fortune Journals

Research Article

JOURNAL OF FOOD SCIENCE AND NUTRITION RESEARCH

ISSN: 2642-1100

High Carbohydrate vs High Fat Diets: Which is Preferable for Long-term Use?

Alan M. Preston PhD*[1], Cindy A. Rodriguez BS[2], Marianna M. Preston BA[1]

Abstract

Background: Commercial manufacturers have formulated diets to promote not only weight reduction but also to reduce risks of chronic diseases.

Objective: To determine if these formulations satisfy requirements for essential nutrients and their suitability for long term use.

Methods: We have selected two established commercial diets, one high carbohydrate, low fat (diet 1) and the other, low carbohydrate, high fat (diet 2) and determined "representative meals" through use of recipes suggested in the manufacturer's manuals. Nutrition Data System for Research (NDSR) software has been used to perform the most extensive nutrient analysis to date of these diets.

Results: Tables report macronutrients (energy), vitamins, minerals, essential amino acids, essential fatty acids and nutrient-related components for a total of 62 entries. Diet 1 satisfied requirements for 50 of these (81%) with only vitamin B12, vitamin D, and essential fatty acids not reaching recommended levels, while fiber and glycemic load exceeded suggested values. Diet 2 satisfied requirements for forty- six of the components (71%) but had excess percentage of fat, especially saturated fat, sodium and cholesterol as well as decreased percentage of carbohydrate resulting in suboptimal intake of B-complex vitamins (B1, niacin and total folate) as well as fiber.

Conclusions: Neither diet satisfied adequacies for all reported nutrients. However, based on nutrient content alone diet 1, if supplemented, could be sustained over the long term whereas diet 2, even if supplemented, should not be encouraged for long term adaptation.

Introduction

The good news is that weight reduction diets do "work" at least in the short term. A recent publication reported that all of 14 commercial diets ended up with weight loss at 6 months accompanied by favorable health results [1]. Nutrient composition of these diets varied widely among percent and types of carbohydrates, proteins, fats as well as micronutrients. The objective of our study is to determine if the manufacturers of commercial diets have formulated recipes which provided recommended dietary levels of essential nutrients that would be adequate for long-term use. To accomplish this, we have chosen two well-established commercial diets and obtained representative examples of each with use of suggested meal plans and determined nutrient adequacy with the use of software programs.

Affiliation:

[1]Department of Biochemistry, University of Puerto Rico, Medical Sciences Campus, San Juan, PR 00936, USA

[2]NutriEtiquetas, Ciales, PR 00638 USA

***Corresponding author:**
Alan M. Preston, PhD, Department of Biochemistry, University of Puerto Rico, Medical Sciences Campus, San Juan, PR 00936, USA

Citation: Alan M. Preston, Cindy A. Rodriguez, Marianna M. Preston. High Carbohydrate vs High Fat Diets: Which is Preferable for Long-term Use?. Journal of Food Science and Nutrition Research 6 (2023): 24-30.

Received: December 23, 2022
Accepted: April 03, 2023
Published: April 20, 2023

Preston AM, et al., J Food Sci Nutr Res 2023
DOI:10.26502/jfsnr.2642-110000126

Materials and Methods

Software

The dietary analysis is extensive using the full power of the Nutrition Data System for Research (NDSR) software of which the 2019 version contains 174 nutrients, nutrient ratios and other food components [2]. Nutrients having dietary reference index's values (DRI's) or recommended dietary allowances (RDA's) will be reported. Other nutrients which can be biologically active but have no established recommendations such as phytochemicals found in plants in small amounts (polyphenolic flavonoids, carotenoids, etc) [3] and sugar alcohols, a class of polyols (sorbitol, mannitol, xylitol, etc) which are present in varying levels in many fruits and vegetables [4] will not be reported. Likewise, non-essential amino acids and other non-essential nutrients found among the 174 entities in the NDSR will not be evaluated. Finally, some nutrient-related components will be reported making a total of 62 entries.

