WEP Warwick Evans Publishing

International Journal of Public Health and Medical Research
ISSN: 3006-7707 (Print), ISSN: 3006-3752 (Online) | Volume 2, Number 3, Year 2024
DOI: https://doi.org/10.62051/ijphmr.v2n3.15
Journal homepage: https://wepub.org/index.php/IJPHMR/index

The Impact of Socioeconomic Status on Diabetes Prevalence: A Systematic Review and Meta-Analysis

Jixiao Liu [a], Yecheng Ma [b]

School of Mathematics, Shanghai University of Finance and Economics, Shanghai, 200433, China
[a] 1297049157@qq.com; [b] 2418529449@qq.com

ABSTRACT

This study explores the impact of socioeconomic status (SES) on diabetes prevalence through a meta-analysis. We systematically searched PubMed, Cochrane Library, and Google Scholar databases, and used random-effects models to calculate pooled odds ratios (ORs) and 95% confidence intervals (CIs). We conducted heterogeneity tests, publication bias analysis, sensitivity analysis, and assessed the quality of literature using GRADE. Results showed that individuals with low SES had a significantly higher risk of diabetes compared to those with high SES (OR=1.61, 95%CI: 1.10-2.69). Blue-collar workers (OR=1.72, 95%CI: 1.10-2.69) and manual laborers (OR=1.85, 95%CI: 1.32-2.59) also had significantly higher diabetes risk compared to white-collar workers and non-manual laborers. No significant differences were found in analyses of education and income levels. This meta-analysis examined the impact of SES on diabetes prevalence, and while some individual factors did not show statistical significance, an overall association between SES and diabetes risk was observed.

KEYWORDS

Diabetes prevalence; SES; Education; Income; Occupation

1. INTRODUCTION

Diabetes Mellitus is an increasingly serious global public health problem, especially in low- and middle-income countries where diabetes prevalence is rapidly rising [2]. For example, studies in countries like Egypt and South Africa have shown that social and economic inequalities lead to high incidence rates of diabetes [2, 3]. Diabetes not only increases the health burden on individuals but also places enormous pressure on national healthcare systems and economies [1]. Socioeconomic status (SES) refers to an individual's economic and social position, usually measured by indicators such as education, income, and occupation [4]. Previous studies have shown that lower socioeconomic status is significantly associated with diabetes prevalence, but the associations in different regions and populations still show inconsistent conclusions [5, 6].

For instance, studies have shown that in Asian countries such as Thailand and China, people with lower socioeconomic status have higher rates of diabetes [5, 6, 9]. However, in some high-income countries and regions, the influence of socioeconomic factors appears more complex, with different income and education levels potentially having varying impacts on diabetes risk [7, 8]. These inconsistencies may be related to differences in study design, definition criteria, and statistical methods [11]. Furthermore, risk factors for diabetes, such as unhealthy lifestyles, obesity, and chronic stress, play different roles in various socioeconomic backgrounds [13, 14].

Therefore, this study aims to systematically evaluate the association between socioeconomic status and its various dimensions, such as education level, income level, and occupational classification, with diabetes prevalence through meta-analysis. The study will also assess the consistency and heterogeneity of these socioeconomic factors across different studies, thereby providing more targeted evidence for the formulation of diabetes prevention strategies [17-19].

2. METHODS

The review was registered in PROSPERO (https://www.crd.york.ac.uk/PROSPERO/, identifier CRD42024595996).

2.1. Search Strategy

Literature search was conducted through PubMed, Cochrane Library, and Google Scholar databases, until August 2024 with no restriction to calendar date. The search keywords included "diabetes," "prevalence," "socioeconomic status," "education level," "occupation," and "income." The language was limited to English and Chinese, and the literature search was conducted according to pre-set inclusion and exclusion criteria. Additionally, the reference lists of the retrieved articles were checked to find further relevant studies. The literature search was conducted jointly by two authors.

2.2. Data Extraction

After determining the study selection, we extracted the following characteristic information from each article: title, study variables, sample size, number of cases, study results, odds ratios (ORs) and their corresponding 95% confidence intervals (CIs), and adjusted variables. When a study used PR values instead of OR values, PR values were used as an approximation for OR values. If a study only provided separate risk estimates for male and female participants, we combined the OR values using a fixed-effects model before including them in the meta-analysis. When the classification standards for variables were not entirely consistent across studies, OR values were integrated using a fixed-effects model before inclusion in the meta-analysis to standardize the criteria.

2.3. Quality Assessment

We used the GRADE (Grading of Recommendations Assessment, Development, and Evaluation) system to assess the quality of the 40 included studies. GRADE is a widely recognized method for evaluating the quality of evidence and determining the strength of recommendations. Its advantages lie in its systematic, transparent, and comprehensive approach, which helps researchers and decision-makers better understand and interpret the reliability of evidence. Our assessment covered five key aspects: risk of bias, inconsistency, imprecision, indirectness, and publication bias. This multi-dimensional evaluation method allowed us to comprehensively grasp the overall quality of the included studies, providing a solid foundation for subsequent analysis and conclusions.

2.4. Statistical Analysis

This study employed random-effects models for meta-analysis to calculate pooled odds ratios (ORs) and 95% confidence intervals (CIs). Random-effects models are suitable for situations with heterogeneity or inconsistent results across studies, allowing for more accurate estimation of overall effects. Heterogeneity between studies was assessed using Q statistic, I^2 statistic, and p-value, with an I^2 value greater than 50% suggesting substantial heterogeneity. To explore the impact of different variables on diabetes prevalence, we conducted subgroup analyses based on socioeconomic status (SES), education level, income, and occupation type. The specific classifications were as follows:

SES: Low SES, Medium SES, and High SES groups

Education level: No education/Lowest education level, Primary, Secondary, and Higher education groups

Income: Low income, Medium income, and High income groups

Occupation type: Classified according to ISCO-08 (International Standard Classification of Occupations 2008), including low-level occupations, medium-level occupations, and high-level occupations; managers (including government and administrative personnel), professionals (high-level technicians, scientific professionals, teachers, etc.), service industry (including farmers, salespeople, craftsmen, etc.); blue-collar and white-collar; manual labor and non-manual labor.

Additionally, we used Egger's test and funnel plots to assess the presence of publication bias. Sensitivity analysis was conducted by excluding studies with high risk of bias or comparing different analytical methods to check the robustness of the results. Through these methods, we aim to gain a more comprehensive understanding of the impact of various factors on diabetes prevalence and ensure the reliability and accuracy of the results.

3. RESULTS

Out of 15,618 records identified by the literature search, 64 full-text articles were assessed in detail as they reported on one or more of the socioeconomic factors (SES, education, income, occupation) and their association with type 2 diabetes (T2D) prevalence.

Forty studies were included in the meta-analysis: 4 for SES (References 1, 12, 25, 32), 33 for education (References 2–11, 13–24, 25, 26, 28–30, 32–34, 37, 39, 40), 20 for income (References 6–9, 11, 15, 16, 18, 21, 22, 26, 28–34, 39, 40), and 18 for occupation (References 15, 19, 20, 22–26, 29–32, 34–39). These studies cover various subgroups of socioeconomic status, education levels, income brackets, and occupational categories, allowing for a comprehensive assessment of the relationship between these factors and T2D prevalence.

