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80/20 Diet Efficacy in Regard to Physiology and Psychosocial Factors

Mercedes Hernandez*

Department of Sports and Exercise Sciences, West Texas A&M University College of Nursing and Health Sciences, USA

***Corresponding author:** Mercedes Hernandez, Department of Sports and Exercise Sciences, West Texas A&M University College of Nursing and Health Sciences, WTAMU Box 60971 Canyon, TX 79016, USA, Tel: +18065771904; E-mail: mahernandez5@buffs.wtamu.edu

Abstract

Considering the scope of diets available, research studying the efficacy of these diets is necessary. An increasingly popular form of dieting known as "flexible dieting," and the most recent dietary guidelines released in 2010, USDA MyPlate, are two dietary plans with insufficient amount of efficacy research via randomized-controlled trials. Therefore, the purpose of this research is to assess the 80/20 diet, a specific form of flexible dieting, and USDA MyPlate in hopes of adding more empirical data to these areas of nutritional studies. This mixed-methods study recruited 29 participants and measured changes in physiological and emotional elements, across a three-month timeframe. Seventeen participants were randomly assigned to the control (followed MyPlate guidelines 100% of meals), and 12 to the 80/20 group (followed MyPlate recommendations in an 80/20 fashion). Preliminary analysis revealed the control group experienced an approximate 58.8% drop-out rate (n=10), compared with the 80/20 group drop-out rate of 16.67% (n=2). Mixed-model ANOVA analysis of the remaining 17 subjects' data showed no significant relationship between intervention and changes in physiological or emotional factors for both groups. MyPlate adherence analysis showed similar results among both groups (average control adherence: 19.75 days; average 80/20 adherence: 20.64 days). The post-study questionnaire revealed that "MyPlate issues" was the number one cited aspect that participants struggled with most during the study. These results may indicate that an 80/20 diet is a reasonable dietary plan for the general public due to its flexibility; however MyPlate guidelines are difficult to abide by. This difficulty may have contributed to the low adherence rates for both groups, and consequentially, an insignificant relationship between intervention and changes in physiology and psychosocial factors.

Keywords: Obesity; Diet; Health; Psychosocial factors

Introduction

Obesity is a pressing issue that continues to evade the attention of many, despite the drastic effects it has on Americans. An estimated 34.9% of American adults are obese [1]. Obesity is a complex issue, as its growth is influenced by a wide variety of factors, making it a difficult issue to combat. Some of the challenges Americans face in dietary health include a poor understanding of health, knowing which diet to choose among the numerous existing diets, and struggling to adhere to those strict diets, as many are not easily sustainable past a few months. Many Americans are aware of the health benefits of adopting a healthier lifestyle; however the challenges lie in the pursuit of health, and how that pursuit translates for the average American.

It is hypothesized that if focus was shifted to progress, rather than perfection more Americans may be able to achieve successful weight loss and improved health [2]. Flexible dieting is gaining popularity among many people because of its lack of rigid constraints and focus on progress, rather than perfection. Unsurprisingly, flexibility has been cited several times as a vital component for dietary success [3]. Identified four successful dietary advising recommendations utilized in nutrition counselling, two of which include "flexible instead of rigid controls, and flexible and realistic targets [2]. Identified crucial characteristics that promoted healthy eating, and included in the top five parameters was "flexible restraint of eating".

Furthermore, flexible dieting's efficacy was compared; that a rigid diet to a moderation diet with five groups of individuals, all at varying stages of change (weight management, pre-surgery, post-surgery, college dieters, and college non-dieters) [4]. The results suggested a positive correlation between the moderation diet and positive outcomes, regardless of the baseline stage of change of the groups. Whereas the rigid diet only produced positive outcomes for some of the groups, suggesting efficacy for individuals only at specific stages of change. Overall, the number studies in this area are minimal, and more research is needed to assert flexible dieting as a successful dieting mechanism, which this 80/20 study seeks to ensue.

80/20 Diet and USDA MyPlate

An 80/20 diet is a specific type of flexible dieting that recommends individuals eat "healthy" 80% of total weekly meals and allows "reasonable indulgences," 20% of weekly meals. The definition of "healthy" often varies depending on individual needs, however in this study; the selected definition of a healthy meal is one that abides by USDA's MyPlate recommendations. Considering that individuals are allotted weekly "cheat meals," the flexibility as a critical component for dietary success, is integrated within the dietary plan and may better suit American lifestyles as a result [3,4].

