```
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

```
df=pd.read_csv('/content/drive/MyDrive/Heart Disease data.csv')
```

Dataset First View

```
df.head(10)
```

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target
0	52	1	0	125	212	0	1	168	0	1.0	2	2	3	0
1	53	1	0	140	203	1	0	155	1	3.1	0	0	3	0
2	70	1	0	145	174	0	1	125	1	2.6	0	0	3	0
3	61	1	0	148	203	0	1	161	0	0.0	2	1	3	0
4	62	0	0	138	294	1	1	106	0	1.9	1	3	2	0
5	58	0	0	100	248	0	0	122	0	1.0	1	0	2	1
6	58	1	0	114	318	0	2	140	0	4.4	0	3	1	0
7	55	1	0	160	289	0	0	145	1	0.8	1	1	3	0
8	46	1	0	120	249	0	0	144	0	0.8	2	0	3	0
9	54	1	0	122	286	0	0	116	1	3.2	1	2	2	0

The attributes of this data set are disease

Dataset Rows & Columns count

```
shape_of_df = df.shape
print(f'Number of Rows = {shape_of_df[0]} and Number of Columns = {shape_of_df[1]}')
```

```
Number of Rows = 1025 and Number of Columns = 14
```

Dataset Information

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1025 entries, 0 to 1024
Data columns (total 14 columns):
 #   Column    Non-Null Count  Dtype  
---  ------    --------------  -----  
 0   age       1025 non-null   int64  
 1   sex       1025 non-null   int64  
 2   cp        1025 non-null   int64  
 3   trestbps  1025 non-null   int64  
 4   chol      1025 non-null   int64  
 5   fbs       1025 non-null   int64  
 6   restecg   1025 non-null   int64  
 7   thalach   1025 non-null   int64  
 8   exang     1025 non-null   int64  
 9   oldpeak   1025 non-null   float64
 10  slope     1025 non-null   int64  
 11  ca        1025 non-null   int64  
 12  thal      1025 non-null   int64  
 13  target    1025 non-null   int64  
dtypes: float64(1), int64(13)
memory usage: 112.2 KB
```

```
# Dataset Duplicate Value Count
df_duplicate = df[df.duplicated()]
df_duplicate
```

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target
15	34	0	1	118	210	0	1	192	0	0.7	2	0	2	1
31	50	0	1	120	244	0	1	162	0	1.1	2	0	2	1
43	46	1	0	120	249	0	0	144	0	0.8	2	0	3	0
55	55	1	0	140	217	0	1	111	1	5.6	0	0	3	0
61	66	0	2	146	278	0	0	152	0	0.0	1	1	2	1
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1020	59	1	1	140	221	0	1	164	1	0.0	2	0	2	1
1021	60	1	0	125	258	0	0	141	1	2.8	1	1	3	0
1022	47	1	0	110	275	0	0	118	1	1.0	1	1	2	0
1023	50	0	0	110	254	0	0	159	0	0.0	2	0	2	1
1024	54	1	0	120	188	0	1	113	0	1.4	1	1	3	0

723 rows × 14 columns

```
# Missing Values/Null Values Count
missing_values_count = df.isnull().sum()
print(missing_values_count)
type(missing_values_count)
```

```
age         0
sex         0
cp          0
trestbps    0
chol        0
fbs         0
restecg     0
thalach     0
exang       0
oldpeak     0
slope       0
ca          0
thal        0
target      0
dtype: int64
```

```
pandas.core.series.Series
def __init__(data=None, index=None, dtype: Dtype | None=None, name=None, copy: bool | None=None,
fastpath: bool=False) -> None
```

```
One-dimensional ndarray with axis labels (including time series).

Labels need not be unique but must be a hashable type. The object
supports both integer- and label-based indexing and provides a host of
methods for performing operations involving the index. Statistical
methods from ndarray have been overridden to automatically exclude
```

Observation: None of the variable contains of the null values

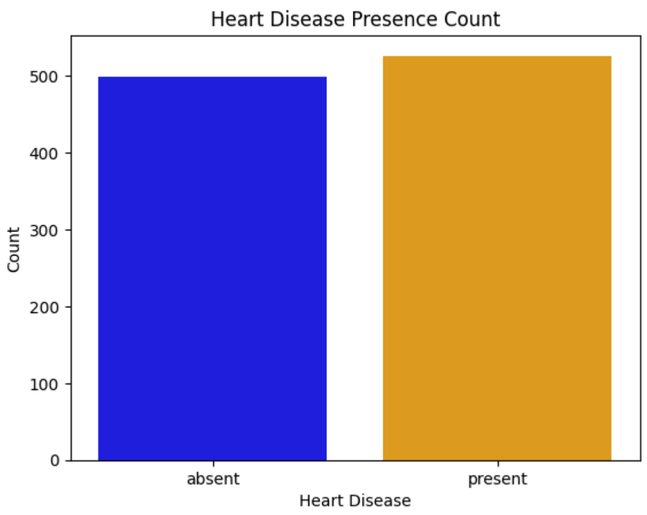
Changing column type for 'sex' and 'target' to category from int.

```
# Convert 'sex' column to categorical
df['sex'] = df['sex'].map({1: 'female', 0: 'male'}).astype('category')

# Convert 'target' column to categorical
df['target'] = df['target'].map({1: 'present', 0: 'absent'}).astype('category')

# Display the first few rows to verify the changes
print(df.head())
```

```
   age     sex  cp  trestbps  chol  fbs  restecg  thalach  exang  oldpeak  \
0   52  female   0       125   212    0        1      168      0      1.0   
1   53  female   0       140   203    1        0      155      1      3.1   
2   70  female   0       145   174    0        1      125      1      2.6   
3   61  female   0       148   203    0        1      161      0      0.0   
4   62    male   0       138   294    1        1      106      0      1.9   

   slope  ca  thal  target  
0      2   2     3  absent  
1      0   0     3  absent  
2      0   0     3  absent  
3      2   1     3  absent  
4      1   3     2  absent  
```

