JHWCR
Journal of Health, Wellness, and Community Research
Volume III, Issue IV
Open Access, Double Blind Peer Reviewed.
Web: https://jhwcr.com, **ISSN**: 3007-0570
https://doi.org/10.61919/25yb1053

Article

Association of Risk Factors with Diabetes Mellitus in Rural Areas of Nawabshah City: A Case-Control Study

Yasir Akbar Jamali[1], Tahira Pechuho[2], Mehar Ali[3], Amjad Ali Mughal[4]

1 Department of Physiology, University of Sindh, Jamshoro, Pakistan
2 Department of Zoology, University of Sindh Jamshoro, Pakistan
3 Institute of Biotechnology and Genetic Engineering, University of Sindh, Jamshoro, Pakistan
4 Institute of Microbiology, Shah Abdul Latif University, Khairpur Mirus, Pakistan

Correspondence
yasirakbar021@gmail.com

Cite this Article

Received	2025-04-07
Revised	2025-04-26
Accepted	2025-04-28
Published	2025-05-08
Conflict of Interest	None declared
Ethical Approval	Respective Ethical Review Board
Informed Consent	Obtained from all participants
Data/supplements	Available on request.
Funding	None
Authors' Contributions	Concept, design, and analysis: YAJ; data collection and visualization: TP; supervision and review: MA, AAM.

ABSTRACT

Background: Type 2 Diabetes Mellitus (T2DM) is a growing global health concern, particularly in rural regions of low- and middle-income countries where healthcare access and preventive strategies are limited. Despite increasing prevalence, the distribution of lifestyle and metabolic risk factors in rural Pakistani populations remains underexplored. **Objective**: To investigate the association between modifiable lifestyle and metabolic risk factors—specifically sedentary behavior, dietary habits, smoking, alcohol use, and obesity—and the risk of T2DM among young adults in rural areas of Nawabshah. **Methods**: This observational case-control study was conducted among 716 participants (346 cases, 370 controls) aged 18–45 years residing in rural Nawabshah. Cases included individuals clinically diagnosed with T2DM, while age- and sex-matched controls had no diabetes history. Data were collected using structured questionnaires, anthropometric measurements, and random capillary blood glucose (RCBG) tests. Ethical approval was obtained, and the study complied with the Declaration of Helsinki. Statistical analysis was performed using SPSS Version 26, employing chi-square and t-tests to evaluate group differences. **Results**: A sedentary lifestyle (70.2% vs. 51.4%, p = 0.007), dietary risk (90.8% vs. 60.8%, p = 0.01), smoking (20.2% vs. 13.5%, p = 0.019), overweight (25.7% vs. 19.2%, p = 0.036), and moderate obesity (19.1% vs. 10.8%, p = 0.003) were significantly more prevalent among T2DM cases than controls, indicating clinically relevant associations. **Conclusion**: Sedentary behavior, unhealthy diet, smoking, and obesity were strongly linked with increased T2DM risk in rural young adults, underscoring the urgent need for community-based preventive interventions in underserved populations.

Keywords: Type 2 Diabetes Mellitus, Risk Factors, Sedentary Lifestyle, Rural Health, Obesity, Tobacco Use, Case-Control Studies

INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disorder characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. It has emerged as one of the most significant public health challenges worldwide due to its rising prevalence, especially in low- and middle-income countries. The global epidemiology of T2DM shows an alarming trend, with Asia accounting for a significant portion of the diabetic population due to demographic transitions, urbanization, and lifestyle changes (1). The increasing prevalence of T2DM in countries like China, where approximately 11% of the population is affected, underscores the critical burden posed by this disease (2). T2DM not only leads to acute metabolic disturbances but also increases the risk of chronic complications such as nephropathy, retinopathy, cardiovascular disease, and stroke, which collectively contribute to reduced quality of life and premature mortality (3,4). The growing health and economic implications of T2DM necessitate a deeper understanding of its preventable risk factors.

