Importing Libralies

```
import pandas as pd
import numpy as np
pd.set_option("display.max_columns",None)
pd.set_option("display.max_rows",None)
import warnings
warnings.filterwarnings("ignore")
import seaborn as sns
import matplotlib.pyplot as plt
from statsmodels.stats.outliers_influence import variance_inflation_factor
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
from statsmodels.tools.tools import add_constant
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import confusion_matrix,classification_report,accuracy_score
```

Reading Dataset and Initial Observations

```
df=pd.read_csv("/content/drive/MyDrive/Colab Notebooks/Data Science Projects & Resources/Student Stress Level/Dataset.csv")
```

```
df.head()
```

	anxiety_level	self_esteem	mental_health_history	depression	headache	blood_pressure	sleep_quality	breathing_problem	noise_level	living_conditions	safe
0	14	20	0	11	2	1	2	4	2	3	
1	15	8	1	15	5	3	1	4	3	1	
2	12	18	1	14	2	1	2	2	2	2	
3	16	12	1	15	4	3	1	3	4	2	
4	16	28	0	7	2	3	5	1	3	2	

```
df.columns = [col.replace("_", " ").title() for col in df.columns]
```

```
df.head()
```

	Anxiety Level	Self Esteem	Mental Health History	Depression	Headache	Blood Pressure	Sleep Quality	Breathing Problem	Noise Level	Living Conditions	Safety	Basic Needs	Academic Performance	Study Load	Teacher Student Relationship	Future Career Concerns	So Sup
0	14	20	0	11	2	1	2	4	2	3	3	2	3	2	3	3	
1	15	8	1	15	5	3	1	4	3	1	2	2	1	4	1	5	
2	12	18	1	14	2	1	2	2	2	2	3	2	2	3	3	2	
3	16	12	1	15	4	3	1	3	4	2	2	2	2	4	1	4	
4	16	28	0	7	2	3	5	1	3	2	4	3	4	3	1	2	

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1100 entries, 0 to 1099
Data columns (total 21 columns):
 #   Column                        Non-Null Count  Dtype
---  ------                        --------------  -----
 0   Anxiety Level                 1100 non-null   int64
 1   Self Esteem                   1100 non-null   int64
 2   Mental Health History         1100 non-null   int64
 3   Depression                    1100 non-null   int64
 4   Headache                      1100 non-null   int64
 5   Blood Pressure                1100 non-null   int64
 6   Sleep Quality                 1100 non-null   int64
 7   Breathing Problem             1100 non-null   int64
 8   Noise Level                   1100 non-null   int64
 9   Living Conditions             1100 non-null   int64
 10  Safety                        1100 non-null   int64
 11  Basic Needs                   1100 non-null   int64
 12  Academic Performance          1100 non-null   int64
 13  Study Load                    1100 non-null   int64
 14  Teacher Student Relationship  1100 non-null   int64
 15  Future Career Concerns        1100 non-null   int64
 16  Social Support                1100 non-null   int64
 17  Peer Pressure                 1100 non-null   int64
 18  Extracurricular Activities    1100 non-null   int64
 19  Bullying                      1100 non-null   int64
 20  Stress Level                  1100 non-null   int64
dtypes: int64(21)
memory usage: 180.6 KB
```

```
df.duplicated().sum()
```

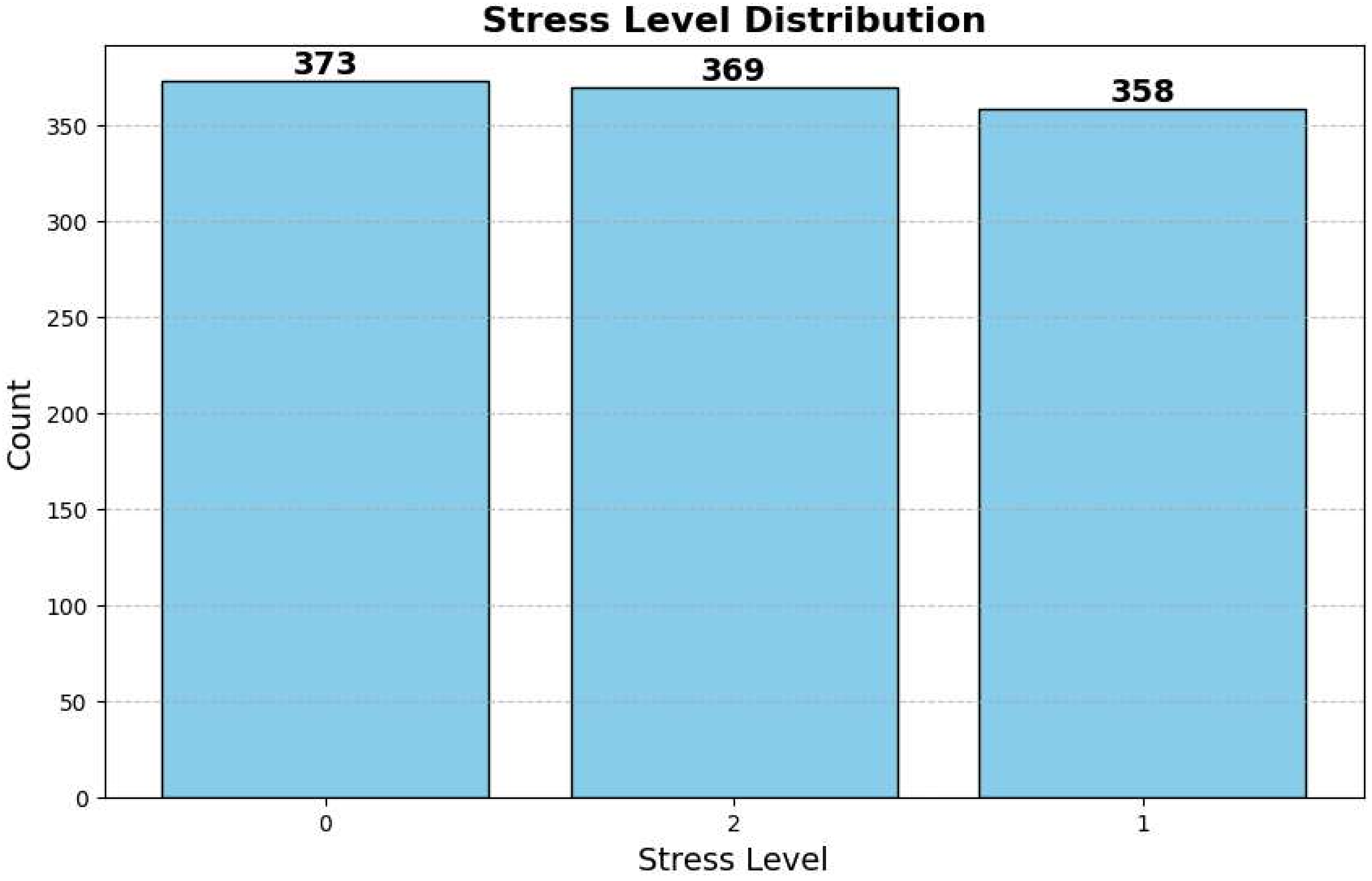
```
np.int64(0)
```

Dataset Overview

- **Entries:** 1,100 rows
- **Columns:** 21 features (all numeric, int64)
- **No missing values** – all columns have 1,100 non-null entries.
- **Memory usage:** ~180.6 KB
- **Duplicate entries:** None reported.

Statistical Analysis with Its Visualizations

