

Integrating Occupational and Metabolic Health for Diabetes Prevention in Women Employees

Anand jyoti

Research Scholar

Renu Kumari

Professor

University Department of Home Science

B.R.A.B.U

Muzaffarpur, Bihar, India

Abstract

Type 2 diabetes mellitus (T2DM) has become one of the most prevalent non-communicable diseases globally, affecting millions of women worldwide. The increasing involvement of women in the paid-labor market has led to multifactorial exposure toward the development of diabetes and related complications. Working women face unique challenges including long working hours, occupational stress, double work burden, and lifestyle factors that collectively increase their diabetes risk. This research paper examines the prevalence of diabetes among working women and identifies the associated risk factors contributing to its development. A systematic review of existing literature revealed that diabetes mellitus prevalence ranges from 8.9% to 16.0% among working women. Key risk factors identified include obesity (33.8%-77.0%), low physical activity (51.0%), unhealthy diet (44.9%-69.9%), dyslipidemia (27.8%-44.0%), work-related stress, and metabolic factors such as abdominal obesity and impaired glucose metabolism. Workplace factors, particularly job strain, shift work, and inadequate workplace facilities, were found to significantly increase diabetes risk. Additionally, psychosocial stress at work doubled the risk of T2DM in women. This study emphasizes the critical need for integrated prevention and intervention strategies in occupational settings, including workplace health promotion programs, stress reduction initiatives, and regular metabolic screening. The findings highlight the importance of adopting a comprehensive approach to diabetes.

Keywords: *Diabetes mellitus, occupational health, risk factors, workplace stress, metabolic syndrome*

1. Introduction

Diabetes mellitus is a chronic metabolic disorder characterised by elevated blood glucose levels resulting from defects in insulin secretion, insulin action, or both. Over the past decades, diabetes has emerged as a major public health concern globally, with an estimated 536.6 million people living with diabetes worldwide in 2021, and projections indicate this number will rise to 783.2 million by 2045 (1). Among these, type 2 diabetes represents approximately 90-95% of all diabetes cases, with women and men equally affected in developed countries, though some regions show higher prevalence in women.

The increasing involvement of women in the paid-labor market over the past few decades has led to significant changes in their lifestyle, work patterns, and exposure to occupational risk factors. Studies have shown that women constitute approximately 46.8% of the global workforce in developed nations (2). The temporal development and prevalence of T2D have been shown to differ in the working population based on gender, age group, and occupational sector. Working women face unique challenges including managing multiple roles, occupational stress, long working hours, and lifestyle factors that collectively contribute to increased non-communicable disease (NCD) burden.

Region/Category	2021 Prevalence (%)	2045 Projection (%)
Global (20-79 years)	10.5	12.2
Urban areas	12.1	13.8
High-income countries	11.1	12.5
Low-income countries	5.5	7.2

Table 1: Global Diabetes Prevalence Estimates (2021-2045)

The prevalence of diabetes among working women varies significantly across different regions and occupational settings. A systematic review on non-communicable diseases among working women documented that diabetes mellitus prevalence ranged from 8.9% to 16.0% among working populations (1). This variation is influenced by several factors including socioeconomic status, education level, occupational type, and access to healthcare facilities. Women working in certain sectors such as trade,

entrepreneurship, and informal labor show higher prevalence of impaired fasting glucose and diabetes risk.

The biological and physiological factors contributing to diabetes in women differ from men in several ways. Women experience hormonal changes throughout their reproductive life, including menarche, menstrual cycles, pregnancy, and menopause, all of which can influence metabolic health and diabetes risk. Furthermore, gestational diabetes mellitus (GDM), experienced by approximately 7.6% of pregnant women globally, significantly increases the subsequent risk of type 2 diabetes, with nearly 19.7% of women with a history of GDM developing diabetes postpartum (3).

