```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns
import plotly.express as px
import plotly.graph_objects as go
from sklearn.impute import SimpleImputer
# Basic packages
import pandas as pd, numpy as np, matplotlib.pyplot as plt, seaborn as sns, gc
from scipy import stats; from scipy.stats import zscore, norm, randint
import matplotlib.style as style;
style.use('fivethirtyeight')

# Display settings
pd.options.display.max_rows = 400
pd.options.display.max_columns = 100
pd.options.display.float_format = "{:.2f}".format

random_state = 42
np.random.seed(random_state)

# Suppress warnings
import warnings; warnings.filterwarnings('ignore')

data = pd.read_csv('/content/malnutrition-estimates.csv')
data_by_country = pd.read_csv('/content/country-wise-average.csv')
data.drop(['Unnamed: 0','ISO code','Survey Year','Source','Report Author','Notes','Short Source'], axis=1, inplace=True)

def income_map(val):
    mapper = {0:'Low Income', 1:'Lower Middle Income', 2:'Upper Middle Income',3:'High Income'}
    return mapper[val]
def lldc_map(val):
    mapper = {0:'Others', 2:'SIDS', 1:'LLDC'}
    return mapper[val]

data['Income Classification'] = data['Income Classification'].apply(income_map)
data['LLDC or SID2'] = data['LLDC or SID2'].apply(lldc_map)
```

```
data.head()
```

	Country	Year	Income Classification	LDC	LIFD	LLDC or SID2	Survey Sample (N)	Severe Wasting	Wasting	Overweight	Stunting	Underweight	Populat ('00
0	AFGHANISTAN	1997	Low Income	1.00	1.00	LLDC	4,846	NaN	18.20	6.50	53.20	44.90	383
1	AFGHANISTAN	2004	Low Income	1.00	1.00	LLDC	946	3.50	8.60	4.60	59.30	32.90	478
2	AFGHANISTAN	2013	Low Income	1.00	1.00	LLDC	44,26,469	4.00	9.50	5.30	40.40	24.60	544
3	AFGHANISTAN	2018	Low Income	1.00	1.00	LLDC	NaN	1.60	5.10	4.10	38.20	19.10	560

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 924 entries, 0 to 923
Data columns (total 13 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   Country                924 non-null    object
 1   Year                   924 non-null    int64
 2   Income Classification  924 non-null    object
 3   LDC                    924 non-null    float64
 4   LIFD                   924 non-null    float64
 5   LLDC or SID2           924 non-null    object
 6   Survey Sample (N)      861 non-null    object
 7   Severe Wasting         696 non-null    float64
 8   Wasting                877 non-null    float64
 9   Overweight             788 non-null    float64
 10  Stunting               887 non-null    float64
 11  Underweight            902 non-null    float64
 12  U5 Population ('000s)  924 non-null    float64
dtypes: float64(8), int64(1), object(4)
memory usage: 94.0+ KB
```

```
data.describe().T
```

	count	mean	std	min	25%	50%	75%	max
Year	924.00	2003.73	8.79	1983.00	1996.00	2004.50	2011.00	2019.00
LDC	924.00	0.35	0.48	0.00	0.00	0.00	1.00	1.00
LIFD	924.00	0.42	0.49	0.00	0.00	0.00	1.00	1.00
Severe Wasting	696.00	2.19	1.91	0.00	0.80	1.60	2.90	12.90
Wasting	877.00	6.96	5.04	0.00	2.90	5.90	9.70	25.30
Overweight	788.00	6.43	4.64	0.00	2.90	5.50	8.70	30.10
Stunting	887.00	29.06	15.83	0.00	16.65	29.20	40.20	73.60
Underweight	902.00	15.84	12.51	0.00	4.93	13.40	23.10	66.80
U5 Population ('000s)	924.00	6182.70	16795.94	1.00	559.67	1795.52	4194.21	132966.78

```
# Check missing values in the dataframe
data.isnull().sum()
```

```
Country                    0
Year                       0
Income Classification      0
LDC                        0
LIFD                       0
LLDC or SID2               0
Survey Sample (N)         63
Severe Wasting           228
Wasting                   47
Overweight               136
Stunting                  37
Underweight               22
U5 Population ('000s)      0
dtype: int64
```

```
columns = list(['Severe Wasting', 'Wasting','Overweight', 'Stunting', 'Underweight'])

print('Descriptive Stats before imputation for columns with missing values: \n', '--'*35)
display(data[columns].describe().T)

data['Wasting'].fillna(data['Wasting'].mean(), inplace=True)
data['Severe Wasting'].fillna(data['Severe Wasting'].mean(), inplace=True)
data['Overweight'].fillna(data['Overweight'].mean(), inplace=True)
data['Stunting'].fillna(data['Stunting'].mean(), inplace=True)
data['Underweight'].fillna(data['Underweight'].mean(), inplace=True)

print('Descriptive Stats after imputation: \n', '--'*35)
display(data[columns].describe().T)
```

```
Descriptive Stats before imputation for columns with missing values:
 ----------------------------------------------------------------------
```

	count	mean	std	min	25%	50%	75%	max
Severe Wasting	696.00	2.19	1.91	0.00	0.80	1.60	2.90	12.90
Wasting	877.00	6.96	5.04	0.00	2.90	5.90	9.70	25.30
Overweight	788.00	6.43	4.64	0.00	2.90	5.50	8.70	30.10
Stunting	887.00	29.06	15.83	0.00	16.65	29.20	40.20	73.60
Underweight	902.00	15.84	12.51	0.00	4.93	13.40	23.10	66.80

```
Descriptive Stats after imputation:
 ----------------------------------------------------------------------
```

	count	mean	std	min	25%	50%	75%	max
Severe Wasting	924.00	2.19	1.66	0.00	1.10	2.19	2.50	12.90
Wasting	924.00	6.96	4.91	0.00	3.10	6.20	9.50	25.30
Overweight	924.00	6.43	4.28	0.00	3.48	6.30	8.10	30.10
Stunting	924.00	29.06	15.51	0.00	17.20	29.06	39.82	73.60
Underweight	924.00	15.84	12.36	0.00	5.00	13.80	22.80	66.80

Univariate Analysis

```
def odp_plots(df, col):
    f,(ax1, ax2, ax3) = plt.subplots(1, 3, figsize = (15, 7.2))

    # Boxplot to check outliers
    sns.boxplot(x = col, data = df, ax = ax1, orient = 'v', color = 'darkslategrey')

    # Distribution plot with outliers
    sns.distplot(df[col], ax = ax2, color = 'teal', fit = norm).set_title(f'{col} with outliers')

    # Removing outliers, but in a new dataframe
    upperbound, lowerbound = np.percentile(df[col], [1, 99])
    y = pd.DataFrame(np.clip(df[col], upperbound, lowerbound))

    # Distribution plot without outliers
    sns.distplot(y[col], ax = ax3, color = 'tab:orange', fit = norm).set_title(f'{col} without outliers')

    kwargs = {'fontsize':14, 'color':'black'}
    ax1.set_title(col + ' Boxplot Analysis', **kwargs)
    ax1.set_xlabel('Box', **kwargs)
    ax1.set_ylabel(col + ' Values', **kwargs)

    return plt.show()
```

DISTRIBUTION PLOTS

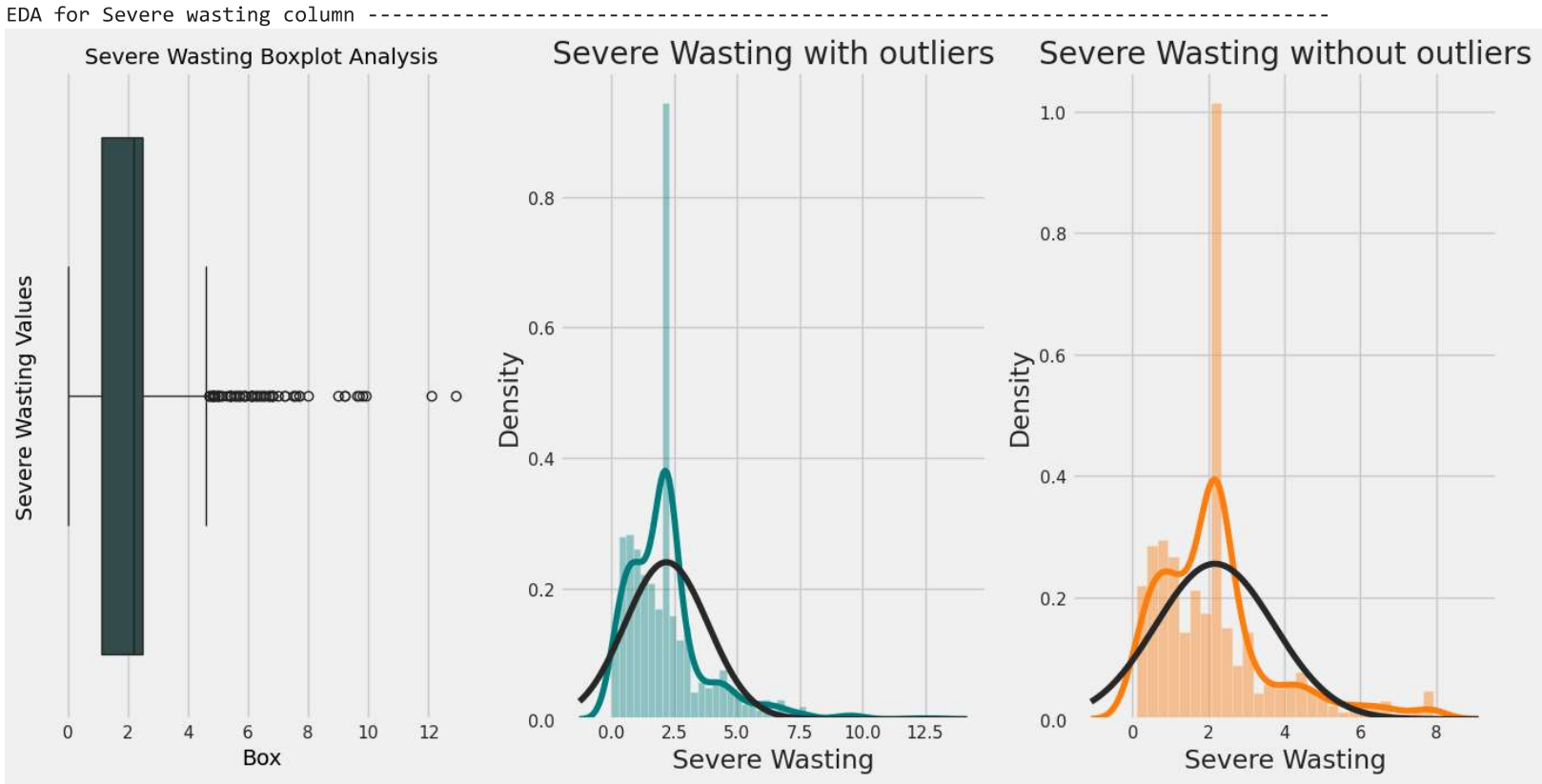
```
# Outlier, distribution for columns with outliers
boxplotcolumns = ['Severe Wasting', 'Wasting', 'Overweight', 'Stunting',
                  'Underweight']
for cols in boxplotcolumns:
    Q3 = data[cols].quantile(0.75)
    Q1 = data[cols].quantile(0.25)
    IQR = Q3 - Q1

    print(f'{cols.capitalize()} column', '--'*40)
    count = len(data.loc[(data[cols] < (Q1 - 1.5 * IQR)) | (data[cols] > (Q3 + 1.5 * IQR))])
```

