PROJECT : Calories Burnt Prediction

Import required libraries

In [126…
```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.model_selection import GridSearchCV
df=pd.read_csv('/content/calories.csv')
df
```

Out[126…

	User_ID	Calories
0	14733363	231.0
1	14861698	66.0
2	11179863	26.0
3	16180408	71.0
4	17771927	35.0
…	…	…
14995	15644082	45.0
14996	17212577	23.0
14997	17271188	75.0
14998	18643037	11.0
14999	11751526	98.0

15000 rows × 2 columns

In [127…
```
df1=pd.read_csv('/content/exercise.csv')
df1
```

Out[127…

	User_ID	Gender	Age	Height	Weight	Duration	Heart_Rate	Body_Temp
0	14733363	male	68	190.0	94.0	29.0	105.0	40.8
1	14861698	female	20	166.0	60.0	14.0	94.0	40.3
2	11179863	male	69	179.0	79.0	5.0	88.0	38.7
3	16180408	female	34	179.0	71.0	13.0	100.0	40.5
4	17771927	female	27	154.0	58.0	10.0	81.0	39.8
…	…	…	…	…	…	…	…	…
14995	15644082	female	20	193.0	86.0	11.0	92.0	40.4
14996	17212577	female	27	165.0	65.0	6.0	85.0	39.2
14997	17271188	female	43	159.0	58.0	16.0	90.0	40.1
14998	18643037	male	78	193.0	97.0	2.0	84.0	38.3
14999	11751526	male	63	173.0	79.0	18.0	92.0	40.5

15000 rows × 8 columns

Concatination two tables

In [128…
```
cal=pd.concat([df,df1],axis=1)
cal
```

Out[128...

	User_ID	Calories	User_ID	Gender	Age	Height	Weight	Duration	Heart_Rate	Body_Temp
0	14733363	231.0	14733363	male	68	190.0	94.0	29.0	105.0	40.8
1	14861698	66.0	14861698	female	20	166.0	60.0	14.0	94.0	40.3
2	11179863	26.0	11179863	male	69	179.0	79.0	5.0	88.0	38.7
3	16180408	71.0	16180408	female	34	179.0	71.0	13.0	100.0	40.5
4	17771927	35.0	17771927	female	27	154.0	58.0	10.0	81.0	39.8
...	...	...	...	...	...	...	...	...	...	...
14995	15644082	45.0	15644082	female	20	193.0	86.0	11.0	92.0	40.4
14996	17212577	23.0	17212577	female	27	165.0	65.0	6.0	85.0	39.2
14997	17271188	75.0	17271188	female	43	159.0	58.0	16.0	90.0	40.1
14998	18643037	11.0	18643037	male	78	193.0	97.0	2.0	84.0	38.3
14999	11751526	98.0	11751526	male	63	173.0	79.0	18.0	92.0	40.5

15000 rows × 10 columns

In [129...
```
cal.head()
```

Out[129...

	User_ID	Calories	User_ID	Gender	Age	Height	Weight	Duration	Heart_Rate	Body_Temp
0	14733363	231.0	14733363	male	68	190.0	94.0	29.0	105.0	40.8
1	14861698	66.0	14861698	female	20	166.0	60.0	14.0	94.0	40.3
2	11179863	26.0	11179863	male	69	179.0	79.0	5.0	88.0	38.7
3	16180408	71.0	16180408	female	34	179.0	71.0	13.0	100.0	40.5
4	17771927	35.0	17771927	female	27	154.0	58.0	10.0	81.0	39.8

In [130...
```
cal.tail()
```

Out[130...

	User_ID	Calories	User_ID	Gender	Age	Height	Weight	Duration	Heart_Rate	Body_Temp
14995	15644082	45.0	15644082	female	20	193.0	86.0	11.0	92.0	40.4
14996	17212577	23.0	17212577	female	27	165.0	65.0	6.0	85.0	39.2
14997	17271188	75.0	17271188	female	43	159.0	58.0	16.0	90.0	40.1
14998	18643037	11.0	18643037	male	78	193.0	97.0	2.0	84.0	38.3
14999	11751526	98.0	11751526	male	63	173.0	79.0	18.0	92.0	40.5

Statistical measures of the dataset

In [131...
```
cal.describe()
```

Out[131...

	User_ID	Calories	User_ID	Age	Height	Weight	Duration	Heart_Rate	Body_Tem
count	1.500000e+04	15000.000000	1.500000e+04	15000.000000	15000.000000	15000.000000	15000.000000	15000.000000	15000.00000
mean	1.497736e+07	89.539533	1.497736e+07	42.789800	174.465133	74.966867	15.530600	95.518533	40.02545
std	2.872851e+06	62.456978	2.872851e+06	16.980264	14.258114	15.035657	8.319203	9.583328	0.77923
min	1.000116e+07	1.000000	1.000116e+07	20.000000	123.000000	36.000000	1.000000	67.000000	37.10000
25%	1.247419e+07	35.000000	1.247419e+07	28.000000	164.000000	63.000000	8.000000	88.000000	39.60000
50%	1.499728e+07	79.000000	1.499728e+07	39.000000	175.000000	74.000000	16.000000	96.000000	40.20000
75%	1.744928e+07	138.000000	1.744928e+07	56.000000	185.000000	87.000000	23.000000	103.000000	40.60000
max	1.999965e+07	314.000000	1.999965e+07	79.000000	222.000000	132.000000	30.000000	128.000000	41.50000

In [132...
```
cal.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 15000 entries, 0 to 14999
Data columns (total 10 columns):
 #   Column      Non-Null Count  Dtype  
---  ------      --------------  -----  
 0   User_ID     15000 non-null  int64  
 1   Calories    15000 non-null  float64
 2   User_ID     15000 non-null  int64  
 3   Gender      15000 non-null  object 
 4   Age         15000 non-null  int64  
 5   Height      15000 non-null  float64
 6   Weight      15000 non-null  float64
 7   Duration    15000 non-null  float64
 8   Heart_Rate  15000 non-null  float64
 9   Body_Temp   15000 non-null  float64
dtypes: float64(6), int64(3), object(1)
memory usage: 1.1+ MB
```

Checking missing values

In [133…
```
cal.isna().sum()
```

Out[133…
```
User_ID       0
Calories      0
User_ID       0
Gender        0
Age           0
Height        0
Weight        0
Duration      0
Heart_Rate    0
Body_Temp     0
dtype: int64
```

In [134…
```
cal.dtypes
```

Out[134…
```
User_ID         int64
Calories      float64
User_ID         int64
Gender         object
Age             int64
Height        float64
Weight        float64
Duration      float64
Heart_Rate    float64
Body_Temp     float64
dtype: object
```