USDA's MyPlate was chosen as the standard for a healthy meal for three main reasons. First, it represents a synthesized version of the most recent (as of May 2015). Dietary Guidelines for Americans (DGAs) published in 2010. This is essential, as many critics of the DGAs claim that the recommendations are too convoluted to be easily adapted by the general public [5]. It was noted that the increase in number of recommendations from seven to twenty-three, which does in fact seem counterproductive in making health information more

comprehensible for the general public [6]. Second, MyPlate efficacy research via randomized-controlled is minimal. This may be attributed to the fact that MyPlate's intended use is primarily as a public health campaign to raise awareness of the significance of nutritional eating. Accordingly, studies relating to MyPlate chiefly evaluate how successfully the MyPlate recommendations are communicated to the public, as exemplified by Levine. Though research appraising MyPlate efficacy is minimal, a few studies do exist in which some form of MyPlate evaluation is performed such as study of a modified version of MyPlate and study of the effects of the National Heart, Lung, and Blood Institute's (NHLBI). Dietary Approaches to Stop Hypertension (DASH) and utilized MyPlate as a control, proposed USDA MyPlate guidelines as a diet for obese adults with physical impairments [7,8]. Third, the evidence-based methodology used to construct the DGAs is often criticized by experts for "inaccurately summarizing the literature". Thus, considering the on-going debate regarding DGA/MyPlate efficacy and construction, this study may provide additional information regarding MyPlate feasibility and its efficacy as a physiologically beneficial nutritional plan.

The purpose of this research is to determine the effectiveness of an 80/20 diet (and inadvertently, USDA MyPlate) while paying special attention to physiological and psychosocial changes consequential to the intervention. It is hypothesized that an 80/20 diet will yield comparable physiological benefits (improvements to body fat percentage, blood pressure, and weight) and overall greater self-reported emotional wellness scores than a typical, restrictive diet as represented by MyPlate.

Materials and Methods

A total of 29 college students (16 females, 13 males), ages 18-24, who identified as "healthy" and reported not currently seeing a physician for a reoccurring ailment or illness, were recruited to partake in the three-month study. During recruitment, a small incentive to finish the study (finishing the study was the only stipulation and adherence to the diet was not a condition) was advertised. The incentive to finish was a chance to win a free iPad mini at the conclusion of the study via a drawing.

Group assignments

After obtaining an informed consent, subjects were randomly assigned to either the Control or the 80/20 group. Seventeen participants (9 females, 8 males) were randomly assigned to the control group, and instructed to abide by MyPlate recommendations 100% of the time for 3 months. 12 participants (7 females, 5 males) were randomly assigned to the 80/20 group, and instructed to abide by MyPlate recommendations 80% of total weekly meals, while allowing reasonable indulgences 20% of weekly meals.

MyPlate breakdown

In Table A1 a specific breakdown of the slightly modified (protein requirement increased by 0.5 Oz for calculation and measurement ease) MyPlate guidelines (based on a 2,000 calorie diet) utilized by the Control 100% of the time, and in an 80/20 fashion by the 80/20 group, can be found in Appendix A. Concerning exercise, subjects in both groups were instructed to continue their normal exercise/physical activity habits, and to not modify these habits during the three-month timeframe.

80/20 Diet breakdown

The number of healthy/cheat meals allowed in the 80/20 diet plan varied upon the number of times a subject ate per week. A typical three meals per day diet (therefore, a total consumption of 21 meals per week) had the following weekly healthy to cheat meal ratio: 17 meals (80%) to 4 meals (20%). The designation for a "meal" was anytime the participants consumed food (meal or snack), and excluded beverages, as MyPlate did not have specifications for drink requirements other than consuming beverages that are "nutrient-dense" and "lower in saturated fat, sodium, and added sugar". 80/20 dieters were instructed to not exceed one cheat meal per day. On days that 80/20 dieters chose to indulge in a cheat meal, MyPlate guidelines were modified to the values represented in Table A2 to account for the loss of one healthy meal to meet the normal daily MyPlate recommendations (modification represents 80% of normal recommendations).

Design and measurements

This mixed-methods research design qualitatively measured changes in: self-efficacy, barriers, and mood, and quantitatively measured changes in: blood pressure, body fat percentage, and weight, by the Control and 80/20 Group at three time points: pre-, mid-, and post-study. After the randomized group assignments, demographic information and baseline data were collected. Baseline data included pre-study: body weight, body fat percentage using a handheld bioelectric impedance machine, blood pressure using an automatic blood pressure monitor, mood (Positive and Negative Affect via PANAS), perceived barriers, and self-efficacy (psychosocial elements assessed via a questionnaire).

Instruction

Pre-study, both groups were given identical instruction over MyPlate dietary guidelines, specifically an overview of: Allowable foods that fall within each food group and accurately completing food logs. Food logging required three main pieces of information: identity of food groups consumed during a meal, the amount of said food group consumed in the appropriate units, and at the end of the day, a "Yes" or "No" to indicate if MyPlate daily recommendations were hit for that particular day.

Additionally, identical supplemental resource suggestions were provided (online food tracking options and other MyPlate resources found on myplate.gov) to both groups. Mid-study (~45 days) and post-study (~90 days) measurements were completed in the same manner as the pre-study evaluation and MyPlate food journals were collected at each time. The group comparison data was evaluated via mixed model ANOVA analysis using SPSS for data input.

Results

Drop-outs

Preliminary analysis revealed drastic differences in drop-outs by group assignments. At the conclusion of the three-months, a collective 12 subjects dropped out of the study. 10 of those subjects were assigned to the Control, and 2 were assigned to the 80/20 group. Therefore, the control group experienced an approximate 58.8% drop-out rate (n=10), compared with the 80/20 group drop-out rate of 16.67% (n=2). Z-test using sample proportions indicates the difference in number of drop-outs is statistically significant (p=0.023).

Physiological effects: Body fat percentage

Using the 17 remaining subjects' data, it was noted that there were no outliers in the data, as assessed by inspection of a boxplot for values greater than 1.5 box-lengths from the edge of the box. Body fat was normally distributed for both groups at all-time points, as assessed by Shapiro-Wilk's test (p>0.05), and therefore failing to reject the null hypothesis that the data came from an abnormal distribution as a result of the intervention. Mauchly's test of sphericity indicated that the assumption of sphericity was not violated. According to Levenes' Box, the interaction was not significant as (p-value>0.05), stating that the null hypothesis was failed to be rejected. The above statistical analyses, along with the computed F-value, indicated that there was no statistically significant interaction between the intervention and time on body fat percentage. The control group had a higher estimated marginal means of body fat percentage at all three time points, though insignificant.

Physiological effects: Weight

There were six overall outliers in the data, as assessed by inspection of a boxplot for values greater than 1.5 box-lengths from the edge of the box. Body fat was normally distributed for control group at all-time points, as assessed by Shapiro-Wilk's test (p>0.05). Body fat was not normally distributed for 80/20 group at all-time points (pre: p=0.007; mid: p=0.001; post: p=0.007). Mauchly's test of sphericity indicated that the assumption of sphericity was not violated. According to Levenes' Box, the interaction was not significant as (p-value>0.05). The control group produced higher estimated marginal means of weight at all three time points (though insignificant).

Physiological effects: Systolic pressure

There were 4 overall outliers in the data, as assessed by inspection of a boxplot for values greater than 1.5 box-lengths from the edge of the box. Same subject at 2 of the time points in the control during systolic-mid and systolic-post. In the control group, there was an abnormally high subject and an abnormally low subject, though not evident at the pre-test measurement. Systolic pressure was normally distributed for control group at all-time points, as assessed by Shapiro-Wilk's test (p>0.05). Systolic pressure was not normally distributed for 80/20 group at all-time points (pre: p=0.007; mid: p=0.001; post: p=0.007). Mauchly's test of sphericity indicated that the assumption of sphericity was not violated. According to Levenes' Box, the interaction was not significant as (p-value >0.05). There was no statistically significant interaction between the intervention and time on systolic pressure. The control group had higher estimated marginal means of systolic pressure at all three time points (though, insignificant).

Physiological effects: Diastolic pressure

There were 4 overall outliers in the data, as assessed by inspection of a boxplot for values greater than 1.5 box-lengths from the edge of the box, which was a result of a different participants each time. Diastolic pressure was normally distributed for the control group at all-time points, as assessed by Shapiro-Wilk's test (p>0.05). Diastolic pressure was not normally distributed for 80/20 group at latter 2 time points (mid: p=0.016; post: p=0.006). Mauchly's test of sphericity indicated that the assumption of sphericity was not violated. According to Levenes' Box, the interaction was not significant as (p-value>0.05). There was no statistically significant interaction between the intervention and time on diastolic pressure. The control group had higher estimated marginal means of diastolic pressure at all three time points, though insignificant.

Psychosocial effects: Self-efficacy

There were no outliers in the data, as assessed by inspection of a boxplot for values greater than 1.5 box-lengths from the edge of the box. Self-Efficacy was normally distributed for all interventions at all-time points, as assessed by Shapiro-Wilk's test (p>0.05). Mauchly's test of sphericity indicated that the assumption of sphericity had been violated, χ^2=7.803, p=0.020. (Greenhouse-Geisser=0.677; Huynh-Feldt=0.785). Homogeneity of variances was present, as assessed by Levene's test of homogeneity of variance (p>0.05). The 80/20 group produced higher self-efficacy scores at all three time points (though insignificant).

Psychosocial effects: PANAS positive affect (Mood)

There were two outliers in the data, as assessed by inspection of a boxplot for values greater than 1.5 box-lengths from the edge of the box. Both these outliers were kept in the analysis as upon inspection were evaluated as true data points. PANAS positive affect was normally distributed for all interventions at all-time points, as assessed by Shapiro-Wilk's test (p>0.05), except control group at pre-study measurement (p=0.013). A robust mixed ANOVA was run anyway. Mauchly's test of sphericity indicated that the assumption of sphericity had not been violated. There was no statistically significant interaction between the intervention and time on PANAS positive affect. Levenes' Box indicated that the interaction was not significant as (p-value>0.05).

Psychosocial effects: PANAS negative affect (Mood)

There were no outliers in the data, as assessed by inspection of a boxplot for values greater than 1.5 box-lengths from the edge of the box. PANAS negative affect was normally distributed for both groups at all-time points, as assessed by Shapiro-Wilk's test (p>0.05). Mauchly's test of sphericity indicated that the assumption of sphericity had not been violated. There was no statistically significant interaction between the intervention and time on PANAS negative affect.

Psychosocial effect: Barriers

Barrier scores were normally distributed for both the control and the 80/20 group at all-time points, as assessed by Shapiro-Wilk's test (p>0.05), except 80/20 group at mid-study measurement (p=0.019). A robust mixed ANOVA was run anyway. There were two outliers in the data for barriers mid and two for barriers post, as assessed by inspection of a boxplot for values greater than 1.5 box-lengths from the edge of the box. Both of these outliers were kept in the analysis as upon inspection were evaluated as true data points. Mauchly's test of sphericity indicated that the assumption of sphericity had not been violated. Homogeneity of variances was present, as assessed by Levene's test of homogeneity of variance (p>0.05). There was no statistically significant interaction between the intervention and time on barrier scores.

Diet adherence

Out of the 90-day period, the mean number of days participants demonstrated compliance by completing his or her daily food journals were: 56.75 days (Control) and 58.37 days (80/20). See Appendix B for

additional results regarding diet adherence (number of days a participant met MyPlate nutritional guidelines according to group assignment) and non-adherence (number of days a participant failed to meet MyPlate nutritional guidelines according to group assignment) for both groups.

Post-study questionnaire

The Post-Study Questionnaire, completed by the non-dropouts, consisted of four questions prompting participant elaboration about their individual experiences. The answers and results are listed in Appendix C. Graph 1 shows majority of responders cited participating in the dieting research as a beneficial learning experience. Graph 2 summarizes subject responses into three categories: MyPlate Issues, External Factors, and Other. Responses that fell under "MyPlate Issues" included commonly reported issues such as: measuring/proportion difficulties, unfamiliarity to eating recommended amount of foods, and struggling to meet certain food group recommendations. "External Factor" responses encompassed responses such as: vacation/holiday interference, expenses, work, and time management issues. The "Other" category included the following responses: food journaling difficulties and lack of personal drive. On Graph 3, the responses represented as "Other" were: cooking, maintaining consistent exercise habits, and none (indicating that all aspects were difficult). On Graph 4 responses represented by "Positive Comments" were: benefited from the experience and clear instructions were administered. "Negative Comments" were comprised by responses regarding: MyPlate difficulty, MyPlate recommendation complaints, and food logging complaints.

Discussion

Drop-outs

In terms of subject finishers (non-dropouts), the 80/20 Group surpassed the Control Group, as the difference in number of drop-outs (80/20: n=2; Control: n=10) was statistically significant (p<0.05). It should also be noted that these numbers do not reflect 5 additional subjects who dropped out prior to the commencement of the study, 3 of which were assigned to the Control Group. After 2 weeks, 2 more participants dropped out from the Control (included in the final number of drop-outs), and by mid-study (~45 days), the final 8 drop-outs withdrew. Whereas, the 2 drop-outs from the 80/20 group withdrew after the 60-day mark. These findings give reason to believe that the 80/20 diet may seem more manageable to dieters than 100% MyPlate adherence, and for this reason, continued their participation in the research.

Psychosocial/physiological changes and adherence

ANOVA analysis of the finishers physiological and psychosocial measurements showed no significant relationship between the intervention and changes in factors for both the Control and 80/20 Group. This unfortunate finding however, can be explained after looking at adherence rates and food journal completion compliance for both groups. For the 90-day timeframe, subjects, on average, completed their food logs for about 57 days, and adhered to their prescribed MyPlate diets for only about 20 days, regardless of group assignment. Therefore, the physiological/psychosocial changes (or lack thereof) do not accurately reflect the efficacy of neither MyPlate nor the 80/20 diet. The potential of the 80/20 diet to produce better

adherence rates due to its flexibility and allotment of cheat meals was perhaps masked by the MyPlate recommendations composing majority of their diet, as the average adherence rates between groups were comparable.

Post-study questionnaire responses

The notion that USDA MyPlate was likely a large contributor to the inconclusive results of this study are further supported by the responses collected from the Post-Study Questionnaire. They indicated their prominent struggle and complaint of participating was MyPlate (Graph 2, Graph 3). The notion that the 80/20 dieters struggled to a comparable degree (as reflected by the mean numbers of adherence and non-adherence days) with those in the Control, is likely due to the unpopular, and perhaps, unreasonable MyPlate recommendations.

Limitations

Due to the time constraints placed on this project, the study was limited to three-months. Future researchers should include a longer timeframe to assert subjects to the respective diets in order to determine long-term efficacy. In regard to methodology, two different automated blood pressure machines were used and may have contributed to some degree of blood pressure measurement error. After calculating the pre-study estimated marginal means of: Barrier scores, Self-Efficacy scores, PANAS Scores (Positive and Negative Affect), Body Fat Percentage, Weight, and Blood Pressure, it became evident that the randomized assignments of participants should have factored in these baseline measurements to minimize variances between the two groups. All information that was gathered regarding diet adherence and psychosocial changes were self-reported, and therefore inherent unreliability comes with this form of measurement. The 80/20 diet may also be applied to different standards of nutritional guidelines, for comparison of efficacy with varying dietary parameters. Concerning the sample of volunteers recruited, a greater assortment of ages should be utilized to determine 80/20 effectiveness for different age ranges, rather than limiting ages to 18-24 years, as performed in this study. Future researchers should also consider incentivizing subjects to a greater degree in order to encourage greater diet adherence and accurately measure diet effects on physiology. However, recruiting a larger sample size, but maintaining a reasonably low-incentive would more accurately measure ease of diet adherence, or feasibility of the diets in question.

Conclusion

Due to the gap in research concerning the effectiveness of flexible diets and USDA's MyPlate, it was necessary to conduct this study. Although this study failed to produce conclusive results of the diet's efficacy or inefficacy in regards to physiology and psychosocial variables, it opens the door for similar research regarding the usefulness of MyPlate and flexible dieting techniques. Though this study failed in the mentioned aspects, it repeatedly highlighted the difficulty of adopting MyPlate recommendations, which is reasonably unsettling as USDA MyPlate is recommended for the general public.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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