In [1]:
```
import pandas as pd
```

In [2]:
```
df = pd.read_csv("recipe_site_traffic_2212.csv")
```

In [3]:
```
df.head()
```

Out[3]:

	recipe	calories	carbohydrate	sugar	protein	category	servings	high_traffic
0	1	NaN	NaN	NaN	NaN	Pork	6	High
1	2	35.48	38.56	0.66	0.92	Potato	4	High
2	3	914.28	42.68	3.09	2.88	Breakfast	1	NaN
3	4	97.03	30.56	38.63	0.02	Beverages	4	High
4	5	27.05	1.85	0.80	0.53	Beverages	4	NaN

In [4]:
```
df.isna().sum()
```

Out[4]:
```
recipe            0
calories         52
carbohydrate     52
sugar            52
protein          52
category          0
servings          0
high_traffic    373
dtype: int64
```

In [5]:
```
for i in df.columns:
    print(df[i].dtypes)
```

```
int64
float64
float64
float64
float64
object
object
object
```

In [6]:
```
df["high_traffic"].value_counts()
```

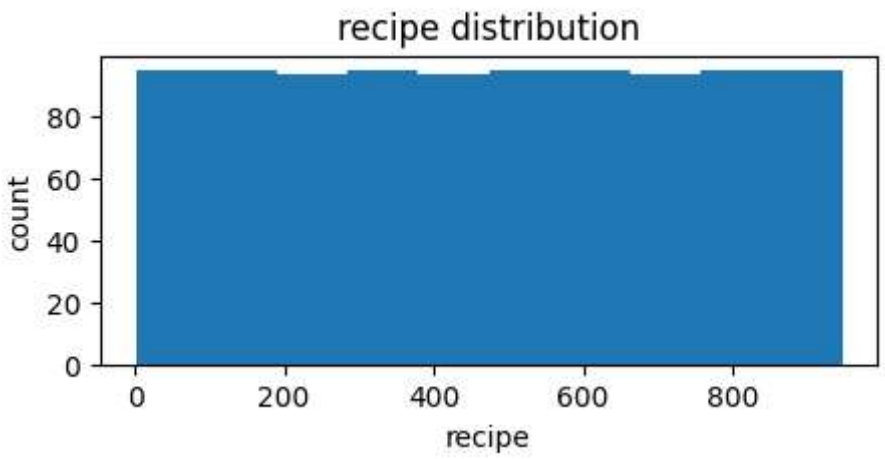
Out[6]:
```
high_traffic
High    574
Name: count, dtype: int64
```

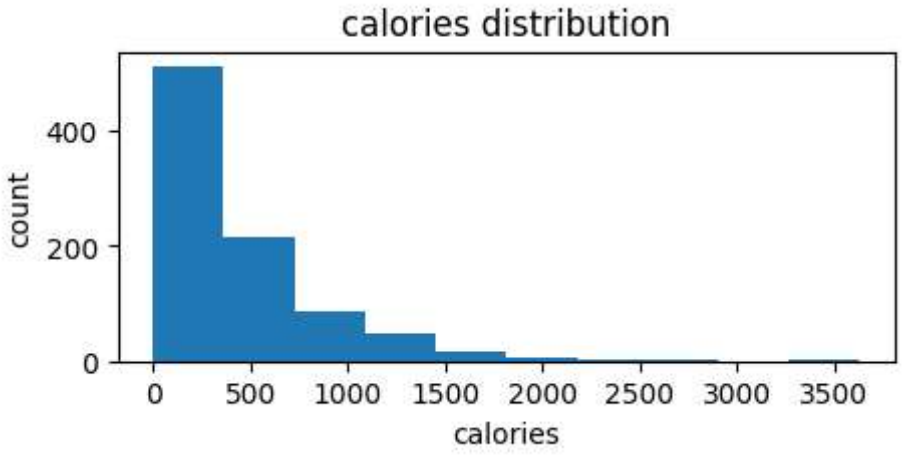
In [7]:
```
df["category"].value_counts()
```

