In the world of nutritional sciences, monitoring and manipulating calories has been the cornerstone in numerous weight-loss diets over the past several decades. Recently, there has been growing contention to this notion that weight loss efforts boils down to an equation of calories in minus calories out, as evidenced in books such as “The Calorie Myth” by Jonathan Bailor, published in 2013.

Whether or not calories impact our weight is critical information in the realm of nutrition and health. Today, Americans are becoming increasingly overweight and many are in desperate search of viable options to lose excess pounds in a quest to feel healthy and confident. Taking this into account, I sought to explore whether or not counting or limiting calories is in fact necessary in weight-loss efforts, as opposed to only manipulating macronutrient variables such as a low-fat or low-carbohydrate diet, as made by new claims. Having read “The Calorie Myth” earlier this year, I hypothesized that calories did not make as big of a difference as conventional wisdom emphasizes.

The notion that weight is an equation of calories in minus calories out has been the overall general consensus in nutrition. This is backed by the laws of thermodynamics and the implications that consuming either too few or too many calories has on weight and body composition. Alternatively, claims have been made that calories are only a small part in weight loss due to the various hormonal responses that fat, proteins, and carbohydrates elicit in our bodies. Evidence for this viewpoint lies in studies highlighting different responses to diets where the ratio of macronutrients is manipulated to evoke a change in weight or body composition. The following studies explore this controversy in nutrition. The first two studies back the notion that calories of all various macronutrient

profiles effect weight in similar manners, while the latter two find that the macronutrient composition plays an important role.

In addressing the macronutrient source and body composition, Sacks, et. al conducted a study, titled "Comparison of Weight-Loss Diets with Different Compositions of Fat, Protein, and Carbohydrates". Their motive for such a study was to investigate the differences, if any, that a macronutrient profile of a diet may have on the weight-loss efforts of an individual. They hypothesized that macronutrients may indeed have different effects when administered in varying ratios to study subjects. This randomized clinical trial lasted from October of 2004 until December of 2007. Participants were screened, with criteria including a BMI of 25 to 40, and ages 30 to 70-years old, and were divided into one of four assigned diet groups, with each individual consuming 750 less calories than their average output. The four diet were as follows: 1) Low fat (20%) and average protein (15%), 2) low fat (20%), high protein (25%), 3) high fat (40%), average protein (15%), and 4) high fat (40%), high protein (25%). The rest of the caloric sources in each diet came from carbohydrates. Each participant took part in 90 minutes of moderate exercises per week, which was self-reported.

The results of the study showed insignificant differences ($P>.20$ for all diet comparisons) in weight loss in people who consumed 25% of their daily calories from protein (4.5 kg avg. lost) versus 15% from protein (3.6kg avg. lost; $P=0.22$). The same held true for those who consumed a high fat of 40% versus a low fat diet of 20% (each 3.3kg avg. lost; $P=0.94$). The researchers also discussed the effect each of the four diets had on risk factors, adherence, and adverse effects, with no striking differences observed. Thus, Sacks, et. al concluded that the macronutrient composition of one particular diet

does not produce any more or less weight loss than other, as long as participants are held to a set caloric intake while attempting to lose weight.

This study is strengthened by its duration of time and selection and distribution of participants. A comprehensive screening was conducted prior to the beginning of the study, and there was a high retention rate and adherence to the assigned diet(s). This further bolsters the legitimacy of the study, due to the fact that it could be replicated and sustained in a real-world context. Another major strength is the analysis of four different macronutrient-comprised diets as opposed to simply a high-carbohydrate vs. high fat analysis. A greater comparison with more options to analyze leaves smaller room for debate and other alternative conclusions that can be drawn from the results.

There are a few weaknesses in the design of the study as well. It lacked a control group, and exercise and food intake was self-reported, leaving a potentially wide margin of error if participants over or under-estimated certain values. All participants were already overweight and on a calorie-restricted diet as well, so this study cannot represent the "average American".

Sacks, et. al present an incredibly strong case that varying macronutrient diets all have very similar effects on weight loss. This backs the theory that different sources of calorie-restricted diets will produce similar weight loss, regardless of the macronutrient composition of the diet. What is more, the findings can most likely be applied in a real-world setting for recommendations of weight-loss.

Bradley et al. published a study titled "Low-fat versus low-carbohydrate weight reduction diets: effects on weight loss, insulin resistance, and cardiovascular risk: a randomized control trial." in December of 2012. In this study, the researchers wanted to

compare the weight loss and insulin resistance of pre type-2 diabetics following a low-carbohydrate (20%, 60% fat) versus a low-fat (20%, 60 carbohydrate) diet protocol. They authors hypothesized that a lower-carbohydrate diet would be favorable to pre-diabetic patients with insulin resistance, and allow them to lose more weight.

The study was structured as an 8-week randomized control trial, with participants consuming a 500-calorie deficit diet each day. A pulse-wave analysis was used to measure body composition, while a euglycemic clamp measured insulin secretion of each individual. Physical activity was not prescribed, nor was it monitored. The participants consisted of twenty-seven obese but otherwise healthy men and women, ages not given.

The results of the study showed weight reduction in both dietary protocols, with the mean weight loss being very similar between the two groups ($P<.01$ within each group). No significant difference between the low-fat and low-carbohydrate groups was observed in terms of body composition, and no statistically significant difference in glucose suppression was observed ($P=0.72$). The researchers concluded that in a caloric-deficit, a low-fat and low-carbohydrate diet are equally effective in producing weight loss, with similar effects on body composition. What is more, they found no statistically significant difference in a specific diet protocol on insulin sensitivity.

The set-up of this study gives it great merit, being a randomized control design. The rigorous supervision of dietary compliance is another strength, as individuals were tested every 2-3 days for changes in weight and insulin sensitivity. The eight-week duration of the study gives it further legitimacy, as this time period cuts down on any confounding variables skewing results.

A big limitation of the study is that the findings are only relevant to obese individuals consuming a caloric deficit. The small sample size of each group is certainly a weakness, as is the fact that the low-carbohydrate diet did not induce ketosis, which could have altered the results both in terms of weight loss and insulin sensitivity of pre-diabetic participants. In addition, the researchers cite all participants as being of western-European origin, limiting the results to this ethnic group. Physical activity was not monitored as well, which could have affected the results.

Overall, this study is cited as evidence for calories being more important than macronutrients in affecting the weight and body composition of an individual. The "low carbohydrate" group still derived 20% from carbs—which is relatively high compared with other lower-carb studies. Because individuals in this group did not experience ketosis, the study cannot claim that all low-carb diets elicit the same response as low-fat diets in terms of insulin sensitivity and weight gain or loss. However, aside from this flaw the study is well-structured, and appears to serve as strong evidence in the argument that calories are important in terms of weight change and body composition.

In their examination on the source of calories and the effect on body composition, Ebbeling et al. (2012) conducted a 3-way crossover design study on sixteen overweight and obese individuals, each of whom had already completed a 10 to 15 percent weight-loss diet. The researchers were interested in measuring the effects of how different metabolic pathways influence energy expenditure, hypothesizing that a lower-carbohydrate diet could have a "metabolic advantage" due to hormonal responses elicited in the body leading to greater weight loss. Thus, this type of diet would indeed serve

people best in terms of weight loss, rather than simply limiting caloric consumption of an individual.

The three diets tested consisted of a low fat diet (60% carbohydrates, 20% fat and protein), a low-glycemic index diet (40% carbohydrates and fat, 20% protein) and a low carbohydrate diet (10% carbohydrate, 60% fat, 30% protein). The analyses ran for four years, from June 2006 until June 2010, as individuals each consumed three diets varying in macro-nutrient composition in a randomized order for four weeks and were seen and tested after each completion phase. While tracking the participants, the researchers measured resting energy expenditure (REE), total energy expenditure (TEE), hormone levels, and metabolic syndrome components. At the end of the study, Ebeling et al. found that a low-fat diet resulted in the greatest reduction in REE and TEE (-265 to -144 kcal/day, overall $P<.001$), a low-glycemic index diet showed the second-greatest reduction (-227 to -106 kcal/day, overall $P=.005$), while a low-carbohydrate showed the least reduction (-198 to -77 kcal/day, overall $P=.04$). Hormone and metabolic syndrome components also varied, but not enough to be deemed significant. Thus, the group of researchers concluded that all calories are not created equal from a metabolic standard due to the effects they elicit in individuals.

This study has several main strengths and weaknesses. One major strength is the fact that each participant in the study consumed all three diets, in a randomized order. Each diet was short enough in length that it could be closely monitored and adhered to, but long enough to extract significant results. The cross-over design is another asset to the credibility of the study, allowing for individual comparisons to be made among the

subjects studied. The mix of both men and women (ages 18 to 40) is another plus, ensuring gender does not skew results.

The study has weaknesses as well. Participants in the study had already lost weight on a diet beforehand as part of the "test phase", which could have affected their TEE and REE, which were being measured. A second major weakness is the overall length that each diet was consumed—four weeks. While differences were clearly observed in metabolic responses to each diet, it is uncertain that the results would extrapolate to long-term adherence to one of the prescribed diets. Another problem is the fact that because participants were pre-screened, they cannot fully represent the general American public as certain individuals were left out that did not meet criteria relating to BMI, body weight, or weight changes. Finally, any kind of mental component that could have influenced test results was not tracked, i.e. relative ease or difficulty following one or more of the three prescribed diets.

In analyzing the structure of the study and its results, there is evidence that varying the macronutrient source of consumed calories contributes to a change in metabolism, thus affecting the weight loss efforts of an individual. This challenges the notion that all calories are created equal in a metabolic perspective, but does not offer ample evidence is dispelling the notion that total calories consumed is an integral part of weight loss, no matter the macronutrient source.

Bray et al. published a study titled "Effect of Dietary Protein Content on Weight Gain, Energy Expenditure, and Body Composition During Overeating" in early January of 2012. The researchers sought to determine the role that that macronutrient protein has on the metabolism and weight of individuals. The motivation and underlying hypothesis

(that is not specifically stated) for conducting the study came from the long-standing concept that protein may not affect weight gain to the same degree of carbohydrates and fats.

The study was a single-blind, randomized controlled trial conducted over the span of two years, from June of 2005 to October 2007. Twenty-five US citizens' ages 18 to 35 took part, all of who had a body mass-index of 19 to 30. Each participant first consumed a "weight-stabilizing diet" for 13 to 25 days, then were assigned to one of 3 randomized diets: 1) A low-protein diet of 5% of total calories, 2) a normal-protein diet of 15% total calories, or 3) a high-protein diet of 25% total calories. Each participant stayed on their assigned diet for 10 to 12 weeks, with a 40% increased caloric total (in the form of dietary fat) for the final 8 weeks to show the effects of overfeeding. Body composition was measures via a DEXA scan, and total energy expenditure by double-labeled water both before and after the 8-week overfeeding period.

After the conclusion of the study, the researchers found the least amount of weight gain in the low protein diet group compared with the other two groups ($P<.001$) while body fat increased proportionally among each group. In terms of energy expenditure, they found it increased significantly in the normal and high protein diets as compared with the low protein protocol. Thus, the researchers concluded a lower-protein diet minimized the rate of weight gain with the same number of extra calories, while a higher protein diet increased the energy expenditure of an individual in times of overeating.

The first major strength of this study is the length in which individuals followed an assigned protocol: ten to twelve weeks. This is a long time period that can generate

significant, applicable results. The second major strength is the tools used to assess the changes in participants of the study—both a DEXA scan and double-labeled water are incredibly accurate and considered top-notch methods of analysis. Another strength is that all excess energy consumed was regulated, to minimize confounding variables.

The number of individuals that participated in this study is a weakness, as a mere twenty-five people were studied. Another major weakness is the fact that these results are only applicable to periods of over-feeding, not a normalized caloric consumption. Thus, they cannot be applied to people outside of the study who do not over-indulge every day. Additionally, no control group is used as a baseline of comparison.

This study by Gray et al. suggests that in the cases of overeating, all calories do not have the same effects on the body—in this case, protein is the manipulated macronutrient. While the study is certainly credible, the small sample size, restriction to only periods of over-eating, and lack of a control group all pose point to potential issues, and it would seem that another study of this nature would need to be conducted to back up the evidence presented.

From the interpretation of the results yielded by these four case studies, it is clear in my mind that calories do play a role in weight and body composition of an individual, as this piece of "conventional wisdom" holds true. Whether or not the variation of a macronutrient source can elicit weight and body changes holding calories constant is somewhat hazy, as two studies produced results in favor of this proposition while the other two showed a null effect. In my own interpretation of the results, I find that the limitations each study comes with--especially those with conclusions suggesting different macronutrient ratios effect weight in addition to calories--are too great to extrapolate to

make a claim for macronutrients effecting weight change in addition to calories. This conclusion differs from my initial beliefs before analyzing the four above studies. While it is clear much more research needs to be done in this realm of nutrition before concrete claims can be made, I found the studies showing calories, not macronutrients, to be the biggest factor in weight change to be most structurally-sound and complete in their findings. Thus from this analysis, calories cannot be “ignored” or forgotten when thinking about the weight of an individual, contrary to new books and articles written on the subject matter.

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