

## Blood and Nutritional Profiles of an Individual Consuming a High Protein-Low Fat Diet

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This is the case of a normal weight, physically active 24-year old Puerto Rican woman consuming a highly unusual diet. Through careful selection of foods, the diet contains a high percent protein, a low percent fat, adequate fiber and zero cholesterol. Popular commercial diets high in protein all contain high fat, high cholesterol and low fiber. Blood samples were taken and dietary recalls were collected for 6 consecutive days to evaluate hematological and nutritional parameters. A blood lipid profile showed low circulating levels of cholesterol and triglycerides and a beneficial HDL/LDL ratio. However, nutritional

analysis revealed insufficient ingestion of vitamin D and an unhealthy balance of servings from the food pyramid. Long-term consequences of this diet could put the subject at risk for kidney and bone diseases. Immediate discontinuation of the diet is the preferred recommendation to the subject. This case report illustrates the danger of adapting a self-prescribed eating plan without the consultation of a dietitian or other qualified health professional.

*Key words: High protein diet, High fiber diet, Low fat diet, Nutrition, Diet analysis, Fad diets*

Eating patterns of individuals are important in establishing a long-term life of good health, nutritional deficiency or caloric excess. In developed societies, recommendations for the optimal proportion of carbohydrate, protein and fat in the diet has been the holy grail of professional nutritionists as well as countless "dietary experts." It is a rare best seller book list that does not include at least one "latest dietary breakthrough" scheme. While the principal objective of a diet is to lose weight, there is an increasing tendency for normal weight and even skinny people to adopt an unorthodox eating pattern to achieve perceived health benefits.

### Case Report

This case study reports dietary habits of a 24-yr. old Puerto Rican woman whose height and weight are 5ft 8" and 130 pounds respectively. Body mass index (BMI) is calculated to be 20, which is within the recommended range of 20-25 for normal weight persons (1). Her physical activity level is high, spending ca 2 hrs/day at a health club participating in weight training and aerobic exercise. Her

energy requirement is calculated to be ca. 2450 cal/day (2).

**Nutritional profile.** The subject performed 24-hr dietary recalls for 6 consecutive days, listing all foods consumed and their amounts including supplements. A typical day's intake is shown in Table 1.

Table 1. Meal Pattern for Typical Day

Breakfast	Dinner
10-12 med. egg whites	14 med. egg whites
16 tbs. fat-free margarine*	24 tbs. fat-free margarine
3 tbs. sugar-free maple syrup	4 tbs. sugar-free maple syrup
1 cup Special K cereal (dry)	1 cup Special K cereal (dry)
4 spears broccoli	6 spears broccoli
1 cup coffee (black)	4 tbs. chunky peanut butter
	2 (8-oz) glasses diet cola
Lunch	Snack
10 med. egg whites	6 med. egg whites
16 tbs. fat-free margarine	16 tbs. fat-free margarine
4 tbs. sugar-free maple syrup	2 tbs. sugar-free maple syrup
5 spears broccoli	2 spears broccoli
4 ice cream cones (sugar free)	2 ice cream cones (sugar free)
2 (8-oz) glasses diet cola	2 cups coffee (black)

\*Fat-free margarine contained no trans fatty acids.

#### Vitamin supplement

1200 mg calcium	50 mg vit B <sub>6</sub>
250 mg vitamin C	400 µg folic acid
200 mg Tocopherol (vit E)	100 µg vit B <sub>12</sub>

A nutritional analysis of the 24-hr recalls was carried out using the Minnesota Nutrition Data System 32 which contains more than 6000 brand name foods and 16,000 other foods (See Table 2). Results from Table 2 show little day to day variation in nutrient consumption as indicated

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**Table 2.** Nutritional Analysis of Diet

Nutrient	RDA	Average for 6 24-hr recalls	Standard Deviation
Energy (Kcal)	2450	2422	300
Protein (g)	46	248	23
Fat (g)		34	20
Carbohydrate (g)		283	71
Protein (%)	12	41.5	3.1
Fat (%)	30	13.1	7.7
Carbohydrate (%)	60	46.7	8.1
Caffeine (mg)		464	34
Calcium (mg)	1200	1950	81
Iron (mg)	15	28	17
Magnesium (mg)	280	543	42
Phosphorus (mg)	1200	1400	161
Potassium (mg)	3500	4282	230
Sodium (mg)	<2400	8919	1804
Zinc (mg)	12	20.5	14.2
Copper (mg)	1.5-3.0	2.3	0.5
Selenium (µg)	55	340	53
Total vitamin A (µg)	800	9012	2197
-carotene (µg)	Ca 2 x retinol to meet vit A requirement	10762	2107
-Tocopherol (mg)	8	248	2
Vitamin D (µg)	10	5.2	4.7
Vitamin C (mg)	60	658	127
Thiamin (mg)	1.1	4.0	2.2
Riboflavin (mg)	1.3	9.7	2.0
Niacin (mg)	1.5	44.9	22.3
Folacin (µg)	180	1404	435
Pantothenic acid (mg)	4.0-7.0	5.2	0.6
Vitamin B-6 (mg)	16	54	2.5
Vitamin B-12 (µg)	20	103	0.5
Cholesterol (mg)	<300	0	0.4
Total g SFA		6.8	4.0
g MFA		15.5	9.6
G PFA		10.1	5.6
P:S	1.0	1.8	0.6
Percent SFA (%)	<10	2.6	1.5
Percent MFA (%)		5.9	3.6
Percent PFA (%)		3.8	2.2
Dietary fiber (g)	20-35	41.9	6.7
Animal protein (g)		177	24
Vegetable protein (g)		68	17
Sucrose (g)		19	5
Water (g)	1340-1500	5288	376