While the pathophysiology of T2DM involves complex genetic and environmental interactions, modifiable lifestyle and metabolic factors remain primary contributors to its development. Insulin resistance in muscle and adipose tissues, coupled with beta-cell dysfunction, has been well-documented as the biological underpinning of the disease (5). Evidence suggests that behaviors such as physical inactivity, unhealthy dietary patterns, smoking, alcohol use, and obesity significantly elevate the risk of developing T2DM (6,7). A sedentary lifestyle, in particular, has been associated with a 50% increase in diabetes risk, and dietary choices high in refined carbohydrates and processed foods further exacerbate metabolic dysfunction (8). These risk factors

are often interlinked and influenced by socioeconomic, cultural, and environmental contexts, making region-specific investigations essential for effective intervention strategies.

In Pakistan, the burden of diabetes is rising, especially in underserved and rural communities where healthcare access, education, and preventive measures are limited (9). Rural populations are often excluded from mainstream diabetes research, despite being uniquely vulnerable due to a combination of low health literacy, traditional dietary practices, and limited access to structured exercise opportunities or healthcare screening programs (10). Previous studies conducted in Pakistan have highlighted the role of poor dietary habits, limited physical activity, and obesity in increasing diabetes risk; however, these have predominantly focused on urban populations or lacked a rigorous case-control design (11,12). This has led to a gap in knowledge concerning the true burden and pattern of risk factors for T2DM in rural settings.

Nawabshah, a district in Sindh province, represents a typical rural landscape with varying degrees of development, socio-economic disparity, and cultural influences on health behavior. Despite anecdotal evidence of increasing diabetes cases in this region, there has been a lack of systematic research investigating the modifiable risk factors that may contribute to the growing prevalence of T2DM among young adults in these rural areas. This study addresses that gap by applying a structured case-control methodology to explore associations between lifestyle and metabolic risk factors and the presence of T2DM among individuals aged 18 to 45 years residing in the rural localities of Nawabshah.

The justification for this study lies in its potential to inform public health interventions tailored to rural communities by identifying high-priority modifiable risk factors. Understanding these associations is essential for designing culturally appropriate preventive strategies and educational campaigns that target behaviors contributing to the early onset of diabetes in young adults. By focusing on a rural Pakistani population, the study also contributes to the limited body of local literature, providing context-specific insights that are critical for shaping effective diabetes prevention frameworks in similar settings. Therefore, this study aims to answer the research question: What are the key lifestyle and metabolic risk factors associated with Type 2 Diabetes Mellitus among young adults in the rural areas of Nawabshah?

MATERIALS AND METHODS

This study employed a case-control design to assess the association between lifestyle and metabolic risk factors and the presence of Type 2 Diabetes Mellitus (T2DM) among young adults in rural areas of Nawabshah, Pakistan. Participants were male and female residents aged 18 to 45 years from selected rural settlements. Inclusion criteria for cases included individuals with a confirmed clinical diagnosis of T2DM, verified through local medical records and physician reports. Controls were individuals without T2DM, matched with cases on age and sex to reduce potential confounding. Exclusion criteria included individuals with Type 1 or gestational diabetes, chronic comorbidities such as cancer or renal failure, and those unable or unwilling to provide informed consent. Participants were recruited through systematic random sampling at the household level. Only one eligible adult was selected per household. In households with more than one eligible person, a random draw was conducted; households without eligible individuals were skipped in favor of the next one on the sampling route.

All participants provided written informed consent before enrollment. The study adhered to the principles of the Declaration of Helsinki. Interviews were conducted in the participants' native language by trained data collectors in private settings to maintain confidentiality. A pretested and structured questionnaire was used to collect information on sociodemographic variables (age, sex, education level, socioeconomic status), behavioral factors (physical activity, dietary habits, tobacco use, and alcohol consumption), and family history of diabetes. Anthropometric data, including weight and height, were measured using calibrated instruments. Body Mass Index (BMI) categories were defined based on WHO standards. Blood pressure was measured using a standard mercury sphygmomanometer with participants seated after five minutes of rest. Random capillary blood glucose (RCBG) was assessed using a standardized glucometer to verify diabetes status in controls and to document blood glucose levels in both groups.

A sedentary lifestyle was operationally defined as engaging in less than 45 minutes of physical activity per day on fewer than four days per week. Dietary risk was defined as consuming fewer than three servings of fruits and vegetables per week, with high intake of processed and sugary foods. Smoking and harmful alcohol use were self-reported. A participant was classified as having diabetes-related knowledge if they could correctly identify at least three known risk factors for diabetes, the method of diagnosis, and at least three components of its management, such as medication adherence, dietary changes, or routine physician follow-up.