```
counts = df["Stress Level"].value_counts()

plt.figure(figsize=(10,6))
bars = plt.bar(counts.index.astype(str), counts.values, color="skyblue", edgecolor="black")


for bar in bars:
    yval = bar.get_height()
    plt.text(bar.get_x() + bar.get_width()/2, yval + 0.5, str(yval),
             ha='center', va='bottom', fontsize=14, fontweight="bold")

plt.title("Stress Level Distribution", fontsize=16, fontweight="bold")
plt.xlabel("Stress Level", fontsize=14)
plt.ylabel("Count", fontsize=14)
plt.grid(axis="y", linestyle="--", alpha=0.7)

plt.show()
```



Stress Level Distribution Observation

- There are three distinct stress levels, labeled as 0, 2, and 1.
- The number of samples in each category is as follows:
    - **Stress Level 0:** 373 samples
    - **Stress Level 2:** 369 samples
    - **Stress Level 1:** 358 samples
- The distribution is fairly balanced, with no category significantly larger or smaller than the others.
- This suggests that all stress levels are similarly represented in the dataset.

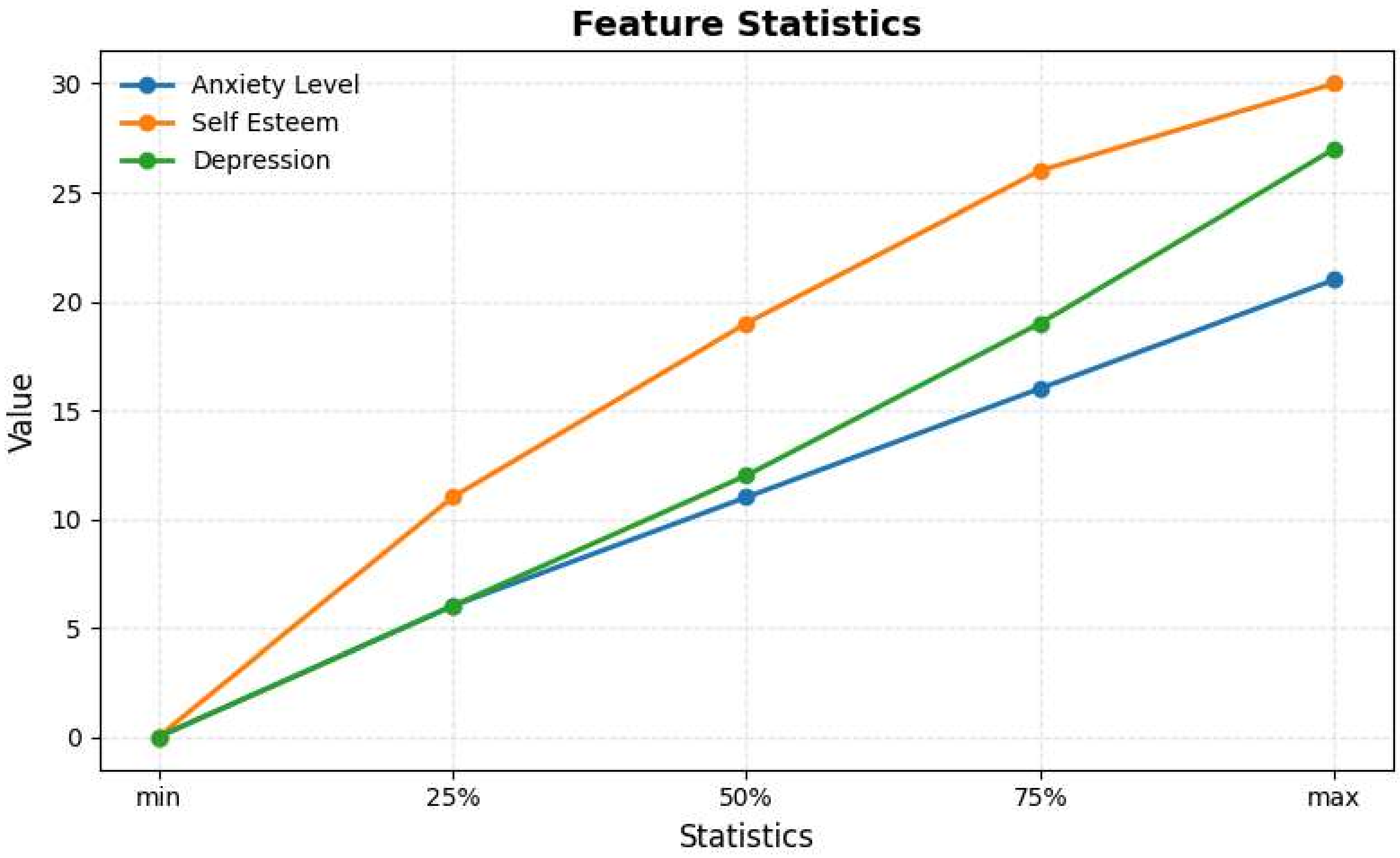
```
df.describe()
```

	Anxiety Level	Self Esteem	Mental Health History	Depression	Headache	Blood Pressure	Sleep Quality	Breathing Problem	Noise Level	Living Conditions	Safety	Basic Needs	Ac Perfo
count	1100.000000	1100.000000	1100.000000	1100.000000	1100.000000	1100.000000	1100.000000	1100.000000	1100.000000	1100.000000	1100.000000	1100.000000	1100.
mean	11.063636	17.777273	0.492727	12.555455	2.508182	2.181818	2.660000	2.753636	2.649091	2.518182	2.737273	2.772727	2.
std	6.117558	8.944599	0.500175	7.727008	1.409356	0.833575	1.548383	1.400713	1.328127	1.119208	1.406171	1.433761	1.
min	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.
25%	6.000000	11.000000	0.000000	6.000000	1.000000	1.000000	1.000000	2.000000	2.000000	2.000000	2.000000	2.000000	2.
50%	11.000000	19.000000	0.000000	12.000000	3.000000	2.000000	2.500000	3.000000	3.000000	2.000000	2.000000	3.000000	2.
75%	16.000000	26.000000	1.000000	19.000000	3.000000	3.000000	4.000000	4.000000	3.000000	3.000000	4.000000	4.000000	4.
max	21.000000	30.000000	1.000000	27.000000	5.000000	3.000000	5.000000	5.000000	5.000000	5.000000	5.000000	5.000000	5.

