In [66]:
```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
import seaborn as sns
sns.set_style('whitegrid')
```

In [67]:
```
data=pd.read_csv("C:\COURSES\data science projects\Heart rate diagonstic\Heart Dise
data
```

Out[67]:

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

1025 rows × 14 columns

In [68]:
```
data.columns
```

Out[68]:
```
Index(['age', 'sex', 'cp', 'trestbps', 'chol', 'fbs', 'restecg', 'thalach',
       'exang', 'oldpeak', 'slope', 'ca', 'thal', 'target'],
      dtype='object')
```

In [69]:
```
data.isnull().sum()
```

Out[69]:
```
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
```

In [70]:
```
target=data.groupby('target').size()
target
```

Out[70]:
```
target
0    499
1    526
dtype: int64
```

In [71]:
```
def heart_disease(row):
    if row==0:
        return'Absence'
    elif row==1:
        return 'Presence'
```

In [72]:
```
data['Heart_Disease']=data['target'].apply(heart_disease)
data.head()
```

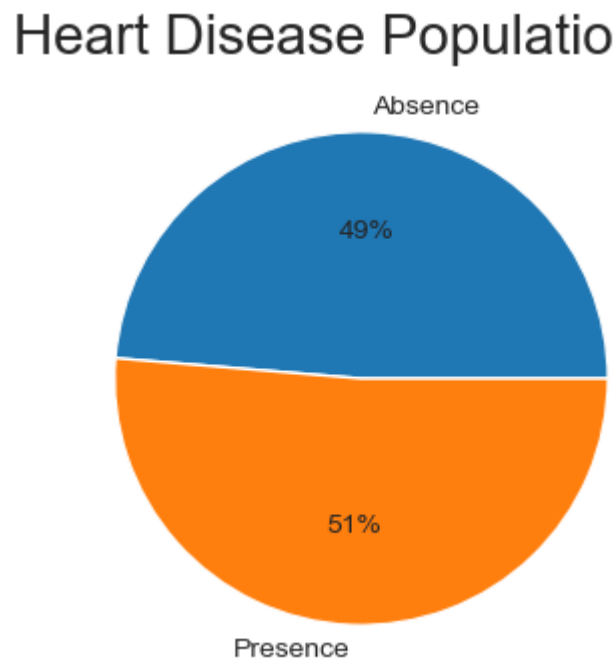
Out[72]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target	H
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	

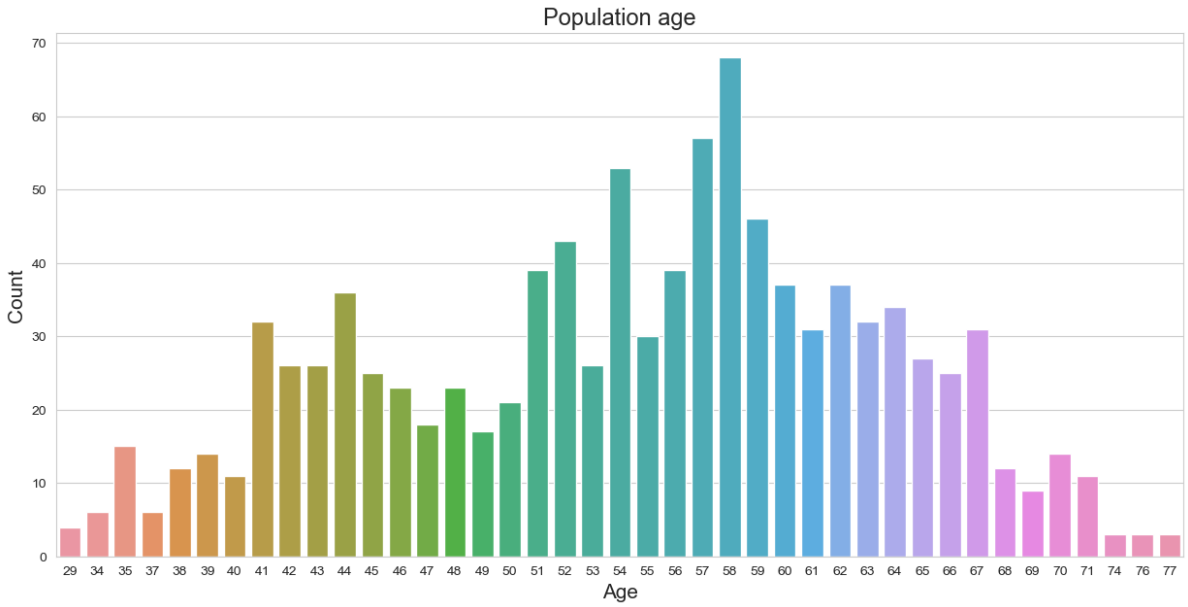
In [73]:
```
hd=data.groupby('Heart_Disease')['target'].count()
print(hd)
```

```
Heart_Disease
Absence     499
Presence    526
Name: target, dtype: int64
```

In [74]:
```
plt.figure(figsize=(9,4))
plt.pie(hd, labels=['Absence', 'Presence'],autopct='%0.0f%%')
plt.title('Heart Disease Population %', fontsize=20)
plt.show()
```



In [75]:
```
plt.figure(figsize=(15,7))
sns.countplot(x='age',data=data)
plt.title('Population age', fontsize=17)
plt.xlabel('Age', fontsize=15)
plt.ylabel('Count',fontsize=15)
plt.show()
```



In [76]:
```
Min_Age=data['age'].min()
Max_Age=data['age'].max()
Mean_Age=data['age'].mean()

print("Minimum Age =",Min_Age)
print("Maximum Age =",Max_Age)
print("Mean Age =",Mean_Age)
```

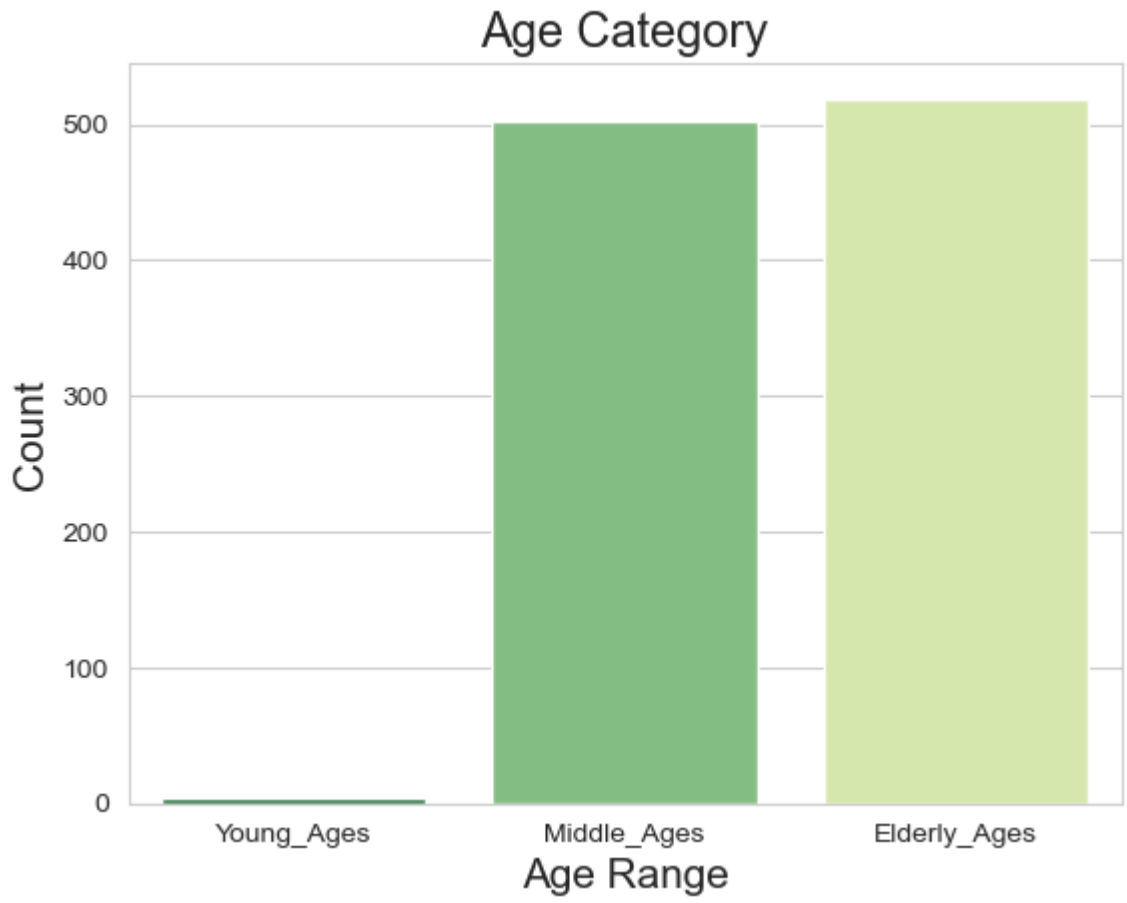
```
Minimum Age = 29
Maximum Age = 77
Mean Age = 54.43414634146342
```

