.1% obese. Particularly relevant, 50% of the workers presented with abdominal obesity, a direct marker of insulin resistance and an important predictor of T2DM and cardiovascular risk. Furthermore, 13.6% presented with elevated blood pressure or hypertension, reinforcing the presence of a high-risk metabolic profile.

Table 1. Anthropometric characteristics and blood pressure of the participants (n= 22)

Variable	Frequency (n)	Percentage
Age < 45 years	21	95.5
Overweight (BMI 25–30 kg/m^2)	13	59.1
Obesity (BMI > 30 kg/m^2)	2	9.1
Abdominal obesity	11	50.0
High blood pressure or hypertension	3	13.6

Nearly half of the participants (45.5%) presented a low risk of developing T2DM in the next 10 years, according to their total FINDRISC questionnaire score (Table 2). However, 27.2% of the sample showed a moderate to high risk, highlighting the existence of a vulnerable group within the apparently healthy population. An additional 9.1% fell into the slightly elevated risk category, indicating the presence of predisposing habits or factors that could be modified with early interventions. Overall, more than a third of the workers (36.3%) have some degree of risk that is not low, justifying preventive measures in the workplace.

Table 2. Risk level of developing DM2 according to the FINDRISC questionnaire (n = 22)

Risk level	Frequency (n)	Percentage
Low risk	10	45.5
Slightly elevated	2	9.1
Moderate risk	3	13.6
High risk	1	4.5

Of the 22 participants assessed using the FINDRISC scale, 15 (68.2%) presented a low risk of developing T2DM in the next 10 years (Figure 1). A slightly elevated risk and a moderate risk were observed in 3 people each (13.6%). Only one participant (4.5%) presented a high risk, which implies a considerable probability of developing T2DM if timely interventions are not taken. No participants were reported as being at very high risk.

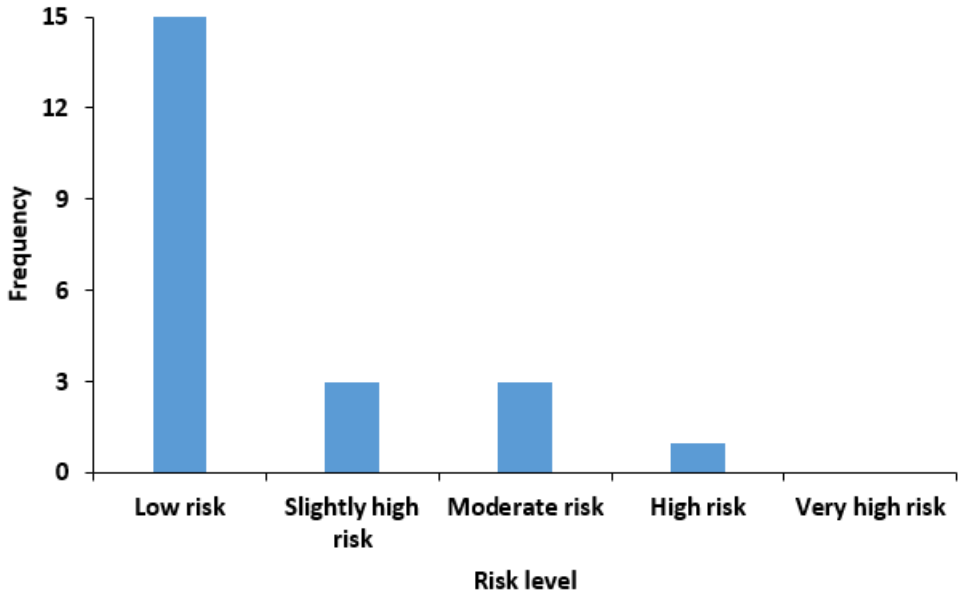

Figure 1. Risk level distribution according to FINDRISC (n= 22).

It was observed that 68.2% of the workers were overweight or obese according to BMI, indicating a high prevalence of nutritional deficiencies within the evaluated population. Furthermore, 50% of the participants presented with abdominal obesity, a condition that reflects the accumulation of visceral fat and is directly associated with a higher risk of insulin resistance and the development of T2DM. This pattern demonstrates the presence of relevant metabolic risk

factors, even in a predominantly young population. The combination of excess weight and abdominal obesity suggests an increased cardiometabolic risk profile, which is subsequently reflected in the risk levels identified using the FINDRISC test.