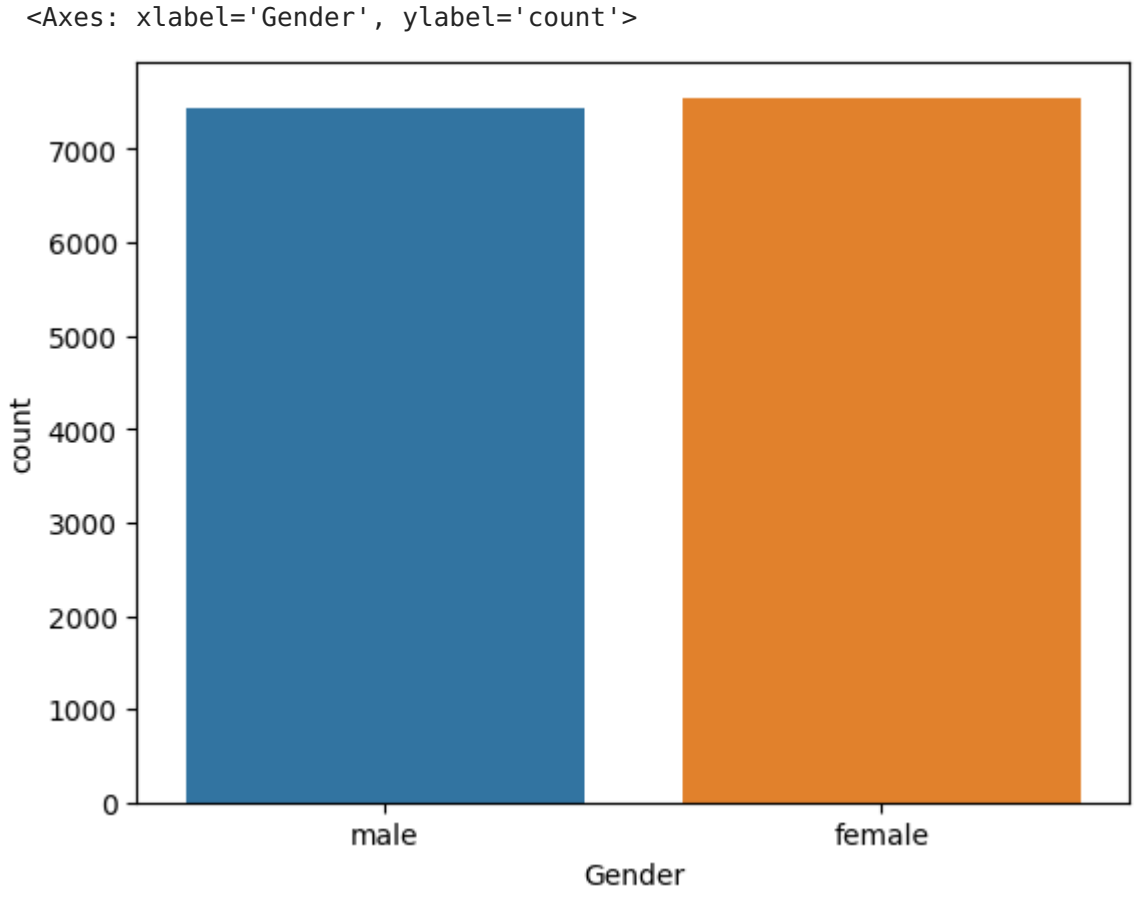
Find value counts and visual representation

In [135…
```
cal['Gender'].value_counts()
```

Out[135…
```
female    7553
male      7447
Name: Gender, dtype: int64
```

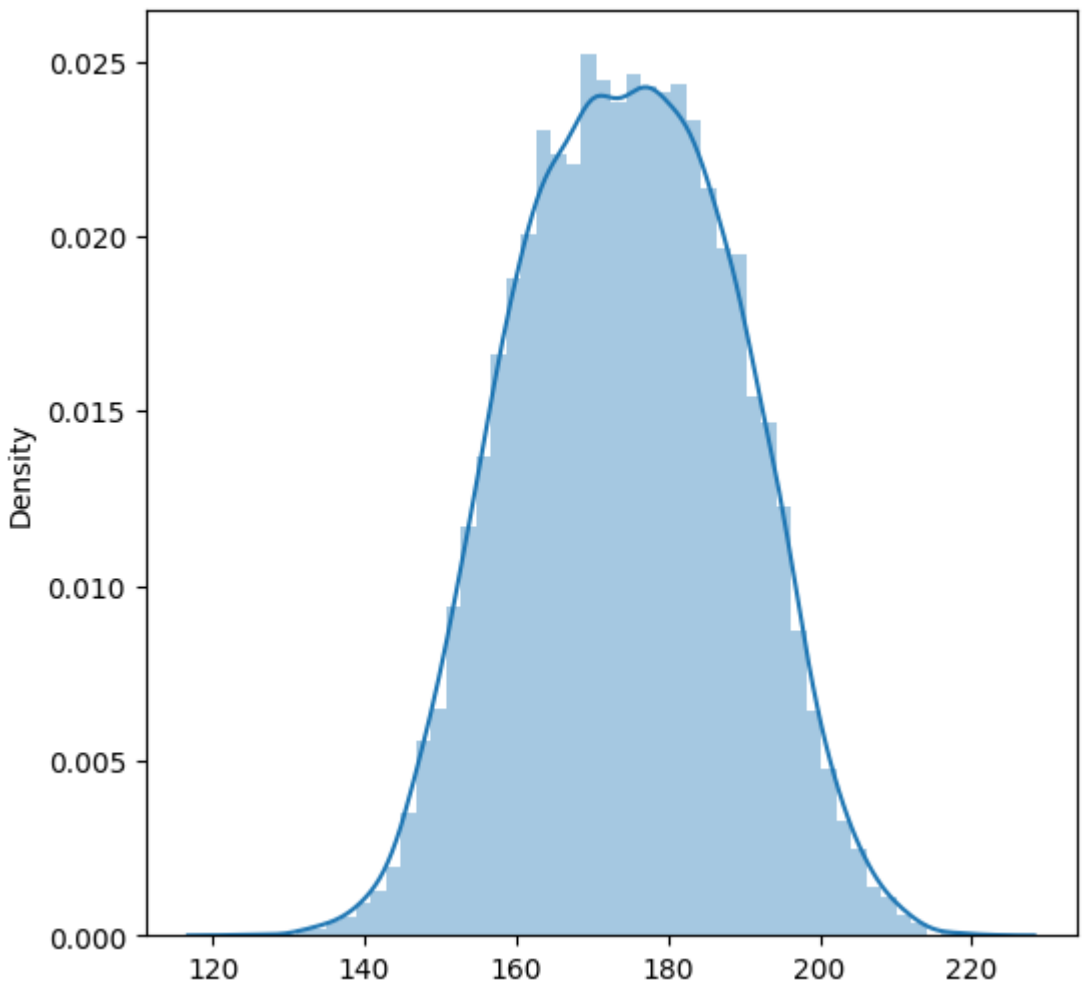
In [136…
```
sns.countplot(x='Gender',data=cal)
```

