

QUANTITATIVE COMPARATIVE ANALYSIS OF PROTEINS IN THREE TYPES OF BEANS: GREEN BEANS, LIMA BEANS, AND SOY BEANS

BY, ASHLEY ROWLES

ABSTRACT

Proteins are essential molecules needed for survival in many organisms and are highly important in one's diet. Lima beans, soy beans, and green beans were studied to determine which bean had the greatest amount of protein concentration. It is hypothesized that soy beans may have the greatest amount of protein since soy beans have been noted to contain many essential proteins. Two experiments were conducted, each in triplicate. The protein assay determined the protein concentration based on optical density using a spectrophotometer. The lima beans in both experiments were determined to have the greatest amount of protein, thus not supporting the hypothesis. Although the hypothesis was not supported, further research may be conducted to determine the exact types of protein found in each bean. Therefore, this study concluded that for an individual who may want to increase protein intake with a certain type of bean, (of the three beans tested), lima beans may contain the most amount of protein.

SPECIFIC AIMS

The aim of this research is to determine the amount of protein in three randomly picked frozen beans: soy beans, lima beans, and green beans, for nutritional value. This research may also apply to a vegetarian's diet which includes various types of beans.



GREEN BEANS



SOY BEANS



LIMA BEANS

METHODOLOGY

The BioRad Protein assay (Coomassie blue) was used for the binding of the proteins. Albumin was used for the control sample to generate the standard curve. 80 g or 1-1.5 cups of each bean type were placed into a blender individually, to collect the bean extract. Cheesecloth was used to drain the beans. The bean extracts were diluted according to the specific concentration of each sample. To perform the experiment, 4mL of BioRad and 100uL of the sample solution were put into a tube to be tested. The Spec20 spectrophotometer's wavelength was set at 595nm. A "blank" tube was used to adjust the calibration knob between each reading. The optical density was read for each tube, and each bean extract was conducted in triplicate.



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Bean:	Correction Factor	Weight (g)	Optical Density	Average of OD	Protein Concn.	Avg Protein Concn.(mg/ml L)
Green Beans	10	80.02	0.145	0.135	.5170	4.662
			.135		.4662	
			.125		.4154	
Lima Bean	10	80.57	0.358	0.3583	1.599	16.01
			0.359		1.604	
			0.358		1.599	
Soy Bean	20	80.21	0.15	0.151	.5424	10.96
			0.15		.5424	
			0.152		.5525	

Table 1.3 Protein Concentration of the Beans after being weighed:
A spectrophotometer was used to find the optical density for each test tube. By using what was given the standard curve from above could be used to figure out the protein concentration of each. The beans were all weighed out to approximately 80g each to receive a more scientific approach of protein concentration.

Bean:	Correction Factor	Optical Density	Average of OD	Protein Concn.	Avg Protein Concn.(mg/ml L)
Green Beans	10	0.15	0.153	.5424	5.593
		0.14		.4916	
		0.17		.5440	
Lima Bean	10	0.38	0.388	1.711	17.53
		0.4		1.812	
		0.385		1.736	
Soy Bean	20	0.058	0.0585	.07516	1.554
		0.0585		.07770	
		0.059		.08024	

Table 1.4 Protein Concentration of about 1-1.5 cups of beans:
A spectrophotometer was used to find the optical density for each test tube. By using what was given the standard curve from above could be used to figure out the protein concentration of each. The beans in this study included taking an average of about 1-1.5 cups of beans for a more nutritional approach.

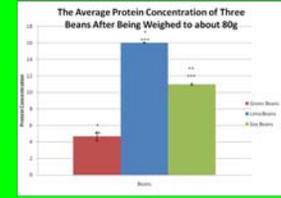


Figure 2: There is significance in comparing the beans protein concentration due to the fact that they were all less than the p value. The t-test was used to take into account that the variances were equal. They were all less than 5%.

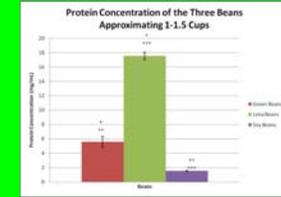


Figure 3: There is also significance in comparing the beans protein concentration while approximating the cups of beans due to the fact that they were all less than the p value. The t-test was used to take into account that the variances were equal. They were all less than 5%.

CONCLUSION

Unexpectedly, for both experiments the protein concentration of the soy beans did not result in the highest concentration. Soy beans contain all of the amino acids necessary for one's health which led the hypothesis in this research. Future experiments need to be done to determine the exact proteins in the different types of beans. This would allow a further study to conclude that the type of protein found in each bean would determine the importance in one's health.