```
    print(f'no of records with outliers values: {count}')

    display(data.loc[(data[cols] < (Q1 - 1.5 * IQR)) | (data[cols] > (Q3 + 1.5 * IQR))].head())
    print(f'EDA for {cols.capitalize()} column', '--'*40)
    odp_plots(data, cols)

del cols, IQR, boxplotcolumns
```

```
Severe wasting column --------------------------------------------------------------------------------
no of records with outliers values: 74
```

	Country	Year	Income Classification	LDC	LIFD	LLDC or SID2	Survey Sample (N)	Severe Wasting	Wasting	Overweight	Stunting	Underweight	Populatio ('000
5	ALBANIA	2000	Upper Middle Income	0.00	0.00	Others	1,382	6.20	12.20	30.10	39.20	17.00	279.8
7	ALBANIA	2009	Upper Middle Income	0.00	0.00	Others	1,489	5.90	9.60	23.20	23.20	6.30	179.3
13	ALGERIA	2002	Upper Middle Income	0.00	0.00	Others	4,357	5.00	9.60	15.10	24.00	11.10	2877.7
48	BANGLADESH	1997	Lower Middle Income	1.00	1.00	Others	5,204	6.80	20.70	2.40	59.60	53.60	16160.1
61	BANGLADESH	2013	Lower Middle Income	1.00	1.00	Others	4,029	4.90	18.10	2.60	38.70	35.10	14844.4

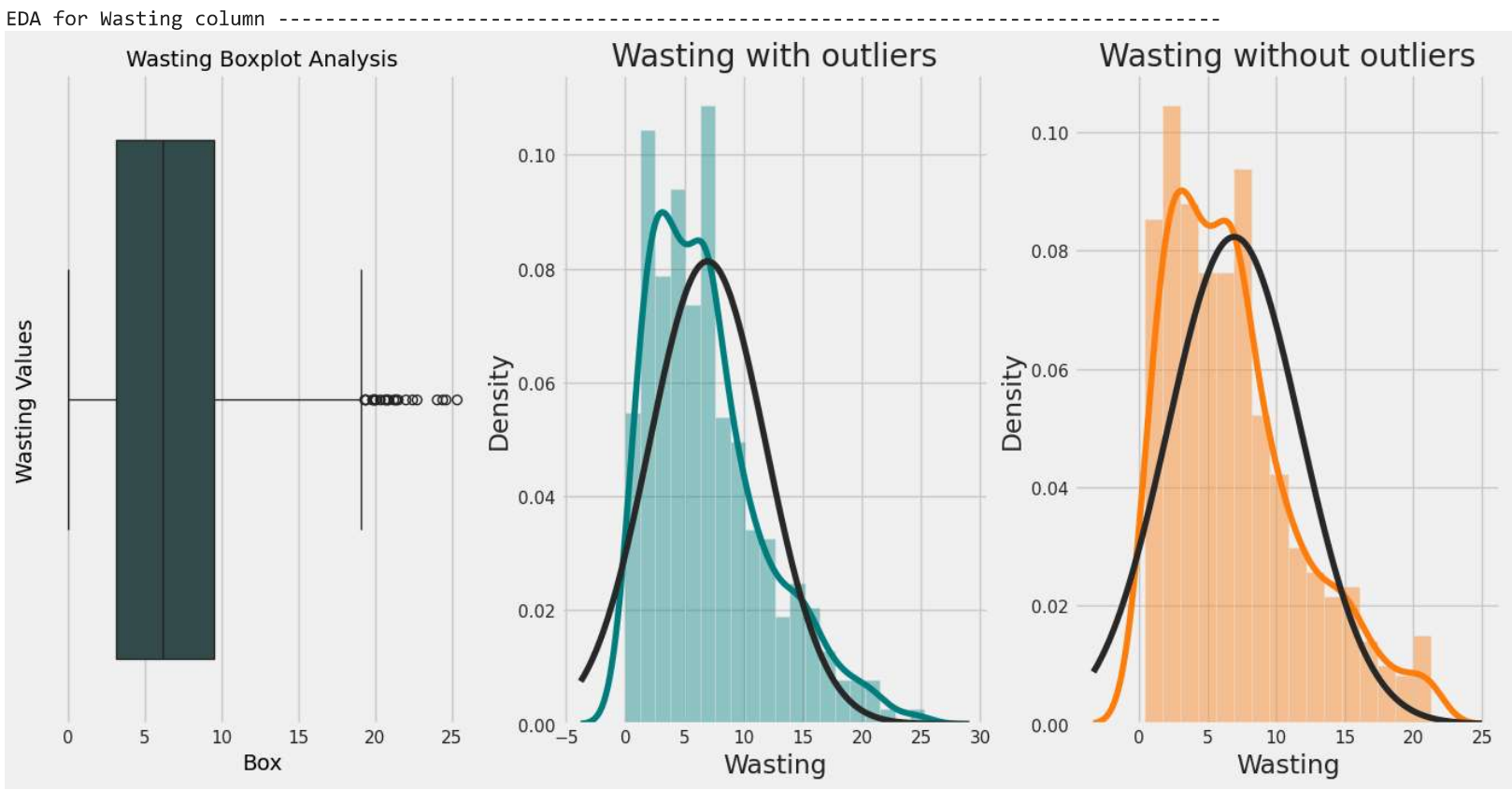
```
EDA for Severe wasting column ------------------------------------------------------------------------
```




```
Wasting column ---------------------------------------------------------------------------------------
no of records with outliers values: 24
```

	Country	Year	Income Classification	LDC	LIFD	LLDC or SID2	Survey Sample (N)	Severe Wasting	Wasting	Overweight	Stunting	Underweight	Populat ('00
48	BANGLADESH	1997	Lower Middle Income	1.00	1.00	Others	5,204	6.80	20.70	2.40	59.60	53.60	16160
105	BURKINA FASO	2003	Low Income	1.00	1.00	LLDC	9,290	9.70	21.20	5.40	43.10	35.20	2360
106	BURKINA FASO	2006	Low Income	1.00	1.00	LLDC	4,321	12.10	24.40	7.00	40.00	35.90	2564
209	DEMOCRATIC PEOPLE'S REP. OF KOREA (THE)	1998	Low Income	0.00	1.00	Others	1,263	2.19	20.80	6.43	63.90	55.50	2063
223	DJIBOUTI	2002	Lower Middle Income	1.00	1.00	Others	1,425	9.60	19.40	8.40	27.10	24.40	105

```
EDA for Wasting column -------------------------------------------------------------------------------
```

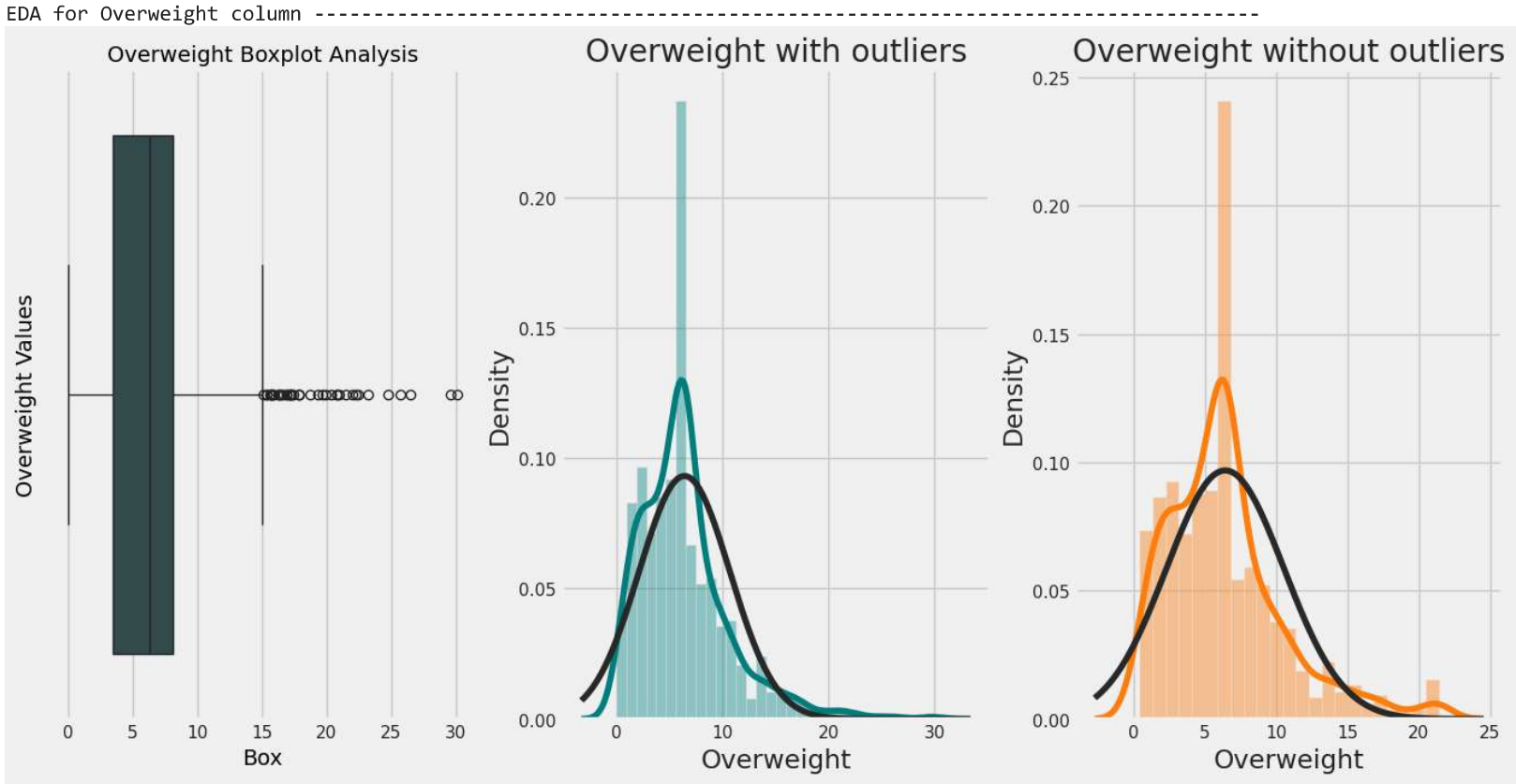