Out[136…
```
<Axes: xlabel='Gender', ylabel='count'>
```



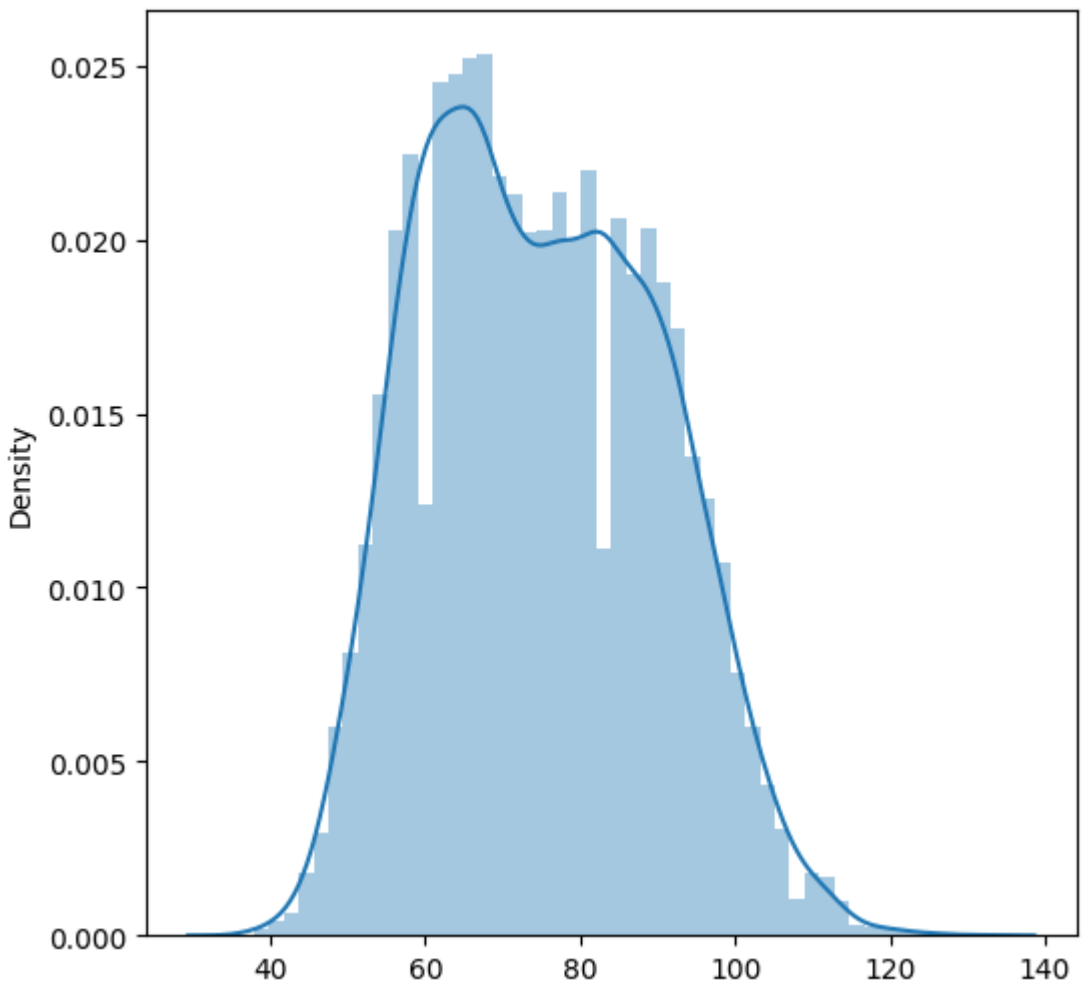
Distribution of Height

In [137…
```
plt.figure(figsize=(6,6))
sns.distplot(x=cal.Height)
plt.show()
```



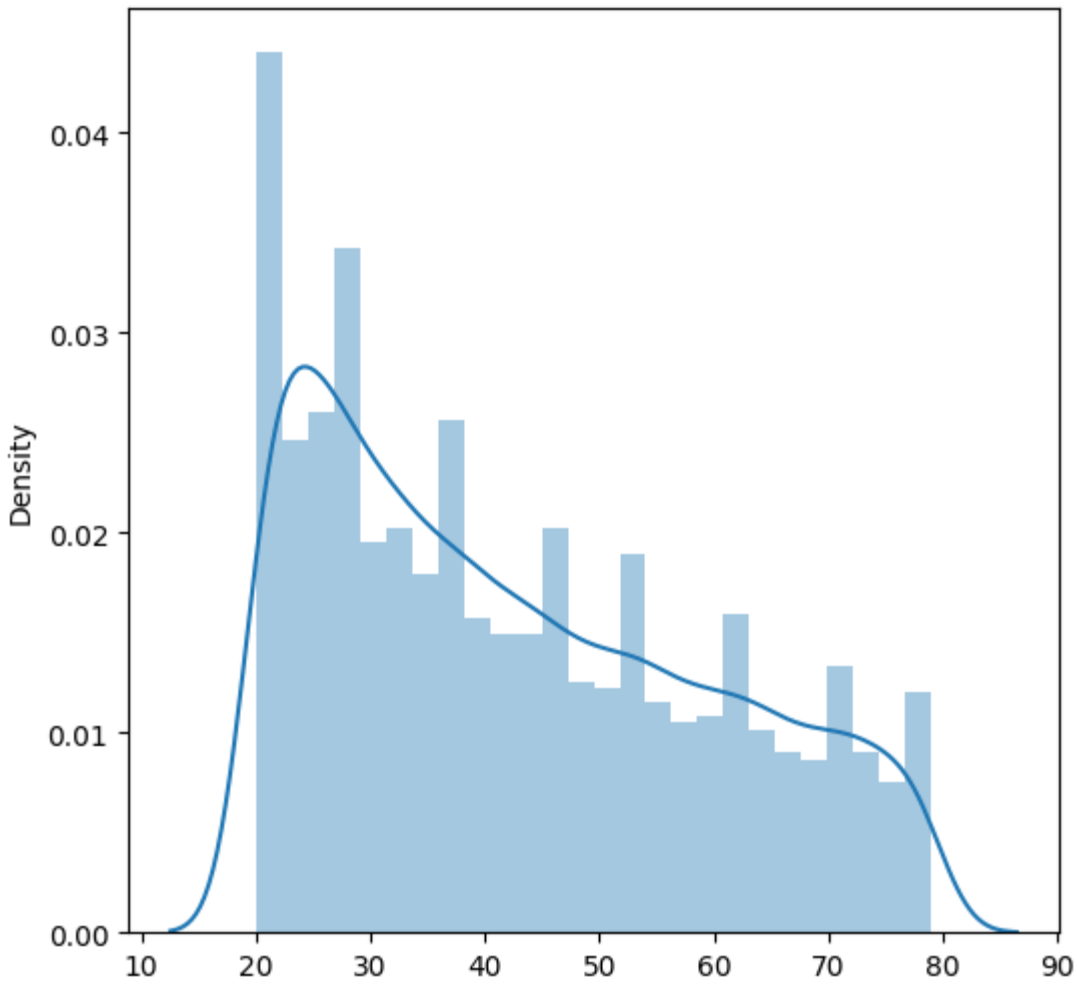
Distribution of Weight

In [138…
```
plt.figure(figsize=(6,6))
sns.distplot(x=cal.Weight)
plt.show()
```



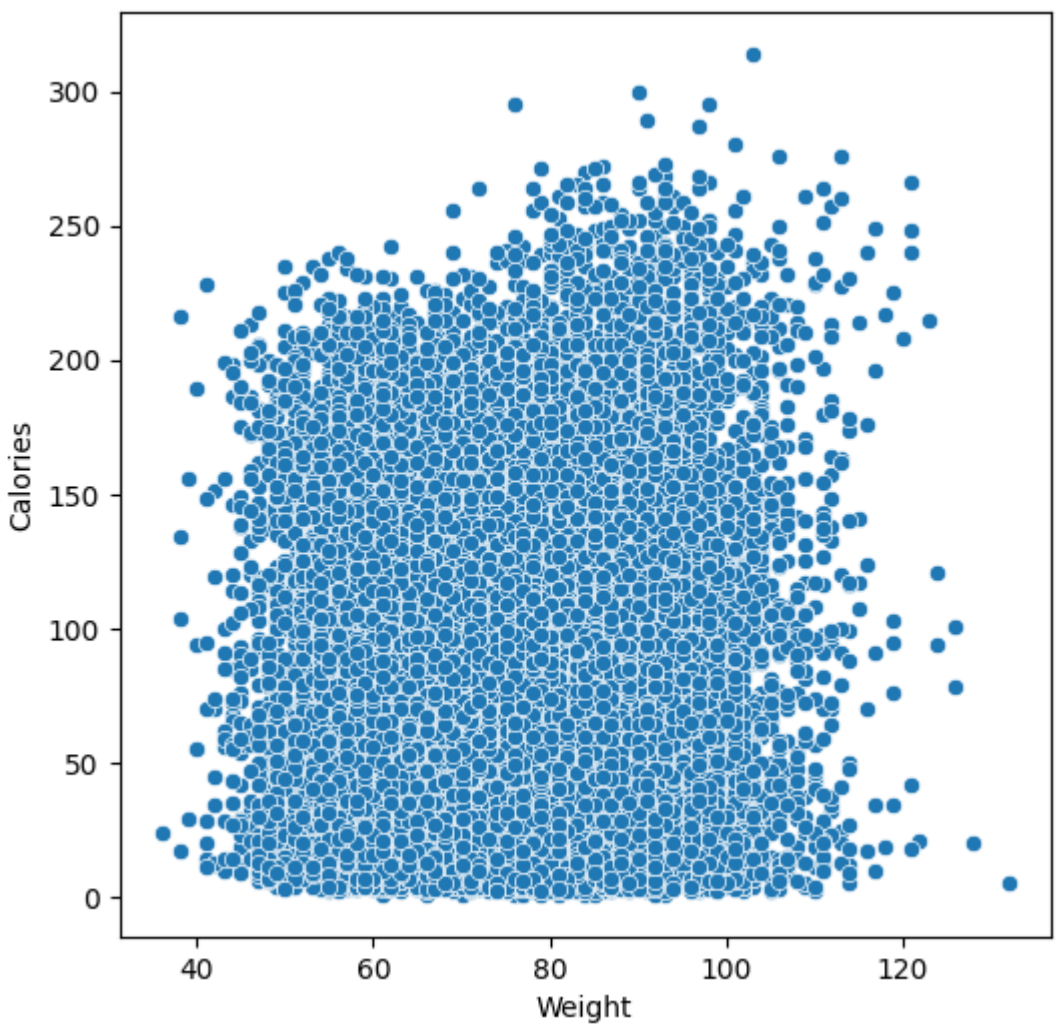