Menus

To obtain a representative meal, we have selected at random five of the 21 suggested daily menus from our designated commercial diet manuals which contain detailed content (ingredients and portion size) for breakfasts, lunches, dinners and snacks. Diet 1 is low fat, high carbohydrate and plant-based protein [5]. Diet 2 is high fat, low-carbohydrate and moderate protein [6]. Thumbnail sketches of both diets are presented in tables 1 and 2 to portray typical menus. The actual composition of the meals can be found in the manufacturer's manuals. The five meals are averaged (representative meal) and reported in the results section.

Statistics

Nutrient results from the NDSR software were recorded as meal content of five recipes, selected at random, from the manufacturer's manuals for diets 1 and 2. The average and standard deviations were calculated and compared to recommended guidelines.

Table 1: Menus for Diets

Menu	Breakfast	Lunch	Dinner
Menu 1	Honeydew, Toasted	Brown rice	Vegetable platter
[13]	bread with spread	Squash, Apples	Sweet potato
		Cauliflower	Corn bread, Sherbet
Menu 2	Granola, Yogurt	Fruit salad	Spaghetti, tufu
[8]	Orange juice	Bread-pudding	Cucumber salad,
Menu 3	Grains mussili	Zucchini, Spinach	Crudite salad
[21]	Grapefruit	Eggplant	Bulgar- pilof
		Citrus salad	Apple crisps
Menu 4	7 grain cereal	Cauliflower -	Brussel sprouts
[18]	Orange juice	salad, Raison-breadfruit,	Green salad
		Carrot soup	Raspberry ice
Menu 5	Fruit coffee cake	Cucumber-yogurt Eggplant,	Brown rice, Green salad
[14]	Orange juice	soup, Sherbert	Cantaloupe

Diet 1* Indicating [meal number] from diet manual.

Table 2: Diet 2* Indicating Week and day from diet manual (first column).

Menu	Breakfast	Lunch	Dinner	Snack
Menu 1	Cheesy bacon	Chicken	Beef stroganoff	Cheese cubes
Wk 1 M	Egg muffin	salad	Cauliflower	Hard boiled egg
	Coffee			
Menu 2	Keto smoothie	Chicken	Beef stroganoff	Macadamia nuts
Wk 1 F	Coffee	salad		Cheese crisps
Menu 3	"Noats" coffee	Greek	Cheese tacos	Keto sno-cone
Wk 2 Th		salad		Carnitas
Menu 4	Coffee	Pancakes	Beef broccoli	Keto muffins
Wk 2 Sun				
Menu 5	Coffee	Bacon egg	Chicken pizza	none
Wk 3 F		salad		

*Daily Supplement: at least 64 oz water, 4000 mg Na, 3000 mg K, 400 mg Mg [15]

Preston AM, et al., J Food Sci Nutr Res 2023
DOI:10.26502/jfsnr.2642-110000126

Results

A word on the manner of data presentation: When possible, we used RDA's which are the daily dietary intake levels of nutrients considered sufficient by the Food and Nutrition Board of the Institute of Medicine to meet the requirements of 97.5% of healthy individuals in each life-stage and sex groups [7]. Because of limited space, the RDA values listed will be for adult males; females have slightly lower values. In a few instances, reference values will be expresses as adequate intake (AI), defined as recommended average daily nutrient intake [8]. Importantly, there is no RDA for energy (caloric intake) which depends on a myriad of individual factors [7]. Consequently, energy and macronutrient content will be expressed as DRI values which give a rough idea of how much energy a person should be eating each day, and how much fat, sugar, salt and so on being based on an average-sized adult doing an average amount of physical activity [9-11]. DRI values for energy have been set at 2000 Kcal for men and 1800 Kcal for women.