```
Overweight column ------------------------------------------------------------------------------------
no of records with outliers values: 43
```

	Country	Year	Income Classification	LDC	LIFD	LLDC or SID2	Survey Sample (N)	Severe Wasting	Wasting	Overweight	Stunting	Underweight	U5 Population ('000s)

5	ALBANIA	2000	Upper Middle Income	0.00	0.00	Others	1,382	6.20	12.20	30.10	39.20	17.00	279.83
6	ALBANIA	2005	Upper Middle Income	0.00	0.00	Others	1,090	3.70	7.30	24.80	26.70	6.60	219.41
7	ALBANIA	2009	Upper Middle Income	0.00	0.00	Others	1,489	5.90	9.60	23.20	23.20	6.30	179.31
8	ALBANIA	2017	Upper Middle Income	0.00	0.00	Others	2,367	0.50	1.60	16.40	11.30	1.50	176.52
13	ALGERIA	2002	Upper Middle Income	0.00	0.00	Others	4,357	5.00	9.60	15.10	24.00	11.10	2877.72

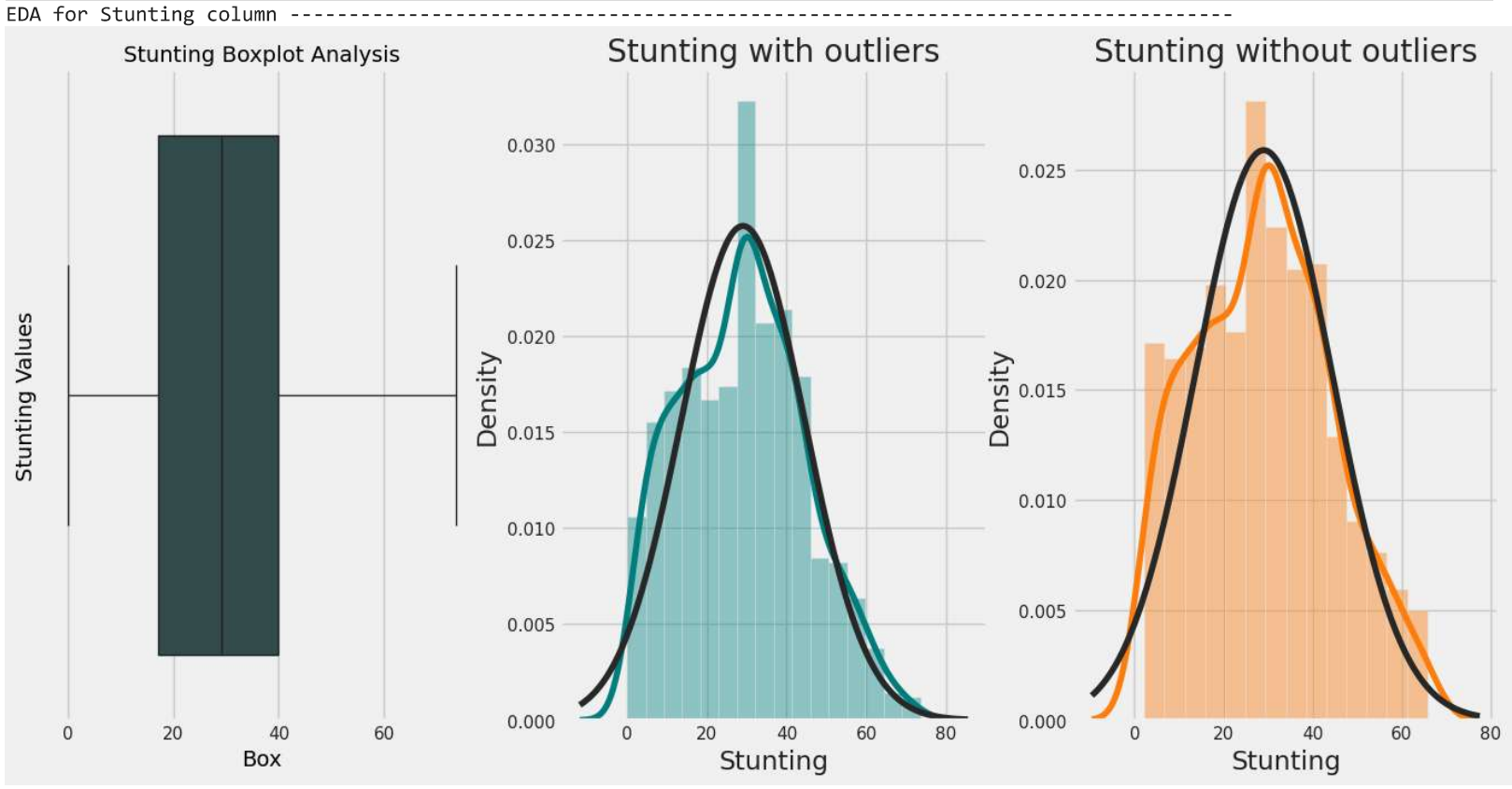
EDA for Overweight column ----------



Stunting column ----------
no of records with outliers values: 0

	Country	Year	Income Classification	LDC	LIFD	LLDC or SID2	Survey Sample (N)	Severe Wasting	Wasting	Overweight	Stunting	Underweight	U5 Population ('000s)

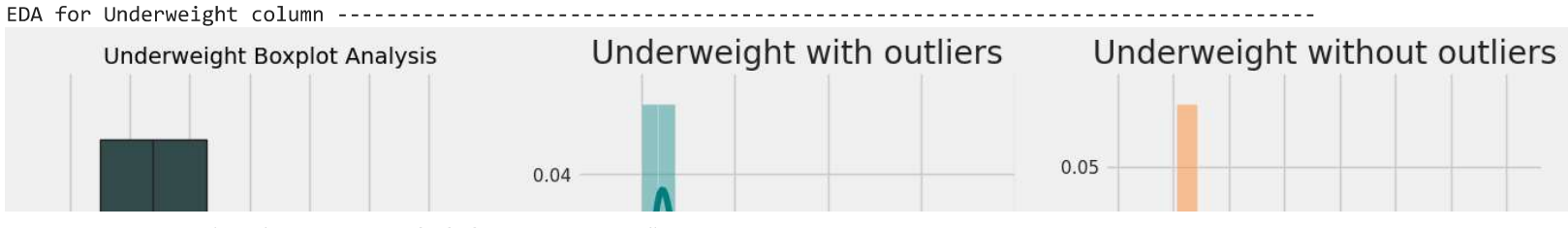
EDA for Stunting column ----------

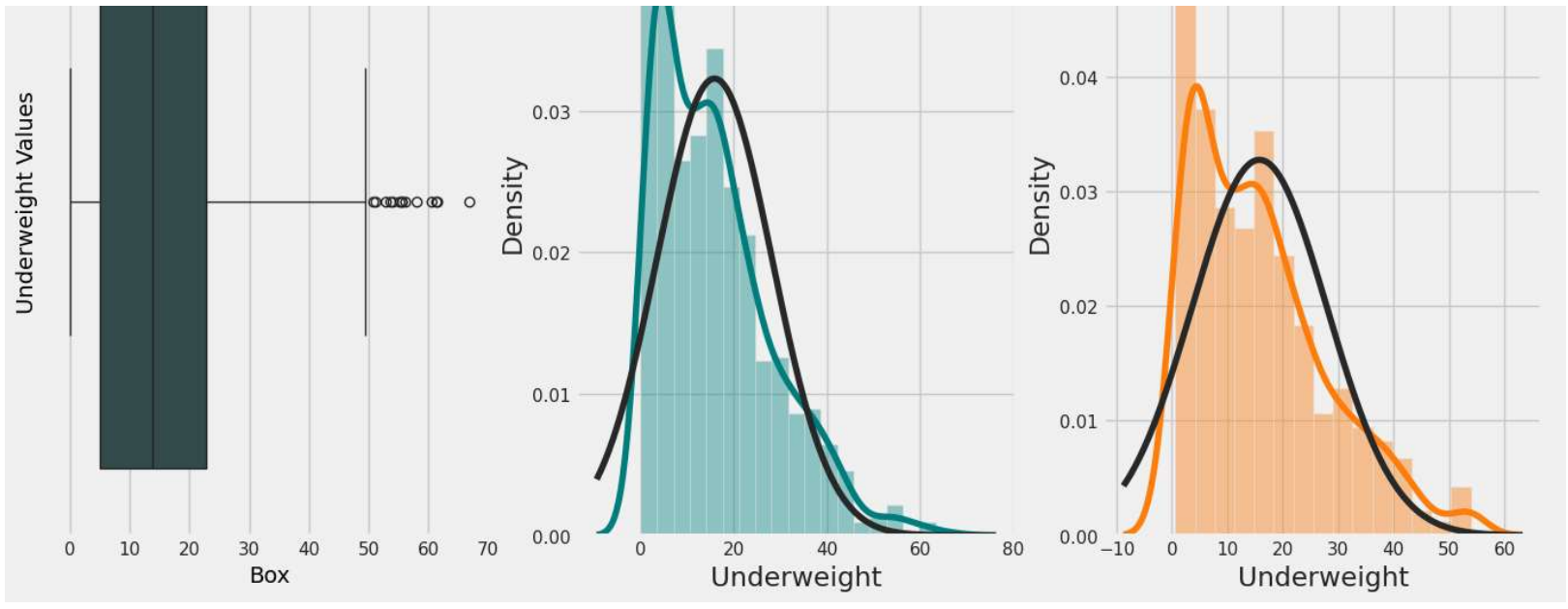


Underweight column ----------
no of records with outliers values: 14

	Country	Year	Income Classification	LDC	LIFD	LLDC or SID2	Survey Sample (N)	Severe Wasting	Wasting	Overweight	Stunting	Underweight	Populati ('000
40	BANGLADESH	1986	Lower Middle Income	1.00	1.00	Others	2,675	2.19	17.30	0.20	70.90	66.80	15384.(
41	BANGLADESH	1990	Lower Middle Income	1.00	1.00	Others	1,914	2.19	17.50	0.60	63.40	61.50	15889.5
42	BANGLADESH	1991	Lower Middle Income	1.00	1.00	Others	32,493	2.60	15.20	0.30	73.60	61.20	15998.5
43	BANGLADESH	1992	Lower Middle Income	1.00	1.00	Others	36,997	3.00	16.10	0.20	71.50	60.60	16042.(
44	BANGLADESH	1993	Lower Middle Income	1.00	1.00	Others	42,826	2.50	14.00	0.40	69.20	56.10	16047.(

EDA for Underweight column ----------

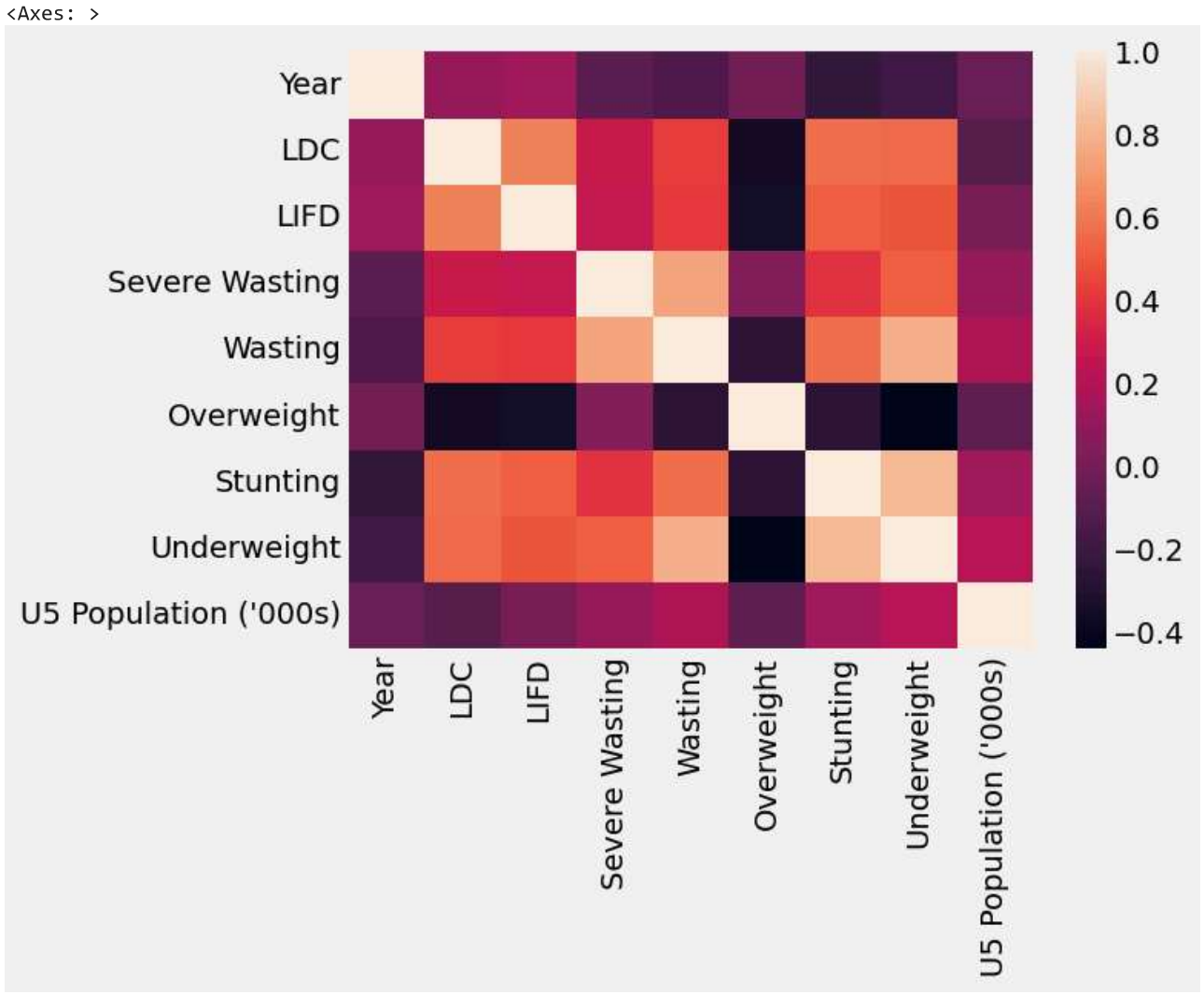




HEAT MAP

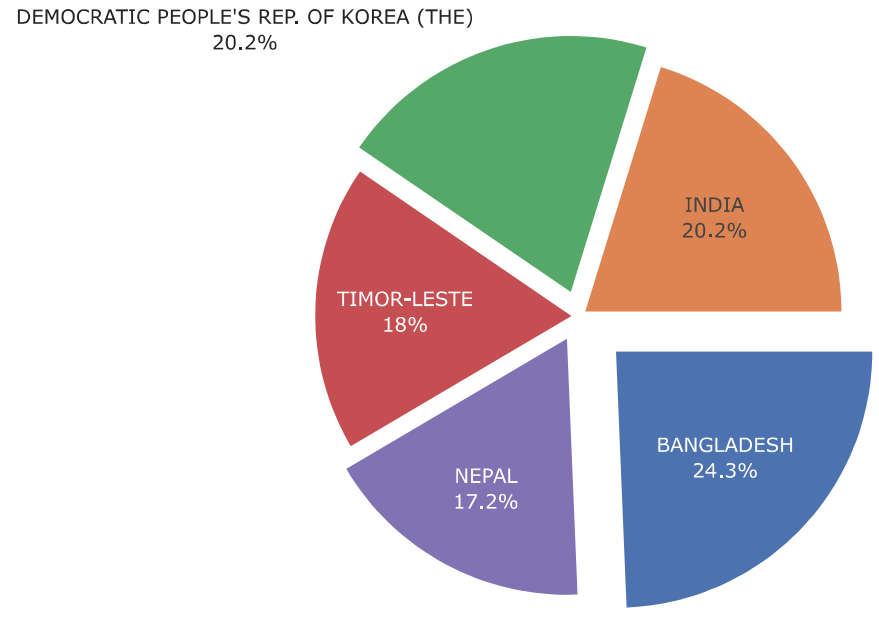
```
sns.heatmap(data.corr(numeric_only=True))
```

```
<Axes: >
```



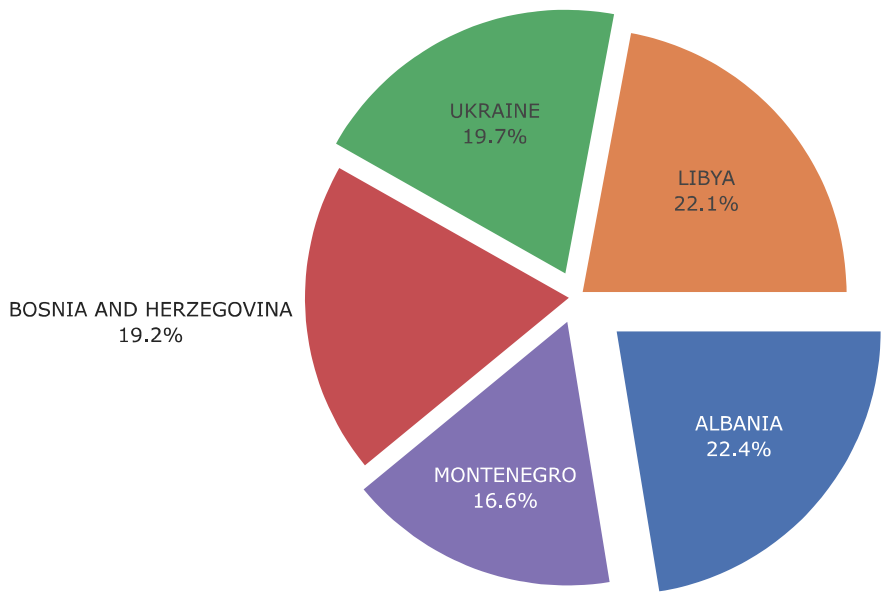
Which country shows highest Underweight percentage? ---> Bangladesh

```
country = data.loc[:,['Country','Underweight']]
country['percunder'] = country.groupby('Country')['Underweight'].transform('max')
country = country.drop('Underweight',axis=1).drop_duplicates().sort_values('percunder', ascending=False).head()

