



AP[®] Statistics 2003 Sample Student Responses Form B

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4. There have been many studies recently concerning coffee drinking and cholesterol level. While it is known that several coffee-bean components can elevate blood cholesterol level, it is thought that a new type of paper coffee filter may reduce the presence of some of these components in coffee.

The effect of the new filter on cholesterol level will be studied over a 10-week period using 300 nonsmokers who each drink 4 cups of caffeinated coffee per day. Each of these 300 participants will be assigned to one of two groups: the experimental group, who will only drink coffee that has been made with the new filter, or the control group, who will only drink coffee that has been made with the standard filter. Each participant's cholesterol level will be measured at the beginning and at the end of the study.

A

- (a) Describe an appropriate method for assigning the subjects to the two groups so that each group will have an equal number of subjects.

Each participant will be assigned a number from 1 to 300. Numbers will then be drawn from a hat (after being shuffled up), and the first 150 numbers called will be assigned to the experimental group, while the rest will go to the control group.

- (b) In this study, the researchers chose to include a group who only drank coffee that was made with the standard filter. Why is it important to include a control group in this study even though cholesterol levels will be measured at the beginning and at the end of the study?

A control group is necessary because there could be other lurking variables or confounding factors in the experiment that affect the results from the beginning to the end of the study. Having a control group gives the researchers another group with which to compare that would also be affected by these other unknown factors. In this way the control group ensures that the only variable being measured is ^{the effect of} whether or not the new filter or standard filter was used.

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(c) Which test would you conduct to determine whether the change in cholesterol level would be greater if people used the new filter rather than using the standard filter?

subjects using ~~the~~ A 2-sample t -test of ^{the} mean cholesterol level change for the new filter from beginning measurement to end measurement, as well as the mean cholesterol level change for subjects using the standard filter.

(d) Why would the researchers choose to use only nonsmokers in the study?

To reduce the variability in the data because it may be more common for smokers to have higher cholesterol than non-smokers or vice versa.

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- $n = 300$
new filter
cholesterol level
control (standard filter)
"
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The effect of the new filter on cholesterol level will be studied over a 10-week period using 300 nonsmokers who each drink 4 cups of caffeinated coffee per day. Each of these 300 participants will be assigned to one of two groups: the experimental group, who will only drink coffee that has been made with the new filter, or the control group, who will only drink coffee that has been made with the standard filter. Each participant's cholesterol level will be measured at the beginning and at the end of the study.

- (a) Describe an appropriate method for assigning the subjects to the two groups so that each group will have an equal number of subjects.

Randomization should be employed. All of the subjects should be numbered from 1 through 300. Using the random digit table, starting from upper left, the investigator should pick out the 1st 3 digits that is the number of a certain subject into a certain treatment group. The next 3 digits should be the label of the next subject. The process should be continued until that treatment group contains 150 subjects. The rest of subjects (150) becomes the other treatment group.

- (b) In this study, the researchers chose to include a group who only drank coffee that was made with the standard filter. Why is it important to include a control group in this study even though cholesterol levels will be measured at the beginning and at the end of the study?

It is important that the cholesterol level is compared between new filter and the old filter treatment group because of the possible lurking variables. For example, there might be a psychological effect on the subjects by the successive consumption of coffee. This might alter the cholesterol level of the subjects. Also, the real effect of the new filter can only be obtained through comparing it to the old filter effect because with high possibility, drinking coffee (w/ old filter) will raise the cholesterol level. Only when the difference between these treatments is observed can one conclude that the new filter is / is not effective.

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(c) Which test would you conduct to determine whether the change in cholesterol level would be greater if people used the new filter rather than using the standard filter?

I would conduct a 2 sample t hypothesis for this study, with $H_0 = \mu_{\text{new}} - \mu_{\text{old}} = 0$ and $H_a = \mu_{\text{new}} - \mu_{\text{old}} > 0$.

(d) Why would the researchers choose to use only nonsmokers in the study?

Researchers only picked nonsmokers because they thought that smoking would be a confounding variable. If smokers were also used in this study, researchers would not know whether the change in cholesterol is due to what filter the subjects used or how much the subjects smoked.

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