

A Dietary Approach to Reduce Viral Sickness (DARVS)

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Abstract

There are many components of the diet that are necessary and beneficial to promote health and prevent viral sickness. A Dietary Approach to Reduce Viral Sickness (DARVS) is designed based on sound dietary principles and the correct proportions of foods and beverages across food groups. The DARVS includes whole grains, vegetables, protein and protein-like foods, dairy and dairy-like foods, fruits, and sources of liquid oils. Calories and macronutrients (carbohydrates, proteins, and fats) are balanced to support energy needs and body functioning. Six micronutrients including four vitamins (A, C, D, and E) and two minerals (selenium and zinc) are discussed and highlighted in the DARVS. These micronutrients have antiviral, antioxidant, and/or anti-inflammatory properties. Some of the micronutrients discussed also support immunity and detoxification along with additional dietary considerations of adequate fluid/water, dietary fiber, and beneficial plant (phyto) chemicals.

Keywords: Diet; Food; Health; Virus; Macronutrient; Micronutrient; Carbohydrate; Protein; Fat; Vitamin; Mineral; Water; Fiber; Phytochemical

Abbreviations

AIDS: Acquired Immunodeficiency Syndrome; ALA: Alpha-Linolenic Acid; Cals: Calories; Carb: Carbohydrate; DARVS: Dietary Approach to Reduce Viral Sickness; DHA: Docosahexaenoic Acid; DNA: Deoxyribonucleic Acid; DRI: Dietary Reference Intake; EFA: Essential Fatty Acid; EPA: Eicosapentaenoic Acid; HCoV: Human Coronavirus; HIV: Human Immunodeficiency Virus; LA: Linoleic Acid; mcg: microgram; mg: milligram; Pro: Protein; RAE: Retinol Activity Equivalents; RNA: Ribonucleic Acid; SARS: Severe Acute Respiratory Syndrome

Introduction

Among the many systems in the human body is the immune system that provides the body with a powerful ability to remain healthy against foreign invaders and abnormalities. A dietary approach can be followed to maximize the functionality of the immune system. This increases the potential to promote health amidst the many types of pathogenic foreign threats to humans of which viruses are one.

Viruses are small parasites. Once a virus invades the body it uses cell machinery to replicate and survive. Viruses can be deoxyribonucleic acid (DNA) or ribonucleic acid (RNA) genetic material encapsulated in a protein virion shell. DNA viruses directly integrate into host DNA while RNA viruses reverse transcribe to DNA using cell machinery and then integrate into host DNA. Once a virus is integrated into the host cell, it can monopolize cell functions and resources for its own replication and continued infection [1]. Examples of disease-causing viruses now and in human history are influenza, coronavirus, human immunodeficiency virus (HIV), and the Ebola virus.

Influenza virus strains implicated in pandemics include H1N1 causing the Spanish flu, pH1N1/09 causing swine flu/Mexican flu, H2N2 causing the Asian flu, and H2N3 causing Hong Kong flu [2]. The human coronaviruses (HCoV) cause severe acute respiratory syndrome (SARS) along with the common cold [3,4]. The disease has been referred to as SARS-CoV. More recently, the novel SARS-CoV-2 virus has caused the disease COVID-19 and pandemic [5]. The HIV virus causes acquired immunodeficiency syndrome (AIDS). The Ebola virus causes Ebola virus disease previously called Ebola hemorrhagic fever [6].

The immune system is comprised of several organs and cell types. When it encounters a threat like a viral invasion, it mounts a reaction to counteract it. This requires a significant amount of energy and nutrients to send out communication messages, elicit immune cells, present cells with the invader, build an army of antibody generating specific cells to neutralize the invader, and in many cases build a memory or immunity to the invader for possible repeat invasions [7]. The entire immune cascade requires proper nutrition to keep immune-mediated inflammation under control, neutralize reactive oxygen species generated by some immune cells when destroying invaders, and support immune cell differentiation/maturation and proliferation [7].

Eating a healthy diet will promote a strong immune system. This will help a person fight viral infection, recovery from it, and possibly develop immunity to the virus strain [8]. There are many aspects of the healthy diet including proper intake of calories, macronutrients, micronutrients, fluid, dietary fiber, and phytochemicals.

Diet planning for macronutrients

A healthy diet should be composed of the correct proportions of foods and beverages across food groups and provide an appropriate balance of energy (calories) from the energy-producing macronutrients: carbohydrates, proteins, and fats along with the essential non-energy-producing micronutrient vitamins and minerals (See table 1 and 2). Other necessary or beneficial dietary components include adequate intake of water/fluid and dietary fiber, as well as consuming a variety of phytochemicals from plant foods [9,10].

Carbohydrates

The majority of calories in the diet should be from complex carbohydrates. The adult diet should provide 45 - 65% of calories from carbohydrates with added simple sugar intake limited to less than 10% of calories. Eating complex carbohydrates from whole grains (like whole wheat, brown and wild rice, cornmeal, quinoa, barley, rye, and sorghum), legumes (dried beans, peas, and lentils), vegetables and fruits will provide adequate dietary fiber. Alcohol intake should be limited or eliminated [9-11].