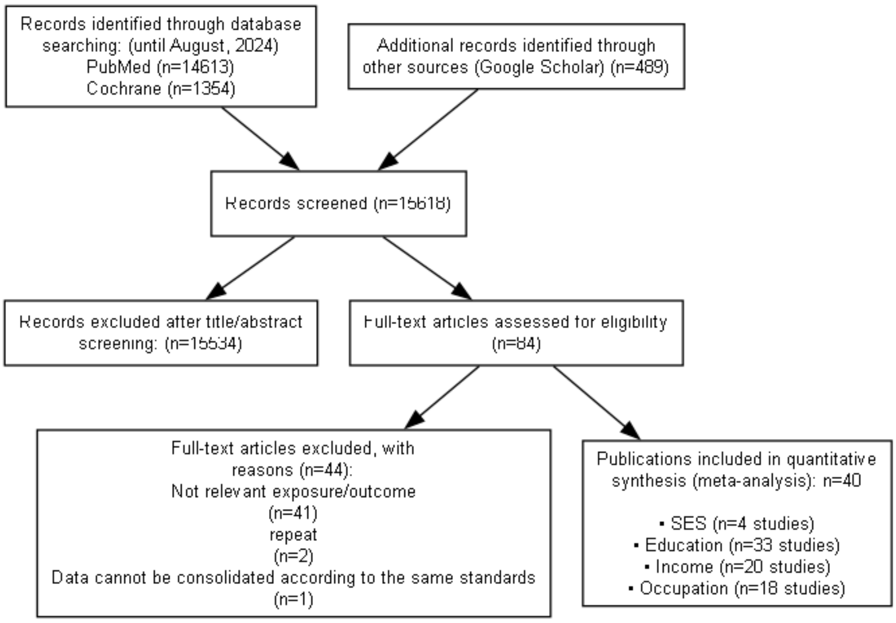

Figure 1. Flow Diagram for Study Selection

3.1. The Impact of Socioeconomic Status (SES) on Diabetes Prevalence

In this meta-analysis, we evaluated the impact of different socioeconomic status (SES) levels on diabetes prevalence. SES was divided into low, medium, and high groups, with high SES as the reference group. Using a random-effects model, results showed that the low SES group had a significantly higher risk of diabetes compared to the high SES group (OR=1.61, 95%CI: 0.92-2.80), while the medium SES group also had a slightly higher risk than the high SES group (OR=1.38, 95%CI: 0.63-3.00).

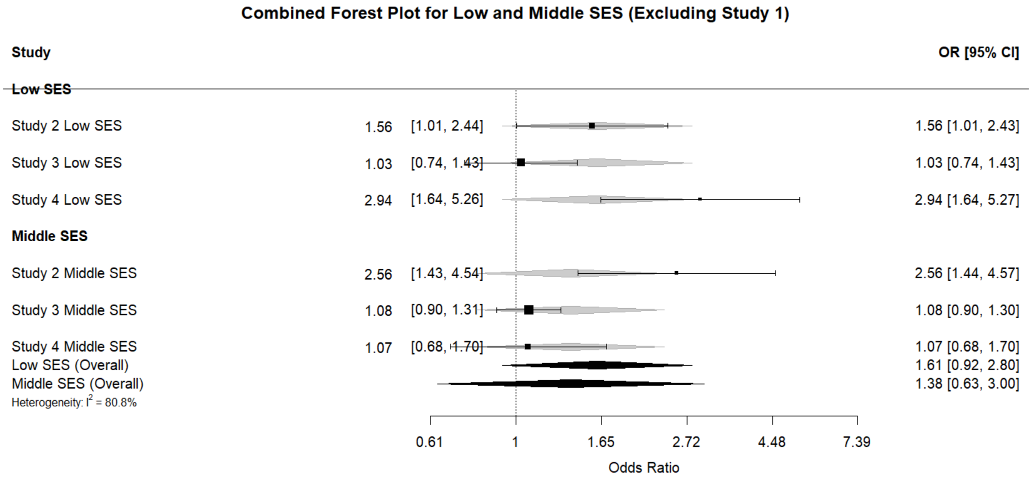

Figure 2. Forest Plot of Pooled Odds Ratios for Low and Middle SES Groups

Heterogeneity analysis showed significant heterogeneity among SES studies (Q = 19.2, df = 5, p = 0.00177), with an I^2 value of 80.8%. Regarding publication bias, Egger's test results indicated funnel plot asymmetry (z = 2.5684, p = 0.0102). This suggests the possibility of publication bias, meaning that small sample studies or those with smaller effect sizes may not have been adequately published or included in the analysis.

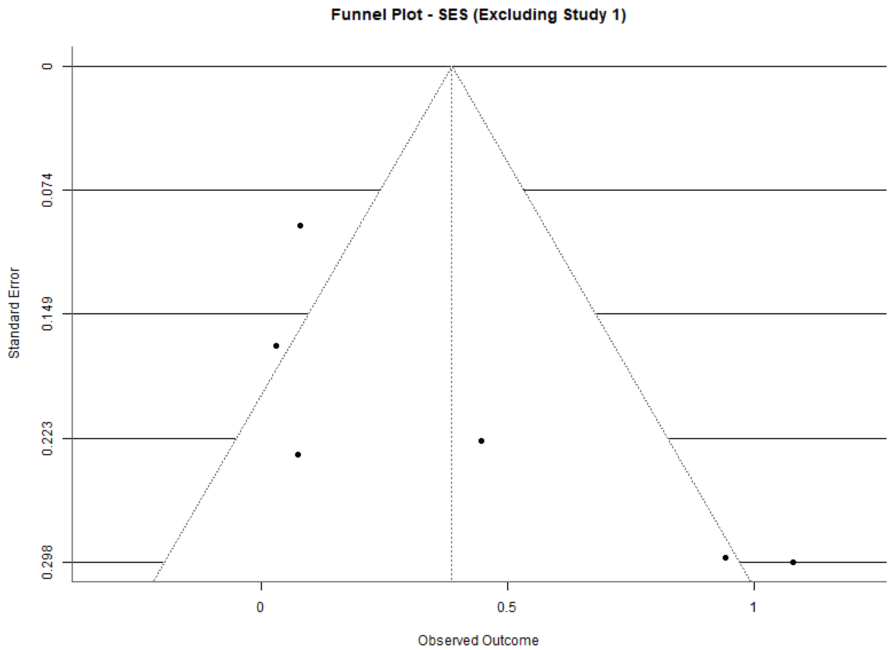

Figure 3. Funnel Plot - SES

To ensure the accuracy of the analysis results, we conducted a sensitivity analysis, mainly by excluding studies that might have an outsized influence on the overall effect size to assess their impact on the analysis results. In this sensitivity analysis, we removed data from Study 3 and observed the following significant changes:

First, heterogeneity significantly decreased (Q = 9.33, df = 3, p = 0.0252, I^2 = 67.85%), compared to Q = 19.2 (df = 5, p = 0.00177, I^2 = 80.8%) before removal, showing lower heterogeneity between studies. Additionally, the symmetry of the funnel plot improved.

In terms of effect size, the OR value for the low SES group increased from 1.61 (0.92-2.80) to 2.10 (1.00-4.41), while the OR value for the medium SES group decreased from 1.38 (0.63-3.00) to 0.77 (0.27-2.21). These results indicate that after removing data from Study 3, the association between the low education group and diabetes prevalence strengthened, while the association for the medium education group weakened.

The above analysis suggests that the data from Study 3 had a significant impact on the overall analysis results.