ACKNOWLEDGEMENTS

This study was funded by Waynesburg University and was performed in the Science Laboratory. I would like to thank Marietta Wright, MS for her assistance as a mentor throughout the research and for her help through my entire experience at the University. I would also like to thank Chad Sethman, PhD for his support in the senior research program offered at Waynesburg.

“The Use of EMG to Determine the Electrical Activity Differences between Concentric and Eccentric Contractions Along With the Correlation of Other Factors”

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ABSTRACT: This investigation addressed the differences between the electrical activities of a concentric (shortening) muscle contraction versus an eccentric (lengthening) muscle contraction through electromyography (EMG) in the human biceps, brachioradialis, and deltoid muscles. I also sought to determine if muscle strength, subcutaneous fat or mass of the subject had any bearing on the results. The hypothesis of the research states that the concentric muscle contractions will show higher electrical activity on the EMG than the eccentric contractions. With this finding, fitness trainers and rehabilitation experts may want to revamp exercise programs to focus more extensively on the eccentric contraction. The original hypothesis proved to be correct. With twenty-nine human subjects, in every instance, the concentric contraction generated more electrical activity than the eccentric contraction. However, other factors such as the maximum strength, subcutaneous fat of the bicep, and body mass assumed no correlations with the EMG data gathered. In conclusion, the research was successful in proving the electrical activity differences; however, various other correlations were found unsuccessful throughout the data accumulated in the investigation.

INTRODUCTION: This investigation focuses on important physiological concepts. Neuromuscular transmission, the firing of action potentials in the muscle, and cross bridge cycling are the basic foundations behind electromyography (EMG). The research focuses on two types of muscle contractions: the concentric contraction and the eccentric contraction. General knowledge reveals that performing a concentric contraction, such as walking up stairs, is more difficult than performing the eccentric contraction, walking down the stairs. This allowed for my hypothesis to develop. I believe the concentric contraction should show more electrical activity in the EMG than the eccentric contraction. With the use of 29 human subjects, the research focused on three muscles: the biceps, the brachioradialis, and the deltoid. With a seven pound dumbbell, a bicep curl using both the concentric and eccentric motions was used to measure electrical activity of the biceps and brachioradialis, while a lateral shoulder raise was used for the deltoid.

INTRODUCTION CONTINUED: The EMG measured both area and amplitude, area being the sum of the mechanical activity of the muscle during the contraction and amplitude being the maximum electrical activity. The measurement of the electrical activity provided means for the main area of investigation of the research; however, the investigation also correlated EMG amplitude with maximum strength (by performing maximum effort curl and raise preliminaries in each subject), with subcutaneous fat measurements of the bicep, and the subject's body mass to determine any differences in EMG readings. The research was done to help aid in the fitness realm. If the concentric contraction did prove to have higher electrical activities than the eccentric contraction, personal trainers and rehabilitation experts may want to focus more on the eccentric motion to help in training and rehab.

AIMS:

- To investigate whether the concentric contraction revealed more electrical activity than the eccentric contraction.
- To use the above information to aid the fitness realm in the development of training and rehabilitation techniques involving a more eccentric contraction centered work-out.
- To correlate strength of the subject with his/her EMG amplitude.
- To correlate subcutaneous fat of the subject with EMG amplitude.
- To correlate subject's body mass with EMG amplitude.

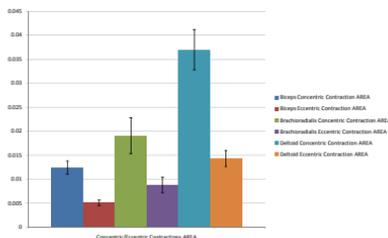
METHODS:

- I received participation from 29 subjects (WU students) and asked for each subject to complete a simple survey involving age, weight, and activity level participation.
- Each subject performed a maximum effort bicep curl and lateral shoulder raise in the fitness center.
- Each subject was taken to the lab where first, the bicep muscle was hooked to three electrodes (one being the ground electrode).
- The BIOPAC EMG software was used to measure the subject's electrical activity during the concentric and eccentric contraction of a bicep curl using a seven pound dumbbell.
- The process was repeated with the brachioradialis.
- The process was again repeated with the deltoid and with a lateral shoulder raise rather than a bicep curl.
- The subcutaneous fat of the subject's bicep was measured with a skin fold caliper.
- Results were confidentially compiled and analyzed.

RESULTS

GRAPH 1:

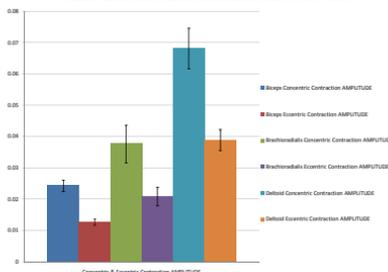
3 Muscles-Concentric Vs Eccentric Contraction: EMG AREA



Graph 1 shows the values for EMG area of the three muscle groups. On the far left is the biceps muscle concentric contraction, followed by the eccentric contraction. Next is the brachioradialis and finally the deltoid. The y-error bars represent the standard error of the mean.

