European Journal of Clinical Pharmacy
Print ISSN: 2385-409X **Online ISSN**: Applied Website:
https://farmclin.com/

A survey study on Risk Prediction of Cardiovascular Disease as per Human constitution Among Type 2 Diabetes

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ABSTRACT

Background: Chronic high glucose concentration causes tissue injury and increases risk of heart attack. The Atherosclerotic Cardiovascular Disease (ASCVD)is a risk predictor used to estimate the current 10-year risks of cardiovascular events. Prakriti a unique constitution type determined by the predominance of Vata, Pitta, and Kapha doshas. Each prakriti determine unique physique, physiological functions, psychological attributes and unique responses according to different diseases. In this study we have assessed ASCVD risks according to Prakriti in patients with T2DM and compare it with non-diabetic. Methods: A cross-sectional analysis was conducted among 290 patients. A validated prakriti questionnaire was used to determine the prakriti. ASCVD risk scores were calculated using the risk calculator developed by American College of Cardiology. Results: Among 290 participantsThe ASCVD risk score was significantly higher in diabetic patients compared to non-diabetic patients (Mann-Whitney U test, $p<0.001$, OR=1.38).Among diabetics, Vata-dominant individuals had the highest

ASCVD risk, with 3.16 and 4.24 times higher odds of high-risk (≥7.5%) than Pitta and Kapha, respectively. Hypertension posed a catastrophic risk for Vata-dominant diabetics (OR=21.8), while alcohol did so for Pitta-dominant diabetics (OR=25.43) and smoking for Pitta and Kaphadominant diabetics (OR≈12.3); an overweight BMI was a significant general risk (OR=3.33). Conclusions: Vata Prakriti diabetic individuals had highest ASCVD score followed by Pitta dominant, with adverse lifestyle factors such as hypertension, smoking, alcohol, dyslipidemia, and overweight were found to affect ASCVD risk across all Prakriti types of Diabetic Patients.

KEYWORDS: Ayurveda; ASCVD risk score; cardiovascular disease; diabetes mellitus Type 2, Prakriti.

How to Cite: Shubham Maharana, Rakesh Roushan, (2025) A survey study on Risk Prediction of Cardiovascular Disease as per Human constitution Among Type 2 Diabetes, European Journal of Clinical Pharmacy, Vol.7, No.1, pp. 8033-8038

INTRODUCTION

Cardiovascular disease (CVD) continues to be the leading cause of death worldwide, accounting for an estimated 17.9 million deaths annually.1 Among the major risk groups, individuals with type 2 diabetes mellitus (T2DM) face a two- to four-fold higher risk of developing CVD compared to non-diabetic populations.2 The coexistence of diabetes and CVD not only worsens clinical outcomes but also imposes a substantial economic and social burden on health care systems.3 This challenge is particularly acute in India, which is home to the second-largest population of people with diabetes globally, with prevalence projected to rise from 77 million in 2019 to over 134 million by 2045.4 The main reason is sedentary lifestyles. Among these chronic diseases, such as heart disease, stroke, diabetes, obesity, metabolic syndrome, chronic obstructive pulmonary disease, and some types of cancer are brought on by lifestyle that have risk factors in common with long-term exposure to three modifiable lifestyle behaviors: smoking, eating poorly, and being inactive. Estimated 537 million adults worldwide global prevalence of 10.5 percent among adults aged 20 to 79 years.5

Conventional biomedical models, such as the Atherosclerotic Cardiovascular Disease (ASCVD) risk score, Framingham Risk Score, and QRISK, are widely used to predict cardiovascular risk.6 The ASCVD Risk Score are employed to estimate the likelihood of future cardiovascular events. These tools integrate parameters like age, lipid profile, blood pressure, smoking status, and diabetic status to predict 10-year risk. While these models have been validated in Western populations, their applicability in South Asian cohorts remains limited. Studies have shown that South Asians develop CVD at younger ages, with higher rates of central obesity, insulin resistance, and dyslipidemia compared to Western populations.7

Ayurveda, India's traditional system of medicine, offers a complementary framework for understanding health and disease. Prakriti (constitutional type), which classifies individuals into three primary categories Vata, Pitta, and Kapha and their combinations.8 Ayurveda considered a healthy person one whose humors and metabolic state are in equilibrium, whose functional activities of the tissues and excretory products (i.e. physical state) are in balance and the soul, senses, and mind (i.e.

mental state of the body) are in a state of total well-being.9 Prakriti is believed to influence metabolism, physiology, disease susceptibility, and therapeutic response. Modern studies have begun to explore the biological correlates of Prakriti, linking it with genomic, biochemical, and metabolic profiles.10 Associations have also been reported between Prakriti and metabolic disorders such as obesity, hypertension, and diabetes.11 12 However, evidence on the relationship between Prakriti and cardiovascular risk prediction in patients with T2DM remains sparse.

Integrating Prakriti assessment with biomedical risk models may provide a more holistic and personalized approach to cardiovascular risk stratification. Such integration could be particularly valuable in India, where Ayurveda is widely practiced alongside modern medicine, and where the urgent need exists for culturally and population-specific risk prediction tools.13 This interdisciplinary approach has the potential to improve early identification of high-risk individuals, guide preventive strategies, and ultimately reduce the burden of CVD in diabetic populations.

Hence, a cross-sectional analysis of the data generated from this study was used to determine the risk of cardiovascular diseases as per Prakriti among patients of Type 2 diabetes mellitus to those who do not, by using ASCVD score.
The primary objective of the cross-sectional analysis was to determine the Association of Type 2 Diabetes Mellitus on cardiovascular disease as per Prakriti by using ASCVD score among patients of diabetes mellitus to those who do not. Secondary objective was to find the association of other risk factors (Hypertension, Smoking, Alcohol, Lipid profile, BMI) for developing cardiovascular diseases by using ASCVD score.

METHODS

STUDY DESIGN:

This is a cross-sectional analysis of data generated through questionnaire and the biochemical reports were used to determine the risk prediction of CVD as per Prakriti among patients with T2DM. We followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines when reporting the findings.14

INFORMED CONSENT AND ETHICAL CONSIDERATIONS

The study was approved by the Institutional Ethics Committee (IEC Code: CBPIEC/2023/KS/MD/06; dated 29.11.2023) and registered with the Clinical Trial Registry of India (CTRI/2024/05/067087; dated 09.05.2024). Prior to the inclusion of patients in the trial, written informed consent was taken to the mandated proforma. The user was informed that the information they entered would only be used for research purposes and that their anonymity and confidentiality would be maintained. The users were also informed that by choosing to provide information, they were making a valuable contribution to public health research in the country. It was made explicitly clear that by participating in the survey, users were voluntarily giving their consent to use the data for research purposes.

STUDY SETTING

The study was conducted at Ch. Brahm Prakash Ayurved Charak Sansthan (CBPACS), Khera
Dabar, New Delhi, Patients who attended the OPD of CBPACS from 18 May 2024 to 30 June 2025 and met the inclusion criteria were enrolled.

PARTICIPANTS

The study included 290 participants, with 145 diagnosed Type 2 Diabetes Mellitus patients and 145 non-diabetic controls, aged between 30–70 years. Participants were selected using a non-randomized purposive sampling method from the OPD of CBPACS. Inclusion criteria encompassed individuals of either sexes, with or without associated cardiovascular risk factors, who were willing to participate and had no history of apparent illness in the preceding month. Exclusion criteria included a past history of cardiovascular events, disorientation, or inability to complete the required questionnaires or provide blood samples.

VARIABLES

The Primary Exposure is the presence of Type 2 Diabetes Mellitus, with participants divided into two groups: Diabetic and Non-Diabetic (n=145). Secondary Exposure is the dominant Prakriti, classified as Vata-dominant, Pitta-dominant, and Kapha-dominant based on a validated Self-Assessment Questionnaire (SAQDP). The Primary Outcome variables are CVD risk, quantified as a percentage using the ASCVD Risk Score. The score categorizes risk as Low (0–4.9%), Borderline (5–7.4%), Intermediate (7.5–20%), or High (>20%) for a major cardiovascular event within 10 years. Potential Confounders are age, Gender, Socio-economic status, Occupation, Diet, Nature of work. Therapeutic: Use of Anti-hypertension medication and oral hypoglycemic drugs.

DATA COLLECTION METHODS

Data were collected by using a structured Case Report Proforma which included:

- Demographic details (age, gender, religion, education, occupation, socioeconomic status)
- Clinical parameters (height, weight, BMI, waist circumference, blood pressure)
- Laboratory investigations (lipid profile: total cholesterol, HDL, LDL, triglycerides)
- Atherosclerotic Cardiovascular Disease (ASCVD) Risk Score assessment using the ACC/AHA online calculator.15
- Prakriti assessment using the validated Self-Assessment Questionnaire for Determining Prakriti (SAQDP).16

OUTCOME MEASURES

The primary outcome of the study was to determine the association between Prakriti and cardiovascular disease risk among

patients with Type 2 Diabetes Mellitus compared to nondiabetic individuals, by using ASCVD Risk Score. The ASCVD score categorizes individuals into:

- Low risk (0–4.9%)
- Borderline risk (5–7.4%)
- Intermediate risk (7.5–20%)
- High risk (>20%)

The secondary outcomes included: Association of BMI, hypertension, smoking and alcohol, impact of lipid profile parameters (total cholesterol, triglycerides, LDL, HDL) with ASCVD risk across different Prakriti types.

BIAS

The sampling bias cannot be ruled out because purposive sampling method was employed to ensure equal representation of diabetic and non-diabetic groups. The possibility of information bias could also not be completely ruled out, as the information provided by the patients retrospectively, such as lenient to provide answer of DSAQ questionnaire, frequency and duration of use of risk predictors etc.

However, the study was conducted in a single institutional setting, which may limit the generalizability of findings to the broader population.

STUDY SIZE

A total of 290 participants were included in the study, with 145 in the diabetic group and 145 in the non-diabetic group.

STATISTICAL ANALYSIS

Data collected through the case report proforma, Prakriti questionnaire, and ASCVD calculator were compiled in Microsoft Excel. The coded dataset was imported into SPSS version 22 for statistical analysis. Descriptive statistics were presented as frequencies and percentages for categorical variables. Continuous variables were summarized using mean and standard deviation where applicable. Inferential statistical tests included Mann–Whitney U test: For comparing ASCVD risk scores between two independent groups (e.g., diabetic vs. nondiabetic), Kruskal–Walli's test: For comparing ASCVD risk scores across three or more Prakriti types, Unpaired t-test: For comparing means of normally distributed continuous variables between two groups. Logistic regression analysis was performed to compute crude odds ratios for the association between Prakriti and high ASCVD risk, A p-value of <0.05 was considered statistically significant.

OBSERVATION & RESULT

Demographic and Clinical Characteristics of the Study Population (N=290)

Out of 290 participants, 145 were diabetic and 145 were non-diabetic, matched for comparison.

Age and Gender A majority of diabetics (46.9%) were aged ≥50 years, compared to 78.6% in the non-diabetic group, indicating that diabetes was more common among older individuals. Males predominated in both groups (60.0% diabetics vs. 51.7% non-diabetics). Religion Most participants were Hindus (95.9%), followed by Muslims (3.8%) and a single Sikh participant (0.3%), showing a largely homogeneous religious distribution. Education Graduates formed the largest proportion (53.4%), followed by those educated up to the metric level (37.9%). A slightly higher percentage of diabetics were graduates (60.7%) compared to non-diabetics (46.2%). Occupation Employment was the most common occupation (43.8%), followed by housewives

(28.6%) and businesspersons (15.5%). Marital Status Nearly all participants were married (97.6%), reflecting the middle-aged nature of the study population. Socioeconomic Status Most belonged to the lower-middle (46.6%) and middle (33.8%) classes. A higher proportion of nondiabetics (57.2%) were from the lower-middle class, whereas more diabetics (49.7%) belonged to the middle class. Income The majority (62.4%) reported an annual income between ₹1–5 lakhs, with a greater proportion of diabetics in this bracket (59.3%). Dietary Habits A mixed diet was predominant (60.3%), especially among non-diabetics (71.0%), while half of diabetics were vegetarian (49.7%). Agni Samagni was most frequent (58.3%), followed by Mandagni (22.8%). Mandagni was more common among non-diabetics (28.3%), whereas Samagni predominated in diabetics (65.5%). Bowel Habit Regular bowel habits were seen in 47.9% overall, while constipation (20.7%) was more frequent among diabetics (24.8%). Sleep Pattern Sound sleep was reported by 64.8%, though disturbed sleep was more frequent among nondiabetics (40.7%) than diabetics (22.1%). Nature of Work Sedentary (34.8%) and moderate (28.6%) work types were most common. Diabetics had a higher sedentary lifestyle (36.6%), while travelling-type work was notably higher among non-diabetics (16.6%). In BMI classification Most participants had normal weight (68.6%). Overweight status was found in 30%, slightly higher among non-diabetics (31.7%). Obesity was rare (0.7%).

ASCVD Scores by Diabetic Status and Prakriti Type (Ayurvedic Constitution)

Diabetic Status

The Mann–Whitney U test shows statistically significant difference between the two groups ($U = 8752.5$, $Z = 2.464$, $p = 0.0139$), confirming that the distribution of ASCVD risk scores differs significantly with diabetic status. Diabetic individuals have approximately 1.38 times higher odds of having elevated ASCVD risk (≥7.5) compared with non-diabetic individuals.

Prakriti Type among Diabetic Patients

The Kruskal–Walli's test shows statistically significant difference in ASCVD risk scores across the three Prakriti types, $p = 0.00041$. Post-hoc Dunn's multiple comparison tests showed significant differences between Vata and Pitta ($p = 0.0052$) and between Vata and Kapha ($p = 0.0003$) Prakriti types, while no significant difference was observed between Pitta and Kapha (p

= 0.2955). These results suggest that Vata Prakriti diabetic patients have significantly higher ASCVD risk scores compared to both Pitta and Kapha types. while comparing Odds Ratio we conclude: Vata dominant Diabetic Patients are 3.16 times more prone to ASCVD risk than Pitta dominant Diabetic Patients, Vata dominant Diabetic Patients are 4.24 times more prone from Kapha dominant Diabetic Patients, Pitta dominant Diabetic Patients are 1.34 times more prone to ASCVD Risk than Kapha dominant Diabetic Patients.

Prakriti Type among Non-Diabetic Patients

The Association size ($\varepsilon^2 = 0.0$) indicates a negligible association, suggesting that the variance in ASCVD scores cannot be attributed to differences in Prakriti. while comparing Odds Ratio we conclude: Vata dominant Non-Diabetic Patients are 0.86 times more prone to ASCVD Risk than Pitta dominant Non-Diabetic Patients and Vata dominant Non-Diabetic Patients are 0.92 times more prone from Kapha dominant Non-Diabetic Patients. Pitta dominant Non-Diabetic Patients are 1.07 times more prone to ASCVD Risk than Kapha dominant Non-Diabetic

Patients. The Kruskal–Walli's test shows non-significant difference is seen in ASCVD risk scores across the three Prakriti types,

Prakriti risk with other risk factors

The analysis of modifiable risk factors revealed significant associations with ASCVD scores, further quantified by odds ratios for high ASCVD risk. Diabetic patients with hypertension (HTN) had a significantly higher mean ASCVD score than those without. This effect varied by Prakriti; Vata-dominant (OR 21.8) and Pitta-dominant (OR 5.1) diabetic patients with HTN had substantially higher odds of high ASCVD risk compared to their non-exposed counterparts, whereas the difference was not significant for Kapha-dominant diabetics. Among nondiabetics, Kapha-dominant individuals with HTN also showed elevated odds (OR 2.56). Across the entire cohort, exposure to HTN was associated with 2.3 times higher odds of high ASCVD risk. Similarly, exposure to smoking significantly increased ASCVD scores among diabetic patients. This was particularly pronounced for Pitta-dominant (OR 12.09) and Kapha-dominant (OR 12.38) diabetic smokers, who had markedly higher odds of high risk. The association for Vata-dominant diabetic smokers was not statistically significant. Overall, smokers had 3.34 times higher odds of high ASCVD risk than non-smokers. Alcohol consumption was associated with significantly elevated ASCVD scores across all Prakriti types in the diabetic group, with correspondingly high odds ratios: Vata (OR 9.1), Pitta (OR 25.43), and Kapha (OR 15.56). A strong association was also observed in Vata-dominant non-diabetic patients (OR 18.58). Pooled analysis showed alcohol consumption conferred 5.72 times higher odds of high ASCVD risk. While elevated total cholesterol (>200 mg/dL) and triglycerides (>150 mg/dL) were associated with higher ASCVD scores in the overall population (OR 2.82 and OR 1.16, respectively), these lipid parameters did not show a statistically significant differential effect within diabetic patients when stratified by Prakriti. A similar pattern was observed for elevated LDL (>100 mg/dL), which was significant in the overall cohort but not within diabetic Prakriti subgroups. Aggregate lipid analysis confirmed diabetic patients had significantly higher mean cholesterol and triglyceride levels than non-diabetics, but no significant difference in LDL or HDL. Diabetic status itself was associated with 1.39 times higher odds of elevated ASCVD risk from dyslipidaemia. Finally, being overweight was associated with 3.33 times higher odds of high ASCVD risk in the overall population. However, within the diabetic group, overweight status did not confer a significant increase in ASCVD score, and this null finding was consistent across all Prakriti types.

DISCUSSION

Key Results

The present study demonstrates clear demographic, metabolic, and constitutional differences influencing diabetes status and ASCVD risk. Diabetic individuals were predominantly younger than 50 years and male, highlighting an earlier onset of type 2 diabetes in economically productive age groups, consistent with Indian and global trends linking insulin resistance and β-cell dysfunction to age-related metabolic stress.17 Higher educational attainment and employee-based occupations among diabetics suggest the contributory role of sedentary lifestyle and occupational stress, as supported by earlier epidemiological findings.18 Socioeconomic transition, particularly within the middle class, further appears to amplify diabetes risk through dietary excess and reduced physical activity.19 Diabetes emerged as a strong determinant of ASCVD risk, with diabetics exhibiting significantly higher ASCVD risk (≥7.5) scores and approximately 1.38 times greater cardiovascular risk compared with nondiabetics. This aligns with robust evidence identifying diabetes as an independent cardiovascular risk enhancer.20 Importantly, Prakriti significantly modified ASCVD expression among diabetics, with Vata-dominant individuals consistently showing the highest risk, followed by Pitta, while Kapha demonstrated relative protection. This supports integrative research suggesting that constitutional factors influence metabolic instability, vascular stress, and atherosclerotic susceptibility under diabetic conditions.21

Hypertension, smoking, and alcohol consumption markedly amplified ASCVD risk, particularly among diabetic and Vata- or Pitta-dominant individuals, corroborating findings from large cohort studies such as UKPDS, INTERHEART, and Framingham, which emphasize the synergistic effects of these modifiable risk factors in diabetes.22,23 Lipid parameters showed heterogeneous associations: while total cholesterol, triglycerides, and LDL were significant

ASCVD determinants in pooled analyses, their predictive strength varied by diabetes status and Prakriti, reflecting evidence that qualitative lipid abnormalities and metabolic context are more relevant than isolated lipid levels in diabetes.24

Overall, the findings reinforce diabetes and hypertension as dominant ASCVD drivers, while highlighting that Prakriti-based stratification offers additional explanatory power for interindividual variability. Integrating Ayurvedic constitutional assessment with conventional risk profiling may enhance personalized cardiovascular risk prediction and targeted prevention strategies.

Principal Findings

This study demonstrated that cardiovascular risk, as measured by the ASCVD score, was significantly higher among patients with T2DM compared to non-diabetic controls. Importantly, Prakriti was significantly associated with ASCVD risk categories in the diabetic group (Kruskal-Wallis p=0.00041). Vata-dominant individuals showed the greatest clustering in high-risk categories, with significantly higher median ASCVD scores (16.03, IQR 16) compared to Pitta-dominant (10.03, IQR 8) and Kapha-dominant (9.24, IQR 10.5) individuals. In contrast, no significant association was observed between Prakriti and ASCVD risk among non-diabetic participants (Kruskal-Wallis p=0.9334), with all Prakriti types showing similar median scores (Vata: 8.02, Pitta: 8.12, Kapha: 7.88).