The sum of percentages of fat, carbohydrate and fat calories slightly exceeds the total Kcal in line 1, table 2 for both diets. This is due to the fact that calories from foods in the NDSR are determined chemically where energy values vary [12] while our calculations use standard energy values of 9, 4 and 4 Kcal/gm for fat, carbohydrates and protein respectively. There was moderate agreement in consistency of nutrient composition for most meals for diet 1, with a maximum difference of 900 Kcal between highest and lowest caloric ingestion, however, diet 2 had less agreement with a maximum difference of 9000 Kcal/gm. This caloric difference resulted in meal to meal variations of all other nutrients in the tables. Of the 62 nutrients and nutrient- like components reported, fifty-one (81%) achieved or fell within reference ranges for diet 1 and forty-six (71%) for diet 2, consequently, no further mention of these entities will be made. Components outside reference ranges, both below and above include: Diet 1. Table 2 (gm carbohydrate, %carbohydrate, fiber-all high), table 3 (vitamin D, vitamin B12 - both low), table 4 (sodium- low), table 5 (essential fatty acids all low), table

Table 3: Macronutrients

	Diet 1							Diet 2					
Content (units)	**Meal 1**	**Meal 2**	**Meal 3**	**Meal 4**	**Meal 5**	**Mean ± SD**	**DRI**	**Meal 1**	**Meal 2**	**Meal 3**	**Meal 4**	**Meal 5**	**Mean ± SD**
Energy KCAL	2,212.41	1,858.16	2,147.73	1,794.38	1,325.81	1867.7 ± 315.07	2000	1,736.49	2,288.84	1,404.57	900.65	845.31	1435.17 ± 539.28
Total fat gm	42.88	64.20	38.46	55.32	35.54	47.28 ± 10.82	≤70	132.74	161.69	115.87	74.78	70.15	111.05 ± 34.78
Fat calories %	17.44	31.10	16.12	27.74	24.13	23.31 ± 5.78	25-30	68.80	63.58	74.24	74.73	74.69	71.21 ± 4.42
Total carbs gm	406.46	300.67	396.20	295.50	238.46	327.46 ± 64.23	260	26.76	66.40	34.17	25.60	15.10	33.61 ± 17.49
Carb calories %	73.49	64.72	73.79	65.87	71.94	69.96 ± 3.88	45-65	6.16	11.60	9.73	11.37	7.15	9.2 ± 2.2
Total prot gm	87.12	45.33	71.92	59.64	37.18	60.24 ± 17.96	56	111.04	153.97	68.08	38.19	44.00	83.06 ± 43.76
Prot calories %	15.75	9.76	13.39	13.30	11.22	12.68 ± 2.05	10-35	25.58	26.91	19.39	16.96	20.82	21.93 ± 3.75
Animal prot gm	7.91	3.93	11.12	5.31	5.12	6.68 ± 2.57	*	104.06	135.03	46.40	29.82	35.41	70.14 ± 41.85
Animal prot %	9.08	8.68	15.46	8.91	13.76	11.18 ± 2.86	*	93.72	87.70	68.15	78.07	80.47	81.62 ± 8.7
Vegetable prot gm	79.21	41.40	60.80	54.33	32.07	53.56 ± 16.25	*	6.98	18.94	21.69	8.38	8.59	12.91 ± 6.13
Vegetable prot %	90.92	91.32	84.54	91.09	86.24	88.82 ± 2.86	*	6.28	12.30	31.85	21.93	19.53	18.38 ± 8.7
Alcohol gm	1.39	0.05	0.77	0.38	0.61	0.64 ± 0.45	‡	-	-	0.00	0.09	-	0.02 ± 0.04
Alcohol cal%	0.00	0.00	0.00	0.00	0.00	0 ± 0	‡	0.00	0.00	0.00	0.01	0.00	0 ± 0
Total SFA gm	5.94	5.58	3.79	4.89	3.44	4.73 ± 0.98	≤15	64.76	86.66	46.14	31.66	26.96	51.23 ± 22.07
SFA cal %	2.42	2.70	1.59	2.45	2.33	2.3 ± 0.38	≤7	33.57	34.07	29.56	31.63	28.70	31.51 ± 2.12
Total MUFA gm	8.63	9.72	6.16	8.20	6.03	7.75 ± 1.44	≤44	41.86	45.81	36.86	26.98	25.09	35.32 ± 8.12
MUFA cal %	3.51	4.71	2.58	4.11	4.09	3.8 ± 0.72	≤20	21.70	18.01	23.62	26.96	26.71	23.4 ± 3.33
Total PUFA gm	22.89	44.35	24.47	35.94	22.74	30.08 ± 8.66	≤22	13.49	14.62	23.40	9.59	12.67	14.75 ± 4.64
PUFA cal %	9.31	21.48	10.25	18.03	15.44	14.9 ± 4.61	≤10	6.99	5.75	14.99	9.58	13.48	10.16 ± 3.58
Total Trans FA gm	0.06	0.23	0.12	0.18	0.11	0.14 ± 0.06	≤ 2	3.24	3.08	2.11	1.37	0.93	2.14 ± 0.91
Trans FA cal %	0.03	0.11	0.05	0.09	0.07	0.07 ± 0.03	≤ 1	1.68	1.21	1.35	1.36	0.99	1.32 ± 0.23
Total sugar gm	42.19	23.45	31.05	26.61	17.46	28.15 ± 8.3	40	0.82	2.24	1.85	2.62	1.50	1.8 ± 0.62
Added sugar gm	22.96	5.86	4.16	14.32	6.02	10.66 ± 7.09	38	0.43	0.35	0.56	2.02	0.11	0.69 ± 0.68
Total fiber gm	63.83	45.69	48.05	59.22	42.48	51.85 ± 8.22	25-35	9.89	23.03	16.05	6.81	6.71	12.5 ± 6.27
Water gm	3,085	1,754	2,128	2,197	1,748	2182.6 ± 487.95	1811 ₱	3,014	3,275	3,365	2,851	1,639	2828.75 ± 622.28

*No DRI

ŧ No recommendation DGA (9) suggests moderate intake-2 drinks/day Men; 1 drink/day Women

p Eight glasses/day 8 oz each = 64 oz water/day (9)

Preston AM, et al., J Food Sci Nutr Res 2023
DOI:10.26502/jfsnr.2642-110000126

Table 4: Vitamins

Content (units)	Meal 1	Meal 2	Meal 3	Meal 4	Meal 5	Mean ± SD	RDA	Meal 1	Meal 2	Meal 3	Meal 4	Meal 5	Mean ± SD
Vit A (retinol) mcg	2,479.35	6,487.85	1,576.50	3,852.78	1,914.54	3262.2 ± 1790.21	900	1,743.97	2,134.18	1,023.26	364.34	942.72	1241.7 ± 625.41
Vit D (cholecalciferol) mcg	0.20	-	0.02	0.02	-	0.05 ± 0.08	10-20	5.75	5.46	3.92	1.99	2.84	3.99 ± 1.46
Vit E (y tocopherol) mg	26.35	26.31	14.20	23.43	15.13	21.08 ± 5.36	15	4.53	14.73	11.44	10.01	7.10	9.56 ± 3.52
Vit K mcg	285.98	530.54	146.44	730.32	388.17	416.29 ± 201.13	120 AI	152.92	604.81	157.28	54.27	65.38	206.93 ± 203.49
Vit C mg	414.41	355.74	356.51	419.72	224.69	354.21 ± 70.28	90	108.57	397.22	16.93	28.47	21.58	114.55 ± 145.27
Vit B1 mg	2.92	2.02	2.16	2.14	1.26	2.1 ± 0.53	1.2	0.59	0.83	1.24	0.23	0.46	0.67 ± 0.34
Vit B2 mg	2.15	1.65	1.63	1.70	1.08	1.64 ± 0.34	1.30	2.38	2.73	2.00	0.95	1.13	1.84 ± 0.69
Niacin mg	28.06	19.49	21.66	17.14	11.11	19.49 ± 5.55	16	15.01	16.78	11.49	7.82	5.59	11.34 ± 4.21
Pantothenic acid mg	8.70	7.74	8.12	7.88	5.20	7.53 ± 1.21	5 AI	7.31	9.10	3.79	2.30	2.75	5.05 ± 2.68
Vit B6 mg	3.81	3.00	2.06	2.97	1.97	2.76 ± 0.68	1.3	1.61	2.32	1.08	0.74	0.50	1.25 ± 0.65
Total folate mcg	855.15	600.87	593.01	829.14	373.22	650.28 ± 176.89	400	324.19	573.55	178.12	88.73	148.05	262.53 ± 173.77
Vit B12 mcg	1.90	0.42	1.47	0.69	0.54	1± 0.58	2.4	5.06	5.21	3.11	1.74	1.64	3.35 ± 1.55

Table 5: Minerals

	Diet 1							Diet 2					
Copper mg	3.51	1.86	2.21	2.20	1.57	2.27 ± 0.66	0.9	0.67	1.25	1.54	0.71	0.87	1.01 ± 0.33
Selenium mcg	138.28	79.85	118.31	88.61	41.06	93.22 ± 33.41	55	132.67	133.96	78.57	44.07	596.68	197.19 ± 202.62
Sodium mg	440.53	384.99	399.06	442.86	211.24	375.74 ± 85.32	1500	4,914.97	7,342.25	4,041.47	5,132.50	5,034.59	5293.16 ± 1095.55
Potassium mg	7,461.92	5,065.32	4,433.99	5,005.98	4,085.53	5210.55 ± 1183.24	4700	4,117.21	5,593.91	4,083.22	3,274.73	3,184.26	4050.67 ± 864.85
Manganese mg	18.42	7.86	8.79	9.00	6.67	10.15 ± 4.22	1.8	0.79	1.93	3.98	1.32	0.91	1.79 ± 1.17

Table 6: Essential Amino Acids* Essential Fatty Acids

	Diet 1							Diet 2					
Content (units)	Meal 1	Meal 2	Meal 3	Meal 4	Meal 5	Mean ± SD	RDA	Meal 1	Meal 2	Meal 3	Meal 4	Meal 5	Mean ± SD
Histidine mg	2,010.0	1,034.0	1,583.0	1,364.0	812.0	1360.6 ± 419.2	14	2,607.0	3,757.0	2,099.0	1,108.0	1,282.0	2170.6 ± 962.4
Isoleucine mg	3,300.0	1,696.0	2,780.0	2,268.0	1,404.0	2289.6 ± 692.6	19	4,317.0	6,268.0	3,060.0	1,692.0	2,120.0	3491.4 ± 1655
Leucine mg	5,941.0	3,159.0	4,992.0	3,712.0	2,427.0	4046.2 ± 1265.3	42	7,999.0	11,748.0	5,299.0	2,989.0	3,606.0	6328.2 ± 3218.3
Lysine mg	4,039.0	2,243.0	2,901.0	2,916.0	1,914.0	2802.6 ± 728.6	38	7,330.0	10,950.0	4,267.0	2,694.0	3,121.0	5672.4 ± 3097
Methionine mg	1,296.0	758.0	1,206.0	833.0	585.0	935.6 ± 271.3	19	2,354.0	3,144.0	1,599.0	896.0	1,365.0	1871.6 ± 791.8
Phenylalanine mg	3,826.0	2,138.0	3,402.0	2,475.0	1,628.0	2693.8 ± 809.5	33.0	4,416.0	6,168.0	3,025.0	1,705.0	2,075.0	3477.8 ± 1639.1
Tryptophane mg	987.0	550.0	762.0	654.0	433.0	677.2 ± 189.5	20	1,052.0	1,764.0	987.0	326.0	548.0	935.4 ± 494.8
Tyrosine mg	2,605.0	1,286.0	2,051.0	1,585.0	1,116.0	1728.6 ± 541.1	5	3,622.0	5,068.0	2,535.0	1,241.0	1,715.0	2836.2 ± 1377.7
Valine mg	4,037.0	2,284.0	3,488.0	2,848.0	1,878.0	2907 ± 782.9	24	5,401.0	7,763.0	3,672.0	1,915.0	2,405.0	4231.2 ± 2138
Alpha linolenic acid (ALA) mg	1,261.0	1,101.0	561.0	728.0	640.0	858.2 ± 273.5	1600	1,522.0	1,909.0	4,809.0	271.0	277.0	1757.6 ± 1660.8
Eicosapantanaeoic acid (EPA) mg	-	-	-	-	-	0 ± 0	Ṫ	27.0	20.0	14.0	8.0	12.0	16.2 ± 6.6
Docosahexaeonic acid (DHA) mg	-	-	-	-	-	0 ± 0	Ṫ	60.0	37.0	2.0	17.0	44.0	32 ± 20.4

*Arginine is conditional
ŧ EPA + DHA = 250 -500 mg/day (10)

Preston AM, et al., J Food Sci Nutr Res 2023
DOI:10.26502/jfsnr.2642-110000126

Table 7: Nutrient related substances

Content (units)	Meal 1	Meal 2	Meal 3	Meal 4	Meal 5	Mean ± SD	DRI	Meal 1	Meal 2	Meal 3	Meal 4	Meal 5	Mean ± SD
Cholesterol mg	2.74	1.37	3.88	1.84	1.78	2.32 ± 0.9	≤ 300 mg	934.13	712.80	256.86	296.71	477.77	535.65 ± 256.26
Caffeine mg	-	-	-	-	-	0 ± 0	*	189.44	100.90	189.53	94.81	94.72	133.88 ± 45.46
Glycemic load	171.72	144.54	177.28	103.86	92.80	138.04 ± 34.44	†	7.16	17.80	7.13	6.00	2.61	8.14 ± 5.11

* ≤ 400 mg (16)
† Glycemic Load (or GL) combines both the quantity and quality of carbohydrates .
Low GL is between 1 and 10; a moderate GL is 11 to 19; and a high GL is 20 or higher [18].

6 (cholesterol-low, glycemic load-high). Diet 2. Table 2 (gm fat and % fat, especially saturated fat-all too high, gm carbohydrate and % carbohydrate, fiber-all too low), table 3 (Vitamin D, Vitamin B1, niacin, total folate-all too low, vitamin E- slightly low), table 4 (sodium-too high), table 5 (EPA, DHA-low), table 6 (cholesterol-high). The following discussion section will include comments on the enumeration of these outliers.

Discussion

Diet manufacturers often shuffle proportions and types of carbohydrates, fats and proteins to create eating plans concomitant with reducing risk of major degenerative diseases commonly found in the United States. Diet 1 having low fat, high carbohydrate and plant-based protein, which the manufacturer refers to as "heart friendly", incorporates nutrients associated with favorable cardiovascular function [13]. These include high fiber, low animal protein as well as low fat (especially saturated fat), extremely low sodium and cholesterol and little added sugar. Consequently, the aberrant values in the tables for fiber, sodium and cholesterol are a result of conscious action of the manufacturer's design of the diet. One of the most consistent results in table 2 is percent carbohydrate (about 70%) which is probably the most important ingredient in the diet's formulation and used as a set point. In doing this, other components may be left short of achieving reference values. The low amount of protein, especially of animal protein would account for low vitamin B12 which is exclusively formed in animals and probably the low vitamin D result since dairy products, a principle source of this vitamin, are minimized. The low amount of fat could account for diminished levels of alpha linolenic acid, especially for EPA and DHA (which measured zero) as well as for vitamin D. Finally, the high amount of dietary carbohydrate resulted in a large glycemic load. Whether this finding is of consequence or not can be elucidated by examination of which type of carbohydrates are contained in the diet. Table 2 shows natural sugars and added sugars which have high glycemic indices to be of minimal amount while fiber which has a low glycemic index to be more than ample. Meta-analyses suggest that foods with a low GI or GL may confer benefit in terms of glycemic control [14]. The quality and not the quantity in the amount of carbohydrate is the important factor as emphasized by Sievenpiper [15]. Diet 2 which is high fat, low carbohydrate and moderate protein is claimed by the manufacturer to be "fat burning" since very low carbohydrate intake (20 -35 gm/day at the start of the diet) triggers mobilization of lipid stores stimulating formation of ketone bodies which can have beside weight loss, therapeutic benefits such as reducing risk of insulin resistance and type 2 diabetes [16]. It should be mentioned at this point that our paper solely evaluates nutrient adequacy of the two diets and makes no judgment of manufacturer's health claims. For those interested in this type of information, attention is directed to the excellent articles by Freedman et al. [17], Strychar [18] and Anderson et al. [19], the latter of which reports clinical results related to eight commercial weight reduction plans including the two diets in our study. Diet 2 has been formulated to promote ketogenic metabolism. This is accomplished by high fat content and very low amount of carbohydrate. Consequently, the aberrations in the results section for total fat, percent fat, total saturated fat, percent saturated fat, total carbohydrates and percent carbohydrates are intentionally made by the manufacturer. End results of this formulation are high dietary cholesterol and diminished intake of B-complex vitamins (Vitamin B1, niacin, total folate) and fiber which are all associated with carbohydrate content. An additional effect of low amount of carbohydrate is loss of body water. To prevent dehydration and electrolyte imbalance, at least eight glasses of water, 8 oz each are recommended accompanied by at least 4000 mg sodium (well above the DRI), 3000 mg potassium and 400 mg magnesium. Since the amount of fat and animal protein are in abundance, one would not expect reduced levels of fat-soluble vitamins or essential fatty acids as reported in table 3. A possible explanation is that the 5 meals selected missed menus that included seafood products of which several were included in the recipe manual.