```
df[["Anxiety Level","Self Esteem","Depression"]].describe().iloc[3:].T
```

	min	25%	50%	75%	max
Anxiety Level	0.0	6.0	11.0	16.0	21.0
Self Esteem	0.0	11.0	19.0	26.0	30.0
Depression	0.0	6.0	12.0	19.0	27.0

```
stats = df[["Anxiety Level","Self Esteem","Depression"]].describe().iloc[3:].T

plt.figure(figsize=(8,5))
for col in stats.index:
    plt.plot(stats.columns, stats.loc[col], marker="o", linewidth=2, markersize=6, label=col)


plt.title("Feature Statistics", fontsize=14, fontweight="bold")
plt.xlabel("Statistics", fontsize=12)
plt.ylabel("Value", fontsize=12)
plt.legend(frameon=False)
plt.grid(alpha=0.3, linestyle='--')
plt.xticks(rotation=0)
plt.tight_layout()
plt.show()
```

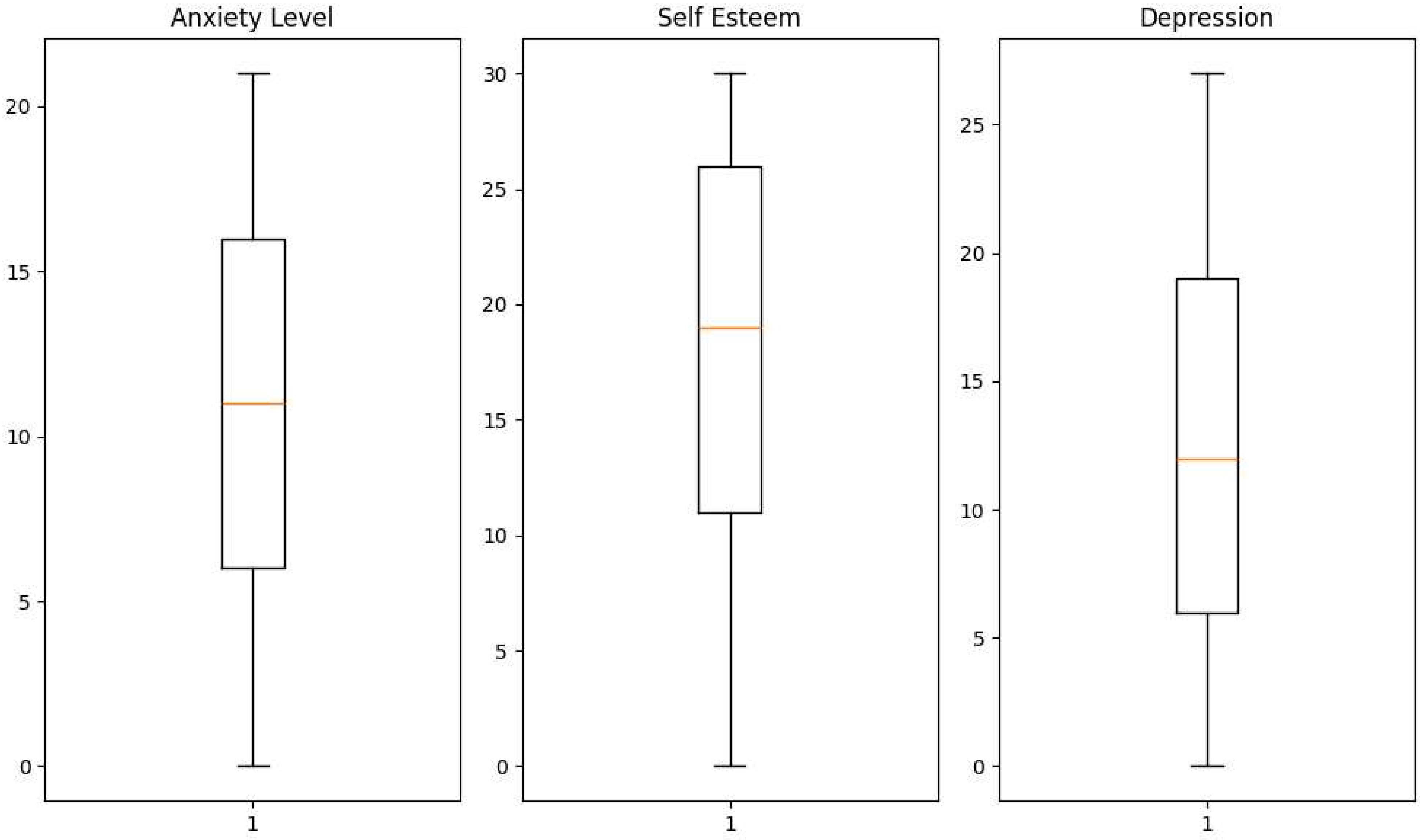


Observations

- **Anxiety Level:** The median (50th percentile) is 11.0, indicating half of the participants have an anxiety score of 11 or less. The distribution extends up to a maximum of 21.0, with the middle 50% falling between 6.0 and 16.0.
- **Self Esteem:** The scores range from 0.0 to 30.0, with a median of 19.0. This indicates a relatively higher variability and central tendency compared to anxiety and depression.
- **Depression:** The depression scores have a median of 12.0, and the upper quartile (75%) is 19.0, with scores reaching up to 27.0. Like anxiety, the distribution is moderately spread out with a similar interquartile range.

```
features = ["Anxiety Level", "Self Esteem", "Depression"]

plt.figure(figsize=(10,6))
```

```
for i, col in enumerate(features, 1):
    plt.subplot(1, 3, i)
    plt.boxplot(df[col])
    plt.title(col)