Distribution of Age

In [139…
```
plt.figure(figsize=(6,6))
sns.distplot(x=cal.Age)
plt.show()
```



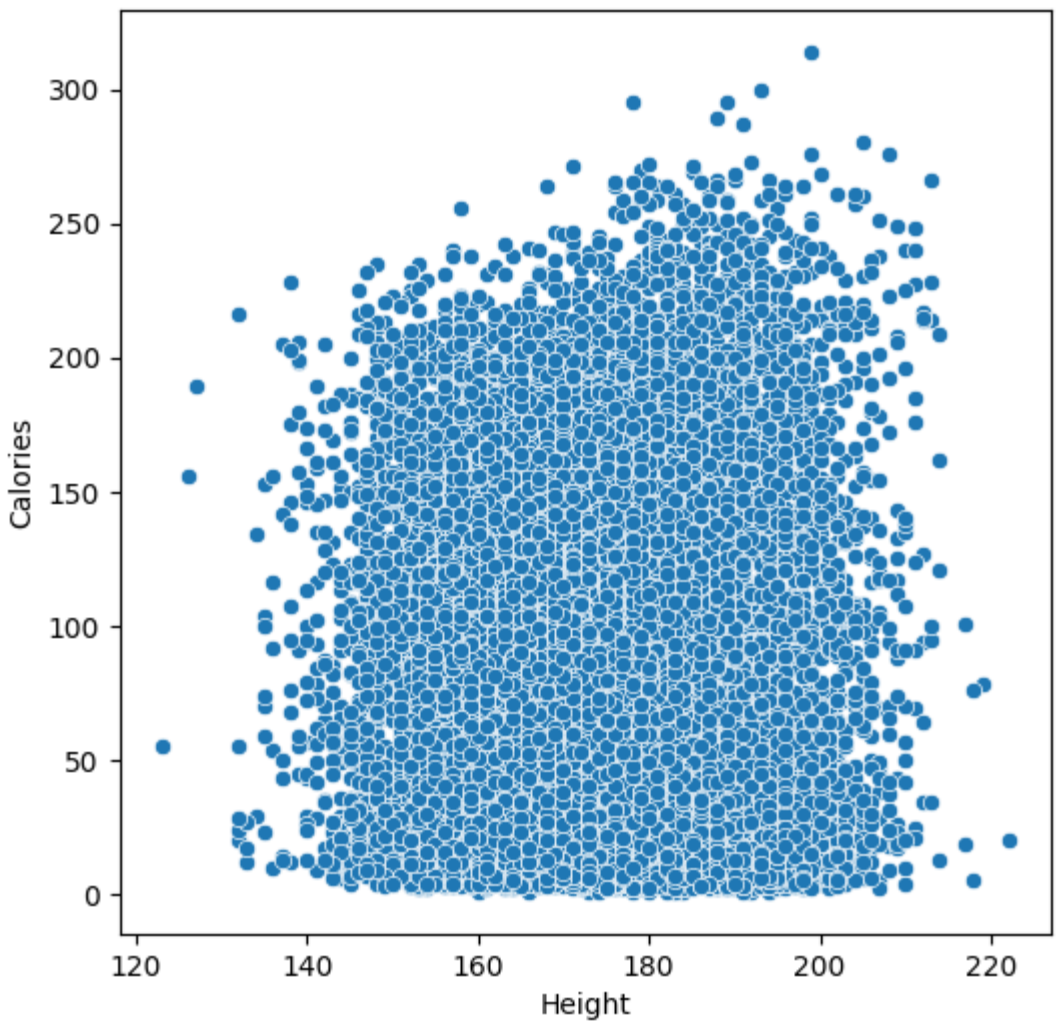
In [140…

```
plt.figure(figsize=(6,6))
sns.scatterplot(x=cal.Weight,y=cal.Calories)
plt.show()
```



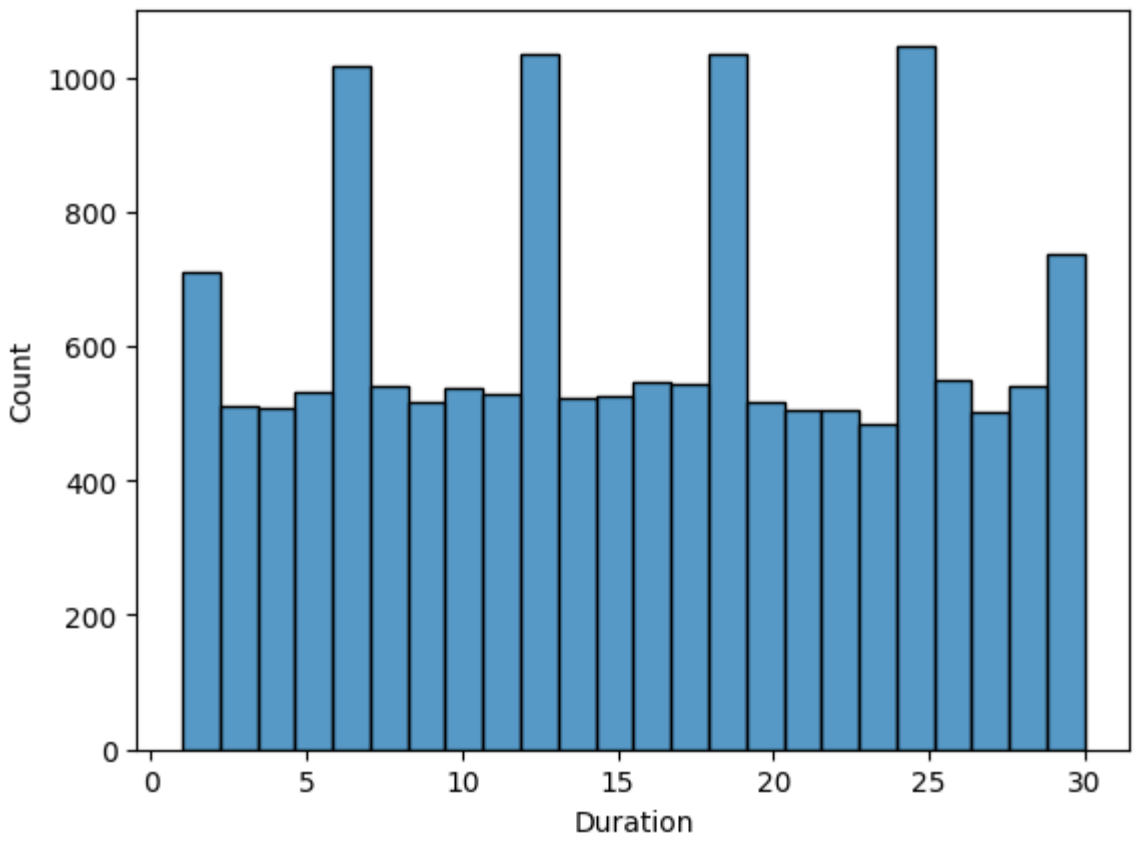
In [141…

```
plt.figure(figsize=(6,6))
sns.scatterplot(x=cal.Height,y=cal.Calories)
plt.show()
```



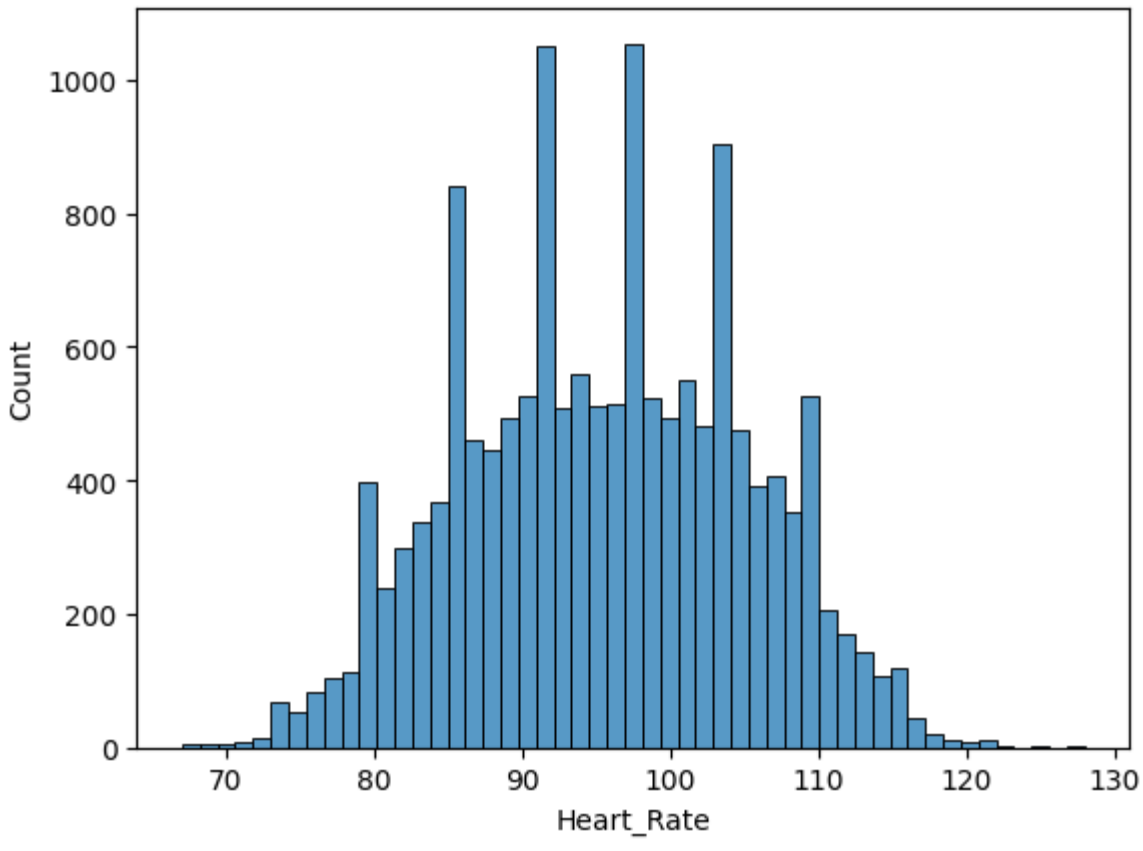
In [142…
```
sns.histplot(x=cal['Duration'])
```

Out[142…
```
<Axes: xlabel='Duration', ylabel='Count'>
```



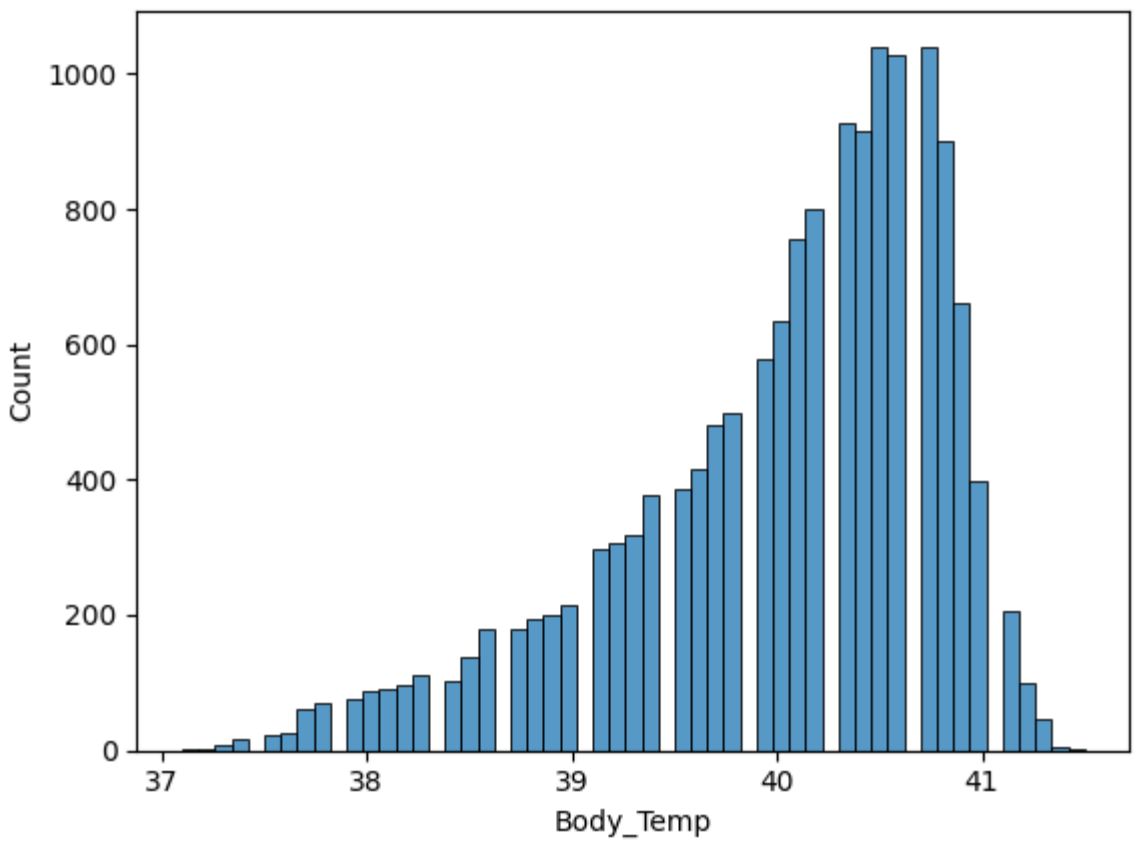
In [143…
```
sns.histplot(x=cal['Heart_Rate'])
```

Out[143…
```
<Axes: xlabel='Heart_Rate', ylabel='Count'>
```



In [144…
```
sns.histplot(x=cal['Body_Temp'])
```

Out[144… <Axes: xlabel='Body_Temp', ylabel='Count'>

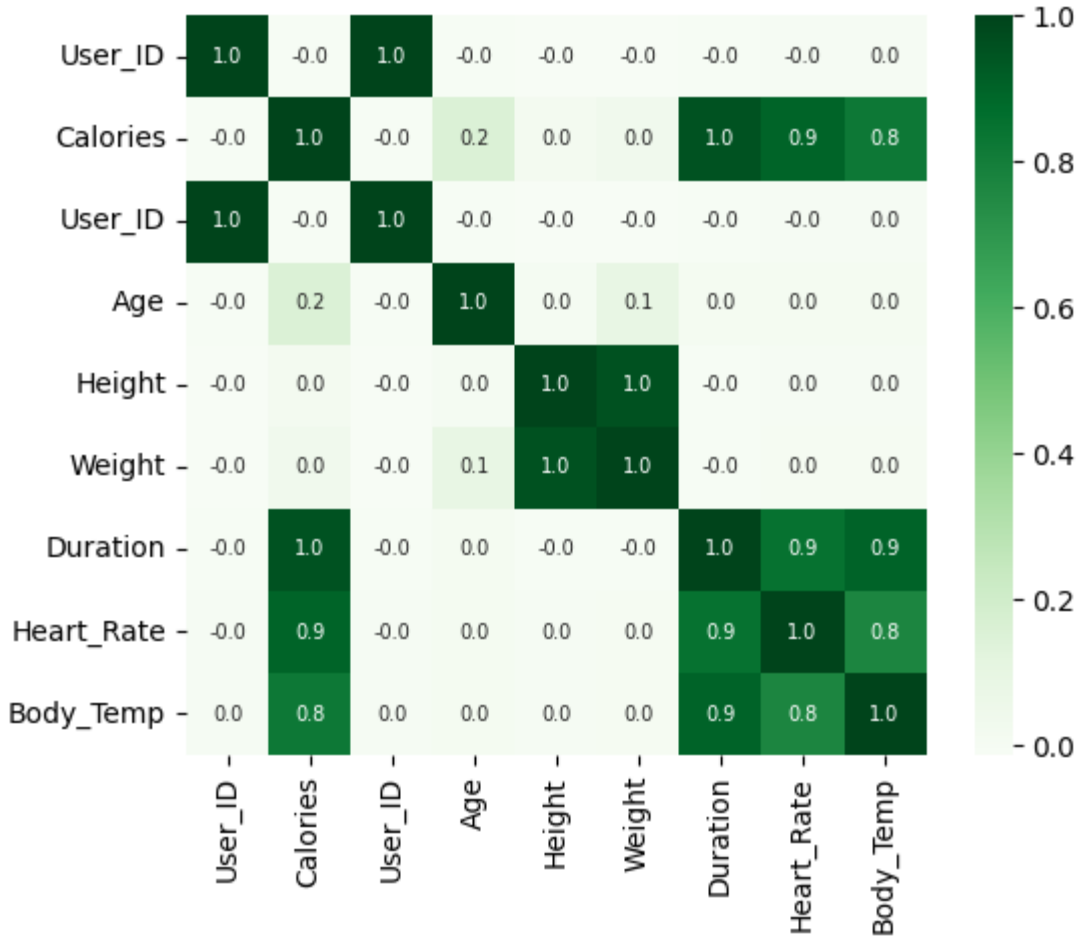


Display Correlation of data

In [145…
```
corr=cal.corr()
```

In [146…
```
sns.heatmap(corr,cbar=True,square=True,fmt='.1f',annot=True,annot_kws={'size':7},cmap='Greens')
```

Out[146… <Axes: >



Remove unwanted columns

In [147…
```
cal.drop(['User_ID','Gender','Age','Height','Weight'],axis=1,inplace=True)
cal.head()
```

Out[147…

	Calories	Duration	Heart_Rate	Body_Temp
0	231.0	29.0	105.0	40.8
1	66.0	14.0	94.0	40.3
2	26.0	5.0	88.0	38.7
3	71.0	13.0	100.0	40.5
4	35.0	10.0	81.0	39.8

Separate input features and target

In [148…
```
x=cal.iloc[:,1:]
x
```

Out[148…

	Duration	Heart_Rate	Body_Temp
0	29.0	105.0	40.8
1	14.0	94.0	40.3
2	5.0	88.0	38.7
3	13.0	100.0	40.5
4	10.0	81.0	39.8
…	…	…	…
14995	11.0	92.0	40.4
14996	6.0	85.0	39.2
14997	16.0	90.0	40.1
14998	2.0	84.0	38.3
14999	18.0	92.0	40.5

15000 rows × 3 columns

In [149…
```
y=cal['Calories']
y
```

Out[149…
```
0        231.0
1         66.0
2         26.0
3         71.0
4         35.0
         ...
14995     45.0
14996     23.0
14997     75.0
14998     11.0
14999     98.0
Name: Calories, Length: 15000, dtype: float64
```

Feature selection using Pearson's

In [150…
```
correlation_matrix=x.corrwith(y)
```

In [151…
```
selected_features=correlation_matrix.abs().sort_values(ascending=False).index
selected_features
```

Out[151…
```
Index(['Duration', 'Heart_Rate', 'Body_Temp'], dtype='object')
```

In [152…
```
x1=x[selected_features]
x1
```

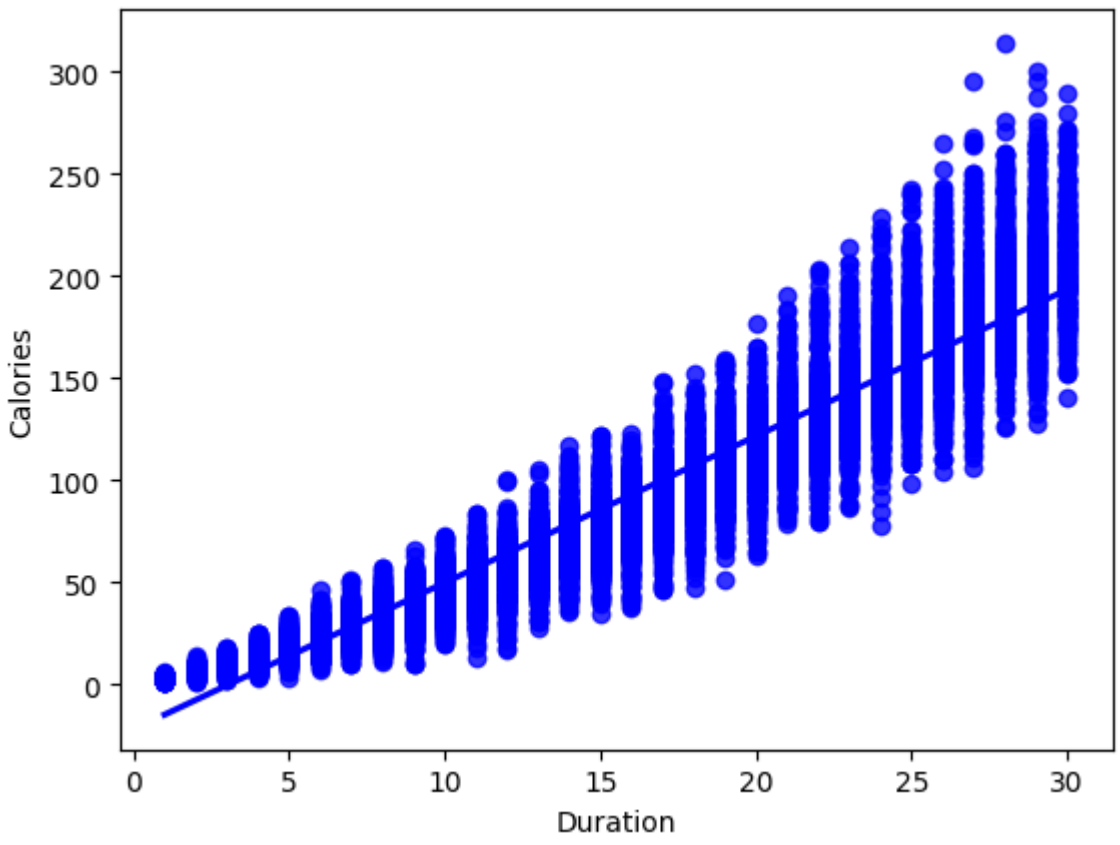
Out[152…

	Duration	Heart_Rate	Body_Temp
0	29.0	105.0	40.8
1	14.0	94.0	40.3
2	5.0	88.0	38.7
3	13.0	100.0	40.5
4	10.0	81.0	39.8
...	...	...	...
14995	11.0	92.0	40.4
14996	6.0	85.0	39.2
14997	16.0	90.0	40.1
14998	2.0	84.0	38.3
14999	18.0	92.0	40.5

15000 rows × 3 columns

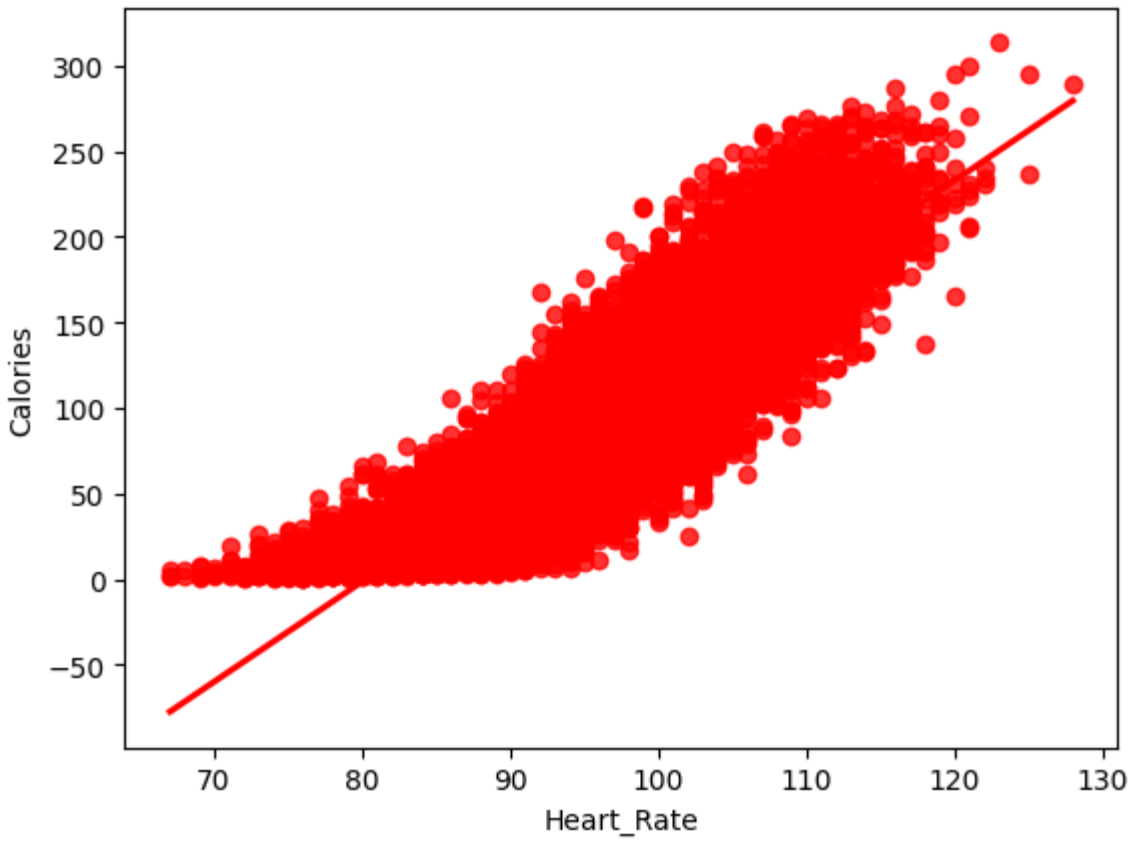
In [153…
```
sns.regplot(x=cal['Duration'],y=y,color='blue')
```

Out[153…
```
<Axes: xlabel='Duration', ylabel='Calories'>
```



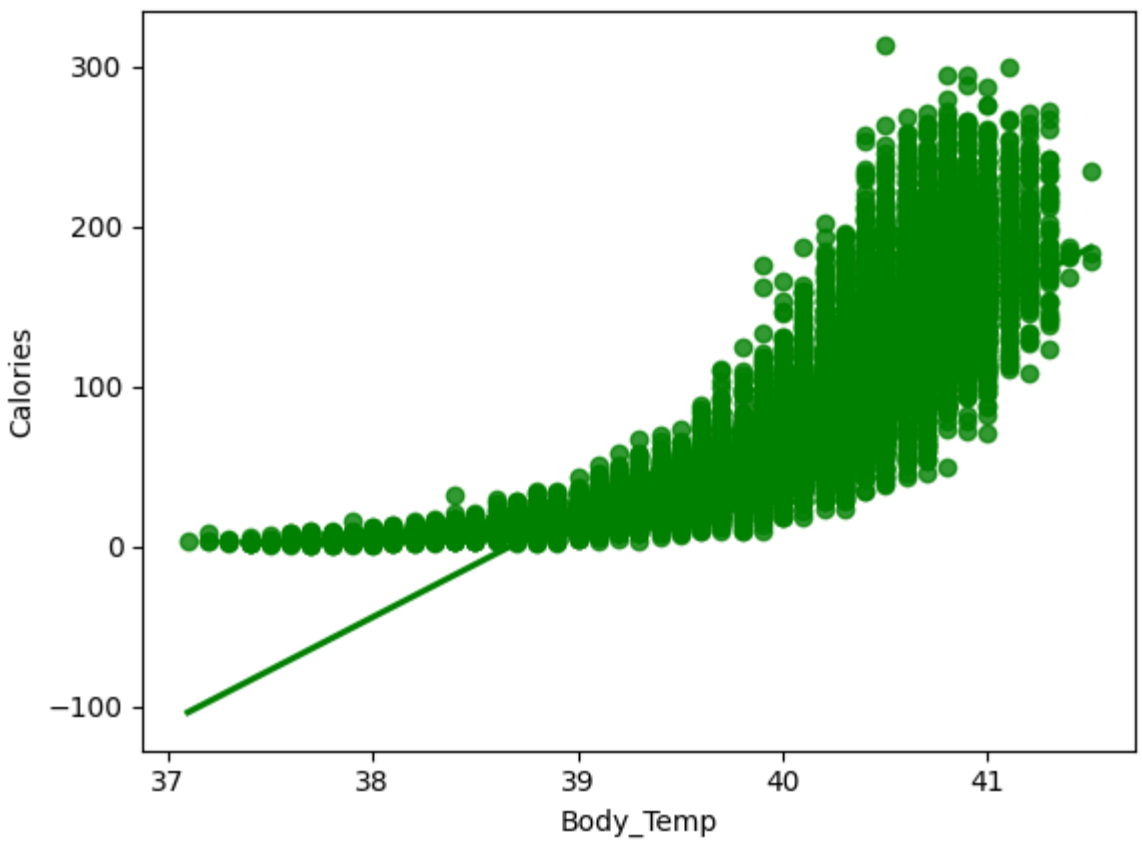
In [154…
```
sns.regplot(x=cal['Heart_Rate'],y=y,color='red')
```

Out[154…
```
<Axes: xlabel='Heart_Rate', ylabel='Calories'>
```



In [155…
```
sns.regplot(x=cal['Body_Temp'],y=y,color='green')
```

Out[155… <Axes: xlabel='Body_Temp', ylabel='Calories'>



Training & Testing data

In [156…
```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(x1,y,test_size=0.30,random_state=42)
x_train
```

Out[156…

	Duration	Heart_Rate	Body_Temp
11797	3.0	79.0	38.6
5899	20.0	98.0	40.2
9513	19.0	100.0	40.4
1572	28.0	107.0	40.9
12995	4.0	85.0	39.0
...	...	...	...
5191	22.0	104.0	40.6
13418	20.0	104.0	40.7
5390	8.0	90.0	39.5
860	12.0	97.0	40.2
7270	16.0	91.0	40.5

10500 rows × 3 columns

In [157…
```
x_test
y_train
y_test
```

Out[157…
```
11499    173.0
6475     189.0
13167     53.0
862      161.0
5970     226.0
         ...
4217      40.0
13886     38.0
10464     30.0
6902     198.0
4874     138.0
Name: Calories, Length: 4500, dtype: float64
```

Model Creation using

- LinearRegression
- DecisionTreeRegressor
- RandomForestRegressor

LinearRegression

Hyperparameter tuning

In [158…
```
from sklearn.linear_model import LinearRegression
lg_model=LinearRegression()
lg_model.get_params()
```

Out[158…
```
{'copy_X': True, 'fit_intercept': True, 'n_jobs': None, 'positive': False}
```

In [159…
```
import warnings
warnings.filterwarnings('ignore')
```

In [160…
```
parameter={'copy_X':[True,False],'fit_intercept':[True,False],'n_jobs':[None,1,5,7,6],'positive':[True,False]}
gsv=GridSearchCV(lg_model,parameter,cv=10,scoring='accuracy')
gsv.fit(x_train,y_train)
print(gsv.best_params_)
```

```
{'copy_X': True, 'fit_intercept': True, 'n_jobs': None, 'positive': True}
```

Model creation

In [161…
```
lg_model1=LinearRegression(positive=True)
lg_model1.fit(x_train,y_train)
y_pred=lg_model1.predict(x_test)
y_pred
```

Out[161…
```
array([166.81480338, 190.39659098,  54.89597475, ...,  32.89775586,
       162.02961276, 134.04128449])
```

Find errors

In [162…
```
df2=pd.DataFrame({'act_value':y_test,'pred_value':y_pred,'diff':y_test-y_pred})
df2
```

Out[162…

	act_value	pred_value	diff
11499	173.0	166.814803	6.185197
6475	189.0	190.396591	-1.396591
13167	53.0	54.895975	-1.895975
862	161.0	158.414856	2.585144
5970	226.0	200.380107	25.619893
...	...	...	...
4217	40.0	62.504137	-22.504137
13886	38.0	44.499325	-6.499325
10464	30.0	32.897756	-2.897756
6902	198.0	162.029613	35.970387
4874	138.0	134.041284	3.958716

4500 rows × 3 columns

Slop and Constant

In [163…
```
print('slope',lg_model1.coef_)
list(zip(x,lg_model1.coef_))
```

```
slope [5.19832503 1.99670313 0.        ]
```

Out[163…
```
 [('Duration', 5.198325029082913),
  ('Heart_Rate', 1.9967031287008616),
  ('Body_Temp', 0.0)]
```

In [164…
```
print('constant',lg_model1.intercept_)
```

```
constant -181.98888215126755
```

Performance Evaluation(errors)

In [165…
```
from sklearn.metrics import mean_absolute_percentage_error
print('MAPE',mean_absolute_percentage_error(y_test,y_pred))
```

```
MAPE 0.3898731483519509
```

In [166…
```
from sklearn.metrics import r2_score
r0=r2_score(y_test,y_pred)
print('R2_SCORE: ',r0)
```

```
R2_SCORE:  0.9367666829129554
```

