In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from xgboost import XGBRegressor, plot_importance
from sklearn.model_selection import RandomizedSearchCV
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import mean_squared_log_error
from scipy.stats import randint, uniform
from sklearn.preprocessing import LabelEncoder
```

In [2]:
```
train = pd.read_csv("C:\\train.csv")
test = pd.read_csv("C:\\test.csv")
submission = pd.read_csv("C:\\sample_submission.csv")
```

In [3]:
```
train.head(5)
```

Out[3]:

	id	Sex	Age	Height	Weight	Duration	Heart_Rate	Body_Temp	Calories
0	0	male	36	189.0	82.0	26.0	101.0	41.0	150.0
1	1	female	64	163.0	60.0	8.0	85.0	39.7	34.0
2	2	female	51	161.0	64.0	7.0	84.0	39.8	29.0
3	3	male	20	192.0	90.0	25.0	105.0	40.7	140.0
4	4	female	38	166.0	61.0	25.0	102.0	40.6	146.0

In [4]:
```
test.head(5)
```

Out[4]:

	id	Sex	Age	Height	Weight	Duration	Heart_Rate	Body_Temp
0	750000	male	45	177.0	81.0	7.0	87.0	39.8
1	750001	male	26	200.0	97.0	20.0	101.0	40.5
2	750002	female	29	188.0	85.0	16.0	102.0	40.4
3	750003	female	39	172.0	73.0	20.0	107.0	40.6
4	750004	female	30	173.0	67.0	16.0	94.0	40.5

In [5]:
```
submission.head()
```

Out[5]:

	id	Calories
0	750000	88.283
1	750001	88.283
2	750002	88.283
3	750003	88.283
4	750004	88.283

In [6]:
```
train.drop("id", axis=1, inplace=True)
test_ID = test["id"]
```

```
test.drop("id", axis=1, inplace=True)
```

In [7]:
```
le = LabelEncoder()
train['Sex'] = le.fit_transform(train['Sex'])
test['Sex'] = le.transform(test['Sex'])
```

In [8]:
```
# BMI
train['BMI'] = train['Weight'] / ((train['Height']/100) ** 2)
test['BMI'] = test['Weight'] / ((test['Height']/100) ** 2)

# Workout Intensity
train['Workout_Intensity'] = train['Heart_Rate'] * train['Duration']
test['Workout_Intensity'] = test['Heart_Rate'] * test['Duration']

# Temp-HR Ratio
train['Temp_HR_Ratio'] = train['Body_Temp'] * train['Heart_Rate']
test['Temp_HR_Ratio'] = test['Body_Temp'] * test['Heart_Rate']

# Age Groups
age_bins = [0, 20, 40, 60, 100]
age_labels = [0, 1, 2, 3]
train['Age_Group'] = pd.cut(train['Age'], bins=age_bins, labels=age_labels).astype
test['Age_Group'] = pd.cut(test['Age'], bins=age_bins, labels=age_labels).astype(i
```

In [9]:
```
train.head()
```

Out[9]:

	Sex	Age	Height	Weight	Duration	Heart_Rate	Body_Temp	Calories	BMI
0	1	36	189.0	82.0	26.0	101.0	41.0	150.0	22.955684
1	0	64	163.0	60.0	8.0	85.0	39.7	34.0	22.582709
2	0	51	161.0	64.0	7.0	84.0	39.8	29.0	24.690405
3	1	20	192.0	90.0	25.0	105.0	40.7	140.0	24.414062
4	0	38	166.0	61.0	25.0	102.0	40.6	146.0	22.136740

In [10]:
```
print("Checking for missing values...")
print(train.isnull().sum())
print(test.isnull().sum())
```

```
Checking for missing values...
Sex                  0
Age                  0
Height               0
Weight               0
Duration             0
Heart_Rate           0
Body_Temp            0
Calories             0
BMI                  0
Workout_Intensity    0
Temp_HR_Ratio        0
Age_Group            0
dtype: int64
Sex                  0
Age                  0
Height               0
Weight               0
Duration             0
Heart_Rate           0
Body_Temp            0
BMI                  0
Workout_Intensity    0
Temp_HR_Ratio        0
Age_Group            0
dtype: int64
```

In [11]:
```
target_corr = train.corr()['Calories'].sort_values(ascending=False)
print(target_corr)
```