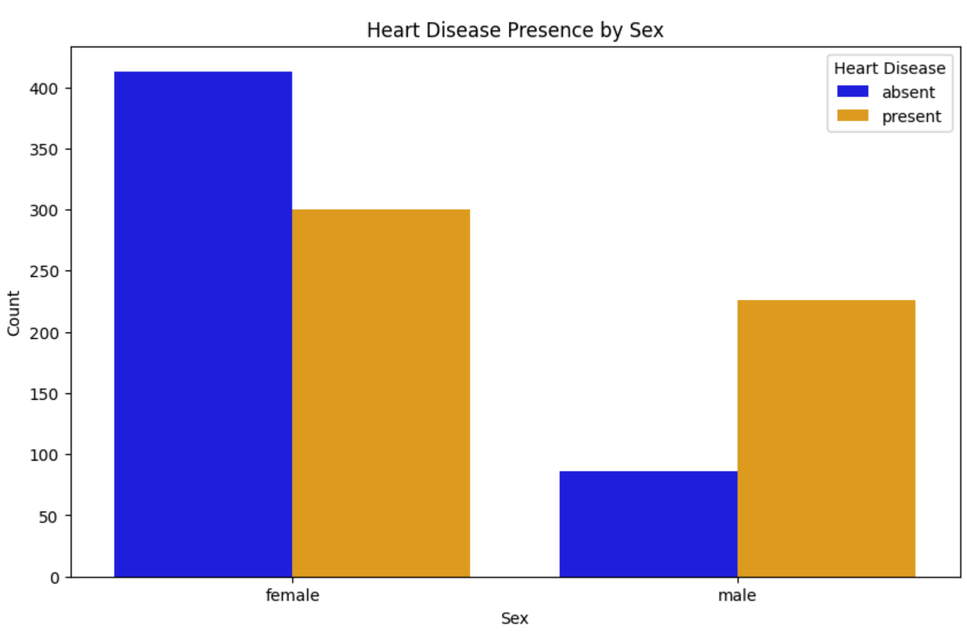
```
# Print the counts of 'absent' and 'present'
counts = df['target'].value_counts()
print("Counts of Heart Disease Presence:")
print(counts)

# Create the bar chart with different colors
sns.countplot(data=df, x='target', palette={'absent': 'blue', 'present': 'orange'})
plt.xlabel('Heart Disease')
plt.ylabel('Count')
plt.title('Heart Disease Presence Count')
plt.show()
```

```
Counts of Heart Disease Presence:
target
present    526
absent     499
Name: count, dtype: int64
<ipython-input-10-40af9a0addfd>:7: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same effect.

  sns.countplot(data=df, x='target', palette={'absent': 'blue', 'present': 'orange'})
```

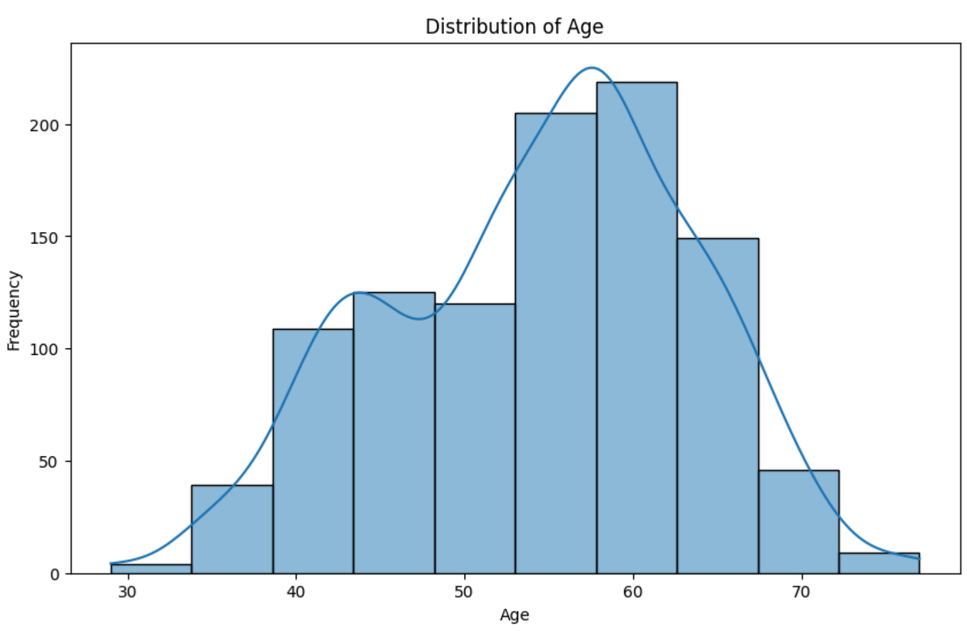


In the given sample data the number of people with heart disease are 526 and without heart disease are 499

```
# Create a countplot
plt.figure(figsize=(10, 6))
sns.countplot(data=df, x='sex', hue='target', palette={'absent': 'blue', 'present': 'orange'})
plt.xlabel('Sex')
plt.ylabel('Count')
plt.title('Heart Disease Presence by Sex')
plt.legend(title='Heart Disease')
plt.show()
```



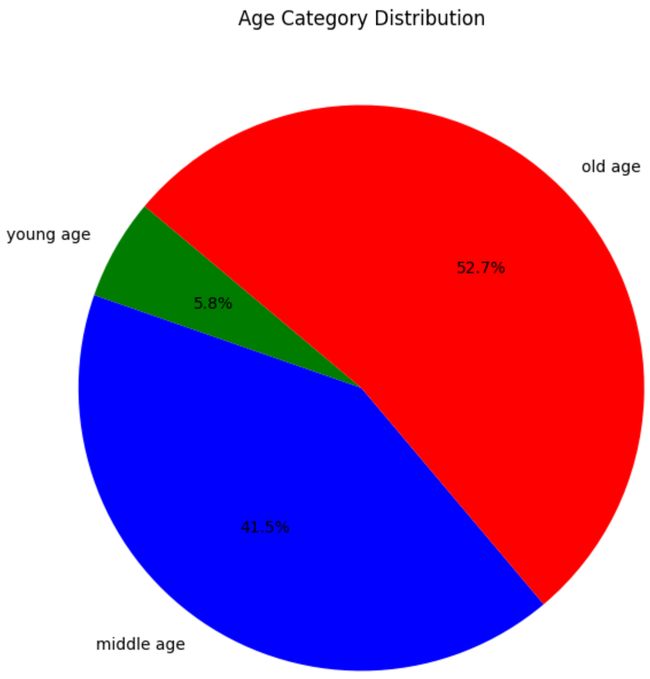

```
# Create a histogram using seaborn
plt.figure(figsize=(10, 6))
sns.histplot(df['age'], bins=10, kde=True)
plt.xlabel('Age')
plt.ylabel('Frequency')
plt.title('Distribution of Age')
plt.show()
```




```
X1=len(df[(df['age']<40)])
X2=len(df[(df['age']>40) & (df['age']<55)])
X3=len(df[df['age']>55])
print('The number of the people below the age of 40 : ',X1)
print('The number of the people between the age group 41 to 54 :',X2)
print('The number of the prople above age 55 :',X3)
print("Minimum age is ",np.min(df['age']))
print("Maximum age is ",np.max(df['age']))
print("Mean of age is",round(np.mean(df['age']),1))
```

```
The number of the people below the age of 40 :  57
The number of the people between the age group 41 to 54 : 408
The number of the prople above age 55 : 519
Minimum age is  29
Maximum age is  77
Mean of age is 54.4
```

```
# Data for the pie chart
Y = [X1, X2, X3]
X = ['young age', 'middle age', 'old age']

# Create the pie chart
plt.figure(figsize=(8, 8))
plt.pie(Y, labels=X, autopct='%1.1f%%', colors=['green', 'blue', 'red'], startangle=140)
plt.title('Age Category Distribution')
plt.show()
```



The given data has more number of people in old age group

```
def age_category (value):
    if value<=40:
        return 'young age'
    elif value>40 and value<55:
        return 'middle age'
    else :
        return 'old age'
df['Age_category']=df['age'].apply(age_category)
df
```

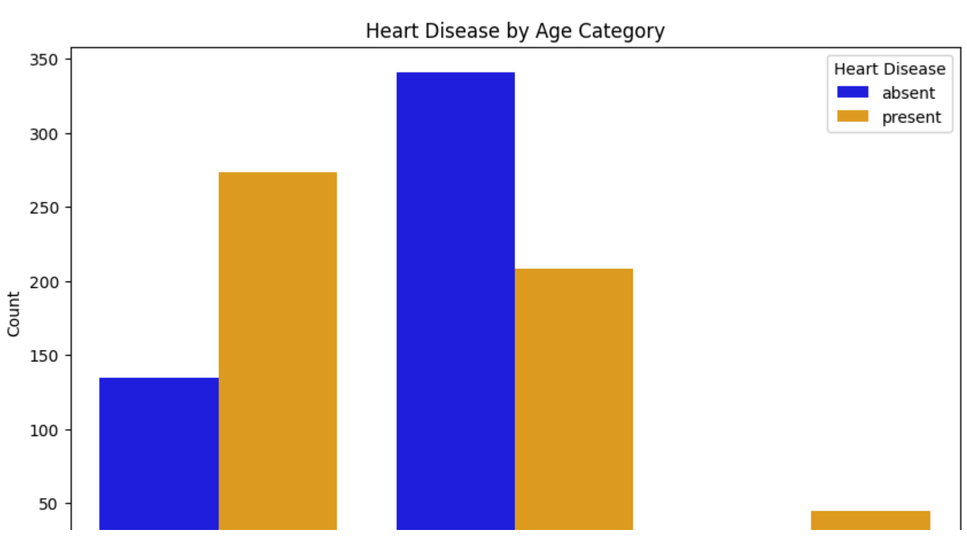
	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target	Age_category
0	52	female	0	125	212	0	1	168	0	1.0	2	2	3	absent	middle age
1	53	female	0	140	203	1	0	155	1	3.1	0	0	3	absent	middle age
2	70	female	0	145	174	0	1	125	1	2.6	0	0	3	absent	old age
3	61	female	0	148	203	0	1	161	0	0.0	2	1	3	absent	old age
4	62	male	0	138	294	1	1	106	0	1.9	1	3	2	absent	old age
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1020	59	female	1	140	221	0	1	164	1	0.0	2	0	2	present	old age
1021	60	female	0	125	258	0	0	141	1	2.8	1	1	3	absent	old age
1022	47	female	0	110	275	0	0	118	1	1.0	1	1	2	absent	middle age
1023	50	male	0	110	254	0	0	159	0	0.0	2	0	2	present	middle age
1024	54	female	0	120	188	0	1	113	0	1.4	1	1	3	absent	middle age

1025 rows × 15 columns

```
# Print the counts of heart disease presence by age category
counts = df.groupby(['Age_category', 'target']).size().reset_index(name='count')
print(counts)
```

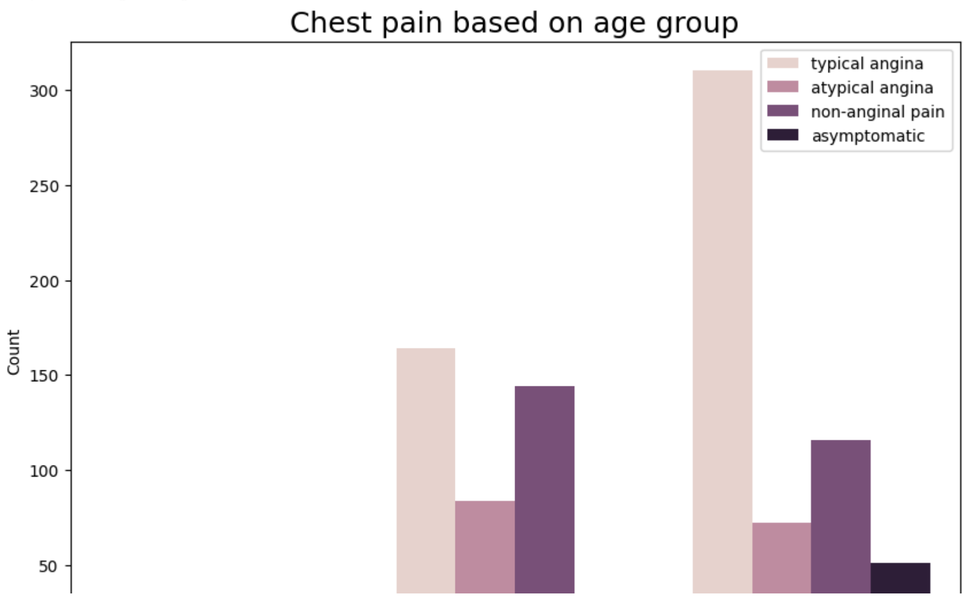
```
  Age_category   target  count
0   middle age   absent    135
1   middle age  present    273
2      old age   absent    341
3      old age  present    208
4    young age   absent     23
5    young age  present     45
```

```
# Create the count plot
plt.figure(figsize=(10, 6))
sns.countplot(data=df, x='Age_category', hue='target', palette={'absent': 'blue', 'present': 'orange'})
plt.xlabel('Age Category')
plt.ylabel('Count')
plt.title('Heart Disease by Age Category')
plt.legend(title='Heart Disease')
plt.show()
```




```
plt.figure(figsize=(10,7))
plt.title("Chest pain based on age group", fontsize=18)

plt.xlabel('Age Groups')
plt.ylabel('Count')
sns.countplot(x='Age_category',data=df,hue='cp',order=['young age','middle age','old age'])
plt.legend(labels=['typical angina', 'atypical angina', 'non-anginal pain', 'asymptomatic'], loc='upper right')
```

