DIETARY EFFECTS ON THE BRAIN WITH REGARDS TO LEARNING AND MEMORY

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by

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ABSTRACT

An analysis of diets of 14-15 year olds was conducted to determine if there was a significant relationship between the quality of a student's diet and the quality of their schoolwork based on the assessments in their 9th grade Biology class. Eighty-three 9th grade students completed a daily diet log for four weeks showing both the quality and quantity of foods that were consumed on the previous day. At the end of the four-week period they filled out a single personal diet survey to show average weekly consumption rates for various food types. From this group of 83 students, 10 students with average academic performances but a poor diet were selected to receive a daily multivitamin for a four-week period. The purpose of the multivitamin variable was to test the hypothesis that the brain cannot function at its optimal performance level without receiving a sufficient quality and quantity of vitamins and nutritional substances; therefore, supplementing a poor diet with a multivitamin can improve the brain's ability to function for learning and memory. The method used to determine the effect was a statistical comparison between the variations in the average grades of the students taking a multivitamin with those students who did not receive any multivitamin. The control group had a drop of 3.61 points whereas the group receiving the vitamin only saw a drop of 1.70 points. An independent "t" test was used to show significance differences between the averages of the two groups both before and after the supplementation period. A dependent "t" test was used to show significance changes in the averages of each group over time. The results showed there was no significance and the null hypothesis was not rejected; therefore, the research hypothesis was not supported. The study did show the positive effects of vitamin supplementation but should be continued for a longer period of time to accurately depict the relationship between diet and learning.

INTRODUCTION

"You are what you eat!" If you stop and think for a minute, your entire body, from head to toe and from skin to bone, is composed of the organic compounds and natural elements that you consume each day. Organic compounds, such as carbohydrates, lipids, proteins, and nucleic acids, compose even the tiniest parts of your body called cells. They regulate what nutrients enter and leave the cell, hormones levels, and even the copying of genetic material that contains the instructions on how your body was made, how it grows, and how it repairs itself when it breaks down. Combined with important elements, such as sodium, potassium, iron, etc., organic compounds are essential in allowing our body and mind to function at its maximum level. If these organic compounds and natural elements are so important to our body then obviously they are important to our brain and can affect our learning and memory. "You are what you eat!" Hearing this now might be troubling for some as many people are adopting a poorer but more convenient diet. Our western society has evolved to a point at which we function around a faster, but poorer diet despite the inflated cost of these inadequate meals. The economic success of our society has altered our lifestyles and the cost is not only in our food budget, but in our health as well. The most vulnerable to this new lifestyle of a poor diet may very well be the children. They are at an important stage in their lives where they are growing, developing, and obtaining new knowledge to lay as a foundation for their education in their lives ahead. The vast majority of students in schools are consuming a poor array of foods and beverages at home, then showing up to school where the food options in the school cafeterias are not much better. We see this physically as obesity in children is at an all time high. With obesity comes many health risks such as diabetes, which is also at an all time high in children. Long term complications can result in high blood pressure, arteriosclerosis, heart attacks and even strokes. How can we expect our students to learn and retain new knowledge into memory when their poor diet is damaging their body and starving their brain? In the scientific community much is known about the damage poor dietary habits can have on major organs such as the heart, liver, pancreas, kidneys, and lungs but little is known about the effects on our brain. This is the organ we are asking our students to use the most and if they are not receiving the right proportions of organic compounds and natural elements then their brains are starving; thus, it cannot function at its maximum capacity and the student's academic performance in the classroom is inhibited. As we learn more about our brain, we should use our brain to create a diet that allows our brain to function at the highest level so that we can increase learning, memory, and performance in our schools and in our society.

DISCUSSION / LITERATURE REVIEW

FATS: Friend or Foe?

