

Time and Risk Preferences of Children Predict Health Behaviors but not BMI *

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Abstract

We conduct experiments with 720 children ages 9-11 to evaluate the relationship of time and risk preferences with health. Children who are more patient report consuming fewer unhealthy calories and spending less time on sedentary activities such as video games. Children who are more risk seeking report engaging in more exercise and more screen time. However, time and risk preferences are not predictive of body mass index (BMI). Moreover, some of the negative health behaviors, such as screen time, are associated with lower – rather than higher – BMI.

JEL classifications: C72, C91

Keywords: Risk preferences, Time preferences, Health, Children.

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1 Introduction

There is a growing literature correlating time and risk preferences with health behaviors and outcomes. Studies show that among adults, higher levels of impatience are associated with less physical activity, less healthy diet, and higher body mass index (BMI) (Joireman et al., 2012; Ikeda et al., 2010; Courtemanche et al., 2015; Leonard et al., 2013).¹ Risk tolerance has also been found to be positively associated with BMI (de Oliveira et al., 2016). Similar work has been done among adolescents. Sutter et al. (2013), for example, finds that higher levels of impatience are associated with spending more money on alcohol and cigarettes and higher BMI. Relatedly, Samek et al. (2019) finds that survey measures – but not experimental measures – of time preferences are associated with physical activity and BMI. (Schneider and Sutter, 2020) find that higher order risk preferences (i.e prudence and temperance) are related to adolescents’ health-related behavior, addictive behavior and financial decision making.

We contribute to this literature by evaluating the association between time and risk preferences and health behaviors of more than 700 children aged 9-11 years old. We focus specifically on food intake, physical activity, and overweight/obesity. Our investigation is timely since childhood obesity is on the rise, with over 340 million children and adolescents aged 5-19 considered overweight and obesity worldwide up from just 4% in 1975 to nearly 20% today. Understanding the association of economic preferences with obesity can help better understand the individual factors that shape the obesity epidemic (WHO, 2021).

Our paper differs from the previous literature in several key ways. First, our sample is taken from a low-income, high-minority population, which is policy-relevant since this is the group that is most at risk of obesity (CDC, 2021). Second, we attempt to overcome potential biases in self-reports by including both a self-reported and an incentivized measure of food choice, whereas prior studies use experimental measures for preferences but self-reported measures only for food choices. Finally, our sample is on average 7 years younger compared to, for example, Samek et al. (2019). Studying children at a younger age is important since obesity emerges at an early age and is

¹Time and risk preferences are also associated with smoking, drinking and drug abuse behavior (Bradford, 2010; Harrison et al., 2010; Anderson and Mellor, 2008).

persistent (CDC, 2021).

Children in our study participated in both an experiment and a survey. In the experiment, children chose between rewards earlier and later (time preferences) and between a smaller, certain reward and a chance of a larger reward with some probability (risk preferences). In the survey, children responded to questions about time spent on sedentary and physical activity, as well as on foods consumed in a typical week. Children also participated in an incentivized food choice task. They were given the choice of one of six different snacks to be eaten during the session, three of which were relatively unhealthy processed foods and three of which were a healthier fruit or vegetable. At the end of the session, we also measured child height and weight in order to calculate BMI.

We find that children who are more patient in the experiment report consuming fewer unhealthy calories and spending less time on sedentary activities. Children who are more risk seeking report spending more time on sedentary activities and engaging in more exercise. However, we find no association between risk and food intake. Time and risk preferences are not predictive of body mass index (BMI). Moreover, surprisingly, some of the negative health behaviors are associated with lower – rather than higher – BMI.

In what follows, Section 2 describes our experimental design, Section 3 presents our results and Section 4 concludes.

2 Experimental Setting

2.1 CHECC overview

Children in our study were participants of the Chicago Heights Early Childhood Center (CHECC) program. CHECC studies the role of different early education programs (implemented from 2010 to 2014) on schooling outcomes.² We follow the general experimental protocol approach with children outlined in (List et al., 2022) in our experiment.

²CHECC randomly assigns children and parents from Chicago Heights, Illinois and surrounding areas to 1) a free high-quality preschool program, 2) a parenting program or 3) a control group.

The study was conducted in three waves: December 2017, December 2018-January 2019, and December 2019-January 2020. To reduce noise, in our analysis we aggregate the data by taking the average of the variables of interest for the three waves for each child.