by the low standard deviation. Most nutrients are ingested well in excess of their recommended dietary allowances (RDA) with the exception of vitamin D, which is only half the RDA. Low consumption of vitamin D is a common observance in persons limiting fat intake. Vitamin D deficiency can be a major risk factor for bone loss and fracture (3).

**Table 3.** Healthy Eating Index

Component	Scoring range	Criteria for maximum score of 10	Criteria for minimum score of 0	Subject score
Grain consumption	0-10	9 or 7.4 servings	0 servings	6.7
Vegetable consumption	0-10	4 or 3.5 servings	0 servings	10
Fruit consumption	0-10	3 or 2.5 servings	0 servings	0
Milk consumption	0-10	3 or 2 servings	0 servings	0
Meat consumption	0-10	2.4 or 2.2 servings	0 servings	10
Total fat intake	0-10	≤ 30% of energy from fat	≥ 45% of energy from fat	10
Saturated fat intake	0-10	< 10% of energy from saturated fat	≥ 15% of energy from saturated fat	10
Cholesterol intake	0-10	≤ 300 mg	≥ 450 mg	10
Sodium intake	0-10	≤ 2400 mg	≥ 4800 mg	0
Dietary variety	0-10	≥ 24 different items over 3 d	≤ 9 different items over 3 d	8
Total Score				64.7

If supplements were not considered, vitamins B<sub>6</sub>, B<sub>12</sub> and calcium would also be below RDA values. Other noteworthy findings are a high percent protein (ca 3.5 x RDA), low percent fat (ca 40% suggested value) and slightly low percent carbohydrate (ca 78% suggested value). Caffeine consumption is ca twice the US average for adults of 4-mg/kg (4). While consumption of caffeine above 400 mg/d is associated with bone loss in post-menopausal women (5) levels below 800 mg/d are generally considered safe (6). Sodium is more than 3.7 times the RDA, dietary cholesterol is essentially zero. While analysis of specific nutrients is of interest, most nutritionists now believe that dietary quality depends upon intake of food groups. To this purpose, the United States Department of Agriculture (USDA) has developed the Healthy Eating Index (HEI) which is composed of 10 food components adapted from the Dietary Guidelines for Americans and the food guide pyramid (7). HEI for the study subject is presented in Table 3. Her total score of

64.7 falls below the average score of 77.3 in a clinical sample of women (8).

Fasted samples were collected and standard chemistries performed. Results are presented on Table 4. Hematology and comprehensive tests fall within normal ranges.

Due to the low percent dietary fat in the reported case, focus is directed toward the lipid profile (Table 4). Total cholesterol is below the 4<sup>th</sup> percentile for adult women (9) and serum triglycerides are below the 5<sup>th</sup> percentile in

**Table 4.** Blood Profile of Subject

Test	Units	Results	Normal Range	
<b>Hematology</b>				
White blood cell count	X10-3/C.MM	7.40	4.80	10.80
Red blood cell count	X10-6/C.MM	4.33	4.20	5.40
Hemoglobin	G/DL	13.50	12.00	16.00
Hematocrit	%	41.30	36.00	46.00
MCV	FL	95.38	81.00	99.00
MCH	PG	31.18	27.00	31.00
MCHC	GM/DL	32.69	26.00	40.00
Platelet count	x10-3	241.00	140.00	400.00
RDW	CV %	12.70	11.50	14.50
<b>Comprehensive Panel</b>				
Glucose	MG/DL	93.00	65.00	110.00
Blood urea nitrogen	MG/DL	19.00	7.00	20.00
Creatinine	MG/DL	0.70	0.70	1.50
Bun/Creat ratio		27.14	7.00	25.00
Sodium	MMOL/L	140.00	135.00	145.00
Potassium	MMOL/L	4.20	3.50	5.10
Chloride	MMOL/L	103.00	96.00	110.00
Carbon dioxide - total	MMOL/L	27.00	22.00	31.00
Anion gap	MMOL/L	10.00	7.00	16.00
Calcium	MG/DL	9.10	8.40	10.20
Protein total	G/DL	7.20	6.30	8.40
Albumin	GM/DL	4.00	3.50	5.00
Albumin/Globulin ratio		1.30	1.10	2.20
AST (SGOT)	U/L	27.00	8.0	50.00
ALT (SGPT)	U/L	43.00	9.00	72.00
Alkaline phosphatase	U/L	52.00	38.00	126.00
Bilirubin total	MG/DL	0.20	0.10	1.30
<b>Lipid Profile</b>				
Cholesterol	MG/DL	109.00	50.00	200.00
Triglycerides	MG/DL	39.00	50.00	250.00
HDL	MG/DL	42.80	35.00	130.00
LDL	MG/DL	58.40	50.00	130.00
VLDL	MG/DL	7.80	8.80	33.00
Cholesterol/HDL		2.55	0.00	4.88
Risk ratios:LDL/HDL		1.36		

women 20-34 yrs (10). While the risk ratios of cholesterol/HDL and LDL/HDL place the subject at very low risk for coronary heart disease, extremely low plasma cholesterol values have been associated with increased risk of suicide (11) as well as colon cancer (12).