Statistical analysis was performed using IBM SPSS Statistics, Version 26. Descriptive statistics, including means and standard deviations for continuous variables and frequencies with percentages for categorical variables, were computed. Chi-square tests were used to compare proportions between cases and controls for categorical variables, while independent samples t-tests were applied to assess differences in continuous variables assuming normal distribution. Z-tests were used for comparing two proportions where applicable. A two-tailed P-value of <0.05 was considered statistically significant. Missing data were minimal and handled by listwise deletion. Matching by age and sex between cases and controls was intended to reduce confounding, and no further adjustment was made for these variables in the analysis (1).

RESULTS

A total of 716 participants were included in the study, comprising 346 cases diagnosed with Type 2 Diabetes Mellitus (T2DM) and 370 age- and sex-matched controls without diabetes. Table 1 summarizes the demographic and clinical characteristics of the study population.

There was no statistically significant difference in sex distribution between cases and controls (p = 0.25), with males representing 70.8% of cases and 74.6% of controls. However, a statistically significant difference was observed in age distribution (p < 0.001), with the majority of cases (77.5%) falling within the 31–45 age group, while most controls (72.4%) were between 18–30 years. Educational attainment differed significantly between the two groups (p = 0.02); although the proportion completing primary school was comparable (31.8% vs. 35.7%), a higher proportion of cases had completed higher secondary education (20.2%) compared to controls (17.6%). University-level education was more frequent among controls (9.2%) than cases (6.4%).

A family history of diabetes mellitus was significantly more prevalent among cases (28.0%) than controls (6.8%) (p < 0.001), suggesting a strong genetic or familial predisposition. Socioeconomic status also showed a significant association with diabetes status (p = 0.03), with a slightly higher proportion of controls belonging to the middle and upper classes. Systolic and diastolic blood pressure readings were marginally higher in cases than controls, but these differences were not statistically significant (p = 0.31 and p = 0.089, respectively), indicating that blood pressure levels were relatively comparable at baseline between the two groups.

Table 1. Demographic and Clinical Characteristics of the Study Population (N = 716)

Characteristic	Cases (n = 346)	Controls (n = 370)	p-value
Sex			0.25
Male	245 (70.8%)	276 (74.6%)	
Female	101 (29.2%)	94 (25.4%)	
Age Group (years)			<0.001
18–30	78 (22.5%)	194 (52.4%)	
31–45	268 (77.5%)	176 (47.6%)	
Education Level			0.02
Primary School	110 (31.8%)	132 (35.7%)	
Secondary	90 (26.0%)	88 (23.8%)	
Higher Secondary	70 (20.2%)	65 (17.6%)	
College	54 (15.6%)	51 (13.8%)	
University	22 (6.4%)	34 (9.2%)	
Blood Pressure (mmHg)			
Systolic (mean ± SD)	120.2 ± 0.9	118.6 ± 1.3	0.31
Diastolic (mean ± SD)	84.1 ± 1.7	80.9 ± 0.8	0.089
Family History of DM			<0.001
Yes	97 (28.0%)	25 (6.8%)	
No	249 (72.0%)	345 (93.2%)	
Socioeconomic Status			0.03
Lower Class	156 (45.1%)	140 (37.8%)	
Middle Class	170 (49.1%)	201 (54.3%)	
Upper Class	20 (5.8%)	29 (7.8%)	

Table 2 presents the distribution of behavioral and metabolic risk factors associated with T2DM. A significantly higher proportion of cases reported a sedentary lifestyle (70.2%) compared to controls (51.4%) (p = 0.007), reflecting a moderate effect size and suggesting a meaningful lifestyle-behavioral association. Similarly, dietary risk factors were present in 90.8% of cases versus 60.8% of controls (p = 0.01), indicating a robust association between poor nutritional practices and T2DM.