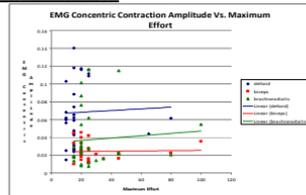
GRAPH 2:

3-Muscles-Concentric vs Eccentric Contraction: EMG AMPLITUDE



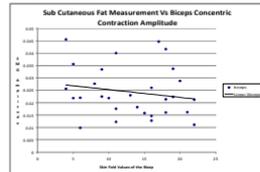
Graph 2 is set up in accordance with Graph 1. Graph 2 represents EMG Amplitude.

RESULTS CONTINUED: GRAPH 3



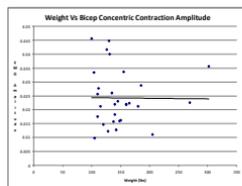
Graph 3 represents the correlations between EMG amplitude and maximum effort for all three muscle groups. The graph reveals relatively straight trendlines, which proves there is no correlation between strength and EMG readings.

GRAPH 4:



Graph 4 reveals the relationship between subcutaneous fat measurement of the bicep and EMG concentric amplitude in the bicep. The graph shows a straight trendline, which reveals no correlation.

GRAPH 5:



Graph 5 represents the relationship between body mass in pounds versus EMG amplitude in the biceps. The graph shows a straight trendline and reveals no correlation.

CONCLUSIONS:

- The average concentric contraction produced more electrical activity than the eccentric contraction in each of the three muscles studied (biceps, brachioradialis, and deltoid) in both the EMG area and the EMG amplitude.
- There appears to be no correlation between the EMG readings of amplitude (maximal electrical activity) and strength (maximum effort) in any of the three muscles.
- There also appears to be no correlation between subcutaneous fat on the bicep and EMG amplitude in any of three muscles investigated. Only the graph of the biceps is shown; however, the two other muscle groups revealed similar results.
- There is no correlation between the EMG readings of amplitude and body mass (weight) of the subject in any of the three muscles studied.

THE FITNESS REALM: The major thesis of the research stated that the concentric contraction created more electrical activity, both area and amplitude, than the eccentric contraction. Personal trainers and rehabilitation professionals may want to study this when working on strengthening individuals. People may want to focus more on a workout centered around eccentric contractions. This could allow injured individuals to become stronger over a shorter time period along with experiencing less pain. I would be interested to see further research focused on training individuals over a period of time using both methods. This type of research would be an interesting investigation.

ACKNOWLEDGMENTS: I would like to take the time to give a special thanks to Waynesburg University department of biology for giving me the funds and supplies needed to perform my research. I would like to thank Dr. Brian Hamilton, professor of physiology, for all his help in planning and performing the research. I also would like to thank all of my subjects who willingly participated in the research. Without each of you, this project would not have been a success.



Tactile Loss Due To Tattooing

Joseph A. Walker

Mentored By: Dr. Bryan Hamilton

Abstract

Tattooing involves injecting an ink into the dermal layer of the skin via a needle. The ink is injected into the dermal layer of the skin, below the germinal layer of the epidermis, because at this depth the tattoo will not fade as the skin sheds. It was hypothesized that there might potentially be a loss of sensitivity in the tattooed area due to nerve damage from the needle penetrating the dermal layer during the tattooing process. A two-point discrimination test was utilized to test for any relative decrease in sensory receptor density by measuring two-point distance in the tattooed area and comparing with the non-tattooed area on the opposite side of the body. According to experimentation done by Shooter, a two-point discrimination test is a valid way to test for nerve damage and tactile loss. My results show that there is some decrease in sensitivity measures as an increase in two-point distance in tattooed skin when compared to the same, non-tattooed, region on the opposite side of the body. This tactile loss is likely due to nerve damage in the dermal layer, though this can not be verified by using only the two-point discrimination.

Introduction

Tattooing is a process in which an ink or dye is placed under the skin by way of a needle. The ink is placed into the dermis layer where it will stay forever. Investigations of the tactile loss at the sights of tattooing are limited. It is suspected that nerve loss or nerve damage would be the cause of any type of loss of tactility.

According to research done by Karanth, samples were taken from the epidermis and observed for the presence of damaged dendrites. Karanth discovered that there were wide spread, branching dendrites. This research suggests that there is little or no damage done to cutaneous nerve cells due to tattooing.

From Karanth's experiment it can be hypothesized that there will be no loss of touch on the skin of people with tattoos. To test this theory a two-point discrimination test will be run on subjects with areas of tattooing. According to experimentation done by Shooter, a two-point discrimination test is a valid way to test for nerve damage and tactile loss.

Method

A two-point discrimination (TPD) test will be run of subjects to test if they have less feeling on sights with tattoos compared to sights without tattoos on the same area of the body. A TPD test utilizes a tool that has two points. The researcher will bring these two points closer together until the subject can not feel the difference between one point and two points. The TPD test will be run on both sides of the body in the same area of the tattoo to see if there is a difference between a non-tattooed area and a tattooed area. In order to determine a control, tests will also be run on both sides of the body of people with no tattoos to test if there is a difference in tactility from one side of the body compared to another; no difference is suspected.



Results/Discussion

This study suggests that there is a loss of sensitivity over a tattooed area that may be due to nerve damage done by the needle during the tattooing process. It was determined that there is a loss of sensitivity over a tattooed area compared to a non-tattooed area. It was found that an average difference of 8.43mm with a standard error of 1.23mm was present when comparing a tattooed area versus a non-tattooed area. The non-tattooed, control group was found to have an average difference of 3.7mm with a standard error of 0.667mm when comparing the right side of the body to the left. A t-test was calculated to be 0.00734. Since this value is less than 0.05 the difference between the tattooed average distance and the control average distance is significant.

Errors in this experiment were able to be limited by only testing tattoos that were solid in color rather than tattoos that were just outlined. Other errors were eliminated by only testing subjects who were between the ages of 19 and 23 and who have had their tattoo less than 5 years. Errors due to the small amount of subjects can be eliminated since the t-test revealed that the differences were significant.

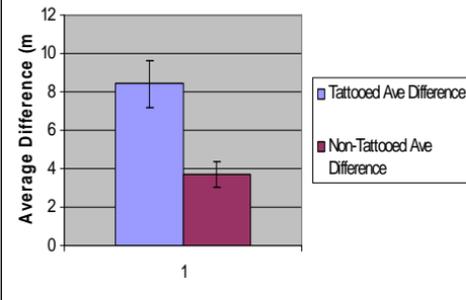
Non-Tattooed Stats

Subject	Right side (mm)	Left side (mm)	Difference	Area
1	26	22	4	arm
2	7	4	3	ankle
3	41	36	5	shoulder blade
4	44	49	5	shoulder blade
5	4	4	0	ankle
6	5	7	2	ankle
7	15	12	3	arm
8	36	34	2	ribs
9	45	38	7	ribs
10	35	41	6	shoulder blade
			Average Diff	3.7
			St. Dev of Average Diff	2.110818693
			St. Error	0.667

Tattooed Stats

Subject	Tattooed area (mm)	Non-tattooed area (mm)	Difference (mm)	Area	Yrs. Tattooed
1	21	17	4	neck	2
2	15	11	4	arm	1.5
3	8	2	6	caif	1.5
4	43	27	16	shoulder blade	4
5	45	36	9	ribs	<1
6	71	57	14	chest	1
7	57	40	17	shoulder blade	2
8	29	23	6	ankle	3 wks
9	4	1.5	2.5	ankle	1
10	7	4	3	ankle	1
11	53	43	10	shoulder blade	1
12	55	42	13	shoulder blade	2
13	41	31	10	ribs	1
14	17	12	5	arm	3
15	17	10	7	arm	<1
			Average Diff	8.433333333	
			St. Dev of Average Diff	4.761702377	
			St. Error	1.23	
			T-test	0.007342124	

Tattooed vs. Non-Tattooed Average Difference



Testing the Efficiency of *HindIII* Restriction Enzyme at Various Temperatures using Plasmid DNA

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ABSTRACT

Restriction enzymes are endonucleases that digest DNA at specific palindromic sites. These enzymes require a certain temperature to avoid denaturing and for efficient digestion. For many restriction enzymes it is recommended to allow 45-60 minutes for complete digestion of DNA at 37°C. After DNA isolation, the temperature was varied during *HindIII* restriction digest for 15, 30, and 60 minutes. The objective of this study was to test the optimal time and temperature of *HindIII* digestion. It was concluded that *HindIII* is able to completely digest the samples at 43°C at 15 and 30 minutes in addition to the recommended time and temperature.

INTRODUCTION

During the 1960s, extracted enzymes from *E. coli* were found to have broken down unmethylated DNA and were called "restriction nucleases." Since then, more restriction enzymes have been isolated.

Restriction enzymes act as "molecular scissors" to digest DNA at specific palindromic sequences to produce DNA fragments. Most enzymes require an optimal temperature of 37°C to ensure efficient digestion as well as avoid denaturing.

Plasmids are circular accessory DNA genes that encode for antibiotic resistance, such as ampicillin.

Isolated plasmids are confirmed using agarose gel electrophoresis. This process is useful in separating bands within a given sample for analyzing using an electrical field. DNA is comprised of a negatively charged phosphate backbone. The gel acts as a sieve to separate the bands according to band size (measured in base pairs). Larger fragments will move more slowly than smaller fragments.

Samples produce bands that may be measured and compared to a standard curve of the known base pairs (bp) of the marker.

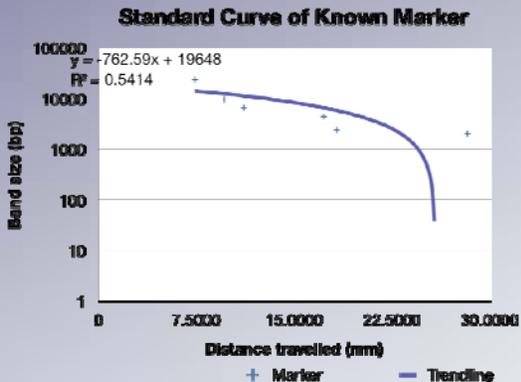
The objective of this study was to test the optimal time and temperature of the restriction enzyme, *HindIII*, digestion.

METHODOLOGY

Bacterial Transformation: Plasmid DNA transferred to competent *E. coli* (DH5 α), S.O.C. medium added to the iced tubes, shaken for an hour. Luria broth (LB) agar plates poured with ampicillin (100ug/mL). Bacterial cells spread on plates and left to grow over night, inverted at 37°C.

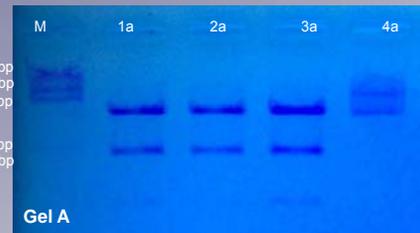
Isolation of DNA: *E. coli* cells were picked from streaked plates. Left shaking over night at 37°C to grow in ampicillin and LB broth. Used Holmes and Quigley's boiling prep method for isolating plasmids.

Temperature Variation: Isolated plasmid DNA is subjected to restriction enzyme digest. Three temperatures (31°C, 37°C, 43°C) at three different time points, 15, 30 and 60 minutes, were tested in triplicate and triplicate to test the efficiency of the *HindIII* restriction enzyme. Digestion efficiency was confirmed using agarose gel electrophoresis.



Standard Curve of Known Marker:

The distance travelled by the marker's bands were correlated to the known band sizes, measured in base pairs (bp). A standard curve was generated to find the band size (in bp) of the tested samples.

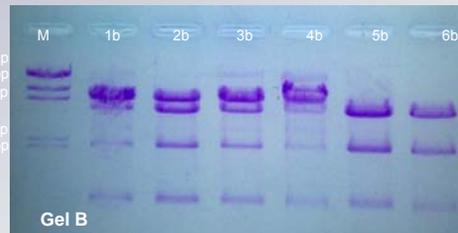


Gel A: 60 min digestion with Temperature Variation

"M" denotes the known Marker. Lane 1 was digested at 31°C. Lane 2 was digested at 37°C. Lane 3 and 6 were digested at 43°C. The sample in Lane 4 was not subjected to the *HindIII* enzyme for a negative control.

All lanes were allowed to digest for 60 minutes. Each sample was confirmed using gel electrophoresis.

Note: All samples were completely digested within 60 minutes at various temperatures



Gel B: 15 and 30 min Digestion with Temperature Variation

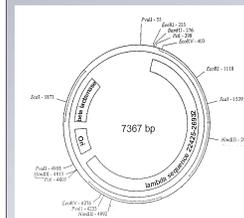
"M" denotes the known Marker. Lanes 1 and 2 were digested at 31°C. Lanes 3 and 4 were digested at 37°C. Lanes 5 and 6 were digested at 43°C.

Lanes 1, 3, and 5 were allowed to digest for 15 minutes, while lanes 2, 4, and 6 were allowed to digest. Each sample was confirmed using gel electrophoresis.

Note: Lane 4b and 5b were completely digested at 43°C in 15 and 30 minutes.

Plasmid Map of the DNA sample:

The sample of plasmid DNA used was comprised of 7,367 base pairs. The restriction enzyme *HindIII* digests the sample at specific palindromic sites to produce three fragments (4,627, 2,027bp, and 713bp).



CONCLUSION

When triplicate samples were subjected to *HindIII* digestion at the varied temperatures 31°C, 37°C, and 43°C for 60 minutes, all samples visually confirmed complete digestion and resulted in the three bands (see Gel A).