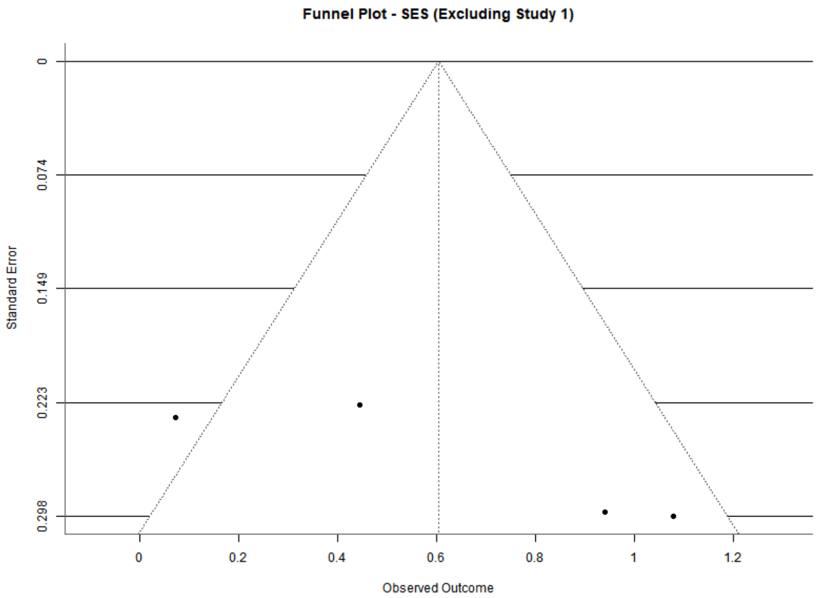

Figure 4. Funnel Plot - SES after sensitivity analysis

3.2. The Impact of Education Level on Diabetes Prevalence

Education level is also an important factor affecting diabetes prevalence. In this meta-analysis, education levels were divided into no education/lowest education level, primary school, secondary school, and higher education, with the lowest education level as the reference group. Results showed that individuals with primary school (OR=0.93, 95%CI: 0.72-1.20), secondary school (OR=0.91, 95%CI: 0.73-1.15), and higher education (OR=0.79, 95%CI: 0.60-1.05) all had lower risks of diabetes compared to those with no education, although the differences between education groups were not significant.

Table 1. The Impact of Education Level on Diabetes Prevalence

Education Level	OR Value	95% Confidence Interval	Risk Compared to Reference Group
No education/Lowest	1 (Reference)	-	-
Primary education	0.93	0.72 - 1.20	Lower
Secondary education	0.91	0.73 - 1.15	Lower
Higher education	0.79	0.60 - 1.05	Lower

Education level studies showed extremely high heterogeneity (Q statistic: 8606.78, df = 62, p = <2e-16), with an I^2 value of 99.28%. Egger's test did not show significant publication bias (z = 1.3095, p = 0.1904). This means that among the included education studies, there may not be obvious small study effects or selective reporting.

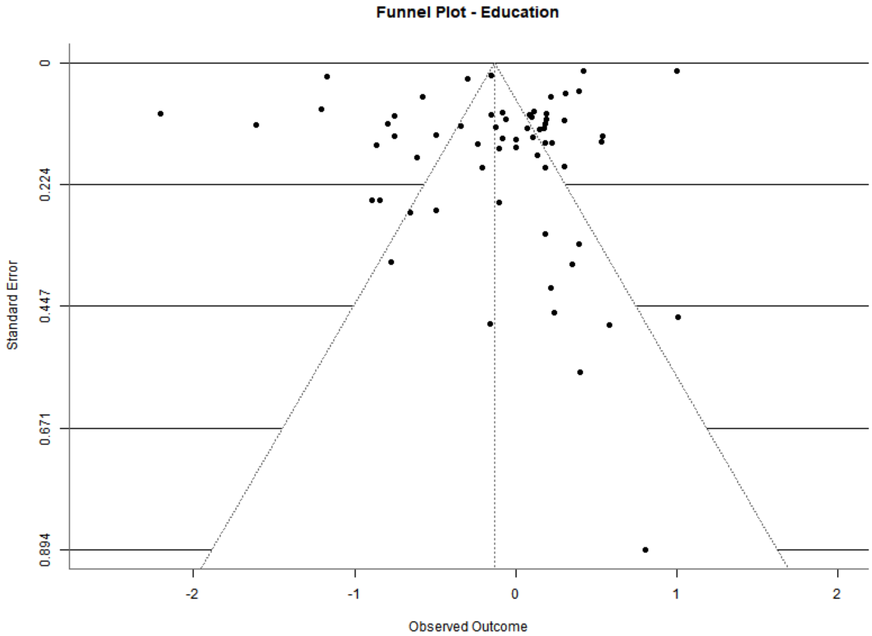

Figure 5. Funnel plot - Education

To ensure the accuracy of the analysis results, we similarly conducted a sensitivity analysis, removing data from Studies 3, 4, 6, and 9. After removing these studies, heterogeneity significantly decreased, with the Q statistic dropping from 8606.78 (df = 62, $p < 2e-16$, $I^2 = 99.28\%$) to 1105.26 (df = 50, $p < 2e-16$, $I^2 = 95.48\%$), indicating reduced heterogeneity between studies.

In terms of effect sizes, before removing these studies' data, the OR for the primary school group was 0.93 (95% CI: 0.72-1.20), for the secondary school group was 0.91 (95% CI: 0.73-1.15), and for the higher education group was 0.79 (95% CI: 0.60-1.05). After removal, the OR for the primary school group slightly decreased to 0.89 (95% CI: 0.65-1.22), for the secondary school group to 0.85 (95% CI: 0.68-1.07), and for the higher education group to 0.83 (95% CI: 0.60-1.15). These changes indicate that despite removing some study data, the overall association between education level and diabetes prevalence remained consistent, with the association for the low education group slightly strengthening.

3.3. The Impact of Income Level on Diabetes Prevalence

In this study, the impact of income level on diabetes prevalence was also further explored. We divided the study subjects into low, medium, and high income groups, with the high income group as the reference. Results showed that both low income (OR=0.97, 95%CI: 0.71-1.33) and medium income groups (OR=0.87, 95%CI: 0.55-1.38) had slightly lower diabetes risks compared to the high income group, but the differences were not significant.

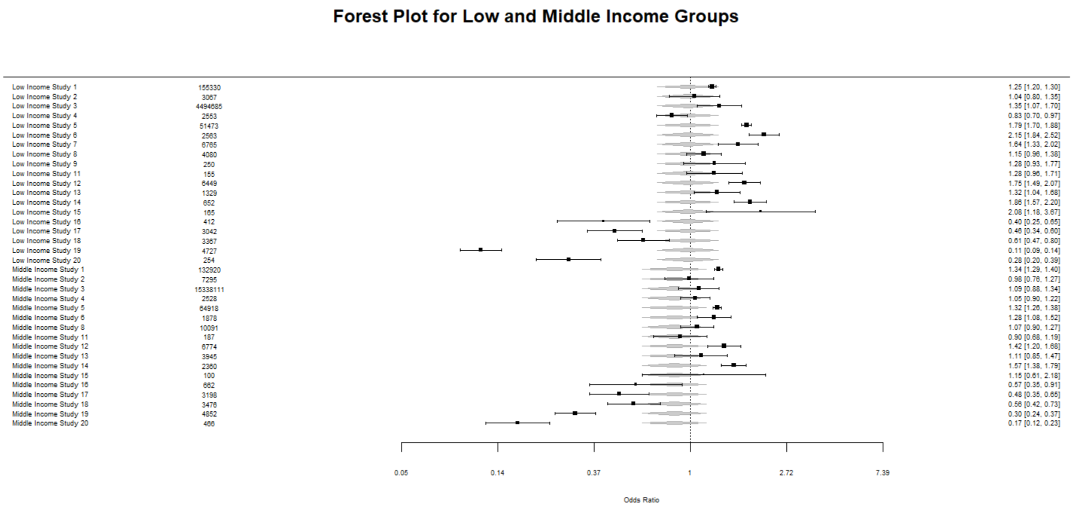

Figure 6. Forest Plot of Pooled Odds Ratios for Low and Middle Income Groups

Income studies also showed high heterogeneity (Q = 1410.99, df = 35, $p < 0.0001$), with an I^2 value of 97.52%. This suggests that the relationship between income and health outcomes may be influenced by multiple factors, leading to significant differences in results between studies. Egger's test results approached but did not reach statistical significance (z = -1.7415, p = 0.0816). Although the possibility of publication bias cannot be completely ruled out, the evidence is not sufficient to confirm its existence.

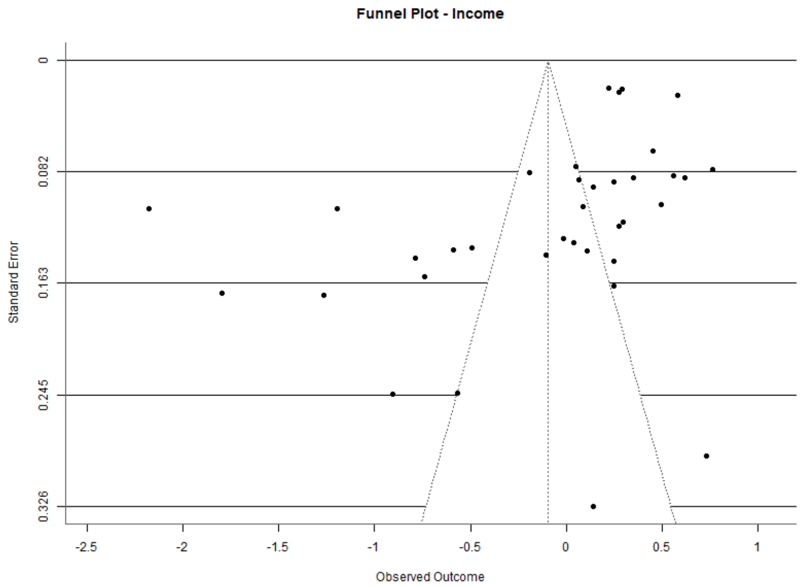

Figure 7. Funnel plot - Income

To ensure the accuracy of the analysis results, we still conducted a sensitivity analysis, removing Studies 1, 3, 19, and 20. After removal, heterogeneity decreased, with the Q statistic dropping from 1410.99 (df = 35, $p < 0.0001$, $I^2 = 97.52\%$) to 473.69 (df = 27, $p < 2e-16$, $I^2 = 94.3\%$). Although heterogeneity remained high after removing these studies, the heterogeneity between studies significantly decreased.

In terms of effect sizes, before removing these studies, the combined OR for the low income group was 0.97 (95% CI: 0.71-1.33), and for the medium income group was 0.87 (95% CI: 0.55-1.38). After removal, the OR for the low income group increased to 1.18 (95% CI: 0.94-1.49), showing a stronger positive association with diabetes prevalence, while the OR for the medium income group changed little to 0.84 (95% CI: 0.60-1.17). These results indicate that after removing specific studies, the association between the low income group and diabetes prevalence strengthened.

3.4. The Impact of Occupation Type on Diabetes Prevalence

Occupation type was analyzed as an important socioeconomic indicator in this study. First, occupations were divided into low, medium, and high categories according to the ISCO-08 (International Standard Classification of Occupations 2008) standard, with the high occupation group as the reference group. The low occupation group had a higher risk of diabetes (OR=1.44, 95%CI: 1.08-1.94), while the medium occupation group had a slightly lower risk than the high occupation group (OR=0.77, 95%CI: 0.51-1.16). In further occupational subgroup analysis, compared to managers, professionals (OR=1.00, 95%CI: 0.90 - 1.11) showed little difference in diabetes risk, while service industry personnel (OR=1.19, 95%CI: 0.79 - 1.78) had a higher risk of diabetes. In the comparison between blue-collar and white-collar workers, blue-collar workers had a significantly higher risk of diabetes than white-collar workers (OR=1.72, 95%CI: 1.10-2.69). Finally, when grouped and compared based on whether they perform manual labor, results showed that manual laborers had a significantly higher risk of diabetes than non-manual laborers (OR=1.85, 95%CI: 1.32-2.59). Overall, it is not difficult to see that occupation type, especially the distinction between manual and non-manual labor, may be an important factor affecting diabetes prevalence.

3.4.1. Classified into low, medium, and high categories using ISCO-08 as the classification standard

With high category as the reference group

Low:1.44 (1.08-1.94)

Medium:0.77 (0.51-1.16)

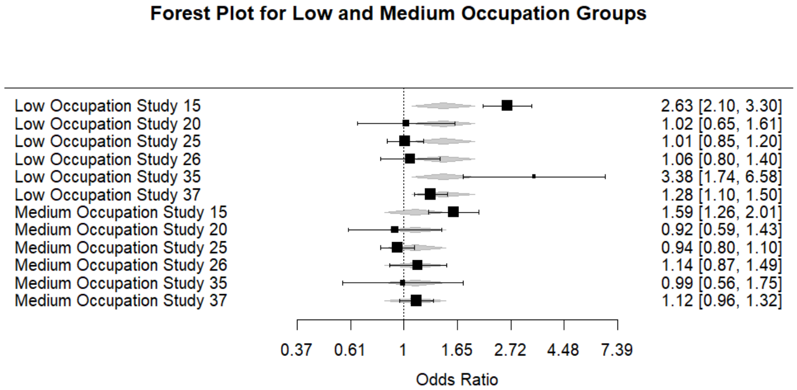

Figure 8. Forest Plot of Pooled Odds Ratios for Low and Medium Occupation Groups

This grouping showed significant heterogeneity among studies ($Q = 78.73$, $df = 11$, $p < 0.0001$), with an I^2 value of 86.03%. This indicates considerable differences between different occupational categories or studies. Egger's test did not find significant publication bias ($z = 0.7131$, $p = 0.4758$), suggesting that publication bias may not be a major concern for this group of studies.

