

# Perform a One Sample t-Test in SAS

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## RECOMMENDED CITATION

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The [one sample t-test](#) stands as a cornerstone in inferential statistics, serving as a powerful tool to evaluate whether the true [population mean](#) ( $\mu$ ) of a continuous variable deviates significantly from a specific, hypothesized value. This test is essential when analyzing data derived from a random sample, allowing researchers to draw conclusions about the larger population.

This comprehensive tutorial is meticulously designed to guide users through the entire workflow--from data preparation to results interpretation--for executing a [one sample t-test](#) utilizing the industry-standard statistical analysis system, [SAS](#).

## Case Study: Testing Plant Growth Against a Standard

To illustrate the practical application of the one sample t-test, let us examine a study conducted by a developmental botanist. The botanist is interested in determining if a newly cultivated plant species achieves a specific benchmark height. Her established hypothesis suggests that the true [population mean](#) height for this species is exactly 15 inches.

To empirically test this hypothesis, the researcher gathered a random and representative **sample** consisting of 12 plants. The heights were carefully measured in inches, yielding the following observations: 14, 14, 16, 13, 12, 17, 15, 14, 15, 13, 15, and 14. This collected data forms the basis for our statistical investigation.

Our objective is to employ the structured analytical capabilities of [SAS](#) to perform the [one sample t-test](#). The ultimate goal is to ascertain whether the evidence derived from the sample provides statistically significant support to reject the claim that the population **mean** height is 15 inches.

### Step 1: Structuring and Loading Data with a SAS Data Step

The foundational step in any statistical analysis within **SAS** involves defining and loading the raw data into a structured dataset. We accomplish this efficiently using the `DATA` step, which is responsible for creating the dataset and assigning values to variables. In our case, we name the dataset `my_data` and define a single variable, `Height`, to hold the collected measurements.

The code below utilizes the `DATALINES` statement to input the 12 observed plant heights directly into the program environment. Following the data input, the `PROC PRINT` procedure is used as a verification step, ensuring that the data has been imported correctly and is ready for analysis.

```
/*create dataset*/  
data my_data;  
input Height;  
datalines;  
14
```

```
14  
16  
13  
12  
17  
15  
14  
15  
13  
15  
14  
;  
run;  
  
/*print dataset*/  
proc print data=my_data;
```

The successful execution of this code generates the output shown below, confirming the structure of the `my_data` table:

Obs	Height
1	14
2	14
3	16
4	13
5	12
6	17
7	15
8	14
9	15
10	13
11	15
12	14

## Step 2: Executing the Hypothesis Test Using PROC TTEST

With the dataset successfully loaded, we proceed to the core analytical step utilizing the `PROC TTEST` procedure in [SAS](#). This procedure is specifically designed to perform t-tests, including the

one sample variant. To correctly configure the test against the botanist's hypothesis, several critical parameters must be specified within the procedure statement.

The `PROC TTEST` statement requires us to explicitly define the parameters that govern the test's structure and criteria. We must specify the dataset, the directionality of the test, the risk level (alpha), and the benchmark value we are testing against (the null value). The `VAR` statement then selects the continuous variable--`Height`--upon which the analysis will be performed.

Key parameters used in the SAS code:

`data=my_data`: Identifies the input source containing the observations.

`sides=2`: Establishes a **two-sided test** (or two-tailed test), meaning we are testing for a difference in the mean in either direction (i.e.,  $\mu \neq 15$ ).

`alpha=0.05`: Sets the predetermined **significance level** ( $\alpha$ ), which represents the maximum acceptable probability of committing a Type I error.

`h0=15`: Specifies the hypothesized value under the **null hypothesis** ( $H_0$ ), which is the assumed population **mean** height of 15 inches.