In [77]:
```
Young_Ages=data[(data['age']<30)]
Middle_Ages=data[(data['age']>=30) & (data['age']<=55)]
Elderly_Ages=data[(data['age']>55)]

print('Young Ages =', len(Young_Ages))
print('Middle Ages =', len(Middle_Ages))
print('Elderly Ages =', len(Elderly_Ages))
```

```
Young Ages = 4
Middle Ages = 502
Elderly Ages = 519
```

In [78]:
```
sns.barplot(x=['Young_Ages','Middle_Ages','Elderly_Ages'], y=[len(Young_Ages), len(
plt.title('Age Category', fontsize=17)
plt.xlabel('Age Range', fontsize=15)
plt.ylabel('Count', fontsize=15)
plt.show()
```



In [79]:
```
def gender(row):
    if row==1:
        return 'Male'
    elif row==0:
        return 'Female'
```

In [80]:
```
data['sex1']=data['sex'].apply(gender)
data.head()
```

Out[80]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target	H
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	

In [81]:
```
def age_range(row):
    if row<30:
        return 'Young Age'
    elif row>=30 and row<55:
        return 'Middle Age'
    elif row>55:
        return 'Elder Age'
```

In [82]:
```
data['Age_Range']=data['age'].apply(age_range)
data.head()
```

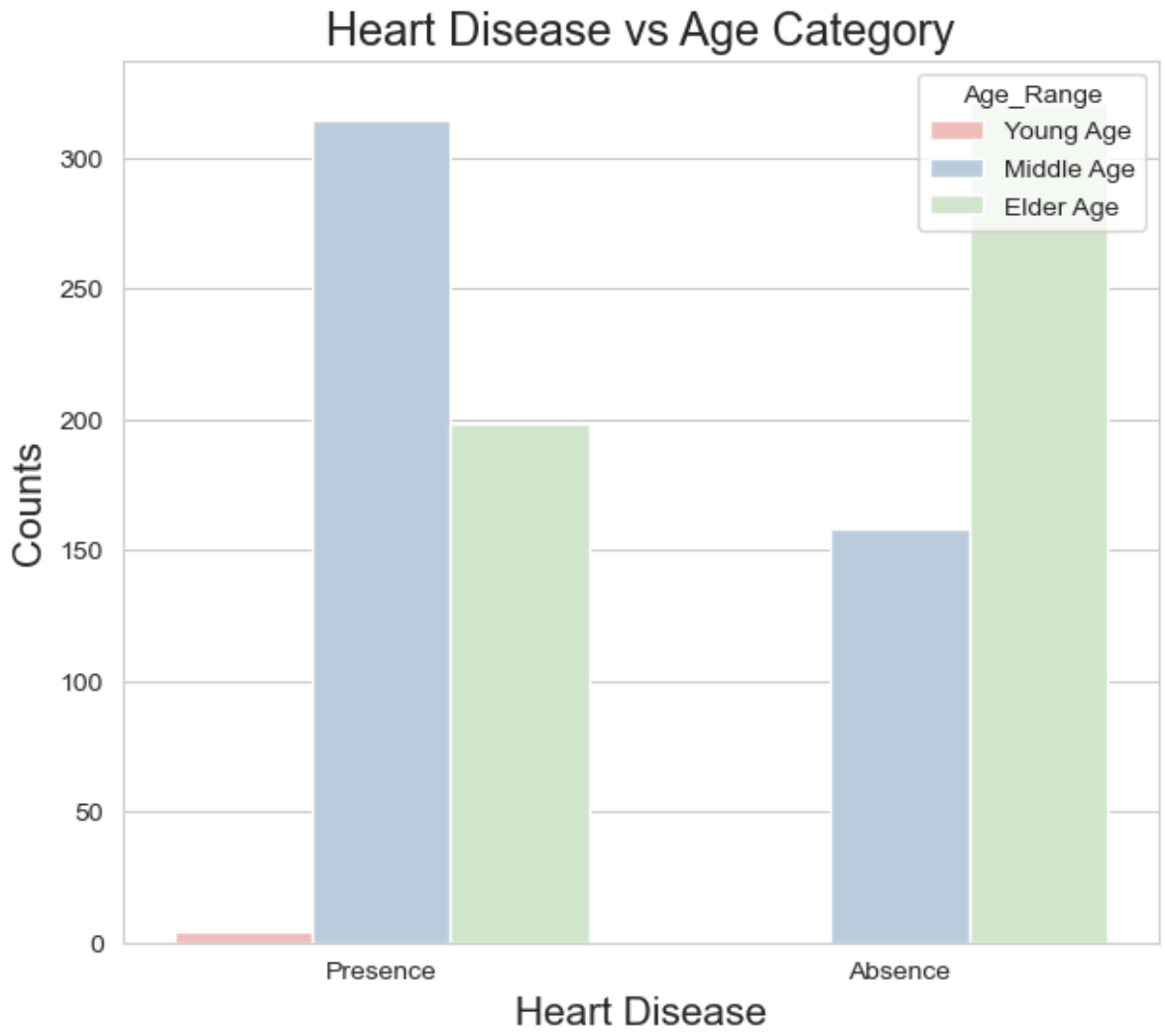
Out[82]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target	H
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	