plt.tight_layout()
plt.show()
```



Outlier Analysis Summary

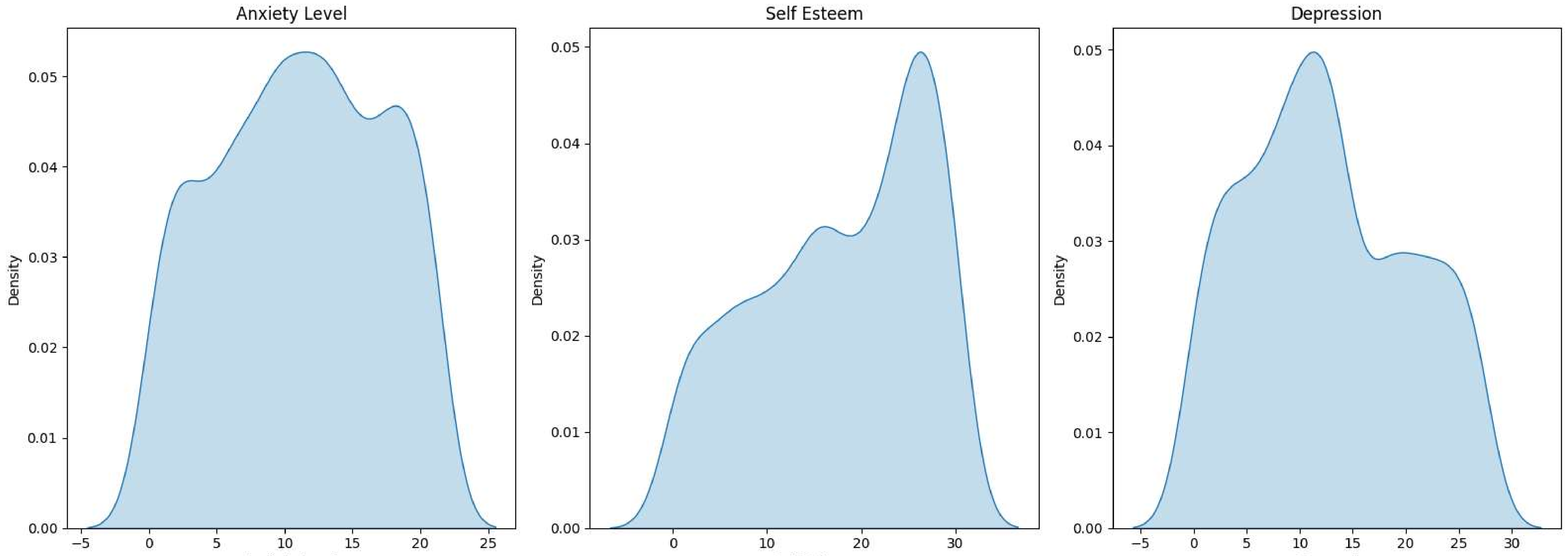
- **No potential outliers were identified** in the data for Anxiety Level, Self Esteem, or Depression.

- While certain extreme values exist, they cannot collectively be termed as outliers because psychological measures can differ greatly among individuals.
- Therefore, **no data capping or exclusion is appropriate in this context**, and it is concluded that **no outliers were found**.

```
df[["Anxiety Level","Self Esteem","Depression"]].describe().iloc[1:-1:4,].T.rename(columns={"mean":"Mean","50%":"Median"})
```

	Mean	Median
Anxiety Level	11.063636	11.0
Self Esteem	17.777273	19.0
Depression	12.555455	12.0

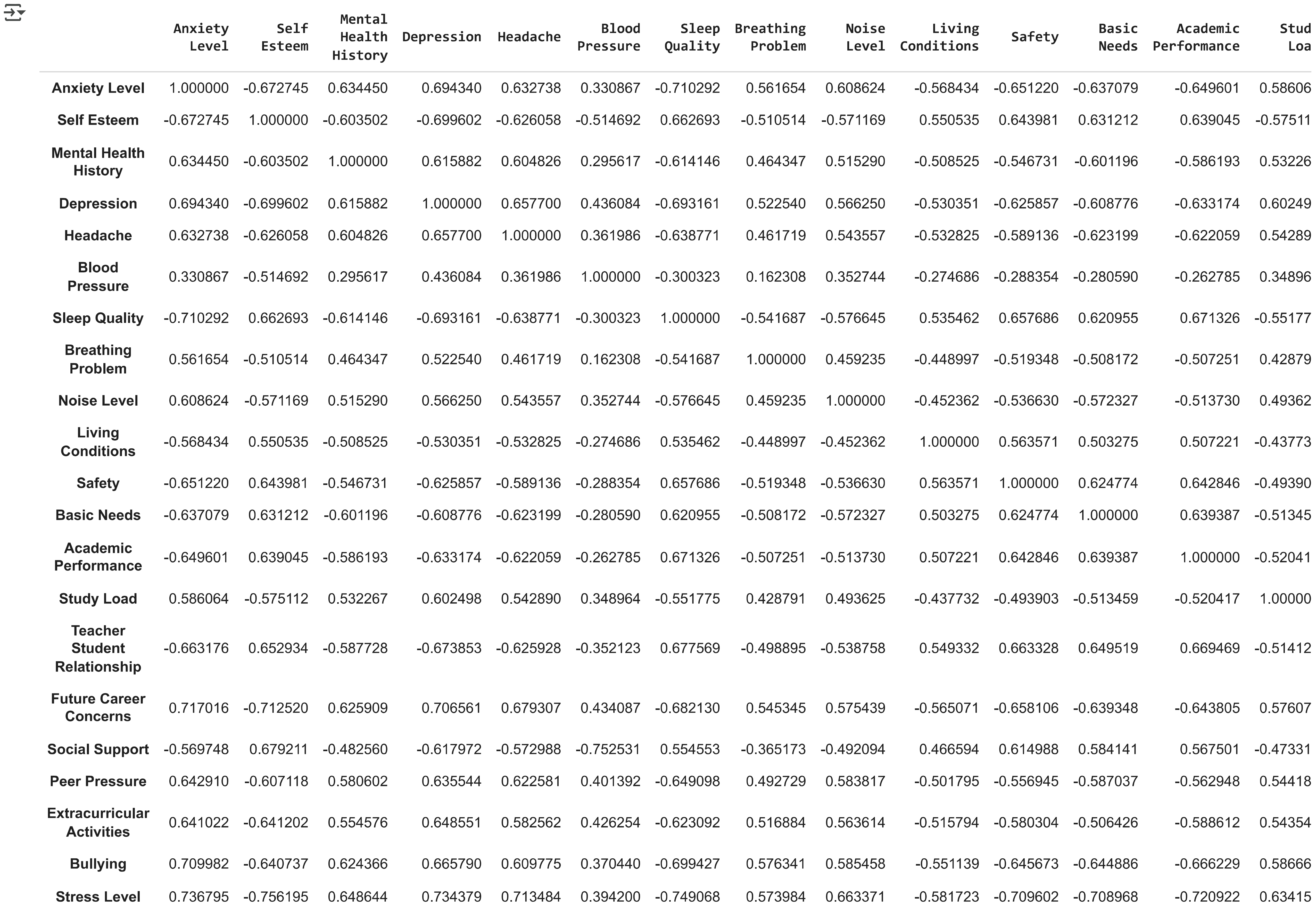
```
features = ["Anxiety Level", "Self Esteem", "Depression"]

plt.figure(figsize=(16,6))

for i, col in enumerate(features, 1):
    plt.subplot(1, 3, i)   # 1 row, 3 columns
    sns.kdeplot(df[col], fill=True)
    plt.title(col)

plt.tight_layout()
plt.show()
```



Observations

- **Anxiety Level:** The mean (11.06) and median (11.0) are very close, indicating a roughly symmetric distribution.
- **Self Esteem:** The mean (17.78) is slightly less than the median (19.0), which may suggest a left-skewed distribution with a few lower values.
- **Depression:** The mean (12.56) and median (12.0) are again quite similar, supporting that the depression scores are nearly symmetrically distributed.