When one hears the word "fat" they immediately link it to being unhealthy. Although this relationship exists for many types of fats, fats are an important part of our diet that is crucial to growth and development as well as cellular communication for maintaining homeostasis and responding to stimuli from our environment. As for our brain's ability to learn and recall memory, fats can play an important role in both inhibiting and enhancing the basic functioning of the neural network that makes our brain and gives it the capacity to learn, retain memory, and recall memory. Fats are key ingredients in our diet that control neurotransmitter synthesis and release, which allows our brain cells to communicate with one another to process information received from our environment. Fats also control genes and comprise steroids that control the hormone production and balance within our body. If these fats are consumed are appropriate levels with proportionate ratios between different types of fats, learning and memory can be improved or more importantly not inhibited by our diet. Furthermore, if the students in our public school systems are feed a diet more equipped with the right fats both at school and at home, this could play an important role in improving student achievement in our schools.

Fats fall into one of two categories based on their state of matter at room temperature: saturated fats, which are more solid in nature, and unsaturated fats, the more fluid counterpart. Chemically, unsaturated fats can be further classified as Omega-6 fat or Omega-3 fat. A greater understanding of the roles these groups of fats play in the functioning of our brains hopefully will help us design our diets to allow our brain to function at its maximum capacity so that we have the ability to learn, think, and retain and recall memory at the highest level possible.

Saturated fats are the familiar “bad fats” that are linked to heart disease and have been studied extensively in regards to the circulatory system, but one would conclude that if they are bad for the heart they must be bad for the brain. Indeed these conclusions would be correct. Saturated fats have been shown to create major havoc in the ability of neurons to communicate. Studies have shown diets high in saturated fats to be directly related to the hardening and shriveling in the dendritic regions of the neurons; thus, the ability or efficiency of neural communication is inhibited (Wainwright, 1998). Dendrites are the part of the neuron that receives chemical messages sent across the gap, called the synapse, from the neighboring neuron. Obviously, if the neurons are damaged, less fluid, or shortened by saturated fats, then they will be less efficient in the communication process, if part of it at all. Studies with rats fed diets with different concentrations of saturated fats have shown a decrease in learning curve that is directly related with the increase in the concentration of saturated fats in the diet (Greenwood, 1996). As we look back at history, we see that over the past century, and even more alarming the past few decades, the concentration of saturated fats has vastly increased in the average person’s diet.

This develops a serious question – has our learning curve decreased due to an increase in saturated fats in our diet as the studies have shown in other mammalian species? Furthermore, in addition to learning decreases, has the increase in saturated fats in our diets created an epidemic of related disease such as diabetes? Saturated fats have been linked to a decline in learning and memory due to its ability to force the body to become insulin resistant, which leads to diabetes. Other effects of insulin resistance include high blood pressure and reduced levels of beneficial HDL cholesterol (the good one as opposed to the harmful LDL cholesterol). How can we expect our brain to function at its highest level to obtain new knowledge and create new ideas when we damaging its hardware and its supporting cast (the body) with diets high in saturated fats? How can we expect our students to do well in laboratory investigations, unit tests, and even those universal standardized tests if they are not provided with an opportunity for an adequate diet in our school cafeterias and at home? Finally, what are the solutions? It will be very hard to convince Americans not to eat the fried, fast food we have grown to love. So, what are the alternatives? Studies have shown that consuming more Fish Oil may combat insulin resistance and hardened dendrites by making the membranes for fluid, thus allowing a better communication system within the brain to enhance learning and memory (Hibbeln, 1998). In addition, Hibbeln found that Fish Oil regulates levels of a neurotransmitter called serotonin, a chemical messenger between nerve cells, which is associated with increasing positive moods and avoiding depression. What better for our schools and our society, a more positive environment for learning with a more efficient brain!

BATTLE I: Omega-6 Fat verses Omega-3 Fat

The apparent magic of fish oil brings us to the other category of fat – unsaturated Omega-6 fats and Omega-3 fats. Fish Oil is high in Omega-3 unsaturated fats, which are naturally found in fish, seafood, nuts, legumes and green leafy plants. Omega-6 fats are found in oils, dressings, pork, beef as well as processed, baked, and fried foods. To understand to relationship between Omega 6 fats and Omega-3 fats and saturated verses unsaturated we first have to look at our evolutionary history. In an evolutionary since, the more complex the organism is, the longer it takes for it to be changed, in whole, by evolutionary forces. This is why the insect world is so enormous and keeps the pesticide industry growing and us consumers frustrated; those little guys aren't as complex so they can adapt rapidly to changes in their environment (i.e. chemical assault). So from a different viewpoint, our brain is by far the most complex organ in our body (you don't hear of many brain transplants) and it is the slowest to change in its entirety. Since the dawn of mankind, our diet as evolved to the point today to where it vaguely resembles the diet of our early ancestors and some argue that our brain hasn't been able to evolve at the rate in which our diet has, leaving it starved and inefficient at times. During a long period at the beginning of hominid history, the brain size changed very little as hominid remained land locked in their geographical range and the brain didn't start expanded until the range expanded to the large lakes and the coastal regions due to the presence of a different food source – fish and seafood with high amounts of Omega-3 fats (Crawford). So as the diet increased in Omega-3 fats, the brain size and capacity increased and language, culture, art, technology, and the ability to understand science was born (Crawford). Unfortunately, the story doesn't stop here! After a vast time as a hunting and gathering society endlessly searching for food and feeding on fruits and vegetables combined with lean meat rich in Omega-3 fats, man decided to begin controlling his environment and diet by agricultural means. Thus we introduced two food groups that our brain is unaccustomed to – the bread group from harvesting grain and the milk group from domesticating mammals. Furthermore, we altered the quality of one of the two original groups by replacing the lean meat high in Omega-3 fats of fish, crustaceans, and mollusks with new fatty, red mammalian meat high in Omega-6 fats. Sadly, the story continues. Man again grew tired of working the land for food and the Industrial Revolution was born and we began to process food and even pay others to prepare our food. As this new market expanded, taste became an important commodity to lure business and the delicious taste of grease and oil captured the globe. So now we have added harmful saturated fats to the harmful fatty Omega-6 fats in our brain and we have all but completely eliminated the rich, healthy Omega-3 fats all together and our brain has yet to adjust. So what is the hope in all of this since time and ease in America has become more important than the dollar and health. We are certainly in no hurry to give up the convenience of the fast food drive through and the microwavable meal and our school cafeterias are in no hurry to provide a better diet for our students. The answer lies in reincorporating some features of our ancestors' diet back into our own so that the primitive nutritional needs our brain developed around can be met. This is where fish oil comes into play.

Although reducing saturated fats is still required for optimal brain efficiency, reducing the ratio of Omega-6 fats to Omega-3 fats by increasing the amount of Omega-3 fats in our diet is the key. If other words, we have two choices being lower Omega-6 fats (which is not likely as long as we have the hamburger and fries option) or increase Omega-3 fats, which seems the be the more convincing choice. To increase learning and memory we must decrease this ratio by eating more foods and snacks with greater amounts of Omega-3 fats such as fruits, vegetables, seafood, fish, nuts, and legumes. We aren't headed in the right direction as it appears that red meat has replaced lean meat, grains have replaced fruits and vegetables as our main carbohydrate source coupled with "sweets" and we are the only animals that continue to consume fattening dairy products past infancy. We need to get back to a diet more compatible with our brain's physiological make-up if we want to increase learning and memory (Eaton, 1996). Here are some alarming facts illustrating the inversion of our diet as opposed to our ancestors and how it is inhibiting our brain's ability to enhance our learning and memory. Our ancestors had a Omego-6 to Omega-3 ratio of 1:1 and the average American today is expected to have a ratio of approximately 20:1 with research showing cognitive impairment beginning above a ratio of 4:1 (Yehuda, 1998). As the ratio increases and Omega-6 fats become disproportionate, neural inflammation occurs injuring or killing neurons, damaging blood vessels in the brain, and disrupting the optimal composition of neural membranes all of which impede neural communication and inhibit the learning and memory abilities of the brain (Yehuda, 1998). Although all ethnic groups eat a similar amount of saturated and Omega –6 fats, the Asian populations consume a greater amount of Omega-3 fats than Caucasians, which consume more than populations of African and Hispanic descent. Shockingly, these numbers are directly related to many of the overall performances by these ethnic groups on standardized tests and one can only speculate at this point as to the significance of this relationship. Therefore, one could conclude that with an alteration in their diet to consume to right proportions of fats and other nutrients, one could increase their learning ability and memory capacity. Indeed several studies have shown that student intelligence and performance on tests can be increased with a proper supplementation of vitamins and minerals (Benton, 1991; Scholanther, 1991; Yudkin, 1991). Vitamin E and C have specifically been shown to help combat the inflammation, caused by the production of arachidonic acid which in turn produces glutamate that kills brain cells leading to a smaller brain with associated problems such as Alzheimer's. Vitamin and other supplements, such as fish oil, might be a short-term answer to correcting a diet with an unbalanced ratio of Omega-6 fats to Omega-3 fats. Although vitamin supplementation is aimed at improving learning and memory and even student performance in school during laboratory investigations and tests, one would hope that the long-term solution would be an alteration in an individual's diet that would decrease saturated fats and Omega-6 fats while increasing Omega 3 fats. If we desire to improve our learning and memory ability, especially in our students in public schools, we have to move away from our new age diet low in Omega-3 fats or supplement the diet with fish oil to increase the amount of Omega-3 fat the brain receives. If we are unable to reduce our saturated fat and Omega-6 fat intake, a rich array of vitamins are needed to counteract the harmful effects these fats have on our brain's ability to function. Finally, in addition to inhibiting learning and memory, low amounts of Omega-3 fats have been linked to learning disorders such as ADD/ADHD in students (Stevens, 1995). The increase of these diagnoses in students could be related to the decline in the quality of fat in our diet over the past few decades.

BATTLE II: Sodium verses Potassium

Other than fat ratios, the ratio between two important naturally occurring elements is crucial to optimizing the functioning power of the brain. Sodium and potassium are two natural elements used profusely by the nervous system to relay electrical messages within neurons. The Sodium-Potassium pump is a physiological mechanism in the cell membrane that actively pumps three sodium ions out of the cell while pumping two potassium ions into the cell. This changes the voltage within the membrane and allows the electrical signal to travel from one end of the cell to the next. Also, the excessive concentration of sodium outside the cell naturally diffuses back into the cell and carries sugars and other required organic compounds into the cell. Unfortunately, our sodium intake is significantly higher than our potassium intake and is possibly one of the leading inhibitors of learning and memory. As we revisit the diet of our ancestors we find that they actually consumed 12 times as much potassium as sodium compared to our modern diet that averages nearly half as much potassium as sodium. We are the only species of animal that consumes more sodium than potassium and it appears that our brain has not evolved to the point yet to which it can function at its most efficient level with this high level of sodium (Eaton, 1996). Sodium ions cause the brain tissue and blood vessels to become more permeable and cause cells to lose water by osmosis. This can cause high blood pressure, rupture blood vessels, and even cause strokes. It is apparent that too much sodium can damage the brain and promotes a valid argument that as sodium levels increase the brain's ability to learn, retain memory, and recall memory will be inhibited. On the other hand, potassium ions seem to be very beneficial for the brain. High potassium levels can counteract sodium levels and protect the brain from damage by preventing blood pressure from increasing and preventing strokes. Again, one can conclude that higher levels of potassium can allow the brain to function more efficiently and enhance learning and memory. Remembering that it is not so much the amounts of each element consumed individually, but the ratio of consumption between the two is the key to maximizing the efficiency of brain performance. The ratio of sodium to potassium in a student's diet can have an impact on the student's ability to concentrate, process new knowledge, retain it, and then recall it at a later date for a test, thus improving academic performance.

Numerous studies have been conducted to show the relationship between diet and learning. Some have taken the approach that improvements in organisms' diets can improve the learning and memory of that organism while others have approached their research from the other perspective that decreases in the quality or quantity can lower an organism's memory and learning ability. Some research experiments have been conducted with human subjects while others have used non-human species, such as rats or monkeys. The studies involving human subjects have studied the young and the old as well as those with preexisting learning disabilities, such as ADD, ADHD and dyslexia, and those without. Despite all these variables, the research has shown a common trend in the relationship between diet and learning. Vitamins improved intelligence scores in six year olds (Benton, 1991). Vitamins improved intelligence with other experimental groups (Schoenthaler, 1991 & Yudkin, 1991). Fish consumption is related to the increase in learning and memory as well as the reduction of depression (Hibbeln, 1998). Saturated fats destroy brain cells and decrease learning and memory (Greenwood, 1996 & Wainwright, 1998). Fats have also been the attention of studies surrounding the outbreak of learning disorders such as ADD, ADHD, and dyslexia (Stephens, 1995 & Yehuda, 1998). Finally, research has shown that specific quantities of food itself are required and that breakfast is vitally important to learning and memory (Murphy, 1998). An evolutionary perspective as to why our current diet is not sufficient in supporting optimal learning and memory has been given as well (Eaton, 1996). Research overwhelmingly shows our diet is related to our learning and memory and it is completely in our control to improve our learning ability and memory by improving our diet. We must educate our students and children and provide an environment in which they can obtain an optimal diet both at home and at school.

