

Project 3: Two Sample Hypothesis  
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Part 1: FEV Dataset

- a. Compare mean FEV between each age group (boys and girls)

**Step 1:** We want to compare the mean FEV levels between boys and girls between distinct age groups (5-9, 10-14, and 15-19 years).

**Step 2:** The level of significance is  $\alpha = 0.05$ .

**Step 3:**

	Ages 5-9	Ages 10-14	Ages 15-19
T-statistic	1.1129	5.3381	8.3764
P-value	0.2666	0.0000001880	0.00000000007026

**Steps 4 & 5:** Since the P-value for the 5-9 age group is greater than 0.05, we have evidence in favor of the null hypothesis. This means that we cannot claim that there is a significant difference in FEV levels between boys and girls between ages 5-9.

Looking at the P-values for ages 10-14 and 15-19, the small numbers suggest that the chances of observing such differences between FEV levels by chance is very low. Or in other words, Sex seems to play a major role in determining FEV levels. For these reasons, we can confidently reject the null hypothesis, in favor of the alternative hypothesis for age groups 10-14, and 15-19.

- b. Compare mean FEV between smokers and nonsmokers separately for each age group (boys and girls)

**Step 1:** We want to compare the mean FEV levels between boys and girls that smoke vs boys and girls that not smoke (separately for each age group)

**Step 2:** The level of significance is  $\alpha = 0.05$ .

**Step 3:**

**SMOKE vs NON-SMOKE (boys)**

	Ages 10-14	Ages 15-19
T-statistic	1.8667	-2.3047
P-value	0.0638	0.0297

**SMOKE vs NON-SMOKE (girls)**

	<b>Ages 10-14</b>	<b>Ages 15-19</b>
<b>T-statistic</b>	<b>2.0438</b>	<b>0.0428</b>
<b>P-value</b>	<b>0.0428</b>	<b>0.1227</b>

As we can see from the tables, we have a P-value lower than 0.05 for boys ages 15-19, and girls ages 10-14. This means that there is a significant difference in FEV levels between those two groups, and we can reject the null hypothesis. The other two groups, however, have P-values greater than 0.05. The girls aged 15-19 in particular have a very large P-value. This means that we cannot conclude that there is a significant difference in FEV between Smoking and Non-smoking for this group.

**Part 2: HORMONE Dataset**

a.

	<b>T-statistic</b>	<b>P-value</b>
Biliary Secretion Difference	3.2208	0.0127
Biliary pH Difference	4.1552	0.0026
Pancreatic Secretion difference	6.2219	0.000073087
Pancreatic pH Difference	4.0145	0.0033

Based on the P-values, we can see that there is a significant difference between each secretion and pH difference among all hormones and saline. This gives us evidence to reject the null hypothesis.

b. Saline vs Each Hormone:

<b>Saline vs APP</b>	<b>T-statistic</b>	<b>P-value</b>
Biliary Secretion Difference	1.0701	0.2886
Biliary pH Difference	2.7522	0.0077
Pancreatic Secretion difference	1.1546	0.2525
Pancreatic pH Difference	2.5228	0.0141

<b>Saline vs CCK</b>	<b>T-statistic</b>	<b>P-value</b>
Biliary Secretion Difference	-0.8180	0.4143
Biliary pH Difference	-1.2882	0.1991
Pancreatic Secretion difference	-1.9680	0.0504
Pancreatic pH Difference	0.4040	0.6866

<b>Saline vs SEC</b>	<b>T-statistic</b>	<b>P-value</b>
Biliary Secretion Difference	2.3162	0.0236
Biliary pH Difference	0.5416	0.5899
Pancreatic Secretion difference	-0.0470	0.9625
Pancreatic pH Difference	0.5899	0.6309

<b>Saline vs VIP</b>	<b>T-statistic</b>	<b>P-value</b>
Biliary Secretion Difference	-0.5653	0.5726
Biliary pH Difference	-0.9386	0.3493
Pancreatic Secretion difference	-2.2725	0.0244
Pancreatic pH Difference	0.012069219	0.990385615

Results for part b:

**Saline vs APP:** Comparing the P-values to the level of significance (0.05), we can see that there are significant changes in Biliary and Pancreatic pH levels. This means that we have sufficient evidence to reject the null hypothesis.

**Saline vs CCK:** Based on these P-values, we can conclude that there is no evidence indicating a difference between each of these specific hormones compared to the placebo. Because of this, we can accept the null hypothesis for this hormone.

**Saline vs SEC:** As we can see here, we have very high P-values for this hormone, with the exception of biliary secretion. This tells us that there is a significant difference between biliary secretion of this hormone compared to the placebo, but not with the pH levels or pancreatic secretion. Based on this, we can reject the null hypothesis for the biliary secretion, and reject the alternative hypothesis for each other category.

**Saline vs VIP:** Similar to the SEC hormone, we can see very high P-values, aside from the pancreatic secretion. This tells us that there are significant differences between pancreatic secretion between saline and VIP, but not with any of the pH levels or biliary secretion. We can reject the null hypothesis for pancreatic secretion, and reject the alternative hypothesis for everything else.

c. Dose-response Relationship

High-Dose vs Low-Dose	T-statistic	P-value
Biliary Secretion Difference	0.8983	0.3695
Biliary pH Difference	-0.0298	0.9761
Pancreatic Secretion difference	-0.4153	0.6781
Pancreatic pH Difference	-1.4309	0.1532

As we can see from each of the P-values being lower than 0.05, there doesn't seem to be a significant difference between secretion or pH with High Dose vs Low Dose trials. This leads me to believe that dosage doesn't have a major effect on the pH and secretion levels. Due to this, we can confidently reject the alternative hypothesis in favor of the null hypothesis.