A Human Variation with Possible Adaptive Value

I. Introduction

Assume if you can that suddenly, for some unknown reason, our food source becomes limited to carbohydrates. Those people who can digest carbohydrates most efficiently survive. Those who cannot digest carbohydrates may die. Therefore, those humans who are best *adapted* to this sudden change in eating habits will live. Those least adapted to this change will not.

An enzyme present in human saliva, salivary amylase, begins to digest carbohydrates in the mouth. If some humans have more salivary amylase in their saliva, they would be better suited to this new environment than humans having little salivary amylase. Do humans have variation in the amount of amylase? Would this variation become an advantage for persons having more amylase if diets restricted to carbohydrates?

II. Objective

(a) use the iodine test to indicate the change of starch to sugar
(b) determine how long it takes for a given amount of your salivary amylase to chemically change starch into sugar
(c) determine if all students have similar or different amounts of salivary amylase
(d) determine if there is variation of a genetic trait in a population (your class) and determine if this variation has possible adaptive value

III. Materials

1. Test tubs – 16
2. I-KI solution
3. Graduated cylinder
4. Test tube rack
5. Beaker
6. Clock or watch with second hand
7. Medicine dropper
8. Starch solution
9. Water

IV. Procedure

1. Add 2 ml of I-KI solution to each of 15 test tubes placed in a rack.
2. Prepare a 6% saliva solution. Collect 1 ml of your saliva in a graduated cylinder. Then pour the saliva into a beaker containing 17 ml of water. Mix the saliva and water.
3. Fill the clean test tube with 7 ml of starch solution.
4. Add 1 ml of you 6% saliva solution to the starch solution. Mix the contents by inverting the test tube. *Note the exact time* you mixed the starch and saliva solutions.
5. After two minutes, remove some starch-saliva mixture from the test tube with a medicine dropper. Add two drops to the first test tube containing I-KI solution. Return the rest of the contents of the dropper to the starch-saliva mixture.
6. Record in Table 44-1 the color change (if any) in the I-KI solution.
7. At two-minute intervals, add two drops of starch-saliva mixture to each of the remaining test tubes of I-KI solution. Record any color change in Table 44-1.
8. Continue with the two-minute intervals until all test tubes of I-KI solution have been used up, or until a blue-black color *no longer appears* in the I-KI test tubes.
   The appearance of a blue color in the I-KI solution indicates starch is present. The saliva has not yet changed it. No blue color in the I-KI solution means that the saliva has changed all of the starch to sugar.
9. Indicate in Table 44-2 the total number of studnets (if any) who completed starch change within each of the two minute intervals.

Table 44-1. Individual Results

Two-minute intervals	Color of I-KI solution
2	
4	
6	
8	
10	
12	
14	

16	
18	
20	
22	
24	
26	
28	
30	

Table 44-2. Class Results

Time in minutes for complete change	Number of students
2	
4	
6	
8	
10	
12	
14	
16	
18	
20	
22	
24	
26	
28	
30	

V. Analysis

1. Persons with little amylase in their saliva should take longer to digest the 7 ml of starch than persons with much amylase. (a) What length of time was needed for your saliva to digest the starch? _____ (b) How does your time compare to the time needed by other students?
   _____ (c) How does your amylase amount comp are to the amount of other students?
   _____
2. If the problem stated in the introduction were to become reality, which students in your class would most likely survive, those with the longest recorded times needed to have no effect on the I-KI solution of those with the shortest recorded time?
   _____
   Explain._____
   _____
3. Do your experimental class results show variation of amylase produced in saliva?_____
   Explain._____
   _____
4. Do your experimental class results show chemical variation among humans? _____
   Explain._____
   _____
5. Does your understanding of the experiment help to illustrate that survival of the fittest means those most genetically fit can survive this change in diet? _____
   Explain._____
   _____
6. What is the source of this chemical variation (is it genetic)? _____ When did the chemical variation occur (before or during the experiment)? _____ Do you think most variations occur before they are adaptive? _____
   Explain._____
   _____
7. Prepare a horizontal bar graph using your data from Table 44-2 and the graph outline on the next page.
   <graph>