fig = px.pie(country, names='Country', values='percunder', template='seaborn')
fig.update_traces(rotation=90, pull=[0.2,0.03,0.1,0.03,0.1], textinfo="percent+label", showlegend=False)
fig.show()
```



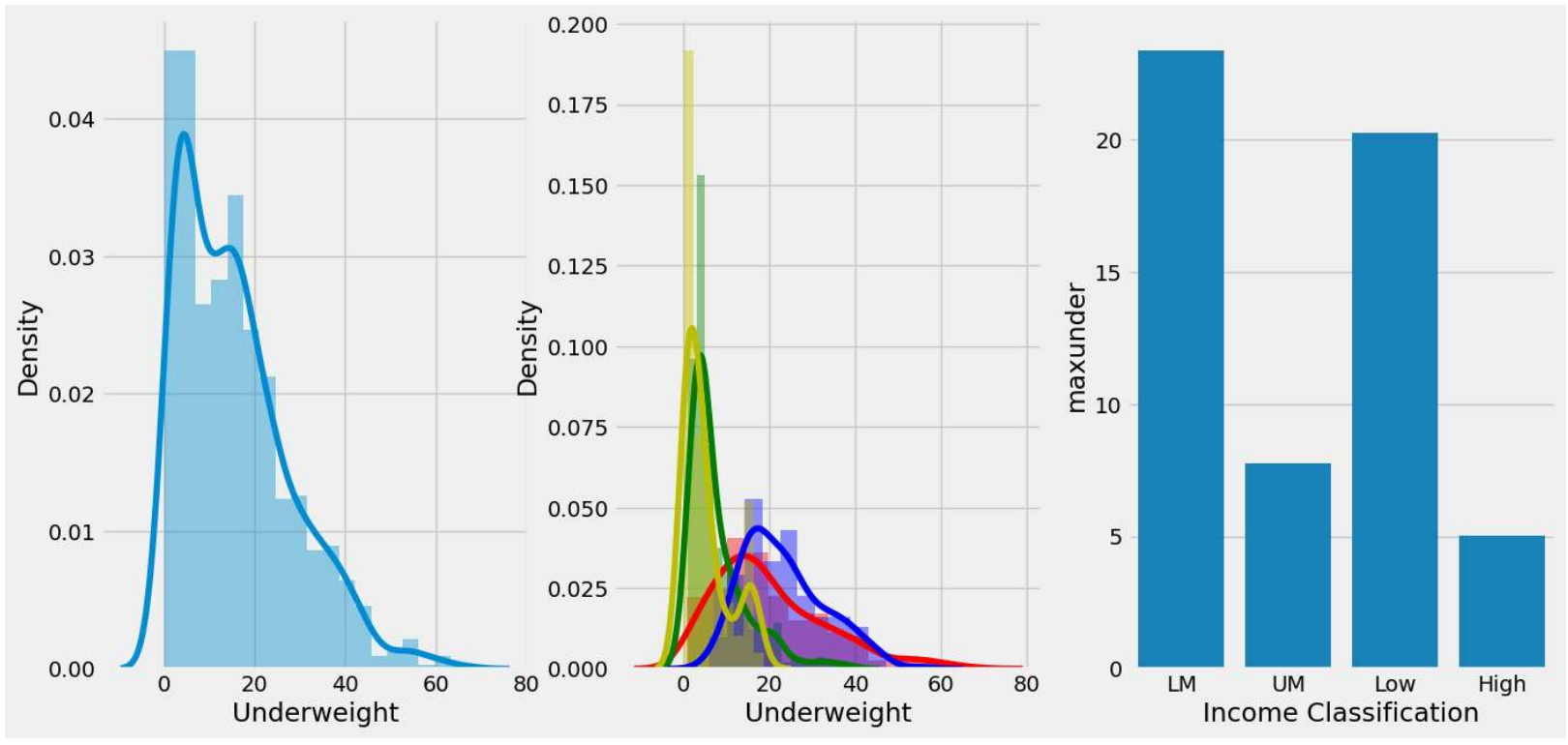
Which country shows highest Overweight percentage? ---> Albania

```
country = data.loc[:,['Country','Overweight']]
country['percunder'] = country.groupby('Country')['Overweight'].transform('max')
country = country.drop('Overweight',axis=1).drop_duplicates().sort_values('percunder', ascending=False).head()

fig = px.pie(country, names='Country', values='percunder', template='seaborn')
fig.update_traces(rotation=90, pull=[0.2,0.03,0.1,0.03,0.1], textinfo="percent+label", showlegend=False)
fig.show()
```

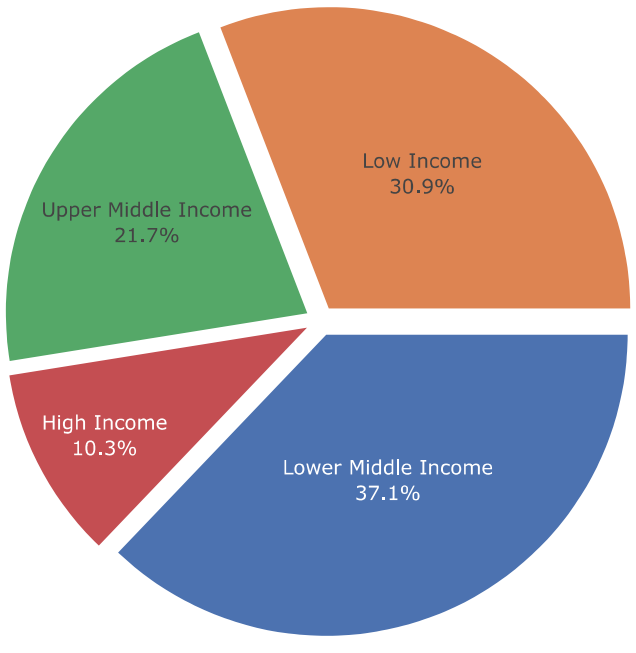


Which income class have highest underweight percentage? ---> Lower Middle Income

```
f,(ax1, ax2, ax3) = plt.subplots(1, 3, figsize = (15, 7.2))
sns.distplot(data['Underweight'], ax=ax1)

df_LM = data.loc[data['Income Classification'] == 'Lower Middle Income']
df_UM = data.loc[data['Income Classification'] == 'Upper Middle Income']
df_Low = data.loc[data['Income Classification'] == 'Low Income']
df_High = data.loc[data['Income Classification'] == 'High Income']

sns.distplot( df_LM['Underweight'],ax = ax2 , color = 'r')
sns.distplot( df_UM['Underweight'],ax = ax2, color = 'g')
sns.distplot( df_Low['Underweight'],ax = ax2, color = 'b')
sns.distplot( df_High['Underweight'],ax = ax2, color = 'y')

df = data.loc[:,['Income Classification','Underweight']]
df['maxunder'] = df.groupby('Income Classification')['Underweight'].transform('mean')
df = df.drop('Underweight', axis=1).drop_duplicates()
df = data.loc[:,['Income Classification','Underweight']]
df['maxunder'] = df.groupby('Income Classification')['Underweight'].transform('mean')
df = df.drop('Underweight', axis=1).drop_duplicates()

fig = sns.barplot(data=df, x='Income Classification', y='maxunder')
fig.set(xticklabels = ['LM', 'UM', 'Low', "High"])
plt.show()
```

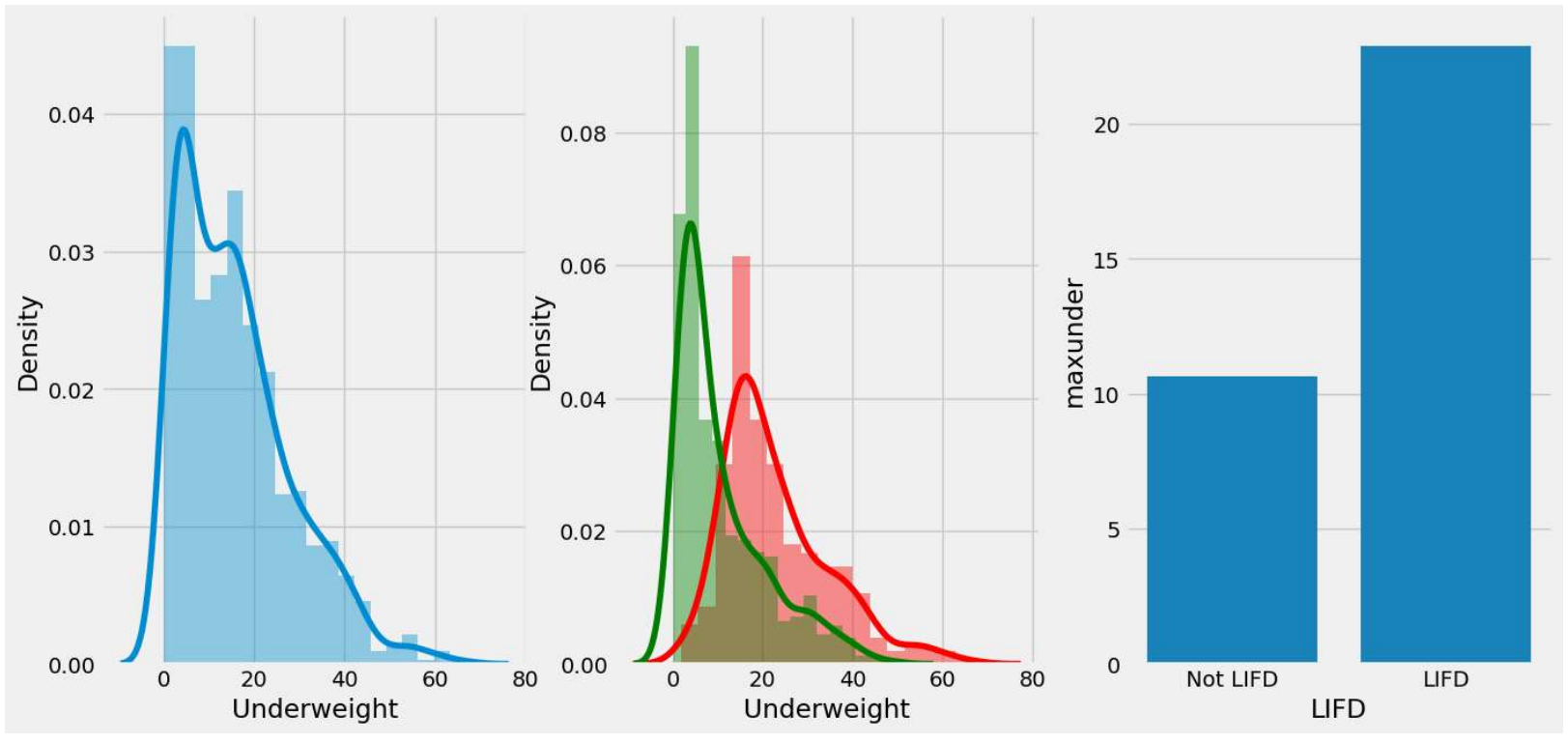



```
df = data.loc[:,['Income Classification','Underweight']]
df['maxunder'] = df.groupby('Income Classification')['Underweight'].transform('max')
df = df.drop('Underweight', axis=1).drop_duplicates()

fig = px.pie(df, names='Income Classification', values='maxunder', template='seaborn')
fig.update_traces(rotation=90, pull=0.05, textinfo="percent+label", showlegend=False)
fig.show()
```



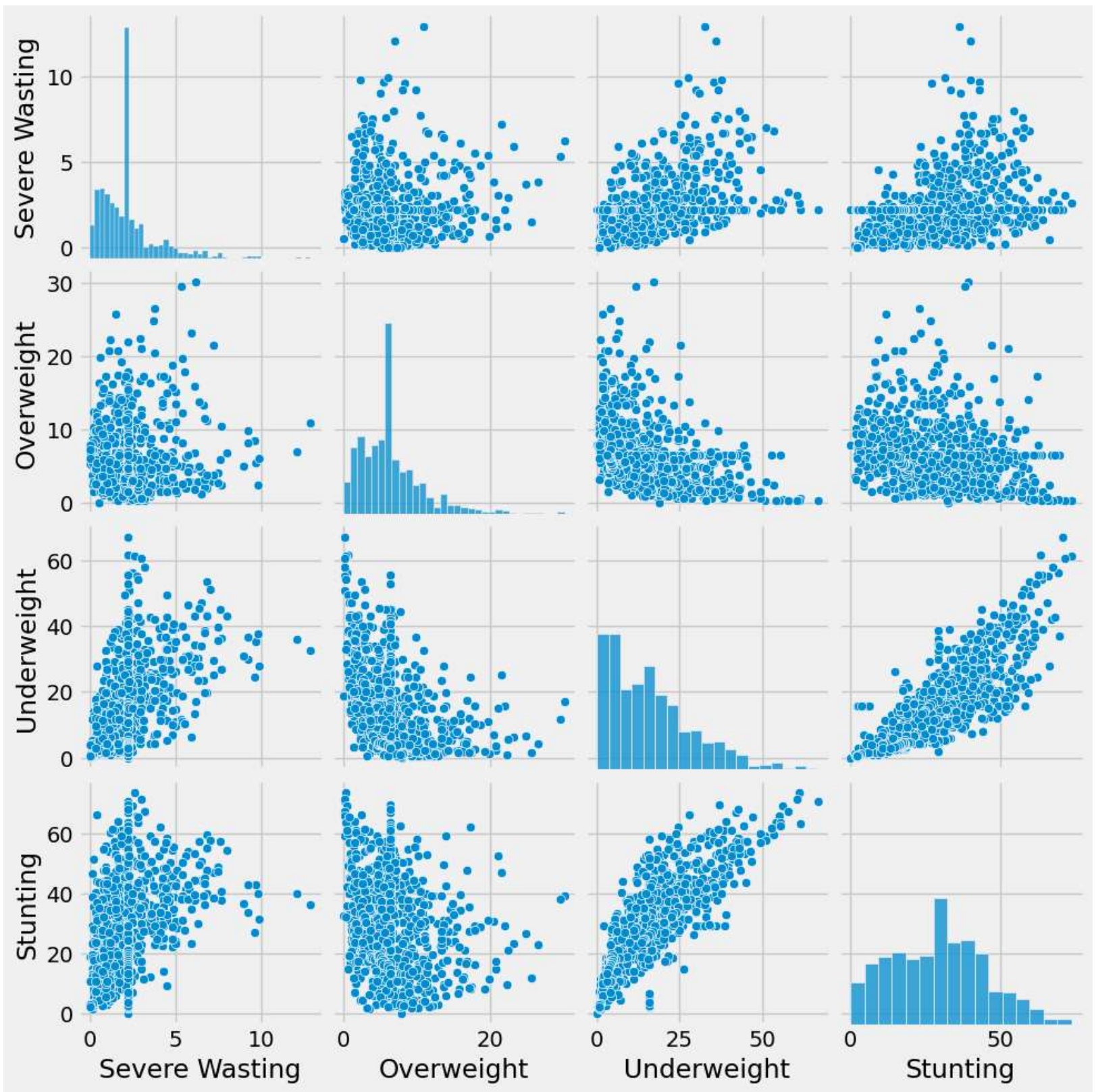
Low Income Food Deficient Countries Underweight percentages

```
f,(ax1, ax2, ax3) = plt.subplots(1, 3, figsize = (15, 7.2))
df_with_LIFD = data.loc[data['LIFD'] == 1]
df_with_NLIFD = data.loc[data['LIFD'] == 0]

sns.distplot(data['Underweight'], ax=ax1)
sns.distplot( df_with_LIFD['Underweight'],ax = ax2 , color = 'r')
sns.distplot( df_with_NLIFD['Underweight'],ax = ax2, color = 'g')

df = data.loc[:,['LIFD','Underweight']]
df['maxunder'] = df.groupby('LIFD')['Underweight'].transform('mean')
df = df.drop('Underweight', axis=1).drop_duplicates()
df = data.loc[:,['LIFD','Underweight']]
df['maxunder'] = df.groupby('LIFD')['Underweight'].transform('mean')
df = df.drop('Underweight', axis=1).drop_duplicates()

fig = sns.barplot(data=df, x='LIFD', y='maxunder')
fig.set(xticklabels = ['Not LIFD', 'LIFD'])
plt.show()
```



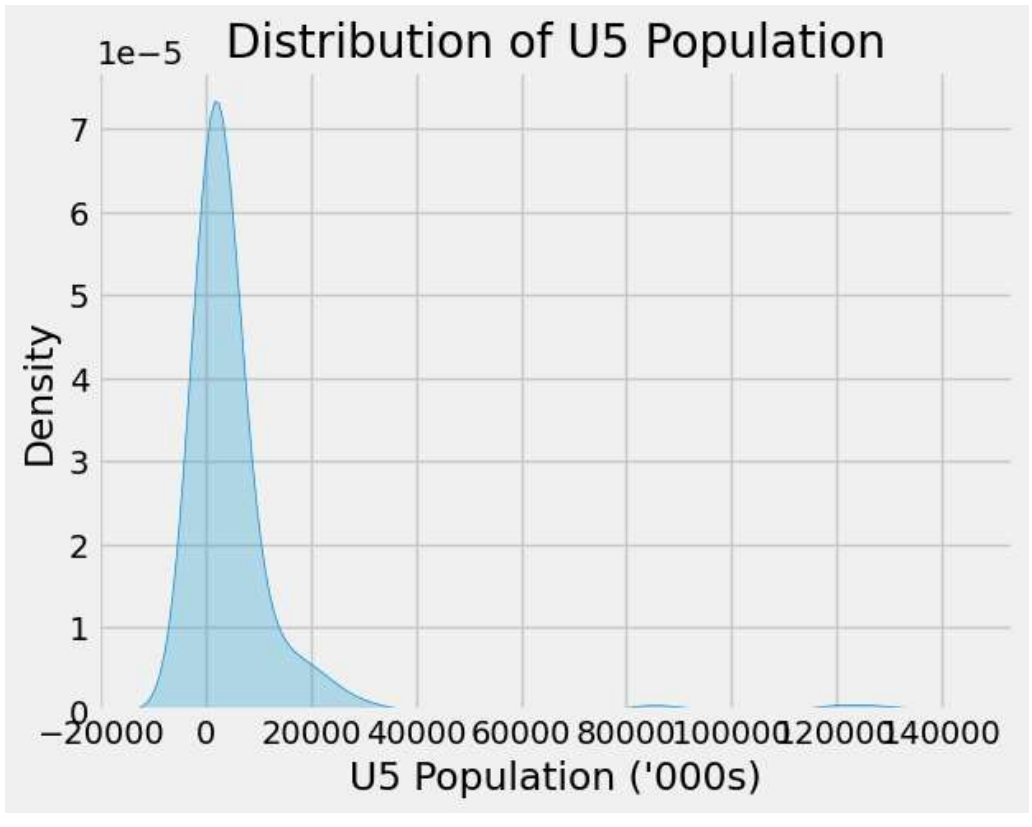
Severe Wasting - Wasting - Overweight - Underweight

```
sns.pairplot(data[['Severe Wasting','Overweight','Underweight', 'Stunting']])
plt.show()
```



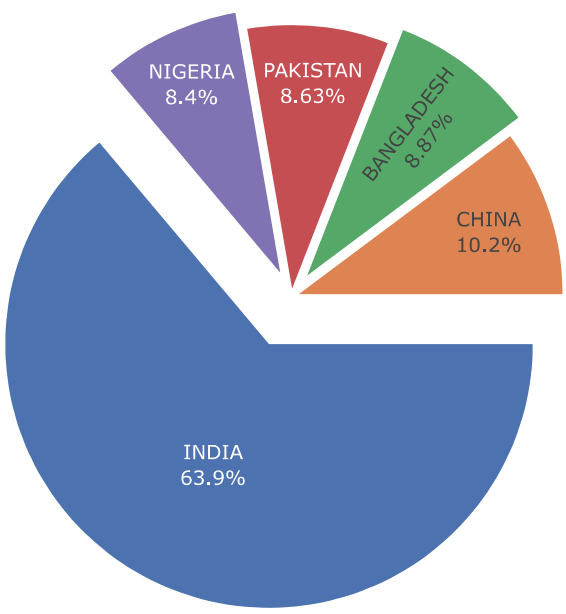
U5 Populatio of that country under the age of 5

```
sns.kdeplot(data=data['U5 Population (\'000s)'], shade=True)
plt.title('Distribution of U5 Population')
plt.show()
```



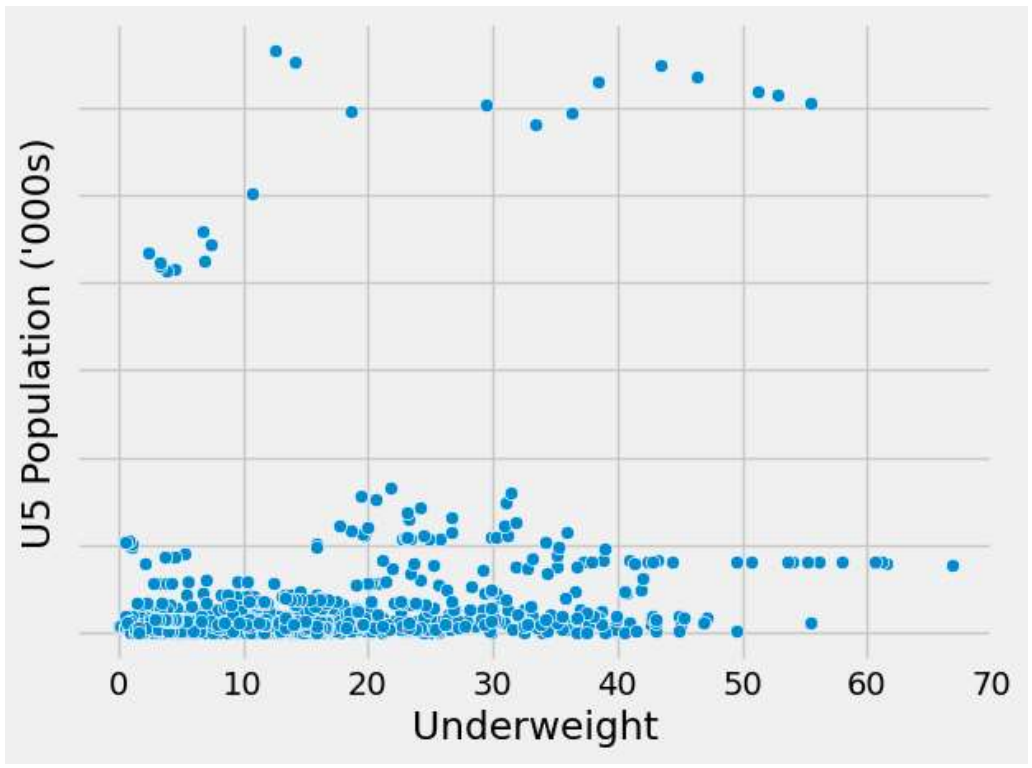
Which country shows highest underweight count? ---> India

```
df = data.loc[:,['Country','Underweight','U5 Population (\'000s)']]
df['underweight_count'] = (df['U5 Population (\'000s)'] * df['Underweight'])/100
df.drop(['Underweight','U5 Population (\'000s)'], axis=1, inplace=True)
df['undermean'] = df.groupby('Country')['underweight_count'].transform('mean')
df = df.drop('underweight_count', axis=1).drop_duplicates().sort_values('undermean', ascending=False).head()

fig = px.pie(df, names='Country', values='undermean', template='seaborn')
fig.update_traces(rotation=90, pull=[0.2,0.03,0.1,0.03,0.1], textinfo="percent+label", showlegend=False)
fig.show()
```



Relation of Underweight % to U5 population

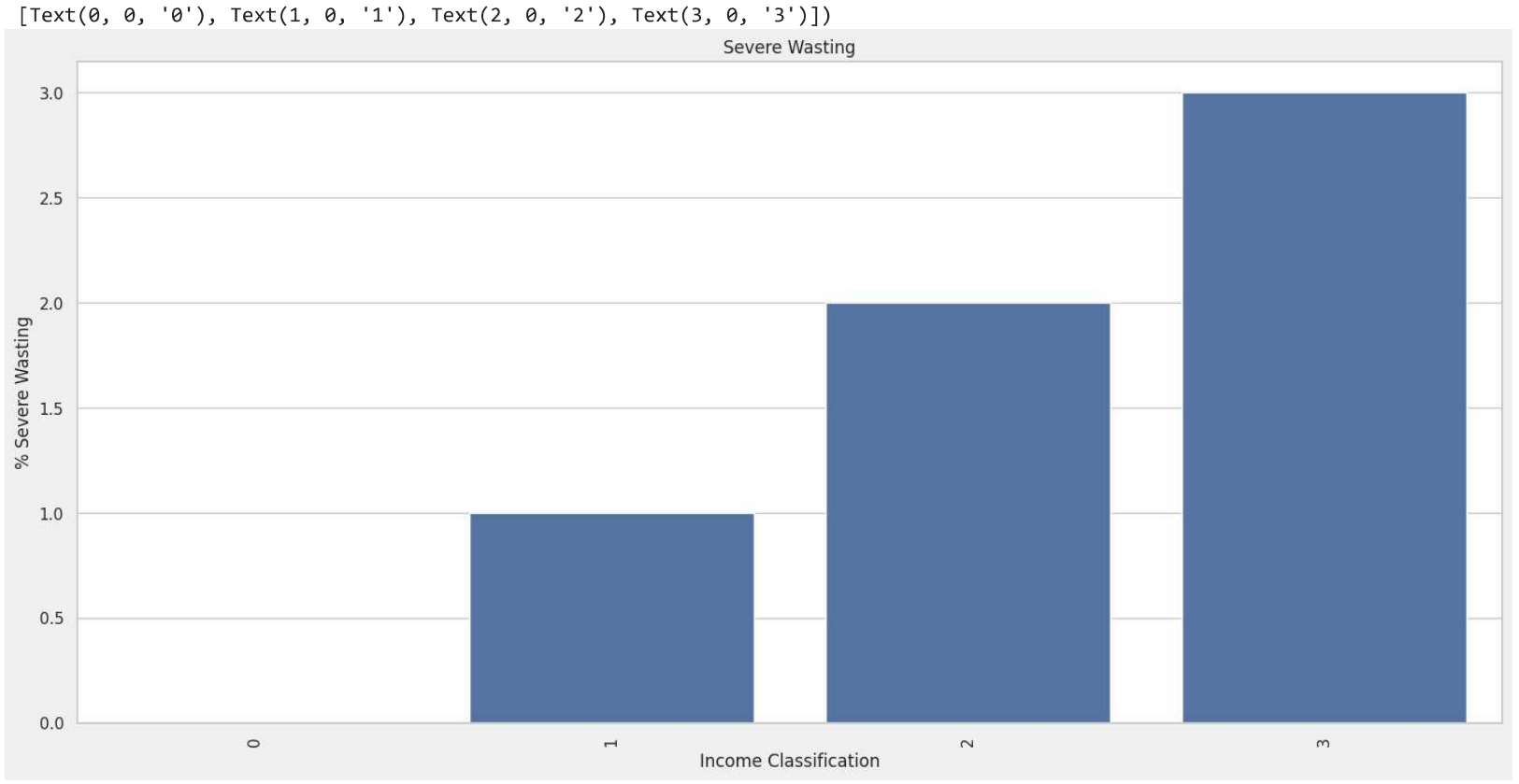
```
fig = sns.scatterplot(data=data, x='Underweight', y='U5 Population (\'000s)')
fig.set(yticklabels=[])
plt.show()
```




```
df_country = pd.read_csv("/content/country-wise-average.csv")
df_world = pd.read_csv("/content/country-wise-average.csv")
df_region = pd.read_csv("/content/country-wise-average.csv")
```

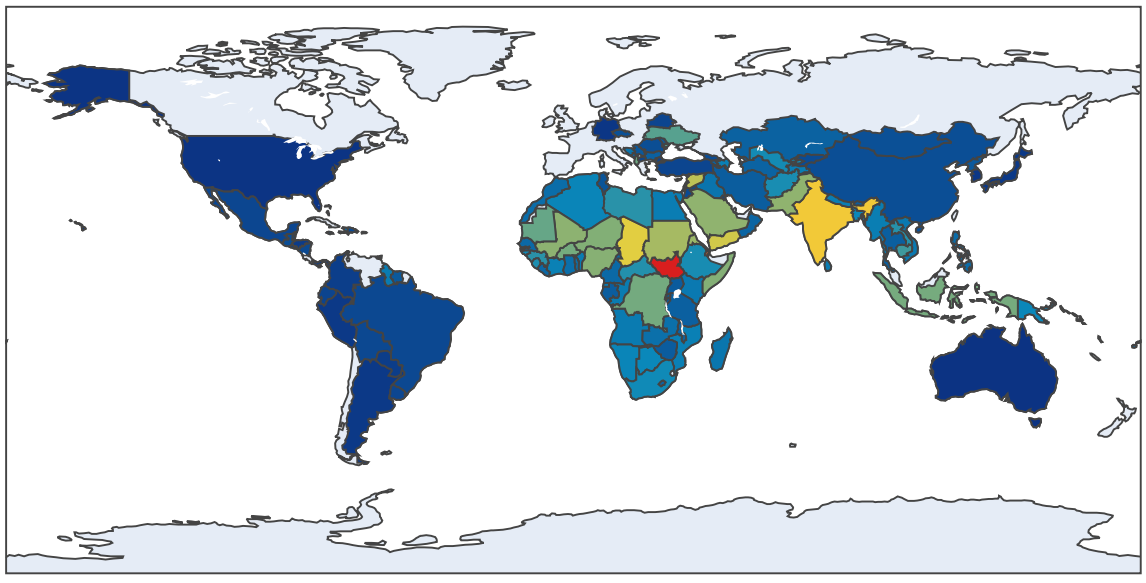
```
plt.figure(figsize=(16, 8))
x = df_country.groupby(["Income Classification"])["Severe Wasting"].mean()
sns.set(style="whitegrid")
ax = sns.barplot(x.index)
ax.set_title('Severe Wasting')
ax.set_ylabel('% Severe Wasting')
ax.set_xlabel('Income Classification')
plt.xticks(rotation = 90)
```

```
([0, 1, 2, 3],
 [Text(0, 0, '0'), Text(1, 0, '1'), Text(2, 0, '2'), Text(3, 0, '3')])
```