Comparison With Prior Work

Our findings are consistent with established evidence that T2DM is a major risk factor for cardiovascular disease (CVD) .25,26 The elevated ASCVD scores among diabetics in this study align with global and Indian data on the diabetes-related cardiovascular burden .27,28 From an Ayurvedic perspective, Vata dominance has traditionally been associated with instability, irregularity, and susceptibility to degenerative and vascular conditions.29 The clustering of Vata-dominant individuals in higher ASCVD risk categories resonates with these classical descriptions. Previous integrative studies have also suggested associations between Vata Prakriti and metabolic dysfunction30,31 though evidence remains limited. This study adds quantitative support to such associations using a standardized biomedical risk score.

Interpretation

The findings suggest that Prakriti may modify CVD risk among individuals with Type 2 diabetes, with Vata-dominant constitution associated with the least favourable risk profile. This aligns with Ayurvedic concepts of Vata's association with instability, variable metabolism, and neuroendocrine sensitivity, which may exacerbate metabolic and cardiovascular dysregulation in diabetes. However, diabetes itself remains the most potent risk factor, overshadowing Prakriti-based differences in non-diabetic individuals. These results reinforce the importance of integrating traditional constitutional assessment with conventional risk stratification in diabetic patients, particularly for early identification of high-risk subgroups. Caution is warranted given the observational design and potential for unmeasured confounding; nevertheless, the patterns observed support further longitudinal research into Prakriti as a potential amplifier for personalized cardiovascular prevention.

Clinical and Public Health Implications

The integration of Prakriti assessment with biomedical risk models may enhance personalized prevention strategies. Identifying Vata-dominant individuals with T2DM as a subgroup at higher cardiovascular risk could inform targeted lifestyle interventions, closer monitoring, and early preventive measures. At a public health level, incorporating culturally relevant frameworks like Ayurveda into risk prediction models may improve patient engagement and adherence, particularly in Indian populations where traditional medicine remains widely practiced.32

Strengths, Limitations, and Future Directions

The study's strengths include the use of validated tools for Prakriti assessment and ASCVD calculation, along with a matched design. The integration of robust statistical measures (pvalues, effect sizes, odds ratios) strengthens the findings. Limitations include its cross-sectional nature, which precludes causal inference, and the single-center design, which may affect generalizability. The use of the ASCVD score, derived primarily from Western cohorts, is another recognized limitation. Future research should employ longitudinal designs to establish causality and explore the genomic, metabolomic, and inflammatory correlates of highrisk Prakriti-diabetes phenotypes. Randomized controlled trials are needed to test if Prakrititailored lifestyle, dietary, and pharmacological interventions can more effectively reduce ASCVD risk compared to standard care.

CONCLUSION

This cross-sectional study demonstrated that cardiovascular risk, as measured by the ASCVD score, was significantly higher among patients with T2DM compared to non-diabetic controls. Importantly, Prakriti was significantly associated with ASCVD risk categories in the diabetic group, with Vata-dominant individuals showing the greatest clustering in intermediate and high-risk categories.

- These findings suggest that Prakriti-based stratification may provide additional insights into cardiovascular risk prediction beyond conventional biomedical models. Integrating Ayurvedic constitutional assessment with established risk scores could enhance personalized prevention strategies, particularly in populations where Ayurveda is culturally relevant and widely practiced. Diabetes magnifies ASCVD risk the most.
- Prakriti significantly modifies the ASCVD risk,
- Vata Prakriti + Diabetes + risk factors (smoking, alcohol, dyslipidaemia) → highest ASCVD vulnerability Odds Ratio 21.8 times.
- Pitta Prakriti + Diabetes + risk factors (smoking, alcohol, dyslipidaemia) → moderate ASCVD vulnerability Odds Ratio 5.1 times.
- Kapha Prakriti + healthy metabolic status → lowest ASCVD risk.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. The study was conducted using institutional resources from Ch.
Brahm Prakash Ayurved Charak Sansthan.

Conflicts of Interest

The authors declare no conflicts of interest. No financial or personal relationships exist that could have influenced the study design, data collection, analysis, interpretation, or reporting.

Future longitudinal studies are needed to establish causal pathways and to explore the biological correlates of high-risk Prakriti-diabetes phenotypes. Randomized controlled trials are warranted to evaluate the efficacy of Prakriti-tailored interventions in reducing cardiovascular risk.

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