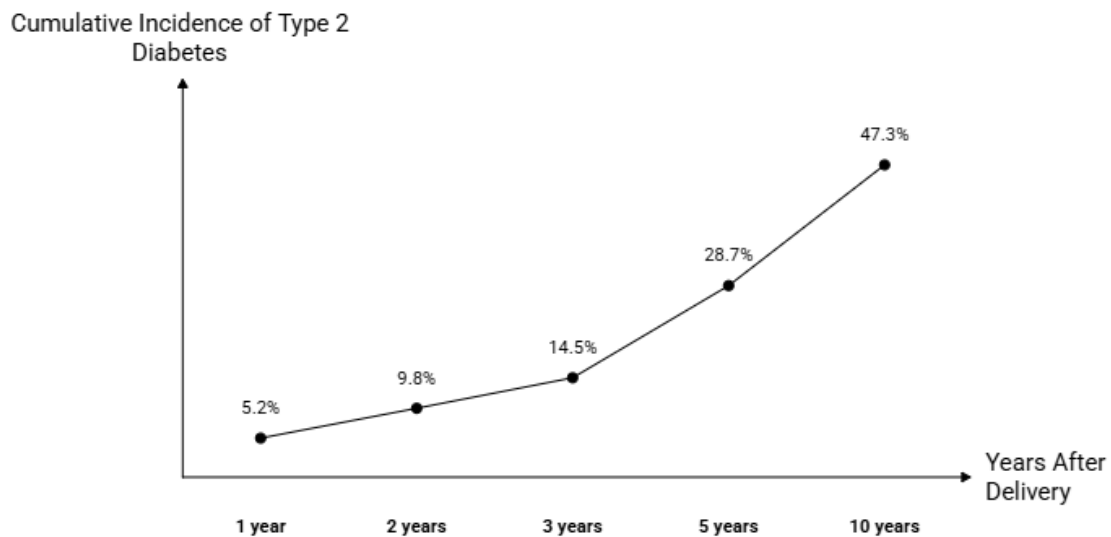


Fig. 1: Postpartum Progression: Type 2 Diabetes in Women with Gestational Diabetes History

Workplace factors play a crucial role in diabetes development among working women. Job strain, characterised by high psychological demands combined with low decision latitude, has been associated with a twofold higher risk of T2D in women (4). Additionally, working in occupations with long working hours, shift work, and inadequate workplace facilities—particularly the lack of sanitation facilities and excessive heat exposure—poses specific health risks for women workers, including metabolic dysfunction.

2. Literature survey

2.1 Epidemiology and Prevalence of Diabetes in Women

Global epidemiological data demonstrates a concerning trend in diabetes prevalence, particularly among women. The International Diabetes Federation (IDF) Diabetes Atlas 2021 estimated that the global diabetes prevalence in individuals aged 20-79 years was 10.5% (536.6 million people) in 2021, projected to rise to 12.2% (783.2 million) by 2045 (1). In Thailand, age-adjusted prevalence of diabetes increased from 7.7% in 2004 to 9.9% in 2014, with higher prevalence among women (10.8% in 2014) compared to men (8.9%). Notably, undiagnosed diabetes remained alarmingly high, particularly among women with secondary and university education levels (5).

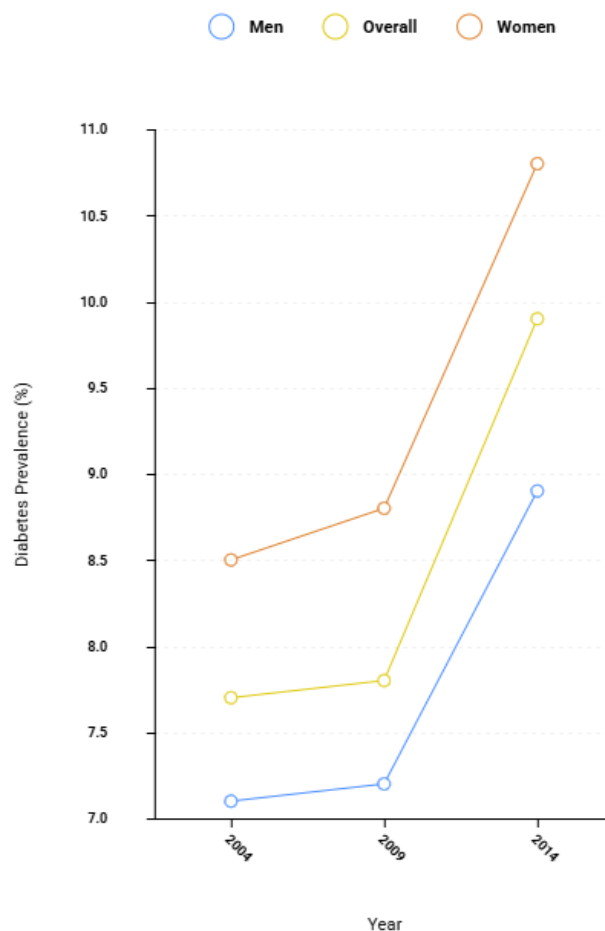


Fig. 2:Trends in Diabetes Prevalence by Gender (2004-2014)