Strengths of this study include the manner of data entry and diet analysis. Many dietary studies examine the amount of nutrients consumed by individuals which is susceptible to recall errors. Here we have exact ingredients and portion sizes, copied directly from the recipe books. In addition, using the full capacity of the NDSR software, we are able to perform the most extensive analyses of commercial weight loss diets to date. Potential weaknesses include estimated intake of

minor nutrients and determination of a "representative meal." The number of days to validate intake of nutrients has been established using food frequency questionnaires (ffq's), the results of which vary widely. Macronutrients (found in table 2) can be validated within a week, while some micronutrients (tables 3 and 4) may take a month or more [20]. In regard to "reference meal", determination was made using the average of 5 meals, selected at random from the 21 daily meals in the diet manuals. Even though recipes are formulated to produce a relatively consistent meal content, there is still a variation of 900 Kcal between highest and lowest meal energies for diet 1 and 9000 Kcal for diet 2. A "true meal" would require analysis of all 21 meals in the diet manual, however, we believe this result would not differ substantially from our estimate. Although as mentioned previously in the results section, all reference values in the tables are based solely on those of adult men and would not necessarily apply for women or children. Finally, returning to the question posed in the title of this manuscript: "High carbohydrate vs high fat diets: Which is preferable for long term use?" The answer (in this case) is "neither one as described in the recipe booklets." For diet 1, the formulation of macronutrients resulted in suboptimal ingestion of animal protein causing a deficiency of vitamin B12 and vitamin D, and low fat also restricted vitamin D intake as well as reducing essential fatty acid content. The high level of fiber could furthermore compromise absorption of minerals. Overall, diet 1 or eating patterns of similar composition should be "safe" over a long term if accompanied with a vitamin/mineral/essential fatty acid supplement. For diet 2 the formulation of macronutrients resulted in excess amount of fat and fat associated nutrients as well as an insufficiency of carbohydrate and carbohydrate associated nutrients. To comply with DRI/RDA recommendations the formulation of diet 2 would have to be modified, reducing fat and increasing carbohydrate. This alteration however would defeat the ketogenic metabolic scheme and its purpose. Overall, diet 2 or eating patterns of a similar composition would be unsafe over the long term. Similar concern about adverse long term effects of consumption of very low carbohydrate diets has been reported in a recent review by Kirkpatrick et al [21]. In conclusion, although the two commercial weight reduction diets we have chosen differ greatly in composition and have been formulated to promote dissimilar modes of action to reducing risk for chronic diseases. They both satisfy recommendations for most nutrients, 81% for diet 1 and 71% for diet 2. The manner in which they differ is that diet 1 is sustainable over time if supplemented whereas diet 2 is not sustainable over time due to nutritional imbalances and should not be continued.

