**🫀 Heart Disease Data Analysis Report**

**📌 Introduction**

This report presents the findings of an analytical study on a dataset of individuals with and without heart disease. The goal is to uncover patterns and key risk factors associated with heart disease using exploratory data analysis (EDA) techniques. The analysis addresses important questions related to demographics, lifestyle, biological indicators, and health history.

**Dataset Description**

The dataset includes the following variables:

* **Demographics**: Age, Gender, BMI
* **Lifestyle Factors**: Physical activity, Sleep duration, Sugar intake, Alcohol consumption
* **Medical Indicators**: Blood pressure, FBS (fasting blood sugar), CRP, Homocysteine
* **Family History**: Heart disease in the family, Diabetes
* **Target**: Presence of heart disease (Yes/No)

**🎯 Analytical Questions & Answers**

**1. What are the demographic characteristics of individuals with heart disease?**

* Most patients with heart disease are **older**, have a **higher BMI**, and tend to get **less sleep** than healthy individuals.

**2. Is there a gender difference in heart disease prevalence?**

* Yes, males show a **slightly higher prevalence** of heart disease compared to females.

**3. Is high blood pressure or cholesterol associated with heart disease?**

* The analysis shows a **strong correlation** between high blood pressure and heart disease.
* Cholesterol levels (added in later analysis) also tend to be **elevated in patients** with heart disease.

**4. Are physically active individuals less likely to have heart disease?**

* Yes, individuals who **engage in regular physical activity** are statistically **less likely** to have heart disease.

**5. What is the relationship between sleep, sugar, alcohol, and heart condition?**

* Patients with heart disease:
  + Sleep **fewer hours** on average.
  + Consume **more sugar and alcohol**.
  + These lifestyle factors appear to be **positively associated** with the condition.

**6. Which biological indicators are most associated with heart disease (CRP, FBS, Homocysteine)?**

* All three indicators show **notably higher values** in individuals with heart disease.
  + **CRP**: Suggests inflammation.
  + **FBS**: Indicates blood sugar control.
  + **Homocysteine**: Linked to blood vessel health.
* **CRP** and **Homocysteine** show the strongest differences.

**7. Does family history or diabetes increase the risk?**

* Yes, individuals with a **family history of heart disease** or with **diabetes** have **markedly higher** rates of heart disease.

**8. What are the most common factors among patients?**

* Among the most frequent factors in patients:
  + High blood pressure
  + Physical inactivity
  + Short sleep duration
  + High CRP levels
  + Diabetes or family history

**📊 Key Findings Summary**

| **Factor** | **Relationship with Heart Disease** |
| --- | --- |
| Age | ↑ Higher age = ↑ Risk |
| Gender | Males slightly more affected |
| Blood Pressure | Strong positive correlation |
| CRP / Homocysteine | Elevated in patients |
| FBS (Fasting Sugar) | Elevated in patients |
| Physical Activity | Less activity = ↑ Risk |
| Sleep Duration | Less sleep = ↑ Risk |
| Alcohol & Sugar | Higher consumption = ↑ Risk |
| Family History | Strongly linked to disease |
| Diabetes | Strongly linked to disease |

**✅ Recommendations**

Based on the data and findings, the following recommendations are proposed:

1. **Promote healthy lifestyle habits**: Encourage physical activity, adequate sleep, and reduced sugar/alcohol intake.
2. **Screen high-risk individuals**: Especially those with high blood pressure, high CRP, or family history.
3. **Early intervention**: For diabetic patients or those with elevated biological markers.
4. **Public awareness campaigns**: Focus on preventive strategies, especially in older adults and males.
5. **Routine medical checkups**: Regular monitoring of blood pressure, CRP, and blood sugar for early detection.

**📌 Conclusion**

This analysis demonstrates that heart disease is strongly linked to both **biological** and **behavioral** factors. Through early screening and lifestyle modifications, many cases of heart disease can potentially be prevented. Future work could include applying machine learning models for predictive analytics.