HindIII enzyme is also able to completely digest the samples in 15 and 30 minutes at 43°C, but is unable to completely digest the sample at other time points (see Gel B).

These results may be of great importance to future research assays as it allows for the time of digestion to be two to three times faster than the optimal time and temperature currently suggested and used by companies.

The critical use of restriction enzymes is necessary for research today. It aids in many assays and is critical in processes such as identifying gene function, isolating genes, cutting and cloning plasmids.

ACKNOWLEDGEMENTS

I would like to thank Professor Marietta Wright, M.S. for allowing me to learn biotechniques under her wing and for answering my numerous questions along the past two years.

I would also like to thank Dr. Chad Sethman for acting as a co-mentor who interjected helpful tips and analytical ideas regarding this project.

Lastly, I would like to thank the Waynesburg University Biology Department and the Center for Research and Educational Development for allowing me to use their instruments and facilities.





"The Effects of Oral Contraceptives on Female Athletes' Bone Mineral Density"

By: Megan Grover and Dr. B. Hamilton

Abstract:

The initial aim of this research was to prove whether or not oral-contraceptives affect college female athletes' bone mineral density. Oral-contraceptives are made up of synthetic hormones, which may have a detrimental effect on bone mineral storage, especially in females who menstruate regularly and whose bodies naturally generate enough estrogen. The International Osteoporosis Foundation reiterates this: "Given the potent role of reproductive hormones on bone development, the use of hormonal birth control medication during skeletal consolidation could influence development of peak bone mass" (Shoep 2005). There were 34 female athlete participants with 12 who used oral-contraceptives, and 22 who did not. The participants' bone mineral density was tested by a DEXA bone mineral density scanner. The data was analyzed to see if there was a significant difference in the body mass index (BMI) and t-score between the users and non-users by using the results from the scanner and survey questionnaire. The t-test proved there is no significant difference in the BMI or in the t-score between the two groups. This could also be because the majority of the oral contraceptive users took a calcium supplement while most of the non-users did not. BMI also did not have a significant effect on the females' bone mineral density. The participants in this study are very young and have not been using oral-contraceptives long-term. Additionally, the effects on bone mineral density are less evident until later years, and therefore the results in this study do not signify whether or not females will be at risk for osteoporosis in the future.

Introduction:

The effects oral contraceptives (OC) have on female bone mineral density (BMD) is the essential variable in this study. Considering OCs are synthetic hormones, many researchers and the women who use OCs believe they have a positive effect on BMD, yet there are several contradictory results. Although OCs have been effective in increasing BMD in females who have an abnormal menstrual cycle by supplementing the female's lowered hormonal levels, it has a contradictory effect on the BMD of females who already menstruate regularly. Another study revealed that in adolescent females who already had a normal menstrual cycle, OC use had a negative effect on their bone formation and metabolism. This is due to an inhibitory effect on bone cell turnover (Prior 2001 and Shoep 2005). Oral contraceptives have also shown positive effects after long-term use, especially those with higher levels of estrogen. Estrogen's role is in stimulating secretion of growth hormones, which causes bone growth at puberty. Estrogen also inhibits bone growth by inducing closure of the epiphyseal growth plates. Estrogen maintains bone health and prevents osteoporosis through the stimulation of bone growth. Considering these findings, I hypothesized the results would be based on the individual and her reasons for taking an oral contraceptive (OC).

In this experiment, the accuDEXA Bone scanner was used to test the middle finger of each participant. Upon completion, it gave a Densitometry Report, reporting the females' z-score, t-score, and analysis as to whether or not the values were normal or abnormal. The t-score is most important and signifies as to whether an individual has a high BMD, a normal BMD, osteopenia, or osteoporosis. It attests if one falls in the normal range for their age group. The t-test and BMI were utilized to compare and contrast the two groups in this study.

Methodology:

~Test Bone Mineral Density of Waynesburg University female athletes with a DEXA bone mineral density scanner. Testing the middle finger of the dominant hand.