Table 2. Distribution of Behavioral and Metabolic Risk Factors for Type 2 Diabetes Mellitus (N = 716)

Risk Factor	Cases (n = 346)	Controls (n = 370)	Total (N = 716)	p-value
Sedentary Lifestyle (%)	243 (70.2%)	190 (51.4%)	433 (60.5%)	0.007
Dietary Risk Factors (%)	314 (90.8%)	225 (60.8%)	539 (75.3%)	0.01
Harmful Alcohol Use (%)	33 (9.5%)	24 (6.5%)	57 (8.0%)	0.13
Smoking/Tobacco Use (%)	70 (20.2%)	50 (13.5%)	120 (16.8%)	0.019
Overweight (%)	89 (25.7%)	71 (19.2%)	160 (22.4%)	0.036
Moderately Obese (%)	66 (19.1%)	40 (10.8%)	106 (14.8%)	0.003
Random Blood Glucose (mg/dL)	100.5 ± 1.1	98.3 (87.78–90.82)	—	0.36

Although harmful alcohol use was higher among cases (9.5%) than controls (6.5%), the difference was not statistically significant (p = 0.13), indicating a possible but inconclusive trend. In contrast, smoking and tobacco use were significantly more frequent in cases (20.2%) than controls (13.5%) (p = 0.019), reinforcing the established role of tobacco exposure in metabolic dysfunction. Weight-related variables also showed clear trends: overweight status was observed in 25.7% of cases

versus 19.2% of controls (p = 0.036), while moderate obesity was significantly more prevalent in cases (19.1%) than controls (10.8%) (p = 0.003), suggesting a strong dose-response relationship between body weight and diabetes risk.

Random capillary blood glucose (RCBG) levels were slightly higher in cases (100.5 ± 1.1 mg/dL) compared to controls (98.3 mg/dL, 95% CI: 87.78–90.82), although this difference was not statistically significant (p = 0.36). This may reflect the effect of ongoing treatment or glucose regulation efforts in known diabetic cases at the time of assessment.

In summary, the results demonstrate statistically and clinically significant associations between T2DM and modifiable behavioral and metabolic factors such as physical inactivity, unhealthy dietary habits, smoking, overweight, and moderate obesity. These findings emphasize the importance of targeted interventions to mitigate lifestyle-related risk factors in rural populations vulnerable to early-onset diabetes.

DISCUSSION

The present study provides compelling evidence of significant associations between modifiable lifestyle and metabolic risk factors and the development of Type 2 Diabetes Mellitus (T2DM) in young adults residing in rural areas of Nawabshah, Pakistan. The findings support existing global and regional research, confirming that a sedentary lifestyle, unhealthy dietary practices, smoking, and excess body weight substantially increase the risk of T2DM. These associations remained robust even after adjusting for age and sex through matched case-control design, reinforcing the critical role of behavioral and environmental determinants in the pathogenesis of T2DM in underserved populations.

Consistent with our findings, sedentary behavior was markedly higher among cases than controls, aligning with results from large-scale cohort studies such as the one by Hu et al., which demonstrated that physical inactivity elevates diabetes risk by up to 50% (8). Similarly, a review by Fogelholm et al. emphasized the synergistic impact of physical inactivity and obesity on insulin resistance and glucose dysregulation (6). These physiological disruptions occur due to reduced muscle glucose uptake and mitochondrial dysfunction, reinforcing the biological plausibility of sedentary lifestyles as a potent contributor to T2DM pathogenesis. This study further underscores the need for culturally adapted physical activity promotion strategies in rural settings, where recreational infrastructure is often limited.

Dietary risk factors were significantly more prevalent among diabetic cases, echoing findings from prior studies that linked high intake of processed foods, saturated fats, and sugar-sweetened beverages with elevated diabetes risk (10). The mechanistic underpinnings of this relationship involve chronic postprandial hyperglycemia, increased lipid accumulation, and systemic inflammation, which together impair insulin signaling pathways. Our results resonate with the meta-analysis by Malik et al., which showed that frequent consumption of sugary beverages increases T2DM risk by 26% (11). The high burden of dietary risk factors observed in our study highlights the urgent need for community-based nutritional education programs that are sensitive to local food practices and economic constraints.

While the association between alcohol use and diabetes risk was not statistically significant in this cohort, the trend observed aligns with the mixed evidence in the literature. Moderate alcohol consumption has been linked with improved insulin sensitivity, whereas heavy consumption correlates with beta-cell toxicity and systemic inflammation (13). The lack of statistical significance in our study may reflect underreporting due to cultural stigmas surrounding alcohol in rural Pakistan, or a relatively low prevalence of alcohol use in this population. In contrast, smoking was significantly associated with increased diabetes risk, corroborating a meta-analysis by Willi et al. which found that smoking increases the risk of T2DM by up to 44% in heavy smokers (14). Nicotine-induced oxidative stress, endothelial dysfunction, and low-grade inflammation are recognized contributors to insulin resistance, providing a plausible biological explanation for this association.

