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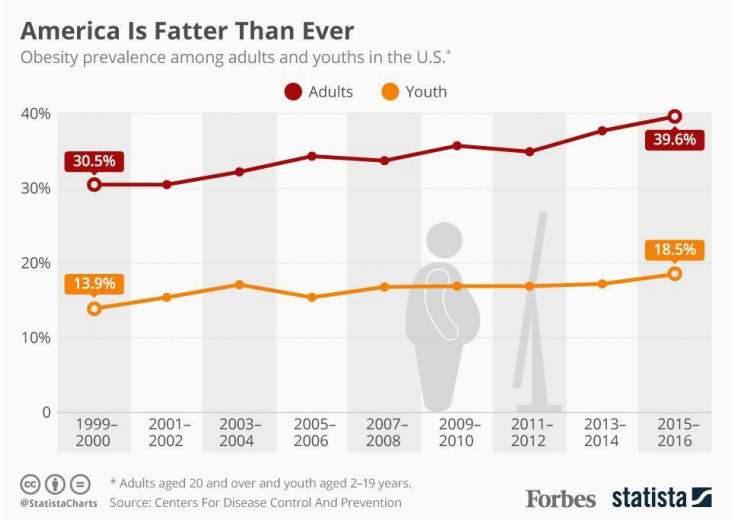
An Economic Study on Diet in Low-Income Communities

The rate of obesity in America is at an all-time high, reaching a staggering 39.6% among adults and 18.5% among youth in 2015-2016[1]. Furthermore, over 70% of Americans are classified as either overweight or obese[2]. This statistic is not only troubling because it consumes over half of the American population, but also because the number seems to be growing.

Figure 1



The infographic in Figure 1 depicts the increasing trend of obesity in the United States. From 1999 to 2016, the rate of obesity among adults and youths in the United States has grown 9.1% and 4.6%, respectively. Much of the obesity that exists in the United States is prevalent in low-income areas due to the scarcity as well as the high cost of healthy, organic foods. Though

[1] McCarthy, N. *U.S. obesity rates have hit an all-time high [infographic]*. (2017).
[2] Ibid.

consuming large amounts of fats and sugary foods is viewed as a poor, unhealthy decision, it has proven to be quite the opposite when analyzed through an economic scope. This study will evaluate the relationship between energy density and diet choice as well as the optimization of the diet of low-income families.

Firstly, it is crucial to examine the existing conditions of low-income communities. It is more than likely that extremely poor neighborhoods are classified as food deserts, which according to the United States Department of Agriculture (USDA) are "urban neighborhoods and rural towns without ready access to fresh, healthy, and affordable food." Rather than grocery stores such as Acme and Shoprite, these communities are typically only able to purchase food through convenience stores and fast food restaurants. Upon entering these convenience stores, consumers are met with a wide array of candy, chocolate, soda, and chips. On the contrary, there are hardly any yogurts, granola bars, or organic snacks. It is also important to note that many convenience stores and fast food restaurants accept EBT food stamps[3]. With the USDA's Supplemental Nutrition Assistance Program (SNAP), "soft drinks, candy, cookies, snack crackers, and ice cream are food items and are therefore eligible items" to purchase with food stamps[4]. Thus, it is no coincidence that low-income communities tend to make what most would consider "poor" dietary decisions compared to those living in wealthy communities.

Research from The National Institute of Health suggests that the growing rate of obesity in the United States may be due to the profuse array of inexpensive calorie-dense foods such as chips and cereals[5]. Just as taste and convenience factor into one's dietary decisions, cost plays a

[3] Terrero, N. (2011). Fast food chains getting Into the Food Stamp Act.
[4] Supplemental Nutrition Assistance Program (SNAP). (2017).
[5] Drewnowski, A., Darmon, N. (2005). Food Choices and Diet Costs: an Economic Analysis, *The Journal of Nutrition*. 135 (4). 900–904. https://doi.org/10.1093/jn/135.4.900

major role in what food one chooses to consume. This is especially true for low-income families, where taste and cost are the most important factors of food purchases[6]. On the other hand, wealthier households tend to factor in convenience, health, and variety in addition to taste and cost[7]. Because inexpensive snack foods are energy-dense and typically tasty, the marginal benefits are high, while the marginal cost is extremely low. The Centers for Disease Control and Prevention (CDC) defines energy-density as "the amount of energy or calories" in a gram of food [8]. Furthermore, when Calories are consumed in large amounts, they eventually become stored as fat[9]. Despite its unhealthiness, a cheap, energy-dense diet is optimal for low-income households. This idea is directly proportional with the growing rate of obesity in the United States.

Creating a well-balanced, inexpensive diet plan has been a prevalent issue for centuries. In fact, the relationship between the cost of foods and the dietary energy that they supply has been studied since nutrition research started to become a topic of study in the United States. Wilbur Olin Atwater—an American chemist who is often credited with being the founder of USDA nutrition research—delved into the cost of protein in different foods. By studying the 1887 prices of food and their protein content, Atwater found a negative relationship between energy density (MJ/kg) and energy cost (cents/10 MJ)[10]. That is, foods such as wheat flour, dried beans, white bread, and cheese were more energy-dense and cheaper than foods such as oranges and oysters.

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[6] Drewnowski, A., Darmon, N. (2005). Food Choices and Diet Costs: an Economic Analysis, *The Journal of Nutrition*. 135 (4). 900–904. https://doi.org/10.1093/jn/135.4.900
[7] Ibid.
[8] The Editors of The Center for Disease Control and Prevention. (n.d.). Low-energy-dense foods and weight management: Cutting calories while controlling hunger.
[9] Kannall, E. (2018). How does your body store excess Calories?
[10] Drewnowski, A., Darmon, N. (2005). Food Choices and Diet Costs: an Economic Analysis, *The Journal of Nutrition*. 135 (4). 900–904. https://doi.org/10.1093/jn/135.4.900

Figure 2

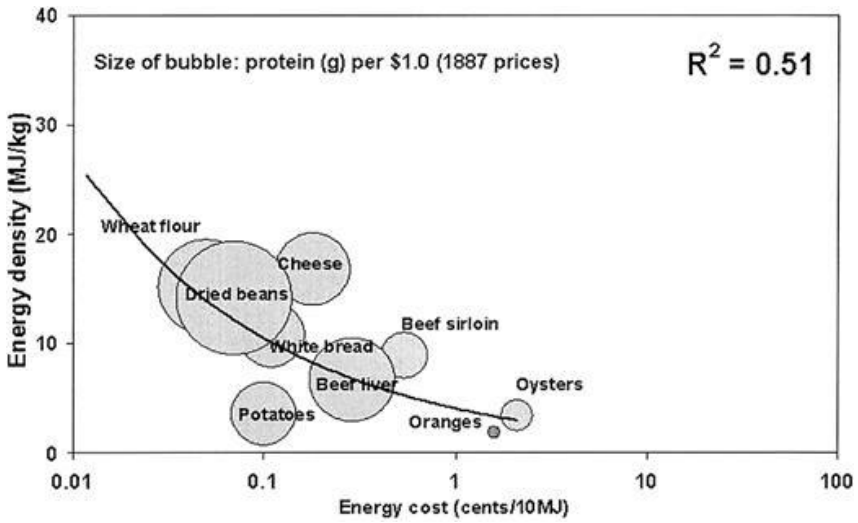

Figure 2 depicts the results of W.O. Atwater's study. The size of each bubble corresponds to the amount of protein (g) that one could consume for $1.00 in 1887. The higher the food is along the placement of the line, the more dense in energy it is. In a similar sense, foods further to the right signify a higher cost. Interestingly, more expensive foods provide the least energy density and protein, whereas inexpensive foods that are typically available in bulk such as dried beans and wheat flour provide the most energy density and protein. These statistics are relatively consistent with today's food options.

George Stigler—an American economist—also developed an attempt to create an optimal diet plan in 1945. He created this plan through linear programming—a mathematical method of calculating the optimal results in a given situation that contains constraints[11]. Though Stigler was able to generate a diet plan that aligned with daily nutritional requirements, it greatly lacked variety. In fact, the only foods that were included in the plan were wheat flour, dried navy beans,

[11] The Editors of Encyclopaedia Britannica. (2017). Linear programming.

evaporated milk, cabbage, and spinach. Despite being affordable and nutritious, it was neither appetizing nor diverse.

In more recent years, the USDA created the Thrifty Food Plan (TFP), which is an optimal diet that meets the Recommended Dietary Allowances (RDAs) and the Pyramid Guidelines. Taking monthly CPI into account, the plan is conscious of price, costing only $107 per week for a family of four. In other words, the plan aims to cost only $3.80 each day to feed one individual. However, the TFP presents several issues, the primary issue being that it lacks variety and does not follow usual eating patterns. Because the TFP suggests inexpensive foods, energy stems mainly from "oil, shortening and mayonnaise, sugar, white bread, potatoes, and beans" (Drewnowski and Darmon). The inclusion of fresh fruits and vegetables is extremely limited and does not provide much nutritional benefit.

Figure 3

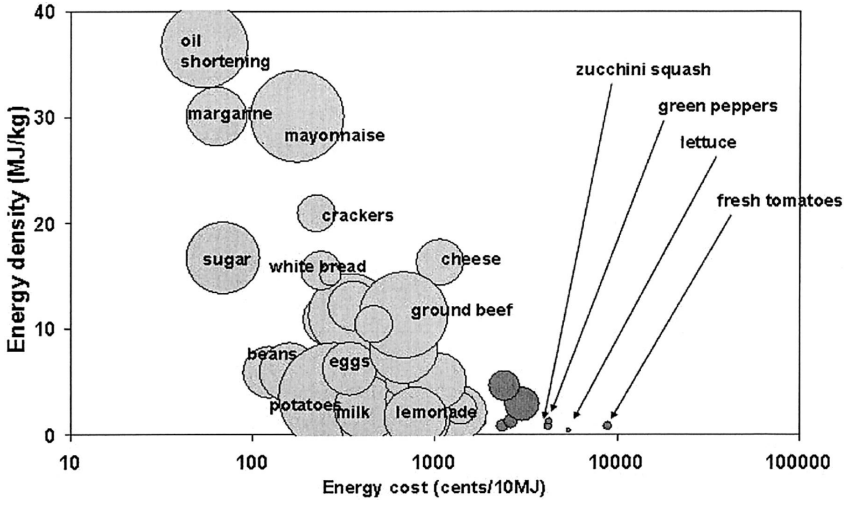

Figure 3 depicts the relationship between energy density and energy cost for foods included in the Thrifty Food Plan. Similar to Figure 2, the larger the bubble, the higher the

weekly energy content for a family of four. Thus, it is observable that oil shortening and mayonnaise are extremely inexpensive and dense in energy, whereas zucchini, squash, green peppers, lettuce, and fresh tomatoes are more costly and have a lower energy content. This directly coincides with the idea that choosing relatively unhealthy options often maximizes benefits due to their high energy density and low cost.

Furthermore, French datasets studied by Adam Drewnowski and Nicole Darmon—leading nutrition researchers—confirm that attempting to optimize one's diet while keeping costs relatively low ultimately results in diets high in added sugars and fat as opposed to diets containing meats, fish, cheeses, fruits, and vegetables. These optimal diets mirror those of low-income families. This raises a particularly interesting question: Why are low-income families and individuals often shamed for their dietary decisions despite unhealthier, energy-dense foods being the optimal choice?

Throughout recent years, there has been an observable trend toward inexpensive diets in the United States. Between 1985 and 2000, the average energy intake of Americans increased by 300 Calories, with refined grains comprising 40% of this intake, 24% added fats, and 23% added sugars. It is believed that this Calorie increase is due to the growing rate of food consumption at outside establishments rather than at home. In fact, the rate of spending money on foods from outside sources grew from 25% to 40% between the years 1970 and 1995. This is primarily due to the convenience and low cost of eating at fast food restaurants and purchasing snacks at corner stores. Furthermore, added sugars and fats comprise approximately 40% of daily energy intakes. This is yet another leading factor in Americans' inexpensive diets.

While the consumption of added sugars and fats rose significantly in the average American diet, the consumption of expensive fruits rose by only 0.3 servings since the 1970s. In 2000, the food supply in the United States allowed for a daily intake of 1.4 servings of fruit and fruit juices and 3.8 servings of both fresh and processed vegetables per person. Undoubtedly, inexpensive foods continued to dominate American food consumption. “Half of total fruit servings in 2000 were accounted for by only 6 items: orange juice (17%), bananas (9%), apple juice (8%), fresh apples (7%), fresh grapes (5%), and watermelon (4%). Low-cost potatoes (fresh, frozen, and potato chips), canned tomatoes, and iceberg lettuce accounted for 48% of total vegetable servings” (Drewnowski and Darmon).

When analyzing food consumption through an economic standpoint, it is important to take the two constraints into concern. Firstly, there exists a need to fulfill the daily energy intake of 2,000-2,500 Calories. The second constraint is price; the individual must purchase food within their budget. Taking these constraints into account, individuals’ food choices attempt to “maximize...direct benefits” of the given food (Drewnowski and Darmon). Food consumption is constant “as long as the marginal benefit of the next unit consumed is equal to or greater than its marginal cost” (Drewnowski and Darmon). The marginal benefit of food consumption may be decreased hunger or simply pure enjoyment, whereas the elements of marginal cost are the price of food as well as the negative effects of the consumption of an additional unit.

Because energy-dense foods are typically tasty, one can assume that the marginal benefit of consuming foods rich in added sugars and fats is high. This is because the individual is satisfying their hunger while also enjoying the taste of the food. For example, a 3.5-ounce bag of Flamin’ Hot Cheetos has approximately 595 Calories, whereas a 3.5-ounce serving of broccoli

contains only 35 Calories. Thus, one who consumes a bag of Cheetos satisfies their hunger more than one who chooses the broccoli. Furthermore, the cost of consuming Cheetos is significantly cheaper than consuming broccoli in relation to Calorie intake. For instance, one 3.5-ounce bag of Cheetos at Walmart costs $1.06, whereas broccoli costs $1.88 per pound. If one wanted to consume the same calorie intake as one bag of Cheetos, he or she would have to consume 59.5 ounces of broccoli, or approximately 3.72 pounds. Therefore, one would have to spend $6.99 on broccoli if he or she wanted to consume 595 Calories—the same amount of Calories in a 3.5-ounce bag of Cheetos that costs $1.06. It is also likely that the individual enjoys the taste of the cheesy snack more than he or she would of the broccoli. The idea that these foods satisfy a higher portion of the required daily Calorie-intake at a relatively low cost suggest that the marginal cost is extremely low. Thus, choosing foods that provide a higher marginal benefit and lower marginal cost yield optimal results.

This study proves that choosing palatable foods that have a higher energy density and lower cost creates optimal results. Though from a nutritional standpoint these dietary decisions may not be advantageous, they certainly are from an economic standpoint. One common mistake that individuals often make when studying diet trends and obesity is considering eating unhealthy as one simple decision rather than a complex decision-making process containing many elements. When analyzing dietary decision-making, it is crucial that one factors in marginal benefit and marginal cost. Despite our existing knowledge on its dangers, obesity remains one of the largest unsolved issues in the United States today. However, we cannot place the individual entirely at fault. More than often, those who make unhealthy decisions are optimizing, whether they are conscious of it or not.

Despite efforts to minimize obesity through nutrition education, obesity will remain a prevalent issue in the United States until prices of healthy food significantly drop to match the price as well as the convenience of unhealthy foods. One possible solution to this epidemic is an increase in nutritional education. The teaching of conscious healthy diet choices should begin in elementary schools. More importantly, these concepts should be applied and practiced in schools through providing nutritious lunch options and keeping students engaged in their health with classroom gardens. Through persistent efforts by both large-scale government policies as well as individuals, there is hope that America's obesity epidemic will one day dissipate entirely.

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