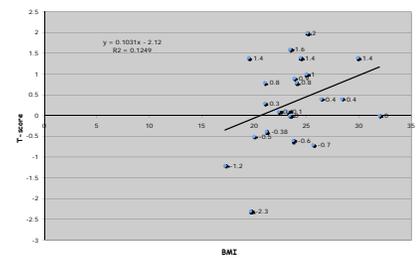
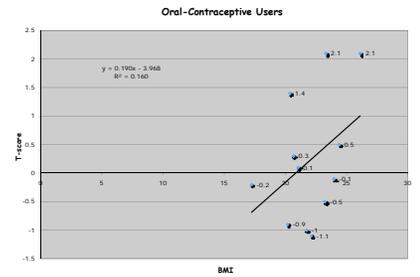
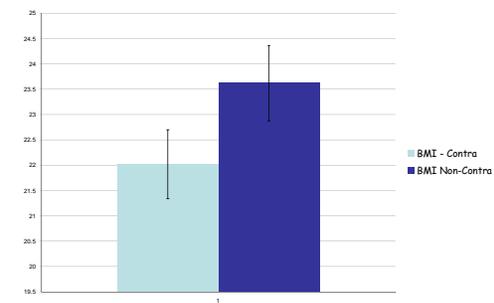
~Have participants complete a survey asking questions regarding diet, calcium intake, activity level, height, weight, contraceptive use, menstrual cycle, family history, drinking and smoking use.

Comparing and Contrasting BMI

	Oral CU	Non-Oral CU
Mean	22.0225	23.62318182
Variance	5.554365909	12.18120368
Observations	12	22
Hypothesized Mean Difference	0	
df	30	
t Stat	-1.58759452	
P(T<=t) one-tail	0.061431677	
t Critical one-tail	1.697260851	
P(T<=t) two-tail	0.122863353	Not significant
t Critical two-tail	2.042272449	

Comparing and Contrasting t-score

	Oral CU	Non-Oral CU
Mean	0.225	0.314545455
Variance	1.258409091	1.036083117
Observations	12	22
Hypothesized Mean Difference	0	
df	21	
t Stat	-0.22970788	
P(T<=t) one-tail	0.410270707	
t Critical one-tail	1.720742871	
P(T<=t) two-tail	0.820541414	Not significant
t Critical two-tail	2.079613837	



Conclusions:

~T-test between BMI's of two groups = 0.122. Not a significant difference.

~T-test between t-score of two groups = 0.8205. Not a significant difference.

~Slight correlation between Body mass index (BMI) and t-score. Females with a higher BMI tend to have a higher bone mineral density (BMD), while females with a lower bone mineral density more frequently have lower t-scores, yet not necessarily.

~The majority of the oral-contraceptive users take a daily calcium supplement, while most of the non-oral contraceptive users do not. Most of the users take oral-contraceptives to regulate irregular menstrual cycles, indicating their bodies are in need of the supplemented hormones.

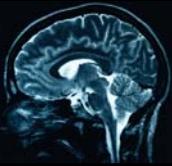
~These results do not determine the effects of oral-contraceptives on future female bone health, since the participants are young and have not used oral-contraceptives for greater than five years. They also do not signify their future risk for osteoporosis.

~Clearly, these results indicate that amongst the younger, female population, oral contraceptives do not have a significant affect on their present bone mineral density. Additionally, my hypothesis was disproven as the t-scores were similar between the two groups in this study indicating no significant difference.

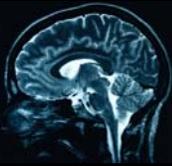
~In the future, the results would be more accurate if tested on a greater and older population and amongst females who have used oral contraceptives for greater than five years.

Acknowledgements:

I would first like to thank my advisor, Dr. Bryan Hamilton, and Waynesburg University, who supported me in my research. I also would like to thank the Waynesburg University female college athletes who were willing to participate in my research project. This project would also not have been possible without Tri-State Health Care Chiropractic Clinic, who tested the BMD of my participants with their DEXA BMD scanner.



Behavioral and Medical Trends in Sensitivity to the Effects of Caffeine



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Abstract

Caffeine has unquestionably become the world's most popular psychomotor drug. While its effects are known to vary widely from person to person, limited research examining factors influencing such interpersonal variance exists. This study examines such trends in sensitivity to caffeine via a with-in subject study comparing behavioral and medical factors reported in questionnaire form with changes in EEG recording and performance of psychomotor vigilance and cognitive tasks after both consumption of a placebo and 200mg of caffeine (a quantity determined safe for most adults by the International Food Information Council).

Introduction

Caffeine acts primarily by competitively inhibiting adenosine receptors. This inhibition triggers increased neuron firing as well as increased adrenaline and dopamine secretion. The drug's stimulatory physiological effects are furthered in its secondary role in inhibiting cAMP-phosphodiesterase, creating a build-up of cAMP and subsequently higher glucose levels.

Previous studies have indicated that those with a high baseline anxiety experience greater sensitivity to the stimulatory effects of this drug. This study aims to discover behavioral and medical factors influencing subjective response to the effects of caffeine.

Methodology

- Behavioral and medical information was gathered via a self-reported questionnaire.
- An EEG was administered for detection of alpha waves in the occipital lobes.
- Stroop's Test: Printed words are displayed in a color different from that which it actually names. Subjects were asked to name the colors in series and time of completion was correlated with cognitive attentiveness.
- Reaction Time: Subjects were tested for psychomotor vigilance by striking a key in response to visual stimuli (character appearance on a computer screen).