Among cleaning staff at Domingo Savio Private University, overweight and obesity, assessed using BMI and waist circumference, were identified as the main risk factors for developing T2DM. High risk of abdominal obesity was also identified, along with sedentary lifestyles and inadequate dietary habits, particularly low fruit and vegetable consumption. Furthermore, a significant number of workers reported a family history of diabetes, increasing the likelihood of developing the disease in the coming years. Based on the results of the FINDRISC questionnaire, it was determined that while most workers presented a low risk, a considerable percentage of the sample had a moderate to high risk of developing T2DM within 10 years. This result aligns with the findings of Carlsson et al. (2020), who found that cleaning staff were among the occupations with the highest prevalence of T2DM, with a risk up to three times greater than other professions, such as university professors and physical therapists, due to work-related and lifestyle factors.

It was identified that the majority of participants were under 45 years of age (95.5%), representing a relatively young population in which it is important to implement preventive strategies for avoiding progression to T2DM in later stages. This coincides with the findings reported by González et al. (2018), who highlighted that the application of the FINDRISC questionnaire in young adults is useful for detecting risk factors before metabolic complications.

Regarding BMI, more than half of the respondents were overweight, while 9.1% were in the obese range. This result is consistent with the findings of Carlsson et al. (2020). With respect to waist circumference, 40.9% of participants had values in the intermediate range, while 22.7% had measurements above the established cutoff values. This indicates visceral fat accumulation, which is directly associated with insulin resistance and significantly contributes to a higher FINDRISC score. In fact, other studies, such as those by Soprani et al. (2025) and Kokubun (2025), reported that abdominal obesity was also common among workers in industrial sectors, showing similarities to the results of the present study.

Regarding physical activity, although most participants indicated that they exercise daily,

31.8% reported not engaging in any regular physical activity, representing a significant risk factor. González et al. (2018) noted that physical inactivity is one of the factors that most increase the likelihood of developing T2DM. A total of 68.2% of individuals did not maintain an adequate daily intake of fruits and vegetables.

A relevant aspect was the history of antihypertensive medication use, since although only 4.5% of participants reported taking them, this is important because the presence of hypertension, combined with overweight and a sedentary lifestyle, increases the likelihood of developing T2DM. Furthermore, it was found that 4.5% of the workers had elevated blood pressure readings according to the European classification (Vischer et al., 2021). This is important because several of the factors assessed in the FINDRISC questionnaire, such as overweight, abdominal obesity, and lack of physical activity, increase the risk of T2DM and are closely related to the development of high blood pressure (Öhlin et al., 2023).

These results underscore the need for preventive interventions to address the potential development of cardiovascular and metabolic complications in the medium term. Regarding a history of elevated blood glucose, 13.6% reported having had high values in at least one blood glucose test, making them a priority group for metabolic monitoring. Finally, concerning family history, 36.4% of the workers reported a family history of T2DM in first-degree relatives, increasing the genetic predisposition and aligning with the findings of Jiménez-Corona et al. (2013), who reported that a family history of T2DM doubles the future risk of developing the disease.

These results demonstrate that, although the majority presented a low risk, there is a considerable percentage (31.7%) of participants at slightly elevated, moderate, and high risk of developing T2DM within 10 years, requiring specific preventive interventions aimed at modifying the identified risk factors. Interventions based on nutritional education and physical activity in the workplace have been shown to reduce FINDRISC risk scores in populations at low to moderate risk (Gea et al., 2021; Jiménez-Cano et al., 2025).

CONCLUSIONS

Although most participants presented a low risk according to the FINDRISC questionnaire, a high prevalence of overweight (68.2%) and abdominal obesity (50%) was observed, conditions

directly related to insulin resistance and a progressively increased risk of T2DM. Furthermore, the presence of a family history, inadequate dietary habits, and insufficient levels of physical activity reinforce the vulnerability of this group. This highlights the importance of implementing workplace health promotion and prevention programs aimed at encouraging healthy eating, regular physical activity, and periodic monitoring of metabolic indicators, thereby reducing the future incidence of T2DM, improving the quality of life of employees, and decreasing the associated healthcare burden.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

AUTHOR CONTRIBUTIONS

Conceptualization: Pamela I. Noriega and Carlos D. Llanos. **Data curation:** Mabella Campos and Sergio G. Roca. **Formal analysis:** Pamela I. Noriega and Carlos D. Llanos. **Investigation:** Pamela I. Noriega, Carlos D. Llanos, Mabella Campos, and Sergio G. Roca. **Methodology:** Pamela I. Noriega. **Writing – original draft:** Pamela I. Noriega, Carlos D. Llanos, Mabella Campos, and Sergio G. Roca. **Writing – review & editing:** Pamela I. Noriega, Carlos D. Llanos, Mabella Campos, and Sergio G. Roca.

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