```
df.corr()
```

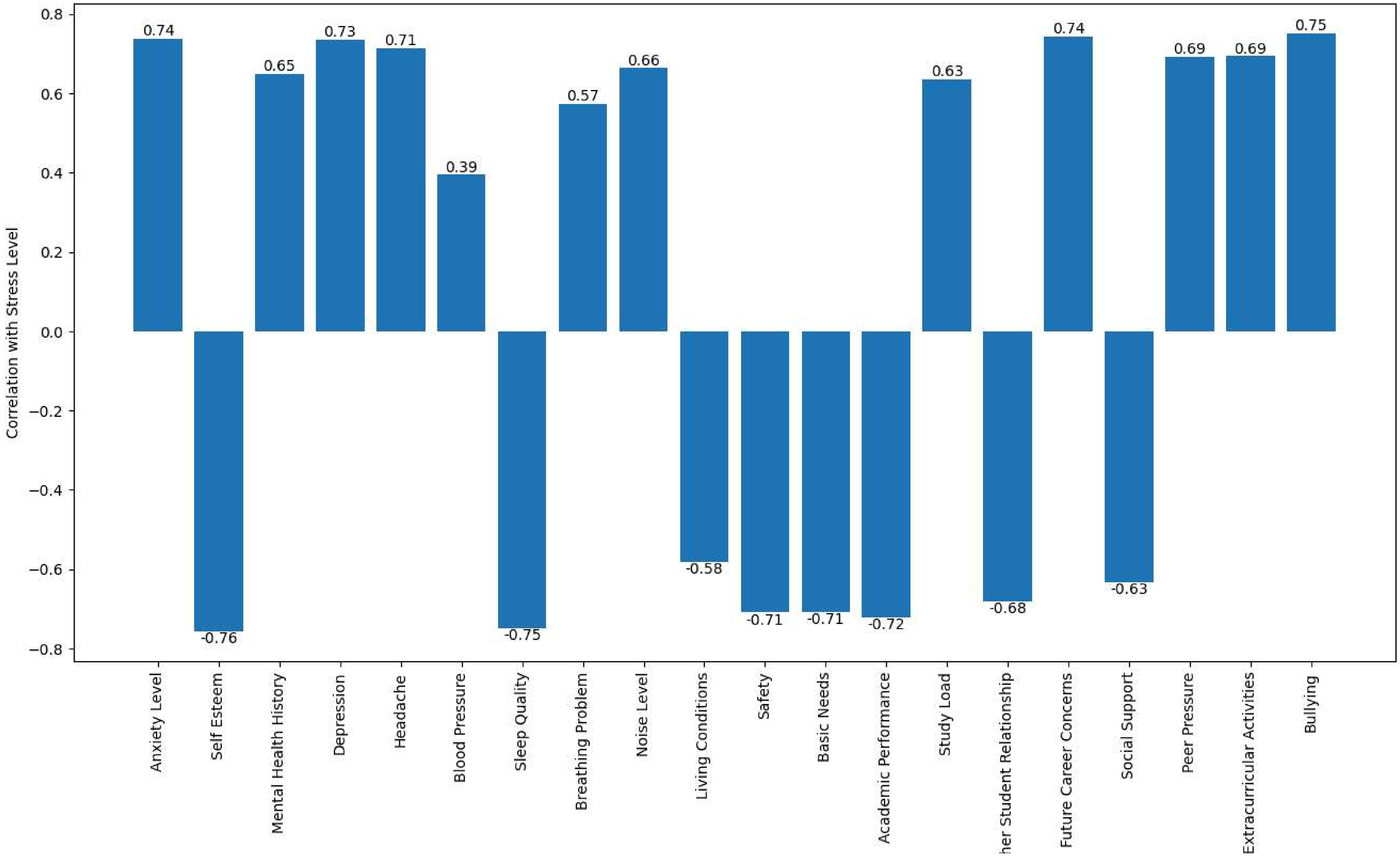


	Anxiety Level	Self Esteem	Mental Health History	Depression	Headache	Blood Pressure	Sleep Quality	Breathing Problem	Noise Level	Living Conditions	Safety	Basic Needs	Academic Performance	Stud Loa
Anxiety Level	1.000000	-0.672745	0.634450	0.694340	0.632738	0.330867	-0.710292	0.561654	0.608624	-0.568434	-0.651220	-0.637079	-0.649601	0.58606
Self Esteem	-0.672745	1.000000	-0.603502	-0.699602	-0.626058	-0.514692	0.662693	-0.510514	-0.571169	0.550535	0.643981	0.631212	0.639045	-0.57511
Mental Health History	0.634450	-0.603502	1.000000	0.615882	0.604826	0.295617	-0.614146	0.464347	0.515290	-0.508525	-0.546731	-0.601196	-0.586193	0.53226
Depression	0.694340	-0.699602	0.615882	1.000000	0.657700	0.436084	-0.693161	0.522540	0.566250	-0.530351	-0.625857	-0.608776	-0.633174	0.60249
Headache	0.632738	-0.626058	0.604826	0.657700	1.000000	0.361986	-0.638771	0.461719	0.543557	-0.532825	-0.589136	-0.623199	-0.622059	0.54289
Blood Pressure	0.330867	-0.514692	0.295617	0.436084	0.361986	1.000000	-0.300323	0.162308	0.352744	-0.274686	-0.288354	-0.280590	-0.262785	0.34896
Sleep Quality	-0.710292	0.662693	-0.614146	-0.693161	-0.638771	-0.300323	1.000000	-0.541687	-0.576645	0.535462	0.657686	0.620955	0.671326	-0.55177
Breathing Problem	0.561654	-0.510514	0.464347	0.522540	0.461719	0.162308	-0.541687	1.000000	0.459235	-0.448997	-0.519348	-0.508172	-0.507251	0.42879
Noise Level	0.608624	-0.571169	0.515290	0.566250	0.543557	0.352744	-0.576645	0.459235	1.000000	-0.452362	-0.536630	-0.572327	-0.513730	0.49362
Living Conditions	-0.568434	0.550535	-0.508525	-0.530351	-0.532825	-0.274686	0.535462	-0.448997	-0.452362	1.000000	0.563571	0.503275	0.507221	-0.43773
Safety	-0.651220	0.643981	-0.546731	-0.625857	-0.589136	-0.288354	0.657686	-0.519348	-0.536630	0.563571	1.000000	0.624774	0.642846	-0.49390
Basic Needs	-0.637079	0.631212	-0.601196	-0.608776	-0.623199	-0.280590	0.620955	-0.508172	-0.572327	0.503275	0.624774	1.000000	0.639387	-0.51345
Academic Performance	-0.649601	0.639045	-0.586193	-0.633174	-0.622059	-0.262785	0.671326	-0.507251	-0.513730	0.507221	0.642846	0.639387	1.000000	-0.52041
Study Load	0.586064	-0.575112	0.532267	0.602498	0.542890	0.348964	-0.551775	0.428791	0.493625	-0.437732	-0.493903	-0.513459	-0.520417	1.00000
Teacher Student Relationship	-0.663176	0.652934	-0.587728	-0.673853	-0.625928	-0.352123	0.677569	-0.498895	-0.538758	0.549332	0.663328	0.649519	0.669469	-0.51412
Future Career Concerns	0.717016	-0.712520	0.625909	0.706561	0.679307	0.434087	-0.682130	0.545345	0.575439	-0.565071	-0.658106	-0.639348	-0.643805	0.57607
Social Support	-0.569748	0.679211	-0.482560	-0.617972	-0.572988	-0.752531	0.554553	-0.365173	-0.492094	0.466594	0.614988	0.584141	0.567501	-0.47331
Peer Pressure	0.642910	-0.607118	0.580602	0.635544	0.622581	0.401392	-0.649098	0.492729	0.583817	-0.501795	-0.556945	-0.587037	-0.562948	0.54418
Extracurricular Activities	0.641022	-0.641202	0.554576	0.648551	0.582562	0.426254	-0.623092	0.516884	0.563614	-0.515794	-0.580304	-0.506426	-0.588612	0.54354
Bullying	0.709982	-0.640737	0.624366	0.665790	0.609775	0.370440	-0.699427	0.576341	0.585458	-0.551139	-0.645673	-0.644886	-0.666229	0.58666
Stress Level	0.736795	-0.756195	0.648644	0.734379	0.713484	0.394200	-0.749068	0.573984	0.663371	-0.581723	-0.709602	-0.708968	-0.720922	0.63415

Correlation Matrix Key Observations

- **Strong Positive Correlations:**
    - **Stress Level** correlates highly with **Anxiety Level (0.74)**, **Depression (0.73)**, **Bullying (0.75)**, **Future Career Concerns (0.74)**, and **Peer Pressure (0.69)**, suggesting these factors often rise together.
    - **Depression** is also strongly correlated with **Anxiety Level (0.69)** and **Bullying (0.67)**.
- **Strong Negative Correlations:**
    - **Stress Level** shows strong negative correlation with **Self Esteem (-0.76)** and **Sleep Quality (-0.75)**, indicating higher stress is associated with lower self esteem and poorer sleep.
    - **Self Esteem** has strong negative relationships with **Anxiety Level (-0.67)**, **Depression (-0.70)**, and **Bullying (-0.76)**.
- **Moderate Correlations:**
    - Many variables show moderate relationships, such as **Study Load** with **Anxiety Level (0.59)** and **Self Esteem (-0.58)**, or **Academic Performance** with **Self Esteem (0.64)** and **Sleep Quality (0.67)**.
- **Interpretation:**
    - Variables relating to social wellbeing and academic factors are interconnected, showing that increases in stress or anxiety are linked to decreases in positive traits like self esteem and sleep quality.
    - **No single variable operates in isolation**; psychological, social, and academic factors jointly influence mental health outcomes.