DecisionTreeRegressor

Hyperparameter tuning

In [167…
```
from sklearn.tree import DecisionTreeRegressor
dec=DecisionTreeRegressor()
param={'max_depth':[2,4,6,8],'min_samples_split':[2,4,6,8],'min_samples_leaf':[1,2,3,4],'max_features':['auto','sqr
grid_search=GridSearchCV(estimator=dec,param_grid=param,cv=5,scoring='neg_mean_squared_error',n_jobs=1)
grid_search.fit(x_train,y_train)
best_params=grid_search.best_params_
print('Best Hyperparameters',best_params)
```

```
Best Hyperparameters {'max_depth': 8, 'max_features': 'auto', 'min_samples_leaf': 3, 'min_samples_split': 8}
```

Model creation

In [168…
```
dec1=DecisionTreeRegressor(max_depth=8,max_features='auto',min_samples_leaf=3,min_samples_split=4)
dec1.fit(x_train,y_train)
y_pred1=dec1.predict(x_test)
y_pred1
```

Out[168…
```
array([170.34210526, 205.60550459,  50.        , ...,  28.22222222,
       157.42592593, 133.57664234])
```

Find errors

In [169…
```
df3=pd.DataFrame({'act_value':y_test,'pred_value':y_pred1,'diff':y_test-y_pred1})
df3
```

Out[169…

	act_value	pred_value	diff
11499	173.0	170.342105	2.657895
6475	189.0	205.605505	-16.605505
13167	53.0	50.000000	3.000000
862	161.0	165.794118	-4.794118
5970	226.0	226.407407	-0.407407
...	...	...	...
4217	40.0	60.101010	-20.101010
13886	38.0	41.365854	-3.365854
10464	30.0	28.222222	1.777778
6902	198.0	157.425926	40.574074
4874	138.0	133.576642	4.423358

4500 rows × 3 columns

Performance Evaluation(errors)

In [170…
```
from sklearn.metrics import mean_absolute_percentage_error
print('MAPE',mean_absolute_percentage_error(y_test,y_pred1))
```

```
MAPE 0.12339144744903312
```

In [171…
```
from sklearn.metrics import r2_score
r1=r2_score(y_test,y_pred1)
print('R2_SCORE: ',r1)
```

```
R2_SCORE:  0.9566564677075071
```

RandomForestRegressor

In [172…
```
from sklearn.ensemble import RandomForestRegressor
rfg=RandomForestRegressor(n_estimators=100,random_state=40)
rfg.fit(x_train,y_train)
y_pred2=rfg.predict(x_test)
y_pred2
```

Out[172…
```
array([170.57919517, 219.9575    ,  50.56783719, ...,  27.6625    ,
       160.64405556, 126.48587698])
```

Find errors

In [173…
```
df4=pd.DataFrame({'act_value':y_test,'pred_value':y_pred2,'diff':y_test-y_pred2})
df4
```

Out[173…

	act_value	pred_value	diff
11499	173.0	170.579195	2.420805
6475	189.0	219.957500	-30.957500
13167	53.0	50.567837	2.432163
862	161.0	167.416215	-6.416215
5970	226.0	239.479869	-13.479869
...	...	...	...
4217	40.0	53.210333	-13.210333
13886	38.0	42.773556	-4.773556
10464	30.0	27.662500	2.337500
6902	198.0	160.644056	37.355944
4874	138.0	126.485877	11.514123

4500 rows × 3 columns

Performance Evaluation(errors)

In [174…
```
from sklearn.metrics import mean_absolute_percentage_error
print('MAPE',mean_absolute_percentage_error(y_test,y_pred2))
```

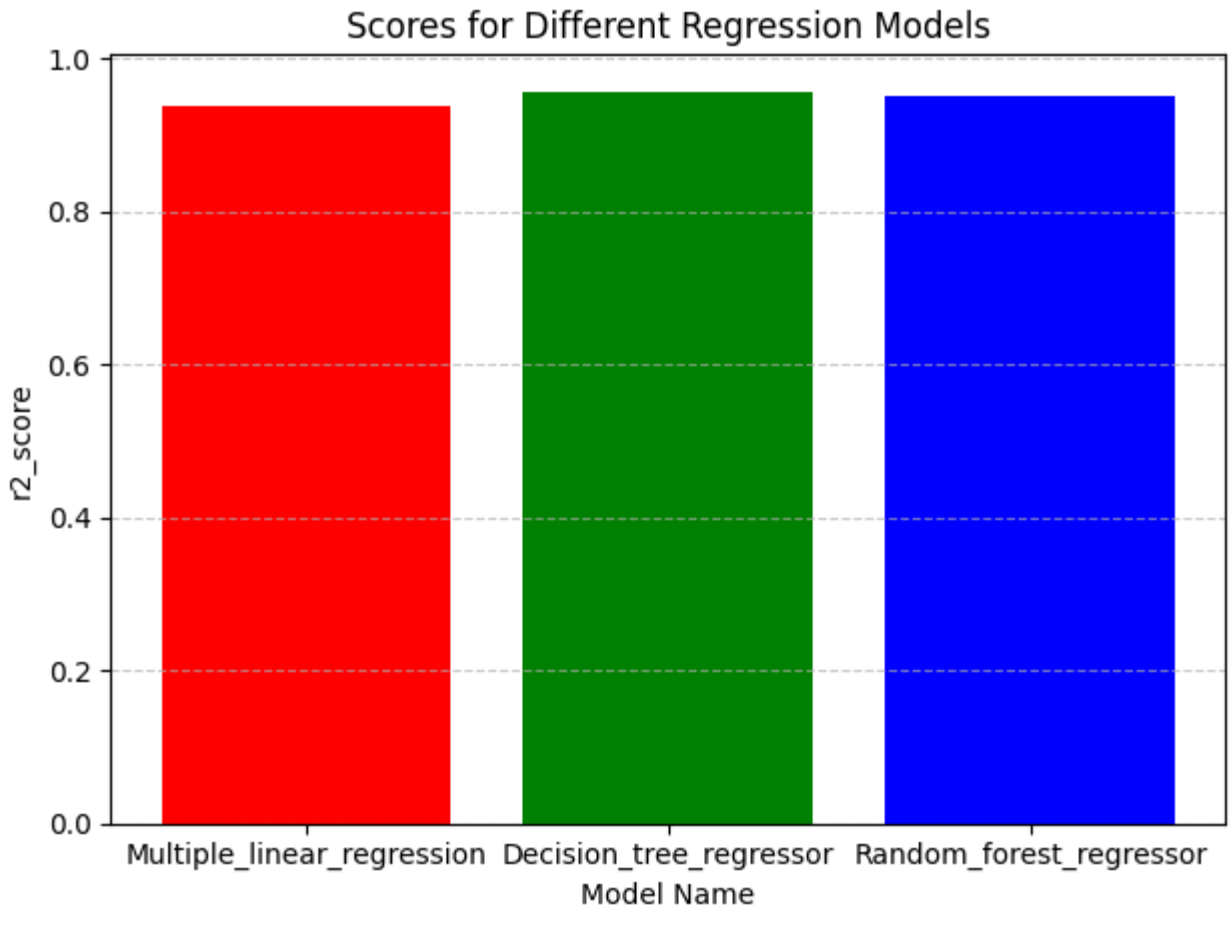
```
MAPE 0.13322413864178376
```

In [175…
```
from sklearn.metrics import r2_score
r2=r2_score(y_test,y_pred2)
print('R2_SCORE: ',r2)
```

```
R2_SCORE:  0.9505296072243411
```

In [180…
```
visual=['Multiple_linear_regression','Decision_tree_regressor','Random_forest_regressor']
result=[r0,r1,r2]
plt.bar(visual,result,color=['red','green','blue'])
plt.xlabel('Model Name')
plt.ylabel('r2_score')
plt.title('Scores for Different Regression Models')
plt.tight_layout() #ensure labels are not cut off
plt.grid(axis='y',linestyle='--',alpha=0.7)
plt.show
```

Out[180…
```
<function matplotlib.pyplot.show(close=None, block=None)>
```


Scores for Different Regression Models
r2_score
1.0
0.8
0.6
0.4
0.2
0.0
Multiple_linear_regression
Decision_tree_regressor
Random_forest_regressor
Model Name