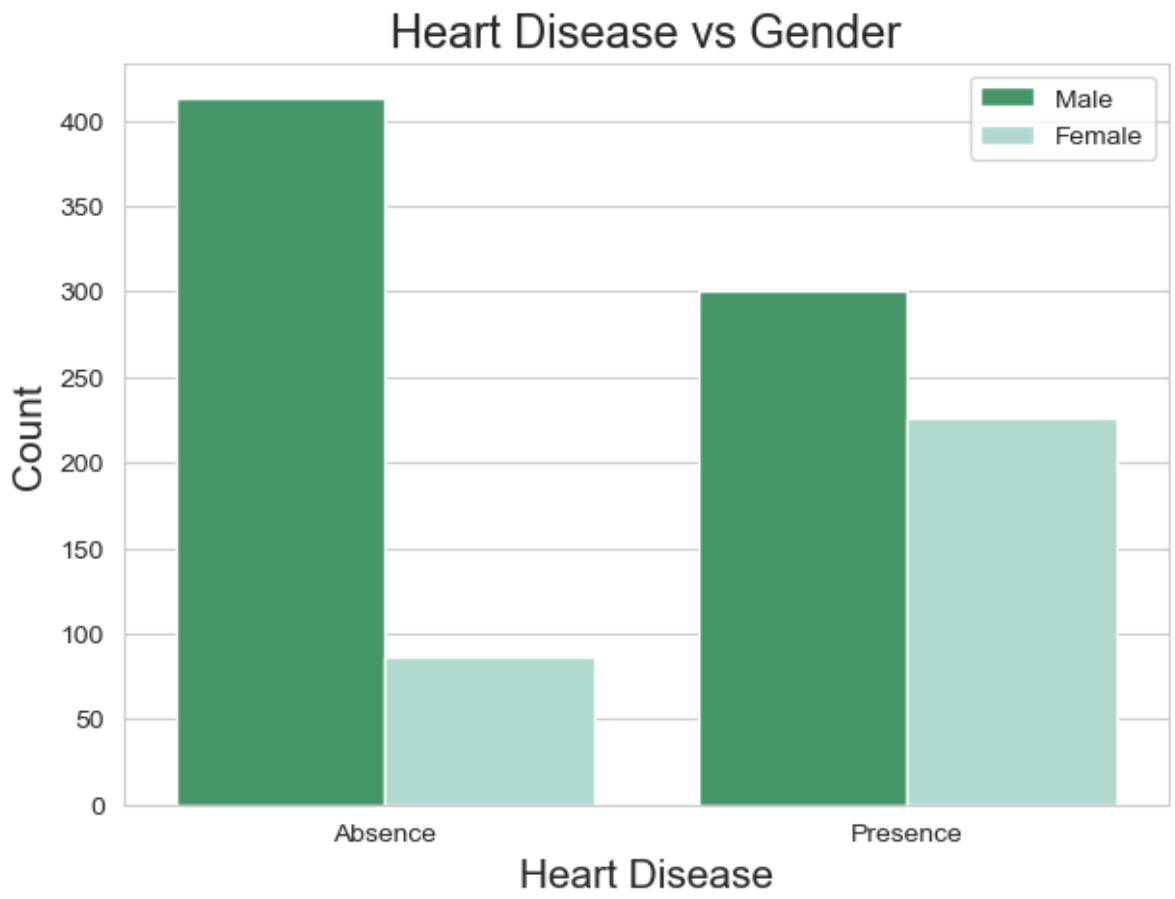
In [83]:
```
plt.figure(figsize=(20,20))
sns.swarmplot(x='Age_Range', y='age', hue='sex1', data=data, order=['Young Age','Mi
plt.title('Gender Based Age Category', fontsize=17)
plt.xlabel('Age Category', fontsize=15)
plt.ylabel('Age', fontsize=15)
plt.show()
```

In [84]:
```
plt.figure(figsize=(7,6))
hue_order=['Young Age', 'Middle Age', 'Elder Age']
sns.countplot(x='Heart_Disease', hue='Age_Range', data=data, order=['Presence','Abs
plt.title('Heart Disease vs Age Category', fontsize=17)
plt.xlabel('Heart Disease', fontsize=15)
```

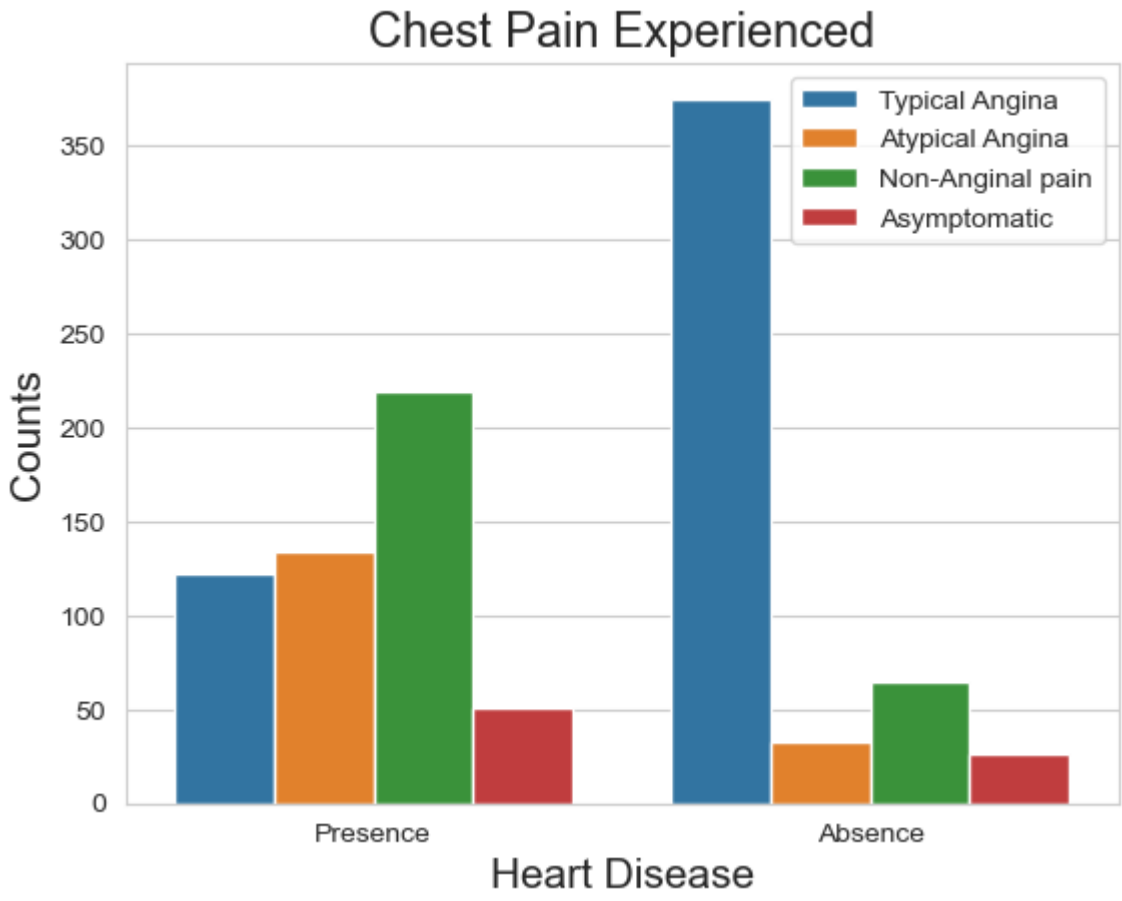
```
plt.ylabel('Counts', fontsize=15)
plt.show()
```