The activities for the present study took about an hour to complete and were conducted one-on-one with an experimenter during the school day. The sections below describe each of the measures that we used. We supplement the data we collected in the experiment with parent surveys about parental background and home environment.

2.2 Preference Elicitation

Children participated in one time preference activity and one risk preference activity. Both activities included tokens that they could use to purchase prizes in a 'prize store.' Children were able to see the prize store during the assessment, and it contained assorted prizes that we pre-screened for suitability for this age group, as per (List et al., 2022). In the time preference activity, children were given a Multiple Price List (MPL) in which they had to make four decisions, choosing between a lower number of coins given to them on that day (green plate) and a higher number of coins given to them on the next day (orange plate). In each successive decision, the reward for waiting (i.e. the number of coins they would receive on the next day) increased by 1 coin. The action set was as follows: {4 vs. 5; 4 vs. 6; 4 vs. 7; 4 vs. 8}. Figure A1 shows a diagram of the time preference task.

In the risk preference activity, children were again given an MPL in which they had to make five decisions. In the first four decisions, they needed to choose between the safe option of getting 1 coin for sure or the risky option of getting 2 coins with a known probability (versus 0 coins). The probability of winning the two coins increased in each successive decision. Yellow and white spinners were used when the child chose the riskier option, where the child got 2 coins if the spinner stopped on yellow and 0 if it stopped on white. The proportion of the spinner colored yellow corresponded to the probability of winning in the particular decision. Therefore, children could see and understand the relative odds of winning. The spinners presented the following probabilities: $\{1/8, 1/4, 1/2, 3/4\}$. In the fifth decision, children had

to choose between receiving 1 coin with certainty and receiving 2 coins with an unknown probability, and this time one of the four spinners was randomly used if the child picked the riskier option. Figure A2 shows the risk task.

For the analysis, our measures of time and risk preferences are the value of the number of times the child chose the more patient or riskier option. We first aggregate the measures for the three waves and then we standardize.

2.3 Health Behaviors and Outcomes

Our main outcomes of interest for the children’s health-related behavior are food choices, exercise measures, ‘screen-time’ measures, and weight measures. For the food choices, we collected information of children’s intake of various healthy foods – i.e carrots, other vegetables, salads and fruits, and unhealthy foods – i.e soda, sweets, fast foods and salty snacks. Specifically, we asked them if during the past 7 days they had the food of interest. If they answered yes, we then asked them if they had it every day. If they answered yes to that query, we then asked them to tell us how many times a day: 1, 2, 3 or 4 times per day. If they answered that they didn’t consume it daily we asked them if they consume it 1-3 times in the past 7 days or 4-6 times. Based on their responses we obtained the number of times they consumed the food per week and on average per day. We then created a single measure of the average number of "healthy calories" and “unhealthy calories" that each child consumed per day. Calorie numbers for specific food items were taken from the average figures found on USDA (U.S Department of Agriculture). Figures A3 and A4 provide examples of the food questions and the corresponding pictures seen by the children.

After collecting food consumption measures, we collected information about their activities. For exercise, we obtained two measures: intense and moderate. For the intense measure we asked them how many of the past 7 days they exercised or took part in physical activity that made their heart beat fast and made them breathe hard for at least 20 minutes. We told them basketball, soccer, running, swimming, and tennis were examples of intense activity. For the moderate measure we asked each child how many of the past 7 days they did any exercise that didn’t make their heart beat fast and made them breathe hard for at least 30 minutes. We told them fast walking, slow bicycling, and skating were examples of moderate activity. Figure A5

provides an example of the pictures that children saw for intense exercise.

For the 'screen-time' measures we asked each child how many hours a day they watch TV, played video games, and used the internet. For each of the measures we asked them for their behavior on weekdays and on weekends, wherein they could answer less than 1 hour per day, 1, 2, 3, 4, or 5 or more hours per day. Based on their answers we obtain the number of hours watching TV, playing video games, and using the internet per day. For 'less than 1 hour' we assign 0 hours and for '5 or more' we assign 5 hours. We then compute the average hours per day between weekday measures and weekend measures and we create the 'screen-time' measure by averaging TV, video games, and internet.

After collecting all the behavioral measures we obtain the weight and height of the child 3 times. Based on these measures we calculate the Body Mass Index (BMI). We use the Stata functions to obtain the standardized BMI-for-age measures as defined for American kids and to categorize children as 'normal weight', 'overweight' or 'obese' using the BMI cutoffs recommended by the Childhood Obesity Working Group of the International Obesity Taskforce.³

3 Results

3.1 Summary of the Data

Table 1 provides a summary of the background characteristics of the children. Our analysis sample includes 720 children for which we have at least one measure and at maximum three measures that we average. Our sample of children has an average age of 10 years. The sample is gender-balanced and is primarily low-income and Hispanic. We present the BMI-for-age measure according to the CDC guidelines. Table 1 shows that our sample is more than 1 standard deviation above the mean BMI.

In the main analysis of the experimental measures, we use the standardized value of the number of times out of 4 that children chose the delayed payment to measure time preferences, and number of times out of 5 the child chose the risky payment over the sure payment to measure risk preferences. Figure 1 shows the histogram of

³To standardize the weight we use the function *zanthro* and to determine the categories we use the function *zbmicat*.

the experimentally measured time and risk preferences. Consistent with Samek et al. (2019) and Benjamin et al. (2013), the majority of children (more than 70%) choose 3 or more patient decisions. Further, the majority of the children (more than 70%) choose 3 or more risky decisions.

3.2 Correlation of Preferences with Health Behaviors

We next explore the relationship of time and risk preferences of children with their health-related behaviors. Table 2 presents empirical results of pooled OLS regressions of time and risk preferences on various sedentary activities and food choices.

We find evidence that patience is predictive of fewer unhealthy calories consumed and less screen time. For instance, a one standard deviation increase in patience is associated with a 0.127 standard deviation decrease in consumption of unhealthy calories ($p < 0.01$). We also find that a one standard deviation increase in patience is associated with a reduction of 0.131 standard deviations in screen time. These findings provide evidence that an individual's level of patience affects health-related behaviors that require self-control. These results are consonant with the insights in Samek et al. (2019) in that they show a negative correlation between patience and time spent on sedentary activities. However, Samek et al. (2019) found this correlation only in survey data, while we find it in experimental data. In terms of other results, we find no effect of patience on exercise, consumption of healthy calories or selection of snack.

Related to risk preferences, we find little evidence of an association with food choices, but we find strong evidence of an association with screen time and exercise. An increase of one standard deviation in risk-seeking attitudes is associated with an increase in 0.083 of a standard deviation in the amount of hours doing exercise and an increase in 0.091 of a standard deviation in screen time. Both of these empirical results is significant at the $p < 0.05$ level.

3.3 Correlates with BMI

In Table 3 we explore the associations between BMI and health behaviors. We find that more screen time is associated with a higher BMI and a higher probability of

being obese. This is an expected finding since TV, internet, and video games are sedentary activities. However, surprisingly, we find that an increase in consumption of unhealthy calories leads to a reduction in both BMI and the probability of being obese. We do not find statistically significant associations between BMI measures and exercise.

Table 4 presents our findings related to BMI. We find that neither patience nor risk tolerance is significantly associated with BMI. These results stand in opposition to previous literature: Samek et al. (2019) finds an association between time survey measures and BMI, but finds no evidence when using the experimental measures. Several studies have found a positive association between patience and lower BMI for adults (Ikeda et al., 2010) and for children and adolescents (Sutter et al., 2013; Golsteyn et al., 2014). The possible explanation for this association is that more patient individuals may care more about their future health outcomes which can be translated in healthier decisions related to food and physical activity, even in early stages of life. Related to risk preference, several studies have found an association between high risk tolerance and higher BMI (Sutter et al., 2013; Samek et al., 2019; de Oliveira et al., 2016). More research is necessary.

4 Epilogue

To determine the impact of children’s economic preferences on a variety of health outcomes, we conduct incentivized experiments using time and risk preferences elicitation tasks and collect health behaviors and outcomes of more than 700 children between 7 and 14 years old. Our results suggest that childhood risk and time preferences help understand health behaviors. Our main takeaway is that more patient children consume fewer unhealthy calories, and spend less time on sedentary activities such as watching TV and playing video games. We also find that more risk-seeking children spend more time on screens and exercise more. These findings contribute to the large literature that has focused on the role of time and risk preferences in explaining life outcomes.