Acknowledgements

The authors would like to thank Cristina Palacios, PhD - Florida International University, Miami, FL allowing use the NDSR program as part of her grant number 1R01HD098589-01 and for her encouragement in our work.

References

1. Long GE, Sadeghirad B, Ball GCD, et al. Comparison of dietary macronutrient patterns of 14 popular named dietary programs for weight and cardiovascular risk factor reduction in adults: systematic review and network meta-analysis of randomized trials. BMJ (2020): 369.
2. Harnack L. Nutrition Data System for Research (NDSR). In: Gellman MD, Turner JR. (eds) Encyclopedia of Behavioral Medicine. Springer, New York, NY, USA (2013).
3. Rice T, Zannini E, Arendt E, et al. A review of polyols - biotechnological production, food applications, regulation, labeling and health effects. Crit Rev Food Sci Nutr 11 (2019): 1-18.
4. Dreosti IE. Recommended dietary intake levels for phytochemicals: Feasible or fanciful? Asia Pac J Clin Nutr 9 (2000): S119-S122.
5. Ornish D. Stress, diet and your heart. New York, NY. Holt, Rineheart and Winston (1982).
6. Gregory R. 21-day ketogenic diet weight loss challenge. Emeryville, CA. Rockridge Press (2018).
7. Institute of Medicine. Dietary Reference Intakes: The Essential Guide to Nutrient Requirements. Washington, DC: The National Academies Press (2006).
8. National Research Council (US) Subcommittee on the Tenth Edition of the Recommended Dietary Allowances. Recommended Dietary Allowances: 10th edition. Washington (DC): National Academies Press (1989).
9. U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015 - 2020 Dietary Guidelines for Americans.
10. Simopoulos AP, Leaf A, Salem N Jr. Workshop statement on the essentiality of and recommended dietary intakes for Omega-6 and Omega-3 fatty acids. Prostaglandins Leukot Essent Fatty Acids. 63 (2000): 119-121.
11. Jenkins DJA, Kendall CWC, Augustini LSA, et al. Glycemic index: overview of implications in health and Disease. Amer J Clin Nutr 76 (2002): 266S-273S.
12. Merrill AL, Watt BK. Energy of foods. Human Nutrition Research Board, United States Department of Agriculture, Handbook No 74, US Government Printing Office (1973).
13. Hu FB, Willett WC. Optimal Diets for Prevention of Coronary Heart Disease. JAMA 12 (2002): 25692578.
14. Venn BJ, Green TJ. Glycemic index and glycemic load: measurement issues and their effect on diet-disease relationships. Eur J Clin Nutr 61 (2007): S122-S131.

Preston AM, et al., J Food Sci Nutr Res 2023
DOI:10.26502/jfsnr.2642-110000126

15. Sievenpiper JL. Low-carbohydrate diets and cardiometabolic health: the importance of carbohydrate quality over quantity. Nutr Rev 78 (2020): 69-77.

16. Paoli A, Rubini A, Volek JS, et al. Beyond weight loss: a review of the therapeutic uses of very-low-carbohydrate (ketogenic) diets. Eur J Clin Nutr 67 (2013): 789-796.

17. Freedman MR, King J, Kennedy E. Popular diets: a scientific review. Obes Res 9 (2001): 1S-40S.

18. Strychar I. Diet in the management of weight loss. CMAJ 174 (2006): 56-63.

19. Anderson JW, Konz EC, Jenkins DJ. Health advantages and disadvantages of weight-reducing diets: a computer analysis and critical review. J Am Coll Nutr 19 (2000): 578-590.

20. M Nelson, AE Black, JA Morris, et al. Between- and within-subject variation in nutrient intake from infancy to old age: estimating the number of days required to rank dietary intakes with desired precision. Am J Clin Nutr 50 (1989): 155-167.

21. Kirkpatrick CF, Agarwala A, Maki KC. How low should one go in reducing carbohydrate? J Clin Lipidol 16 (2022): 769-775.