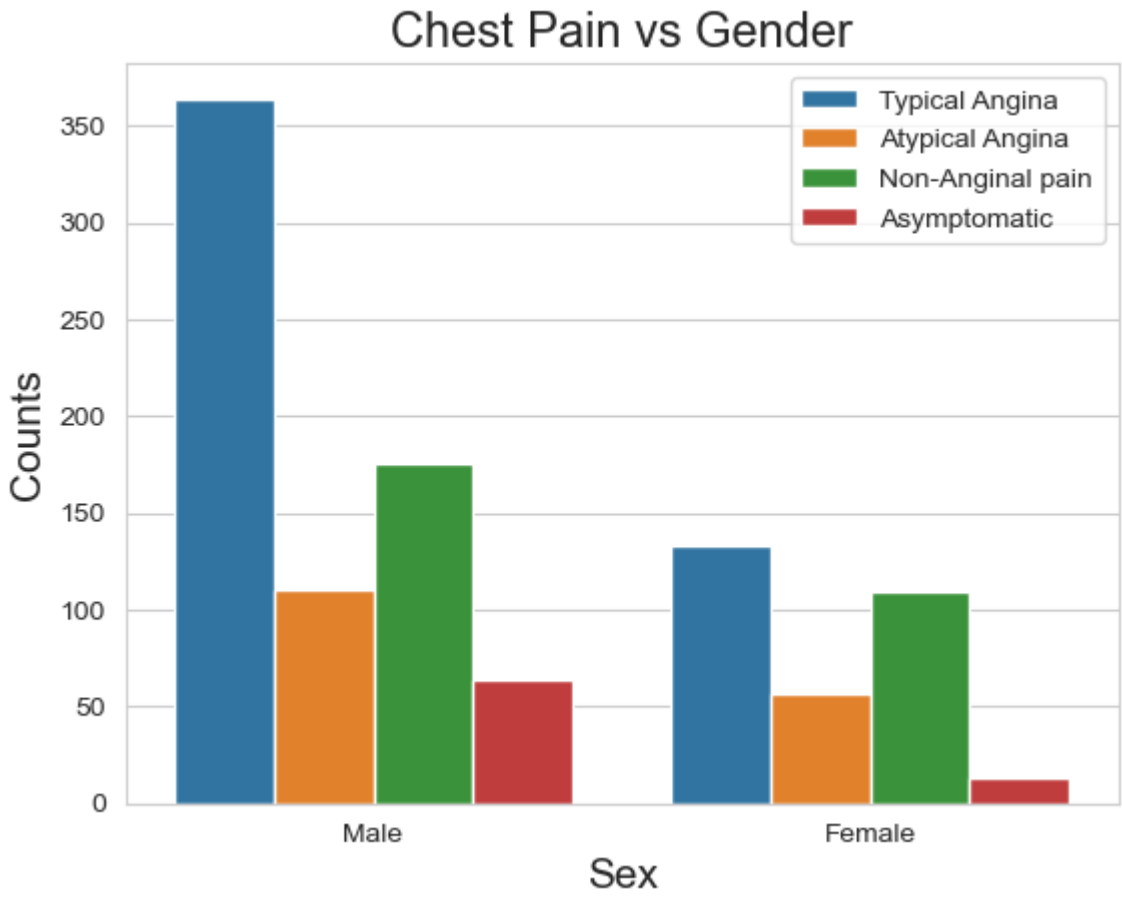
In [85]:
```
plt.figure(figsize=(7,5))
sns.countplot(x=data['Heart_Disease'], hue='sex1', data=data, palette='BuGn_r')
plt.xlabel('Heart Disease', fontsize=15)
plt.ylabel('Count',fontsize=15)
plt.legend(labels=['Male','Female'])
plt.title('Heart Disease vs Gender',fontsize=17)
plt.show()
```



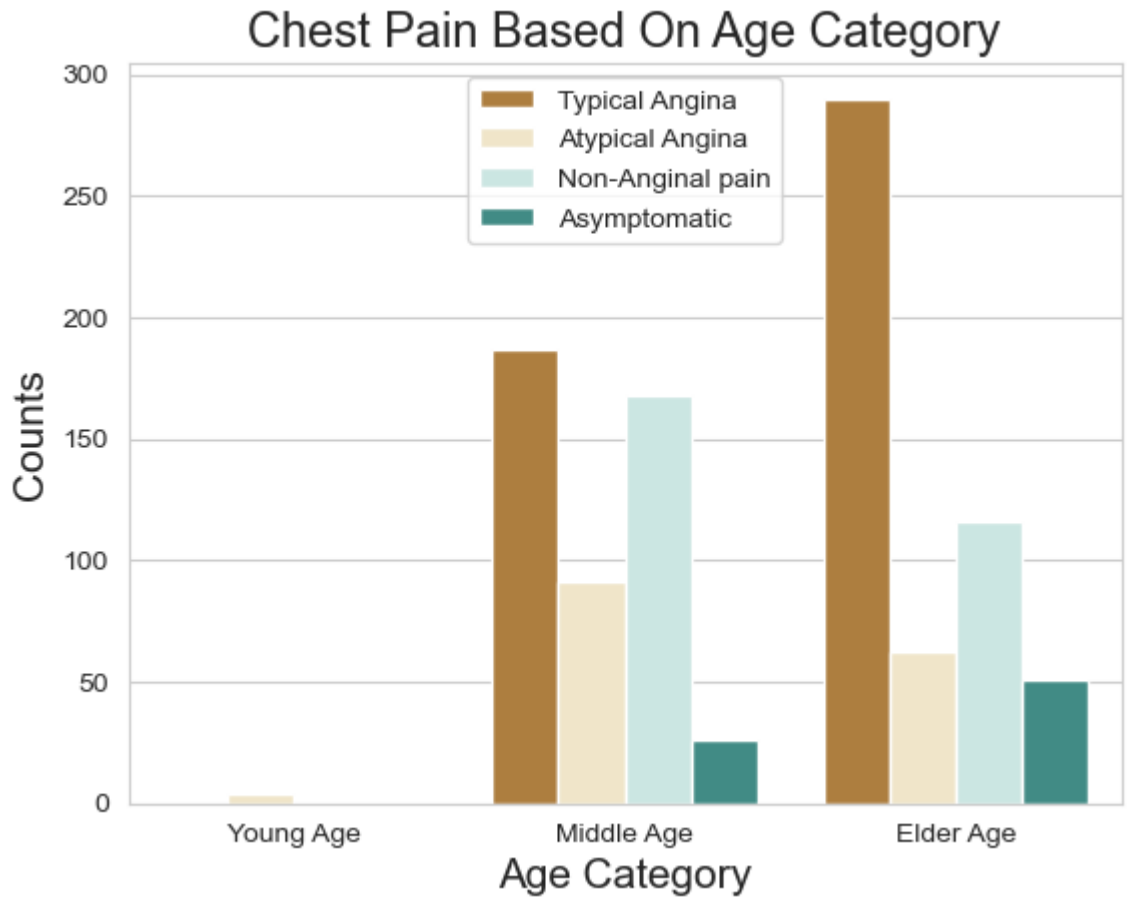
In [86]:
```
sns.countplot(x=data['Heart_Disease'], hue='cp', data=data, order=['Presence','Abse
plt.title('Chest Pain Experienced', fontsize=17)
plt.xlabel('Heart Disease',fontsize=15)
plt.ylabel('Counts',fontsize=15)
plt.legend(labels=['Typical Angina','Atypical Angina','Non-Anginal pain','Asymptoma
plt.show()
```



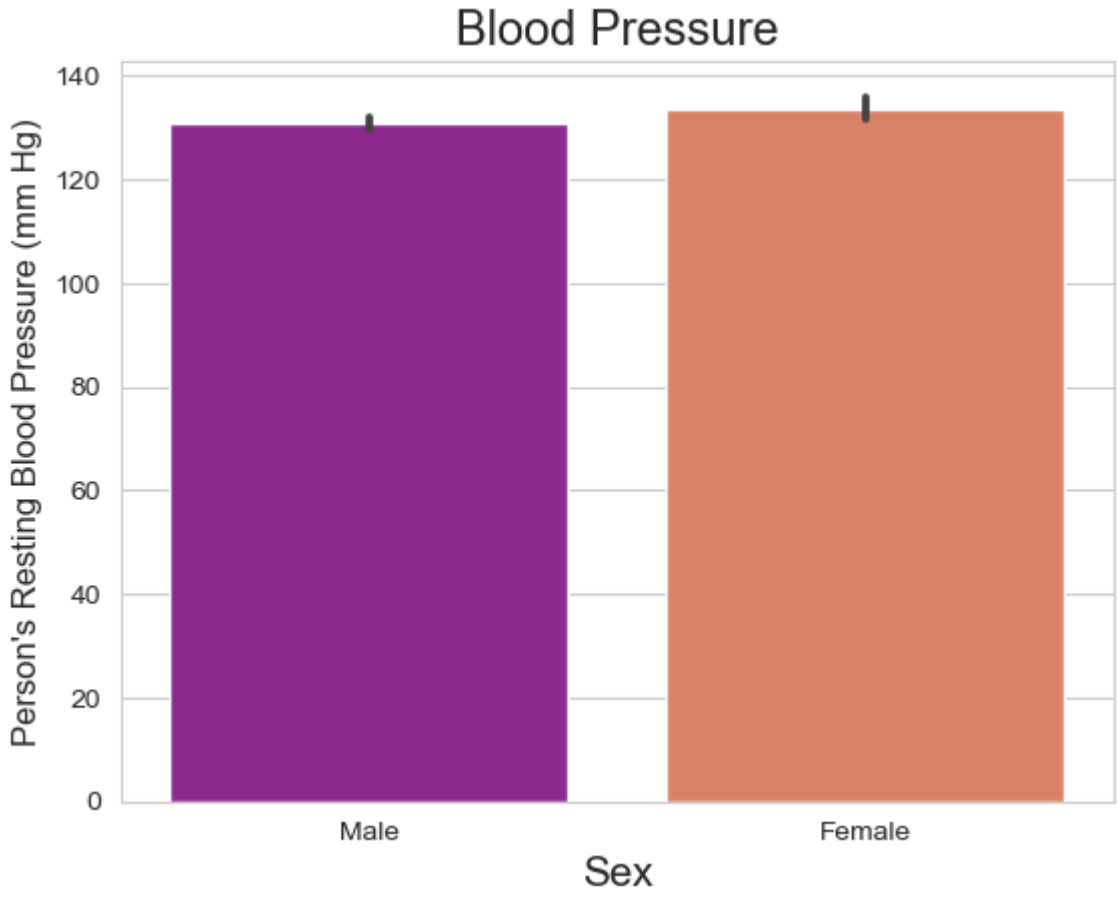
In [87]:
```
sns.countplot(x=data['sex1'], hue='cp', data=data)
plt.title('Chest Pain vs Gender', fontsize=17)
plt.xlabel('Sex', fontsize=15)
plt.ylabel('Counts', fontsize=15)
plt.legend(labels=['Typical Angina','Atypical Angina','Non-Anginal pain','Asymptoma
plt.show()
```



In [88]:
```
sns.countplot(x=data['Age_Range'], hue='cp', data=data, order=['Young Age', 'Middle
plt.title('Chest Pain Based On Age Category', fontsize=17)
plt.xlabel('Age Category', fontsize=15)
plt.ylabel('Counts', fontsize=15)
plt.legend(labels=['Typical Angina','Atypical Angina','Non-Anginal pain','Asymptoma
plt.show()
```

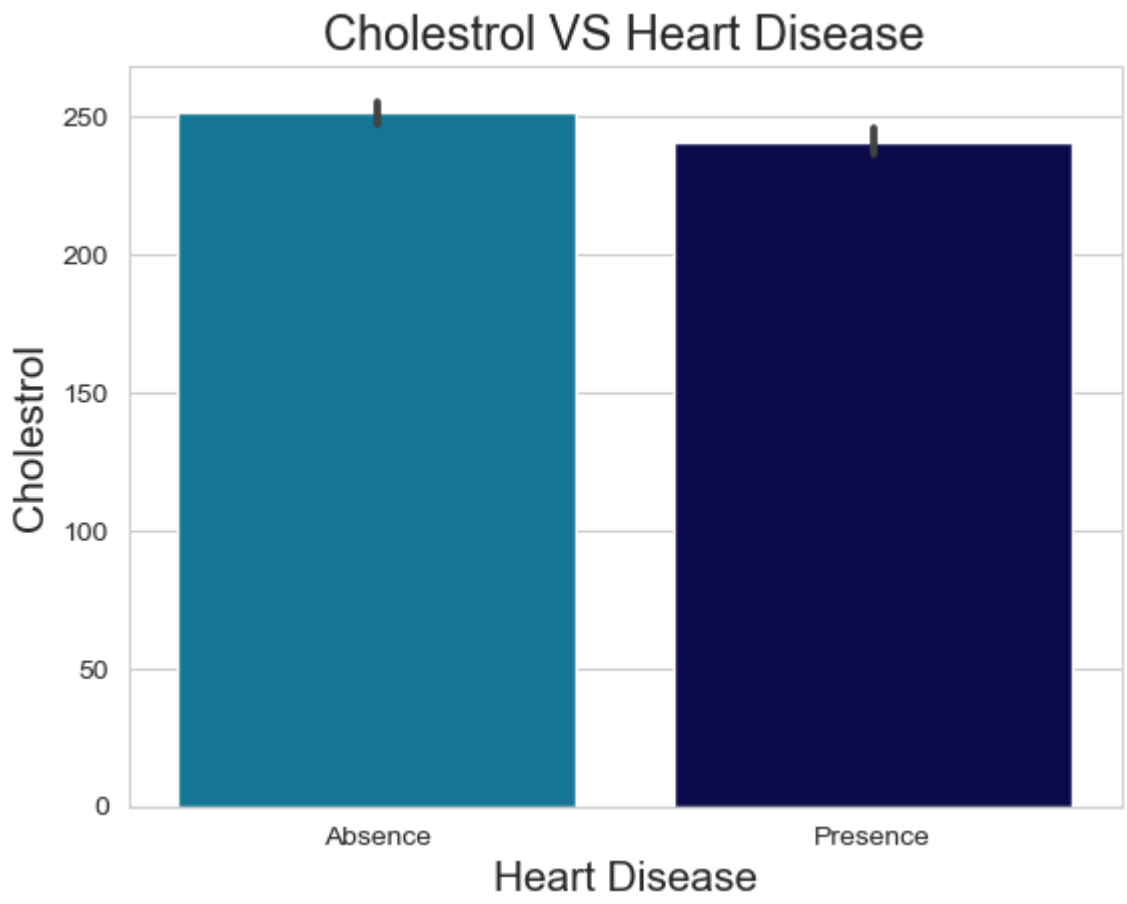


In [89]:
```
sns.barplot(x='sex1', y='trestbps', data=data, palette='plasma')
plt.title("Blood Pressure", fontsize=17)
plt.xlabel('Sex',fontsize=15)
plt.ylabel("Person's Resting Blood Pressure (mm Hg)", fontsize=12)
plt.show()
```