```
corr = df.corr()["Stress Level"].drop("Stress Level")

plt.figure(figsize=(16,8))
corr = df.corr()["Stress Level"].drop("Stress Level")

plt.bar(corr.index, corr.values)
plt.xticks(rotation=90)

for i, v in enumerate(corr.values):
    plt.text(i, v, f"{v:.2f}", ha='center', va='bottom' if v>=0 else 'top')

plt.ylabel("Correlation with Stress Level")
plt.show()
```



Stress Level: Correlation Insights

- **Highly Positive Correlations:**

    - Stress Level has a strong positive correlation with:
        - **Anxiety Level (0.74)**
        - **Depression (0.73)**
        - **Bullying (0.75)**
        - **Future Career Concerns (0.74)**
        - **Peer Pressure (0.69)**
        - **Extracurricular Activities (0.69)**
        - **Headache (0.71)**
        - **Noise Level (0.66)**
        - **Mental Health History (0.65)**
        - **Study Load (0.63)**
        - **Academic Performance (-0.72)** (negative direction)
- **Highly Negative Correlations:**
    - Stress Level is strongly negatively correlated with:
        - **Self Esteem (-0.76)**
        - **Sleep Quality (-0.75)**
        - **Safety (-0.71)**
        - **Basic Needs (-0.71)**
- **Interpretation:**
    - Higher stress levels are closely tied to higher anxiety, depression, bullying, and concerns about the future.
    - As stress increases, self-esteem and sleep quality tend to decrease sharply, reflecting a potential area for interventions focused on building self-esteem and improving sleep routines.

```
X = df.drop(columns=["Stress Level"])
X_const = add_constant(X)


vif_data = pd.DataFrame()
vif_data["feature"] = X_const.columns
vif_data["VIF"] = [variance_inflation_factor(X_const.values, i)
                   for i in range(X_const.shape[1])]