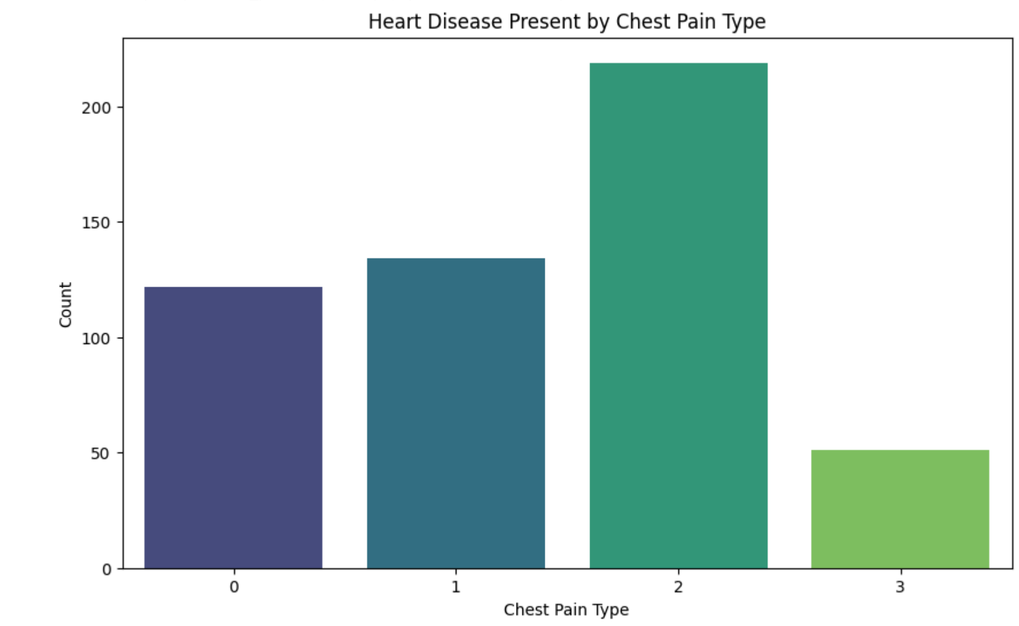
```
<matplotlib.legend.Legend at 0x7e8c2abdd810>
```



It is seen that there are more people with typical angina type of chest pain in every age group.

```
# Filter the dataframe to include only rows where heart disease is present
df_present = df[df['target'] == 'present']

# Create a bar plot to visualize the number of cases with heart disease according to chest pain type
plt.figure(figsize=(10, 6))
sns.countplot(data=df_present, x='cp', palette='viridis')
plt.xlabel('Chest Pain Type')
plt.ylabel('Count')
plt.title('Heart Disease Present by Chest Pain Type')
plt.show()

# Print the counts of heart disease present by chest pain type
counts = df_present['cp'].value_counts().sort_index()
print("Counts of Heart Disease Present by Chest Pain Type:")
print(counts)
```

```
<ipython-input-22-588382cacb1d>:6: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same effect.

  sns.countplot(data=df_present, x='cp', palette='viridis')
```

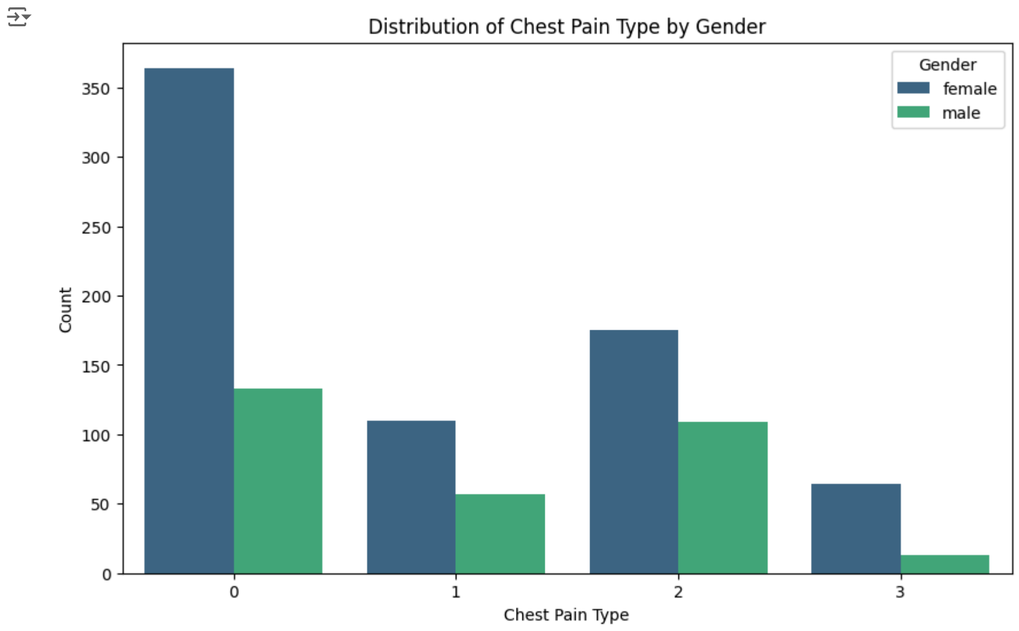



```
Counts of Heart Disease Present by Chest Pain Type:
cp
0    122
```