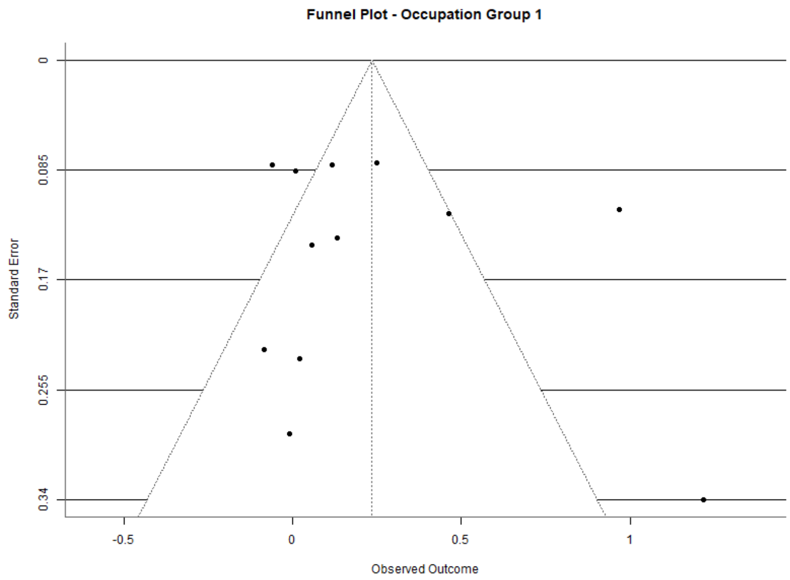

Figure 9. Funnel plot - Occupation Group 1

As with previous analyses, we conducted a sensitivity analysis to ensure the accuracy of the analysis results. We removed Studies 15 and 35. After removal, heterogeneity significantly decreased, with the Q statistic dropping from 78.73 (df = 11, p < 0.0001, I² = 86.03%) to 9.26 (df = 7, p = 0.234, I² = 24.45%), indicating a substantial reduction in variability between studies, with heterogeneity approaching non-significant levels.

In terms of effect sizes, before removing these studies, the combined OR for the low occupation group was 1.44 (95% CI: 1.08-1.94), and for the medium occupation group was 0.77 (95% CI: 0.51-1.16). After removal, the OR for the low occupation group decreased to 1.12 (95% CI: 0.97-1.28), while the OR for the medium occupation group increased to 0.93 (95% CI: 0.77-1.13). These changes show that after removing Studies 15 and 35, the association between the low occupation group and diabetes prevalence weakened, while the association for the medium occupation group strengthened and tended towards neutrality.

3.4.2. Classified according to manager (including government and administrative personnel), professional (including high-level technicians, scientific professionals, teachers, etc.), and service industry (including farmers, salespeople, sales, craftsmen, etc.)

With Manager as the reference group

Professional:1.00 (0.90 - 1.11)

Service:1.19 (0.79 - 1.78)

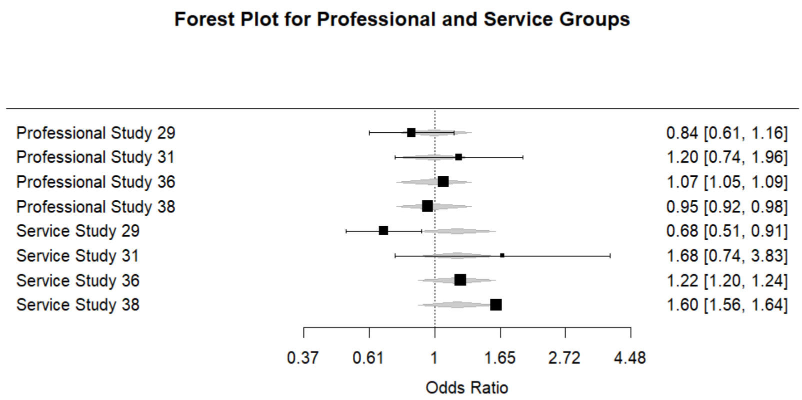

Figure 10. Forest Plot of Pooled Odds Ratios for Professional and Service Groups

This grouping also showed extremely high heterogeneity among studies ($Q = 886.13$, $df = 7$, $p < 0.0001$), with an I^2 value as high as 99.21%. This may reflect the enormous differences in health impacts across different occupational categories. Egger's test did not show significant publication bias ($z = -0.1626$, $p = 0.8708$), indicating that the funnel plot asymmetry is not statistically significant.

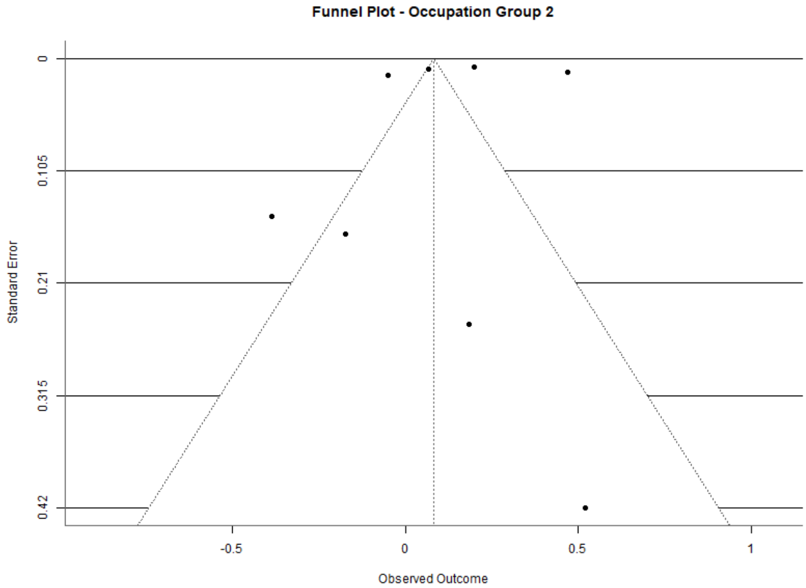

Figure 11. Funnel plot - Occupation Group 2

We conducted two rounds of sensitivity analysis to assess the impact of individual studies on the results. In the first round, Study 36 was removed, and we found that heterogeneity changed little, with the Q statistic remaining nearly unchanged. In terms of effect sizes, the OR for the Professional group slightly decreased from 1.00 (95% CI: 0.90-1.11) to 0.95 (95% CI: 0.92-0.98), while the OR for the Service group changed slightly from 1.19 (95% CI: 0.79-1.78) to 1.18 (95% CI: 0.64-2.17), showing no significant change in effect sizes.

In the second round, we removed Study 29, and heterogeneity still did not change significantly (Q statistic decreased from 886.13 to 866.99, I^2 remained above 99%). In terms of effect sizes, the OR for the Professional group increased from 1.00 (95% CI: 0.90-1.11) to 1.02 (95% CI: 0.91-1.14), while the OR for the Service group increased to 1.42 (95% CI: 1.12-1.79), indicating a strengthened association between the Service group and diabetes prevalence.

Since this classification standard analysis only included four studies, further removal of studies might lead to incomplete data, so we did not perform more removals. Overall, the sensitivity analysis results show that regardless of which study was removed, changes in heterogeneity and effect sizes were not significant, indicating that the study results have relatively high stability, but the high heterogeneity between studies remains an issue that needs attention.

3.4.3. Classified according to blue-collar and white-collar

With white-collar as the reference group

Blue-collar:1.72,95%CI:1.10-2.69

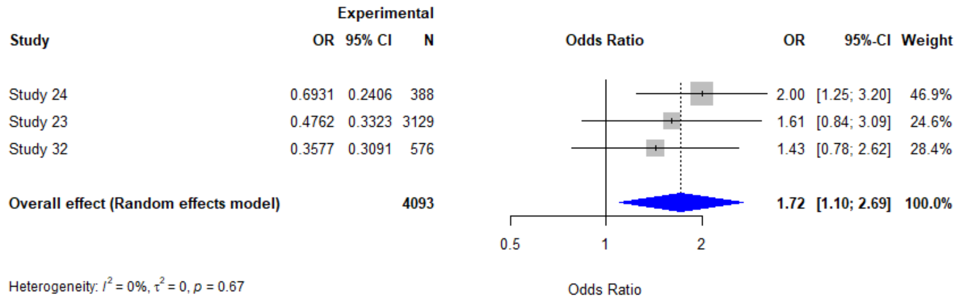

Figure 12. Forest Plot of Pooled Odds Ratios for Blue-collar Groups

Unlike other groups, this grouping did not show significant heterogeneity among studies (Q = 0.79, df = 2, p = 0.674), with an I² value of 0%. This indicates that the results of this group of studies are relatively consistent, possibly reflecting the consistency of health impacts for specific occupational categories.

Egger's test also did not find significant publication bias (z = -0.7761, p = 0.4377), suggesting no evident small-study effects or publication bias.

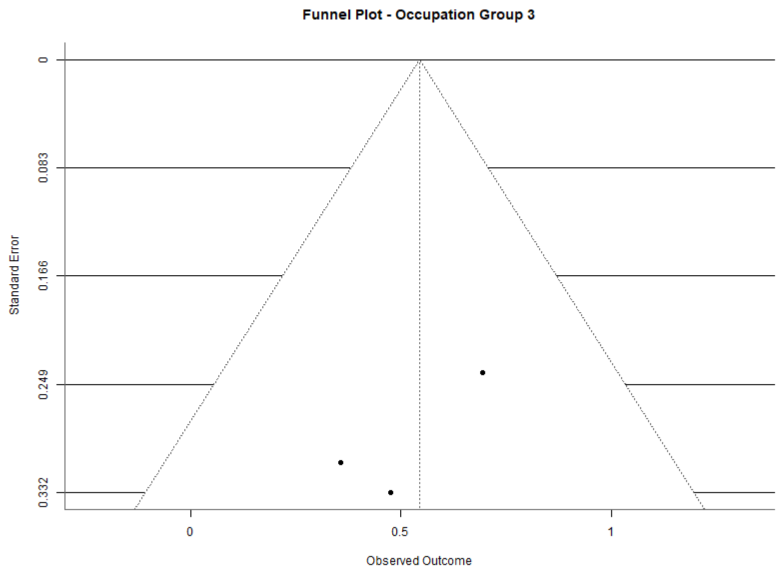

Figure 13. Funnel plot - Occupation Group 3

3.4.4. Grouped according to whether manual labor is performed

With manual labor as the reference group

Non-manual labor: 1.85, 95%CI: 1.32-2.59

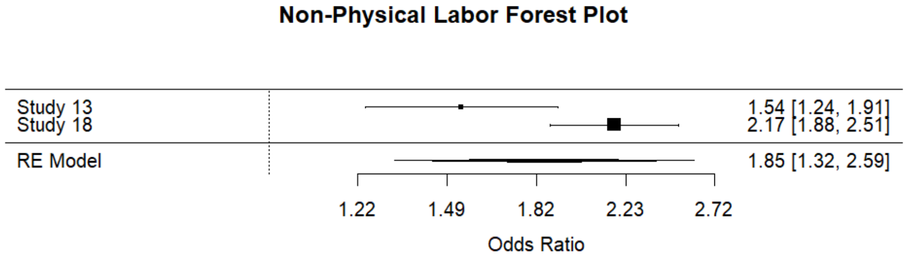

Figure 14. Forest Plot of Pooled Odds Ratios for Non-Physical Labor Groups

3.4.5. Quality assessment

The GRADE assessment results showed that in terms of risk of bias, 45% (18 studies) were low risk, 37.5% (15 studies) were moderate risk, and 17.5% (7 studies) were high risk. Regarding inconsistency, 50% (20 studies) were low, 35% (14 studies) were moderate, and 15% (6 studies) were high. For imprecision, 40% (16 studies) were low, 40% (16 studies) were moderate, and 20% (8 studies) were high. In the assessment of indirectness, 55% (22 studies) were low, 32.5% (13 studies) were moderate, and 12.5% (5 studies) were high. Concerning publication bias, 37.5% (15 studies) were low, 42.5% (17 studies) were moderate, and 20% (8 studies) were high.

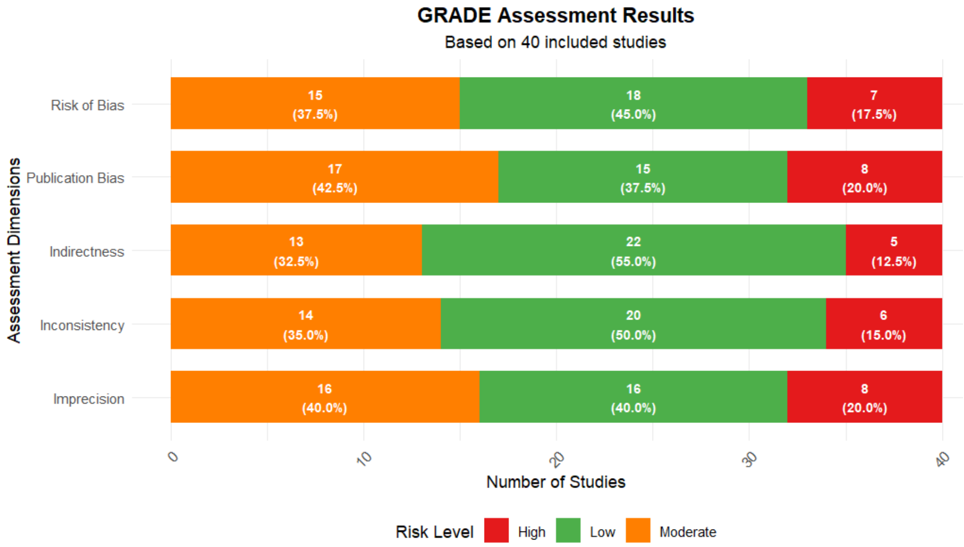

Figure 15. GRADE Assessment Results

4. DISCUSSION

In this meta-analysis, we systematically evaluated the impact of socioeconomic status (SES) (including education level, income level, and occupation type) on the prevalence of diabetes. Our analysis revealed a complex and significant association between SES and diabetes prevalence, with certain factors showing particularly notable effects.

Our GRADE assessment revealed generally good quality across most studies, with some limitations in imprecision and publication bias. This quality foundation supports the reliability of our findings while acknowledging potential areas of uncertainty.

The most significant findings came from the analysis of occupation types. We found that manual laborers had a significantly higher prevalence of diabetes compared to non-manual workers (OR=1.85, 95%CI: 1.32-2.59). Similarly, blue-collar workers had a markedly higher risk of diabetes than white-collar workers (OR=1.72, 95%CI: 1.10-2.69). These results emphasize the important impact of occupational environments on health. Studies have shown significant differences in diabetes incidence and prevalence across different occupations [38], which is consistent with our findings. Possible explanations include factors such as work stress, occupational exposure, and work hours. Additionally, some studies have specifically pointed out that certain occupational exposures (such as those experienced by wood, welding, mechanical, and refinery workers) are associated with the prevalence of prediabetes and type 2 diabetes (T2D) [27].

Furthermore, research has found that non-technical occupations are a risk factor for diabetes among the working population in Hong Kong [35], further supporting our results. In particular, manual laborers may face greater occupational stress, longer working hours, and less access to health resources, all of which may increase the risk of T2D. The study by Anita et al. [37] also emphasizes the relationship between occupation and health disparities, noting that education may modify this relationship.

The analysis of socioeconomic status (SES) also showed significant results. We found that the risk of diabetes prevalence was notably higher in the low SES group compared to the high SES group (OR=1.61, 95%CI: 0.92-2.80). This finding is consistent with previous research results, highlighting the impact of socioeconomic inequalities on health. Studies by Christina et al. [1, 20] in Barbados and Sahar et al. [2, 3] in Egypt and South Africa have confirmed the association between SES and diabetes prevalence. Low SES may increase the risk of T2D through multiple pathways, such as reduced access to quality healthcare, lack of health knowledge, and increased life stress [1-3].

Regarding education level, we observed a trend: groups with higher education had a lower risk of diabetes, although this difference was not significant. The higher education group had the lowest risk (OR=0.79, 95%CI: 0.60-1.05). This may reflect the importance of education in health literacy, lifestyle choices, and health awareness. Kim et al.'s [18] study found an association between education level and diabetes risk, supporting our observation. However, there was extremely high heterogeneity among education level studies ($I^2 = 99.28\%$), indicating that the relationship between education and T2D risk may be influenced by multiple factors such as cultural background and social environment. Barman et al.'s [17] study particularly emphasized the complexity of the relationship between education and diabetes in racially and ethnically diverse populations.

The results of income level analysis were relatively less clear: both low-income (OR=0.97, 95%CI: 0.71-1.33) and middle-income groups (OR=0.87, 95%CI: 0.55-1.38) had slightly lower diabetes risk compared to high-income groups, but the differences were not significant. This finding differs from traditional views and may reflect the complex relationship between income and health. High income may bring more stress and unhealthy lifestyle choices, such as high-fat diets and sedentary work. However, our results differ from some studies, such as Wichai et al.'s [5] research in Thailand and Hongjiang et al.'s [6, 9] studies in China, which found that higher socioeconomic status was associated with lower diabetes prevalence. This discrepancy may reflect the complexity of how socioeconomic factors affect health in different countries and cultural contexts.

Notably, there was significant heterogeneity in our analysis, especially in studies on education and income levels. This reflects the complexity of the relationship between socioeconomic factors and health, and suggests that we need to consider more moderating factors, such as geographic location, cultural background, and healthcare policies. For example, some studies have found that the relationship between socioeconomic status and T2D prevalence varies among Ghanaians in different geographic locations [19].

The results of this study have important implications for public health policy. First, it emphasizes the importance of reducing occupational health inequalities and socioeconomic inequalities in preventing T2D. Second, it suggests that we need to develop differentiated intervention strategies for different socioeconomic groups, especially manual laborers and low SES groups. Studies have confirmed the mediating role of psychosocial work environment in the relationship between socioeconomic status and T2D [15], providing a new perspective for developing intervention strategies.

However, this study also has some limitations. First, the high heterogeneity between studies may affect the reliability of some results. Second, we cannot completely rule out the influence of residual confounding factors, such as dietary habits and physical activity levels. Research has pointed out that genetics, obesity, and environmental risk factors are all associated with T2D [21], which may have influenced our results to some extent. Additionally, most of the included studies were cross-sectional or cohort studies, making it difficult to establish causal relationships.

Future research should focus on the following aspects: 1) Exploring the specific mechanisms by which occupation types and socioeconomic factors influence T2D risk, including physiological, psychological, and behavioral pathways; 2) Conducting more longitudinal studies to establish stronger causal relationships, such as Lindsay et al.'s [12] research on intergenerational educational mobility and T2D; 3) Considering more potential moderating factors, such as culture and policy environment; 4) Evaluating the effectiveness of intervention strategies targeting different socioeconomic groups, especially manual laborers and low SES groups. These studies will help further elucidate the complex relationship between socioeconomic factors and T2D risk.

5. CONCLUSION

This meta-analysis emphasizes the important role of SES in diabetes prevalence risk. Our study found that manual laborers and blue-collar workers face significantly higher risks of prevalence, and lower socioeconomic status is also associated with higher diabetes prevalence risk. These findings provide an important evidence base for understanding and addressing the social determinants of diabetes. Although the relationship between education level, income, and diabetes risk is complex, they still play an important role in understanding and preventing diabetes.

The results of this article have significant public health implications, emphasizing the necessity of considering socioeconomic factors in diabetes prevention and control strategies. Policymakers should pay more attention to reducing socioeconomic inequalities and developing targeted intervention measures for high-risk groups. Future research should further explore the potential mechanisms of these relationships and evaluate the effectiveness of targeted intervention strategies.

By focusing on these socioeconomic factors, we hope to develop more equitable and effective strategies for diabetes prevention and management, thereby improving the health status of the global population. This study not only provides a new perspective for diabetes prevention but also offers important insights into broader health inequality issues.

REFERENCES

[1] Christina H, R I H, C M A R, et al. Social distribution of diabetes, hypertension and related risk factors in Barbados: a cross-sectional study. [J]. BMJ open, 2015, 5(12): e008869.

[2] Sahar S, Siegfried G, Johannes B. Socioeconomic inequalities in diabetes prevalence: the case of Egypt between 2008 and 2015. [J]. BMC public health, 2023, 23(1):1669-1669.

[3] Sahar S, Siegfried G, Johannes B. Socioeconomic inequalities in diabetes prevalence: the case of South Africa between 2003 and 2016. [J]. BMC public health, 2023, 23(1):324-324.

[4] A J S, Maja-Emilia M, Cara E, et al. Diabetes Prevalence and Its Relationship With Education, Wealth, and BMI in 29 Low- and Middle-Income Countries. [J]. Diabetes care, 2020, 43(4):767-775.

[5] Wichai A, Suwat C, Pattapong K, et al. Prevalence of Diabetes and Relationship with Socioeconomic Status in the Thai Population: National Health Examination Survey, 2004-2014. [J]. Journal of diabetes research, 2018, 20181654530.

[6] Hongjiang W, Fiona B, Ling Y, et al. Sex differences in the association between socioeconomic status and diabetes prevalence and incidence in China: cross-sectional and prospective studies of 0.5 million adults. [J]. Diabetologia, 2019, 62(8):1420-1429.

[7] Jeong Y K, Young J J, Jin S H, et al. Effect of socio-economic status on the prevalence of diabetes. [J]. Yonsei medical journal, 2015, 56(3):641-7.

[8] Jongnam H, Changwoo S. Relationship between socioeconomic status and type 2 diabetes: results from Korea National Health and Nutrition Examination Survey (KNHANES) 2010-2012. [J]. BMJ open, 2014, 4(8):e005710.

[9] Hongjiang W, A C J, H S W, et al. Socioeconomic status and self-reported, screen-detected and total diabetes prevalence in Chinese men and women in 2011-2012: a nationwide cross-sectional study. [J]. Journal of global health, 2018, 8(2):020501.

[10] Alemayehu Z, Eskindir L, Tariku E, et al. Prevalence of Diabetes Mellitus and Associated Factors in Southern Ethiopia: A Community Based Study. [J]. Ethiopian journal of health sciences, 2018, 28(4):451-460.

[11] Morteza S S, Louisa J, Hilary B, et al. Independent roles of country of birth and socioeconomic status in the occurrence of type 2 diabetes. [J]. BMC public health, 2013, 13(3):1223.

[12] Lindsay F, B J W, L C M, et al. nIntergenerational Educational Mobility and Type 2 Diabetes in the Sacramento Area Latino Study of Aging. [J]. Annals of epidemiology, 2021, (prepublish):

[13] A T M, S A H, P J S, et al. Diabetes prevalence among Puerto Rican adults in New York City, NY, 2000. [J]. American journal of public health, 2004, 94(3):434-7.

[14] Selçuk KT, Sözmen MK, Toğrul BU. Diabetes prevalence and awareness in adults in the Balçova district in Turkey. Turk J Med Sci. 2015; 45(6):1220-7. doi: 10.3906/sag-1312-62. PMID: 26775374.

[15] Bengisu S, Annemarie K, Jeroen A, et al. Socioeconomic Position and Type 2 Diabetes: The Mediating Role of Psychosocial Work Environment- the Maastricht Study [J]. International Journal of Public Health, 2023, 681606036-1606036.

[16] Rajat G D, Promit C A, Md H B. Association of household wealth and education level with hypertension and diabetes among adults in Bangladesh: A propensity score-based analysis. [J]. Tropical medicine & international health: TM & IH, 2021, 26(9):

[17] L.N. B, F.J. D, K. W. Education and diabetes in a racially and ethnically diverse population [J]. American Journal of Public Health, 2006, 96(9):1637-1642.

[18] Kim J, Noh J, Choi J, et al. Association of Education and Smoking Status on Risk of Diabetes Mellitus: A Population-Based Nationwide Cross-Sectional Study [J]. International Journal of Environmental Research and Public Health, 2017, 14(6):655-.

[19] Juliet A, Charles A, Ama A D, et al. Association between socioeconomic position and the prevalence of type 2 diabetes in Ghanaians in different geographic locations: the RODAM study. [J]. Journal of epidemiology and community health, 2017, 71(7):633-639.

[20] Christina H, R I H, C M A R, et al. Social distribution of diabetes, hypertension and related risk factors in Barbados: a cross-sectional study. [J]. BMJ open, 2015, 5(12):e008869.

[21] Bener A, Zirie M, Al-Rikabi A. Genetics, obesity, and environmental risk factors associated with type 2 diabetes. Croat Med J. 2005 Apr; 46(2):302-7. PMID: 15849854.

[22] Kenan E M, Emmanuel B, Fredirick M, et al. The magnitude of type 2 diabetes mellitus and cardiovascular disease risk factors among young adults in urban settings: a cross-sectional survey in Mwanza, Tanzania. [J]. The Pan African medical journal, 2022, 4219-19.

[23] Azimi-Nezhad M, Ghayour-Mobarhan M, Parizadeh MR, Safarian M, Esmaeili H, Parizadeh SM, Khodaee G, Hosseini J, Abasalti Z, Hassankhani B, Ferns G. Prevalence of type 2 diabetes mellitus in Iran and its relationship with gender, urbanisation, education, marital status and occupation. Singapore Med J. 2008 Jul; 49(7):571-6. PMID: 18695867.

[24] Luís A, Ana A, Susana S, et al. Socioeconomic inequalities in the prevalence of nine established cardiovascular risk factors in a southern European population. [J]. PloS one, 2012, 7(5): e37158.

[25] Gupta R, Deedwania C P, Sharma K, et al. Association of educational, occupational and socioeconomic status with cardiovascular risk factors in Asian Indians: a cross-sectional study. [J]. PLoS ONE, 2017, 7(8): e44098.

[26] Qi Y, Koster A, Boxtel V M, et al. Adulthood Socioeconomic Position and Type 2 Diabetes Mellitus—A Comparison of Education, Occupation, Income, and Material Deprivation: The Maastricht Study [J]. International Journal of Environmental Research and Public Health, 2019, 16(8):1435- 1435.

[27] Meo A S, Al-khlaiwi T, Abukhalaf A A, et al. The Nexus between Workplace Exposure for Wood, Welding, Motor Mechanic, and Oil Refinery Workers and the Prevalence of Prediabetes and Type 2 Diabetes Mellitus [J]. International Journal of Environmental Research and Public Health, 2020, 17(11):3992-3992.

[28] Santos J, Kislaya I, Antunes L, Santos AJ, Rodrigues APP, Neto M, Dias CM. Diabetes: Desigualdades Socioeconómicas na População Portuguesa em 2014 [Diabetes: Socioeconomic Inequalities in the Portuguese Population in 2014]. Acta Med Port. 2017 Aug 31;30(7-8):561-567. Portuguese. doi: 10.20344/amp.8235. Epub 2017 Aug 31. PMID: 28926330.

[29] Nagamine Y, Kondo N, Yokobayashi K, et al. Socioeconomic Disparity in the Prevalence of Objectively Evaluated Diabetes Among Older Japanese Adults: JAGES Cross-Sectional Data in 2010 [J]. Journal of Epidemiology, 2019, 29(8):295-301.

[30] Sims M, Roux D V A, Boykin S, et al. The Socioeconomic Gradient of Diabetes Prevalence, Awareness, Treatment, and Control Among African Americans in the Jackson Heart Study [J]. Annals of Epidemiology, 2011, 21(12):892-898.

[31] Mansour A A M. The Prevalence and Risk Factors of Type 2 Diabetes Mellitus (DMT2) in a Semi-Urban Saudi Population [J]. International Journal of Environmental Research and Public Health, 2019, 17(1):7-7.

[32] De Silva AP, De Silva SHP, Haniffa R, Liyanage IK, Jayasinghe S, Katulanda P, Wijeratne CN, Wijeratne S, Rajapaksa LC. Inequalities in the prevalence of diabetes mellitus and its risk factors in Sri Lanka: a lower middle income country. Int J Equity Health. 2018 Apr 17;17(1):45. doi: 10.1186/s12939-018-0759-3. PMID: 29665834; PMCID: PMC5905173.

[33] Al M G K, Rashidul M H, Mahbub M H, et al. Clustering of hypertension, diabetes and overweight/obesity according to socioeconomic status among Bangladeshi adults. [J]. Journal of biosocial science, 2020, 1-10.

[34] Tuhin B, Nick T, Saimul M I, et al. Association between socioeconomic status and prevalence of non-communicable diseases risk factors and comorbidities in Bangladesh: findings from a nationwide cross-sectional survey. [J]. BMJ open, 2019, 9(3):e025538.

[35] Hung HHY, Chan EYY, Chow EYK, Chung GKK, Lai FTT, Yeoh EK. Non-skilled occupation as a risk factor of diabetes among working population: A population-based study of community-dwelling adults in Hong Kong. Health Soc Care Community. 2022 Jan; 30(1): e86-e94. doi: 10.1111/hsc.13415. Epub 2021 Jun 24. PMID: 34169598; PMCID: PMC9291875.

[36] M T S, J R T, Pyone C. Prevalence of Diagnosed Diabetes Among Employed U.S. Adults by Demographic Characteristics and Occupation, 36 States, 2014-2018. [J]. Journal of occupational and environmental medicine, 2020, Publish Ahead of Print

[37] Anita V, Gert W, Francois S. Health disparities by occupation, modified by education: a cross-sectional population study [J]. BMC Public Health, 2007, 7(1):196.

[38] Sofia C, Tomas A, Mats T, et al. Incidence and prevalence of type 2 diabetes by occupation: results from all Swedish employees. [J]. Diabetologia, 2020, 63(1):95-103.

[39] Talukder A, Sara S S, Hossain T M, et al. Rural and urban differences in the prevalence and determinants of Type-2 diabetes in Bangladesh. [J]. PloS one, 2024, 19(4): e0298071-e0298071.

[40] Phaswana-Mafuya N, Peltzer K, Chirinda W, et al. Self-reported prevalence of chronic non-communicable diseases and associated factors among older adults in South Africa [J]. Global Health Action, 2013, 6(1):1-7.