Health behaviors are strongly related to mortality and morbidity in adulthood. Cawley and Ruhm (2011), for example, show the importance of health behaviors of

adults in modern industrialized economies. They report that excess body weight and physical inactivity are the third and fourth most important factors that contribute to premature death. The second, fifth, and sixth-ranked risk factors are high blood pressure, blood glucose, and cholesterol. All of these are affected by health behaviors such as smoking, physical inactivity, and diet. Our results show that some of these behaviors -physical inactivity, poor diet- in childhood are associated with risk and time preferences. A deeper understanding of how childhood health behaviors translate to health behaviors in adulthood and to what extent influencing preferences in childhood affect health behaviors in adulthood are important topics for future research.

5 Tables and Figures

Table 1: Summary Characteristics

	Mean	Std. Dev.
Age	10.263	1.414
BMI	1.168	1.040
Overweight	0.249	0.433
Obese	0.326	0.469
Female	0.490	0.500
Black	0.205	0.404
White	0.040	0.197
Hispanic/Latino	0.750	0.433
Other Race	0.000	0.000
Household Income: 15k or less	0.455	0.498
Household Income: 16k - 35k	0.386	0.487
Household Income: 36k - 60k	0.124	0.330
Household Income: 60k or more	0.035	0.184
Mother's age	30.493	6.564
Highest Education: less than college	0.320	0.467
Highest Education: high school diploma	0.330	0.471
Highest Education: some college	0.165	0.372
Highest Education: post-secondary degree	0.185	0.389
Observations	720	

This table shows the average values for several demographic and socioeconomic characteristics for the three waves of data.

Table 2: Children Preferences and Healthy Behaviors

	(1)	(2)	(3)	(4)	(5)
	Screen Time	Exercise	Unhealthy Calories	Healthy Calories	Healthy Snack
Time (exp)	-0.131*** (0.036)	0.004 (0.038)	-0.127*** (0.038)	0.041 (0.038)	-0.010 (0.012)
Risk (exp)	0.091** (0.035)	0.083** (0.038)	0.032 (0.037)	0.002 (0.038)	-0.017 (0.011)
Observations	714	714	714	714	712
R^2	0.16	0.06	0.10	0.08	0.03

This table shows OLS regressions of healthy behaviors on time and risk preferences. The variable 'Screen Time' is the standardized average of hours spent daily on TV, internet, and videogames. 'Exercise' is the to the average number of times per week the child participates in intense and moderate physical activity. These measures are self-reported. 'Healthy Calories' measures the average number of calories consumed through fruits and veggies per day. 'Unhealthy Calories' measures the average number of calories consumed through sweets, salty snacks and soda per day. This was computed based on self-reported consumption of these foods and beverages and the average number of calories found in servings of these. 'Healthy Snack' is a dummy variable that takes the value of 1 if the kid prefers a healthy snack over an unhealthy one. Demographic (age, gender, race), CHECC (Kinderprep, Parent Academy, Cog-X Pre-K), and SES (mother's age, mother's education, household income) controls were added in the regressions. We also control for missing data. Time, risk, screen time, exercise, unhealthy calories and healthy calories are standardized variables. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Healthy Behaviors and Weight Measures

	(1)	(2)	(3)	(4)
	BMI	Normal	Overweight	Obese
Screen Time	0.081*	-0.038*	0.007	0.034*
	(0.044)	(0.021)	(0.018)	(0.020)
Exercise	0.029	-0.017	0.010	-0.001
	(0.040)	(0.019)	(0.017)	(0.018)
Unhealthy Calories	-0.190***	0.079***	-0.008	-0.065***
	(0.043)	(0.020)	(0.018)	(0.020)
Healthy Calories	0.063	-0.028	-0.009	0.042**
	(0.042)	(0.020)	(0.018)	(0.019)
Healthy Snack	0.175	-0.103*	0.057	0.071
	(0.131)	(0.062)	(0.056)	(0.060)
Observations	710	717	717	717
R^2	0.08	0.09	0.04	0.06