vif_data = vif_data[vif_data["feature"] != "const"]
```

```
print(vif_data)
```

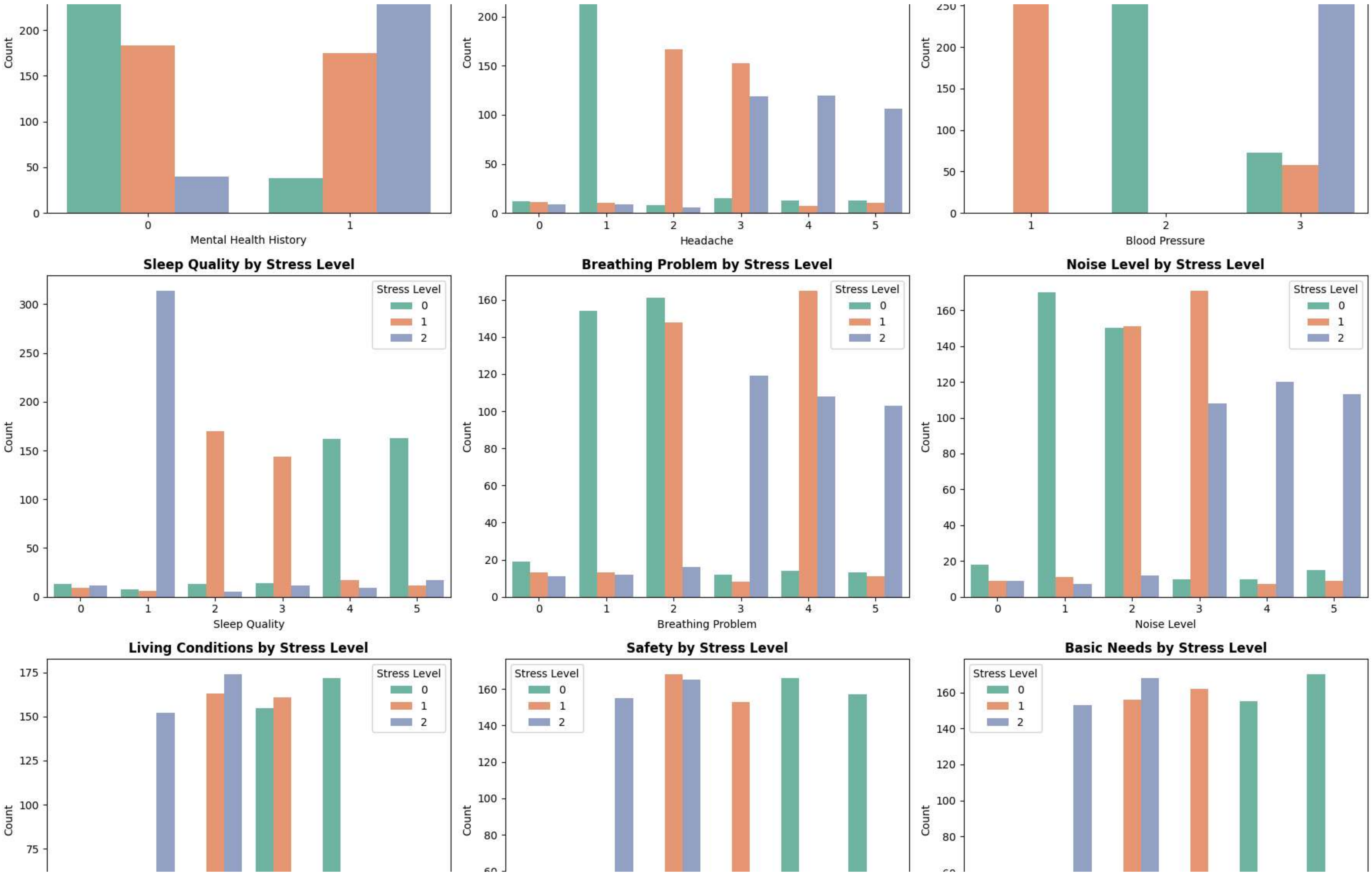
```
                         feature       VIF
1                  Anxiety Level  3.226378
2                    Self Esteem  3.208365
3          Mental Health History  2.218410
4                     Depression  3.090505
5                       Headache  2.534846
6                 Blood Pressure  3.686664
7                  Sleep Quality  3.089081
8              Breathing Problem  1.784443
9                    Noise Level  1.990095
10             Living Conditions  1.797776
11                        Safety  2.790136
12                   Basic Needs  2.679847
13          Academic Performance  2.706926
14                    Study Load  1.900661
15  Teacher Student Relationship  3.198274
16         Future Career Concerns  3.416580
17                Social Support  5.745766
18                 Peer Pressure  2.606810
19      Extracurricular Activities  2.516038
20                      Bullying  3.187411
```

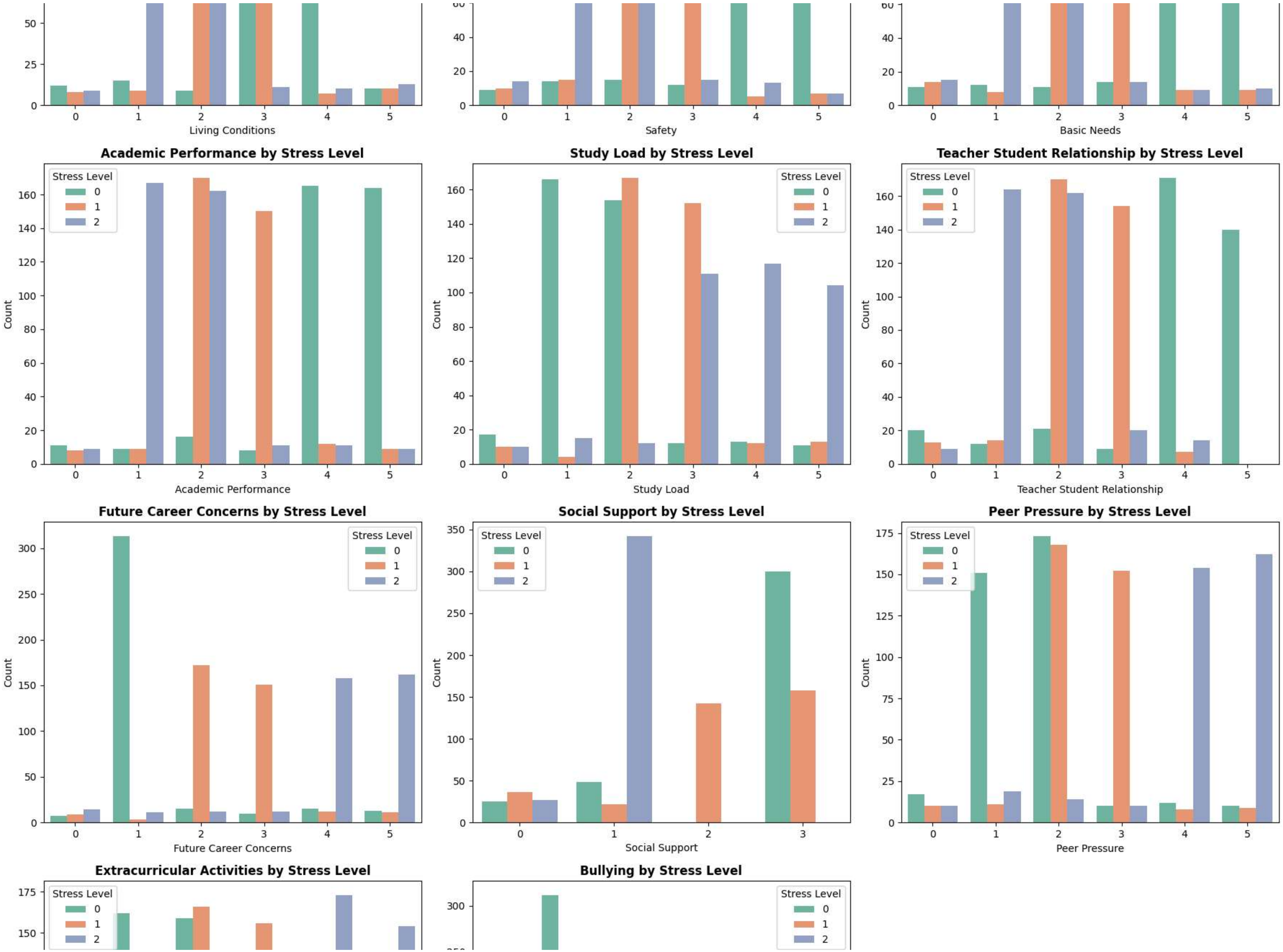
Observations

- **All VIF values are below 10**, indicating that severe multicollinearity is not present in this dataset.
- **Social Support** has the highest VIF (5.75), suggesting moderate correlation with other predictors, but it is still within acceptable limits for regression modeling.
- Most features have VIF values between **1.7 and 3.7**, indicating low to moderate multicollinearity and suggesting all features can generally be retained for further analysis.

