RBCHS HB: Lab 16 Grip Strength Analysis

I want to...

Total Score: _____ / 40

Learning Objectives

In this experiment, you will

1. Measure and compare grip strength of your right and left hands.
2. Correlate grip strength with gender and certain physical characteristics.
3. Compare the pinch strengths of the individual fingers of the dominant hand.

Background

The importance of hand strength and function is evident in all aspects of our daily living, from eating and maintaining personal hygiene to keyboarding at the computer, performing brain surgery, or playing tennis or the piano. People suffering from arthritis or hand injury quickly appreciate the difficulty of performing even the most mundane tasks with reduced grip strength.

In Part I of this experiment, you will measure and compare grip strength in your right and left hands. You will also correlate grip strength with gender, handedness, and height. In Part II you will analyze the pinch strength of each of your four fingers.

1. Write a research question based on the above lab objectives and background information.

Hint: *What will you be testing in this lab?*

Score: 0 / 1

2. Based on the research question, write a hypothesis you could test based on your research question.

Score: 0 / 1

3. **Read the protocol for the Experiment to ensure you understand the steps used to collect data for this experiment.**
   Part I: Hand Grip Strength Comparison

1. Have the subject sit with his or her back straight and feet flat on the floor. The Hand Dynamometer should be held in the right hand. The elbow should be at a 90° angle, with the arm unsupported and their eyes averted from the screen.
2. Click Collect; collect data for 2 seconds for a baseline then have the test subject squeeze, using the right hand, as hard as possible for 8 more seconds.
3. Choose **Store Latest Run** from the Experiment menu to store the data.
4. Repeat with the left hand.
5. Highlight from 4 - 8 seconds and determine the maximum and mean force for both hands. Record in the data table.

Part 2: Pinch Strength

1. Have the subject sit with his or her back straight and feet flat on the floor, holding the Hand Dynamometer along the sides in the non-dominant hand and eyes averted from the screen.
2. Click Collect; have the test subject immediately pinch the end of the sensor between the pads of the thumb and forefinger of his or her dominant hand, and hold for 5 s.
3. **Instruct the subject to switch to successive fingers every 5 s**. Data collection will stop after 20 s.
4. Click and drag the cursor over the flat plateau on the graph; View the statistics and record the mean grip strength in the table. Repeat for each plateau.

Section is Locked

Lab Protocol

Watch the video demonstrating the lab procedure.

Video instance not printed.

?

(/player_help)

1. Identify the:
   - independent variable
   - dependent variable
   - manipulated variable
   - 3 control variables

Score: 0 / 4

Section is Locked

Data Analysis

Follow the directions below to open up Graphical Analysis on your chromebook to analyze the data.

1. Download the **attached file (https://drive.google.com/file/d/1-wIQc-M-63SgodIlshzqraXhysj4mjwT/view?usp=sharing)** to your chromebook.
2. Open up the Graphical analysis on your Chromebook. Access it by searching the apps on your chromebook.
3. Click on "CHOOSE FILE" within Graphical Analysis and select the file Lab 16 Grip Strength.gambl
4. Click on the Y Axis title and select RIGHT HAND and LEFT HAND.
5. Place the cursor over your graph at 4 s and highlight to 8 s.
6. Click  and select statistics. Record the Maximum force and the mean force for EACH run in Table 1 below.
7. Close the statistics box.
8. Click on the Y Axis title and unselect RIGHT HAND and LEFT HAND; Select Finger Strength.
9. Click and drag the cursor over the first Plateau on the graph. Click  then view statistics, and record the MEAN pinch strength to the nearest 0.1 N in Table 2.
10. Repeat step 9 for the second plateau representing the strength of the thumb and middle finger; repeat for the ring and pinky finger.

Data from 26 science students was collected and analyzed based on Gender in Table 3, based on Hand Dominance in Table 4, and based on Height in Table 5.

1. Table 1: Individual Grip Strength

⚙	Hand	Maximum Force		Mean Force	
		N	variable	N	variable
1	Right Hand Grip Strengtl				
2	Left Hand Grip Strength				

Score: 0 / 4

2. Table 2: Individual Pinch Data

Hint: *Select the plateau data for each finger and use the statistics function to record the mean force for EACH finger.*

⚙	Finger	Mean Force	
		N	variable
1	Dominant Hand - Index I		
2	Dominant Hand - Middle		
3	Dominant Hand - Ring F		
4	Dominant Hand - Pinky I		

Score: 0 / 4

3. Table 3: Gender Data from Class Data

⚙	Gender	Average Mean Force	
		N	variable
1	Males (dominant Hand C	273.0	
2	Females (dominant Hanc	175.7	

4. Table 4: Class Grip Strength Based on Hand Dominance

⚙	Handedness (both Gend	Mean Right Hand Force		Mean Left Hand Force	
		N	variable	N	variable
1	Right-handed Individuals	226.2		198.9	
2	Left-handed Individuals	204.5		215.2	

5. Table 5: Class Grip Strength Data based on Height

⚙	Height (Rounded)	Mean Grip Strength of D	
		N	variable
1	Less than 5 ft.	110.7	

⚙	Height (Rounded)	Mean Grip Strength of D	
		N	variable
2	5' 1" - 5' 5'4"	112.1	
3	5' 5" - 5' 8"	162.1	
4	5' 9" - 6'	291.7	
5	6' 1" or taller	483.4	

6. The test subject's dominant hand was his right hand. Is there a difference in grip grip strength in the dominant hand compared to the non-dominant hand? What could explain this difference?