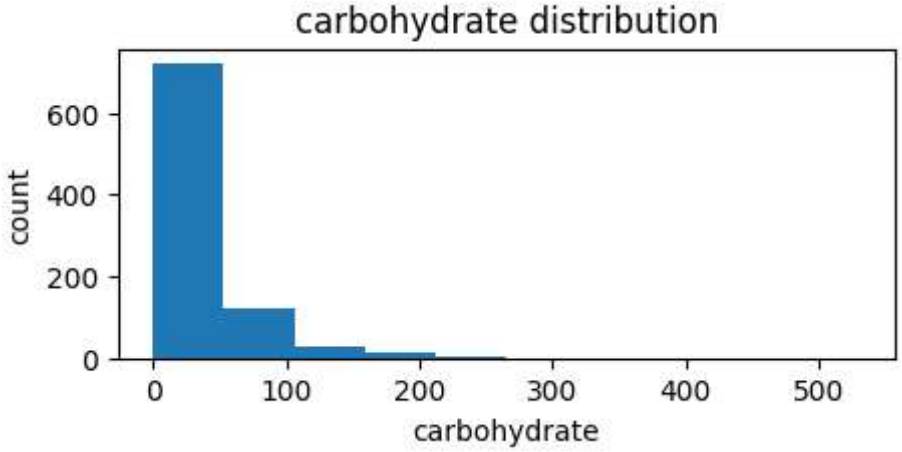
Out[7]:
```
category
Breakfast         106
Chicken Breast     98
Beverages          92
Lunch/Snacks       89
Potato             88
Pork               84
Vegetable          83
Dessert            83
Meat               79
Chicken            74
One Dish Meal      71
Name: count, dtype: int64
```

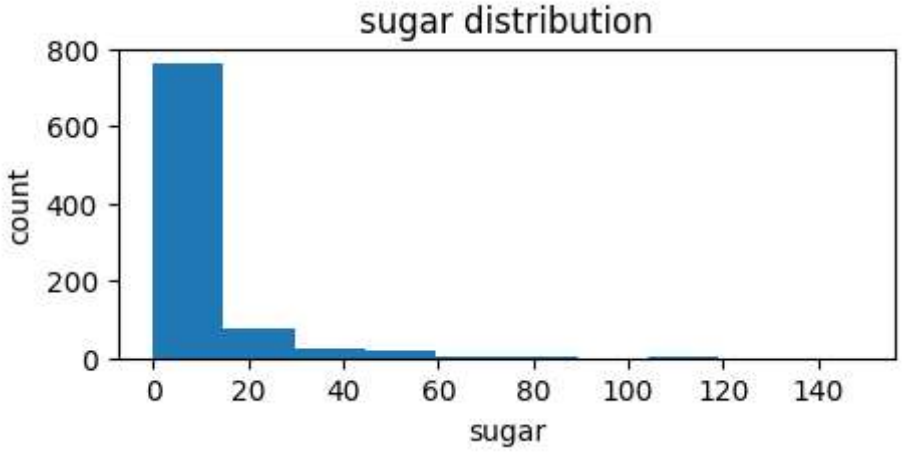
In [8]:
```
import matplotlib.pyplot as plt
```

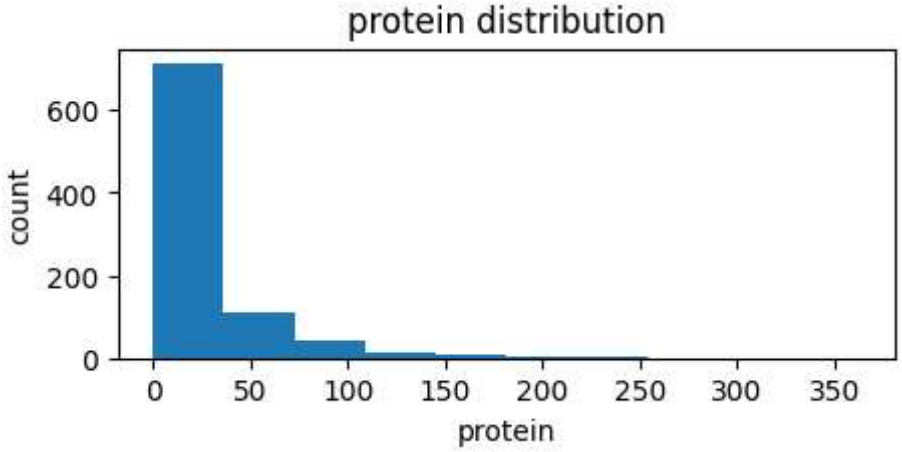
In [9]:
```
for i in df.columns.drop("high_traffic"):
    plt.figure(figsize=(5, 2))
    plt.hist(df[i])
    plt.xlabel(i)
    plt.ylabel("count")
    plt.title(i+" distribution")
    plt.show()
```