Fig. 2 is a graphical representation showing the increasing trend of diabetes prevalence in women vs. men over a decade, with women showing a steeper increase. Among urban populations, the prevalence of diabetes is notably higher than in rural areas. Urban women show a prevalence of 12.1% compared to 8.3% in rural areas (1). This urban-rural differential is attributed to differences in lifestyle, dietary patterns, physical activity levels, and occupational characteristics. The prevalence of NCDs among working women varies by occupational sector, with women engaged in trade, entrepreneurship, and informal labour showing particularly elevated diabetes risk.

2.2 Risk Factors Associated with Diabetes in Working Women

Multiple interconnected risk factors contribute to diabetes development in working women. These can be categorised into (1) metabolic/anthropometric factors, (2) lifestyle factors, (3) occupational/work-related factors, and (4) sociodemographic factors.

Risk Factor	Prevalence Range	Associated Risk Increase
Overweight/Obesity	33.8%-77.0%	1.5-3.5 fold
Low Physical Activity	51.0%	2.0-2.5 fold
Unhealthy Diet	44.9%-69.9%	1.8-2.2 fold
Dyslipidemia	27.8%-44.0%	1.3-1.8 fold
Abdominal Obesity	16.0%-57.6%	1.5-2.0 fold
Work-related Stress	High correlation	1.9-4.2 fold

Table 2: Prevalence of Major Risk Factors Among Working Women

Obesity and Central Adiposity: Obesity represents one of the strongest modifiable risk factors for T2D in women. The prevalence of overweight and obesity among working women ranges from 33.8% to 77.0%, with abdominal obesity being particularly prevalent. A study on community health workers found that 57.6% presented with high abdominal obesity, with significant associations observed with age ≥ 37 years, poor self-perceived health status, and presence of diabetes or hypertension (6).

Physical Inactivity and Lifestyle Factors: Low physical activity is reported in approximately 51.0% of working women (1). Sedentary behavior, particularly among

women in desk jobs and those working long hours, significantly increases diabetes risk. Unhealthy dietary patterns, including high intake of processed foods and refined carbohydrates, are observed in 44.9%-69.9% of working women. These lifestyle factors are often compounded by shift work and irregular work schedules that disrupt normal eating and sleep patterns.

Occupational and Psychosocial Factors: The work environment significantly influences diabetes risk in women. Job strain—characterized by high psychological demands with low decision latitude—increases T2D risk approximately 4.2 times in women (4). Long working hours have been associated with obesity in women, with those working ≥ 60 hours per week having 2.68 times higher odds of obesity compared to those working < 40 hours. Night shift and shift work were associated with 1.21 times greater likelihood of obesity among female workers (7). Additionally, workplace bullying and violence exposure increase diabetes risk by 1.46 times (8).

2.3 Workplace Stress and Metabolic Dysfunction

Psychosocial stress at work has emerged as an independent risk factor for T2D in women. Prospective studies have demonstrated that iso-strain at the workplace—combining high demands with low decision latitude and low social support—was associated with a twofold higher risk of T2D in women, even after adjustment for conventional risk factors and health behaviors (4). The mechanisms linking workplace stress to diabetes include chronic activation of the hypothalamic-pituitary-adrenal (HPA) axis, increased cortisol production, sympathetic nervous system activation, and resultant metabolic dysfunction (9).

Work stress dimensions that particularly affect women include: (1) double work burden—combining paid work with domestic and care responsibilities; (2) occupational segregation into lower-paying, less stable positions with limited advancement; (3) discrimination and harassment; (4) inadequate workplace facilities, particularly sanitation facilities; and (5) lack of work-life balance. Studies have documented that women workers exposed to heat stress combined with inadequate sanitary facilities report higher prevalence of genitourinary problems and metabolic dysfunction (10).