```
#Plotting on the WorldMap using plotly
import plotly.graph_objs as go
x = df_country.groupby(["Country"])["Severe Wasting"].mean()
data = dict(type = 'choropleth',
            locations = x.index,
            locationmode = 'country names',
            colorscale= 'Portland',
            text= x.index,
            z=x,
            colorbar = {'title':'Severe Wasting %', 'len':200,'lenmode':'pixels' })
layout = dict(geo = {'scope':'world'},title="Severe Wasting % around the world")
col_map = go.Figure(data = [data],layout = layout)
col_map.show()
```

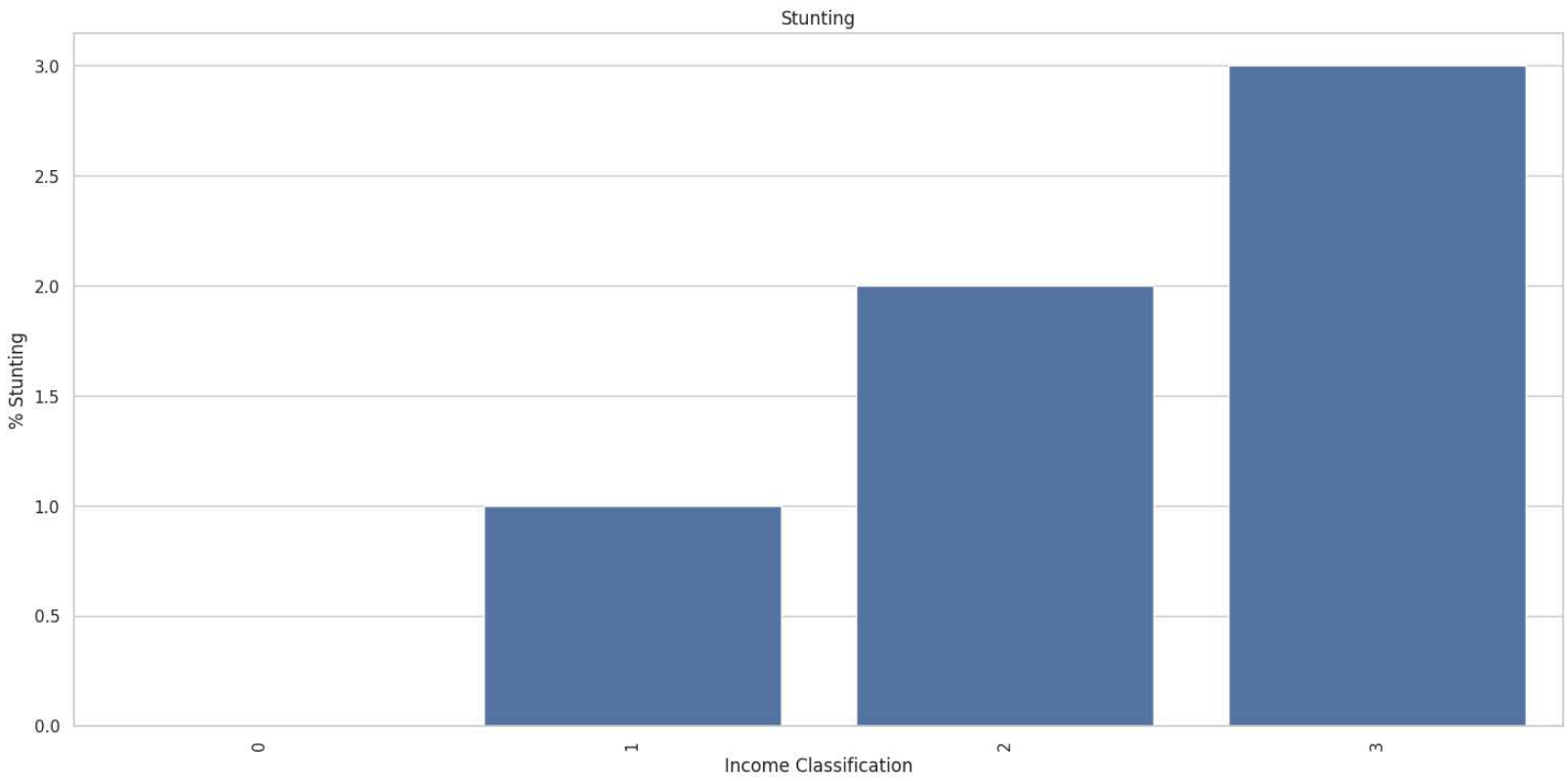
Severe Wasting % around the world



STUNTING

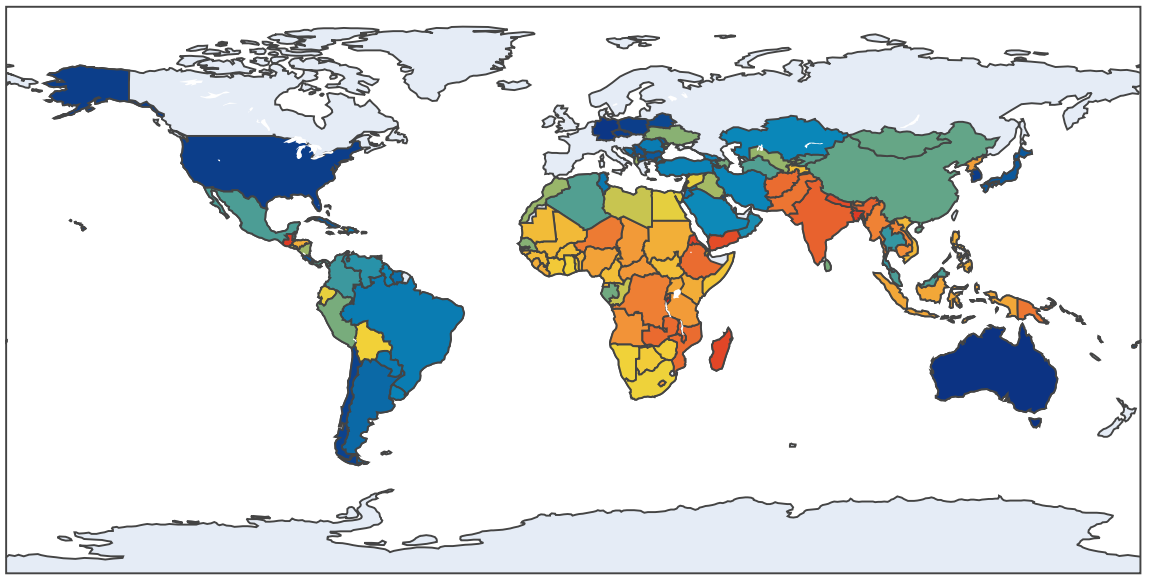
```
plt.figure(figsize=(16, 8))
x = df_country.groupby(["Income Classification"])["Stunting"].mean()
sns.set(style="whitegrid")
ax = sns.barplot(x.index)
ax.set_title('Stunting')
ax.set_ylabel('% Stunting')
ax.set_xlabel('Income Classification')
plt.xticks(rotation = 90)
```

```
([0, 1, 2, 3],
 [Text(0, 0, '0'), Text(1, 0, '1'), Text(2, 0, '2'), Text(3, 0, '3')])
```




```
#Plotting on the WorldMap using plotly
x = df_country.groupby(["Country"])["Stunting"].mean()
data = dict(type = 'choropleth',
            locations = x.index,
            locationmode = 'country names',
            colorscale= 'Portland',
            text= x.index,
            z=x,
            colorbar = {'title':'stunting %', 'len':200,'lenmode':'pixels' })
layout = dict(geo = {'scope':'world'},title="stunting % around the world")
col_map = go.Figure(data = [data],layout = layout)
col_map.show()
```

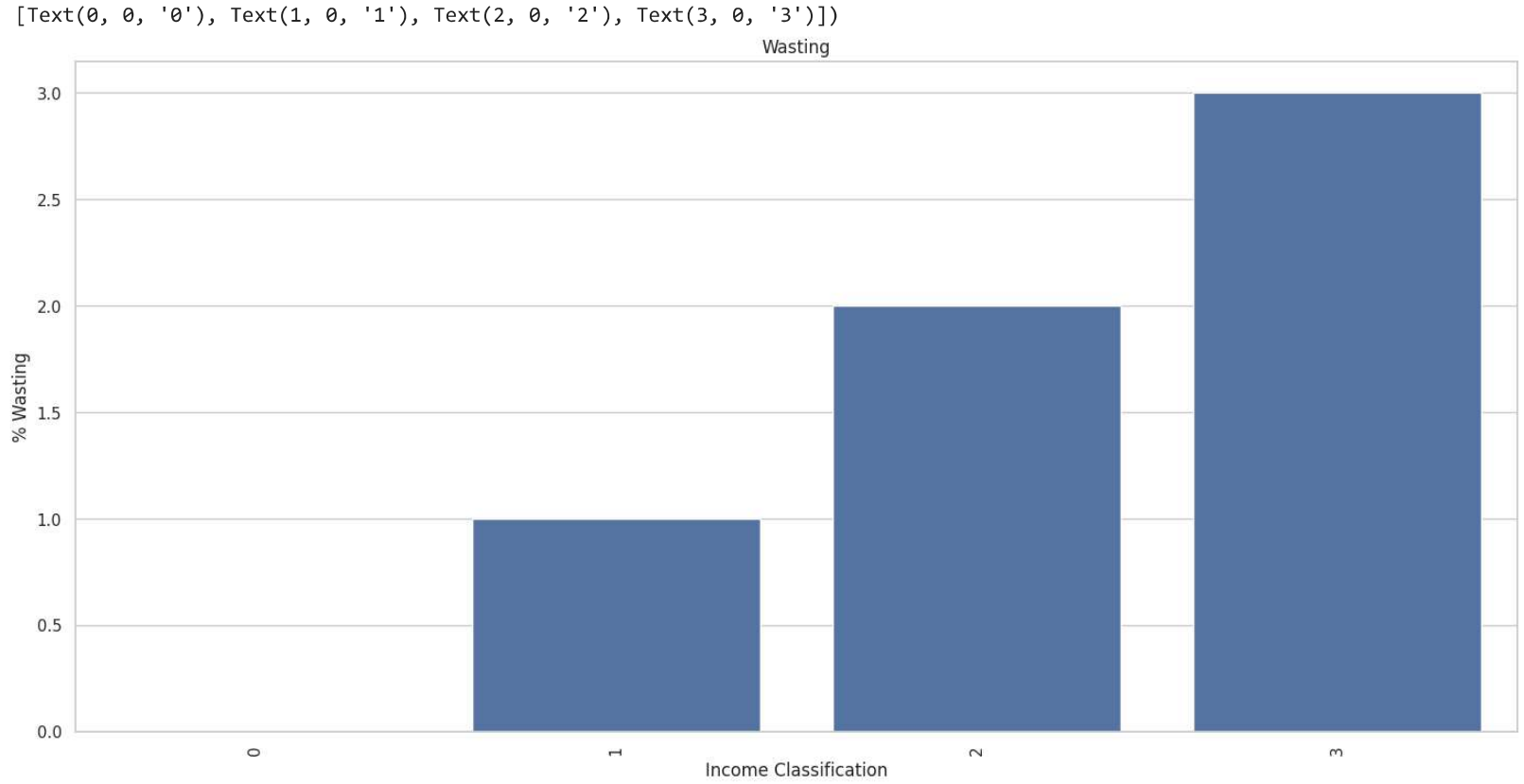
stunting % around the world



WASTING

```
plt.figure(figsize=(16, 8))
x = df_country.groupby(["Income Classification"])["Wasting"].mean()
sns.set(style="whitegrid")
ax = sns.barplot(x.index)
ax.set_title('Wasting')
ax.set_ylabel('% Wasting')
ax.set_xlabel('Income Classification')
plt.xticks(rotation = 90)
```

```
([0, 1, 2, 3],
 [Text(0, 0, '0'), Text(1, 0, '1'), Text(2, 0, '2'), Text(3, 0, '3')])
```




```
#Plotting on the WorldMap using plotly
x = df_country.groupby(["Country"])["Wasting"].mean()
data = dict(type = 'choropleth',
            locations = x.index,
            locationmode = 'country names',
            colorscale= 'Portland',
            text= x.index,
            z=x,
            colorbar = {'title':'Wasting %', 'len':200,'lenmode':'pixels' })
layout = dict(geo = {'scope':'world'},title="Wasting % around the world")
col_map = go.Figure(data = [data],layout = layout)
col_map.show()
```