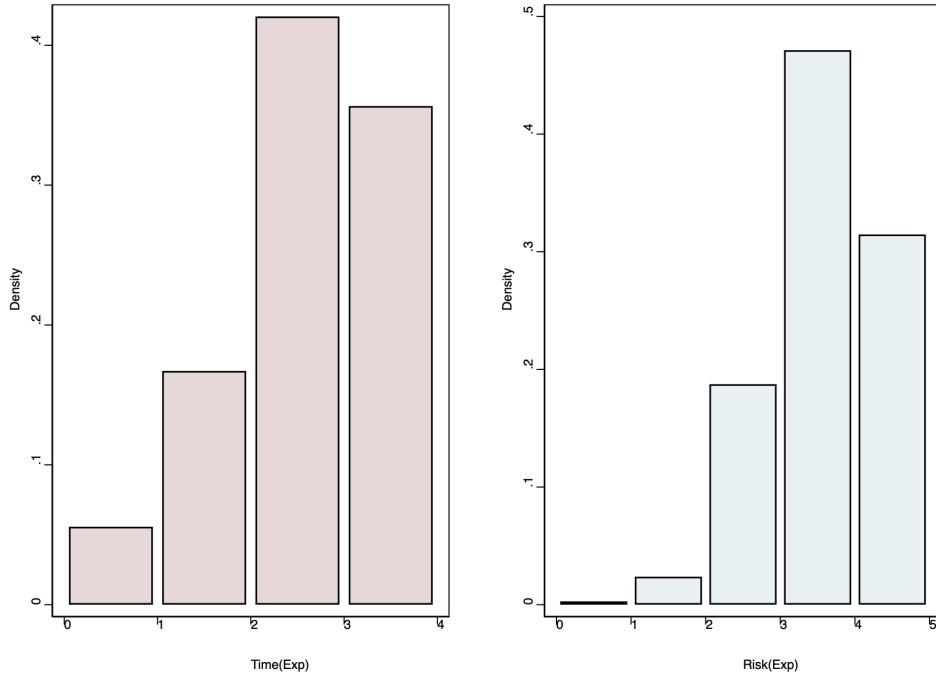
This table reports OLS regressions of child BMI on consumption of unhealthy calories. Demographic (age, gender, race), CHECC (Kinderprep, Parent Academy, Cog-X Pre-K), and SES (mother's age, mother's education, household income) controls were added in the OLS regressions. We also control for missing data. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Preferences and Weight Measures

	(1)	(2)	(3)	(4)
	BMI	Normal	Overweight	Obese
Time (exp)	0.037 (0.040)	-0.002 (0.019)	0.001 (0.017)	0.012 (0.018)
Risk (exp)	-0.026 (0.040)	0.020 (0.019)	-0.025 (0.017)	0.000 (0.018)
Observations	706	714	714	714
R^2	0.05	0.06	0.04	0.04

This table reports OLS regressions of child BMI on consumption of unhealthy calories. Demographic (age, gender, race), CHECC (Kinderprep, Parent Academy, Cog-X Pre-K), and SES (mother's age, mother's education, household income) controls were added in the OLS regressions. We also control for missing data. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 1: Risk and Time Preferences



