Journal
of Negative & No Positive Results

Original
Artículo inglés

Are detox diets an effective strategy for obesity and oxidation management in the short term?

¿Son las dietas de desintoxicación una estrategia eficaz para la gestión de la obesidad y la oxidación a corto plazo?

Ismael San Mauro Martín[1], Victor Paredes Barato[1], Sara Sanz Rojo[1], Sara López Oliva[1], Elena Garicano Vilar[1], Paulina Gudalewska[2], Marta Martín[1], Xin Rui[1], María José Ciudad Cabañas[3], Luis Collado Yurrita[3]

[1] *Research Centre in Nutrition and Health (CINUSA group). Madrid, Spain.*
[2] *Polish Research Unit. Research Centre in Nutrition and Health (CINUSA group). Poland.*
[3] *Departamento de Medicina. Universidad Complutense de Madrid. Madrid, Spain.*

Abstract

Introduction: Detox diets are popular dieting strategies that claim to facilitate toxin elimination and weight loss, thereby promoting health and well-being.

Objective: To examine whether detox diets affect antioxidant markers in blood and body composition.

Methods: 14 participants were randomly divided into two groups: a) Group 1/Detox diet: followed an exclusive detox diet based on juices for three days, followed by a hypocaloric diet for 4 days; and b) Group 2/Mediterranean diet: followed a hypocaloric Mediterranean diet for 7 days.

Results: there were statistically significant differences, in both groups, between the basal and final data in all study variables, except for test PAT. Weight, BMI, total fat, muscle and dROM decreased, while body water increased slightly. Weight loss and body fat were higher in group 2 (Mediterranean diet) than in group 1 (detox diet). The percentage of body water and the level of reactive oxygen metabolites increased. There was greater loss of musculature and water. In group 1, a decrease in the level of reactive oxygen metabolites was observed. However, there was a lower decrease in the body's antioxidant response, in group 1 than in group 2.

Conclusion: There are reports which support that detox diets are useful for health promotion and weight loss; however, some preliminary studies suggest that certain nutritional components possess detoxification properties; we did not meet such a conclusion in our study.

Keywords

detox; oxidation; antioxidant; obesity; diet

Resumen

Introducción: Las dietas de desintoxicación son estrategias populares que pretenden facilitar la eliminación de toxinas y la pérdida de peso, promoviendo así la salud y el bienestar.

* Autor para correspondencia.
Correo electrónico: research@grupocinusa.com (Ismael San Mauro Martin).

Recibido el 27 de junio de 2017; aceptado el 6 de julio de 2017.

Objetivo: examinar si las dietas de desintoxicación afectan a los marcadores antioxidantes en la sangre y la composición corporal.
Métodos: 14 participantes fueron divididos aleatoriamente en dos grupos: a) Grupo 1/Dieta Detox: siguieron de una dieta exclusiva de desintoxicación basada en zumos durante tres días, seguida de una dieta hipocalórica durante 4 días; y b) Grupo 2/Dieta mediterránea: siguió una dieta mediterránea hipocalórica durante 7 días.
Resultados: hubo diferencias estadísticamente significativas, en ambos grupos, entre los datos basales y finales en todas las variables del estudio, excepto para test PAT. El peso, IMC, grasa total, músculo y dROM disminuyeron, mientras que el agua corporal aumentó ligeramente. La pérdida de peso y la grasa corporal fueron mayores en el grupo 2 (dieta mediterránea) que en el grupo 1 (dieta detox). El porcentaje de agua corporal y el nivel de metabolitos reactivos del oxígeno aumentaron. En el grupo 1, hubo mayor pérdida de musculatura y agua. Se observó una disminución en el nivel de metabolitos reactivos del oxígeno. Sin embargo, en el grupo 1 hubo una disminución menor en la respuesta antioxidante del cuerpo que en el grupo 2.
Conclusión: Aunque hay informes que apoyan que las dietas de desintoxicación son útiles para la promoción de la salud y la pérdida de peso y algunos estudios preliminares que sugieren que ciertos componentes nutricionales poseen propiedades de desintoxicación, en nuestro estudio no llegamos a dicha conclusión.

Palabras clave
desintoxicación; oxidación; antioxidante; obesidad; dieta

Introduction

Detox or depurative diets are one of the latest trends in nutrition. Many products, books and websites have appeared in order to disseminate these diets not only in Spain [(1)] but internationally as well [(2-4)]. They are based on facts that our organism is oxidized and it has accumulated toxins that must be eliminated following a series of guidelines that vary according to the method. Some of these plans promise weight loss in a short time; many of these diets last less than a week. Although all of them are short-time diets and they don't contain processed foods, coffee, sweeteners and salt, the composition of the diet and the way to prepare food varies. Some of them allow only consuming liquids, other allow the consumption of fruits and vegetables. Some make a restriction of food that contains protein, like meat or milk and other include protein shakes. These types of diets are used in naturopathy in an extended way, without a standardized methodology [(5)]. In addition, cause of the inequality of these diets, the analysis of their effects on health has to be individualized. Different clinical and review studies have been carried out on the impact of detox diets on health, elimination of toxins and weight loss. One study evaluated the impact of maple syrup in detox diet in one week on weight loss, body fat and insulin resistance.

At the end of the week weight loss, lower insulin resistance and body fat were observed without changes in other hematological parameters [(6)]. In a clinical case, a diet designed based on the phytochemical composition of food was used and improvement was observed, however, it must be taken into account that it is a result of a single person [(7)]. In other review study, a positive impact of these diets on the elimination of toxins such as bisphenol A or on weight loss has not been seen [(8)].

There is a balance between oxidizing molecules and antioxidants In our organism [(9)]. Oxidative stress is a natural process in our body that develops for the reason of imbalance in the concentration of these molecules. Reactive oxygen species (ROS) may be endogenous, due to cell metabolism, and exogenous from the ionizing radiation, tobacco smoke, ozone, hyperoxia or heavy metals [(10)]. Antioxidants can be found in plants, such as medicinal plants [(11)], and products of plant origin. In addition, synthetic antioxidants have been developed, although they have been shown the harmful effect to health [(11)]. When this imbalance occurs, either by excess or defect of ROS, a pathological situation occurs, since ROS acts as signaling molecules in different metabolic pathways [(12)]. Oxidative stress has been associated with certain pathological conditions such as joint pain, diabetes or fertility problems. In addition, it is related to key proteins in neurodegenerative processes [(13)]. Oxidative stress has also been linked with the aging process. It is believed that with the

passage of time ROS levels increase and this leads to functional alterations, pathological conditions and finally to death [9]. One of the most widespread diseases in our century that is associated with oxidative stress is obesity [14]. Obesity involves chronic inflammation of adipose tissue that produces the release of ROS by the innate immune system [15] and pro-inflammatory adipocytokines by adipose tissue. An excess of chronic ROS may contribute to the development of Type 2 Diabetes Mellitus (DM2), insulin resistance, hypertension, atherosclerosis and cancer [14]. Obesity is a health problem that is increasing over the years. It is understood as an excess of the body fat that adversely affects health and mortality. An excess of the fat is considered when the Body Mass Index (BMI) is higher than 30 kg / m2 [16]. This measure presents a number of limitations such as ethnicity [17], (some studies suggest differences in the percentage of the body fat at the same BMI as a function of ethnicity), the age, the gender, the muscle / fat ratio [18].

It has been seen that a distribution of mainly abdominal fat is related to increased inflammation, the oxidation and alterations in glucose and lipid metabolism. A waist circumference more than 80cm in women and 94cm in males is associated with a high level of visceral fat and moderate cardiovascular risk (and > 88 and 102, high risk). The factors that influence on obesity are low physical activity, an excess of calories in the diet in a continuous way, genetic, environmental, cultural and economic factors, endocrine diseases and as a side effect of some pharmacological treatments. The excess of body fat, especially the visceral fat, involves a number of associated diseases such as hypertension, dyslipidemia, coronary heart disease, stroke, renal and hepatic dysfunction, non-alcoholic fatty liver, osteoarthritis, DM2, asthma, Sleep apnea, infertility and colon, prostate, endometrial and breast cancer [19,20] The inflammation and the oxidation present in obesity are closely related. The oxidative stress is a part of the normal physiology of the human body. ROS occur as a consequence of various metabolic processes, forming part of a redox homeostasis [9,10]. Patients with obesity have increased level of oxidation processes.

Inflammation promotes a state of oxidative stress in the body and this in turn prolongs the inflammatory state. Pro-inflammatory transcription factors are sensitive to the free radicals. Both the inflammation and the oxidative stress are involved in the pathogenesis of insulin resistance, DM2, cancer, atherosclerosis and premature aging. Alterations in glucose metabolism are due to inflammation, capable of altering insulin signaling, which can lead to hyperglycemia, which turns oxidative stress and inflammation. The hypertrophy of adipocytes due to obesity compromise the physiology of adipose tissue [21], resulting in increased oxidative stress and the inflammation. The inflammation and the oxidative stress would therefore be linked to the diseases associated with obesity [13,19, 21].

Both inflammation and the oxidative stress decrease with weight loss [14,15,19, 20, 22]. One of the strategies for weight loss is a calorie restriction. This restriction is associated with a reduction in the risk of associated with obesity, as well as an increase in longevity. This has been studied in flies [23], mice, and monkeys [24] and continues the debate about humans [25]. The RC decreases the inflammation and the oxidative stress, as well as damages caused by ROS. Another dietary intervention that seems to improve the inflammation and the oxidative stress is the consumption of food rich in antioxidants such as fruits and vegetables, especially because of their content in polyphenols, which appear to have a direct effect on ROS. These antioxidants would improve the body's antioxidant capacity, vascular function, glucose metabolism, and reduce oxidation of the LDL cholesterol and the progression of atherosclerosis [11,26]. Recent reports have reported that very short-term low-calorie diets in obese subjects improve insulin resistance [27] in those with DM2 with comparable effects to Roux-en-Y gastric bypass [28], the hypothalamic response to glucose [29] and decrease oxidative stress, more effectively in obese people without DM2 [30].

Objective

To evaluate the short-term effect of a hypocaloric, antioxidant-rich diet based on fruit and vegetable juices on antioxidant markers in blood and body composition.

Material and methods

Sample:

14 participants from the Autonomous Community of Madrid, 11 women and 3 men, at the age between 30 and 60 years were recruited. Inclusion criteria were as follows: adult men and / or women at the age from 30 to 60 years, without serious diseases, overweight or obese. Those subjects who did not complete the study or did not provide signed informed consent were excluded. In addition to subjects who had serious illnesses (diabetes, fructose intolerance, celiac disease, neural diseases, heart disease, hepatitis, Chronic Obstructive Pulmonary Disease (COPD), cancer, etc.).

Study design:

A semi-experimental, prospective and comparative study was designed. Participants were randomly divided into two groups:

A) Group 1 / A / Detox: Exclusive detox diet based on juices for three days, followed by a hypocaloric diet for 4 days.

B) Group 2 / B / Mediterranean Diet (MD): Hypocaloric diet for 7 days.

During one full week both groups received a nutritional intervention in which each individual was given a hypocaloric diet. In addition, this diet was adjusted to a negative balance of 500 Kcal / day. The G1, in addition to the above, was given a Detox diet, based on juices, for 3 days within the same week.

The different juices were composed by:

a) Pineapple, apple, spinach, water, lime, cucumber, celery, agave syrup, camu camu, guarana, xanthan

b) Water, celery, mango, pineapple, carrot, passion fruit, reishi, maca, xanthan

c) Apple, water, celery, spinach, lime, kale, pea protein, rice protein, guarana, xanthan, Himalayan salt.

d) Water, strawberry, banana, pomegranate, raspberry, beetroot, agave syrup, pea protein, rice protein, xanthan, açai.

e) Apple, water, kiwi, celery, spinach, goji berries, spirulina, xanthan.

f) Water, mango, orange, pineapple, pomegranate, banana, carrot, celery, flax seed, xanthan, lucuma.

Each of the participants, before being included in the study, received information about the purpose of the study, and signed an informed consent for their participation.

The entire project was carried out with dental staff of the Universidad Complutense de Madrid.

Study factors:

Anthropometric measurement of height, weight and waist circumference was performed. An InBody Model 230 multi-frequency (20-100 kHz) bioimpedance four-phase electric device was used, according to the manufacturer's instructions [(31)], for weight measurement, body fat percentage, subcutaneous fat (kg), The amount of lean body mass (kg) and the percentage of water. Size was also measured with a SECA® mobile squeegee with a precision of 1 mm. Finally, the BMI was calculated (BMI = weight (kg) / height (m2)).

Measurement of d-ROM and PAT test was performed with an analyzer model FRAS 4 Evolvo (H & D SRL, Italy).

Physical activity was assessed by means of the IPAQ questionnaire [(32)], recording the intensity of the exercise, both in its main activity and in free time.An adapted version of the Health Questionnaire (SF-36) [(33)] was used to assess quality of life, and the National Health Survey [(34)] was used to record sleep quality.

Dietary habits were assessed using Food Frequency Frequency Questionnaire.

The DIAL software was used to evaluate the managed menu. The recommendations of the Mediterranean diet pattern were used in terms of the recommended consumption frequencies of the SENC, 2015 [35].

Data were collected by trained and trained dietitian-nutritionists, homogenizing a protocol for data collection and monitoring of the study.

Statistics analysis:

Descriptive analyzes were carried out, presenting the results as means, standard deviation and percentages. Parametric statistics, Student t test and ANOVA were used to analyze the differences between the means of two groups of quantitative variables and χ2 test for nonparametric qualitative variables. Significant differences were considered with p values <0.05. Data analysis was performed using SPSS® (version 20).

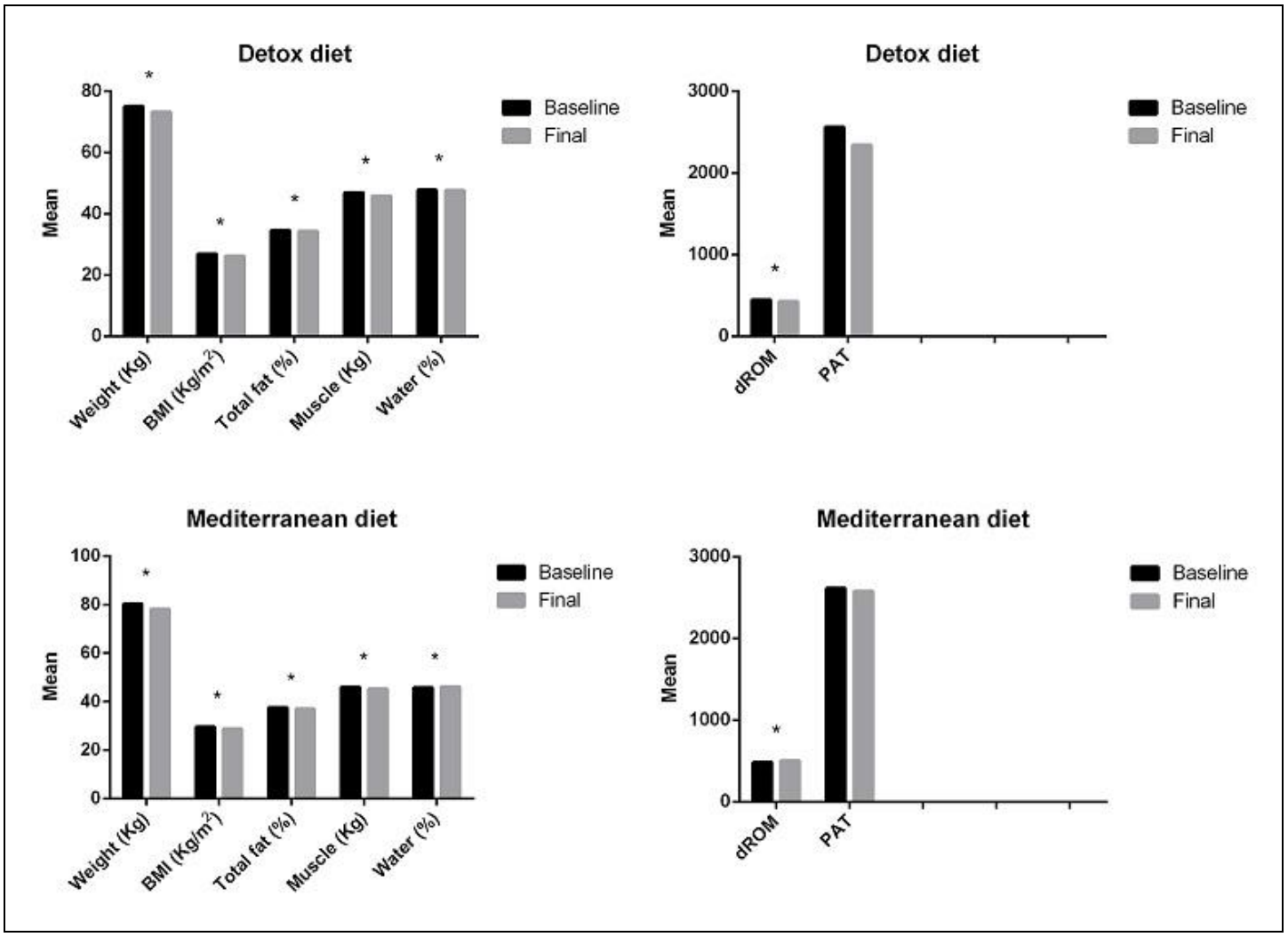
Results

The sample consisted of 14 participants (11 women and 3 men), between 30 and 60 years, with a mean age of 53.14 ± 16.14 years. Baseline demographic and anthropometric data are shown in Table 1.

Table 1: Baseline descriptive data of the sample.

	Total		
	***Detox* diet (n=8)**	**Mediterranean diet (n=6)**	**P-Value**
Height [m] (M ± SD)	166.94 ± 2.18	165.67 ± 2.17	0.483
Weight [kg] (M ± SD)	75.13 ± 3.61	80.28 ± 11.88	0.035*
BMI [kg/m^2] (M ± SD)	26.91 ± 0.93	29.52 ± 4.912	0.044*
Total fat (%)(M ± SD)	34.55 ± 1.92	37.47 ± 4.04	0.336
Muscle (Kg) (M ± SD)	46.90 ± 3.28	45.97 ± 4.49	0.394
Water (%)(M ± SD)	47.78 ± 3.29	45.75 ± 6.63	0.266
dROM (M ± SD)	445.88 ± 26.90	483.50 ± 28.30	0.792
PAT (M ± SD)	2560.75 ± 71.77	2615.50 ± 110.33	0.860
* p<0.05, considered statistically significant.			

In both groups there are statistically significant differences between the basal and final data in all study variables, except for PAT (Figure 1). Weight, BMI, total fat, muscle and dROM decreased, while body water slightly increased (Table 2).



* p<0.05, considered statistically significant.
Figure 1: Difference in weight, BMI, total fat, muscle, water, dROM and PAT, of both groups, at the beginning and at the end of the study.

Table 2: Difference between the study variables, at the beginning and at the end of the study

	Total		
	***Detox* diet (n=8)**	**Mediterranean diet (n=6)**	**P-Value**
Height [m] (M ± SD)	-1.91 ± 0.61	-2.18 ± 1.78	0.693
Weight [kg] (M ± SD)	-0.68 ± 0.20	-0.80 ± 0.63	0.641
BMI [kg/m^2] (M ± SD)	-0.21 ± 1.12	-0.62 ± 2.44	0.684
Total fat (%)(M ± SD)	-1.05 ± 0.60	-0.70 ± 2.75	0.730
Muscle (Kg) (M ± SD)	-1.12 ± 0.76	0.30 ± 1.95	0.581
Water (%)(M ± SD)	-20.63 ± 48.26	19.5 ± 67.43	0.217
dROM (M ± SD)	-220.63 ± 424.11	-38.83 ± 259.49	0.374

The variables "muscle difference" and "weight difference" did not follow a normal distribution and were therefore compared by the Mann-Whitney U test, which indicates that there are no statistically significant differences between the results obtained in groups 1 and 2 (Table 3).

Table 3: Mann-Whitney U test between muscle difference and weight between the two study groups.

Mann-Whitney U test		
	Weight_dif	**Muscle_dif**
U de Mann-Whitney	23.500	22.000
W de Wilcoxon	59.500	43.000
Z	-0.065	-0.259
Sig. asint. (bilateral)	0.948	0.796
Exact significación [2*(sig. unilateral)]	0.950	0.852

Figure 2 shows that weight loss and body fat were higher in group 2 (Mediterranean diet) than in group 1 (detox diet). In group 1, there is greater loss of musculature and water. In the case of group 2, the percentage of body water increased. In group 1, a decrease in the level of reactive oxygen metabolites is observed, whereas in group 2, they increased (Fig. 2). However, in group 1, there is a smaller decrease in the antioxidant response of the organism than in group 2 (Fig. 2).

Discussion

To the best of our knowledge, no rigorous clinical investigations of detox diets have been conducted. The handful of studies that have been published suffer from significant methodological limitations including small sample sizes, sampling bias, lack of control groups, reliance on self-report and qualitative rather than quantitative measurements [(8)]. In addition, health and fitness-related social media content keep including strict diet/exercise plans and “detoxes” that claim to have health and weight loss benefits [(36)].

Liquid-based detox diets that claim to rid the body of toxins (despite no medical evidence indicating this is necessary) have been criticized by the Dietitians Association of Australia and can result in the loss of healthy gut bacteria and electrolytes [(37)].

Commercial detox diets rarely identify the specific toxins they aim to remove or the mechanisms by which they eliminate them, making it difficult to investigate their claims [(8)].

The only commercial detox product to have been evaluated clinically is UltraClear® (Metagenics Inc., Aliso Viejo, CA, USA), a medical food supplement that purports to detoxify the liver [(38,39)]. MacIntosh and Ball examined the effects of UltraClear® in 25 naturopathy students, without the inclusion of a placebo control group. A statistically significant (47%) reduction was observed in the volunteers’ scores on the Metabolic Screening Questionnaire (MSQ) over the 7-day treatment period. The MSQ comprises a short set of questions designed to gauge the severity of a broad range of health complaints, including headaches, nausea, genital itch, coughing, chest pain, mood swings, acne and dark circles under the eyes.

It is possible that malic acid (found in grapes and wine), citric acid (found in citrus fruits), succinic acid (found in apples and blueberries), citrus pectin (found in the peel and pulp of citrus fruits), coriander, selenium, Chlorella (a type of green algae), Nori and Olestra may provide the basis for an evidence-based detox diet in the future (if the need for detoxification is established) [(8)].