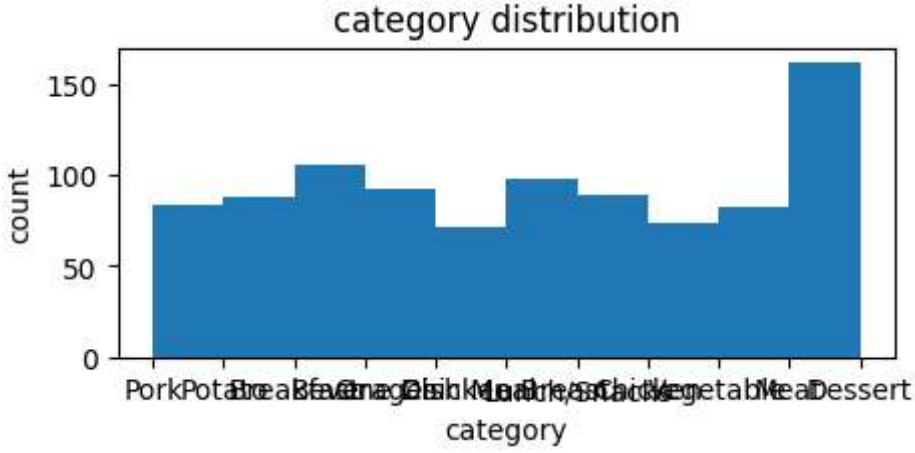


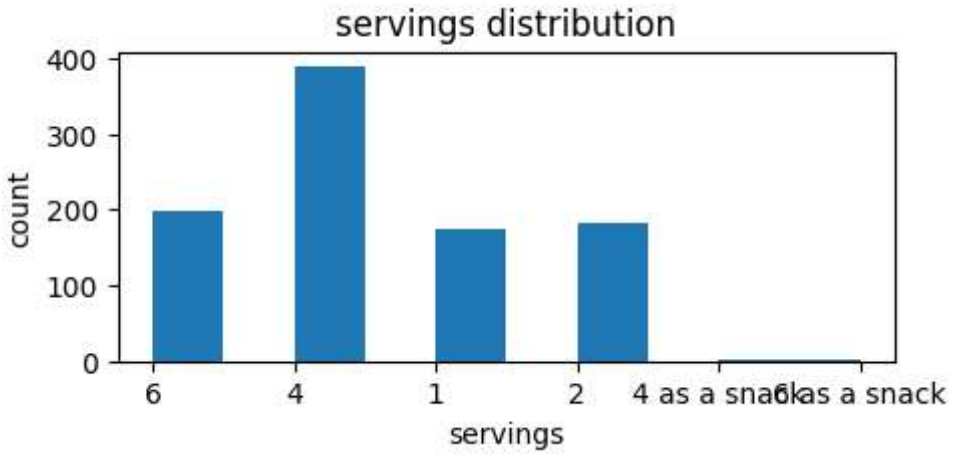



carbohydrate distribution
count
carbohydrate
0
200
400
600
0
100
200
300
400
500

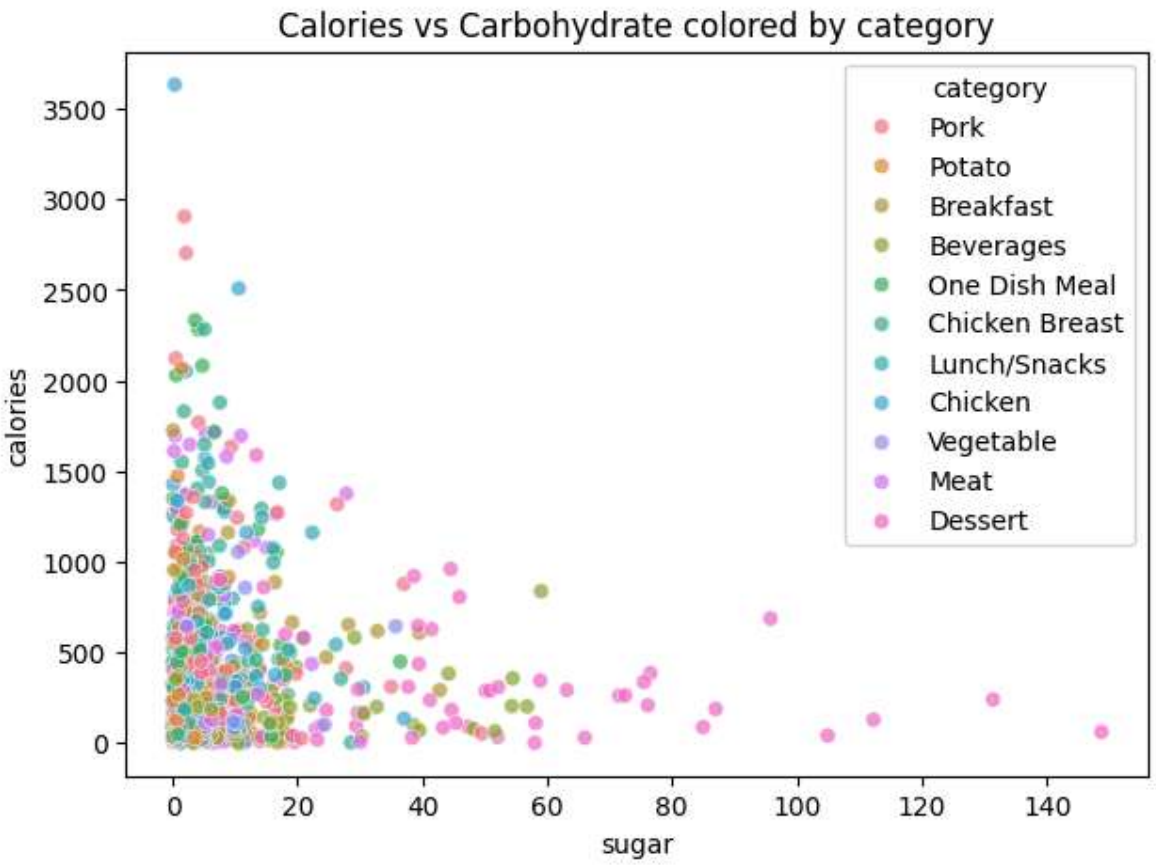

sugar distribution
count
sugar
0
200
400
600
800
0
20
40
60
80
100
120
140


protein distribution
count
protein
0
200
400
600
0
50
100
150
200
250
300
350


category distribution
count
category
0
50
100
150



In [11]:
```
import seaborn as sns
plt.figure(figsize=(7, 5))
sns.scatterplot(
    data=df,
    x="sugar",
    y="calories",
    hue="category",
    alpha=0.7
)
plt.title("Calories vs Carbohydrate colored by category")
plt.show()
```



In [12]:
```
df["servings"].value_counts()
```

Out[12]:
```
servings
4                389
6                197
2                183
1                175
4 as a snack       2
6 as a snack       1
Name: count, dtype: int64
```

In [13]:
```
#Impute
#for right-skewed columns, impute NAs with median