Body weight status emerged as a critical factor, with both overweight and moderate obesity significantly more common among diabetic cases. This supports findings from Colditz et al., who demonstrated a 40-fold increased diabetes risk in women with a BMI ≥30 compared to those with normal weight (12). The Diabetes Prevention Program further validated that even modest weight reduction of 5–7% significantly reduces diabetes incidence (15). The present study's confirmation of this relationship in a rural South Asian context adds weight to calls for early screening and lifestyle interventions targeting weight control, even in settings where obesity prevalence may be underestimated.

The study's strengths include its robust case-control design with matching on key confounders, large sample size relative to similar rural epidemiological studies, and the use of objective measurements such as RCBG and anthropometric assessments. Additionally, the study addresses a critical gap in the literature by focusing on a rural Pakistani population, where social, economic, and healthcare access barriers may compound the effects of behavioral risk factors. However, several limitations must be acknowledged. The cross-sectional nature of the data limits causal inference, and the reliance on self-reported behavioral data introduces the possibility of recall and social desirability bias. Although efforts were made to minimize selection bias through random household sampling, generalizability may still be constrained by regional cultural and socioeconomic characteristics. Furthermore, while the inclusion of adults aged 18–45 allowed for examination of early-onset T2DM, findings may not be extrapolated to older adults or pediatric populations without caution.

Future research should consider prospective cohort designs to establish causal pathways and explore temporal relationships between behavioral changes and diabetes onset. Additionally, qualitative studies could illuminate contextual barriers to lifestyle modification in rural communities, while interventional trials may test the effectiveness of locally adapted public health strategies. Expanding biomarker assessments beyond RCBG—such as HbA1c and insulin resistance indices—could also provide deeper insights into the metabolic profiles of high-risk individuals in rural settings.

In conclusion, this study highlights the central role of modifiable risk factors—particularly physical inactivity, unhealthy dietary habits, tobacco use, and obesity—in the development of T2DM among young rural adults in Nawabshah. These findings reinforce the need for comprehensive, community-based preventive strategies targeting lifestyle modification, early screening, and health education tailored to the unique needs and cultural context of rural populations. Addressing these factors proactively may significantly reduce the burden of diabetes and its long-term complications in underserved regions.

CONCLUSION

This case-control study identified significant associations between modifiable risk factors—specifically a sedentary lifestyle, poor dietary habits, smoking, and elevated body weight—and the prevalence of Type 2 Diabetes Mellitus among young adults in the rural areas of Nawabshah. These findings underscore the urgent need for targeted public health interventions that promote active lifestyles, nutritional education, smoking cessation, and early screening within rural communities. Clinically, the results highlight the importance of integrating lifestyle counseling into primary care services in underserved regions, while also informing future research aimed at developing culturally tailored, community-based prevention programs to curb the growing burden of diabetes in similar rural settings.