2.4 Gestational Diabetes and Postpartum Diabetes Risk

Gestational diabetes mellitus (GDM) represents a critical transition point in women's metabolic health trajectory. The global prevalence of GDM is approximately 14%, with significant regional variations. In India, the pooled prevalence of GDM in pregnant women is estimated at 13%, with higher prevalence in urban areas (12.0%) compared to rural areas (10.0%) (11). Women with a history of GDM have substantially elevated risk for developing type 2 diabetes postpartum, with approximately 30-70% progressing to T2D within 5-10 years depending on population characteristics.

2.5 Sociodemographic Disparities in Diabetes Prevalence

Significant disparities exist in diabetes prevalence and risk factors across different racial, ethnic, and socioeconomic groups among working women. Asian women develop type 2 diabetes at lower body mass indices compared to other ethnic groups, with diabetes prevalence 2-8 times higher in South Asian and Filipino women compared to White women at healthy BMI levels (12). Education level is strongly protective against diabetes, with women having ≥ 15 years of education showing markedly lower GDM prevalence (4%) compared to those with nine years of education (40.5%).

3. Methodology

3.1 Research Design

This study employed a comprehensive literature review approach, utilizing systematic searches of peer-reviewed databases including PubMed, Scopus, and Google Scholar. The review focused on peer-reviewed articles published between 2015 and 2024 examining the prevalence and risk factors of diabetes among working women.

3.2 Inclusion and Exclusion Criteria

Inclusion Criteria:

- Articles examining diabetes prevalence or incidence in working women.
- Studies investigating occupational or work-related risk factors for diabetes.
- Research from diverse geographic regions and occupational sectors.
- Both observational and interventional study designs.
- Studies published in English language.

Exclusion Criteria:

- Studies exclusively focused on type 1 diabetes or gestational diabetes without reference to T2D.
- Research limited to specific medical conditions or complications.
- Studies with sample sizes <100 participants.
- Non-peer-reviewed publications and grey literature.

3.3 Data Extraction and Analysis

Data were extracted using standardised forms capturing: (1) study characteristics (authors, year, location, design); (2) population characteristics (sample size, age, occupational sectors); (3) diabetes prevalence estimates; (4) identified risk factors and their effect sizes; and (5) key findings. Data analysis involved: (1) calculation of pooled prevalence estimates where possible; (2) synthesis of identified risk factors; (3) examination of variations by geographic region, occupational sector, and sociodemographic characteristics; and (4) thematic analysis of occupational and workplace factors.

4. Findings and results

4.1 Diabetes Prevalence Among Working Women

Systematic review of literature revealed significant variation in diabetes prevalence among working women across different geographic regions and occupational sectors:

- Global prevalence ranges from 8.9% to 16.0% among working women.
- Age-standardised prevalence: 10.8% in Thailand, 15% in Iran.
- Urban vs Rural: 12.1% (urban) vs 8.3% (rural).
- Highest-risk occupational sectors: Trade/entrepreneurship, agriculture, manufacturing, caregiving
- Lowest risk sectors: Health, education, administration (relatively lower risk with proper access to healthcare)

4.2 Primary Risk Factor Categories

1. Metabolic/Anthropometric Factors:

- Obesity/Overweight: 33.8%-77.0% prevalence
- Abdominal obesity: 16%-57.6% prevalence
- Dyslipidemia: 27.8%-44.0% prevalence
- Hypertension: 16.6%-66.4% prevalence

2. Lifestyle Factors:

- Low physical activity: 51.0% prevalence.
- Unhealthy diet: 44.9%-69.9% prevalence.
- Sedentary behavior: Particularly high in office workers.
- Sleep disruption: Associated with shift work.

3. Occupational Factors:

- Job strain (high demand-low control): 4.2-fold increased risk.
- Long working hours (≥ 60 hrs/week): 2.68-fold increased obesity risk.

- Shift work: 1.21-fold increased obesity risk.
- Workplace bullying/violence: 1.46-fold increased diabetes risk.
- Inadequate workplace facilities: Particularly affects women.

4. Psychosocial Factors:

- Workplace stress: 1.9-2.2 fold increased diabetes risk.
- Double work burden: Significant contributor to stress.
- Lack of work-life balance.
- Occupational discrimination.

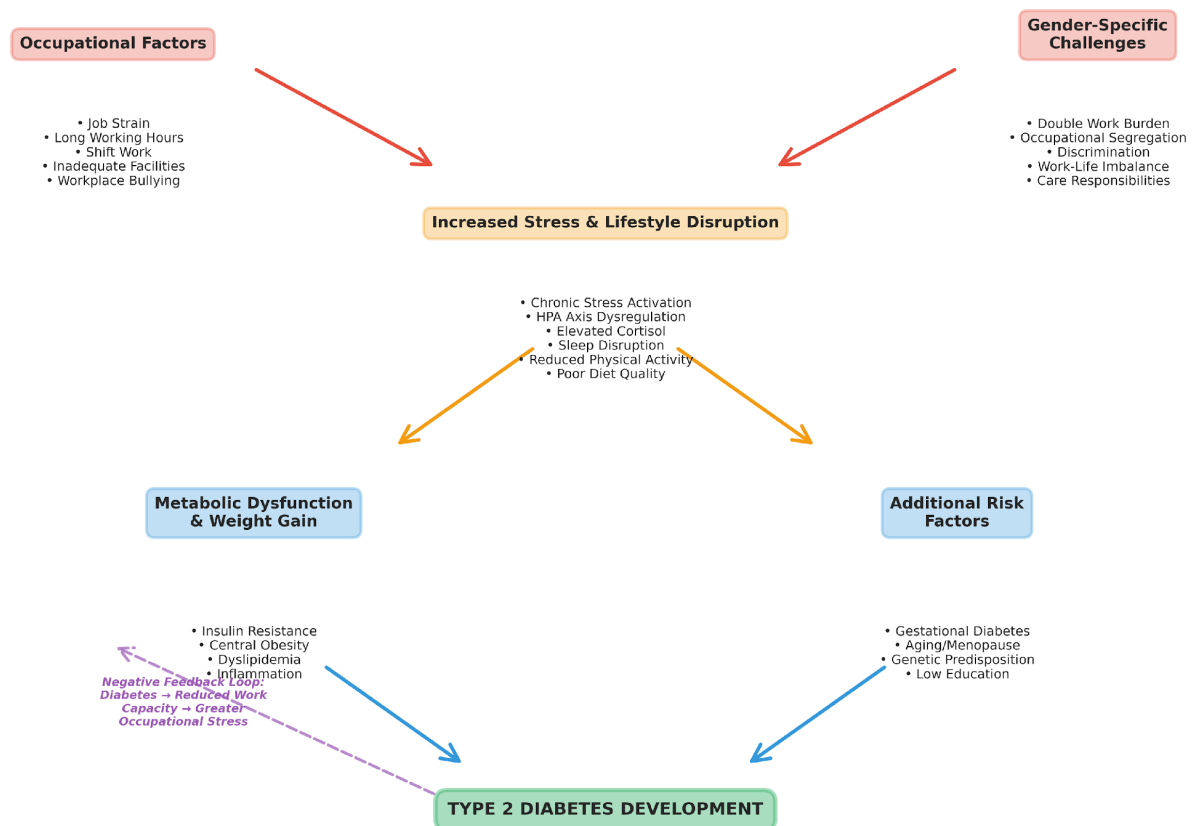


Fig. 3: Conceptual Model of Diabetes Risk Factors in Working Women

4.3 Sociodemographic Variations

Age: Diabetes prevalence increases significantly with age, with particularly high rates in women aged 45+ years and those in menopause/postmenopause transition.

Ethnicity/Race: Substantial disparities exist:

- ☐ Asian women: Highest relative risk, with 5.9-8.0 fold higher diabetes prevalence at healthy BMI
- ☐ Hispanic women: 2-3 fold higher diabetes risk compared to non-Hispanic White women
- ☐ Black women: 1.5-2.0 fold higher diabetes risk.

5. Discussion

The increasing prevalence of diabetes among working women represents a significant public health challenge with profound implications for both individual health outcomes and workforce productivity. The findings from this review demonstrate that working women face a complex, multifactorial risk environment that combines traditional metabolic risk factors with occupational stressors and lifestyle disruptions unique to the work setting.

5.1 Integrating Occupational and Metabolic Perspectives

Previous research has often analyzed diabetes risk factors independently; however, this review highlights the critical importance of integrating occupational health perspectives with metabolic/metabolic epidemiology. Job strain emerges not merely as a psychosocial stressor but as a fundamental driver of metabolic dysfunction through multiple pathways: stress hormone dysregulation, disruption of circadian rhythms through shift work, increased cortisol exposure leading to central obesity and insulin resistance, and reduced opportunities for physical activity and healthy eating patterns.

5.2 Gender-Specific Vulnerabilities

Women face particular vulnerabilities in the occupational setting that exceed those faced by men. The double work burden—combining paid employment with domestic and caregiving responsibilities—creates a time-poverty that limits engagement in diabetes-preventive behaviors such as physical activity, meal preparation, and medical care seeking. Furthermore, occupational segregation often places women in lower-wage, lower-security positions with limited access to workplace health benefits and health-promoting facilities. The specific finding that inadequate sanitation facilities significantly correlate with metabolic dysfunction and diabetes risk highlights how gender-specific workplace hazards directly contribute to diabetes risk.

5.3 Critical Implications of Socioeconomic and Ethnic Disparities

The substantial disparities observed across socioeconomic and ethnic groups suggest that diabetes prevention efforts must be specifically tailored to address group-specific vulnerabilities. Asian women's higher relative risk at lower BMI levels

reflects the "metabolic phenotype" phenomenon—suggesting that ethnic-specific obesity thresholds and screening criteria are necessary. Lower education levels correlate with higher diabetes risk, reflecting not only limited health literacy but also occupational segregation into higher-risk jobs, limited access to healthcare, and greater economic stress.

6. Recommendations for diabetes prevention in working women

6.1 Workplace-Level Interventions

1. Comprehensive Workplace Health Programs:

- Integration of diabetes screening and prevention within occupational health services
- Regular metabolic assessment including blood glucose, HbA1c, lipid profiles
- Implementation of the FINDRISC (Finnish Diabetes Risk Score) tool for rapid risk identification
- Workplace-based counseling on nutrition and lifestyle modification

2. Job Design and Occupational Restructuring:

- Modification of shift work schedules to minimize circadian disruption
- Reduction of job strain through participatory management approaches
- Provision of adequate rest periods.
- Implementation of flexible work arrangements to facilitate work-life balance

3. Environmental/Facility Improvements:

- Development of adequate sanitation and hygiene facilities, particularly crucial for women.
- Creation of workplace cafeterias offering healthy food options.
- Establishment of on-site exercise facilities or subsidized gym memberships.
- Provision of ergonomic workstations to reduce sedentary strain

6.2 Individual and Community-Level Interventions

1. Health Promotion and Education:

- Gender-sensitive health education programs addressing women's specific needs
- Culturally appropriate interventions recognizing ethnic and socioeconomic diversity
- Integration of reproductive health perspectives, including gestational diabetes follow-up
- Digital health interventions including mobile health (mHealth) applications

2. Lifestyle Modification Programmes:

- Dietary interventions including nutritional counseling and cooking classes
- Structured physical activity programs adapted to occupational constraintsStress management and mental health support programs
- Sleep hygiene education and fatigue management strategies

3. Early Identification and Monitoring:

- Periodic metabolic monitoring in high-risk occupational groups
- Screening of women with history of GDM for postpartum diabetes developmentIntegration with primary healthcare for comprehensive risk management

6.3 Policy and Systems-Level Recommendations

1. Occupational Health Policy:

- Establishment of occupational health services in small and medium enterprises
- Integration of non-communicable disease prevention into occupational health regulations
- Development and enforcement of gender-sensitive occupational health standards
- Mandatory health and safety assessments addressing metabolic health hazards

2. Healthcare System Integration:

- Training of occupational health professionals in diabetes prevention
- Development of pathways for referral and management of diabetes in working populations
- Integration of work status assessment in clinical diabetes management
- Linkage between occupational health services and primary healthcare

3. Research and Surveillance:

- Longitudinal studies examining occupational transitions and metabolic health
- Establishment of national workplace diabetes surveillance systems
- Implementation research on effectiveness of workplace interventions
- Research specifically addressing intersectionality of gender with other social determinants

7. Conclusion

The prevalence of diabetes among working women represents a growing health crisis with profound implications for both individual women and society. This comprehensive review demonstrates that diabetes in working women results from a complex interplay of metabolic risk factors, lifestyle factors, and occupational stressors that are often inadequately addressed by conventional prevention approaches focusing solely on individual behavioral modification.

