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MAJOR FOOD COMPANIES AND THE "ENERGY BALANCE" NARRATIVE: IMPLICATIONS FOR FAIRNESS AND RESPONSIBILITY

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Abstract

Energy balance, a fundamental concept rooted in thermodynamics, hinges on the equilibrium between energy intake and energy expenditure within an organism. This equilibrium, or lack thereof, plays a pivotal role in weight management. A positive energy balance occurs when energy intake surpasses expenditure, leading to weight gain, while a negative balance results from higher energy expenditure than intake, causing weight loss. This balance, commonly known as "calories in and calories out," has garnered attention from major food corporations that attempt to divert the focus away from the health implications of their products, including sugar-sweetened beverages and ultra-processed foods. Despite their nutritional deficiencies, these products are marketed to often uninformed consumers. This paper explores the critical concept of energy balance and its impact on body mass and weight management.

Keywords: Energy balance, thermodynamics, weight management, calories, nutritional value

Introduction

Energy balance is a concept based on the thermodynamic principle that energy can only be gained, lost, or stored by an organism. Energy balance is defined as the state achieved when the energy intake equals energy expenditure (Hill et al. 2013). Simply, energy balance is the body's ability to maintain homeostasis through a constant state of regulation as the energy intake and energy expenditure must remain in a stable equilibrium.

Energy balance can be further explained in two ways. First, a positive energy balance exists when energy intake exceeds energy expenditure. Second, a negative energy balance exists when energy expenditure exceeds energy intake. Positive energy balance results in weight gain whereas negative energy balance results in loss of body mass. Most of us likely understand this concept as "calories in and calories out." The concept of energy balance has been endorsed and promoted by large, multinational food corporations such as Coca-Cola, PepsiCo, General Mills, and more, in an effort to divert attention away from the harmful nature of their products. Both sugar sweetened beverages (SSBs) and "pseudofoods" such as ultra-processed food products that are high in salt, sugar, and fat, are produced, marketed, and sold to at least partially uniformed consumers in spite of the fact that they have no or nearly no nutritional value (Ross 2013).

A focus on energy balance helps divert attention from the unhealthy foods produced, marketed, and sold to us by large multinational food companies. Kimura (2019: 63) gives us an example with the soda industry who "funded

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research to respected scientists whose research tended to emphasize the importance of exercise as opposed to eating less and drinking less of their products." When it comes to Coke, Ross (2013: 111) notes that the company promotes "the efficient use of energy" and a program it calls "active healthy living" as means to shift focus from the unhealthy nature of its products. Lest you think Coca-Cola is a moral company with the welfare of its consumers at the top of its priorities, recall that the company is a profit-seeking, amoral company (like virtually any other large business) (Author 2008), and it uses its "Coca-Cola Retailing Research Council" to "plumb() the social science of shopping to identify the ways in which both teens and adults can be made more vulnerable to persuasion" so they will purchase their least healthy products—high calorie, high sugar sodas (Ross 2013: 112).

According to Nestle (2018: 91), Coke got heavily involved in health research starting in 2004 when it established the "Beverage Institute for Health and Wellness" to raise awareness of "active, healthy lifestyles" and of "beverages as effective delivery systems for hydration." An analysis of 389 articles published in 169 journals that had financial ties to Coca-Cola found that the studies "typically concluded that physical activity is more effective than diet in weight control, sugars and soft drinks are harmless, evidence to the contrary is wrong, and industryfunded research is superior to that funded by other sources" (Nestle 2018: 91). A review of the literature shows each of these claims is false (Moss 2021). Coca-Cola also helped fund the "Global Energy Balance Network" (GEBN), whose primary message is a "lack of physical activity is responsible for obesity—not diet, and certainly not soft drinks" (Nestle 2018: 92).

An examination by Nestle (2018: 98) into GEBN found that Coca-Cola was "actively involved in every aspect of the organization, from conception to recruitment of members to dissemination of research results." She writes that "Coca-Cola executives worked closely with GEBN scientists to influence the direction of the research, hide its funding sources, and promote the energy-balance strategy professionals and the media" (p. 98). Not surprisingly, its studies tended to conclude that the most important correlates of obesity in children were things such as low levels of physical activity, not getting enough sleep, and watching too much television, rather than excessive consumption of sugary sodas. Again, this is false (Moss 2021).

Meanwhile, researchers affiliated with Coca-Cola's GEBN wrote a study questioning data from the "National Health and Nutrition Examination Survey" that shows weight gain is associated with higher levels of consumption of sugary drinks. According to Neslte (2018: 179), they claimed the data were "physiologically implausible and should be ignored." Incredibly, such studies would be summarized in the mainstream news media without any reference to the fact that they were funded by Coca-Cola, often because such funding information was kept secret from the news. In this paper, the authors examine the concept of energy balance. We start out by providing necessary background information to understand the concept, and then move on to truths, untruths, and partial truths in claims made about energy balance. We conclude by analyzing different theories of justice and applying them to these claims-making activities in order to demonstrate what is fundamentally wrong with them.

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Background on Energy Balance

As noted at the outset of this paper, energy balance refers to the body's ability to maintain homeostasis through a constant state of regulation as the energy intake and energy expenditure must remain in a stable equilibrium. Regulation of daily energy expenditure starts within the central nervous system. This concept of regulation relates to basic human survival in which the body must remain in constant control of various physiologic functions including body temperature, acid-base status, electrolyte and fluid composition, and ventilatory function. These examples are established by feedback control centers within the central nervous system (Rowland 2017). The regulation of appetite and hunger are controlled by neural centers within the hypothalamus. The hunger center stimulates eating while a satiety center inhibits the hunger center. These specific neural centers work to control energy intake through the oversight of various afferent stimuli that may augment or inhibit food intake (Kang 2012: 337).

Caloric intake is governed by the desire to consume food. At first, it can be easily viewed that people make a conscious decision about how much food they consume. However, appetite is thought to be a biological function rather than a behavioral function as it is controlled by neural centers within the central nervous system. These centers operate beneath the level of conscious awareness (Rowland 2017: 83). In the brain, the hypothalamus channels complex signals that include satiety and blood sugar levels. These signals work to trigger food consumption in order to maintain the body's energy balance. One example is the peptide, Ghrelin. It is synthesized in the stomach and then acts on hypothalamic centers in the brain to stimulate appetite and modulate physical activity (Rowland 2017: 48). According to Kang (2012), the over-production of Ghrelin in the body may contribute to obesity.

To understand energy balance, we must first recognize what energy is. Traditionally, energy has been viewed as the capacity to do work. This energy is transferred throughout the body as it moves from one location to another. We obtain energy from our environment in the form of food. This energy is held within molecular bonds of fat, carbohydrates, and proteins (Boone 2006: 36).

Another aspect of energy balance that we must take into consideration is a principle of thermodynamics. The body can be thought of as a metabolic machine, one that converts chemical energy (energy stored in carbohydrates and fat) to physiologic function as energy expenditure. This balance must abide by the first law of thermodynamics in which energy can be transformed from one form to another but cannot be created or destroyed. Rowland (2017) uses this principle to explain the process in which the amount of energy can be measured. To produce body movement, the body must first convert chemical energy to mechanical energy. This conversion allows actin and myosin filaments to slide in muscle cells, which results in the contraction of skeletal muscle to ultimately produce body movement. The amount of energy expended in the work accomplished by such muscular contractions is proven through the amount of heat (in joules or kilocalories) produced (Rowland 2017: 21). When

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human's intake food, they expend energy through three main contributors: (1) resting metabolic rate (RMR), (2) the thermic effect of food (TEF), and (3) physical activity. Other ways the body expends energy includes natural growth, thermoregulation, fecal fermentative gas, and the energy of urine (Rowland 2017: 81).

Hill, Wyatt, & Peters (2013) define RMR as the energy expenditure required for maintaining normal body functions and homeostasis, while TEF is the energy required to absorb, digest, and metabolize the food consumed. Energy expended through physical activity accounts for energy expended in addition to, the RMR and TEF. To further explain energy expenditure by physical activity, we can divide it into (a) voluntary activities that are purposely designed for improving health or physical fitness and (b) non-exercised activity thermogenesis (NEAT). NEAT is considered the energy expended for activities other than sleeping, eating, or physical fitness (Rowland 2017: 6)

As previously mentioned, the body expends energy partly through diet-induced thermogenesis—the thermal effect of food (TEF). TEF is defined as the significant elevation of the metabolic rate that occurs after ingestion of a meal (Kang 2012: 345). TEF is proportional to the amount of energy being consumed and is estimated to be about 10% of energy intake. TEF can be divided into two subcomponents: obligatory thermogenesis and facultative thermogenesis. Obligatory thermogenesis is the energy cost associated with digestion, absorption, and transport of nutrients, as well as the synthesis of protein, fat, and carbohydrate to be stored in the body. Facultative thermogenesis is moderated by the activation of the sympathetic nervous system, which functions to stimulate the metabolic rate (Kang 2012: 346). This classification explains the increment in thermogenesis following a meal.

TEF can vary depending upon whether protein, carbohydrates, or fat is being consumed. According to Kang (2012), the TEF that is produced by protein is about 20-30% of the energy intake, whereas the TEF for carbohydrate and fat is approximately 5-10% and 0-5%, respectively. This variation is due to the different chemical structures of the nutrients, which dictate the amount of energy that is necessary for them to be digested, absorbed, transported, and stored. Protein is costly in terms of energy, because it contains nitrogen that needs to be removed by the body. In addition, most amino-acids are absorbed by an energy-requiring process that leads to protein synthesis. In this process, energy is mainly used for synthesizing peptide bonds. The relatively large calorigenic effect of ingested protein has been used to promote a high-protein diet for weight loss (Kang 2012). In summary, protein requires more energy to process. Therefore, fewer calories will become available to the body for storage, in comparison to carbohydrate and fat.

When people eat especially more carbohydrates and fat, they tend to end up in a positive energy balance state. We can explain this through obesity. While the body must maintain a stable equilibrium, some people find it nearly impossible to avoid weight gain. This is based on the ever-increasing accessibility to cheap, hyper-palatable, and high-calorie food, paired with ease of transportation. In this environment, the level of physical activity declines and energy intake increases.

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The maintenance of body weight and energy balance can also be viewed through the set point theory. The set point theory is the body's ability to balance energy intake and expenditure at a specific level. According to the set point theory, there is a regulation system naturally occurring in the body. Every person has a set point that dictates how much fat one should carry. The set point for body fat levels is determined by genetics. These percentages are matters of internal controls that are set differently in each individual. Some people may naturally have a high setting while others possess a low setting. One thing to take into consideration about this theory, is that the set point in every individual does not always remain constant. The individual set point can be "manipulated by physiological, psychological, and environmental factors, sometimes resulting in increased body weight over time" (Kang 2012: 337).

Truths about Energy Balance

There is some truth to the energy balance model. Unsurprisingly, the energy balance model has been legitimized by much of medical science, and even the World Health Organization (WHO) claims that the cause of obesity "is an energy imbalance between calories consumed and calories expended" (Taubes 2021). Further, the US government itself, through its Dietary Guidelines for Americans, has long promoted energy balance as a potential solution to weight gain and obesity.

Specifically, since at least the 2005 Dietary Guidelines, the federal government has promoted energy balance as part of its extensive advice about proper eating behaviors. It should be noted, however, that the great bulk of the guidelines deal with food and proper eating behavior, rather than exercise or energy balance. So, it is true that exercise or physical movement matters when it comes to weight management and/or weight loss, as well as some illnesses such as obesity, diabetes, and hypertension.

Studies also generally show that exercise reduces risks of many illnesses, including those related to weight (Anderson & Durstine 2019). For example, Warburton, Nicol, and Bredin, (2006) state: "We confirm that there is irrefutable evidence of the effectiveness of regular physical activity in the primary and secondary prevention of several chronic diseases (e.g., cardiovascular disease, diabetes, cancer, hypertension, obesity, depression and osteoporosis) and premature death. Indeed, studies find evidence that exercise may help prevent as many as 35 chronic conditions; these include accelerated biological aging/premature death, low cardiorespiratory fitness (VO2max), sarcopenia, metabolic syndrome, obesity, insulin resistance, prediabetes, type 2 diabetes, non-alcoholic fatty liver disease, coronary heart disease, peripheral artery disease, hypertension, stroke, congestive heart failure, endothelial dysfunction, arterial dyslipidemia, hemostasis, deep vein thrombosis, cognitive dysfunction, depression and anxiety, osteoporosis, osteoarthritis, balance, bone fracture/falls, rheumatoid arthritis, colon cancer, breast cancer, endometrial cancer, gestational diabetes, preeclampsia, polycystic ovary syndrome, erectile dysfunction, pain, diverticulitis, constipation, and gallbladder diseases (Booth, Roberts, & Laye 2012).

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In spite of the truth that exercise matters when it comes to issues such as obesity, it is also true that diet (i.e., what people eat) and nutrition (i.e., proper eating) also matter. That major food companies ignore this issue may not be surprising, but it is still not just, as we will discuss later in the paper.

Untruths and Partial Truths about Energy Balance

Serious scholars have come to doubt the theory of energy balance and even criticize it due to major problems and "serious inconsistencies" (Arencibia-Abite 2020). Sharma (2014), for example, calls it the "Folk Theory of Obesity" and writes: "The notion is fundamentally flawed, for one simple reason: it assumes that weight is the 'dependent' variable in the [energy-in, energy out] equation." Instead, Sharma demonstrates, "it is as much (if not more) body weight itself that determines energy intake and output as vice versa." Specifically, heavier people tend to eat more "because they have a stronger drive to eat and/or need more calories to function." Eating more also seems to increase desire to eat, leading to further eating (Moss 2021). Taubes (2021) agrees, showing that being overweight often produces overeating rather than the other way around. So, one problem with energy balance is that body weight might be the independent variable.

A second problem with the energy balance model is described by Taubes (2021); he calls the energy balance model "fatally, tragically flawed" and states instead that the real problem is a physiological one in the body, or "a hormonal or constitutional disorder, a dysregulation of fat storage and metabolism, a disorder of fuelpartitioning." Sharma (2014) agrees, showing that various physiological processes occurring in the body help determine weight gain, "including leptin resistance, impaired secretion of incretins … insulin resistance, alterations in the hypothalamic-pituitary-adrenal (HPA axis), and sympathetic activity." Thus, problems of weight seem to stem at least in part from biological problems within individuals.

In essence, some people, by nature of their genetic make-up, are predisposed to gain and keep on weight. Kang (2012) shares recent studies that have identified several obesity genes. These genes may explain why some individuals have an unhealthy set point, as explained earlier. Individuals with a genetic susceptibility to obesity may be predisposed to abnormalities in neural function. In essence, obesity genes influence appetite to increase energy intake or affect metabolism to decrease energy expenditure.

One example is a gene that leads to leptin production, a hormone that signals the body to stop eating. While genetics have not significantly changed since the 1980s—when obesity began rising in the US and around the world—what did change was the food environment. Specifically, a huge variety of highly processed, carbbased snack foods flooded the market (and continue to flood it every year with thousands of new products), providing the types of calories required to gain and keep on weight. So, whereas Taubes describes obesity as a physiological disorder rather than a behavioral disorder—a "disorder of fat accumulation"—the problem behaviors (or culpability) lie with the producers of the foods more so than those who eat them.

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Moss (2021: 201) notes: "We all have a set of genes whose job it is to let us store energy. In evolutionary theory, these genes gained a foothold in our DNA by helping us get through drought and famine. They enabled us to store the food we could get in the good times as body fat, so we could burn that fat for energy in the bad. But the efficiency with which these genes worked is subject to changes in the food environment."

In the current food environment, with wide access to unhealthy, ultra-processed foods, these genes work against us and make us pack on fat, leading to large increases in obesity in the population. Moss explains, writing that we inherited many things from our earliest ancestors, among them "the dual modes of smelling, our craving for fuel, and the propensity to pack that fuel away as body fat—we will continue to go crazy for their products because they are loaded with the things that tap into our deepest biology of desire: salt, sugar, fat, and calories" (p. 204). only one entity is responsible for this—the corporate food manufacturers.

A third major problem with the energy balance model is that it treats all calories the same, when evidence suggests they are not. For example, Mouleson (2021) shows that eating too many carbohydrates can lead to insulin resistance, resulting in excess fat storage in the cells, and ultimately, weight gain. He writes: "Insulin tells your body to convert excess incoming carbohydrates to fat and store them.

Normally, your body would then use that body fat to supply your energy needs throughout the day. But when you become insulin resistance, your body is producing even more insulin than normal." When there is too much insulin in the blood, "it doesn't allow your body to access its stored fat. You can't burn body fat while too much insulin is present" so "you get stuck storing fat while having no access to it." This suggests that it is not just how much you eat those matters (i.e., energy in), but also what you eat those matters. Keep in mind that it is large multi-national food companies that produce, market, and sell a wide variety of high carb foods, raising the issue of culpability for issues of weight gain and the diet-related health conditions of obesity and diabetes. In fact, the snack market itself is a major contributor to this reality (Moss 2021).

Taubes (2021) agrees, showing one of the main problems in weight gain is carbohydrates, both in quantity and quality, that "establish a hormonal milieu that fosters the accumulation of excess fat." He writes: "Diets that can successfully resolve obesity are not those that induce us to eat less, per energy-balance thinking, but those that reduce circulating levels of insulin, accomplished most effectively by replacing dietary carbohydrates—sugars, starchy vegetables and grains, and the like—with fat." You never hear food companies talk about these issues, most notably because they are largely in the business of promoting and selling high-carb foods.

Arencibia-Abite & Mannine (2021) also agree with the idea that carbs are more problematic when it comes to weight gain. They point out that "macronutrient mass intake is significantly greater under the high carbohydrate (HC) diet than in the high fat (HF) diet" because HF diets generally lead to less mass intake (Arencibia-Abite 2020). Arencibia-Abite & Mannine (2021) actually posit an alternative to the energy balance model, one they refer to as the "mass balance paradigm." It holds that "body weight fluctuations are dependent on the difference

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between daily mass intake, in food and beverages, and daily mass excretion (e.g., elimination of macronutrient oxidation products) and not on energy imbalance." The excretion refers to things such as CO_2, water, minerals, urea, SO_3, fecal matter, and other waste products (Arencibia-Abite 2020). The validity of this model is beyond the scope of this paper, but the point is those authors also do not believe the energy balance model is correct.

So, it is clear that food or caloric intake matters to a large degree when it comes to weight management and/or weight loss, as well as prevention of some illnesses such as obesity, diabetes, and hypertension. Silbergeld (2016: 209) agrees, noting that: "Consuming more calories, along with lifestyle changes of reduced activity" are likely culprits when it comes to rising rates of obesity. This means that claims by food companies about the importance of movement or physical exercise in the energy balance equation are only partly true.

It is also important to note here that eating less is more effective than moving more at preventing weight gain and reducing illness (Nestle 2013). Yet, eating less is obviously bad for the food corporations, whose business is literally to sell as much food to produce as much profit as possible (Simon 2006). This may be why they try to focus exclusively on the importance of physical movement rather than consumption of the foods they produce, market, and sell.

A fourth problem with energy balance is that it posits a rational process whereby people can simply calculate calories consumed versus calories expended, when, in fact, there is little rational about eating in the first place. While cognitive decision-making stems from the prefrontal cortex at the front of the brain, the majority of decisions in daily life are made beneath the level of consciousness through deeper brain structures. One example is the amygdala, which Rowland (2017) states is the structure that directs decisions subconsciously based on past experiences and primitive emotions. This relates to energy balance as we are somewhat powerless to what we consume and how much energy we expend, especially given that nearly all eating behavior is considered automatic and driven by primitive brain structures (Moss 2021).

Add on to that the fact that eating certain cheap, hyper-palatable foods have been known to cause a spike of dopamine in the brain as they act as a reward. "Dopamine secreting neurons in the brain could conceptually alter physical activity levels either or both by (a) directly stimulating efferent motor pathways and (b) creating motivation for exercise by reinforcing physical behavior through reward (pleasure)" (Rowland 2017: 44). This raises the question of food addiction driving our food behaviors. An analysis of the literature by Robinson (2022) shows that some foods lead to addiction, according to definitions of addiction by leading addiction and drug abuse organizations.

A fifth and final problem with energy balance that tends to be ignored by its proponents is that environmental factors are highly involved in daily energy intake. Our society promotes increased food intake through ready access to food presented in supermarkets, fast-food restaurants, and all-night convenience stores (Kang 2012: 348).

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The amount and types of unhealthy food available nearly everywhere—even in places where you would not historically expect to find it, such as at the cash registers of even hardware stores—lead to consumption of enormous amounts of calories and then enormous levels of illness and death. Stated simply, we live in and/or are surrounded by "food swamps" filled with "foods" that have little to no nutritional value but that are filled with high levels of salt, sugar, and fat (Ross 2013). Paarlberg (2021: 20) notes that "the excess calories we consume are … damaging to our health. Average per capita food calorie consumption in the United States … increased 25 percent between 1970 and 2002. Physical activity levels declined at the same time, but this was not the heart of the problem." Marion Nestle agrees, writing: "Large portions are a sufficient explanation for why people are gaining weight. It's not because of lack of exercise; it's because we're eating more" (Goldberg 2018: 3).

The food companies, of course, don't recognize the food environment as a culprit in outcomes such as weight gain and obesity, since they are responsible for it. And, they see the problem differently, basically concluding that "it's time Americans got off their lazy duffs" (Simon 2006: 29). As noted by Simon (2006: 29): "Food companies, trade associations, and industry front groups love to portray lack of exercise as the 'true cause' of (and hence the solution to) the obesity epidemic." This effort both deflects blame away from the producers of problematic foods, high in fat, sugar, salt, and calories, and changes the subject from food to exercise. An example of an industry group that has embraced the concept of energy balance is the American Beverage Association (ABA). ABA blames us for being couch potatoes and has even stated "It's about the Couch, Not the Can." This was a statement by ABA in response to efforts to ban sodas in public schools! According to Simon (2006: 31), the term energy balance became "virtually ubiquitous" by 2004 within the food industry. She notes the following examples of how companies have publicly stated support for this notion:

- "We believe this [obesity] is all about energy balance" (Shelly Rosen, McDonald's).
- "Like most experts in the health field, I believe that the ultimate solution to the obesity problem is energy balance" (Susan Finn, American Council for Fitness and Nutrition). Note that the American Council for Fitness and Nutrition is actually a non-profit organization made up of 80 "food and beverage companies, trade associations and nutrition advocates to work toward comprehensive and achievable solutions to the nation's obesity epidemic," according to its website (SourceWatch 2022).
- "We believe, as do many nutrition experts, that solving the obesity problem is about maintaining a healthy lifestyle and achieving the proper energy balance" (Allison Kretser, Grocery Manufacturers Association).

Other companies, such as PepsiCo, have funded braded playgrounds for kids, demonstrating the importance of exercise while simultaneously exposing children and their parents to company logos on playground equipment. And McDonald's sent its famous clown ambassador, Ronald McDonald, to schools, in order to promote exercise (Mayer 2005), as well started an advertising campaign called "Active Achievers" to promote eating right and staying active (energy balance). McDonald's also began a school-based program delivered to 31,000 schools and

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seven million children to "motivate children to be more active in unique and fun ways during grade school physical education classes" (Simon 2006: 35). Earlier the company started a "Global Advisory Council on Balanced Lifestyles," announced a "Balanced Lifestyles Platform" (with fitness guru Bob Greene), launched a "Balanced Active Lifestyles" public awareness campaign, and even gave Ronald McDonald a makeover to make him look more fit, active, and athletic. Never do they acknowledge the unhealthy nature of nearly all of their foods.

Not to be outdone, and illustrating the close connections between government and corporate food producers, the US Department of Health and Human Services started a "Healthy Lifestyles and Disease Prevention Initiative" aimed at promoting modest daily exercise. Further, the Food and Drug Administration's "Obesity Working Group" recommended to food manufacturers that they put advice on their packaging to say "To manage your weight, balance the calories you eat with your physical activity …" (Simon 2006: 151).

Probably most significant is the US government's formal advice for nutrition, the famous Food Pyramid, was revised in 2005, to specifically visually illustrate the importance of exercise in conjunction with healthy eating. Figure 1 illustrates both the original Food Pyramid (aka MyPyramid), which was featured from 1992 to 2005, and the new Food Pyramid which appeared from 2005 through 2011 (this was subsequently replaced with MyPlate, a short-lived attempt to illustrate what one's typical meal should look like on a plate). First, note the stick figure running up stairs on the new pyramid, and second, the fact that all numbers of servings were removed.

The first shows the devotion to energy balance and the second the fact that the new pyramid was less useful in terms of offering dietary advice in terms of how much of each food grouping to eat each day.

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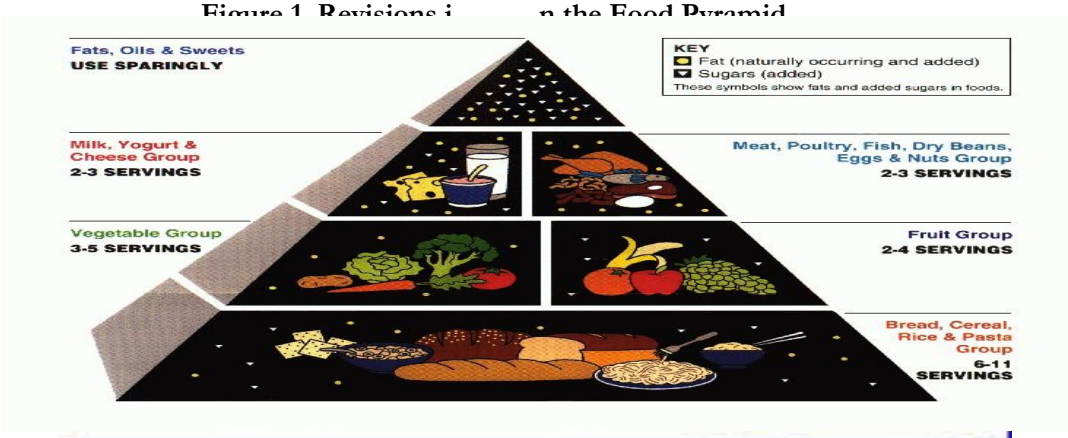
Figure 1. Revisions in the Food Pyramid



The new pyramid was produced by Porter Novelli International, whose prior clients included McDonald's and the Snack Food Association (now called SNAC International, a group that represents 400 companies around the world: "SNAC International business members include manufacturers of potato chips, tortilla chips, cereal snacks, pretzels, popcorn, cheese snacks, snack crackers, meat snacks, pork rinds, snack nuts, party mix, corn snacks, pellet snacks, fruit snacks, snack bars, granola, snack cakes, cookies and various other snacks" (Potato Pro 2022). Simon (2006: 147) claims that "MyPyramid's emphasis on activity plays right into the food industry's hands." Indeed, major food companies from cereal manufacturer (i.e., candy for breakfast) General Mills to PepsiCo to the Grocery Manufacturer's Association made public announcements of support and agreed to promote the new Food Pyramid to their customers, often on product packaging.

In short, energy balance is a tool used by major food corporations to divert attention away from their own culpability when it comes to outcomes such as obesity, diabetes, hypertension, as well as illness and death. So, Simon's (2006: 325) definition of food balance seems appropriate: "The oversimplified term that food executives use to explain obesity in a way that sounds objective and scientific, but which conveniently obscures overconsumption of their healthy products. It also has the added benefit of emphasizing weight loss and physical

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activity, keeping the focus on individual behavioral change" rather than corporate food company change. What's Justice Got to Do With It? According to Sandel (2009), there are at least three major ways of thinking about justice. One is concerned with welfare, another with freedom, and a final view, with virtue. Stated simply, welfare refers to providing a good life for people, freedom refers to protecting people's liberty, and virtue refers to morality.

The main school of thought associated with welfare or well-being is utilitarianism. It argues that what matters most for justice is the welfare of society, or its overall happiness. For example, Jeremy Bentham's (1789) utilitarianism says that whether something is just depends on whether it maximizes utility or the greatest happiness for the greatest number of people. To Bentham, it does not matter what the intent of an act is, only whether it benefits people, and especially a lot of people.

The main school of thought associated with freedom or liberty is libertarianism. For some libertarians, it is most important to protect civil rights such as the right to vote and civil liberties granted to citizens through the US Constitution (e.g., Rawls 1971). These folks may be referred to as "egalitarian libertarians." They argue that what matters most for justice is equality of opportunity in society and taking care of the least advantaged citizens (e.g., Miller 2003). For others a devotion to freedom means assuring the right of people to pursue, own, and control property with minimal governmental interference (e.g., Friedman 1962; Hayek 1960; Nozick1974). The latter camp is often referred to as "free market libertarians" because most of their arguments revolve around the idea that freedom amounts to an unregulated economic marketplace where the government allows people to freely engage in the exchange of property without undue interference.

Given that egalitarians value equality in society—including equality of all rights and liberties—their view of justice tends to be much broader than free market libertarians who focus squarely on economic issues. There is also a basic disagreement between free market libertarians and egalitarians with regard to economic issues. The former end up arguing against government interference in property exchanges even in cases where capitalism produces massive inequities between the wealthy and the poor, whereas the latter often argue for government intervention to make arrangements in society fairer for all and especially for the poor and needy. This is because the main concern of egalitarians is equality in society, and although egalitarians recognize that superior talent and effort ought to result in superior reward, they also argue that inequalities in today's society are not justifiable.

Finally, what is the role of virtue or morality for justice? Other justice theorists argue that what matters most for justice is virtue, or moral goodness and righteousness. Such approaches are often referred to as virtuebased theories. For example, Aristotle's (1280) theory suggests that justice demands giving people what they deserve or what they are due. This means honoring and rewarding those values or virtues that are worthy of honor and reward. In order to make such determinations, we must first make decisions about what is good or righteous in the first place. Kant's (1785) view is also relevant here. According to Kant, whether something is just or not

depends only whether it is the right thing to do, regardless of the consequences. That is, whether something is just is determined by motive, or whether it is morally right. Something is morally right, according to Kant, if it respects the moral law which requires us to treat each other as autonomous beings worthy of respect.

Each of these schools of thought can be applied to any policy or practice in society (Sandel 2009). They are certainly relevant in many ways when it comes to food production and food policy. In this section, we first apply these schools of thought in justice theory to the conventional food system itself. Then, we turn to the issue of what is just and unjust with regard to the issue of energy balance.

A utilitarian analysis would focus on the well-being of both consumers and producers of food in US society. While one argument might be that the conventional food system does a pretty good job of feeding most of the world—certainly a major benefit and an important component for happiness—a counter argument would be that much of the food we are eating has basically no nutritional value. Further, utilitarians would have to grapple with the enormous costs, both financial and to our health that are produced by the pseudofoods eaten by so many Americans. In this way, the logical conclusion is that, especially over time, the conventional food system is unjust from a utilitarian perspective; it simply does more harm than good over time (Robinson, 2024).

A libertarian analysis would instead focus on issues of freedom, including the right to freely produce, advertise, and sell food products, and well as the right of Americans to freely choose what to buy and eat. Most libertarians, especially free market libertarians, would reject any effort to better regular food for safety or even health, as they tend to stand behind any free exchange of property and wealth. They would also agree that it is our personal responsibility to not eat the wrong foods and to exercise more. So, libertarians would generally conclude the conventional food system is just. Yet, a counter argument is that illness and death associated with poor nutritional products produced by global food manufacturers interferes with the liberty of a large portion of Americans due to diminished health and even lifespan, and, in that way, could be seen as unjust.

Egalitarianism focuses on issues of equality and inequality and would focus on things such as who benefits and/or suffers most in the conventional food system. One example is that negative health outcomes associated with diet are most pronounced among the poor and people of color (e.g., African Americans and Latinos) (Robinson, 2024). Like so many other deleterious outcomes in society, those produced by the conventional food system are unequal, and thus egalitarians would likely uniformly conclude the conventional system is unjust. Similarly, since the benefits of the conventional food system are skewed to the largest and most profitable food companies (even to the detriment of farmers who grow our food), egalitarians would argue the system is unjust.

And, of course, the focus of those concerned with virtue would be on issues of morality. Here, people will clearly disagree on a wide variety of topics when it comes to what is moral, ethical, or virtuous within the conventional food system. Our views on this are often directly impacted by our views on liberty, happiness, and equality, three things that are generally considered American virtues. One thing that is certain is that not many people are likely

to view something as virtuous when it interferes with values and outcomes associated with freedom, happiness, and equality. So, since the conventional food system does meaningfully interfere in these things, a possible conclusion from the virtue perspective is that the conventional food system is unjust, at least in some ways. One such way is that global elites in the system profit through unethical culpable behaviors that are the focus of the "food crime" literature (Robinson, 2024; Croall, 2007; Gray & Hinch 2015). This is not virtuous and thus unjust.

Finally, using the theories of utilitarianism, libertarianism, egalitarianism, and virtue-based approaches, the general conclusion is that the promotion of energy balance by food companies is unjust. First, it does not promote overall happiness when companies tell only partial truths and untruths about what causes outcomes such as obesity. There is widespread suffering (and death) from obesity-related health conditions, and dishonesty on the part of food companies contributes to these outcomes. Specifically, obesity is associated with at least 111,909 excess deaths in the United States every year (National Center for Health Statistics, 2018). Clearly, from the review here, food plays a major role in such outcomes. So, to focus on only exercise rather than food is unjust from a utilitarian perspective.

Second, libertarians would likely object to the use of energy balance by food companies on the grounds that there is significant diminishment of liberty in the 111,909 people who die from obesity every year, plus the hundreds of thousands more who die from other diet-related conditions such as diabetes, heart disease, and cancer. Free market libertarians might defend for-profit food corporations in their energy balance advertisements and other programs like those reviewed in this paper, on the grounds of companies participating in a free market enterprise. Yet, it also needs to be pointed out that obesity alone is responsible for $173 billion in additional health care costs in the US alone (US Centers for Disease Control and Prevention, 2023). So, to the degree food companies' use of energy balance keeps people confused about how to effectively manage their weight, even free market libertarians might object to the use of energy balance claims by food companies since there is such a high economic cost associated with the deleterious outcomes of poor eating.

Third, egalitarians would find the use of energy balance by food companies unjust since the deleterious outcomes associated with poor diet and nutrition tend to fall hardest on the already disadvantaged—the poor and people of color. Making false claims about what produces obesity and related conditions assures that negative health outcomes continue to occur, as consumers are likely mislead and confused based on company claims. Whereas all consumers are at risk of health outcomes associated with poor diet and nutrition, it is the poor and people of color who are most likely to suffer from conditions such as obesity and diabetes. As one example, in high-income countries, those with higher SES are less likely to be obese and those with lower SES are more likely to be obese (PRB, 2023). As another example, rates of obesity in the United States are highest for African Americans, followed by Latinx, and then Whites (US Centers for Disease Control and Prevention, 2023). Egalitarians would object to the use of energy balance by food companies on these grounds.

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Finally, definitions of virtue are diverse. Yet, we can logically conclude that dishonesty in the pursuit of profit that leads to widespread suffering such as that cause by poor diet and nutrition is not virtuous, and thus unjust. That is, promoting falsehoods about what causes outcomes such as obesity and related conditions amounts to lying, and lying is generally viewed as immoral and thus not virtuous. Frankly, it is hard to imagine any virtue that one could use to justify what food companies are doing in the energy balance realm other than one rooted in economic gain.

Conclusion

In this paper, the authors defined energy balance and examined arguments related to it both by conventional food system actors as well as experts in exercise physiology and related fields. We find that the concept of energy balance, though rooted to a degree in sound science, is being utilized by large food corporations as a means to divert attention away from their own culpability in rising rates of obesity, diabetes, hypertension, and death in the US, as well as around the world. The paper identified truths, untruths, and partial truths in claims made by members of the conventional food system in hopes of bring some clarity to the issue of energy balance.

The authors then utilized theories of justice in order to assess claims-making when it comes to energy balance, in an attempt to establish what is just and/or unjust. From the "food crime" perspective (Robinson, 2024) and from the notion of certain foods as being addictive (Robinson, 2022), assessing the claims of global food companies about their products is akin to assessing the claims of street-level drug dealers about their products. That is, it might be unreasonable to expect honesty in the first place. We find that large actors in the conventional food system make claims about energy balance that are sometimes true, at other times, partially true, and occasionally even completely untrue.

More importantly, we find that this behavior is unjust using multiple perspectives within the realm of justice theory. Specifically, though a free-market libertarian view might hold that shifting the focus from foods toward exercise as the primary cause of obesity, diabetes, hypertension, and other health conditions is just—since it enables large food corporations to continue to sell and profit from their products—a true libertarian might object on the issue of diminished liberty of those impacted by poor health outcomes associated with the traditional American diet. Yet, other libertarians might simply hold (incorrectly) that individuals are solely responsible for the foods they put in their mouths and, thus, corporations should never be held responsible for the foods eaten by consumers, whether they tell the full truth about their products or not.

Egalitarians would find such behavior unjust since the burdens of poor nutrition tend to fall disproportionately on the poor and people of color. Specifically, rates of obesity, diabetes, hypertension, and other health conditions are higher for people in the lowest classes, as well as for African Americans and Latinos. Meanwhile, it is a matter of debate about whether utilizing the concept of energy balance is virtuous behavior, though we must be reminded that honesty is generally viewed as virtuous whereas dishonesty is not.

Finally, it is undeniably true that there are more benefits than costs associated with the conventional food system, at least from an economic perspective, at least in the short term. Nevertheless, costs of the system are enormous and potentially devastating just in terms of diminished health, premature death, and climate change alone, and they likely outweigh benefits of the system in the long run (Robinson, 2024). So, a utilitarian would likely conclude that making misleading claims about energy balance and companies diverting attention away from themselves and their harmful products by using the concept of energy balance is unjust, for the simple reason that, in the long run, the costs of doing so will greatly outweigh the benefits of doing so.

As scholars of crime and justice, the conventional food system should be of great interest to us. The concept of energy balance illustrates just one example (or many) as to why we should extend some of our focus to "food crime" (Croall 2007).

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