REFERENCES

1. Peer N, Balakrishna Y, Durao S. Screening for Type 2 Diabetes Mellitus. Cochrane Database Syst Rev. 2020;5:CD005266.
2. Galicia-Garcia U, Benito-Vicente A, Jebari S, Larrea-Sebal A, Siddiqi H, Uribe KB, et al. Pathophysiology of Type 2 Diabetes Mellitus. Int J Mol Sci. 2020;21(17):6275.
3. Zheng Y, Ley SH, Hu FB. Global Aetiology and Epidemiology of Type 2 Diabetes Mellitus and Its Complications. Nat Rev Endocrinol. 2018;14(2):88–98.
4. Ma RCW. Epidemiology of Diabetes and Diabetic Complications in China. Diabetologia. 2018;61(6):1249–1260.
5. Faselis C, Katsimardou A, Imprialos K, Deligkaris P, Kallistratos M, Dimitriadis K. Microvascular Complications of Type 2 Diabetes Mellitus. Curr Vasc Pharmacol. 2020;18(2):117–124.
6. Li M, Wang Y, Liu Z, Tang X, Mu P, Tan Y, et al. Females with Type 2 Diabetes Mellitus Are Prone to Diabetic Retinopathy: A Twelve-Province Cross-Sectional Study in China. J Diabetes Res. 2020;2020:5814296.
7. Yun JS, Ko SH. Current Trends in Epidemiology of Cardiovascular Disease and Cardiovascular Risk Management in Type 2 Diabetes. Metabolism. 2021;123:154838.
8. He C, Wang W, Chen Q, Shen Z, Pan E, Sun Z, et al. Factors Associated with Stroke Among Patients with Type 2 Diabetes Mellitus in China: A Propensity Score Matched Study. Acta Diabetol. 2021;58(12):1513–1523.
9. Centers for Disease Control and Prevention. Basics—Diabetes. [Internet]. Atlanta: CDC; 2019 [cited 2019 May 3]. Available from: https://www.cdc.gov/diabetes/basics/diabetes.html
10. International Diabetes Federation. About Diabetes. [Internet]. Brussels: IDF; 2019 [cited 2019 Jun 3]. Available from: https://idf.org/52-aboutdiabetes.html
11. International Diabetes Federation. IDF Diabetes Atlas. 8th ed. [Internet]. Brussels: IDF; 2017 [cited 2019 Jun 3]. Available from: http://diabetesatlas.org/IDF_Diabetes_Atlas_8e_interactive_EN/
12. Hu FB, Sigal RJ, Rich-Edwards JW, Colditz GA, Solomon CG, Willett WC, et al. Walking Compared with Vigorous Physical Activity and Risk of Type 2 Diabetes in Women. JAMA. 2001;285(7):897–904.
13. Fogelholm M, Anderssen SA, Gunnarsdottir I, Lahti-Koski M. Physical Inactivity and Obesity: A Review of the Epidemiological Evidence. Obes Rev. 2021;22(S4):e13260.
14. Malik VS, Popkin BM, Bray GA, Després JP, Willett WC, Hu FB. Sugar-Sweetened Beverages and Risk of Metabolic Syndrome and Type 2 Diabetes: A Meta-Analysis. Diabetes Care. 2010;33(11):2477–2483.
15. Mozaffarian D, Hao T, Rimm EB, Willett WC, Hu FB. Changes in Diet and Lifestyle and Long-Term Weight Gain in Women and Men. N Engl J Med. 2011;364(25):2392–2404.
16. Baliunas DO, Taylor BJ, Irving H, Roerecke M, Patra J, Mohapatra S, et al. Alcohol Consumption and Risk of Incident Type 2 Diabetes: A Systematic Review and Meta-Analysis. Diabetes Care. 2009;32(11):2123–2132.
17. Willi C, Bodenmann P, Ghali WA, Faris PD, Cornuz J. Active Smoking and the Risk of Type 2 Diabetes: A Systematic Review and Meta-Analysis. JAMA. 2007;298(22):2654–2664.
18. Colditz GA, Willett WC, Stampfer MJ, Manson JE, Hennekens CH, Speizer FE. Weight as a Risk Factor for Clinical Diabetes in Women. Ann Intern Med. 1995;122(7):481–486.
19. Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, et al. Reduction in the Incidence of Type 2 Diabetes with Lifestyle Intervention or Metformin. N Engl J Med. 2002;346(6):393–403.
20. Khan MA, Siddiqui F, Qureshi R. Lifestyle Risk Factors for Type 2 Diabetes in Rural Pakistan: A Community-Based Study. J Diabetes Res. 2021;2021:8897672.
21. Ahmed S, Rehman A, Malik N. Predictors of Diabetes Among Adults in Rural Districts of Pakistan. BMC Public Health. 2020;20(1):1236.
22. Fatima T, Iqbal Z, Aslam M. Genetic Predisposition to Diabetes in South Asian Populations: Implications for Prevention. Diabetes Metab Syndr. 2022;16(4):102476.

23. Hussain S, Rasheed H, Akhtar S. Barriers to Diabetes Care in Underserved Regions: A Systematic Review. Glob Health Action. 2023;16(1):2156789.

24. Ali W, Shahid M, Ahmed N. Food Insecurity and Diabetes Risk in Rural Pakistan: A Cross-Sectional Analysis. Nutr Diabetes. 2022;12(1):8.