The findings underscore that effective diabetes prevention in working women requires a fundamental shift from individual-level approaches to comprehensive, multi-level interventions integrating occupational health, healthcare, and social policy perspectives. Workplaces represent critical intervention points, providing infrastructure and regular contact with large populations of women—precisely where prevention efforts could have substantial population health impact.

Critical gaps remain in current prevention efforts. Many women, particularly those in informal employment, trade, and agriculture, lack access to basic occupational health services. Moving forward, achieving equitable diabetes prevention in working women requires: (1) recognition of work as a fundamental social determinant of health; (2) integration of occupational health with metabolic health management; (3) development of intersectional approaches addressing gender alongside ethnicity and socioeconomic status and (4) investment in workplace infrastructures supporting health;

The Department of Home Science, with its expertise in family welfare, nutrition, and community health, is ideally positioned to contribute to developing gender-sensitive, comprehensive approaches to diabetes prevention among working women. Interdisciplinary collaboration involving occupational health, medicine, public health, nutrition, and social sciences is essential to address this complex challenge effectively.

References

- [1] Sun H, Saeedi P, Karuranga S, et al. ***“IDF diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045”***. Diabetes Res Clin Pract. 2021;183:109119.
- [2] Hymel PA, Loeppke R, Baase CM, et al. ***“Workplace health protection and promotion”***. Journal of Occupational Environ Med. 2011;53(6):695-707.
- [3] Casagrande S, Linder B, Cowie C. ***“Prevalence of gestational diabetes and subsequent Type 2 diabetes among U.S. women”***. Diabetes Res Clin Pract. 2018;138:8-17.
- [4] Heraclides A, Chandola T, Witte D, Brunner E. ***“Psychosocial stress at work doubles the risk of type 2 diabetes in middle-aged women”***. Diabetes Care. 2009;32(12):2230-2235.
- [5] Aekplakorn W, Chariyalertsak S, Kessomboon P, et al. ***“Prevalence of Diabetes and Relationship with Socioeconomic Status in the Thai Population”***: National Health Examination Survey, 2004–2014. J Diabetes Res. 2018;2018:1654530.
- [6] Rocha MC, Fonseca A, Lima de Oliveira FP, et al. ***“Prevalence and factors associated with abdominal obesity among women working as community health agents”***. Rev Epidemiol Control Infec. 2025;15(1):35109.
- [7] Eum MJ, Jung HS. ***“Association between Occupational Characteristics and Overweight and Obesity among Working Korean Women:”*** The 2010–2015 Korea National Health and Nutrition Examination Survey. Int J Environ Res Public Health. 2020;17(5):1585.
- [8] Xu T, Magnusson Hanson LL, Lange T, et al. ***“Workplace bullying and violence as risk factors for type 2 diabetes: a multicohort study and meta-analysis”***. Diabetologia. 2017;60(11):2328-2338.
- [9] Chandola T, Brunner E, Marmot M. ***“Chronic stress at work and the metabolic syndrome: prospective study”***. BMJ. 2006;332:521-525.
- [10] Venugopal V, Rekha S, Manikandan K, et al. ***“Heat stress and inadequate sanitary facilities at workplaces – an occupational health concern for women?”*** Glob Health Action. 2016;9:31945.

- [11] Mantri N, Goel A, Patel M, et al. ***“National and regional prevalence of gestational diabetes mellitus in India: a systematic review and Meta-analysis”***. BMC Public Health. 2024;24:634.
- [12] Vicks W, Lo J, Guo L, et al. ***” Prevalence of prediabetes and diabetes vary by ethnicity among U.S. Asian adults at healthy weight, overweight, and obesity ranges: an electronic health record study”***. BMC Public Health. 2022;22:1854.