**`/*perform one sample t-test*/`**

**`proc ttest data=my_data sides=2 alpha=0.05 h0=15;`**

**`var Height;`**

**`run;`**

Executing the code yields the detailed statistical output that must now be systematically interpreted:

The TTEST Procedure					
Variable: Height					
N	Mean	Std Dev	Std Err	Minimum	Maximum
12	14.3333	1.3707	0.3957	12.0000	17.0000

  

Mean	95% CL Mean	Std Dev	95% CL Std Dev
14.3333	13.4624 15.2042	1.3707	0.9710 2.3273

  

DF	t Value	Pr >  t
11	-1.68	0.1201

## Analyzing the Sample: Descriptive Statistics Output

The initial section of the `PROC TTEST` output is dedicated to presenting [descriptive statistics](#). This information provides a fundamental summary of the sample data, enabling us to assess the central tendency, variability, and distribution of the plant heights before moving on to the inferential hypothesis test.

Reviewing these metrics is vital for confirming data integrity and gaining context for the subsequent test results. The table clearly summarizes the size and characteristics of the data collected by the botanist:

**N (Observations):** The sample size is confirmed as **12** individual plants.

**Mean (Sample Mean):** The calculated average height observed in this specific sample is **14.3333** inches. This value is slightly lower than the hypothesized population mean of 15 inches.

**Std Dev (Sample [Standard Deviation](#)):** The measure of spread or variability within the sample is **1.3707** inches.

**Std Error (Standard Error of the Mean):** This metric, calculated as the standard deviation divided by the square root of N ( $s/\sqrt{n}$ ), is **0.3957**. The standard error quantifies the theoretical precision of the sample mean as an estimate of the population mean.

**Range (Min/Max):** The recorded heights range from a minimum of **12** inches to a maximum of **17** inches.

## Evaluating the Confidence Interval and Inferential Test Statistics

The second crucial element of the output focuses on inferential statistics, specifically the 95% [Confidence Interval](#) (C.I.) for the true population mean ( $\mu$ ). This interval provides a range of plausible values for the population mean based on the observed sample data.

The calculated 95% C.I. for  $\mu$  is . A key principle in hypothesis testing using confidence intervals is that if the hypothesized value ( $H_0 = 15$ ) falls within this range, we do not have strong statistical evidence to reject the [null hypothesis](#). Since 15 is included in this interval, the initial assessment suggests a failure to reject  $H_0$ .

The third table contains the definitive results of the t-test, providing the standardized test statistic and the associated probability value. These values are paramount for making the final decision regarding the research question. The output reveals the following critical statistics:

**t Test Statistic: -1.68**

**p-value: 0.1201**

The t test statistic quantifies how many standard errors the sample mean is away from the

hypothesized population mean. It is derived using the following relationship, confirming the calculated value:

Formula:  $t = (\text{Sample Mean} - \text{Hypothesized Mean}) / (\text{Standard Error})$

Substitution:  $t = (14.3333 - 15) / (1.3707/\sqrt{12})$

Result:  $t = -1.68$

## Drawing a Formal Conclusion Based on Hypothesis Testing

To conclude the analysis, we reference the formal structure of the hypothesis test. For this two-tailed procedure, the **null** and **alternative hypotheses** were defined as follows:

**H0 (Null Hypothesis):** The population mean height ( $\mu$ ) is equal to 15 inches.

**HA (Alternative Hypothesis):** The population mean height ( $\mu$ ) is not equal to 15 inches.

The established criterion for decision-making requires comparing the calculated probability value (the p-value) against the predetermined significance level ( $\alpha = 0.05$ ). If the **p-value** is less than alpha, the result is deemed statistically significant, leading to the rejection of the null hypothesis.

In this specific test, the calculated **p-value** is **0.1201**. Since 0.1201 is demonstrably greater than the threshold of 0.05, we consequently **fail to reject the null hypothesis** (H0).

In practical terms, this result suggests that the observed difference between the sample mean (14.3333 inches) and the hypothesized population mean (15 inches) is not statistically significant at the 5% level. The botanist therefore lacks sufficient statistical evidence to conclude that the true **mean** height of the plant species deviates from 15 inches.

## Further Exploration of Statistical Procedures in SAS

To advance your statistical proficiency, consider exploring other procedures available within the powerful **SAS** environment. The following resources offer guidance on executing frequently used statistical tests and analyses: