PARTICIPATING IN PHYSICAL ACTIVITY AFTER CONSUMING MEALS OF DIFFERING CALORIC CONTENT DOES NOT ALTER APPETITE FOUR HOURS POST ACTIVITY

A thesis submitted to the
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This study assessed children’s appetite after eating a low-calorie meal (LC) versus a high-calorie (HC) meal and participating in physical activity. Children (N=19, 6-10 years) participated in two trials. The first consisted of consuming a HC or LC meal then playing in a gymnasium for thirty minutes where children had free-choice access to physical and sedentary activities. Children had the opposite meal for the second trial. The two meal conditions consisted of the same foods, however children consumed 55% less energy in the LC (291.8 ± 12.1 kcals) compared to HC (659.5 ± 101.3 kcals). A total appetite score was calculated by assessing prospective food consumption, hunger and fullness via visual analog scales (VAS) at four time points during each trial.

Appetite Score = Hunger + Prospective Consumption + (100 – fullness)

ANOVA revealed a significant (p = 0.045) meal condition (HC, LC) by time interaction for appetite. Relative to the HC condition, appetite was greater (p ≤ 0.015) in the LC condition immediately post-meal (71 ± 74 HC, 131 ± 96 LC) and post-activity session (96 ± 66 HC, 160 ± 57 LC). There were no differences (p ≥ 0.16) in appetite pre-meal (225 ± 63 HC, 222 ± 61 LC) or four hours post-meal (234 ± 69 HC, 259 ± 52 LC) between the two meal conditions. Eating a LC meal followed by a bout of exercise resulted in a similar appetite compared to a HC meal followed by a bout of exercise four-hours post-meal.
ACKNOWLEDGEMENTS

Thank you to Kent State University and Dr. Jacob Barkley for the administration and coordination of this study. Thank you to Dr. Rachael Pohle-Krauza of Youngstown State University for her expertise and assistance with this study.

Thank you to all of the families that participated in this study, and to the students and that assisted with data collection.
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CHAPTER I
INTRODUCTION

High-intensity exercise has been found to temporarily reduce appetite (Martins 2008). While some previous evidence has indicated the effect of exercise on appetite is brief, one single study has demonstrated that appetite may be suppressed for an extended period of time by post-meal exercise in adults (Cheng 2009). The previous study demonstrated that exercise performed two-hours following meal consumption leads to prolonged decreased hunger scores relative to a meal consumption alone and exercise followed by meal consumption (Cheng 2009). In addition to expending calories during exercise, if exercise blunts appetite it could also encourage lower caloric intake later in the day (Martins 2008). However, to the best of our knowledge previous examination of the influence of exercise on subsequent appetite has been limited to adults. Studying this effect in children is of importance, as 80% of overweight/obese children become overweight obese adults (Burdette 2004). Therefore, children represent an excellent target for obesity prevention interventions and research.

If post-meal exercise reduces appetite in children it may be possible to maintain satiety after exercise even after a lower calorie meal. Such a finding could reform recommendations seeking to encourage healthy weight-control behaviors in children. It is unknown if, post-meal exercise can hold post-prandial appetite constant across two meals of differing caloric content: one high calorie (HC) and one low (calorie). If post-
meal exercise aids in appetite control, it may be possible to feed exercising children lower calorie meals and maintain an appetite that is comparable to a higher calorie meal. This may result in a reduction in daily caloric consumption.

The purpose of this study was to assess children’s appetite for four hours after eating a low-calorie meal (LC) and participating in physical activity versus eating a high-calorie meal (HC) and participating in physical activity. We hypothesized that children will respond in a similar manner to what has been previously demonstrated in adults; post-meal exercise will have prolonged appetite-suppressing effects even after consuming a LC meal.

CHAPTER II

METHODOLOGY

Nineteen children (N = six girls), aged 6-10 years, reported to the applied physiology laboratory on two separate occasions to complete the two experimental conditions (LC, HC). During the initial visit the parents/legal guardians and the children read and signed informed consent and assent forms, respectively. Children were free of any contraindication to physical activity (e.g., cardiovascular, metabolic, orthopedic disorders). All study procedures were approved by the university institutional review board.
Laboratory visits were scheduled for the same day, one week apart and for the same time, either 11:00am or 12:00pm Monday through Friday. Condition order (LC, HC) was randomly assigned. Participants were required to eat a similar breakfast no later than 9:00am and participate in similar activity before each trial. After obtaining consent and assent, children’s height (cm) and weight (kg) were assessed with a balance beam scale and digital stadiometer, respectively. Participants completed the first of four appetite questionnaires and were then given one of the two experimental meals. Children were instructed to eat as much of the food as they could. To encourage full meal consumption children selected an age-appropriate DVD (Scooby Doo or Sponge Bob Square Pants) to watch on a television located in the laboratory while they ate. After the child indicated that they were full, appetite was assessed again.

After completing the second appetite assessment children were taken to a 4,360 square foot gymnasium located within the same building as the applied physiology lab. In the gymnasium, children had free-choice access to physical and sedentary activities for 30 minutes and total activity was monitored via an accelerometer. A third appetite assessment was completed following the activity session.

Children were told to abstain from eating or drinking anything except water until 4 hours after completion of the experimental meal. At the four-hour post-meal time point, children completed a fourth and final appetite assessment. After completing this final assessment, children were allowed to eat as they chose. Parents were instructed to ensure that their child did not eat until the final appetite assessment was completed.
Parents were also given instructions for administering the final appetite assessment to their child. After completion, parent mailed the final appetite assessment back to the laboratory in a postage-paid envelope provided by research personnel. No parents indicated any difficulty in completing this final appetite assessment as instructed and all final assessments were returned to the laboratory.

The second trial was identical to the first except the participant consumed the opposite meal.

**Meal Conditions**

Current dietary guidelines specify that daily energy requirements for children (aged 6 – 10) range from 1600 to 2200 kcal (Torun 2005), consistent with studies employing double labeled water methods, showing calorie needs for this age group to range from 1600 to 2500 kcal/day. Thus, our test meals, (732 or 315 kcal) will provide approximately 38% or 17% of estimated daily needs for participants (assuming 1900 kcal diet). These energy provisions are less than or equal to those provided in an average school lunch for children in this age group (Addison 2006). Experimental meals contained 9% of daily protein, 47% of daily carbohydrates, and 44% of recommended daily fat intake. Meals consisted of Wendy’s® chicken nuggets and French fries, Hawaiian® punch, and ketchup. Food was weighed before and after each meal to obtain weight of all foods consumed. In the HC condition children were served 90 grams of
chicken nuggets, 110 grams of French fries, 27 grams of ketchup, and 10 ounces of Hawaiian punch. In the LC condition children were served 36 grams of chicken nuggets, 44 grams of French fries, 27 grams of ketchup, and 4 ounces of Hawaiian punch. Meals were purchased immediately prior to the session and reheated to 140 degrees before serving. The tray used to serve participants was prepared the same way for each participant for each trial. The tray consisted of a bowl of nuggets, a bowl of fries, ketchup, a cup of Hawaiian punch, and napkins. Participants were able to request water if all Hawaiian punch was consumed. Participants had fifteen minutes to finish as much of the meal as possible; a stopwatch with the remaining time was visible to the participant. Research personnel encouraged children if there was difficulty finishing the meal, for example, “Can you eat one more chicken nugget,” or “Can you finish your juice?” If children were unable to finish, but consumed at least half of the presented meal they were allowed to continue with the study. Caloric content of the second meal was not altered according to calories consumed during the first meal. While some children were not able to consume the HC meal in its entirety, children consumed an average of 55% less energy in the LC (291.8 ± 12.1 kcals) compared to HC condition (659.5 ± 101.3 kcals).

**Gymnasium Set-Up**

Immediately following completion of the meal participants were fitted with a validated accelerometer (Actigraph GT1M) and brought to the gymnasium for a 30-minute free-
choice play session. After the accelerometer was fitted and instructions were given research personnel interacted with the child only if they required assistance. Other than a single member of the research team observing the child, there were no other individuals present in the gymnasium while each child was participating in the activity session. The 4,360 square foot gymnasium provided free-choice access to hurdles, jump rope, Nerf® footballs, soccer balls, basketballs, and two obstacle courses made of gymnastics soft play equipment. A table and chair with sedentary alternatives was also available to the child. Sedentary alternatives included: blank paper and coloring utensils, Perfection™, gender-appropriate dolls and figurines, Jenga™, and crossword/word find puzzles. Children were instructed to sit in the provided chair if they wished to utilize any of the activities on the table. Children moved between physical activities and the sedentary table as much as they pleased for the 30 minutes. Research personnel kept track of the time participants allocated to the sedentary activities with a stopwatch. Total per-minute accelerometer counts and the amount of time children allocate to the sedentary activities was recorded as measures of physical and sedentary activity behavior respectively.

**Appetite Measurements**

Visual analog scale (VAS) booklets were utilized to assess measures of participants’ satiety. The scale used is a 100-millimeter line with extreme opposite ratings of various components that influence satiety at either end of the line. Children were asked to mark a
point on the line to which their sensation of each component corresponds. The marked points were then measured with a standard metric ruler to determine the VAS score for each satiety component at each time point. Criteria assessed included: prospective food consumption (or how much the child feels they could eat), hunger, fullness, as well as thirst and nausea (used as distracters). An appetite score was then calculated. The appetite score incorporated the three measured satiety scores (hunger, fullness and prospective food consumption) and was calculated using the following formula:

\[ \text{Appetite Score} = \text{Hunger} + \text{Prospective Consumption} + (100 - \text{fullness}) \]

Participants completed a VAS appetite assessment booklet before each experimental meal, immediately after those meals, immediately after the 30-minute activity sessions and four hours after the meals. Research personnel read each criterion to the participant as to be sure the child understood the question and responded appropriately. The fourth booklet was sent home with the child and parents were coached on how and when to complete it and asked to bring it back for the second visit or provided with an envelope and stamp to mail it back to the lab.

CHAPTER III

ANALYTICAL PLAN

Participant’s physical characteristics (age, height, weight) were compared between boys and girls using independent-samples t-tests. A paired-samples t-test was performed to compare accelerometer counts-min\(^{-1}\) during the HC condition to the LC condition. A two
sex (boys, girls) by two condition (HC, LC) by four-time point (pre-meal, immediately post-meal, immediately post-activity, four hours post-meal) analysis of variance (ANOVA) with repeated measures on condition and time point was performed to assess changes in appetite scores. Post-hoc t-tests with the Benjamini and Hochberg False Discovery Rate correction for multiple comparisons were performed for any significant main or interaction effects (Benjamini 1995).

CHAPTER IV

RESULTS

Physical Characteristics

Physical characteristics are shown in Table 1. Boys (8.6 ± 1.1 years old) were significantly \( p = 0.004 \) older than girls (6.7 ± 1.1 years old). Boys (136.3 ± 7.7 cm) were also significantly \( p = 0.026 \) taller than girls (125.2 ± 12.0 cm). There was no significant \( p \geq 0.16 \) difference in weight between boys (32.6 ± 9.6 kg) and girls (26.1 ± 6.5 kg). There was also no significant \( p \geq 0.54 \) difference in BMI between boys (17.2 ± 3.1 kg·m\(^{-2}\)) and girls (16.4 ± 1.0 kg·m\(^{-2}\)).
Table 1. *Physical Characteristics*

<table>
<thead>
<tr>
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<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)*</td>
<td>8.6 ± 1.1</td>
<td>6.7 ± 1.1</td>
</tr>
<tr>
<td>Height (cm)*</td>
<td>136.3 ± 7.7</td>
<td>125.2 ± 12.0</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>32.6 ± 9.6</td>
<td>26.1 ± 6.5</td>
</tr>
<tr>
<td>BMI (kg·m⁻²)</td>
<td>17.2 ± 3.1</td>
<td>16.4 ± 1.0</td>
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*significantly different between sexes
Physical Activity

Physical activity during the HC (2729 ± 1066 counts·min$^{-1}$) and LC (2457 ± 1233 counts·min$^{-1}$) conditions was not different ($p = 0.4$, Figure 1).

![Physical Activity Counts](image)

*Figure 1.* Accelerometer counts accumulated during physical activity session following the HC meal, and the LC meal.

Appetite Scores

ANOVA revealed a significant ($p = 0.045$) meal condition (HC, LC) by time (pre-, immediately post-meal, post-activity, four hours post-meal) interaction for appetite (*Figure 2*). Relative to the HC condition, appetite was greater ($p \leq 0.015$) in the LC condition immediately post-meal (71 ± 74 HC, 131 ± 96 LC) and post-activity session (96 ± 66 HC, 160 ± 57 LC). There were no differences ($p \geq 0.16$) in appetite pre-meal...
(225 ± 63 HC, 222 ± 61 LC) or four hours post-meal (234 ± 69 HC, 259 ± 52 LC) between the two meal conditions. There was an additional sex by time interaction ($p = 0.02$) as girls (165 ± 28) had greater ($p = 0.02$) appetite scores than boys (109 ± 49) at the post-activity time point and were not different ($p ≥ 0.15$) at any other time. There were no additional significant ($p ≥ 0.08$) main or interaction effects.

*Figure 2.* Appetite Scores for both low- and high-calorie conditions across four-satiety questionnaire time points. * = $p<0.01$ when compared to pre-meal condition
CHAPTER V

DISCUSSION

While there is equivocal evidence examining the effects of exercise on appetite in adults (Cheng 2009) we are not aware of any previous investigation that has examined the effect of exercise on controlling post-prandial appetite in children who consume meals of different caloric content. The present results indicated that performing a bout of physical activity after eating a LC meal results in a four-hour post-prandial appetite score that is similar to eating a HC meal followed by physical activity. This would suggest that during the LC condition, by the time children would have been eating their next meal (i.e., dinner) their appetite was not different than it was in the HC condition.

The combined effect of exercise and eating on appetite regulation has previously been studied in adults. Specifically, previous reports indicate that a high-intensity bout of exercise following a high fat meal has suppressive effects on appetite in adults (Cheng 2009). Post-meal exercise has been shown to extend depressed appetite scores relative to pre-meal exercise and meal consumption alone (Cheng 2009). Possible mechanisms behind this effect may include changing satiety hormone levels (Martins 2008). For example, O’Connor and colleagues found significant increases in glucagon like peptide-1 (GLP-1), an appetite suppressive gut hormone, levels during and following exercise when compared to resting alone (Martins 2008). In addition, Greenberg and colleagues found a significant increase in post-prandial plasma levels of pancreatic polypeptide (PP) in normal-weight men (Martins 2008). An increase in GLP-1 and PP following exercise is a
possible explanation for the prolonged suppressed appetite effects of exercise as both of these hormones reduce the sensation of hunger. Increased gut hormones and appetite regulating hormones may lead to increased satiety and decreased hunger. This may cause a delayed appetite for the next meal following acute exercise and less caloric consumption during the next meal, lowering daily caloric intake.

While this study shows that the four-hour appetite scores across the two conditions were similar, there are some limitations. The sample size is relatively small and does not allow for the comparison of overweight/obese and non-overweight children. Obesity-status may have an effect on the appetite scores in the present design. Overweight individuals have a lower concentration of GLP-1 when compared to normal weight individuals (Chanoine 2008). If GLP-1 is reduced, appetite scores may be increased, as GLP-1 is an appetite suppressant hormone. This may suggest that obese individuals need to exercise at a greater intensity or duration in order to achieve a similar amount of GLP-1 secretion and satiety as lean individuals. Currently the similar four-hour post-meal appetite scores between LC and HC suggest that caloric consumption at this point should be similar across the two conditions. However, the present study did not examine caloric intake, only appetite. Future research should measure caloric intake at the following meal (i.e., dinner). If the appetite score are predictive of actual caloric consumption, the ability of physical activity to blunt the appetite response may have significant benefits on daily caloric intake. The present study also did not assess
hormones commonly linked to satiety, hunger and appetite: ghrelin, leptin, GPL-1, and PP. Future research should measure these hormones and the responses seen to meal consumption and physical activity. In addition, future studies may want to examine hormone levels, physical activity levels and caloric consumption if the caloric content of the meal was kept constant, but the percent of fat versus carbohydrates was altered. PP increases during a high-protein meal and suppresses appetite (Lonovics 1981), if caloric content was kept the same, but the percent of protein present in the meal was higher, the participant may experience an increased sense of fullness sooner than a lower-protein meal. It may also be beneficial to examine the relationship between hormone levels and VAS subjective appetite scores.

**Conclusion**

This was the first study we are aware of to assess the effect of a bout of exercise has on appetite after consuming meals of differing caloric content in children. Eating a LC meal followed by a bout of exercise resulted in an appetite that was very similar to a HC meal followed by a bout of exercise by the time the child would be eating their next meal. A decrease in caloric consumption did not elicit an increased appetite four-hours post meal. In other words, children had a similar appetite at dinnertime regardless of caloric intake at lunch. If children can reduce the number of calories consumed at lunch, continue expending a similar amount of calories and not have an increased appetite for their next meal, it increases the likelihood that they may avoid a positive daily energy balance which may lead to weight loss and/or maintenance.
APPENDICES
APPENDIX A

INFORMED CONSENT
Appendix A
Informed Consent

Title: Feeding and physical activity study.

1) Introductory Statement.

It is a principle of medical ethics that the human subject participants of a research project be informed of the purpose and benefits of the project; the research methods to be used; the potential risks or hazards of participation and the right to ask for further information at any time during the research procedure. You have the right to know whether medical treatment or compensation is available for physical injuries incurred as a result of participation in the project. Your choice to participate is a voluntary one, and you are free to withdraw from the research project at any time. Your signature at the end of this consent form will indicate that the principal investigator, or his/her agent, has answered all your questions and that you voluntarily consent to participate in this investigation.

2) Purpose/Research Methods of the Study.

The purpose of this proposed study is to test the effect of eating two different meals, one high in fat and calories and one with moderate fat and calories, on subsequent voluntary physical and sedentary activity in children. We will also assess the effects of the different meal conditions on how hungry your child feels after exercise and later in the day.
During one session (or visit) your child will eat a high calorie or low calorie meal consisting of chicken nuggets, fries, and fruit punch. After they eat their meal they will then be taken to a gymnasium where they will be able to participate in physical activity or sedentary activities for a 30 minute session. Your child can participate in any of the activities he or she chooses for as much time as they wish. Your child will be allowed to rest whenever he or she wishes during each 30 minute session. During these 30-minute activity sessions your child will be wearing an activity monitoring and we will record the amount of time they spend participating in the various activities. At the conclusion of each 30-minute session we will ask your child how much they liked the activities they participated in and how tired they feel. Finally, when they get home they will also complete another questionnaire that measures how hungry they are at 4pm.

3) Duration of the Project.
Each lab visit will take approximately 60 minutes. The two visits are to be completed within a single week.

4) Potential Benefits of Participation.
The benefits to you and your child are minimal. The benefits to society will be a better understanding peer inclusion may impact physical activity behavior in children after eating different size meals.
5) **Potential Risks of Participation.**

There is minimal risk for participation in this study. It is probable that your child will experience temporary fast heart rate, shortness of breath, and tiredness during and after exercising in the gymnasium. There is a very slight chance of extra or skipped heart beats. However, your child is free to rest at any time during the 30-minute gymnasium session and will not be encouraged in any way to exert themselves beyond what they choose to do. Only trained and experienced staff will supervise the gymnasium session, minimizing any risks to your child. Any discomfort during exercise will be reduced as much as possible by communication between the experimenters and your child. Allergic reactions to the experimental foods is also possible. However, if you know of any allergies to food your child has, that you have not previously mentioned, you need to inform the investigators immediately. Those children indicating any allergy to the experimental foods will be excluded from the study to prevent allergic reactions to the food we will use in the study. In the case of physical injuries “911” will be called. You or your medical insurance will be billed for this service. No other medical treatment or financial compensation for injury from participation in this project is available.

6) **Alternate Methods of Treatment.**

The alternative is not to participate.
7) **Cost to the Participant.**

There is no cost to you or your child for participating in the program.

8) **Compensation and Medical Care.**

Your child will receive a $15 gift certificate to a local store of their choosing for each lab visit that they complete ($30 total given to them at the conclusion of their participation). This gift certificate will be given upon the completion of their participation in the study. Medical Assistance or emergency medical treatment by the University Health Center is provided only to currently registered students. Please be advised that for all others, “911” will be called for physical injuries occurring on the Kent State University main campus. You or your medical insurance will be billed for this service. No other medical treatment or financial compensation for injury from participation in this project is available.

9) **Right to Withdraw Any Time.**

Your participation in this study is voluntary and you may stop your participation at any time without prejudice.

10) **Contact Person.**

Jacob E. Barkley, Ph.D. Assistant Professor Exercise Science, School of Health Science, MAAC Annex, Room 163E, 350 Midway Dr., Kent, Ohio 44242, (330-672-0209).
11) Confidentiality.

Information related to you will be treated in strict confidence to the extent provided by law. Your child’s identity will be coded and will not be associated with any published results. Your code number and identity will be kept at the Kent State University in a locked file of the Principal Investigator (Dr. Barkley).

12) Statement of Voluntary Agreement to Participate.

All of the above has been explained to me and all of my current questions have been answered. I understand that I am encouraged to ask questions about any aspects of this research study, and that future questions will be answered by the researchers listed below:

Jacob E. Barkley, Ph.D. Associate Professor Exercise Science, School of Health Science, MAAC Annex, Room 163E, 350 Midway Dr., Kent, Ohio 44242, (330-672-0209).
By signing this form I understand that I do not waive any of my legal rights.

By signing this form, I agree to participate in this research study. A signed copy of this consent form will be given to me.

________________________   ___________________                _________
Parent’s Name                                           Parent’s Signature                                 Date

_______________________  _______________________
Witness’ Name                                     Witness’ Signature                                      Date

I certify that the nature and purpose, the potential benefits and possible risks associated with participation in this research study have been explained to the above individual and that any questions about this information have been answered.

___________________________ ______________
Principal Investigator’s Name          Principal Investigator’s Signature                   Date
or Designee
APPENDIX B

LETTER OF ASSENT
Appendix B
Letter of Assent

Title of Study: Feeding and physical activity study.

Child assent script to be read to the potential participants.

Hello my name is Dr. Jacob Barkley and I am an Associate Professor here at Kent State University. Thank you for coming to my work to learn about this study that I and my co-workers are doing. I want to tell you about this study because it is for children like you. I also want to see if you would like to be in this study.

If you have any questions while I am talking just let me know and I will answer them.

In this study we want to look at how kids like to play after they eat a big meal or a small meal. You and your parent will have to come to the lab two times. The first time we will ask you some questions about activities you like to do and see how tall you are and how much you weigh. You will then get to eat a meal of chicken nuggets, french fries, and fruit punch. Then you will go to a gym with us and you can play with any of the things we have in there. In the gym we have balls, things to jump over, things to climb on and places to run. We also have a table with coloring books, crayons, paper and toys...
for you to play with. You will be able to play for 30 minutes. While you are playing we will have you wear a stretchy belt with an activity monitor on it. This monitor tells us how much activity you do. We will also ask you how much you liked the activities and how tired you are after the 30 minutes. Finally, when you go home you will fill out a paper and say how hungry you are.

For your second visit you will be given the same meal but this time it will be bigger or smaller. You will then go in the gym again for 30 minutes with the same activities. Once again you will have to take home a paper to fill out at 4pm where you say how hungry or full you are.

Do you have any questions?

When you are playing you may get a little tired but you can rest whenever you like.

If you have any questions at any time during the study just ask one of us.

You do not have to do the study if you do not want to. No one will be mad at you.
If you do the study you will play in the gym today and one more time. When you finish the two visits we will give you a $30.00 gift card so you can buy something fun at a store you like. This gift card is to thank you for being in our study.

Do you have any questions for us?

Would you like to be in the study?

**If yes parent signs below:**

Signature of Parent: _____________________________ Date: __________

Signature of Witness: ____________________________ Date: __________

Signature of PI: ________________________________ Date: __________
Appendix C
Medical History

Medical History

Subject #_____________  Date____/_____/_______

Child Name_______________________  Parent Name___________________________

Address
________________________________________________________________________

Phone Number_________________________________

Age_______ (must be 8 – 12 y)  DOB_____/_____/_______  Sex m f

Height _______in  Wt _______lbs

Height _______cm (inches *2.54)  Wt _______kg (lbs/2.2)  BMI ___kg/m²

Weight percentile______________________

Which ethnic group does your child (do you) most identify with (circle response):

American Indian or Alaskan Native

Asian or Pacific Islander

Black, not of Hispanic Origin

Hispanic

White, not of Hispanic Origin

Other_____________________
Y/N

___ Has a doctor ever said that your child’s blood pressure was too high or too low?
___ Does your child ever have pain in their heart or chest?
___ Does your child ever notice extra heart beats, skipped beats or a racing heart?
___ Has a doctor ever said that your child has heart trouble, an abnormal electrocardiogram (ECG or EKG), heart attack, or coronary?
___ Does your child often have trouble breathing?
___ Has your child ever been diagnosed with asthma?
___ Has your child ever been diagnosed with diabetes?
___ Does your child have any orthopedic limitations to physical activity?

Does your child have any other medical conditions that affect his/her ability to safely participate in physical activity? If yes, explain.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Is your child currently taking any medication(s)? Y N
If yes, please describe the medication(s) __________________________________________
________________________________________________________________________
Does your child have any known food allergies?  Y  N

If yes, what are these allergies?____________________________________________

Is your child willing to eat the following foods: French fries, chicken nuggets, ketchup, and fruit punch?  Y  N

Do you have any questions?

Does the subject seem eligible?  Y  N

Date of first appointment: ____________________________
Appendix D

Anthropometric Data

Anthropometrics data recording form

Date: ____________________

Name: ____________________

Birth date: ____________________

Age: ____________________

Height (cm): ____________________

Weight (kg): ____________________

BMI: ____________________

BMI Percentile: ____________________
APPENDIX E

VISUAL ANALOG SCALE BOOKLETS
Appendix E

Visual Analog Scale Booklets

How thirsty do you feel right now?

- Not thirsty at all
- Very thirsty

How hungry do you feel right now?

- Not hungry at all
- Very hungry

How much food could you eat right now?

- No food at all
- A lot of food
How nauseated are you?

Not sick at all

Very sick

How full do you feel right now?

Not full at all

Very full
APPENDIX F

MEAL COMPOSITION
## Appendix F

### Meal Composition

<table>
<thead>
<tr>
<th></th>
<th>Weight (g)</th>
<th>Energy (kcal)</th>
<th>Protein (g)</th>
<th>Carbohydrate (g)</th>
<th>Fat (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Higher Calorie</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chicken Nugget</td>
<td>90</td>
<td>279</td>
<td>12</td>
<td>15.6</td>
<td>16.8</td>
</tr>
<tr>
<td>French Fries</td>
<td>110</td>
<td>330</td>
<td>3.9</td>
<td>42.6</td>
<td>16.3</td>
</tr>
<tr>
<td>Hawaiian Punch</td>
<td>10 oz</td>
<td>87.5</td>
<td>0</td>
<td>21.3</td>
<td>0</td>
</tr>
<tr>
<td>Ketchup</td>
<td>27</td>
<td>36.4</td>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>732.9</td>
<td>15.9</td>
<td>87.5</td>
<td>33.1</td>
</tr>
<tr>
<td><strong>Lower Calorie</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chicken Nugget</td>
<td>36</td>
<td>111.6</td>
<td>4.8</td>
<td>6.2</td>
<td>6.7</td>
</tr>
<tr>
<td>French Fries</td>
<td>44</td>
<td>132</td>
<td>1.6</td>
<td>17.1</td>
<td>6.5</td>
</tr>
<tr>
<td>Hawaiian Punch</td>
<td>4 oz</td>
<td>35</td>
<td>0</td>
<td>8.5</td>
<td>0</td>
</tr>
<tr>
<td>Ketchup</td>
<td>27</td>
<td>36.4</td>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>315</td>
<td>6.4</td>
<td>39.8</td>
<td>13.2</td>
</tr>
</tbody>
</table>

**% energy from macronutrients**: 9%, 47%, 44%
## Appendix G

### Meal Form

<table>
<thead>
<tr>
<th>Children: Food and Activity Study</th>
<th>Date:</th>
<th>Calculations verified by:____________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID#:</td>
<td>Session:</td>
<td>Condition: A B</td>
</tr>
<tr>
<td>Food Item:</td>
<td>Amount Presented:</td>
<td>Amount Remaining:</td>
</tr>
<tr>
<td>Chicken Nuggets (g)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>French Fries (g)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ketchup (g)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Juice (oz)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water (oz)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

_____ Normal Meal

_____ Abnormal Meal

Notes:__________________________________________________________

_________________________________________________________________

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_________________________________________________________________

_________________________________________________________________

Initials: ____________

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APPENDIX H

PHYSICAL ACTIVITY LOG
Appendix H

Physical Activity Log

Participant Number ___________________________  Date ________________

Observer Name: ______________________________

<table>
<thead>
<tr>
<th>GAME</th>
<th>Time Spent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obstacle course 1</td>
<td></td>
</tr>
<tr>
<td>Football/ Frisbee toss</td>
<td></td>
</tr>
<tr>
<td>Basketball shoot</td>
<td></td>
</tr>
<tr>
<td>Jump rope</td>
<td></td>
</tr>
<tr>
<td>Mini hurdles</td>
<td></td>
</tr>
<tr>
<td>Cones and soccer ball</td>
<td></td>
</tr>
<tr>
<td>Sedentary Table</td>
<td></td>
</tr>
</tbody>
</table>
REFERENCES