It is observed that people having asymptomatic chest pain have higher chance of heart diseases.

```
3     51
```

```
# Create a bar plot to visualize the number of cases by chest pain type and gender
plt.figure(figsize=(10, 6))
sns.countplot(data=df, x='cp', hue='sex', palette='viridis')
plt.xlabel('Chest Pain Type')
plt.ylabel('Count')
plt.title('Distribution of Chest Pain Type by Gender')
plt.legend(title='Gender')
plt.show()

# Print the counts of chest pain type by gender
counts = df.groupby(['sex', 'cp']).size().unstack(fill_value=0)
print("Counts of Chest Pain Type by Gender:")
print(counts)
```

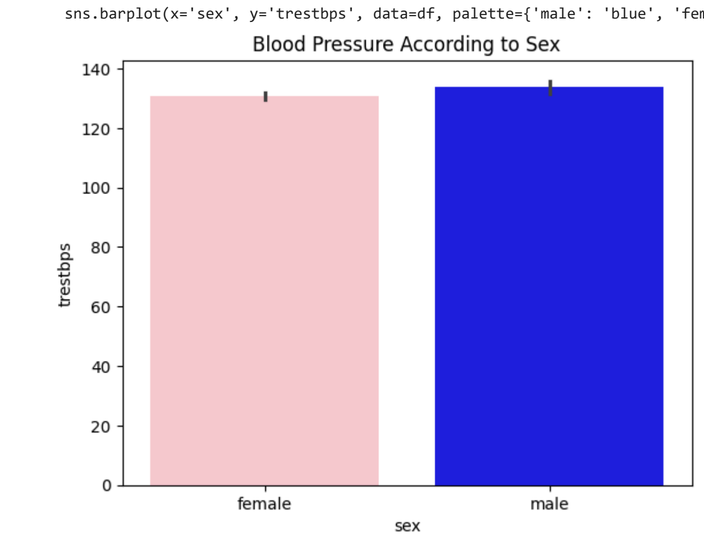


There are more females and males with typical angina type chest pain.

```
sex
```

```
# Example with custom colors
sns.barplot(x='sex', y='trestbps', data=df, palette={'male': 'blue', 'female': 'pink'})

plt.title('Blood Pressure According to Sex')
plt.show()
```

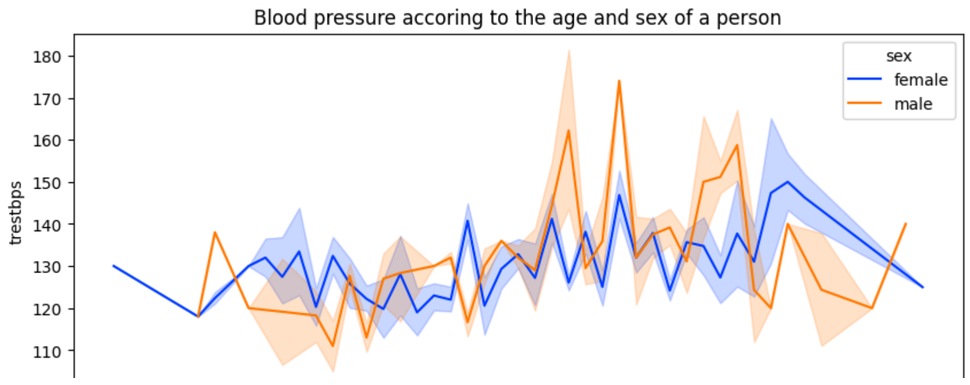
```
<ipython-input-24-eef0518f7494>:2: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same effect.

  sns.barplot(x='sex', y='trestbps', data=df, palette={'male': 'blue', 'female': 'pink'})
```



It is seen that male population has slightly higher BP

```
plt.figure(figsize=(10,4))

ax1=sns.lineplot(x='age',y='trestbps',data =df,hue='sex',palette='bright')
plt.title('Blood pressure accoring to the age and sex of a person')
```

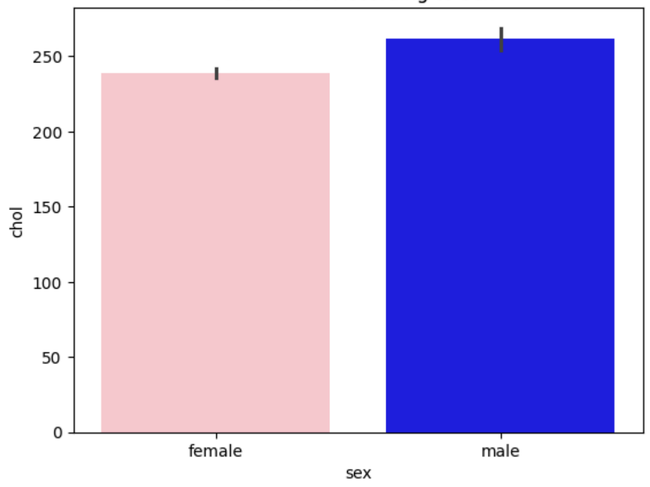
```
Text(0.5, 1.0, 'Blood pressure accoring to the age and sex of a person')
```



Here we observed that the blood pressure is normal from 30 to 50 and after 50 it increases gradually to age of 60. And after age of 55 it is fluctuating drastically.

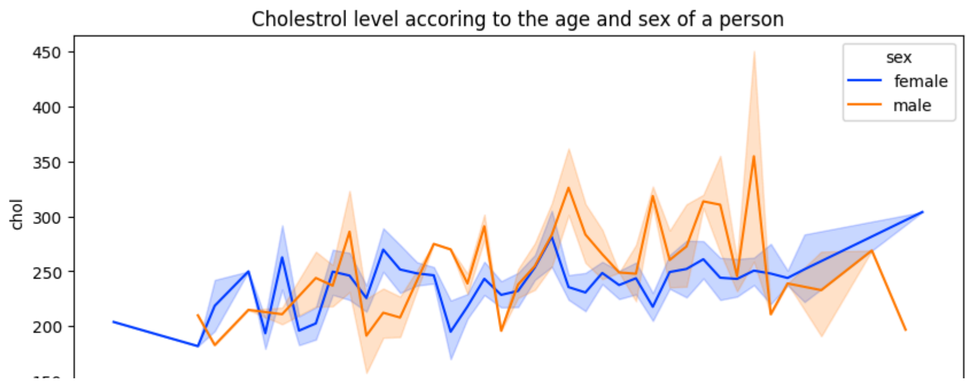
```
# Example with custom colors
sns.barplot(x='sex', y='chol', data=df, palette={'male': 'blue', 'female': 'pink'})

plt.title('Cholesterol According to Sex')
plt.show()
```

```
<ipython-input-26-89c8e50f1eb3>:2: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same effect.

  sns.barplot(x='sex', y='chol', data=df, palette={'male': 'blue', 'female': 'pink'})
```