from sklearn.impute import SimpleImputer
num_cols = ["calories", "carbohydrate", "sugar", "protein"]

imputer = SimpleImputer(strategy="median")
df[num_cols] = imputer.fit_transform(df[num_cols])

#for high_traffic, impute NAs with Low
df["high_traffic"] = df["high_traffic"].fillna("Low")
```

In [14]:
```
df.isna().sum()
```

Out[14]:
```
recipe          0
calories        0
carbohydrate    0
sugar           0
protein         0
category        0
servings        0
high_traffic    0
dtype: int64
```

In [15]:
```
df["servings"] = df["servings"].astype(str).str.extract(r"(\d+)").astype(int)
```

In [16]:
```
df["servings"].value_counts()
```

Out[16]:
```
servings
4    391
6    198
2    183
1    175
Name: count, dtype: int64
```

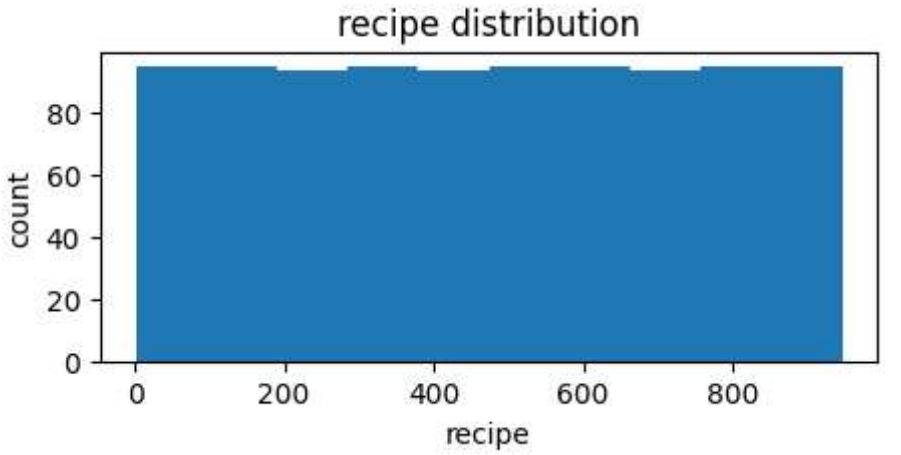
In [17]:
```
df["category"] = df["category"].replace({"Chicken Breast": "Chicken"})
```

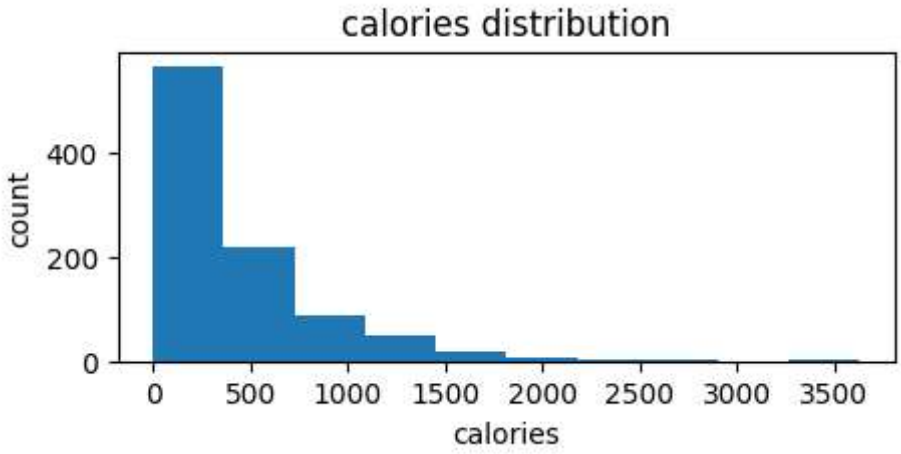
In [18]:
```
for i in df.columns:
    print(df[i].dtypes)
```

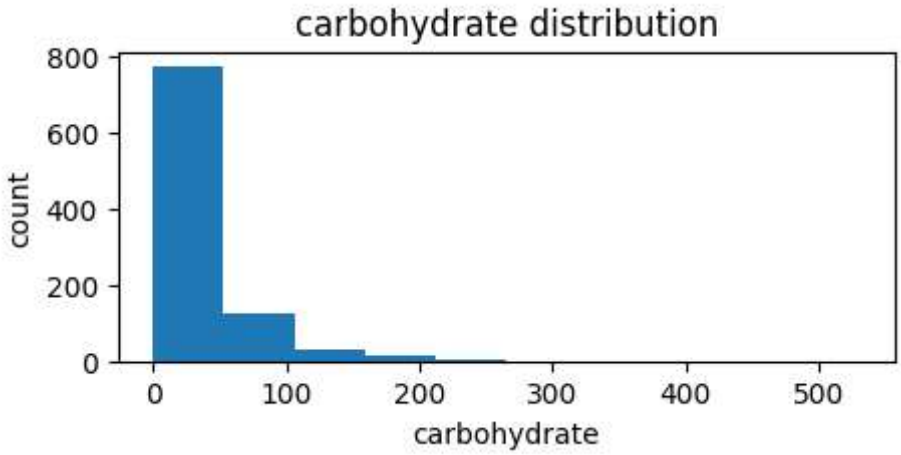
```
int64
float64
float64
float64
float64
object
int32
object
```

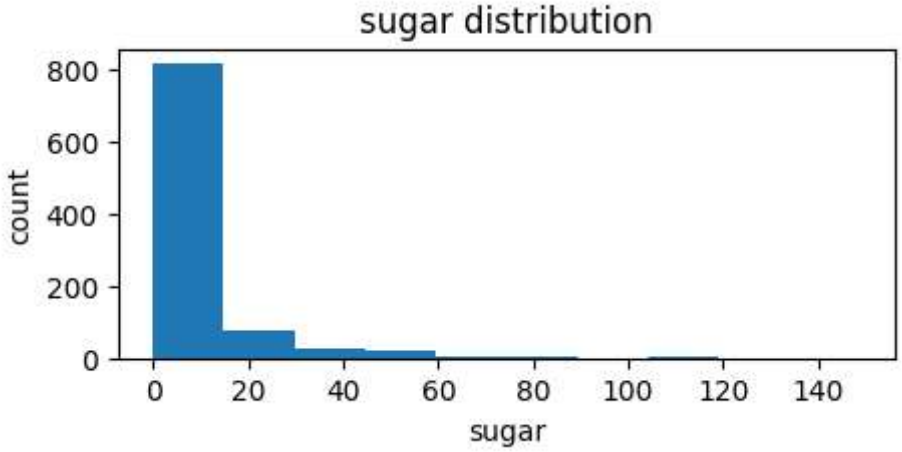
In [19]:
```
for i in df.columns.drop("high_traffic"):
    plt.figure(figsize=(5, 2))
```

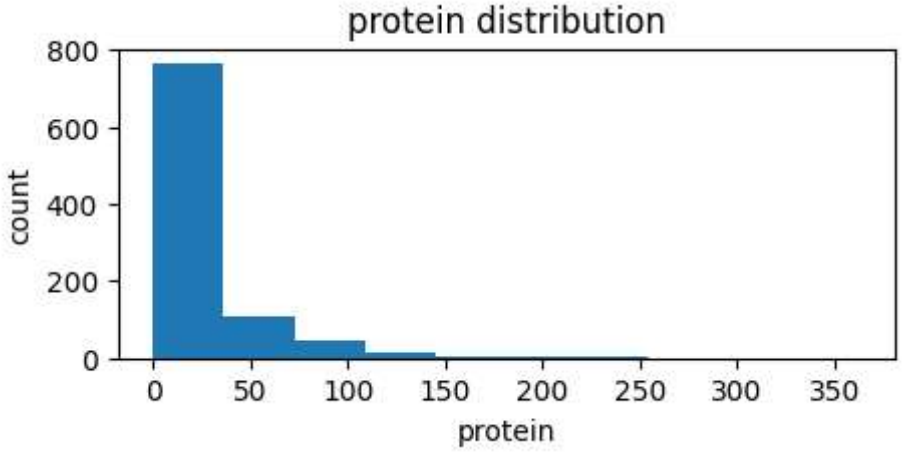
```
    plt.hist(df[i])
    plt.xlabel(i)
    plt.ylabel("count")
    plt.title(i+" distribution")
    plt.show()
```

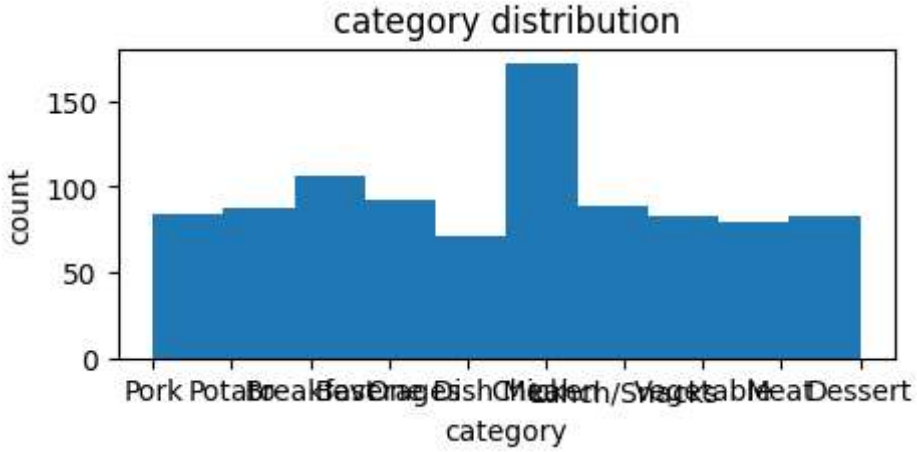


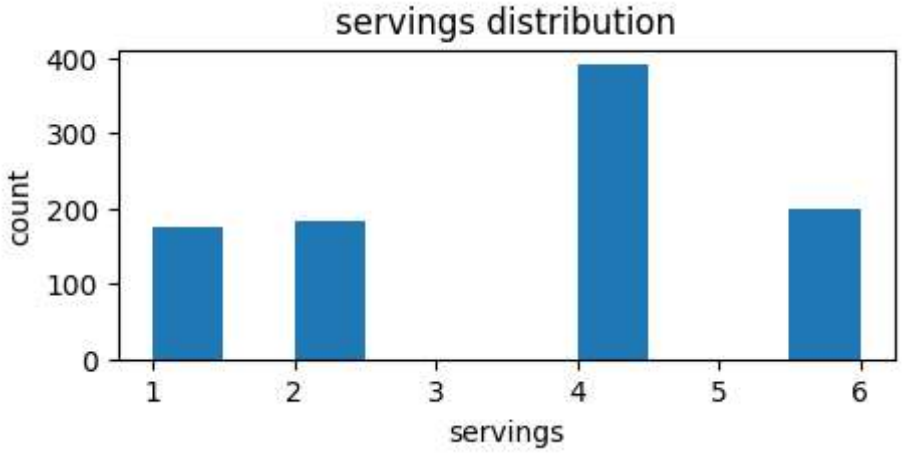






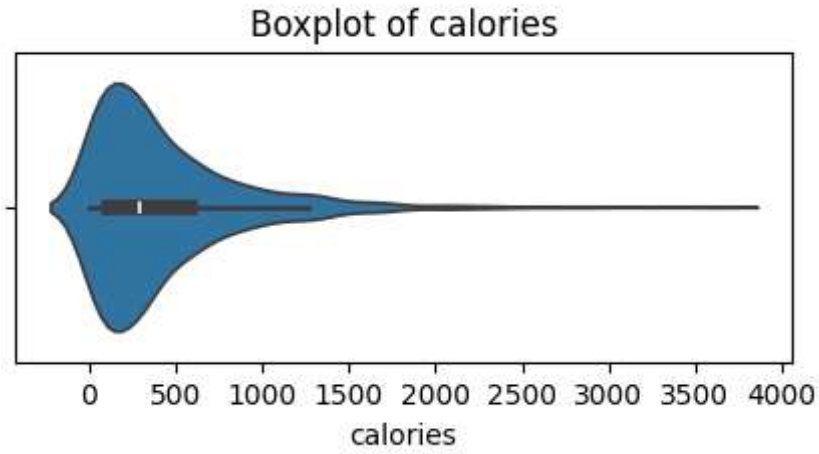


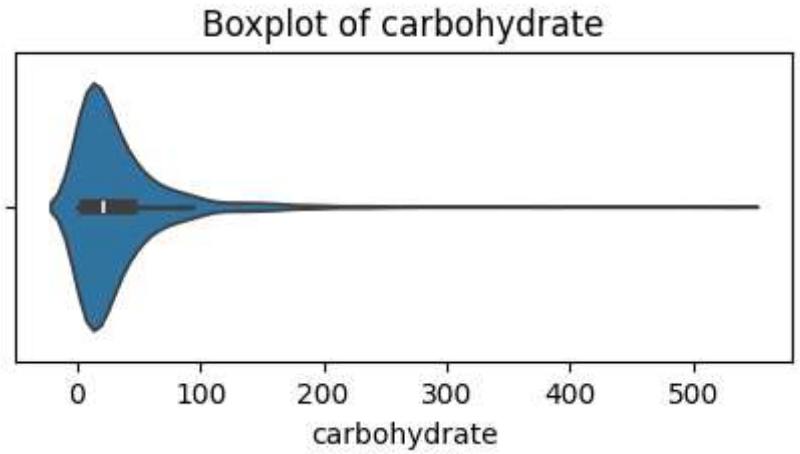


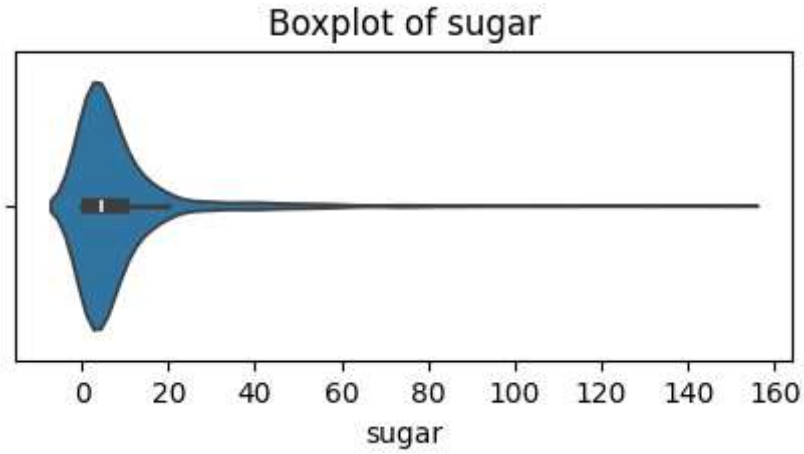


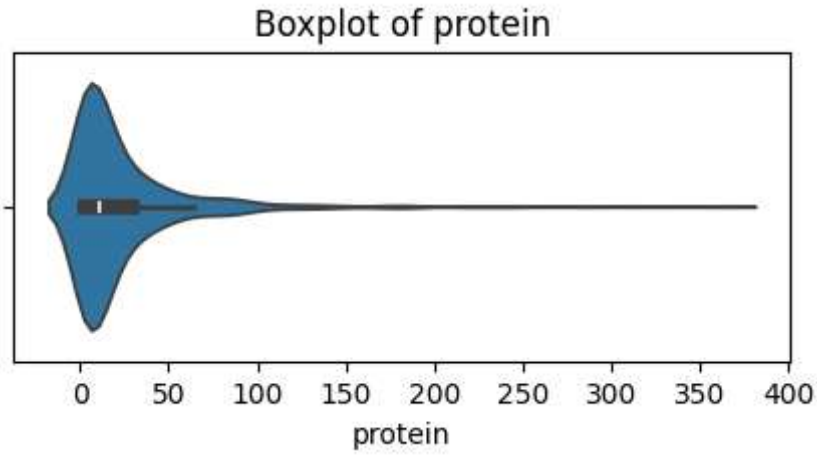
In [20]:
```
for i in df.columns.drop(["high_traffic","recipe"]):
    plt.figure(figsize=(5,2))
```

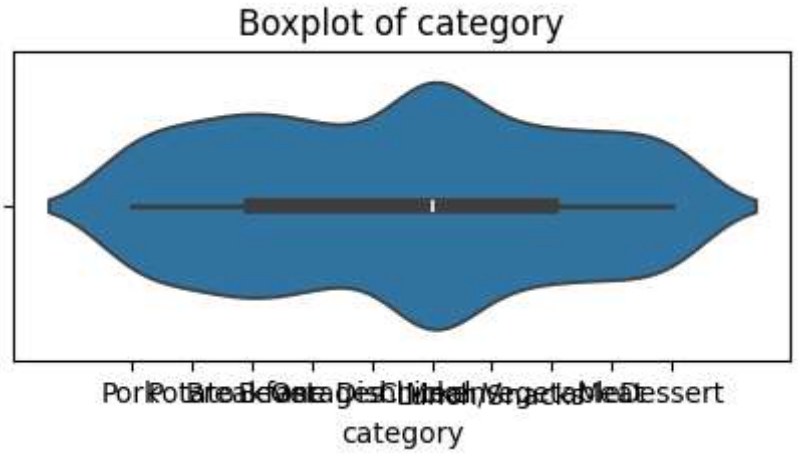
```
    sns.violinplot(x=df[i])
    plt.title("Boxplot of " + i)
    plt.show()
```

