The Efficacy of Solo Exercise vs Sports in Terms of BMI Outcomes

Colby Meline

Southern Utah University

According to the American Time Use Survey 2003-2006, the most popular forms of exercise in the United States (in order of popularity) are walking, weightlifting, using cardiovascular equipment, swimming, and running. One thing to note about these activities is that they are generally solo forms of exercise. The American Time Use Survey 2003-2006 supports this understanding, with more than 50% of respondents, both male and female, who engaged in sports or exercise activities on an average day reporting that they exercise alone. Why is this the case? Participation in group exercise/sports certainly correlates with healthier weight outcomes (Turner) (Antonogeorgos) (Elkins), so why is it that people in the United States generally decide to exercise alone, if they exercise at all? Perhaps it is because exercising with other people requires coordinating more than one schedule, which can be cumbersome. This seems like a distinct possibility. However, studies have shown that exercise and sports with other people come with social and psychological benefits that cannot be gained through solo exercise (Pluhar).

Exercising in a group or through a team sport is less convenient to schedule but comes with social and psychological benefits of which people are generally aware. Yet, a majority of people in the United States who exercise decide to do so alone. If people are rational, it hardly makes sense for them to forego the social and psychological benefits of group exercise/team sport over a mild scheduling inconvenience. Therefore, it would seem that many people perceive an advantage in solo exercise that has not been specified hereto. The most straightforward explanation is that most people who exercise do so alone because they perceive solo-exercise activities to be more effective in terms of health outcomes than group exercise/team sport[1]. The question of this paper is the following, "Does this perception lie in parity to reality?" In more specific terms, "Is participation in

[1] It is important to note that this assumption is ancillary to the findings of this paper. The focus is on the BMI outcomes for different forms of exercise, not on people's relative assessments of value.

solo-exercise more likely to correspond to a normal weight (in terms of BMI) than participation in group exercise/team sport?"

This paper seeks to answer the aforementioned question using the American Time Use Survey of 2015 and 2016 in combination with the Eating & Health Module of those same years. General BMI guidelines for adults specify that a normal weight falls between 18.5 and 25 for both males and females. This permits the creation of a dummy variable for healthy weight. The first model will be a linear probability model, regressing this normal weight dummy variable on time spent doing popular forms of solo exercise to judge their efficacy as well as sports in a general category, controlling for other basic health factors like fast-food consumption. Model (2) will be a logistic model to check the robustness of the findings in Model (1). Next, Model (4) will regress the variables in Model (1), replacing the general sports variable with time spent doing various group exercises/team sports. Finally, those group exercises/team sports with statistically significant coefficients will be tested against the coefficients of solo exercises to see whether they are different from one another.

Data:

The data used in this study comes from the American Time Use Survey (ATUS) and the Eating and Health Module of the American Time Use Survey, years 2015-2016. According to the United States Bureau of Labor Statistics, "The American Time Use Survey (ATUS) provides nationally representative estimates of how, where, and with whom Americans spend their time, and is the only federal survey providing data on the full range of nonmarket activities, from childcare to volunteering." This study has been performed annually from 2003 to 2019, with over 210,000 individuals participating each year. Essentially, respondents keep a detailed account of their activities for one day, writing down what they do, when, and with whom. The Eating and Health Module is a temporary set of questions added to the end of the ATUS regarding eating, meal preparation, and health. Although the Bureau of Labor Statistics is a widely respected institution, perhaps one would prefer to see the demographics themselves to determine whether the study truly is nationally representative. The following provides a demographic breakdown of the ATUS 2015-2016 in the Eating and Health Module. The average age is approximately 49 years old. 45.6% of respondents are male. 78.8% of respondents are white, 14.7% are black, and 6.5% identify with a different race/combination of races.

The outcome variable of interest in this paper comes from Body Mass Index, or BMI. BMI is a person's weight in kilograms divided by the square of their height in meters. The purpose of BMI is to look at the composition of a person's body indirectly through the relationship between their stature and their mass. Although it does not directly measure body fat, BMI does correlate with direct measures of body fat. Other, more direct measures of measuring body fat might be better in terms of analyzing a person's health, but BMI is commonly used to categorize a person's weight because it is easily taken. For an adult, a BMI greater than 18.5 and less than 25 is considered generally to be a normal/healthy weight. This categorization differs for children and teens because of complexities related to growth. The Centers for Disease Control and Prevention state that people 2-years-old to 19-years-old are in a normal weight category if between the 5^{th} and 95^{th} percentile of children of the same age and sex. "These percentiles were determined using representative data of the U.S. population of 2- to 19-year-olds that was collected in various surveys from 1963-65 to 1988-94." From the charts and adult guidelines given by the CDC, a dummy variable for normal weight becomes the outcome variable. In short, the variable "Normal Weight" comes from the predefined percentiles between 5% and 95% for those people under 20 years old, and from the general BMI guidelines of 18.5-25 given for adults by the CDC. According to these guidelines, about 33.4% of people fall into a normal weight category in this data set.

The independent variables of this study include minutes spent doing various activities relating to exercise, separated into two categories. The first category is solo-exercise activities. This category consists of running, walking, hiking, using cardiovascular equipment, yoga, biking, and weightlifting. The second category is sport activities. This category consists of equestrian sports, martial arts, snow sports, water sports, baseball, golfing, gymnastics, hockey, racquet sports, soccer, softball, volleyball, wrestling, basketball, and football. These two categories taken jointly likely appear to be an excessive quantity of independent variables. Keep in mind that the idea is to cast a wide net in order to find out which independent variables of both categories, if any, correlate with normal weight outcomes. The potential correlations between these variables and the normal weight outcomes are important because they can aid people in understanding which activities are effective at predicting normal weight outcomes. When exercising, people are concerned with the health efficacy of the activities they engage in. Exercising might come from many divergent motivations, but it is common to hear people expressing goals for exercising that resemble the phrase, "staying in shape." If one possesses such a goal, it only makes sense to consider which activities correspond with normal weight outcomes. This paper seeks to aid such people in making an educated decision regarding which exercise activities to engage in.

Another portion of the independent variables is the category of control variables. Several things correlate with one's exercise habits and weight outcomes. Because of these covariates, this paper attempts to include sex, age, race, eating habits, exercise habits, and income as controls in the models. The first three are easy to account for, but the last three prove trickier in this data set.

Eating habits are complex. The quality of ingredients, frequency of meals, portion sizes, total caloric intake, and many other variables could plausibly affect one's BMI and also correlate with one's exercise choices. However, this data set does not contain the information needed to control for all of the relevant factors properly. It does, however, have several variables involving the frequency of fast food and non-water drink consumption per week. Fast food consumption correlates with obesity (Maddock), so controlling for frequency of fast food/non-water drink consumption is a stand-in for overall diet choices.

When looking at how effective certain exercises are on weight outcomes, the ideal data will be representative of the respondents' overall exercise habits across time. This is because weight outcomes are a result of habits and consistent exercise, not simply the result of one day's exercise. When measuring only one day of time-use regarding exercise, it is possible to capture data that does not represent someone's overall exercise habits. Some respondents may be regular exercisers and the survey happens to fall upon a rest day. Some respondents may be largely sedentary with an uncharacteristic amount of exercise being recorded by chance. For this reason, this paper seeks to control for the overall exercise habits of respondents. This is done by using the variable "Exercise Frequency." This variable measures the total instances of exercise that the respondent engaged in during the past week. Note that this variable measures instances, not minutes. It would be better to be able to control for total time spent exercising per week and to be able to control for the type of exercise during that entire week, but the best data available in this set only measures minutes for the day of the survey, and instances of exercise over the week before.

Although the relationship between obesity and different socioeconomic groups is complex, income generally correlates positively with healthy BMI outcomes (Ogden). Because of this, the models attempt to control for income. Nonetheless, the data set does not contain the straightforward total personal income of respondents, but rather their income in relation to the poverty threshold. Below is a table showing a tabulation of the relevant variable. This variable of income as it relates to the poverty threshold stands in for a straightforward personal income variable.

Relationship between income and poverty threshold	Frequency	Percent
Income > 185% of poverty threshold	12593	64.84
Income ≤ 185% of poverty threshold	1047	5.39
130% poverty threshold < Income < 185% poverty threshold	1638	8.43
Income ≤ 130% of poverty threshold	4145	21.34
Total	19423	100

Methods:

When deciding which methods to use in data analysis, it is important to keep in mind the question at hand. In this paper, the hope is to identify whether or not participation in solo-exercise is more likely to correspond to a healthy weight (in terms of BMI) than participation in group exercise/team sport. The ATUS data allows for both the analysis of exercise in general categories, and analysis of the per-minute effects of exercises. The models will be estimating the coefficients of different exercises and control variables at the individual level, at one point in time. Initially, this paper will examine the percentage of people in a normal weight category whose exercise habits fall into four groups: only solo exercise, only sport, both solo exercise and sport, and neither solo exercise nor sport. This initial comparison does not identify the efficacy of solo exercise or sport per minute, but it could identify possible qualitative differences between solo exercise and team sport. Perhaps the culture that accompanies sport encourages healthier behaviors than solo exercise, or vice versa. The initial comparison could also identify a synergistic or antagonistic relationship between solo exercise and sport, depending on the outcome of the third category. If people who engage in both solo exercise and sport were, overall, in a normal weight category more frequently than any other group, it would suggest that there might be a synergistic relationship between sport and solo exercise. If engaging in both sport and solo exercise resulted in lower results than only one or the other, then there could be an antagonistic relationship. In other words, the effects of participating in both sport and solo exercise may result in BMI outcomes that are more than the sum of effects of the parts. Thus, it may be mistaken to consider participation in solo exercise to be a linear substitute to participation in sport. The interaction model, Model (6), attempts to address this possibility, and is a falsification test of sorts to test whether or not the question itself is flawed.

This paper then uses a linear probability model to assess the connection between BMI outcomes and various forms of exercise. When looking at exercise forms in relation to BMI outcomes, it is helpful to look first at broader categories of exercise before laying out specifics. This paper uses multiple models accordingly. The variables that are of greatest concern to the thesis of this paper are the exercise variables: running, walking, basketball, etc. These variables measure the total minutes survey participants spent doing the respective activity. In the first model, sports as exercise are grouped into one category, for easy comparison with two of the most common forms of solo exercise: running and walking. Of course, to be accurate in estimating the coefficients of all of these variables, it is important to control for individual characteristics as much as possible. This paper controls for individual characteristics in every model.

Model (1):

$$Prob(Normal\ BMI = 1) = \beta_0 + \beta_1(Total\ Sports\ Time) + \beta_2(Running) + \beta_3(Walking) + \beta_4(Fast\ Food\ Frequency) + \beta_5(Exercise\ Frequency) + \beta'(Individual\ Characteristics) + a_i + u_{it}$$

The controls added in Model (1), represented by the term "Individual Characteristics" are mostly straightforward and the relevance is explained in the data section. They include age, race, gender, and income. However, "Fast Food Frequency" and "Exercise Frequency" warrant a brief redress. "Fast Food Frequency" represents the number of times an individual ate food from a fast-food restaurant in the past seven days. This serves to nullify any omitted variable bias they may come from eating habits that correlate both with exercise habits and with BMI outcomes. "Exercise Frequency" measures the frequency the respondent exercised in the past seven days. This serves to nullify the omitted variable bias that might come from certain forms of exercise being performed more often than others are. For instance, it may be the case that runners go on a run five days per week on average, whereas basketball players only play basketball twice per week on average. In this scenario, even if the exercise time per day and effectiveness per minute were equal between basketball and running, the coefficient of running would be drastically higher. Model (1) is designed to compare playing sports generally to running and walking, before getting into the complexities of comparing individual sports to a greater list of solo exercises. Running and walking are very common forms of exercise and represent different intensities of exercise, which is why they were selected for this first model.

Model (2):

$$Logit(Normal\ BMI = 1) = \beta_0 + \beta_1(Total\ Sports\ Time) + \beta_2(Running) + \beta_3(Walking) + \beta_4(Fast\ Food\ Frequency) + \beta_5(Exercise\ Frequency) + \beta'(Individual\ Characteristics) + a_i + u_{it}$$

No variables change between Model (1) and Model (2); Model (2) simply serves to test the robustness of the findings in Model (1). When recreating a linear-probability model in terms of a logit model, one should expect robust findings to remain largely the same. In other words, the values and p-values of the coefficients should not change by a sizeable margin.

After regressing the probability of an individual being in a normal weight category by sport participation as a general category, this paper delineates each sport in the category individually to examine the efficacy of each sport separately from the others. It may be that some of the sports correspond to normal weight outcomes more strongly than others. It is also possible that participation in some of the sports included in the category "Total Sports" bear no statistically significant relationship to normal BMI outcomes. Model (3) will separate "Total Sports" into all of its component parts. If any of the sports are not statistically significant at the 90% confidence interval, they will be omitted in any models that follow Model (3).

Model (3):

$$Prob(Normal\ BMI = 1) = \beta_0 + \beta'(All\ Solo\ Exercises) + \beta'(All\ Sports) +$$
$$\beta_1(Fast\ Food\ Frequency) + \beta_2(Exercise\ Frequency) +$$
$$\beta'(Individual\ Characteristics) + a_i + u_{it}$$

Any sports or solo exercises not bearing a statistically significant relationship with normal BMI outcomes will be omitted. These sports and solo exercises may, in fact, bear a causal relationship to normal BMI outcomes, but appear otherwise due to limitations in the data[2]. Nonetheless, it is not expedient to include variables without statistically significant coefficients, so

[2] Other sports and solo exercises might not correlate with normal BMI outcomes because they encourage the participant to seek a body weight that is atypical (note that atypical does not necessarily equate to unhealthy). For instance, football, wrestling, and weight lifting are activities that often encourage participants to gain body mass. This is not a condemnation of such activities, but merely an acknowledgement that other metrics may be necessary to determine the health benefits of such activities.

analysis of those activities will be best relegated to other data. The independent variables with statistically significant coefficients will form Model (4). Additionally, Model (4) and the models thereafter will include yoga and hiking as solo exercises, for extra points of comparison with the sport variables.

Model (4):

$$Prob(Normal\ BMI = 1) = \beta_0 + \beta'(Statistically\ Significant\ Solo\ Exercises) + \beta'(Statistically\ Significant\ Sports) + \beta_1(Fast\ Food\ Frequency) + \beta_2(Exercise\ Frequency) + \beta'(Individual\ Characteristics) + a_i + u_{it}$$

Model (5) will mirror Model (2) in the sense that it is a logit recreation of the previous model for a robustness check. It will contain the same variables as Model (4).

The findings of the initial comparison indicate that there may be an interaction between sports and solo exercise in terms of BMI outcomes, so an interaction model will follow Model (5) to see if people who play sports get a different return on solo exercise than people who only do solo exercise. Model (6) will be this interaction model, including both "Any Sports Time" as a dummy variable and "Running * Any Sports Time" as an interaction term[3]. If the coefficient of the former is statistically significant, that could indicate that people who play sports have a different base probability of being in a normal weight category. If the coefficient of the latter is statistically significant, that could indicate that something is different about the way that people who play sports engage in solo exercise compared to people who do not play sports. A statistically significant,

[3] Additional variations of Model (6) will be added according to which variables are statistically significant in the solo-exercise category. See Table (6) below.

positive coefficient for the interaction term in Model (6) could indicate a synergistic relationship between solo exercise and sport participation. A statistically significant, negative coefficient for the interaction term in Model (6) could indicate that sport participation hinders the efficacy of solo exercise. A statistically insignificant coefficient for the interaction term in Model (6) could indicate that this paper is correct in taking sport participation and solo exercise as linear substitutes.

Model (6):

$$Prob(Healthy\ BMI = 1) = \beta_0 + \beta_1(Any\ \ Sports\ Time) + \beta_9(Running) + \beta_{10}(Running * Any\ Sports\ Time) + a_i + u_{it}$$

With the initial comparison and Models (1-5), one should be able to assess whether sport and solo exercise are equal or unequal in their relationships with normal BMI outcomes. This applies to both sport and solo exercise as general participation categories, and as individual activities per minute. For instance, the results of these models should allow someone to compare one hour of reported running participation versus one hour of reported basketball participation in terms of an individual's probability of being in a normal weight category. Furthermore, Model (6) should allow one to determine whether people who participate in sports get equal or unequal return on participation in solo exercises like running. Regardless of the findings, these models are likely to yield informative results.

Results:

An initial comparison of means in terms of exercise participation by category produces differences. About 42% of individuals only participating in solo exercise are in a normal weight category, whereas 44% of individuals who play only sports are in a normal weight category. Both sports and solo exercise has the highest proportion, with nearly 48% of individuals falling into a normal weight category. A regression of normal weight by these basic categories yields statistically significant (at the 99% confidence interval) coefficients with different magnitudes, shown in Table (2). However, these differences in means fail an F-Test, shown in Table (4). Luckily, a breakdown of these categories into per-minute, activity-specific variables provides more substantive results.

When estimating Model (1), one finds that the coefficients of running, walking, and total sports are all positive and statistically significant at the 90% confidence interval or higher. However, the coefficient of running is more than five times greater than the coefficient of total sports. This indicates that, looking at sports generally, one unit of running time provides a much higher probability of an individual being in a normal weight category than one unit of general sports time. More similar are the coefficients of walking and total sports, being the same down to the ten-thousandths decimal place. This would indicate that playing sports generally for one unit of time cannot be differentiated from one unit of time spent walking in terms of the probability that an individual will fall under a normal weight category. F-Tests support this understanding. The probability of Type I[4] error in rejecting the null hypothesis that the coefficient of total sports is equal to the coefficient of running is 0.01%, whereas the probability of Type I error in rejecting the null hypothesis that the coefficient of total sports is equal to the coefficient of walking is 92.4%. These results indicate that sports as a whole are less effective than running in terms of normal BMI outcomes.

Nevertheless, it would be a disservice to sports to stop here. Perhaps certain sports are less rigorous than others are or even share a negative correlation with normal BMI outcomes, and that is why they appear less effective than running as a broad category. Maybe certain sports will be just as

[4] A Type I error occurs when a statistician rejects the null hypothesis when the null hypothesis is, in fact, true.

effective as running or more so in Model (3) and Model (4). Due to this possibility, it is important to address sports individually going forward. In doing so, Table (5) shows that eleven out of the sixteen sports[5] included in the variable "total sports" bear no statistically significant relationship to normal BMI outcomes. This does not necessarily indicate that these sports are unrelated to weight outcomes, but it prevents this paper from drawing conclusions about them with regard to normal BMI outcomes. In accordance with these findings, Model (4) and Model (5) include only equestrian sports, volleyball, basketball, snow sports, and water sports as sport variables.

Initially, the estimation of Model (4) indicates that running remains as the greatest exercise activity in terms of probability added per minute that an individual has a normal BMI. The coefficient of running is nearly 142% of basketball's coefficient, the sport with the next greatest coefficient. This would indicate that reporting an hour of running time results in a 12.42% increase in probability that an individual will fall under a normal weight category, compared to 8.76% added for one hour of basketball. The gap is even wider for other sports, with 5.82% probability added for one hour of volleyball, 7.92% probability added for one hour of equestrian sports, 6.48% probability added for one hour of snow sports, and 2.1% probability added for one hour of water sports. **However, performing an F-Test on running and basketball reveals that rejecting the null hypothesis that "basketball = running" comes with a 29.2% probability of a Type I error**. The same holds true for equestrian sports, with a 31.8% probability of a Type I error. Volleyball, snow sports, and water sports have a probability of Type I error of 6% or less when concluding that they are statistically different from running. The solo exercises with smaller coefficients than running—yoga, hiking, and walking—come with a 9.18% increase, 5.28% increase, and 2.26%

[5] This may indicate that more data is needed regarding weight outcomes and sport participation. For instance, soccer is one of the sports that did not bear a statistically significant relationship to normal BMI outcomes in this data set. Soccer primarily consists of running, so it hardly makes sense for running to bear a strong relationship to normal BMI outcomes while soccer does not. Perhaps exercise frequency and frequency of fast food consumption are insufficient as variables to control for the overall health habits of individuals in this data set.

increase (respectively) in probability that an individual will fall under a normal weight category for one hour of reported participation.

Finally, when looking at the interaction model, one finds that virtually none of the solo exercises has a statistically significant coefficient on the respective interaction term with sport participation. This could indicate that sport participation and solo exercise are linear substitutes. In other words, some fixed amount of sport participation will always be commensurable to one unit of solo exercise in terms of the probability that an individual will fall under a normal weight category. Table (6) includes the output for all of these regressions. This is not pivotal to the paper as a whole, so the conclusion will focus more on the previous findings.

Conclusion:

So, is participation in solo-exercise more likely to correspond to a normal weight (in terms of BMI) than participation in group exercise/team sport? In short, the answer and reasons for the answer depend on the interpretation of the question. If one takes solo exercise and sport to be general categories and takes participation to mean any non-zero level of activity, the answer is no. Table (4) shows that one should fail to reject the null hypothesis that solo exercise is equal to sport in that respect. If one takes solo exercise and sport to be families of activities, where one should compare the most effective member of each at the per-minute level, the answer is still no. Table (6) initially points to a difference between running and basketball, the most effective members of each category. However, an F-Test of these two variables also leads one to fail to reject the null hypothesis that running equals basketball.

In summary, **one cannot conclude that solo exercise and sport (taken as wholes) are statistically different from one another with respect to normal BMI outcomes**, and **one cannot conclude that the most-efficacious solo exercise and most-efficacious sport activity**

are statistically different from one another with respect to normal BMI outcomes. Thus, if an individual is concerned with attaining a normal BMI, he or she should consider the intrinsic costs/benefits of each category (scheduling difficulty, equipment expense, social benefit, etc.) and consult Table (5) and Table (6) when looking at the activity on the individual level.

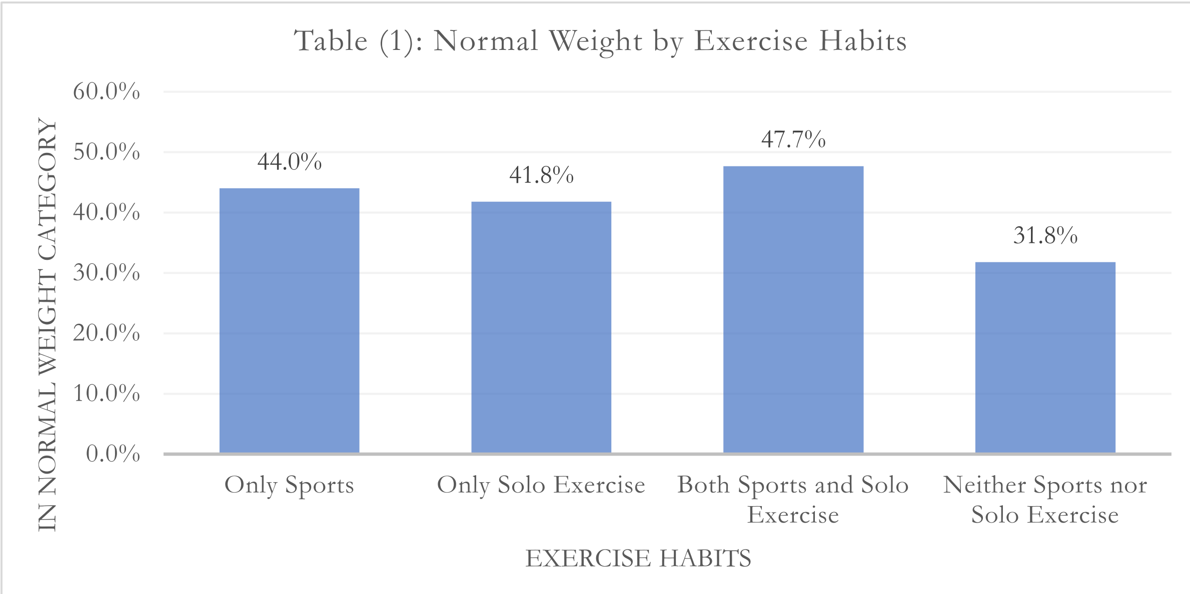

Table (2): Probability of Normal Weight by Participation in Any Amount of Exercise by Type	
	Initial Comparison
VARIABLES	Normal Weight
Only Solo Exercise	**0.0553*** **
	[0.0107]
Only Sports	**0.0775*** **
	[0.0183]
Both Solo Exercise and Sports	**0.106*** **
	[0.0378]
Frequency of Fast Food Consumption	-0.00962***
	[0.00131]
Exercise Frequency	0.0130***
	[0.00108]
Constant	0.479***
	[0.0134]
Controls for Individual Characteristics	Yes
Observations	19,769
R-squared	0.059
Standard errors in brackets	(Participation in neither solo exercise nor sport is the omitted category.)
*** p<0.01, ** p<0.05, * p<0.1	

Table (3): F-Test	Prob > F
Only Solo Exercise = Only Sports	0.2746
Only Solo Exercise = Both Solo Exercise and Sports	0.1924
Only Sports = Both Solo Exercise and Sports	0.4952

Table (4): Solo Exercise and Total Sports Taken Individually	
	Model (3)
VARIABLES	Normal Weight
Running	0.00207***
	[0.000428]
Walking	0.000385**
	[0.000189]
Hiking	0.000882***
	[0.000280]
Using Cardio Equipment	0.000269
	[0.000585]
Yoga	0.00153***
	[0.000539]
Weightlifting	8.72e-05
	[0.000433]
Biking	0.000297
	[0.000330]
Rollerblading	0.000547
	[0.00121]
Equestrian Sports	0.00133**
	[0.000616]
Martial Arts	-0.000527
	[0.00173]
Snow Sports	0.00109*
	[0.000642]
Water Sports	0.000343*
	[0.000190]
Baseball	0.000674
	[0.000743]
Golfing	5.74e-05
	[0.000185]
Gymnastics	0.00361
	[0.00305]
Hockey	0.000305
	[0.00168]
Racquet Sports	0.000289
	[0.000604]
Soccer	0.000540
	[0.000638]
Softball	-0.000194
	[0.00127]
Volleyball	0.000941**
	[0.000409]
Wrestling	-0.00104
	[0.00211]
General Sports	0.000170
	[0.000325]
Basketball	0.00146***
	[0.000400]
Football	-0.000224
	[0.000863]
Frequency of Fast Food Consumption	-0.00958***
	[0.00131]
Exercise Frequency	0.0135***
	[0.00107]
Constant	0.476***
	[0.0135]
Controls for Individual Characteristics	Yes
Observations	19,769
R-squared	0.061
Standard errors in brackets	Statistically-insignificant
*** p<0.01, ** p<0.05, * p<0.1	variables in Red

Table (5): Linear Probability of Being in a Healthy Weight Category				
	Model (1)	Model (2)	Model (4)	Model (5)
VARIABLES	Normal Weight	Normal Weight	Normal Weight	Normal Weight
Running	0.00205***	0.00183***	0.00207***	0.00185***
	[0.000427]	[0.000423]	[0.000427]	[0.000423]
Yoga			0.00153***	0.00180***
			[0.000539]	[0.000609]
Hiking			0.000880***	0.000800***
			[0.000279]	[0.000287]
Walking	0.000363*	0.000331*	0.000376**	0.000341*
	[0.000189]	[0.000183]	[0.000189]	[0.000182]
Equestrian Sports			0.00132**	0.00118*
			[0.000616]	[0.000620]
Volleyball			0.000970**	0.00335**
			[0.000404]	[0.00146]
Basketball			0.00146***	0.00135***
			[0.000400]	[0.000406]
Snowsports			0.00108*	0.00101
			[0.000642]	[0.000685]
Watersports			0.000351*	0.000312*
			[0.000189]	[0.000180]
Total Sports	0.000384***	0.000359***		
	[0.000101]	[9.84e-05]		
Frequency of Fast Food Consumption	-0.00979***	-0.0101***	-0.00960***	-0.00991***
	[0.00131]	[0.00137]	[0.00131]	[0.00137]
Exercise Frequency	0.0140***	0.0141***	0.0137***	0.0137***
	[0.00106]	[0.00109]	[0.00106]	[0.00109]
Constant	0.479***		0.477***	
	[0.0134]		[0.0134]	
Controls for Individual Characteristics	Yes	Yes	Yes	Yes
Observations	19,769	19,769	19,769	19,769
R-squared	0.059		0.061	
Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1	Model (2) is a logit model of Model (1) for robustness. Model (4) is a logit model of Model (3) for robustness.			

Table (6): Interaction Between Sport Participation and Solo Exercise

	Model (6.1)	Model (6.2)	Model (6.3)	Model (6.4)	Model (6.5)	Model (6.6)
VARIABLES	Normal Weight	Normal Weight	Normal Weight	Normal Weight	Normal Weight	Normal Weight
Any Sports Participation	0.0745***	0.0773***	0.0762***	0.0705***	0.0732***	0.0729***
	[0.0175]	[0.0168]	[0.0169]	[0.0170]	[0.0166]	[0.0167]
Total Solo Exercise	0.000616***					
	[0.000128]					
(Total Solo Exercise * Sports)	-0.000186					
	[0.000425]					
Running		0.00225***				
		[0.000446]				
(Running * Sports)		-0.00264*				
		[0.00153]				
Weightlifting			0.000237			
			[0.000451]			
(Weightlifting * Sports)			-0.00137			
			[0.00148]			
Walking				0.000295		
				[0.000195]		
(Walking * Sports)				0.000638		
				[0.000761]		
Yoga					0.00146***	
					[0.000554]	
(Yoga * Sports)					0.000727	
					[0.00246]	
Hiking						0.000894***
						[0.000312]
(Hiking * Sports)						-0.000359
						[0.000704]
Frequency of Fast Food Consumption	-0.00965***	-0.00985***	-0.00987***	-0.00985***	-0.00984***	-0.00983***
	[0.00131]	[0.00131]	[0.00131]	[0.00131]	[0.00131]	[0.00131]
Exercise Frequency	0.0134***	0.0141***	0.0145***	0.0142***	0.0143***	0.0144***
	[0.00107]	[0.00105]	[0.00105]	[0.00106]	[0.00105]	[0.00105]
Constant	0.479***	0.477***	0.480***	0.480***	0.480***	0.480***
	[0.0134]	[0.0134]	[0.0134]	[0.0134]	[0.0134]	[0.0134]
Controls for Individual Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Observations	19,769	19,769	19,769	19,769	19,769	19,769
R-squared	0.059	0.059	0.058	0.058	0.058	0.059
Standard errors in brackets				"Sports" is a dummy variable representing any non-zero level of sport participation.		
*** p<0.01, ** p<0.05, * p<0.1						

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