Male population has higher cholesterol

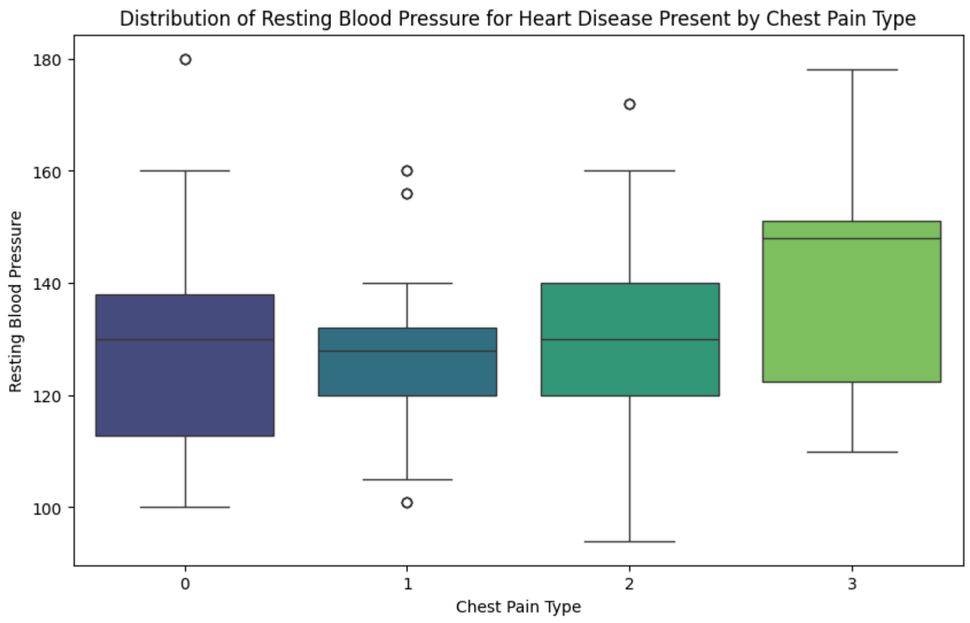
```
plt.figure(figsize=(10,4))
sns.lineplot(x='age',y='chol',data =df,hue='sex',palette='bright')
plt.title('Cholestrol level accoring to the age and sex of a person')
plt.show()
```



It can be seen That the cholestrol level slightly starts increasing at the age after 45 It shows more flactualtion in male than female

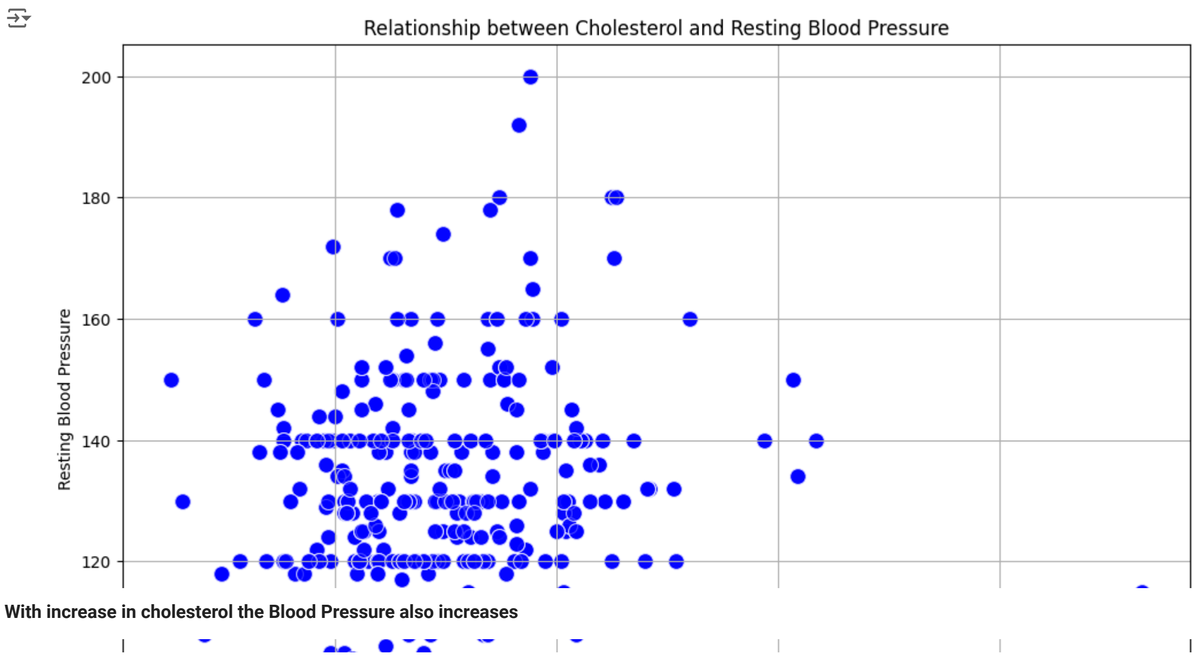
```
plt.figure(figsize=(10, 6))
sns.boxplot(x='cp', y='trestbps', data=df_present, palette='viridis')
plt.xlabel('Chest Pain Type')
plt.ylabel('Resting Blood Pressure')
plt.title('Distribution of Resting Blood Pressure for Heart Disease Present by Chest Pain Type')
plt.show()

# Print summary statistics of trestbps for heart disease present
summary_stats = df_present.groupby('cp')['trestbps'].describe()
print("Summary Statistics of Resting Blood Pressure for Heart Disease Present by Chest Pain Type:")
print(summary_stats)
```

```
<ipython-input-32-9b1ccb0a74f8>:2: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same effect.

  sns.boxplot(x='cp', y='trestbps', data=df_present, palette='viridis')
```




```
Summary Statistics of Resting Blood Pressure for Heart Disease Present by Chest Pain Type:
    count        mean        std    min     25%    50%    75%    max
cp
```