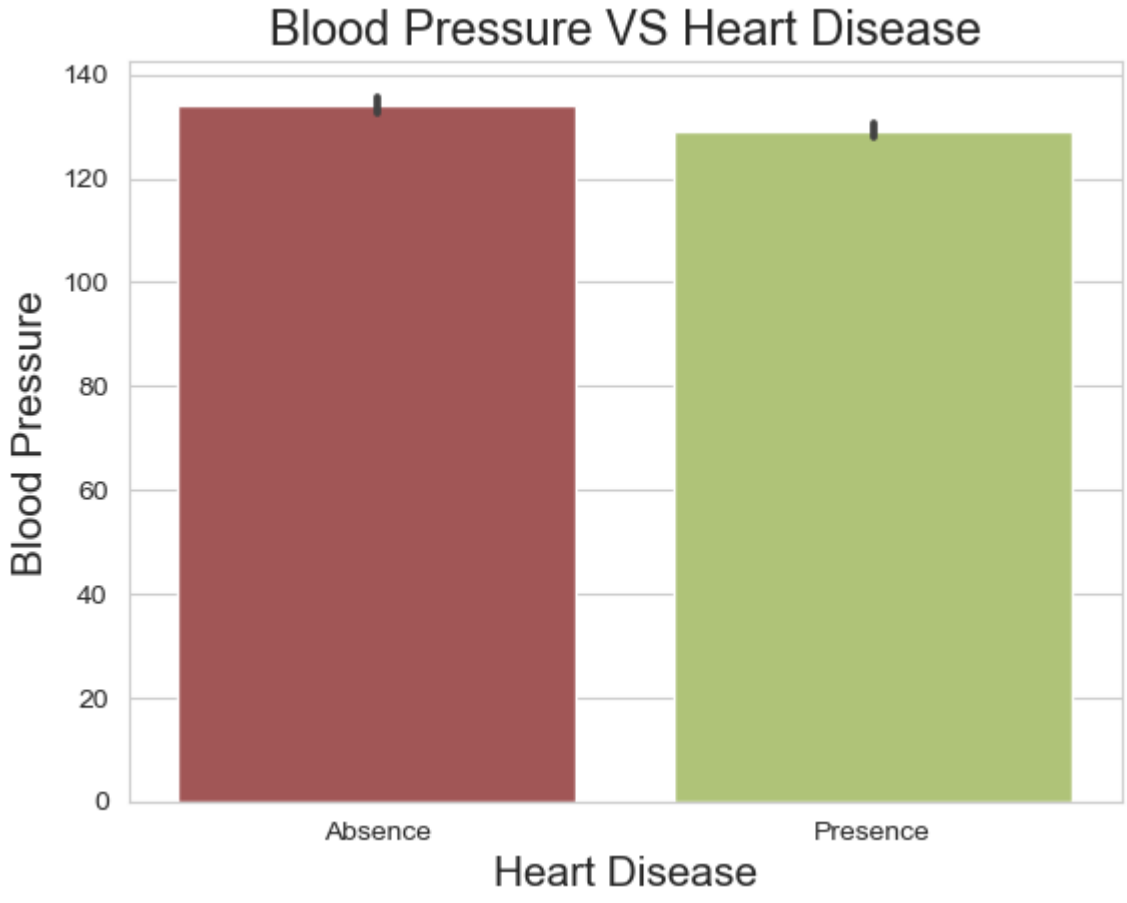


In [90]:
```
sns.barplot(x='sex1', y='chol', data=data, palette='turbo')
plt.title("Cholestrol Level Based On Gender", fontsize=17)
plt.xlabel('Sex',fontsize=15)
plt.ylabel("Cholestrol", fontsize=15)
plt.show()
```

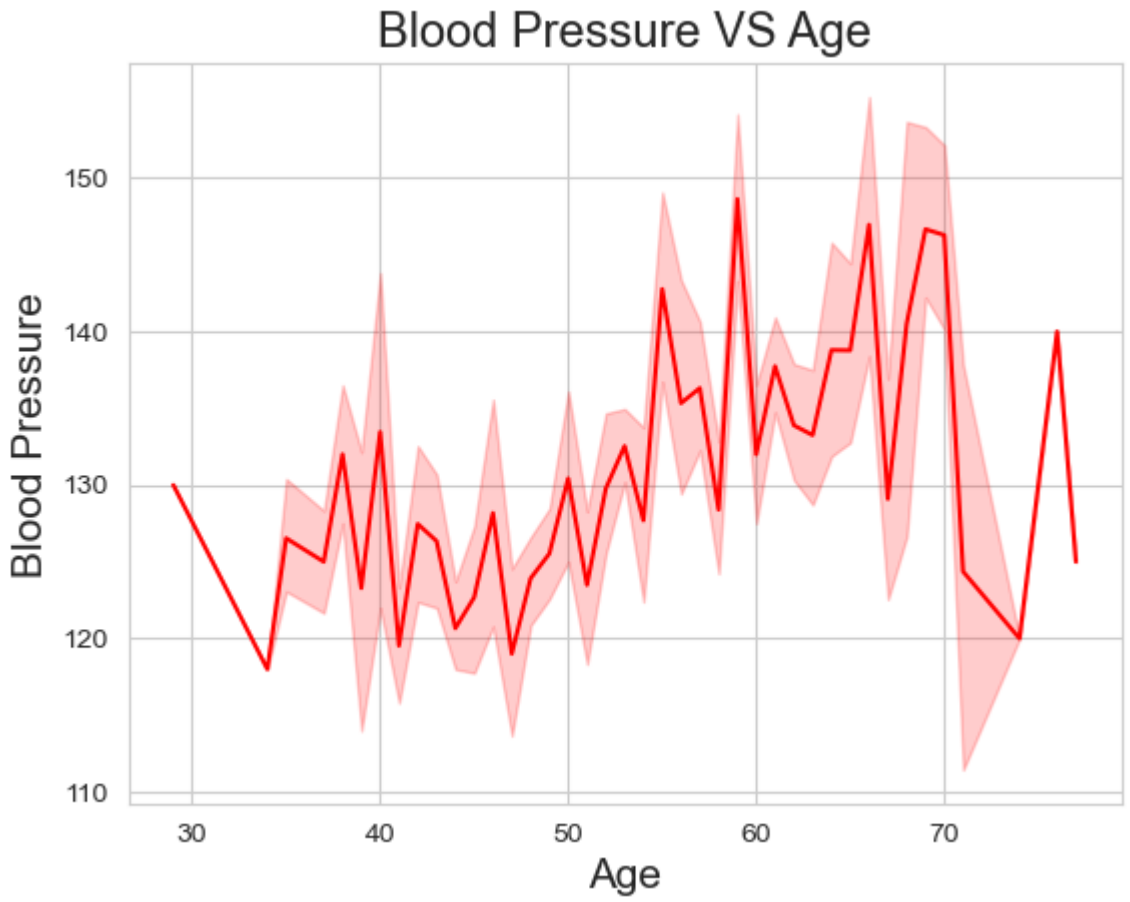
In [91]:
```
sns.barplot(x='Heart_Disease', y='chol', data=data, palette='ocean_r')
plt.title('Cholestrol VS Heart Disease', fontsize=17)
plt.xlabel('Heart Disease', fontsize=15)
plt.ylabel('Cholestrol', fontsize=15)
plt.show()
```



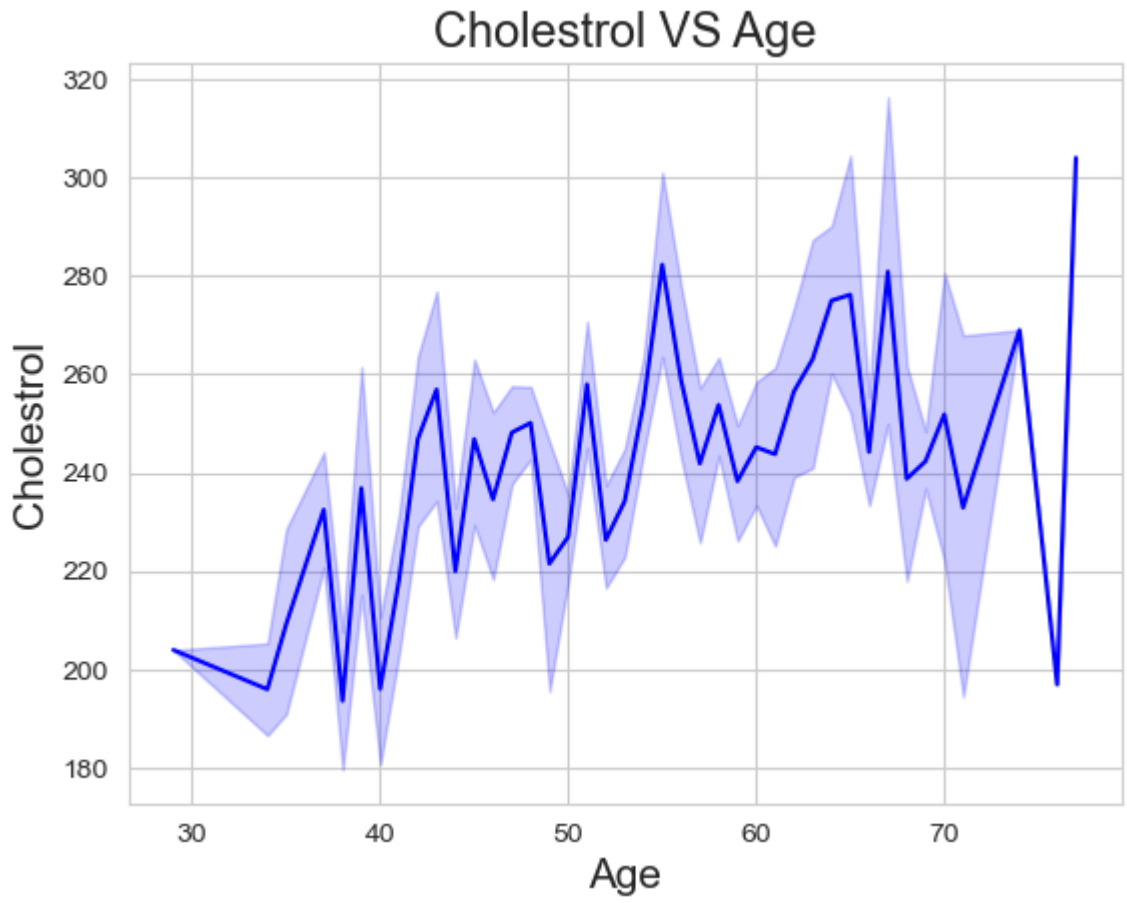
In [92]:
```
sns.barplot(x='Heart_Disease', y='trestbps', data=data, palette='tab20b_r')
plt.title('Blood Pressure VS Heart Disease', fontsize=17)
plt.xlabel('Heart Disease', fontsize=15)
plt.ylabel('Blood Pressure', fontsize=15)
plt.show()
```



In [93]:
```
sns.lineplot(x='age', y='trestbps', data=data, color='r')
plt.title('Blood Pressure VS Age', fontsize=17)
plt.xlabel('Age', fontsize=15)
plt.ylabel('Blood Pressure', fontsize=15)
plt.show()
```



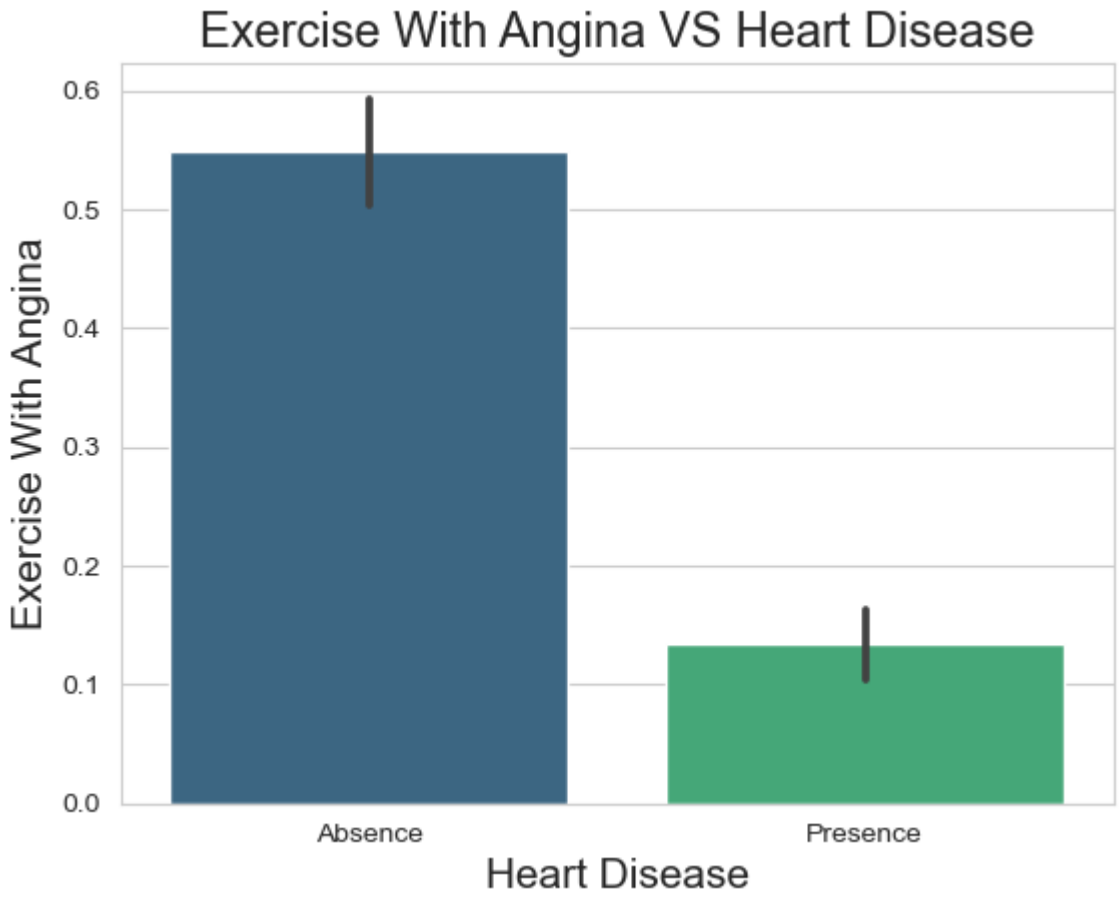
In [94]:
```
sns.lineplot(x='age', y='chol', data=data, color='b')
plt.title('Cholestrol VS Age', fontsize=17)
plt.xlabel('Age', fontsize=15)
plt.ylabel('Cholestrol', fontsize=15)
plt.show()
```



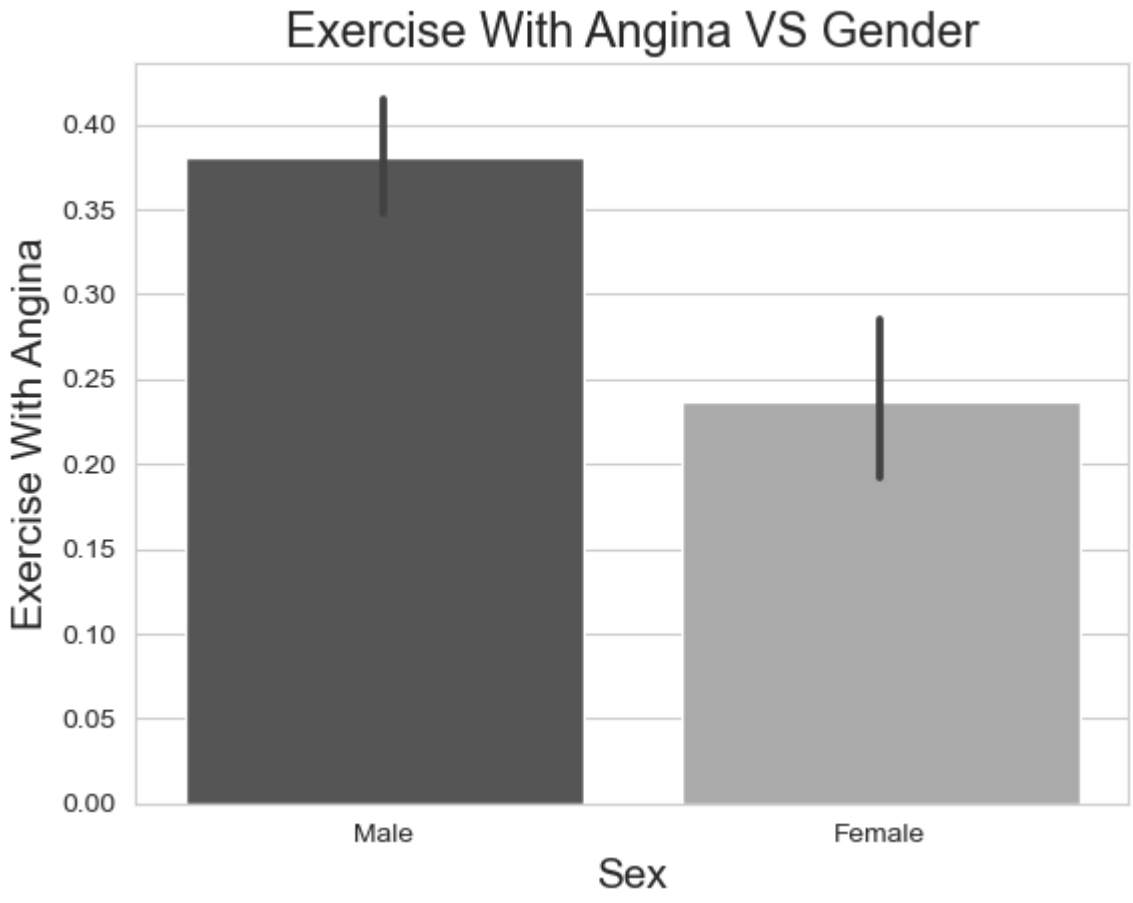
In [95]:
```
sns.lineplot(x='age', y='oldpeak', data=data, color='g')
plt.title('ST Depression VS Age', fontsize=17)
plt.xlabel('Age', fontsize=15)
plt.ylabel('ST depression', fontsize=15)
plt.show()
```

In [96]:
```
sns.barplot(x='sex1', y='oldpeak', data=data, palette='twilight_r')
plt.title('ST depression VS Heart Disease', fontsize=17)
plt.xlabel('Sex', fontsize=15)
plt.ylabel('ST depression', fontsize=15)
plt.show()
```

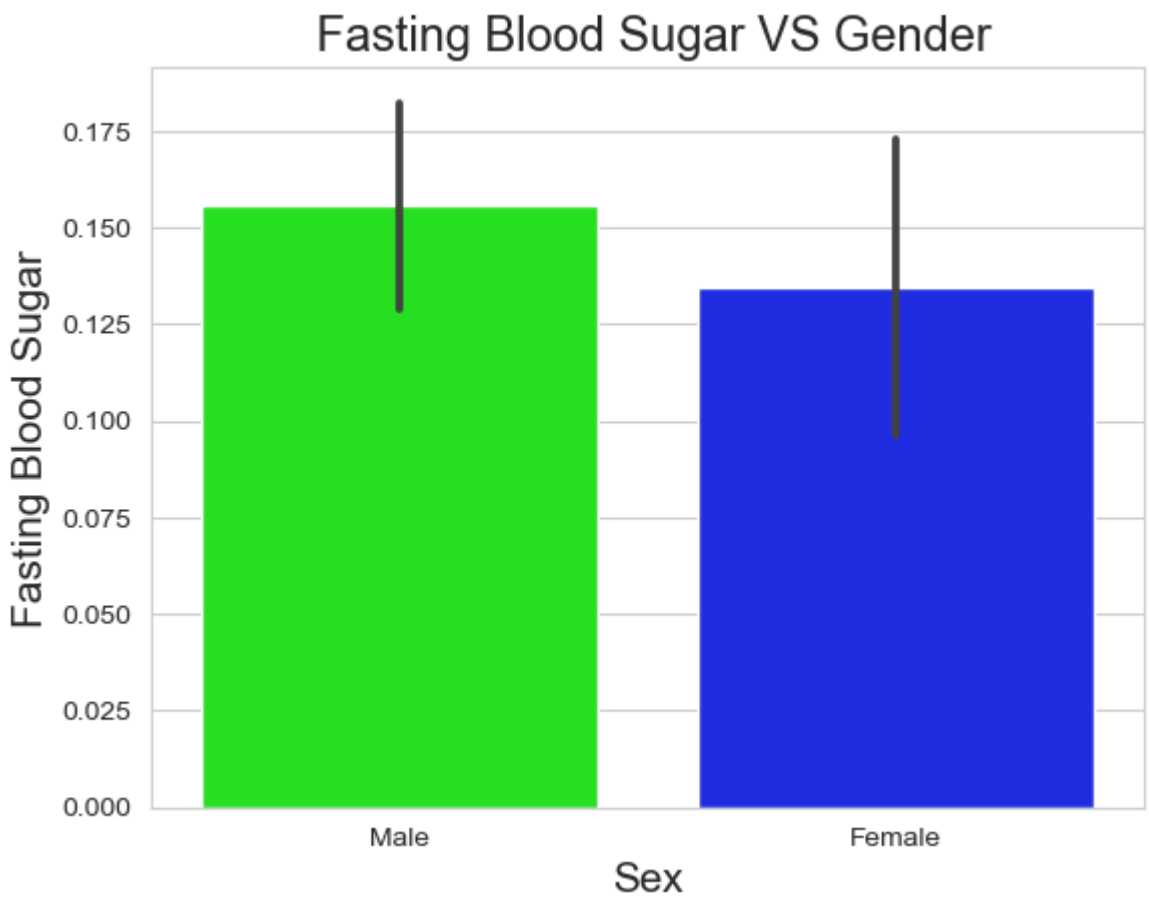
In [97]:
```
sns.barplot(x='Heart_Disease', y='exang', data=data, palette='viridis')
plt.title('Exercise With Angina VS Heart Disease', fontsize=17)
plt.xlabel('Heart Disease', fontsize=15)
plt.ylabel('Exercise With Angina', fontsize=15)
plt.show()
```



In [98]:
```
sns.barplot(x='sex1', y='exang', data=data, palette='binary_r')
plt.title('Exercise With Angina VS Gender', fontsize=17)
plt.xlabel('Sex', fontsize=15)
plt.ylabel('Exercise With Angina', fontsize=15)
plt.show()
```



In [99]:
```
sns.barplot(y='fbs', x='sex1', data=data, palette='hsv')
plt.title(' Fasting Blood Sugar VS Gender', fontsize=17)
plt.xlabel('Sex', fontsize=15)
plt.ylabel('Fasting Blood Sugar', fontsize=15)
plt.show()
```



In [65]:
```
plt.figure(figsize=(16,9))
sns.heatmap(data.corr(), annot=True, linewidth=3)
```

Out[65]:
```
<AxesSubplot:>
```