METHODS

A survey of 83 students aged 14-15 was conducted to get a picture of the average student's dietary consumption rates for various food categories using the daily diet log in Appendix A over a four week span. At the end of the four-week span, each student had completed 20 diet logs from which the students completed the final survey, found in Appendix B, to show a weekly consumption rate and give a clearer view as to the quality and quantity of foods that the students were consuming. From these surveys, 10 students were selected to take part in four-week dietary enhancing vitamin supplementation program at school. The students selected were those who fell in the average range academically but into a below average category based on their diet surveys. These students were informed of the purpose and procedures of the research program and were given a standard medication administration form approved by the school nurse to be signed by their parents. This form, in Appendix C, was used to track the daily administration of the multivitamins for each student. In addition to tracking the dietary supplementation of these 10 students, their grades in their Biology class were collected for six weeks prior to the study and for the four weeks during the study. At the conclusion of the supplementation program after the four-week time period was over, a statistical comparison of grades was made using both an independent t-test and a dependent t-test (Gay, 2000). First, the average grades of the six-week period prior to the supplementation program were compared between the group of students, being those serving as a control by not participating in the supplementation program and those selected to participate. An independent t-test was required for this calculation. Second, the average grades were compared between the two groups after the four-week supplementation program using the independent t-test again. Finally, the change in average grades for each group from the six-week pre-supplementation period to the four week active period was calculated. Two dependent t-tests were used, one for each group. From the values obtained from the two independent t-tests and the two dependent t-tests, the significance of the change in averages between the two groups was determined.

<u>RESULTS</u>

The multivitamin supplementation experiment involved 83 students, 73 which served as the control and 10 which received a multivitamin tablet daily for four weeks. Overall, the grade average of the entire population declined during this period, probably due to the course subject content or the interruption of the week long Spring Break holiday. The focus on the experiment was to determine if the vitamin caused any significant difference in the fluctuation of grade averages. Since averages as a whole decreased, then the students receiving the vitamins should have had a lesser decrease in averages than those students that did not receive the vitamins if the vitamin truly had a positive effect on learning. The positive effect of the vitamins on learning was supported by the data. Prior to the start of the four-week vitamin supplementation program, the 73 students that were to serve as the control for the program had a six weeks average of 77.84 and the 10 students that were to receive vitamins had a six weeks average of 74.80. On average, the students in the control group had an average that was 3.04 points higher than those students about to begin the multivitamin supplementation program. As mentioned, the grades of both groups declined during the supplementation program; however, the grades of the control group saw a more negative decline than the group receiving the multivitamins. After the four-week supplementation program was over, the averages were tabulated for the grades earned during the four-week period. The control group had an average of 74.23 whereas the group that received the vitamins had an average that declined only to 73.10. The average grades for the control group dropped 3.61 points from 77.84 to 74.23 while the average grades for the group that received vitamins only declined 1.70 points from 74.80 to 73.10. From this data, the group receiving the vitamin supplementation shoed a more positive academic performance than the control by decreasing the average gap from –3.61 points to only a gap of –1.13 points. The data and trends are shown below in Table 1 and Figure 1.

Table 1: Differences in Grades

	BEFORE	AFTER	CHANGE
CONTROL GROUP	77.84	74.23	-3.61
VITAMIN GROUP	74.80	73.10	-1.70
DIFFERENCE	-3.04	-1.13	

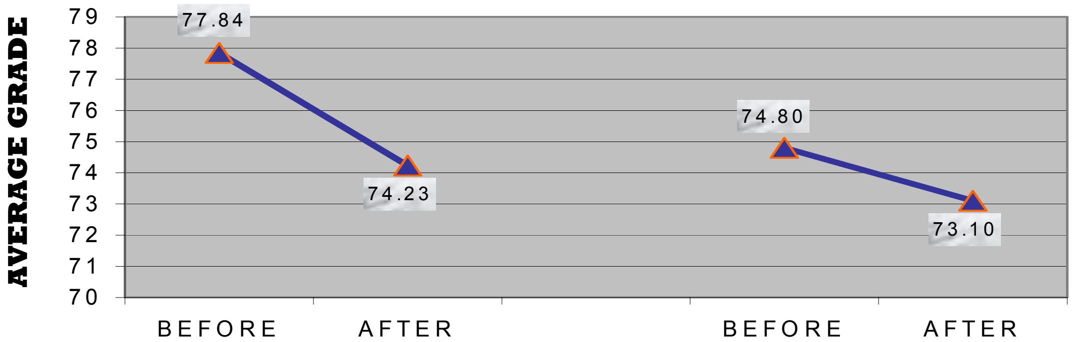

Figure 1: CONTROL GROUP vs. VITAMIN GROUP

CONCLUSION

The data show a trend favoring the students who were receiving multivitamins, but the supplementation program was not long enough to show a dramatic effect. Upon calculating the results for the experiment using the independent and dependent t-tests, it was determined that the data, although different, was not significantly different. The probable cause for this was the short-term nature of the program. Furthermore, an analysis of grades should be conducted after the supplementation period has ended to determine if the changes in grades would return to the normal pre-supplementation period. These two methods, lengthening the supplementation period and analyzing the post-supplementation period, would give a better picture to the significance of the relationship between the quality of our diet and its effects on the brain with regards to learning and memory. As our society and our schools advance into the future, our ability to understand how the changes caused by these advancements affect our body and brain become increasingly important to our success not only as a species but as individuals within a species. If our body and brain cannot evolve at the rate in which our lifestyles change then we cannot give in to the demands placed on ourselves by society. Although food is much more abundant, diverse, and available in today's society, the quality and effect of fast, processed foods might not be the greatest source available for consumption. The foods we eat today are very high in saturated fats, Omega-6 fats, and sodium, all of which can have devastating effects on our brain's ability of function at a level required to obtain new knowledge and memory. In this competitive world where we are judged by academic performances when applying for college and/or jobs, it is conceivable that one could obtain an edge by boosting their brain's ability to perform at a higher level by altering their diet to eliminate potentially harmful compounds and elements that are damaging or inhibiting brain function. If this reduction is not possible or not worth the lifestyle changes then there is still hope. Increasing other compounds that are beneficial, such as vitamins, Omega-3 fats or potassium, can counteract the effects of the less beneficial parts of our diet. If we decrease the ratio of bad to good by either consuming less bad foods or more of the good foods, then the results will be positive for our brain. At this point, though, it must be mentioned that any food is better than no food at all. Studies have shown that any breakfast, especially in school children, is better than no breakfast at all and these studies have shown that academic performance is generally higher in students who were in a school breakfast program as opposed to those students who were not (Murphy, 1998). Having a poor diet definitely has an effect on the brain's ability to function, but it is not near as devastating as no diet at all. We, as individuals of an intelligent species, must come to understand that as we eat, we need to gradually weed out certain inhibiting items from our diet and replace them with more important items that are more useful for our brains. We realize that their will always be unhealthy meals consumed, but they cannot be consumed at the alarming rate at which we are today because our brain cannot function at its maximum efficiency with this disproportion of nutrients. As we improve these ratios, we will not only increase our learning and memory, but we will improve the overall health of our body and possibly delay or prohibit diseases that are frequent in our population, such as obesity, diabetes, high blood pressure, high cholesterol, heart attacks, strokes, ADD, ADHD, dyslexia, and Alzheimer's. Our schools and our society can benefit by educating students and children on the importance of consuming a healthy diet.

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APPENDIX A

Daily Diet Log

DAILY DIET LOG

NAME:____________________ **DATE:**____________________

BREAKFAST		**LUNCH**		**SUPPER**	
Meats/Eggs/Nuts	Amount	Meats/Eggs/Nuts	Amount	Meats/Eggs/Nuts	Amount
Breads/Grains	Amount	Breads/Grains	Amount	Breads/Grains	Amount
Fruits/Vegetables	Amount	Fruits/Vegetables	Amount	Fruits/Vegetables	Amount
Milk/Dairy	Amount	Milk/Dairy	Amount	Milk/Dairy	Amount
Sweets	Amount	Sweets	Amount	Sweets	Amount
Other	Amount	Other	Amount	Other	Amount
Snacks: Breakfast to Lunch		Snacks: Lunch to Supper		Snacks: After Supper	

APPENDIX B

Average Weekly Diet Student Survey

NAME:____DATE:_________________

AVERAGE WEEKLY DIET STUDENT SURVEY

Circle the number of servings you eat on average each week.

Fish/Seafood	0	1-2	3-4	5-6	7-8	9-10	+10
Turkey/Chicken	0	1-2	3-4	5-6	7-8	9-10	+10
Beef/Pork/Ham	0	1-2	3-4	5-6	7-8	9-10	+10
Beans/Nuts	0	1-2	3-4	5-6	7-8	9-10	+10
Eggs	0	1-2	3-4	5-6	7-8	9-10	+10
Milk/Dairy	0	1-2	3-4	5-6	7-8	9-10	+10
Cereal	0	1-2	3-4	5-6	7-8	9-10	+10
Bread/Tortilla	0	1-2	3-4	5-6	7-8	9-10	+10
Pasta/Potato	0	1-2	3-4	5-6	7-8	9-10	+10
Vegetables	0	1-2	3-4	5-6	7-8	9-10	+10
Fruits	0	1-2	3-4	5-6	7-8	9-10	+10
Cookies/Candy/Chips	0	1-2	3-4	5-6	7-8	9-10	+10
Coke/Tea/Caffeine	0	1-2	3-4	5-6	7-8	9-10	+10
Supplements/Vitamins	0	1-2	3-4	5-6	7-8	9-10	+10
Other_____________	0	1-2	3-4	5-6	7-8	9-10	+10

Circle the choice that best answers your thought on the following questions.

Do you eat a healthy breakfast?	A lot	A little	Not at all
Do you think eating a healthy breakfast can improve your grades?	A lot	A little	Not at all
Do you normally skip lunch and/or evening supper/dinner meals?	A lot	A little	Not at all
Can you improve your grades by improving your diet?	A lot	A little	Not at all
Can you improve your memory/attention span by improving your diet?	A lot	A little	Not at all

APPENDIX C

Medical Administration Approval Form and Log

RICHARDSON INDEPENDENT SCHOOL DISTRICT

Medical Administration Approval Form and Log

Date of Request:________________________________ School:_______________________
Student's Name:________________________________ Teacher/Grade:________________
Medication:____________________________________ Dosage:______________________
Times to be Administered:____
Condition for Which Medication in Required:____
Side Effects of Medication:____

Physician's Name:______________________________ Phone:________________________
Physician's Signature:__________________________

My signature below indicates that I approve that RISD staff administer the medication specified above to my child.

Parent/Guardian Signature:______________________ Home Phone:___________________
Email:____ Work Phone:___________________

ADMINISTRATION LOG

Month:_____________________

DATE	DOSAGE	DATE	DOSAGE
_____Monday	_________	_____Monday	_________
_____Tuesday	_________	_____Tuesday	_________
_____Wednesday	_________	_____Wednesday	_________
_____Thursday	_________	_____Thursday	_________
_____Friday	_________	_____Friday	_________
_____Monday	_________	_____Monday	_________
_____Tuesday	_________	_____Tuesday	_________
_____Wednesday	_________	_____Wednesday	_________
_____Thursday	_________	_____Thursday	_________
_____Friday	_________	_____Friday	_________
_____Monday	_________	_____Monday	_________
_____Tuesday	_________	_____Tuesday	_________
_____Wednesday	_________	_____Wednesday	_________
_____Thursday	_________	_____Thursday	_________
_____Friday	_________	_____Friday	_________