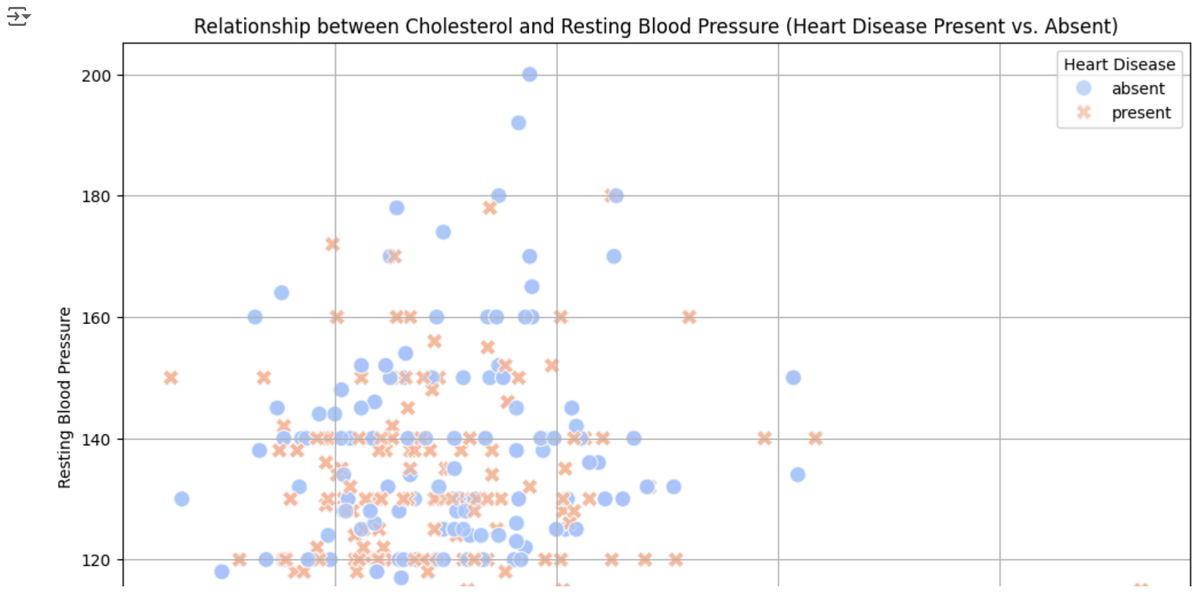
```
# Create a scatter plot to visualize the relationship between cholesterol and blood pressure
plt.figure(figsize=(12, 8))
sns.scatterplot(x='chol', y='trestbps', data=df, color='blue', s=100, alpha=0.7)
plt.xlabel('Cholesterol')
plt.ylabel('Resting Blood Pressure')
plt.title('Relationship between Cholesterol and Resting Blood Pressure')
plt.grid(True)
plt.show()

# Print the correlation coefficient between cholesterol and blood pressure
correlation = df[['chol', 'trestbps']].corr().iloc[0, 1]
print(f"Correlation coefficient between Cholesterol and Resting Blood Pressure: {correlation:.2f}")
```



With increase in cholesterol the Blood Pressure also increases

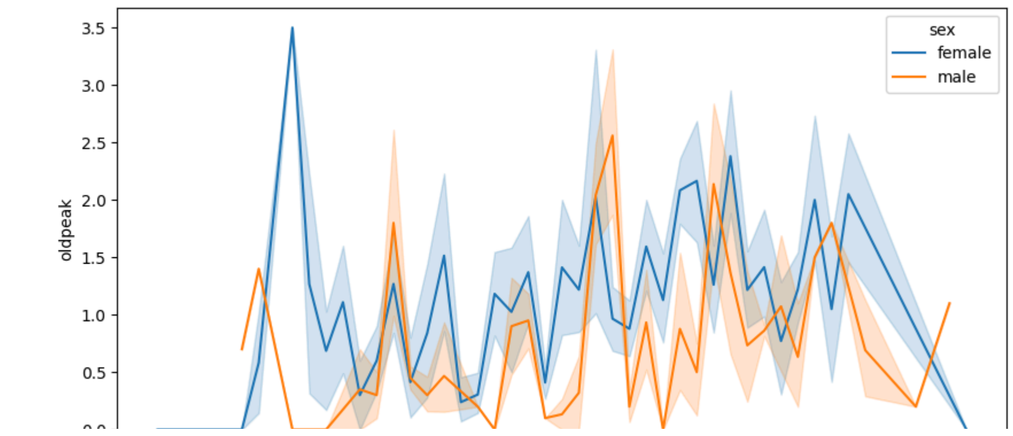
```
# Create a scatter plot to visualize the relationship between cholesterol and blood pressure
plt.figure(figsize=(12, 8))
sns.scatterplot(x='chol', y='trestbps', data=df, hue='target', palette='coolwarm', s=100, style='target', alpha=0.7)
plt.xlabel('Cholesterol')
plt.ylabel('Resting Blood Pressure')
plt.title('Relationship between Cholesterol and Resting Blood Pressure (Heart Disease Present vs. Absent)')
plt.grid(True)
plt.legend(title='Heart Disease', loc='best')
plt.show()
```

```
# Print the correlation coefficient between cholesterol and blood pressure
correlation = df[['chol', 'trestbps']].corr().iloc[0, 1]
print(f"Correlation coefficient between Cholesterol and Resting Blood Pressure: {correlation:.2f}")
```