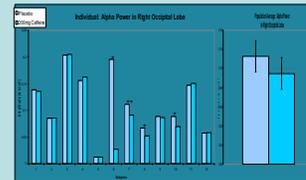
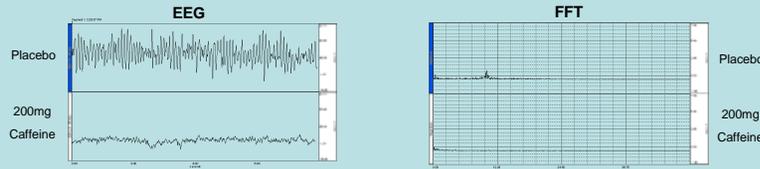


Figure 1. Individual and population averages for alpha wave power in right occipital lobe.

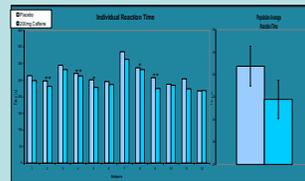


Figure 2. Individual and population averages for reaction time.

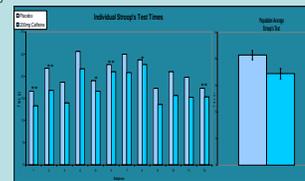


Figure 2. Individual and population averages for Stroop's test completion time.

Discussion

Subjects exhibiting significant differences in at least two of the three tests were assumed to have the highest sensitivity to caffeine. Subjects displaying significant stimulatory effects in only one test were considered mildly sensitive to caffeine and subjects exhibiting no significant effects of caffeine in any of the three tests were categorized as having no significant predisposition to the effects of caffeine.

Of four subjects reporting a history of anxiety, two (subjects 2 and 8) were correlated with an elevated sensitivity to caffeine while two (subjects 3 and 11) displayed no significant effects in any of the tests conducted. Thus, previous findings that those with a high baseline anxiety are more susceptible to the effects of this drug were not confirmed in this study.

Self-reported stress levels at the time of testing, however, proved a better correlation. Of six subjects reporting stress levels above 7 (on a 1-10 scale), five (subjects 1, 2, 5, 7, and 8) displayed significant stimulatory effects in at least one of the three tests with three being categorized as having the highest sensitivity of the tested population.

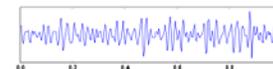
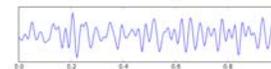
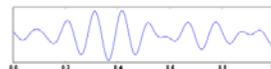
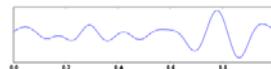
Four of the twelve participants reported consuming highly caffeinated beverages (coffee/energy drinks) less than once a week. Of this group, three (subjects 5, 6, and 10) displayed some level of susceptibility to caffeine with two (5 and 6) demonstrating a high sensitivity.

While caffeine is widely utilized in a non-medical manner, its similarity to pharmacological stimulants such as theophylline, used to treat asthma, has brought its medicinal value into consideration. Furthermore, its chemical relation to pharmacological drugs indicates that caffeine studies may also be applicable to other medicinal stimulants.

Acknowledgements

I would like to thank Dr. Hamilton and Dr. Sellman for their support and guidance, Dr. Hawley Montgomery-Downs and graduate students of West Virginia University's Sleep and Sleep Disorders/Behavioral Neuroscience Laboratory team for their knowledge and training in EEG data acquisition, and all participants in this study for their gracious gift of time.

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Algal turf scrubber successfully controlling pH levels at the Carnegie Science Center

Tonya L. Lewis

Advisor: Paladino, Janet, ScD

INTRODUCTION:

In the summer of 2008, pH levels were investigated in the saltwater aquariums at the Carnegie Science Center (Pittsburgh, PA).

SPECIFIC AIM:

To determine if pH measurements in the Lagoon tank remained within acceptable limits throughout a 24- hour period with the assistance of an algal turf scrubber

METHODS:

Hourly pH measurements were carried out on three separate occasions at the Carnegie Science Center. Each test lasted 24 hours. A fourth test took place to measure pH after calcium hydroxide additions were modified.



RESULTS:

pH spikes were observed during the first three testing days. In attempt to eliminate the pH spikes, the methods of adding calcium hydroxide were modified. For the fourth testing day, the pH remained more stable.



CONCLUSION:

Modifications in the methodology to treat aquariums with calcium hydroxide used in conjunction with an algal turf scrubber at the Carnegie Science Center successfully controlled pH levels.