Score: 0 / 2

7. Examining the Data in Table 2, does there appear to be a correlation between "handedness" and grip strength? Choose the answer with the correct evidence.

- No; Right handed people had stronger left hands and left handed people had stronger right hands.
- Yes; Right handed people had stronger right hands and left handed people had stronger left hands.
- No; Right handed and left handed people both had stronger right hands because of the right handed world we live in.
- Yes; Right handed and left handed people both had stronger right hands because of the right handed world we live in.

Score: 0 / 2

1 / 1 submissions remaining

8. Using Table 4, calculate the loss of force for right handed test subjects as they switched from their dominant to their non-dominant hand. Then calculate the loss of force for left handed individuals as they switched from their dominant to the their non-dominant hand.

- Right handed individuals lost 37.3 N of force where left handed individuals lost 10.7 N.
- Right handed individuals lost 10.7 N of force where left handed individuals lost 27.3 N.
- Right handed individuals lost 27.3 N of force where left handed individuals lost 8.7 N.
- Right handed individuals lost 27.3 N of force where left handed individuals lost 10.7 N.

Score: 0 / 4

1 / 1 submissions remaining

9. Which type of person loses more strength as they switch from their dominant to their non-dominant hand?

- Right handed individuals.
- Left handed individuals.

Score: 0 / 1

1 / 1 submissions remaining

10. Which of the following is the correct conclusion based on the data presented in Table 5?

- As the height of the test subjects increased the average grip strength decreased.
- Males have a higher grip strength compared to females.
- As the height of the test subjects increased the average grip strength increased.
- Females have a higher grip strength compared to males.

Score: 0 / 2

1 / 1 submissions remaining

11. A new, unique group of hominids, called *homo studentus* was discovered to have every person in the population have a height of 5'4.5". Using the data from Table 5, predict the grip strength of these individuals if the experiment above was repeated using *homo studentus* as the subject. The expected grip strength of these 5 foot 4.5" tall people would be closest to:

- 108 N
- 115 N
- 137 N
- 185 N

Score: 0 / 1

1 / 1 submissions remaining

12. Using the pinch strength data found in Table 2, determine the relationship in strength as you move from pointer finger towards the pinky finger for THIS test subject.

- The grip strength increases as you move from pointer finger to pinky finger.
- The grip strength decreases as you move from pointer finger to pinky finger.
- The grip strength increases and then decreases as you move from pointer finger to pinky finger.
- The grip strength decreases then increases as you move from pointer finger to pinky finger.

Score: 0 / 1

2 / 2 submissions remaining

13. Scientists in the South American jungle discovered a new species of human and they've called them *homo extrafingerus.* This new species is unique in that they have two extra fingers on the side of the pinky finger. Based on the data in Table 2, extrapolate and predict the probable grip strength for the extra fingers of this species.

- Finger 5 probable strength = 26 N
  Finger 6 probable strength = 20 N
- Finger 5 probable strength = 45 N
  Finger 6 probable strength = 20 N
- Finger 5 probable strength = 58 N
  Finger 6 probable strength = 45 N
- Finger 5 probable strength = 5 N
  Finger 6 probable strength = 10 N

Score: 0 / 2

2 / 2 submissions remaining

14. Which variable would need to be held constant in this experiment to ensure proper results?

- Subject's body size
- Subject's grip strength
- Subject's hair color
- Subject's body position

Score: 0 / 1

1 / 1 submissions remaining

15. Based on the data in Table 3, which conclusion best describes the data?

- The pointer finger has the strongest grip strength when compared to the other fingers.
- Right-handed individuals have a greater grip strength than left-handed individuals.
- Males have a greater grip strength than females.
- Taller individuals have a greater grip strength than shorter individuals.

Score: 0 / 2

2 / 2 submissions remaining

Section is Locked

Additional Research and Analysis

Testing of hand grip strength is used by orthopedic surgeons and physical therapists to evaluate the extent of an injury and the progress of recovery. Grip strength can also be used to diagnose neuromuscular problems such as stroke, herniated disks in the neck, carpal tunnel syndrome, and elbow tendonitis. Athletes are interested in grip strength because it relates to performance in many sports, such as tennis, golf, baseball, football, gymnastics, and rock climbing.
Pinch strength is a way for occupational therapists to measure loss of fine-motor strength in the thumb, fingers, and forearm. It is useful for analyzing the extent of an injury and the outcome from surgery or therapy.

Normalized grip strength ratings for males and females is detailed in the table below:

	MALES	FEMALES
rating*	**(kg)**	**(kg)**
excellent	> 64	> 38
very good	56-64	34-38
above average	52-55	30-33
average	48-51	26-29
below average	44-47	23-25
poor	40-43	20-22
very poor	< 40	< 20

1. What type of grip strength force would an orthopedic surgeon expect from a male who has just had his hand crushed a large steel door?

- 54 kg of force
- 49 kg of force
- 42 kg of force
- 39 kg of force

Score: 0 / 1

2 / 2 submissions remaining

2. Had this SAME test subject been a female, the orthopedic surgeon would have rated her grip strength as:

- Excellent
- Above average
- Below Average
-

Poor

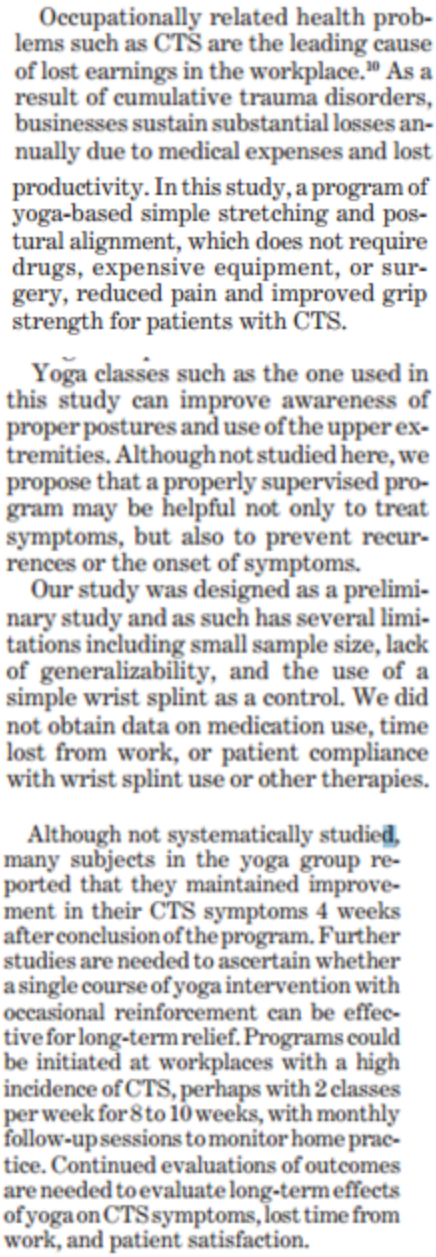
Score: 0 / 1

2 / 2 submissions remaining

Section is Locked

Research Analysis

Read the article below that was taken from www.yogawithtyler.com



Occupationally related health problems such as CTS are the leading cause of lost earnings in the workplace.[10] As a result of cumulative trauma disorders, businesses sustain substantial losses annually due to medical expenses and lost productivity. In this study, a program of yoga-based simple stretching and postural alignment, which does not require drugs, expensive equipment, or surgery, reduced pain and improved grip strength for patients with CTS.

Yoga classes such as the one used in this study can improve awareness of proper postures and use of the upper extremities. Although not studied here, we propose that a properly supervised program may be helpful not only to treat symptoms, but also to prevent recurrences or the onset of symptoms.

Our study was designed as a preliminary study and as such has several limitations including small sample size, lack of generalizability, and the use of a simple wrist splint as a control. We did not obtain data on medication use, time lost from work, or patient compliance with wrist splint use or other therapies.

Although not systematically studied, many subjects in the yoga group reported that they maintained improvement in their CTS symptoms 4 weeks after conclusion of the program. Further studies are needed to ascertain whether a single course of yoga intervention with occasional reinforcement can be effective for long-term relief. Programs could be initiated at workplaces with a high incidence of CTS, perhaps with 2 classes per week for 8 to 10 weeks, with monthly follow-up sessions to monitor home practice. Continued evaluations of outcomes are needed to evaluate long-term effects of yoga on CTS symptoms, lost time from work, and patient satisfaction.

1. Using a minimum of four sentences, summarize the findings of this study.

Score: 0 / 2

2. Why did the researchers believe that home practice with monitoring would be sufficient after the initial yoga class?

- Researchers found that yoga failed to improve the the CTS symptoms but it did improve the overall morale of the company.
- Researchers found that an initial class would teach the subjects the fundamentals needed to continue the yoga stretching at home.
- Researchers found that yoga improved productivity and reduced medical expenses only after 52 weeks of daily yoga practice.

Score: 0 / 2

Submit Answer 1 / 1 submissions remaining

3. According to the study, why would businesses be concerned with cumulative trauma disorders in their employees?

- Businesses have found that cumulative trauma disorders (CTS) in their workers results in increased theft among workers as a result of the injury.
- Businesses have found that cumulative trauma disorders (CTS) in their workers results in high turnover of staff.
- Businesses have found that cumulative trauma disorders (CTS) in their workers results in increased financial losses due to medical expenses and loss of worker productivity.
- Businesses have found that cumulative trauma disorders (CTS) in their workers results in workers showing up late to work due to head traumas.

Score: 0 / 2

Submit Answer 1 / 1 submissions remaining