```
Calories             1.000000
Workout_Intensity    0.977341
Duration             0.959908
Temp_HR_Ratio        0.924599
Heart_Rate           0.908748
Body_Temp            0.828671
Age                  0.145683
Age_Group            0.141307
BMI                  0.049226
Weight               0.015863
Sex                  0.012011
Height              -0.004026
Name: Calories, dtype: float64
```

In [12]:
```
X = train.drop('Calories', axis=1)
y = train['Calories']
```

In [13]:
```
y_log = np.log1p(y)
```

In [14]:
```
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)
X_test_scaled = scaler.transform(test)
```

In [15]:
```
xgb = XGBRegressor(random_state=42)
```

In [16]:
```
param_dist = {
    'n_estimators': randint(50, 150),
    'max_depth': randint(3, 6),
    'learning_rate': uniform(0.03, 0.1),
```

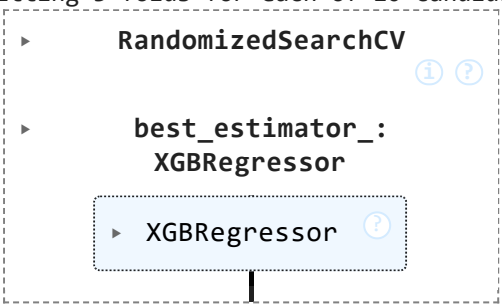
```
    'subsample': uniform(0.8, 0.2),
    'colsample_bytree': uniform(0.8, 0.2)
}
```

In [17]:
```
random_search = RandomizedSearchCV(
    estimator=xgb,
    param_distributions=param_dist,
    n_iter=10,
    scoring='neg_mean_squared_error',  # proxy for RMSLE
    cv=3,
    verbose=1,
    random_state=42,
    n_jobs=1  # prevents freezing
)
```

In [18]:
```
random_search.fit(X_scaled, y_log)
```

```
Fitting 3 folds for each of 10 candidates, totalling 30 fits
```

Out[18]:



In [19]:
```
best_model = random_search.best_estimator_
print("\nBest Parameters:", random_search.best_params_)
```

```
Best Parameters: {'colsample_bytree': np.float64(0.8749080237694725), 'learning_rat
e': np.float64(0.12507143064099163), 'max_depth': 5, 'n_estimators': 121, 'subsampl
e': np.float64(0.9197316968394074)}
```

In [20]:
```
train_preds_log = best_model.predict(X_scaled)
train_preds = np.expm1(train_preds_log)
```

In [21]:
```
rmsle = np.sqrt(mean_squared_log_error(y, train_preds))
print(f"\nTrain RMSLE: {rmsle:.4f}")
```

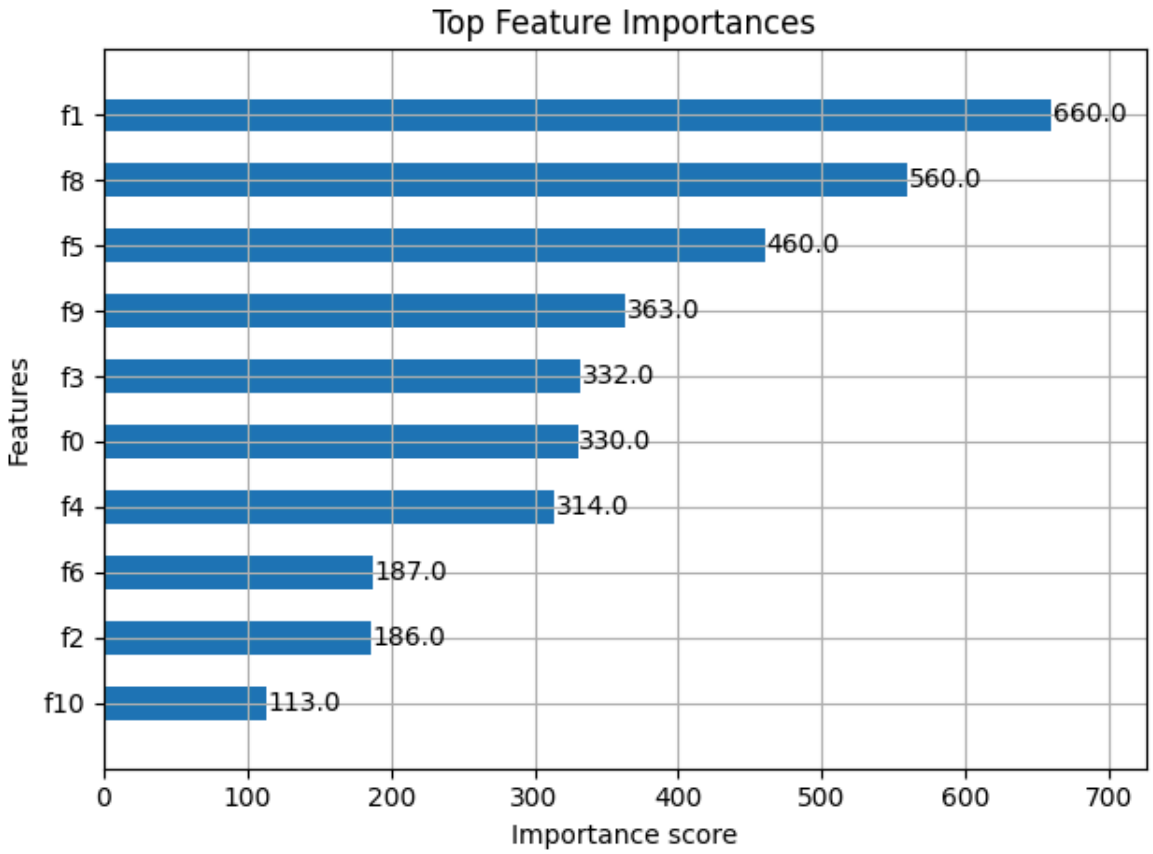
```
Train RMSLE: 0.0604
```

In [22]:
```
test_preds = np.expm1(best_model.predict(X_test_scaled))
```

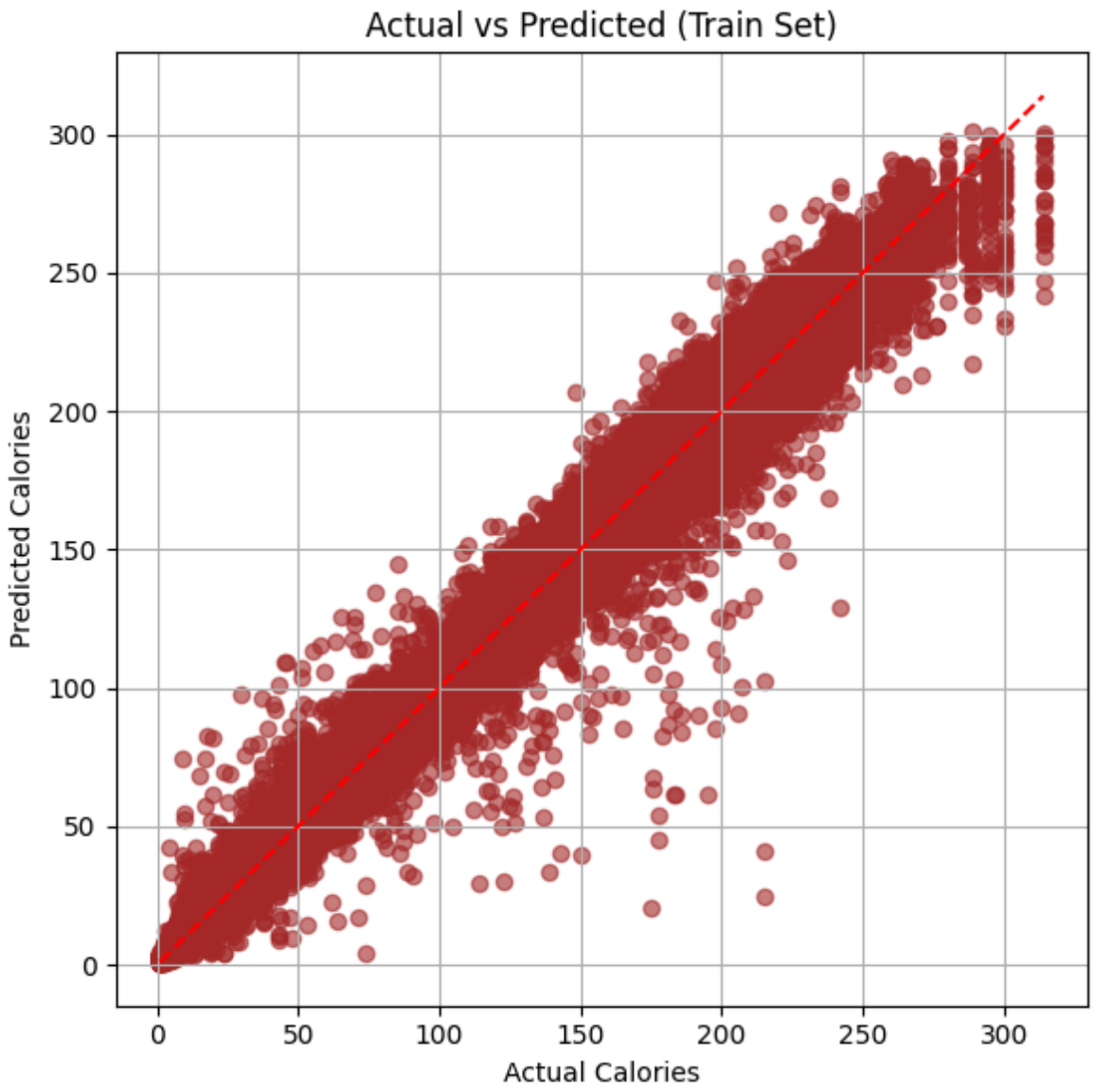
In [24]:
```
# Assign predicted values to the 'Calories' column
submission['Calories'] = test_preds

# Save the updated submission file
submission.to_csv(r'C:\Users\sakshi\submission.csv', index=False)
print("Saved Submission.csv with id and Calories.")
```

```
Saved Submission.csv with id and Calories.
```

In [25]:
```
plot_importance(best_model, max_num_features=10, height=0.5)
plt.title("Top Feature Importances")
plt.tight_layout()
plt.show()
```



In [27]:
```
plt.figure(figsize=(6, 6))
plt.scatter(np.expm1(y_log), train_preds, alpha=0.6, color='Brown')
plt.plot([min(y), max(y)], [min(y), max(y)], 'r--')
plt.xlabel("Actual Calories")
plt.ylabel("Predicted Calories")
plt.title("Actual vs Predicted (Train Set)")
plt.grid(True)
plt.tight_layout()
plt.show()
```


Actual vs Predicted (Train Set)
Predicted Calories
Actual Calories
0
50
100
150
200
250
300

In [ ]: