HAVE PLAYERS IN THE NFL ON AVERAGE CHANGED IN WEIGHT FROM 1999 TO 2015?

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THE PURPOSE OF THIS REPORT IS TO ANSWER THE FOLLOWING QUESTION:

- **Are the weights of NFL players different in 1999 and 2015?**
- **Is a player weighing 226lb too light to be a member of the NFL?**

1. Introduction

》》 The objective of this report is to analyze changes in NFL player weights between 1999 and 2015 and to assess whether a player weighing 226lbs is considered too light to participate in the NFL in 2015. To achieve this, we will utilize sample player data obtained from http://nflsavant.com/about.php for the years 1999 and 2015. Our analysis will involve the construction of 95% confidence intervals for the mean player weights in both 1999 and 2015. Furthermore, we will create 95% confidence intervals for the difference between the mean weights of these two years. We will complement this with two-tailed hypothesis tests using t-statistics to determine if there is a significant difference between the means at a significance level of 0.05. Additionally, we will conduct a right-tailed hypothesis test using a t-statistic to assess whether the mean player weight in 2015 is greater than 226lbs at a significance level of 0.05.

2. Data Visualization

1999 NFL Roster Weight Distribution

2015 NFL Roster Weight Distribution
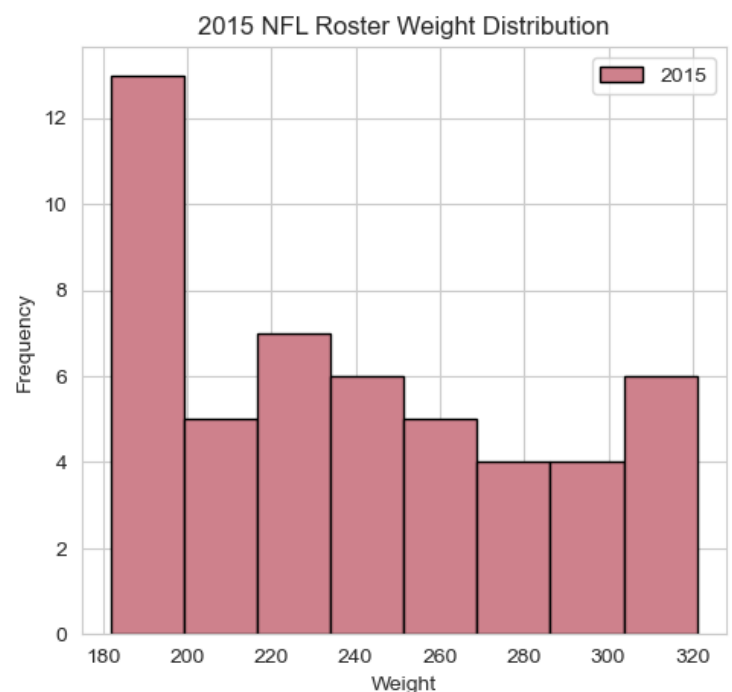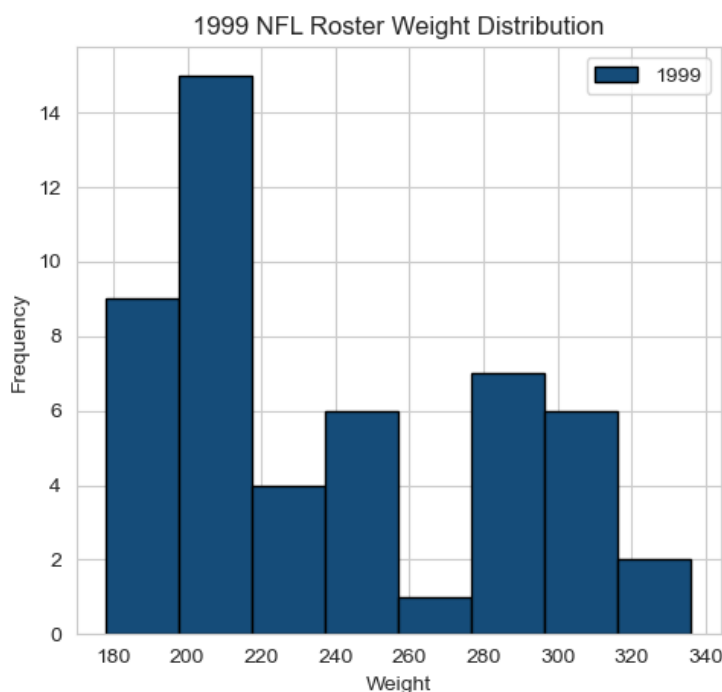
》 The histogram displayed above provides a visual representation of player weight distributions for both 1999 and 2015. These distributions share several similarities. Firstly, both exhibit prominent peaks on the left side, resulting in mild rightward skewness with skewness values of 0.51 and 0.58 for 1999 and 2015, respectively.

In terms of the weight ranges, the distribution for 1999 spans a range of 158 units, with a minimum weight of 178 and a maximum weight of 336. Conversely, the 2015 distribution covers a range of 139 units, ranging from a minimum of 182 to a maximum of 321.

Notably, the difference in standard deviations between NFL player weights for 1999 (45.29) and 2015 (42.47) is a mere 2.82 units.

》 The similarities between the player weight distributions for 1999 and 2015 becomes even more apparent when visualized through the overlapping histograms and KDE (Kernel Density Estimation) plots depicted below.
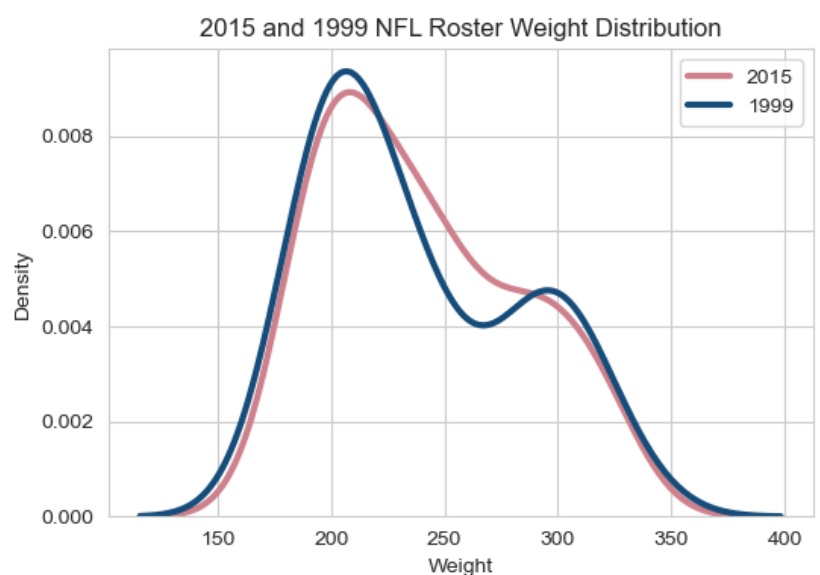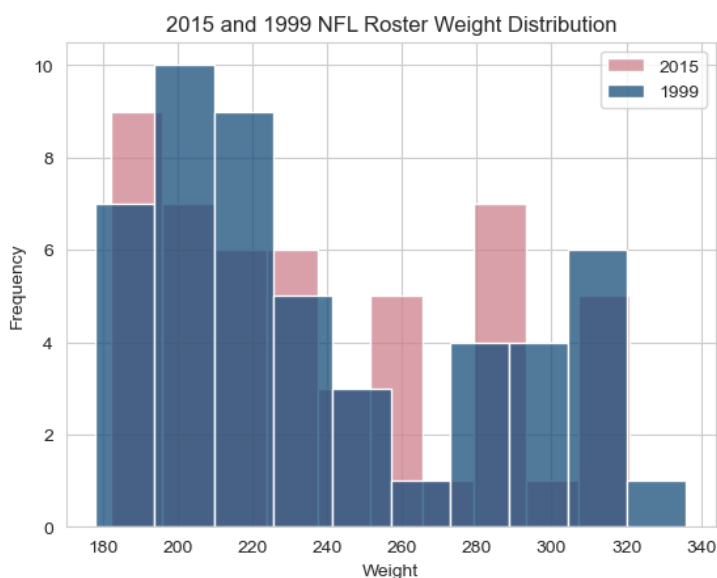
3. Descriptive Statistics

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Statistics	1999 Player Weights
Mean	238.68
Median	224.00
stDev	45.29
Q1	202.25
Q3	283.00
Min	178.00
Max	336.00

The 1999 player weights exhibit a mean value of 238.68, surpassing the median value of 224. This disparity between the mean and median suggests a slight rightward skew in the distribution. The data has a spread of 158 units, with the minimum weight recorded at 178, and the maximum at 336. Additionally, the standard deviation, which measures the

dispersion of data points from the mean, is calculated to be 45.29. These statistical findings corroborate the observations made from the visual representation of the data.

Statistics	2015 Player Weights
Mean	240.34
Median	232.50
stDev	42.47
Q1	200.00
Q3	279.25
Min	182.00
Max	321.00

The 2015 player weights exhibit a mean value of 240.34, surpassing the median value of 232.50. This disparity between the mean and median suggests a slight rightward skew in the distribution. The data has a spread of 139 units, with the minimum weight recorded at 182, and the maximum at 321. Additionally, the standard deviation, which measures the dispersion of data points from the mean, is calculated to be 42.47. These statistical findings corroborate the observations made from the visual representation of the data.

Upon analyzing the visual representations and summary statistics for player weights in both the 1999 and 2015 datasets, it becomes evident that the median serves as the most suitable point estimate for the central tendency of the entire NFL player population. This preference for the median arises from the mild rightward skew observed in the data, where the mean can be significantly affected by extreme values. Therefore, the median provides a more robust representation of the central tendency in this context.

4. Confidence Intervals

The primary purpose of a confidence interval is to furnish a range that contains the actual center or mean of a population, with a specified level of confidence. Here are the confidence intervals for the mean weight of NFL players in the years 1999 and 2015.

NFL Roster	Confidence Interval at 95%
1999 Roster	(225.81, 251.55)
2015 Roster	(228.27, 252.41)

In alignment with the patterns observed in the visualized data and summary statistics, the confidence intervals similarly imply that there is minimal distinction between the weights of NFL players in 1999 and 2015. These intervals exhibit remarkable similarity, differing by only a margin of 1.60 units in their span.

NFL Roster 1999 & 2015	Confidence Interval at 95%
Difference between the mean weights of 1999 and 2015 NFL players	(-15.81, 19.13)

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5. Hypothesis Test 1

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Two-Tailed T-Statistic Hypothesis Test
Python function used: st.ttest_ind()

Assumptions: μ_1 represents the mean weight of 2015 NFL players and μ_2 represents the mean weight of 1999 NFL players.

CLAIM: The mean weight of NFL players in 2015 is NOT the same as the mean weight of NFL players in 1999.

$$\mu_1 - \mu_2 \neq 0$$

Null and Alternative Hypothesis:

Null: The mean weight for NFL players in 2015 is the same as the mean weight of NFL players in 1999.
Alternative: The mean weight for NFL players in 2015 is NOT the same as the mean weight of NFL players in 1999.

$$H_0: \mu_1 - \mu_2 = 0$$
$$H_1: \mu_1 - \mu_2 \neq 0$$

Significance Level: alpha = 0.05

Test Statistic: t- statistic = 0.19

P-Value: 0.8505

Result: We fail to reject the null hypothesis, indicating that there is insufficient evidence to substantiate the claim that the mean weight of NFL players in 2015 differs from that of 1999. This outcome is based on the p-value exceeding the significance level of 0.05. Supporting this conclusion, both the confidence intervals for the mean weight in 2015 and 1999 substantially overlap. Furthermore, the confidence interval for the difference between the mean weights of NFL players in 2015 and 1999 also reinforces this conclusion since it encompasses the value 0.