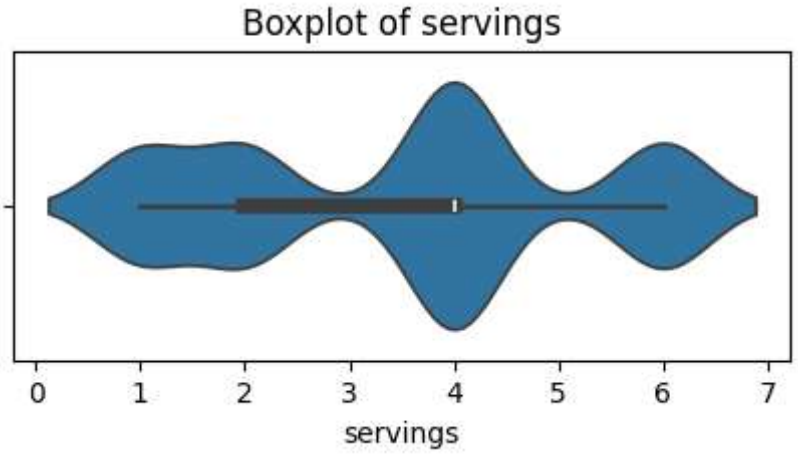












In [21]:
```
from sklearn.preprocessing import OneHotEncoder
encoder = OneHotEncoder(handle_unknown="ignore", sparse_output=False)

encoded_cat = encoder.fit_transform(df[["category"]])

# 转回 DataFrame
encoded_df = pd.DataFrame(encoded_cat, columns=encoder.get_feature_names_out(["c

# 合并回数据
df_encoded = pd.concat([df.drop(columns=["category"]), encoded_df], axis=1)

df_encoded["high_traffic"] = df_encoded["high_traffic"].map({"High": 1, "Low": 0
X = df_encoded.drop(columns=["high_traffic", "recipe"])
y = df_encoded["high_traffic"]
```

In [22]:
```
from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(
    X, y, test_size=0.2, random_state=42, stratify=y
)
```

In [23]:
```
from sklearn.linear_model import LogisticRegression

logit = LogisticRegression(max_iter=50000)
logit.fit(X_train, y_train)
from sklearn.metrics import accuracy_score, classification_report, confusion_mat

y_pred = logit.predict(X_test)

print("Accuracy:", accuracy_score(y_test, y_pred))
print("\nClassification Report:\n", classification_report(y_test, y_pred))
print("\nConfusion Matrix:\n", confusion_matrix(y_test, y_pred))
```

```
Accuracy: 0.7736842105263158

Classification Report:
              precision    recall  f1-score   support

           0       0.69      0.79      0.73        75
           1       0.85      0.77      0.80       115

    accuracy                           0.77       190
   macro avg       0.77      0.78      0.77       190
weighted avg       0.78      0.77      0.78       190


Confusion Matrix:
 [[59 16]
 [27 88]]
```

In [24]:
```
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score, classification_report, confusion_mat

rf = RandomForestClassifier(
    n_estimators=300,
    random_state=42,
    class_weight='balanced',
)

rf.fit(X_train, y_train)

y_pred = rf.predict(X_test)

print("Accuracy:", accuracy_score(y_test, y_pred))
print(classification_report(y_test, y_pred))
print(confusion_matrix(y_test, y_pred))
```

```
Accuracy: 0.7315789473684211
              precision    recall  f1-score   support

           0       0.64      0.72      0.68        75
           1       0.80      0.74      0.77       115

    accuracy                           0.73       190
   macro avg       0.72      0.73      0.72       190
weighted avg       0.74      0.73      0.73       190

[[54 21]
 [30 85]]
```

In [25]:
```
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score, classification_report, confusion_mat


logit = LogisticRegression(max_iter=50000)
logit.fit(X_train, y_train)


y_proba = logit.predict_proba(X_test)[:, 1]


threshold = 0.43
y_pred_new = (y_proba >= threshold).astype(int)


print("Threshold:", threshold)
print("Accuracy:", accuracy_score(y_test, y_pred_new))
print("\nClassification Report:\n", classification_report(y_test, y_pred_new))
print("\nConfusion Matrix:\n", confusion_matrix(y_test, y_pred_new))
```

```
Threshold: 0.43
Accuracy: 0.7684210526315789

Classification Report:
              precision    recall  f1-score   support

           0       0.70      0.72      0.71        75
           1       0.81      0.80      0.81       115

    accuracy                           0.77       190
   macro avg       0.76      0.76      0.76       190
weighted avg       0.77      0.77      0.77       190


Confusion Matrix:
 [[54 21]
 [23 92]]
```