## Discussion

Comparison of the subject's diet to four popular weight diets commercially available (13) shows several unique

**Table 5.** Nutrient Analysis of Popular Commercial Diets at 1600 kcal

	Atkins'	Sugar busters	Pritikin	Ornish	Subject*
% Carbohydrate	5	40	73	74	47
% Protein	35	28	18	18	42
% Fat	59	32	9	7	13
% Saturated fat	26.2	9.4	2.9	2.0	3
% Monounsaturated fat	8.6	7.4	3.1	2.8	6
% Polyunsaturated fat	23.5	14.4	3.0	1.9	4
% Alcohol	1	0	0	1	0
Carbohydrate (gm)	21.6	162.4	291.5	299.3	187
Protein (gm)	145.6	113.0	72.8	73.8	164
Fat (gm)	103.5	55.4	16.0	11.9	22
Saturated fat (gm)	46.5	16.7	5.1	3.5	4.4
Monounsaturated fat (gm)	15.3	13.1	5.5	5.0	10.2
Polyunsaturated fat (gm)	41.7	25.6	5.4	3.4	6.7
Cholesterol (mg)	923.9	279.8	57.1	29.5	0
Dietary fiber (gm)	4.0	23.8	40.7	49.1	28
Sugar (gm)	7.8	68.0	112.9	101.3	13

\*Note: Subject intake adjusted to 1600 kcal

features (Table 5) High protein diets such as the Atkins diet and Sugar Busters are associated with high fat, low carbohydrate intake whereas low fat diet such as Pritikin and Ornish are coupled to high carbohydrate and moderate protein content.

The subject has maintained a high protein intake and low fat intake by eating only egg white (which is essentially albumin) and eliminating fat and cholesterol, which are found in the yolk. Likewise selection of non-fat margarine further reduces lipid intake. Similarly, sucrose intake has been minimized though selection of non-sugar syrup and ice cream cones. Nutritional analysis of the subjects' diet for cholesterol and fiber on the other hand, resembles those of a high carbohydrate diet rather than high protein.

Overall the subject has combined positive elements of both a high protein diet and high carbohydrate diet to: 1) limit fat intake, 2) reduce cholesterol intake to zero, 3) provide adequate fiber, 4) keep sucrose intake low, 5) have a good balance of saturated: monounsaturated:

polyunsaturated fatty acids. Analysis of the subject's blood shows a lipid profile of very low cholesterol and triacylglyceride levels with an associated minuscule risk of CHD.

The question is raised if such a diet is recommendable. As summarized above, several indices of good health are associated with this diet, however other considerations make this diet undesirable in the long run. Nutritional analysis shows vitamin D to be only half the prescribed RDA and if supplemental vitamins were not consumed, vitamin E would be insufficient. Of greater importance the healthy-eating index is only 65. Major groups of the food pyramid are deficient or entirely absent most notably the milk and fruit groups. The milk group is a major source of calcium. It is known that high protein diets cause increased need for calcium (14) with the consequences of increased risk of osteoporosis and bone diseases. It is serendipitous that the subject selected Ca supplementation of 1200 mg/d to increase the probability of normal calcium homeostasis.

In conclusion, we recommend that the subject should be advised to discontinue this diet and to adopt a more healthful diet with a better balance of food selections from the pyramid.

### Resumen

Este es el informe del caso de una mujer puertorriqueña de 24 años de edad, con peso normal, quien está consumiendo una dieta muy fuera de lo usual. Mediante una selección cuidadosa de alimentos, su dieta contiene un porcentaje alto en proteínas, bajo en grasa, adecuado en fibras y cero colesterol. Todas las dietas comerciales populares altas en proteínas contienen un alto contenido en grasa y colesterol con un contenido bajo en fibra. Se le tomaron muestras de sangre a la sujeto y se recopiló el historial dietético por 6 días consecutivos para evaluar los parámetros hematológicos y nutricionales. El análisis (perfil) de lípidos en sangre demostró niveles bajos de colesterol y triglicéridos y una razón HD/LDL beneficiosa. Sin embargo, el análisis nutricional reveló una ingesta insuficiente de vitamina D y un balance poco saludable de los servicios de la pirámide de alimentaria. Las

consecuencias a largo plazo de esta dieta podría poner a la paciente en riesgo de enfermedades renales y óseas. La mejor recomendación para ella es discontinuar esta dieta inmediatamente. Este caso ilustra el peligro de adoptar un plan de alimentación prescrito por uno mismo sin consultar a una dietista u otro profesional de la salud cualificado.

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