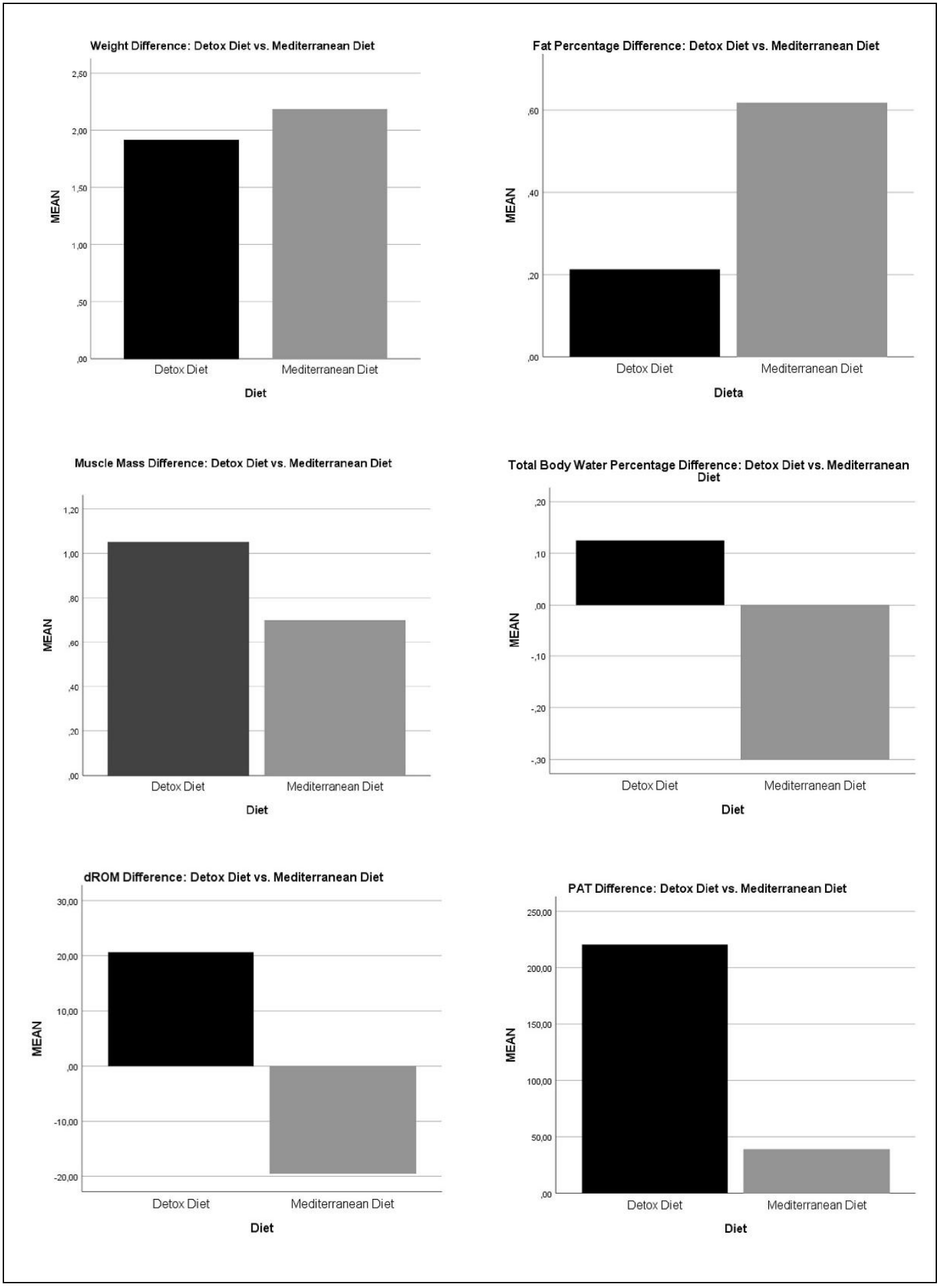


Figure 2: Weight, body fat, muscle mass, body water dROM and PAT differences in group 1 with respect to group 2.

Currently, no scientific studies have investigated the effectiveness of commercial detox diets for losing weight. But there are many anecdotal reports of the stressfulness of popular detox programmes. This is not surprising considering the low-energy, nutrient-poor nature of many of these diets [8]. Based on the work of Mazurak et al. [40] and Tomiyama et al. [41], it is possible that low energy detox diets increase stress, elevate cortisol and stimulate appetite, thereby making it difficult to lose weight. The findings of Pankevich et al. [42] obtained from studies of mice hint that stressful detox diets may set the scene for binge eating and rebound weight gain in the future, although this requires experimental validation.

Most clinical studies of calorie-restricted diets with 9- to- 20 week intervention periods have reported that energy consumption of less than 1,000 kcal/d causes a reduction in body weight, BMI, abdominal visceral fat, and intermuscular fat [43,44]. Although our intervention period was shorter than these studies and higher in calories, no significant decreases in body weight, BMI and body fat percentage were observed in the detox group.

Although it is plausible that energy-restricted detox diets are able to produce short-term weight loss [6], it is unclear whether these diets are useful for maintaining a healthy weight in the long-term. Consumers should be made aware that the weight loss claims of these detox products are not underpinned by any clinical evidence [8].

Conclusion

Although there is scant clinical evidence available to support the use of detox diets, there are anecdotal reports that support they are useful for health promotion and weight loss. Results obtained in our work do not follow this line.

Although there is currently no evidence to support the use of commercial detox diets for removing toxic substances from the body, there are some preliminary studies suggesting that certain nutritional components possess detoxification properties.

Considering the popularity of detox diets, our opinion is that consumers and medical professionals should be better informed about their possible risks and benefits, and that legislation should be put in place to protect consumers from unsubstantiated claims.

Conflict of interests

The authors declare that they have no conflicts of interest.

No funding declared.

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