```
exclude_cols = ["Anxiety Level", "Self Esteem", "Depression"]


cols_to_plot = df.drop(columns=exclude_cols + ["Stress Level"]).columns


n_cols = 3
n_rows = (len(cols_to_plot) + n_cols - 1) // n_cols

plt.figure(figsize=(18, n_rows * 5))
palette = sns.color_palette("Set2")
```

```
for i, col in enumerate(cols_to_plot, 1):
    plt.subplot(n_rows, n_cols, i)
    sns.countplot(x=col, hue="Stress Level", data=df, palette=palette)
    plt.title(f"{col} by Stress Level", fontsize=12, weight='bold')
    plt.xlabel(col)
    plt.ylabel("Count")
    plt.legend(title="Stress Level")

plt.tight_layout()
plt.show()
```


Count
200
150
100
50
0
0
1
Mental Health History
Count
200
150
100
50
0
0
1
2
3
4
5
Headache
250
Count
200
150
100
50
0
1
2
3
Blood Pressure
Sleep Quality by Stress Level
Stress Level
0
1
2
300
250
200
150
100
50
0
Count
0
1
2
3
4
5
Sleep Quality
Breathing Problem by Stress Level
Stress Level
0
1
2
160
140
120
100
80
60
40
20
0
Count
0
1
2
3
4
5
Breathing Problem
Noise Level by Stress Level
Stress Level
0
1
2
160
140
120
100
80
60
40
20
0
Count
0
1
2
3
4
5
Noise Level
Living Conditions by Stress Level
Stress Level
0
1
2
175
150
125
100
75
Count
Safety by Stress Level
Stress Level
0
1
2
160
140
120
100
80
60
Count
Basic Needs by Stress Level
Stress Level
0
1
2
160
140
120
100
80
60
Count



Academic Performance by Stress Level

Study Load by Stress Level

Teacher Student Relationship by Stress Level

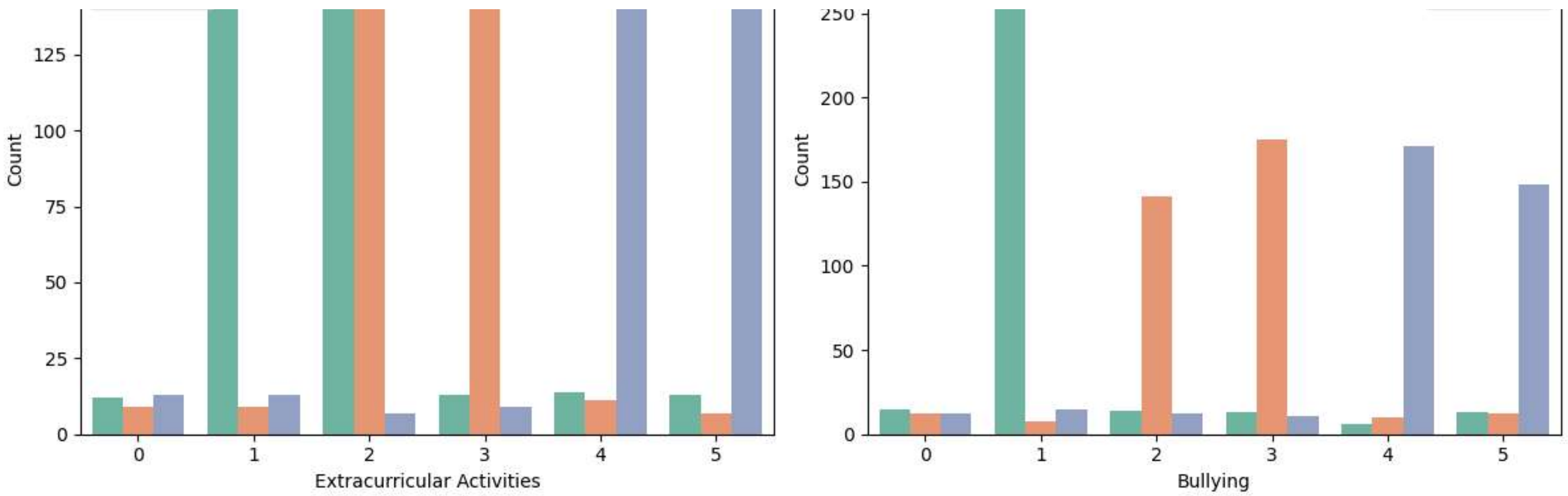
Future Career Concerns by Stress Level

Social Support by Stress Level

Peer Pressure by Stress Level

Extracurricular Activities by Stress Level

Bullying by Stress Level


Count
0
25
50
75
100
125
0
1
2
3
4
5
Extracurricular Activities
Count
0
50
100
150
200
250
0
1
2
3
4
5
Bullying

Stress Level and Influencing Factors: Visual Insights

- **Clear Group Differences:** Many bar charts reveal that higher stress levels (especially Stress Level 2) are associated with higher counts for negative attributes such as prior mental health history, frequent headaches, higher blood pressure, more breathing problems, exposure to noise, and bullying.
- **Protective Factors:** Lower stress levels (Stress Level 0) are more prevalent among those with better sleep quality, adequate safety, fulfillment of basic needs, better academic performance, healthy teacher-student relationships, strong social support, and fewer future career concerns or bullying experiences.
- **Socio-academic Stressors:** Higher stress groups also coincide with greater study loads, more future career concerns, and increased peer pressure, emphasizing the role of both academic and social factors.
- **Multidimensional Impact:** The charts provide strong evidence that stress levels are shaped by a combination of physical, psychological, social, and academic variables, with higher stress consistently clustering with more adverse circumstances across these features.

Model Building

```
X_train,X_test,y_train,y_test=train_test_split(df.drop(columns=["Stress Level"],axis=1),df["Stress Level"],test_size=0.25,random_state=42)
```

```
X_train.shape,X_test.shape,y_train.shape,y_test.shape
```

```
((825, 20), (275, 20), (825,), (275,))
```

```
scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)
```

```
X_train=pd.DataFrame(X_train_scaled,columns=X_train.columns)
X_test=pd.DataFrame(X_test_scaled,columns=X_test.columns)
```

```
model=LogisticRegression()
model.fit(X_train, y_train)


y_train_pred = model.predict(X_train)
y_test_pred = model.predict(X_test)
```

```
train_acc = accuracy_score(y_train, y_train_pred)
test_acc = accuracy_score(y_test, y_test_pred)

print("Test Accuracy : ",test_acc)
print("Train Accuracy : ",train_acc)



print("\nClassification Report:\n")
print(classification_report(y_test, y_test_pred))

cm=confusion_matrix(y_test, y_test_pred)
```

```
Test Accuracy :  0.8945454545454545
Train Accuracy :  0.9054545454545454

Classification Report:

              precision    recall  f1-score   support

           0       0.90      0.87      0.89        95
           1       0.88      0.89      0.89        92
           2       0.90      0.92      0.91        88

    accuracy                           0.89       275
   macro avg       0.89      0.90      0.89       275
weighted avg       0.89      0.89      0.89       275
```

```
plt.figure(figsize=(8,6))
sns.heatmap(cm, annot=True, fmt="d", cmap="Blues",
            xticklabels=model.classes_,
            yticklabels=model.classes_,
            cbar=False, linewidths=2, linecolor='black')

plt.xlabel("Predicted", fontsize=14)
plt.ylabel("Actual", fontsize=14)
plt.title("Confusion Matrix (Heatmap)", fontsize=16, weight='bold')
plt.xticks(fontsize=12)
plt.yticks(fontsize=12)
plt.show()
```