Hypothesis Test for the Difference Between the 2015 and 1999 NFL Weights
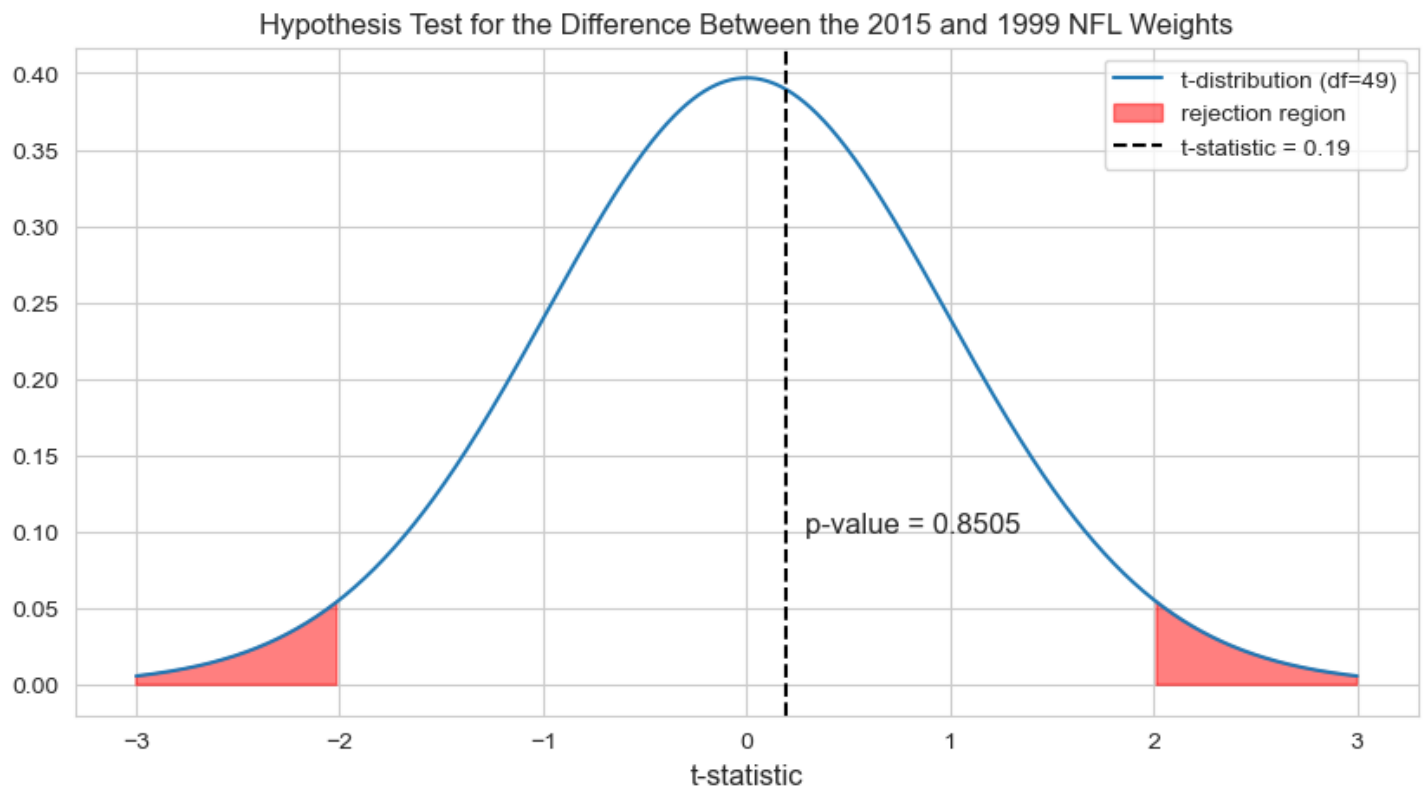
6. Hypothesis Test 2

≫ **Right-Tailed T-Statistic Hypothesis Test**
Python function used: st.ttest_1samp()

Assumptions: **μ** represents the mean weight of 2015 NFL

CLAIM: The mean weight of NFL players in 2015 is greater than 226

$$\mu > 226$$

Null and Alternative Hypothesis:

Null: The mean weight for NFL players in 2015 is 226.
Alternative: The mean weight for NFL players in 2015 is greater than 226.
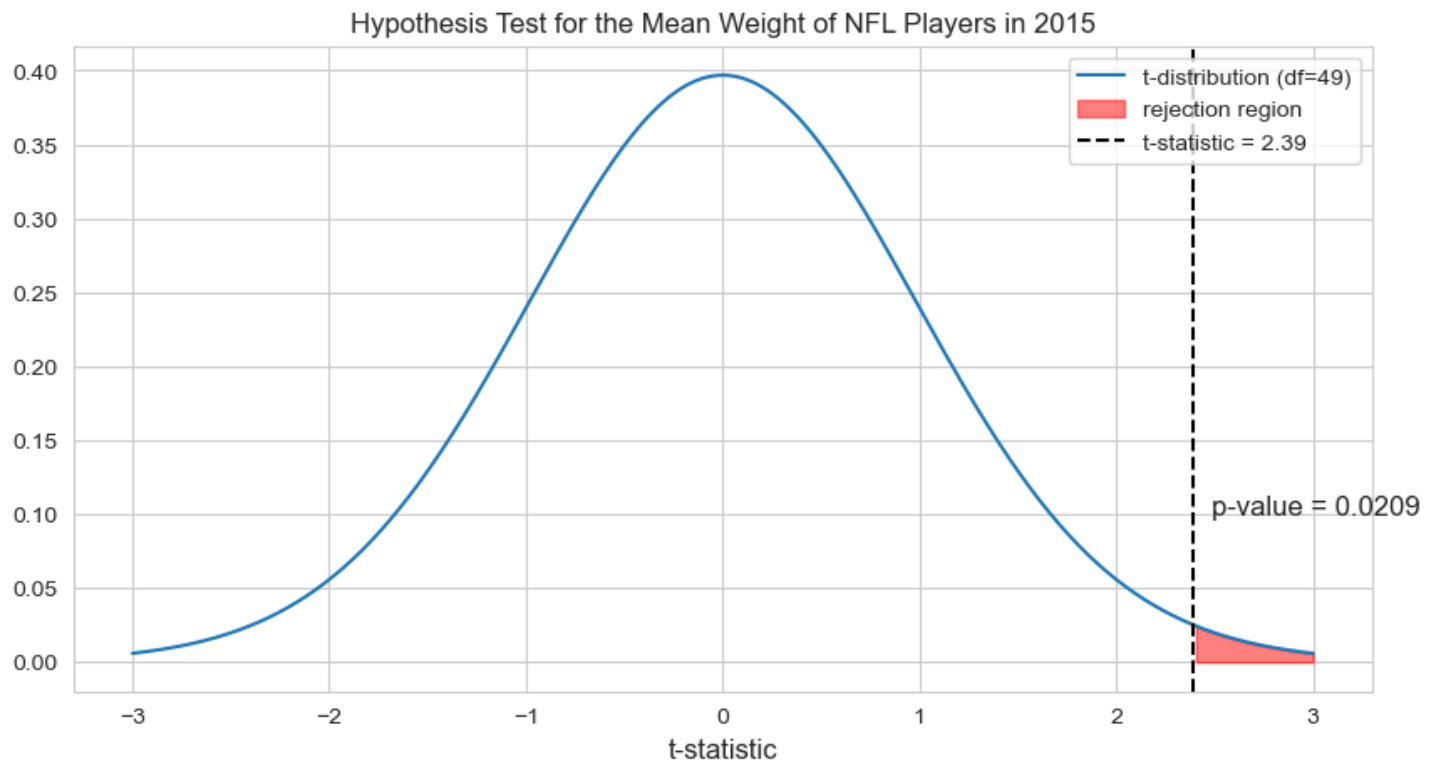
$$H_0: \mu = 226$$

$$H_1: \mu > 226$$

Significance Level: alpha = 0.01

Test Statistic: t- statistic = 2.39

P-Value: 0.0209

Result: Fail to reject the null hypothesis. There is not sufficient evidence to support the claim that the mean weight of NFL players in 2015 is greater than 226 pounds. Therefore, by means of this hypothesis test our player at 226 pounds is not too light to play in the NFL in 2015.

Hypothesis Test for the Mean Weight of NFL Players in 2015

》》 **Right-Tailed Z-Statistic Hypothesis Test**
Python function used: statsmodels.stats.weightstats.ztest()

Assumptions: μ represents the mean weight of 2015 NFL

CLAIM: The mean weight of NFL players in 2015 is greater than 226

$$\mu > 226$$

Null and Alternative Hypothesis:

Null: The mean weight for NFL players in 2015 is 226.
Alternative: The mean weight for NFL players in 2015 is greater than 226.
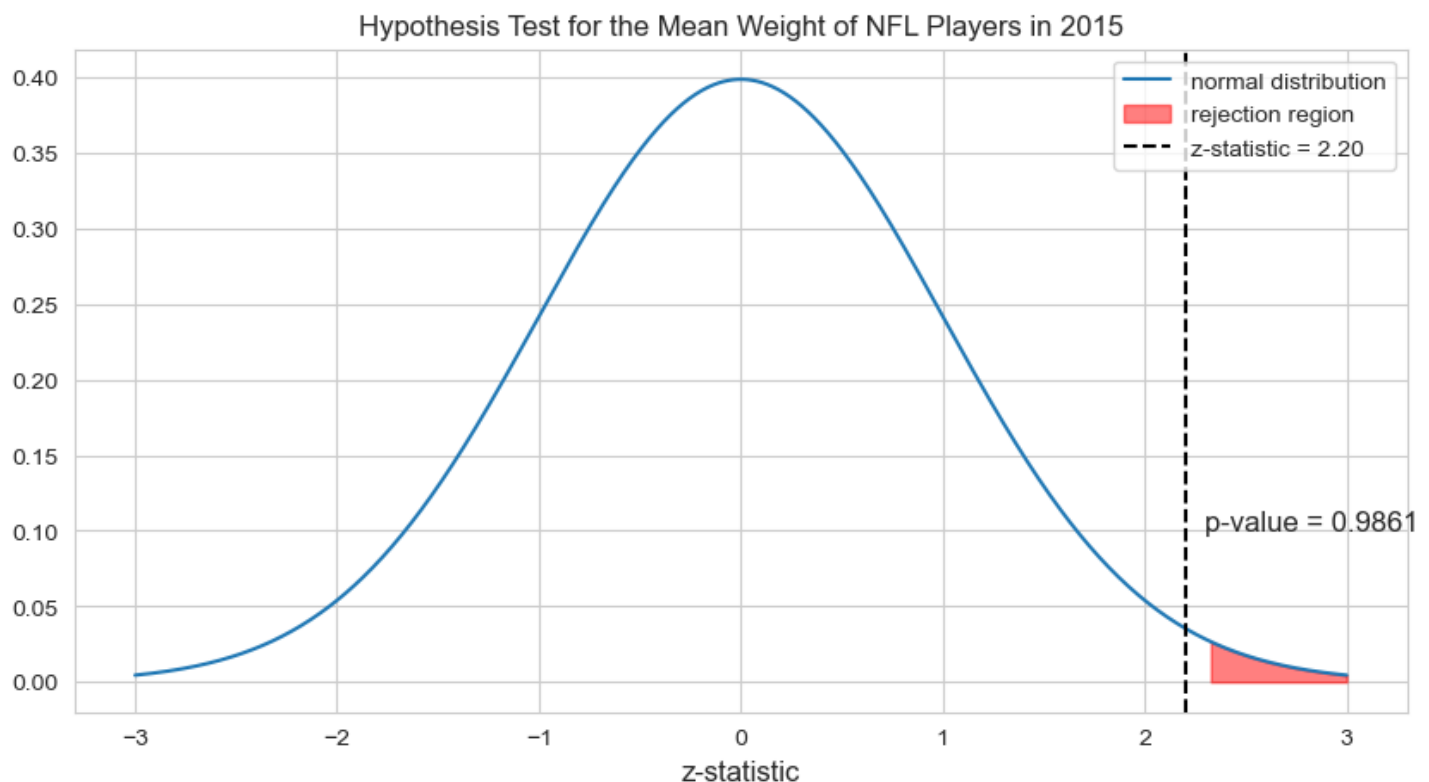
$$H_0: \mu = 226$$

$$H_1: \mu > 226$$

Significance Level: alpha = 0.01

Test Statistic: z- statistic = 2.20

P-Value: 0.9861

Result: Fail to reject the null hypothesis. There is not sufficient evidence to support the claim that the mean weight of NFL players in 2015 is greater than 226 pounds. Therefore, by means of this hypothesis test our player at 226 pounds is not too light to play in the NFL in 2015.

SUMMARY CONCLUSION:

In this report, we have undertaken an in-depth analysis of NFL player weights for the years 1999 and 2015. Our exploration included the use of visual aids such as distribution graphs and summary statistics. Additionally, we computed confidence intervals for the mean weights of NFL players in both 1999 and 2015, along with the confidence interval for the difference between these two means. All confidence intervals were calculated at a 95% confidence level. Furthermore, we conducted a hypothesis test to evaluate the claim that NFL player weights underwent a change between 1999 and 2015. Finally, we presented the outcomes of a hypothesis test aiming to determine whether the mean weight of NFL players in 2015 exceeded 226 pounds.

The outcomes of the hypothesis test, which aimed to evaluate the variation in NFL player weights between 1999 and 2015, ultimately led to the conclusion that we could not reject the null hypothesis. This implies that there was no significant change in player weights between these two years. This conclusion is further substantiated by the graphical representation of the data and the confidence intervals that were calculated.

Regarding the hypothesis tests on the mean weight of NFL players in 2015 surpassing 226 pounds, the null hypothesis, suggesting that the mean weight in 2015 equaled 226 pounds, could not be rejected. This outcome implies that a player weighing 226 pounds is likely not underweight to play in the NFL in 2015.

However, it's important to note that our analysis considered all NFL player positions as a single group, and we did not have information about the specific position of the player in question. This lack of position-specific data could potentially yield different results. To obtain a more precise determination, additional testing could be pursued. This might involve calculating confidence intervals and conducting hypothesis tests for specific position groups, such as offense, defense, and special teams, or further subgrouping by position. Consequently, based on the current data and analysis, we lack sufficient information to definitively determine whether a player at 226 pounds is too light to participate in the NFL in 2015.