DIETARY INTAKE AND HEART RATE IN 3^{RD}-5^{TH} GRADE CHILDREN

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Date Thesis Defended

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Abstract

In adults, published studies have linked choline, magnesium and omega-3 fatty acids to heart rate (HR). No studies were identified that evaluated the affects of nutrients on HR in children. The purpose of this study was to determine if any nutrients affected HR in children, and if they do, were there age, gender or race/ethnic differences. This was a cross sectional analysis of existing data from a larger randomized control trial, the Kansas Intervention with Dairy in Schools project. There were 968 subjects in grades 3-5 from the Kansas City, KS and Shawnee Mission, KS public school districts. Data were collected during the school day in the fall of 2008. A DINAMAP® Compact Monitor (Critikon, Tampa, FL) was used to measure HR and blood pressure, there was a 5 minute period of rest and then 4 measures with 1 minute of rest in between, the 4 measures were averaged together to obtain the average HR. Diet information was obtained using a standardized multiple pass 24 hour diet recall. Diet intake was analyzed using Nutrition Data System for Research (version 2008, University of Minnesota, Minneapolis, MN). Results indicated that the nutrients that were correlated to HR were calcium, daidzein, genestein, glyciten, lactose, erucic acid and saccharin. The results of the best fit regression model that did not consider gender, race/ethnicity

or age included calcium, genestin, erucic acid, saccharine, sodium, gadoleic acid, and caffeine (R2 = 0.0398).The results of the best fit model that did include gender, race/ethnicity and age included white non Hispanic, black non Hispanic, 9 years of age, calcium, genestien, erucic acid, sodium, caffeine and xylitol (R2=0.098). These data suggest that 9 years of age could be the cutoff point when diet begins to play a large role in determining HR, but further research is needed.

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Chapter 1

Justification

The ways in which nutrients affect heart rate (HR) in children has not been extensively studied. There is a plethora of literature regarding the possible ways in which omega 3 fatty acids (FA) work in decreasing HR and limited research regarding other nutrients' effects on HR. However, all studies have been done on adults, most of which have had some sort of cardiovascular event prior to the study. It is widely accepted that family history of cardiovascular disease increases cardiovascular disease risk and that increased HR increases risk of cardiovascular disease. However, no research has been done to determine if nutrients affect HR in children. Preventing cardiovascular disease is easier than treating it and thus if nutrients are indentified that modify HR in children, it could be a possible area of prevention.

The purpose of this study was to evaluate whether dietary intake in children grades 3rd-5th is associated with HR, specific nutrients of interest were omega 3 FA, choline and magnesium. Further, gender and race/ethnic differences were evaluated as research in adults suggests more of an effect of diet on HR in whites than blacks and in men than women.

<u>Research Questions</u>

1. In children ages 8-10 years is there a relationship between energy and nutrient intake and heart rate?

2. If so, are there gender and/or race/ethnic differences in heart rate and nutrient relationships?

Chapter 2

Review of Literature

Heart Physiology

The heart has four chambers. The right atrium receives blood returning from body tissues. The right ventricle pumps blood received from the right atrium into the lungs. The left atrium receives blood high in oxygen content as it returns from the lungs and the left ventricle pumps oxygenated blood to all parts of the body (1). The heart also has four valves. The right atrioventricular valve opens to allow blood to flow from the right atrium to the right ventricle and closes when the right ventricle begins to contract. The left atrioventricular valve allows blood to flow from the left atrium to the left ventricle and closes when the left ventricle begins to contract. The pulmonic valve is located between the right ventricle and pulmonary artery and as soon as the right ventricle has emptied it closes to prevent blood that is on its way to the lungs from returning to the ventricle. The aortic valve is located between the left ventricle and the aorta and after contraction of the left ventricle it closes to prevent flow of blood back from the aorta to the ventricle (1).

The action potential that stimulates the heart to contract is generated by the sinoatrial node (SA), which is located in the upper part of the right atrium and initiates heart beat and sets the rate of the heart contractions (1). The heart beat controlled by the SA node is called the sinus rhythm (1).

Heart rate is controlled by the autonomic nervous system, which consists of the sympathetic nervous system and the parasympathetic nervous system. Both systems consist of a two neuron chain; between each neuron there are ganglia which divide the chain into pre- and post-ganglionic parts. The pre-ganglionic neurons and the post-ganglionic parasympathetic neurons release acetylcholine as a chemical transmitter. The post-ganglionic sympathetic neurons release norepinephrine as their chemical transmitter (1, 2). The sympathetic nervous system increases HR during the fight or flight response by stimulating the SA and AV nodes and leads to increased cardiac output. The parasympathetic nervous system slows HR and restores homeostasis; the vagus nerve stimulates the SA and AV nodes (1). Sympathetic innervations of the heart come from the cervical and upper thoracic ganglia and parasympathetic innervations come from the vagal nerve (2). Beat to beat control of HR is determined to a great degree by the level of vagal innervations of the SA node (2). Hormones, ions, drugs and nutrients can also influence HR (1, 3, 9-15).

Heart Rate Predictive of Cardiovascular Disease

Many studies on adults have found heart rate (HR) to be predictive of cardiovascular risk (16-18). A study of 2,533 men from central Italy, found that the individuals who had HR's over 90 beats per minute (BPM) when compared to men with less than 60 BPM, had an increased risk for all cause mortality, cardiovascular mortality and non-cardiovascular mortality (16). High HR, especially in men, has been linked to cardiovascular events, including mortality and higher blood pressure levels at all age levels (18, 19). The Chicago Board of Health Community Survey found the HR blood pressure relationship to be stronger in men than women and in individuals younger than 65 years of age than in older individuals (18). Another study on adults, found the relationship only in white participants (18).

Several investigators have reported higher HR's in subjects with a family history of hypertension and that young patients with high HR's tend to have borderline hypertension (18). In the Golstrup County Study, investigators found HR to be more predictive of coronary heart disease (CHD) than cholesterol in men aged 50 years and older (18). Results from the Framingham Study indicated that cardiovascular related deaths increased progressively with increasing HR's among all age groups (18). In addition, results from several studies indicate that men who are admitted to the hospital with cancer and high HR's have lower survival rates than those with lower HR's (18).

The Bogalusa Heart Study is the only previous report found that evaluated HR in children, ages 3-20 years. The investigators reported that the HR and blood pressure relationship only occurred in white children, both boys and girls, but not in black children. It should be stated that HR decreases with age (18). A normal HR for children (ages 8-10) is 70-120 BPM, whereas adults have a normal resting HR of 60-100 BPM (20, 21).

Choline and Heart Rate

Choline is a B-vitamin that is used to synthesize acetylcholine, lecithin and platelet-activating factor (22). The availability of choline determines the rate of acetylcholine synthesis (5). As mentioned previously, acetylcholine is a neurotransmitter of the autonomic nervous system, which largely controls HR (1, 2). The methyl group of choline can also be made available for one-carbon transfers. Choline, folate, and methionine are interrelated and interact to convert homocysteine to methionine (5). Choline is also important for brain development. Animal studies have found that male rats are more sensitive to choline deficiency than female rats (5). Pre-menopausal women have a much larger ability to produce endogenous choline than postmenopausal women or men; this is advantageous as there is a great need for choline in the development of the fetus (5). Research on how choline affects HR specifically is lacking, but studies suggest there may be a relationship.

Animal studies suggest that choline and its metabolites influence blood pressure and HR in normal and hypertensive rats (3). Phosphocholine, when injected at 400-600 μmol/kg, significantly decreased HR of rats 5 minutes after injections, however, heart rate returned to baseline values 10 minutes later (3). Intra-peritoneal administration of choline decreased HR and increased blood pressure (3). A report by Neumann and colleagues suggested that individuals with genetic variation in the human choline transporter gene (CHT1) had variations in cholinergic neurotransmission and autonomic cardiac function (23). In addition, when adult men and postmenopausal women are deprived of dietary choline, they develop fatty liver, muscle damage and a decreased ability to handle a methionine load. Elevated methionine can result in elevated homocysteine levels, which is a risk factor for cardiovascular disease (5).

Magnesium and Heart Rate

Magnesium is a cofactor for over 300 enzyme systems and thereby involved in numerous metabolic pathways. It also is involved in neuromuscular transmission as extracellular magnesium concentration is critical for maintenance of electric potentials of nerve and muscle (22). Many studies have suggested that magnesium deficiency may be a factor in cardiac arrhythmias and thereby increase an individual's risk for cardiovascular disease (4). An arrhythmia is a disorder of the heart rate or rhythm. Tachycardia is when the heart beats faster than normal and bradycardia is when the heart beats too slowly (24). When given acutely, high doses of magnesium have been able to correct multifactorial atrial tachycardia and change atrial fibrillation to a normal sinus rhythm (4). Hypomagnesaemia increases risk of arrhythmias, some of which may be caused by an imbalance of electrolytes caused by low dietary magnesium intake (4). In a study of 13 subjects placed on a magnesium deficient diet, four subjects developed heart rhythm changes that were corrected when the magnesium repletion diet was started. The rhythm changes did not reappear during the remainder of the study (4). Magnesium has a regulatory role in sodium and potassium transport (4). The prevalence of magnesium deficiency has been widely debated (4) and few studies have been done to specifically address the effect of magnesium on HR; however, there is evidence to suggest a relationship. Omiva and colleagues reported a relationship between magnesium concentration and HR response in sleep deprived individuals (25).

Omega 3 Fatty Acids and Heart Rate

Omega-3 fatty acids (FA) have been found to be effective in reducing the risk of sudden cardiac death after myocardial infarction and fish consumption is associated with lower risk of fatal and non fatal coronary heart disease (6,7,9,19). The mechanisms for these protective effects have yet to be determined. Many studies have shown decreases in HR due to fish and fish oil consumption, which are high in omega-3 FA (13, 4, 9, 10, 12, 14). O'Keefe et al. reported that omega 3 FA decreased risk for sudden cardiac death by significantly decreasing HR and accelerating return to normal HR after standing and exercise in participants who had had a myocardial infarction 3 months to 5 years previously. HR recovery after exercise, which is controlled by vagal tone, has been shown to be predictive of cardiovascular prognosis (19). These observations suggest omega-3 FAs impact vagal activity but do not rule out other mechanisms for how the omega-3 FA's affect HR (19).

Several studies suggest that omega-3 FA are related to the autonomic nervous system by reducing sympathetic nervous system outflow, as suggested by a decrease in plasma norepinephrine levels after increased dietary intake of fish or fish oils (8). As mentioned previously, the sympathetic nervous system is responsible for increasing HR during the fight or flight response (1). Monahan et al. reported that the infusion of fish oils in dogs slowed heart rate, atrioventricular conduction and affected ventricular repolarization (8). Increased HR and an abnormal QT interval are shown to predict arrhythmic events in humans (8). However, studies indicate that fish oil consumption may affect HR more in individuals who already have higher than average resting HR (8, 12).

Docosahexaenoic acid (DHA) is the major omega-3 FA that gets incorporated into myocardial cells, yet most studies on the cardioprotective effects of fish and fish oil have focused on eicosapentaenoic acid (EPA) because it is more abundant in fish and fish oil (10). Human studies have found that DHA had significant effects on 24 hour HR and EPA did not (10). A meta analysis found that EPA and DHA had larger reductions in HR with longer treatment times, indicating that these omega-3 FA may need time to be incorporated into tissues before an effect is seen in HR reduction(12).

A limited number of clinical interventions have been identified that evaluated providing omega 3 FA on HR outcome. Geelan et al. (7) conducted a study of 84 individuals ages 18 years and older who had been diagnosed with premature ventricular complexes. Those taking 3.5 g of fish oil experienced an average of 2.1 BPM reduction in HR, which they equated to a 6% reduction in their risk for sudden cardiac death. The Diet and Reinfarction Trial (DART) found that men who ate fatty fish twice a week for two years had a 29% decrease in overall mortality (13). In a randomized controlled trial of overweight hypertensive individuals, ages 20-65 years, a 3.1 BPM reduction was found after 16 weeks of consumption of 4 g/d EPA and DHA (10). Metcalf et al. (11) and the GISSI-Prevention study found that a daily dose of 850 mg EPA plus DHA decreased risk of sudden cardiac death by 45%. In a cross-sectional analysis, Mozaffarian et al. found that subjects taking an average of 1,070 mg EPA plus DHA daily had HR's 3.9 BPM lower than those taking an average of 19 mg EPA plus DHA. The author equated a 3.9 BPM reduction in HR to be a 7.5% reduction in risk for sudden death (9). A meta analysis by Mozaffarian et al. reported an average HR reduction of 1.6 BPM with fish oil supplementation, which they equated with a 5% lower risk of sudden death (12). That same meta-analysis found that modest consumption of omega-3 FA, equivalent to consuming 1-2 servings of fish per week or 500-1000 mg/d were equally as effective as much greater consumption (12). A study on heart transplant patients found that 0.45 g EPA and 0.39 g DHA per day over 4 months had a 5 BPM average reduction in HR (14).

Fruits and Vegetables.

Dietary antioxidants may also benefit the autonomic nervous system. Fruits and vegetables are good sources of antioxidants. Data from the Veterans Administration Normative Aging Study was used to explore the relationship between fruit and vegetable intake and heart rate variability. The investigators reported that intake of green leafy vegetables was associated with beneficial effects on heart rate variability. The specific mechanism is not known. The authors did not find any relationship with fish intake (26).

Summary

Heart rate is very complex and many factors contribute. Studies suggest that nutrients may play a role in heart rate, especially magnesium, choline and omega 3 FA. High heart rate is a predictor of cardiovascular disease. There has only been one study identified that evaluated nutrient intake and HR in children.

Chapter 3

Methods

Overview:

This was an auxiliary cross-sectional analysis of data collected as a part of the KUMC KIDS study, a randomized controlled trial under the direction of Dr. Debra Sullivan (15). The primary aim of the KUMC KIDS study was to determine the impact of dairy foods on blood pressure. The current study used baseline data from year two of the KUMC KIDS study. The primary aim of this analysis was to determine if a relationship exists between dietary intake and heart rate in a sample of school children.

Setting

Data were collected during the school day at White Church, Stony Point North, Noble Prentis, Silver City, John F. Kennedy, Welborn, Lindbergh, Grant, W.A. White, Stony Point South and Bethel elementary schools in the Kansas City, Kansas public school district. And, at Tomahawk, Overland Park, Roesland, and Don Bonjour elementary schools in the Shawnee Mission, Kansas public school district. All testing occurred in the fall of 2008.

Sample

The sample was 968 children, grades 3-5, from the Kansas City, KS and Shawnee Mission, KS public school districts. All subjects and legal guardians signed a consent form. For inclusion in this project, children had to have data available for heart rate, dietary intake and demographic information.

Ethics

This study was a sub study of the KUMC KIDS Nutrition Project, which had already been approved by the Human Subjects Committee. All subjects and legal guardians signed a consent form. No new data was collected, only data collected under the KUMC KIDS Nutrition Project was used. Therefore, no further approval was needed for this study.

Procedures

This was a cross sectional analysis of data from the KUMC KIDS study. All subjects with completed data forms and reliable diet recalls were included in the analysis.

Demographics, gender and ethnicity breakdown were determined using the health history form sent home for guardians to complete and self report from children.

Body Mass Index: Children were measured with shoes removed and in normal clothing. If present, they were asked to remove any jackets or sweatshirts. Height was measured using a portable stadiometer (Perspective Enterprises, Portage, MI). Body weight was measured on a digital scale (Seca Platform Scale, model 707, Seca Corp., Columbia, MD). All measurements were measured to the nearest 0.10 centimeter, recorded three times and then averaged. Body Mass Index

(BMI) and weight status were calculated using age, height and weight. Underweight was defined as BMI less than the 5th percentile, normal weight was 5-84.9th percentile, overweight was 89-94.9th percentile and obese was 95th percentile or greater.

Dietary Intake: Nutrient intake was assessed using a standardized multiple-pass 24 hour dietary recall. Research staff of the KUMC KIDS study were trained and certified in the use of probing questions and use of 3–dimensional models to obtain accurate diet recalls from children. The nutrient content of the diet recalls were determined using Nutrition Data System for Research (version 2008, University of Minnesota, Minneapolis, MN).

Heart Rate (HR) was collected using a DINAMAP® Compact Monitor (Critikon, Tampa, FL). Arm circumference was measured for each child to determine appropriate BP cuff size. Children were seated and rested quietly for five minutes before the first reading. Four readings were taken with one minute between each reading. The first reading was discarded and the results of the following three were averaged and used as the HR result.

Analysis of Data

Descriptive statistics such as frequencies, means, and standard deviations were calculated to characterize the population and included age, gender, race/ethnicity and BMI. Data were analyzed using STATA for the multiple linear regressions and SPSS to run the correlation and make the scatter plots.

Chapter 4

Results

This study evaluated whether there was a relationship between dietary intake of several nutrients and HR in children ages 8-10 years. The nutrients of interest were choline, magnesium and omega-3 FA as there are published results linking those nutrients to HR in adults. However, as there were no specific studies on diet and HR in children, we evaluated all nutrients in relation to HR. Any influence by gender, age or ethnicity was also evaluated.

Sample

The study included 968 children aged 8-10 years. Subjects were 52% females and 48% males; 33% white non Hispanic, 21% white Hispanic, 30% black non Hispanic, and 16% other race/ethnicities. Table 1 describes the sample characteristics.

Table 1. Characteristics of the Sample

Characteristic	Mean $\pm$ SD
Age	9.1 $\pm$ 0.9
Gender (n/%)	
Female	500 (52%)
Male	468 (48%)
Race/Ethnicity (n/%)	
White non-Hispanic	319 (33%)
White Hispanic	206 (21%)
Black non-Hispanic	292 (30%)
Other	151 (16%)

Subjects' BMI were distributed as follows: 3% were below the 5th percentile and were classified as underweight, 55% were between the 5th and 85th percentile and were classified as having a healthy weight, 18% were between the 85th and 95th percentile and were classified as being overweight, and 25% were above the 95th percentile and were classified as obese. See Table 2 for a breakdown of weight status.

Table 2. Weight status of the Sample

Weight Status	BMI Percentile	n	Mean BMI $\pm$ SD
Underweight	Under the 5th	25	2.4 $\pm$ 1.5
Healthy Weight	Between 5th and 85th	533	52.5 $\pm$ 22.6
Overweight	Between 85th and 95th	170	90.5 $\pm$ 3.1
Obese	Above the 95th	240	95.5 $\pm$ 0.4

Table 3 shows the distribution of children with below normal, normal and above normal HR.

Table 3. Heart Rate Ranges

HR Range	n	% of sample
Below Normal (under 70)	100	10.33%
Normal (70-120)	867	89.57%
Above Normal (over 120)	2	0.20%

Dietary Intake of Selected Nutrients

Table 4 lists the dietary intake of selected nutrients. The nutrients were selected as they were anticipated to be related or found to be significantly related to HR in the statistical analysis.

Table 4. Average Intake and Range of Intake for Selected Nutrients

Variable	Mean ± SD	Range
Lactose	25 ±14.8 g	0-113 g
Calcium	1056 ± 511.5 mg	94-3987 mg
Magnesium	219±83.6 mg	28-708 mg
Sodium	2926±1284.3 mg	440-12219 mg
Gadoleic Acid	0.2±0.12 g	0-1.1 g
Erucic Acid	0.02± 0.04 g	0-0.5 g
Saccharine	0.06 ± 1.98 mg	0-62 mg
Caffeine	13 ± 24.78 mg	0-247 mg
Omega-3 FA	1.1±0.78 g	0.02-6 g
Daidzein	0.2±0.61 mg	0-9 mg
Genestein	0.4 ± 0.82mg	0-10 mg
Glycitein	0.06 ± 0.16mg	0-3 mg
Choline	255± 113.49 mg	20-900 mg
Xylitol	0.007 ± 0.01 g	0-0.09 mg

Relationship of Dietary Intake and HR

Using Pearson Correlation the following nutrients were identified as having statistically significant relationships with HR. Daidzein, genistein, glycitein, and erucic acid were all negatively correlated to heart rate. Calcium, lactose and saccharin were positively correlated. Table 5 gives the significant correlation results.

Table 5. Pearson Correlation Results

Nutrient	R	P
Calcium	0.070	0.0293
Daidzein	-0.074	0.0209
Genistein	-0.079	0.0129
Glycitein	-0.074	0.0213
Lactose	0.065	0.0448
Erucic Acid	-0.072	0.0257
Saccharin	0.072	0.0259

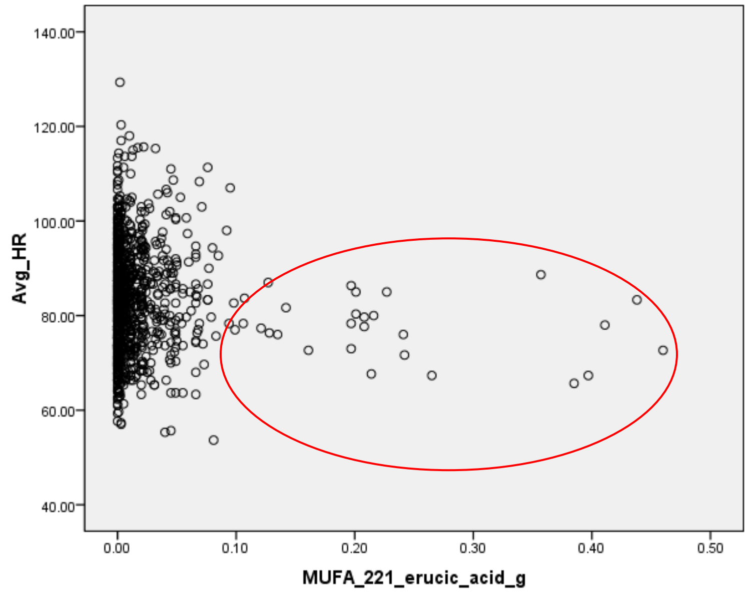
Step-wise regression was used to determine the best predictor for HR. The following regression explains 4% of the variability of the average HR (R2=0.0398). Table 6 shows the results of the best fit model.

Table 6. Step Wise Regression Results

Ave HR	Coef.	St. Err	t	p> ItI	95% Conf.	Interval
Calcium (mg),	0.003377	0.000854	3.95	0	0.001701	0.005053
Genistein (mg)	-1.15633	0.435183	-2.66	0.008	-2.01035	-0.30231
Erucic acid (g)	-19.8288	8.148004	-2.43	0.015	-35.8188	-3.83887
Saccharin (mg)	0.376076	0.177526	2.12	0.034	0.027693	0.724459
Sodium (mg)	-0.00123	0.000379	-3.23	0.001	-0.00197	-0.00048
Gadoleic acid (g)	6.907818	3.18121	2.17	0.03	0.664889	13.15075
Caffeine (mg)	0.028332	0.014267	1.99	0.047	0.000333	0.056331

When creating scatter plots based on this model, the only one of interest is in Figure 1. This scatter plot indicates that when erucic acid intake is above 0.1 g, the average heart rate is relatively low.

Figure 1. Scatter Plot for Erucic Acid



The sources of erucic acid in the children's diets and can be found in Appendix A. The top sources of erucic acid consumed were sesame and sunflower seeds, catfish, dark meat of chicken and turkey, salmon, tuna, hot dogs, cocoa puffs, Poptarts, mustard powder, Dijon mustard and regular mustard.

Table 7 shows the top 10 average HRs. The caffeine consumption was varied.

Table 7. Top 10 Average HR's Compared to the Caffeine Consumption of that Subject

Ave HR	Caffeine (mg)
129.3	**40.152**
120.3	**5.014**
118	17.184
117	10.028
115.7	4.44
115.5	10.028
155.3	67.754
115	4.86
114.3	10.028
113.7	5.094

The sources of caffeine in the subject's diets and can be found in Appendix A. Top sources of caffeine were all types of sodas, tea and chocolate candies and cakes.

Another step wise regression model was done that included race/ethnicity and age in the model. The results indicated that as age increases, heart rate decreases; however, it decreases more slowly in white non Hispanics and black non Hispanics than in other races. This model explains 10% of the variability in HR (R2 = .098). Table 8 gives the results of this regression model.

Table 8. Step Wise Regression Results

Avg HR	Coef.	Std. Err.	t	p>ltl	95% Conf	Interval
White non Hispanic and black non Hispanic	-19.70	7.28	-2.67	0.01	-34.18	-5.22
9 years	-4.17	0.60	-6.97	0.00	-5.34	-3.00
White non-Hispanic and Black Non-Hispanic * 9years	2.08	0.76	2.72	0.01	0.58	3.58
Calcium(, mg)	0.00	0.00	3.30	0.00	0.00	0.00
Genistein (, mg)	-1.07	0.42	-2.54	0.01	-1.90	-0.24
Erucic acid (g)	-22.26	7.92	-2.81	0.01	-37.81	-6.71
Sodium (, mg)	0.00	0.00	-2.10	0.04	0.00	0.00
Caffeine (, mg)	0.04	0.01	2.95	0.00	0.01	0.07
Xylitol (, g)	76.63	37.60	2.04	0.04	2.83	150.43

Chapter 5

Discussion

Heart disease is the leading cause of death in the United States (27). As the nation's children become more overweight and obese leading to earlier heart disease in life, it is important to find out if nutrients could affect HR in children. Research in adults has found HR to be a predictor of heart disease and has suggested that the nutrients choline, magnesium and omega-3-fatty acids may play a role in modulating HR. Few studies have been published exploring what nutrients may influence HR in children.

Sample

The subjects for this project had a mean age of 9.1$\pm$0.9 years years and were fairly evenly distributed between gender and race/ethnicity. The Centers of Disease Control and Prevention estimates that 17% of children ages 6-11 years are obese. In this study, 25% of the sample was obese. The higher than average obesity rates are similar to what is typically observed in lower socioeconomic, urban populations. Wang and colleagues reported that 21.8% of urban African American children in Chicago were obese (28). Trent et al. reported that 26.5% of multi-ethnic, urban children in Baltimore were obese (29). The average HR for this sample was 83.6 BPM which is well within the average range for children, which is 70-120, and 89.6%

of the sample had HR’s within normal limits. No other studies measuring average HR in children were identified.

Relationship between dietary intake and HR

The results of this study were not predicted. Previous studies on diet and HR in adults suggested that choline, magnesium and omega 3 FA would influence HR. The nutrients identified in this study had not been previously mentioned in other studies.

The regression model including race and age indicate that age influences HR more than anything else. As mentioned earlier, heart rate naturally decreases as we age. It very well may be that until 9 years of age, genetics play more of a role in predicting HR. The average HR for children is 70-120 BPM, where the average HR for adults is 60-100 BPM. However, multiple studies found that heart rates near the top of that range were predictive of heart disease (10).

It is interesting that sodium, gadoleic acid, caffeine and xylitol were in the best fit models and yet they were not correlated to HR in the Pearson correlation. Sodium is involved in functioning of the heart, so it does seem reasonable that sodium intake would predict heart rate. Many studies have linked sodium and blood pressure; however, no reports were found that looked at sodium and HR.

Leiw et al. found that in guinea pigs, genestien increased heart contractions and calcium transients in a concentration dependent manner in myocytes in male animals but not females (30). This might indicate that genestien and calcium's relationship to HR could be related to one another.

Caffeine is a stimulant which was in the best fit model but not significantly correlated to heart rate. However, it does make sense that it would be a predictor of heart rate since it is a stimulant, also the 11 subjects with the highest HRs all consumed more than 2.5 mg caffeine in the previous 24 hours.

Erucic acid was negatively correlated to HR and was in both best fit models. There is no research on erucic acid and the limited resources found on erucic acid are not the highest quality. Erucic acid is a mono-unsaturated fatty acid found in rape seed and mustard seed and causes fatty infiltration of heart muscle in animal models (31). Low erucic acid versions of rape seed have been developed to use in the food supply (31). Erucic acid is used as a lubricant, transmission oil, emollients and as a component of bio-diesel (31). Some epidemiological studies have found that in parts of the world that still consume large amounts of mustard oil the people have less heart disease, suggesting that mustard oil may be cardioprotective. It is uncertain what component of the mustard oil makes it carioprotective (31). Studies in rats found that erucic acid causes myocardial lesions in male rats (31). It is interesting that as erucic acid increased in the diet HR decreased, especially since most of the food sources for this sample were basically junk food; however, fish was a source.

There are no data on gadoleic acid related to HR. Glycitein, daidzein and genestein are components of soy. No data exist on the effects of soy and HR.

Saccharin was positivity correlated to HR and xylitol in the best fit model. Both of these are artificial sweeteners and no data were identified regarding artificial sweeteners and HR. However, the Journal of American Dentistry reports that consuming 8 g of xylitol daily during eruption of permanent teeth may prevent up to 70% of tooth decay (32). Abranches et al. report that streptococcus mutans, the primary cause of dental caries, may be responsible for certain types of cardiovascular disease (33). This is an area that could be further explored.

Limitations

There are several limitations to this study. Only one time point was analyzed, there are seasonal differences in food intake, HR, etc. Also, only one 24 hour diet recall per child was used in the analysis and one day is not sufficient to adequately characterize an individual's diet but is is sufficient to characterize a group. However, due to the interesting results of this study, more days would have helped to validate the results. The 24 hour recalls are also subject to the child's memory and may not be 100% reliable.

Strengths

While there are several limitations to this study, there are also several strengths. Multiple HR's were measured and averaged together to determine the child's average HR. The sample was also very large, 968 subjects.

Implications

It would be beneficial to repeat this study with a group of children from birth to age 9 years and from age 9 years to 18 years. Taking several diet recalls instead of one, in order to get a better picture of what the children are consuming. This study may indicate that age 9 years is the cutoff point when diet could be more of a factor than genetics in determining heart rate. The only way to know for sure is to do further research on this topic.

Conclusions

This study found that there is a relationship between HR and calcium, daidzein, genestein, glyciteien, lactose, erucic acid and saccharine. The best fit model that did not include gender, age or race/ethnicity explained only 4 % of the variability in HR and included calcium, genestien, erucic acid, saccharine, sodium, gadoleic acid and caffeine. The best fit model that did include gender, age and race/ethnicity explained 10% of the variability in HR and included being white non Hispanic and black non Hispanic, being 9 years old, and calcium, genestien, erucic acid, sodium, caffeine and xylitol. The results of this study are very inconclusive and further research needs to validate the results.

Chapter 6

Summary

The purpose of this study was to determine whether or not nutrients affected HR in children. Studies in adults have found that certain nutrients can lower HR, and that higher HR is predictive of heart disease.

The subjects for this study were obtained from the first testing period of year two of the KUMC Kids study. All subjects who had complete data were included in this study. HR was measured 4 times; the measures were averaged to determine average HR. HR was measured using a DINAMAP machine. Nutrient intake was determined from a 24 hour diet recall administered by trained staff. Recalls were entered into the Nutrition Data System for Research 2008 and analyzed for nutrient composition. Statistical tests were done using SPSS, STATA and Microsoft Excel.

The nutrients that were correlated to HR were calcium, daidzein, genestein, glyciten, lactose, erucic acid and saccharin. The results of the best fit model that did not consider gender, race/ethnicity or age explained only 4% of the variability of HR and included calcium, genestin, erucic acid, saccharine, sodium, gadoleic acid, and caffeine. The results of the best fit model that did include gender, race/ethnicity and age explained 10% of the variability of HR and included white non Hispanic, black non Hispanic, 9 years of age, calcium, genestien, erucic acid, sodium, caffeine and xylitol.

It seems that 9 years of age could be the cutoff age when genetics stop playing as large of a role in determining HR and diet begins to play a larger role. It would be advantageous to repeat this study with two groups, one with children under 9 years of age and one with children over 9 years of age, looking at several diet recalls and several time points of HR measures.

References

1. Cohen, Barbara Janson and Wood, Dena Lin. The Heart. In: *Structure and Function of The Human Body.* Philadelphia, PA: Lippincott Williams & Wilkins; 2000:195-205.

2. Ansakorpi, Hanah. Autonomic Nervous System. In: Cardiovascular Regulation in Epilepsy with Emphasis on the Interictal State. Oulu University Library. 2003.

3. Cansev, Mehmet, Yilmac, Mustafa Sertac, Illcol, Yesim Ozarda, Hamurtekin, Emre and Ulus, Ismail Hakki. Cardiovascular Effects of CDP-Choline and It's Metabolites: Involvement of Peripheral Autonomic Nervous System . *European Journal of Pharmacology.* 2007;577:129-142.

4. Nielsen, Forest H., Milne, David B., Klevay, Leslie M., Gallagher, Sandra and Johnson, LuAnn. Dietary Magnesium Deficiency Induces Heart Rhythm Changes, Impairs Glucose Tolerance, and Decreases Serum Cholesterol in Post Menopausal Women. *Journal of the American College of Nutrition.* 2007; 26(2):121-132.

5. Ziesel, Steven H. Choline: Critical Role During Fetal Development and Dietary Requirements in Adults. *Annual Rev. Nutr.* 2006; 26:229-250.

6. Rauch, Bernhard, Schiele, Rudolf, Schneider, Steffen, et al. Highly Purified Omega-3 Fatty Acids for Secondary Prevention of Sudden Cardiac Death After Myocardial Infarction-Aims and Methods of the OMEGA-Study. *Cardiovasc Drugs Ther.* 2006; 20:365-375.

7. Geelan, Anouk, Brouwer, Ingeborg, Schouten, Evert, Maan, Arie, Katan, Martijn, anda Zock, Peter. Effects of n-3 Fatty Acids From Fish on Premature Ventricular Complexes and Heart Rate in Humans. *American Journal of Nutrition*. 2005;81:416-420.

8. Monahan, Kevin D., Wilson, Thad E., and Ray, Chester A. Omega 3-Fatty Acids Supplementation Augments Sympathetic Nerve Activity Responses to Physiological Stressors in Humans. *Hypertension*. 2004;44:732-738.

9. Mozaffarian, Dariush, Prineas, Ronald J., Stein, Phyllis K., Siscovick, David S. Dietary Fish and n-3 Fatty Acid Intake and Cardiac Electrocardiographic

Parameters in Humans. *Journal of the American College of Cardiology*. 2006;48(3):478-484.

10. Mori, Trevor A., Bao, Danny Q., Burke, Valeria, Puddey, Ian B., and Deilin, Lawrence J. Docosahexaenoic Acid But Not Eicosapentaenoic Acid Lowers Ambulatory Blood Pressure and Heart Rate in Humans. *Hypertension.* 1999; 34: 253-260.

11. Metcalf, Robert G., Sanders, Prashanthan, James, Michael J., Cleland, Leslie G., and Young, Glenn D. Effect of Dietary n-3 Polyunsaturated Fatty Acids on the Inducibility of Ventricular Tachycardia in Patients With Ischemic Cardiomyopathy. *American Journal of Cardiology.*2008; 101:758-761.

12. Mozaffarian, Dariush, Geelen, Anouk, Brouwer, Ingeborg, Geleijnse, Johanna, Zock, Peter, and Katan, Martijn. Effect of Fish Oil on Heart Rate in Humans A Meta-Analysis of Randomized Controlled Trials. *Circulation*. 2005;112:1945-1952.

13. Das, U.N. Beneficial Effects of n-3 Fatty Acids in Cardiovascular Diseases: But, Why and How? *Prostaglandins, Leukotrienes and Essential Fatty Acids.* 2000;63(6):351-362.

14. Harris, William S., Gonzales, Michael, Laney, Nathan, Sastre, Antonio and Borkon, Michael. Effects of Omega-3 Fatty Acids on Heart Rate in Cardiac Transplant Recipients. *The American Journal of Cardiology.*2006;98:1393-1395.

15. Sullivan, Debra. KUMC Kids Nutrition Project Grant (NIH: R01 HL080967-01A2).

16. Seccareccia, Fluvia, Pannozzo, Fabio, Dima, Francesca, et al. Heart Rate as a Predictor of Mortality: The MATISS Project. *American Journal of Public Health.* 2001;91(8):1258-1263

17. Abe, Chikara, Minami, Junichi, Ohrui, Masami, Ishimitsu, Toshihiko, and Matsuoka, Hiroaki. Lower Birth Weight Is Associated with Higher Resting Heart Rate during Boyhood. *Hypertension Research.* 2007; 30 (10): 945-950.

18. Palantini, Paola and Julius, Stevo. Heart Rate and the Cardiovascular Risk. *Journal of Hypertension.* 1997;15:3-17.

19. O'Keefe, James H., Abuissa, Hussam, Sastre, Antonio, Steinhaus, David M., and Harris, William S. Effects of Omega-3 Fatty Acids on Resting Heart Rate, Heart Rate Recovery After Exercise, and Heart Rate Variability in Men With Healed Myocardial Infarctions and Depressed Ejection Fractions. *American Journal of Cardiology.* 2006;97:1127-1130.

20. Mayo Clinic Staff. MayoClinic.com Tools for Healthier Lives: Tachycardia. Available at:http://www.mayoclinic.com/print/tachycardia/DS00929/DSECTION=all&METHOD=print. Accessed on February 3, 2009.

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21. KOSMIX Corporation. Pulse Guide. Available at: http://www.righthealth.com/topic/

22. The Institute of Medicine (2000) Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B6/12, Folate, Pantothenic Acid, Biotin/Choline. National Academies Press.

23. Neumann SA, Brown SM, Ferrell RE, Flory JD, Manuck SB, Hariri AR. Human choline transporter gene variation is associated with corticolimbic reactivity and autonomic-cholinergic function.Biol Psychiatry. 2006 Nov 15;60(10):1155-62. Epub 2006 Jul 28. Erratum in: Biol Psychiatry. 2007 Feb 1;61(3):424.

24. MedlinePlus. Arrythmia. Available at http://www.nlm.nih.gov/medlineplus/arrhythmia.html

25. Omiya K, Akashi YJ, Yoneyama K, Osada N, Tanabe K, Miyake F. Heart-rate response to sympathetic nervous stimulation, exercise, and magnesium concentration in various sleep conditions. Int J Sport Nutr Exerc Metab. 2009 Apr;19(2):127-35.

26. Park SK, Tucker KL, O'Neill MS, Sparrow D, Vokonas PS, Hu H, Schwartz J.Fruit, vegetable, and fish consumption and heart rate variability: the Veterans Administration Normative Aging Study. Am J Clin Nutr. 2009 Mar;89(3):778-86. Epub 2009 Jan 21.)

27. Centers for Disease Control and Prevention. Heart Disease Statistics. Available at http://www.cdc.gov/heartDisease/statistics.htm

28. Wang Y, Liang H, Chen X., 2009 Jun 12;9:183.Measured body mass index, body weight perception, dissatisfaction and control practices in urban, low-income African American adolescents.

29. Trent M, Jennings JM, Waterfield G, Lyman LM, Thomas H. J Urban Health. 86:571-583, 2009. Finding targets for obesity intervention in urban communities: school-based health centers and the interface with affected youth

30. Liew R, Stagg MA, Chan J, Collins P, MacLeod KT. Gender determines the acute actions of genistein on intracellular calcium regulation in the guinea-pig heart. *Cardiovasc Res*. 2004 Jan 1;61(1):66-76.

31. Erucic Acid. Available from Wikipedia.com

32. Xylitol-containing oral syrup may prevent caries in children. J Am Dent Assoc. 2009 Aug; 140 (8): 972.

33. Abranches, J et al. Invasion of human coronary artery endothelial cells by Streptococcus mutans OMZ175. Oral Microbial Immunology. 2009 April 24 (2): 141-5.

Appendix A

Sources of Erucic Acid in the Subjects Diets and Sources of Caffeine in the Subjects Diets

Sources of Erucic Acid in the Subjects Diets

MUFA22:1 (g)

Food	Amount Per 100 g	Category
Chicken, canned	0.003	Meats/Beans/Seeds (Proteins)
Chicken, dark meat	0.020	
Turkey, dark meat	0.020	
Egg, white	0.000	
Egg, whole	0.003	
Egg, yolk	0.009	
Black-Eyed Peas	0.005	
Lima Beans, canned	0.002	
Cowpeas	0.005	
Sesame Seeds	0.065	
Sunflower Seeds	0.029	
Catfish	0.515	Seafood
Pollock	0.020	
Salmon	0.070	
Shrimp	0.007	
Cod	0.020	
Tilapia	0.020	
Tuna	0.029	
Fish Sticks	0.006	
Imitation Seafood (Surimi)	0.010	
Corn Dog, poultry	0.015	Processed Meats
Bologna, comb. of meats	0.001	
Bologna, turkey	0.003	
Pepperoni, pork & beef	0.091	
Hot Dog, Beef (Kosher)	0.112	
Turkey Bacon	0.017	
Cap'n Crunch	0.001	Cereals (Grains)
Cap'n Crunch Peanut Butter	0.001	
Cheerios	0.004	

Cookie Crisp	0.013	
Cocoa Puffs	0.022	
Franken Berry Cereal	0.016	
Honey Bunches of Oats	0.002	
Lucky Charms	0.003	
Poptart	0.041	
Raisin Bran	0.001	
Cornmeal, yellow	0.002	
Baked Cheetos	0.002	Fried Snack Foods (Chips)
Bugles	0.001	
Cheetos, crunchy	0.001	
Doritos, nacho cheese	0.001	
Funyuns	0.002	
Taco/Tortilla Chips	0.002	
Fruit Preserve type filling	0.014	Condiments
Jelly	0.014	
Mustard Powder	15.820	
Mustard, dijon	1.898	
Mustard, regular	1.263	
Cheese Sauce (Cheez Whiz) - contains mustard	0.079	
Pickle Relish, sweet	0.094	
Fat Free Buttermilk Dressing	0.007	
Fat Free French Dressing	0.049	

Sources of Caffeine in the Subjects diets.

Caffeine (mg)

Food	Amount Per 100 g	Category
Count Chocula	**6.500**	**Chocolate Breakfast Cereals & Granola Bars**
Cocoa Puffs	**8.100**	
Cocoa Puffs Reduced Sugar	**2.070**	
Cocoa Krispies	**3.000**	
Cookie Crisp	**3.400**	
Cocoa Pebbles	**4.100**	
Reese's Puffs	**11.500**	
Milk 'n Cereal Bar - Cocoa Puffs	**11.500**	
Fiber One granola bars - all flavors	**9.579**	
Special K Protein Snacks Bar - all flavors	**9.062**	
Kudos Chocolate Chip or M & M's	**8.662**	
Mountain Dew, regular & Code Red	**15.000**	**Caffeinated Beverages**
Mountain Dew, diet	**15.000**	
Coke, regular	**9.800**	
Coke, diet	**12.000**	
Coke Zero	**12.000**	
Pepsi	**9.800**	
Pepsi, diet	**12.000**	
Dr. Pepper	**9.800**	
Dr. Pepper, diet	**12.000**	
Root beer, regular, w/ caffeine	**6.100**	
Coffee, regular, brewed	**40.000**	
Espresso, regular	**212.000**	
Tea, RTD, regular	**16.784**	
Tea, brewed, regular	**20.000**	
Tea, instant, regular	**10.842**	
Carnation Instant Breakfast, Chocolate	**1.784**	**Chocolate Flavored Beverages**
Cocoa/Hot Chocolate	**1.585**	
Chocolate Milk, skim	**2.006**	

Chocolate Milk, whole	**2.000**	
Chocolate Milk, 2%	**1.000**	
Chocolate Chips	**62.000**	**Chocolate Toppings**
Chocolate Flavored Sprinkles	**25.300**	
Chocolate Syrup, thin type	**6.000**	
Chocolate Sauce, fudge-type	**7.000**	
Chocolate Frosting	**10.663**	
Chocolate Pudding	**2.000**	**Chocolate & Non-Chocolate Snacks/Desserts (Cookies, Cakes, Etc).**
Chocolate Chip Cookie Dough, refrigerated	**8.680**	
Sugar Wafer w/ crème filling	**9.200**	
Little Debbie Cosmic Brownies	**9.200**	
Little Debbie Fudge Brownies	**9.200**	
Hostess Cupcake - Chocolate	**11.500**	
Little Debbie Swiss Roll & Swiss Cake Roll	**6.000**	
Little Debbie Devil Square Cakes	**6.000**	
Little Debbie Star Crunch	**6.000**	
Donettes & Donut Gems- Chocolate	**12.623**	
Little Debbie Zebra Cakes	**6.000**	
Little Debbie Nutty Bar	**23.483**	
Oreo Chocolate Sandwich	**30.498**	
Teddy Grahams - Chocolate Chip	**20.999**	
Teddy Grahams - Honey	**20.999**	
Scooby Doo! Graham Cracker Sticks, Cinnamon	**12.952**	
Scooby Doo! Graham Cracker Sticks, Honey	**12.952**	
Vanilla Wafers	**13.000**	
Nabisco Chip Ahoy! Real Chocolate Chip Cookie	**1.242**	
Oatmeal Cookie, commercial package	**13.000**	
Chocolate Chip Cookie, commercial package	**9.200**	
Keebler Animal Cookies - Frosted	**4.600**	
Keebler Fudge Shoppe - Fudge Stripe Cookies	**4.600**	
Vanilla Sandwich Cookies w/ filling	**4.600**	
Chocolate Cake, RTE, not frosted	**3.318**	
Chocolate Ice Cream	**3.000**	**Chocolate Ice**

Ice Cream Bar	**1.000**	**Cream**
Ice Cream Sandwich	**2.000**	
Drumsticks	**2.000**	
Wendy's, Oreo Frosty	**5.281**	
Wendy's Chocolate Frosty	**0.755**	
Kit Kat	**20.000**	**Chocolate Candy Bars**
Nestle Crunch Bar	**20.000**	
Twix Caramel Cookie bar	**20.000**	
Hershey's Milk Chocolate Bar	**20.000**	
Three Muskateers	**6.000**	
Dove Bar - dark chocolate	**62.000**	
Dove Bar - milk chocolate	**20.000**	
Butterfinger	**4.100**	
M & M's Plain Chocolate Candies	**14.000**	
M & M's Peanut Chocolate Candies	**10.000**	
Tootsie Roll	**7.000**	
Reese's Peanut Butter Cup	**7.000**	
Snickers	**6.385**	

Appendix B

Data Collection Form, Diet Recall Sheet and Consent Form Used for the KUMC KIDS Study

KUMC KIDS Data Collection Form

Administrative Use Only - Affix Label Here

Subject's Name: ___________________________________

Subject ID: __ __ __ __

Date/Period: _ _ / _ _ / _ _ _ _ (Baseline, 3 months, 6 months)

School/School ID: _______________________ / __ __ __

Teacher/Grade: ________________________/ ______ grade

Time

___ ___ : ___ ___ am / pm **(circle one)**

Age: ____ ____ years

Date of Birth (mo/day/year): __ __ / __ __ / __ __ __ __

Grade (circle one): 3rd 4th 5th

Gender (circle one): Boy Girl

What race do you consider yourself to be?

Select all that apply:

_____ White

_____ Black

_____ Hispanic

_____ Asian/Pacific Islander

_____ American Indian/Alaskan Native

_____ Other (please

explain)____________________

	Measurements	Unit	Comment (circle one if needed)	Initials
Height	1) ___ ___ ___ . ___ 2) ___ ___ ___ . ___ 3) ___ ___ ___ . ___	Cm	1. Refused 2. Unable to stand without support 3. Difficult to assess (e.g. hair) 4. Other: ____________________ _	__ __
Weight	1) ___ ___ ___ . ___ 2) ___ ___ ___ . ___ 3) ___ ___ ___ . ___	Kg	1. Refused 2. Unable to stand without support 3. Shoes	__ __

			4. Other: ______________________ _	
Waist Circumference	1) ___ ___ . ___ 2) ___ ___ . ___ 3) ___ ___ . ___	Cm	1. Refused completely 2. Excess clothing (i.e. sweatshirt) 3. Over Shirt: ______________________	___ ___
Mid-Arm Circumference	1) ___ ___ . ___ **right arm**	Cm	*Measure for Blood Pressure Cuff Size*	___ ___
Blood Pressure/ Heart Rate (discard 1st measurement)	Blood Pressure: 1) __ __ __ / __ __ 2) __ __ __ / __ __ ; Heart Rate: 1) __ __ __ 2) __ __ __	mmHg	1. Refused 2. Did not rest long enough	

	3) __ __ __ / __ __ 4) __ __ __ / __ __	__ __ __ __ __ __	**<u>Circle Arm Used</u>** **right** **left** **<u>Machine Used</u>** **A B C D**	3. Will not stop fidgeting 4. Other: ______________		__ __
PAQ Complete	__ __		**DQ complete**	__ __	**Diet Recall Complete**	__ __

KUMC Kids Study

Subject Name/ID #_________________________ Date of Intake: __________________

<u>Testing Period</u>: Baseline / 3 months / 6 months <u>Recall #</u>: 1 2 3

Weekday / Weekend Interviewer: ______ Entered________ Checked ________

Time/Place Meal Food/Beverage Description Amount

Was intake: Typical? Considerably more than usual? Considerably less than usual? Why?

____

____

Was recall: Reliable? Unable to recall 1 or more meals? Unreliable for other reasons? Why?

____

____

Vitamin/Mineral/Supplement Use/Dosage?

____

What time did you go to bed last night?

____

What time did you wake up this morning?

____

Is this your normal time to go to bed and time to get up in the morning? Please explain if not normal?

____

____

University of Kansas Medical Center

Snack Nutrition Program

Dear Parents:

We are inviting all children in grades 3-5 to take part in a snack program at our school. If you decide to let your child participate, then your child may receive healthy snacks each school day if your school is chosen. Half of the schools participating in the program will receive the snacks and the other half of the schools will not receive the snacks. Dietitians from the University of Kansas Medical Center will direct the program.

The purpose of the program is to find out if eating 2 servings of dairy foods every school day will affect children's blood pressure and growth rate.

At the start of the school year, we will measure your child's height, weight, arm circumference, waist circumference, and blood pressure. To find out how active your child is, we will ask some questions about physical activity. We will also ask about the foods your child eats. After the testing is done, if your child is at the school that receives snacks, then he/she will be given healthy snacks each school day for the entire school year. At the middle and end of the year, we will do the same tests again.

If you want your child to be in the program, you must fill out the attached consent form. If you do not wish your child to be part of the program, simply sign the note below and return the form to the school. If you have any questions, we will be at your child's school during the back to school night or you may call us at (913) 588-5357.

We look forward to working with your child. We hope that everyone can participate.

Sincerely,

Debra K. Sullivan

Your child's grade level (circle one): 3 4 5

______ YES, I agree to have my child participate.

______ NO, I do <u>not</u> want my child to participate in the snack nutrition program.

Parent Name: ____

Child's Name: ____

Address:
____

Telephone Number:
____

University of Kansas Medical Center

(Centro Médico de la Universidad de Kansas)

Programa de meriendas nutritivas

Estimados padres:

Estamos invitando a todos los niños de 3-5 grado a participar en un programa de meriendas en nuestra escuela. Si usted decide permitirle participar a su hijo(a), es posible que él (ella) reciba meriendas saludables cada día escolar. Una parte de las escuelas en el programa recibirán meriendas, y la otra parte no las recibirán. El programa será dirigido por especialistas en dietética del Centro Médico de la Universidad de Kansas.

El propósito del programa es descubrir si el consume de 2 porciones de alimentos lácteos cada día escolar afecta la presión arterial y el crecimiento de su hijo(a).

Al comienzo del año escolar, tomaremos las medidas de estatura, peso, circunferencia del brazo, cintura, y además la presión arterial de su hijo(a). Para averiguar el nivel de actividad que tiene su hijo(a), nosotros haremos algunas preguntas sobre su actividad física. También haremos preguntas sobre los alimentos que come su hijo(a). Después de terminar todas las pruebas, si su hijo(a) es estudiante en una de las escuelas que recibe las meriendas, su hijo(a) recibirá meriendas saludables cada día escolar durante todo el año académico. Al final y a los mediados del año, volveremos a las escuelas para hacer las mismas pruebas.

Si usted desea que su hijo(a) sea parte del programa, debe llenar el formulario de consentimiento que hemos adjuntado. Si <u>no</u> desea que su hijo(a) participe en el programa, simplemente firme la nota de abajo y devuelva el formulario a la escuela. Si tiene preguntas, estaremos en la escuela de su hijo(a) en la noche de regreso a clases, o puede llamarnos al (913) 588-5357.

Tenemos grandes deseos de trabajar con su hijo(a). Esperamos que todos puedan participar.

Atentamente,

Debra K. Sullivan

--

Grado escolar de su hijo(a) (marquee uno con un círculo): 3 4 5

______ Sí, estoy de acuerdo en que mi hijo(a) participe.

______ NO, <u>no</u> quiero que mi hijo participe en el programa de bocado nutritivo.

Nombre del padre o de la madre:

____

Nombre del hijo(a):

____

Dirección:

____
__

Número de teléfono:

____

KUMC KIDS STUDY

Child Medical History Form

Administrative Use Only

Student ID: ____ ____ ____ ____

School ID: ____ ____ ____

This survey is confidential and all information will only be used for the purposes of this study.

There are not right or wrong answers and you may choose not to answer any of the questions.

Name of Child: ____

Child's Age: ___ ___

Child's Date of Birth: __ __ / __ __ / __ __ __ __

Child's Gender (check one): ____ male ____ female

What race do you consider your child to be?

Select all that apply.

_____ White

_____ Black

_____ Hispanic

_____ Asian/Pacific Islander

Name of School: ____________________________

Child's Grade (check one): ____ 3rd ____ 4th ____ 5th

Teacher's Name: ____________________________

In general, how would you rate your child's health?

_____ Excellent

_____ Very Good

_____ Good

_____ Fair

______American Indian/Alaskan Native

_____ Poor

_____ Other (please explain)_____________________

Medical History of Child

Has a doctor ever diagnosed your child with any of the following? (Check all that apply)

_____High Blood Pressure	_____High Cholesterol
_____Heart Disease	_____Asthma
_____Kidney Disease	_____Food Allergies
_____Obesity	_____Lactose Intolerance (diagnosed by doctor)
_____Diabetes	_____Elevated Blood Lead Levels (diagnosed by doctor)
_____ADD/ADHD	_____Other (please explain)____

Please list all medications (including vitamins/supplements) that your child takes?

____
____

____
____

____
____

Comments