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Appendix

A Figures

Figure A1: Time Task

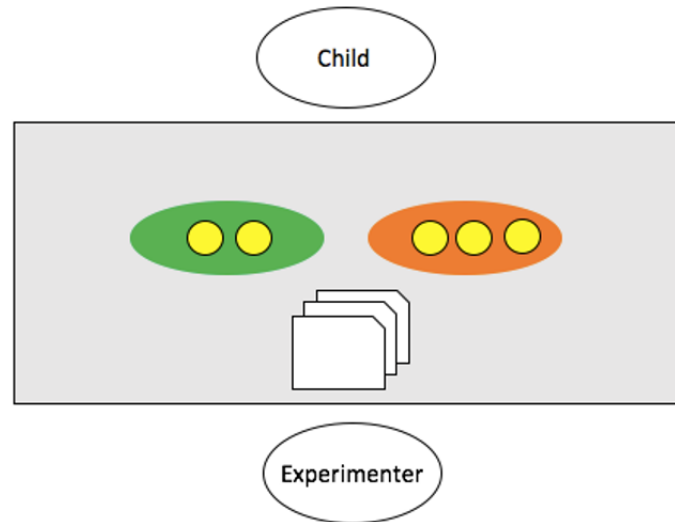


Figure A2: Risk Task

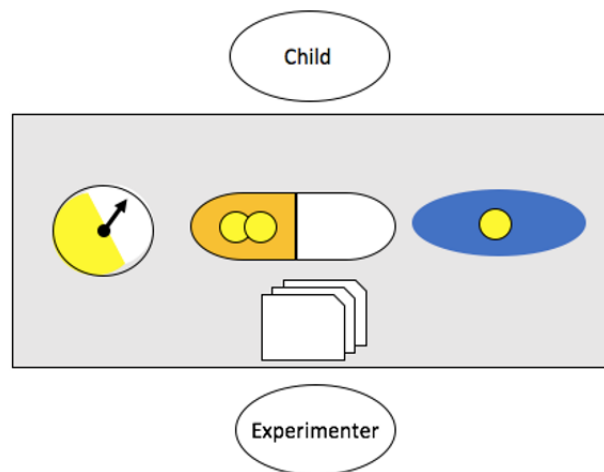


Figure A3: Food Question

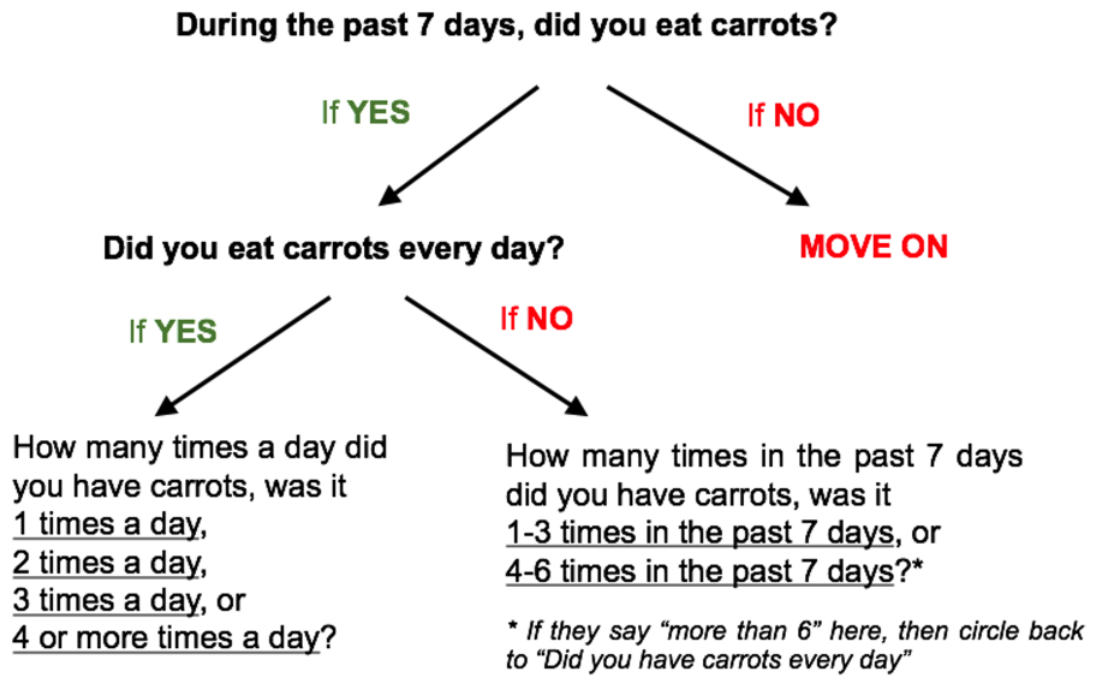


Figure A4: Food Screen

CARROTS

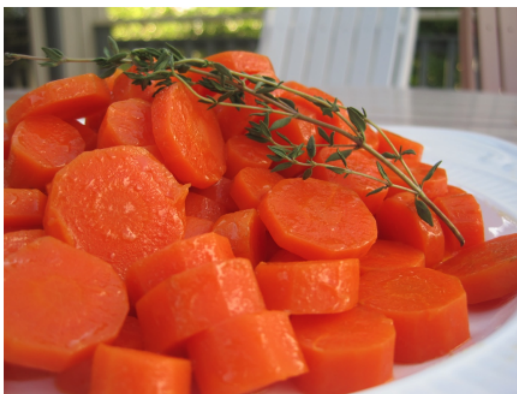


Figure A5: Food Screen