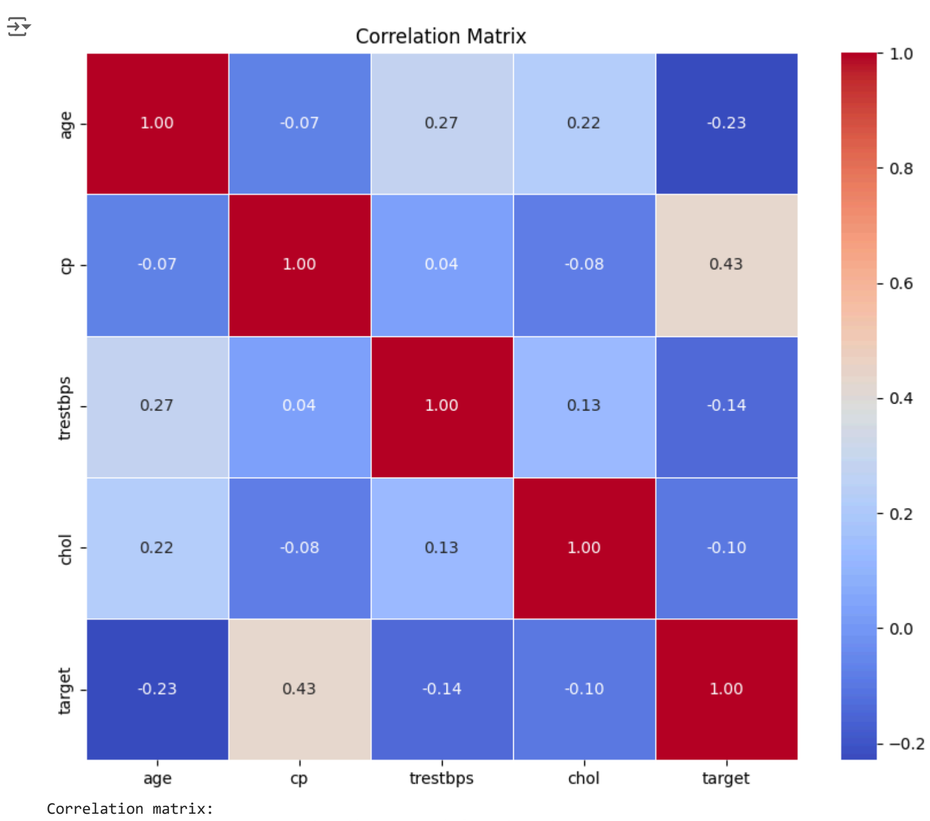

```
# Line plot for ST depression vs age using matplotlib and seaborn
plt.figure(figsize=(10,5))
sns.lineplot(x='age', y='oldpeak',data=df,hue='sex',color='red')
```

```
<Axes: xlabel='age', ylabel='oldpeak'>
```



For female depression is more between age 35-40 but for male the depression rate increases as the age increases.

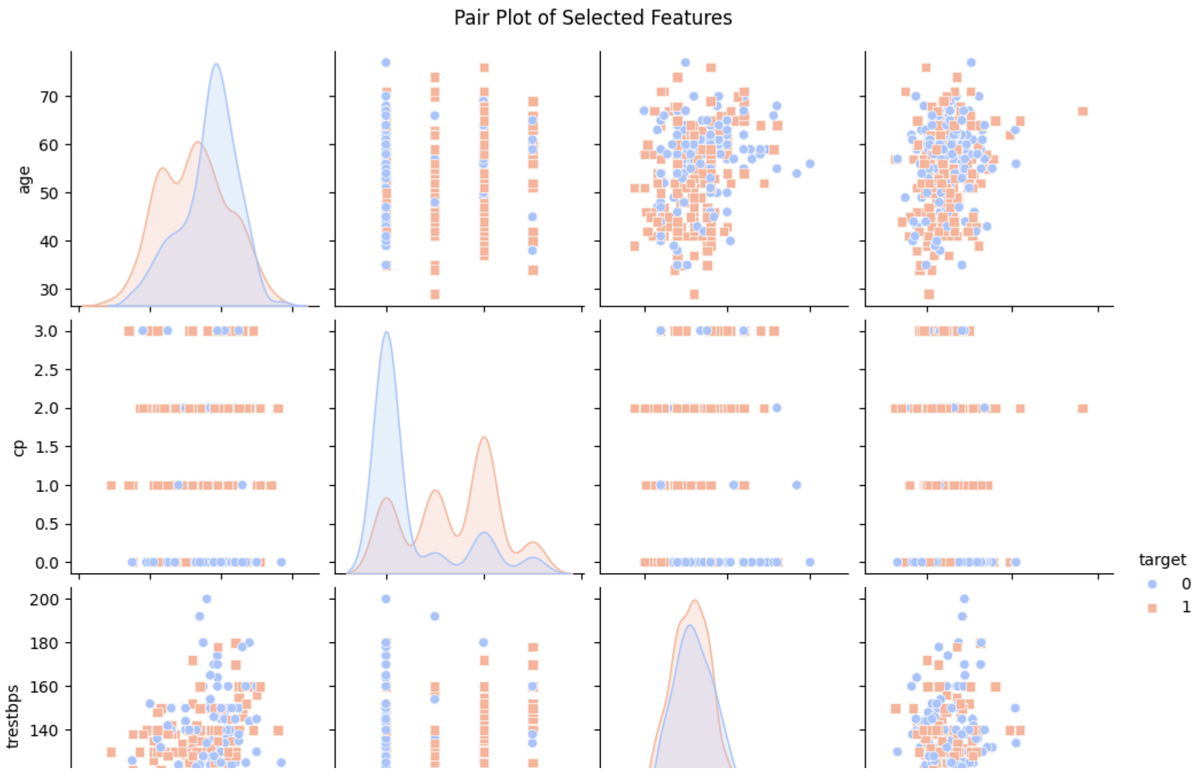
```
# Convert 'cp' and 'target' to numeric if needed for correlation analysis
df['cp'] = df['cp'].astype(float)
df['target'] = df['target'].cat.codes

# Calculate the correlation matrix
correlation_matrix = df[['age', 'cp', 'trestbps', 'chol', 'target']].corr()

# Plot the correlation matrix
plt.figure(figsize=(10, 8))
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm', fmt='.2f', linewidths=0.5)
plt.title('Correlation Matrix')
plt.show()

# Print the correlation matrix
print("Correlation matrix:")
print(correlation_matrix)
```




```
Correlation matrix:
                age        cp  trestbps      chol    target
age        1.000000 -0.071966  0.271121  0.219823 -0.229324
```

```
# Select features for pair plot
features = ['age', 'cp', 'trestbps', 'chol', 'target']

# Create pair plot
sns.pairplot(df[features], hue='target', palette='coolwarm', markers=["o", "s"], diag_kind='kde')
plt.suptitle('Pair Plot of Selected Features', y=1.02)
```

```
Text(0.5, 1.02, 'Pair Plot of Selected Features')
```



CONCLUSION

In the given sample data the nummber of people with heart disease are 526 and without heart disease are 499