Proteins

The adult diet should provide 10 - 35% of the calories from protein. Intake should be minimally adequate to meet the dietary reference intake (DRI) of 0.8 grams per kilogram body weight for adults. Protein intake is very important during an immune response because immune cells communicate with proteins called cytokines, directly kill pathogens with complement proteins, expand clones of cells requiring proteins for cell division, and create specialized antibody proteins to bind to pathogens and tag them for destruction. Excellent sources of proteins are lean meat, fish, poultry, and eggs. Good plant sources of protein that should be combined across food groups in vegetarian diets are grains, legumes, vegetables and nuts/seeds [9-11].

Fats/lipids

The adult diet should provide 20 - 35% of calories from fat. The type of fat is important. Solid saturated fat should be limited to less than 10% of calories. Adequate essential fatty acids (EFAs) are omega-6 linoleic acid (LA) and omega-3 alpha-linolenic acid (ALA). EFAs should come from nuts, seeds, and plant oils. Additional anti-inflammatory omega-3 fatty acids called eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) should come from fatty fish like salmon, herring, and sardines. Omega-9 oleic acid from olive oil should be included to balance the fat in the diet. In general, excellent food sources of fats/lipids are almonds, walnuts, hazelnuts, pistachios, sunflower seeds, pumpkin seeds, flaxseeds, chia seeds, nut butters and liquid vegetable oils. Liquid vegetable oils like olive, sunflower,

safflower, corn, canola, soybean, and other oils, and products made with vegetable oils like salad dressing should be consumed as healthy fat food sources [9-11].

Macronutrient	% of Calories	Food Sources	Special Considerations
Carbohydrate	45 - 65	Whole grains, legumes, vegetables and fruits.	Limit added sugars, refined grain products, and alcohol
Protein	10 - 35	Lean meat, fish, poultry, eggs, grains, legumes, and vegetables.	Consume adequate protein to support immune responses.
Fat	20 - 35	Nuts, seeds, plant and olive oils, and fatty fish.	Limit solid saturated fat and promote healthy essential (LA, ALA) and anti-inflammatory omega-3 (EPA, DHA and ALA) fats.

Table 1: Diet planning for macronutrients.

Diet planning for micronutrients

The essential vitamins include the fat-soluble vitamins A, D, E, and K and the water-soluble vitamins thiamin, riboflavin, niacin, choline, pantothenic acid, vitamin B₆ (pyridoxal 5'-phosphate derivatives) biotin, folate (folic acid), vitamin B₁₂ (cobalamin), and vitamin C (L-ascorbic acid). The essential minerals include calcium, chloride, chromium, cobalt, copper, fluoride, iodine, iron, magnesium, manganese, molybdenum, phosphorus, potassium, selenium, sodium, sulfur, and zinc [11]. The DARVS focuses on four vitamins (A, C, D, and E) and two minerals (selenium and zinc). These micronutrients are highlighted due to their antiviral, antioxidant, anti-inflammatory, and/or pro-immune properties (Table 2 and 3).

Vitamin A

Vitamin A is a family of compounds that come from animal sources as provitamin A or plant sources as provitamin A that can be converted to active vitamin A. Vitamin A in it's various forms has many functions in the body including vision, growth, reproduction, embryonic development, gene expression, and immune function. Provitamin A forms like beta-carotene have antioxidant properties. The animal provitamin A food sources are liver, egg yolk, fortified milk, cheese, and butter. Plant food sources of provitamin A are yellow/orange or dark green vegetables and fruits like spinach, apricot, cantaloupe, squash, carrot, pumpkin, and sweet potato [10-12].

Vitamin C

Vitamin C is most commonly chemically known as L-ascorbic acid. Vitamin C is needed to make collagen, a component of many connective tissues and to make carnitine and neurotransmitters. It is also widely known as a water-soluble antioxidant. Good food sources of vitamin C are in plant foods including citrus fruits (orange, grapefruit, lemon, and lime), berries, kiwi, melons, cabbage-family (cruciferous) vegetables (cauliflower, broccoli, cabbage, brussels sprouts), and peppers [10-12].

Vitamin D

Vitamin D is chemically known as 1,25-dihydroxyvitamin D3 and also called calcitriol. It has steroid-like chemistry and hormone-like functions in the body. Key roles of vitamin D are to regulate calcium and phosphorus balance. It is also prodifferentiative meaning that it promotes cell maturation. This is important in the clonal expansion and maturation (specialization) of immune cells. Vitamin D is not widely found in the food supply. Food sources of vitamin D are fatty fish, cod liver oil, mushrooms, egg yolk, butter, and fortified products like milk and milk-alternatives. Vitamin D can be synthesized from cholesterol upon skin exposure to ultraviolet B light given off by the sun. Self-synthesis is reduced by factors such as cloud cover, sunscreen, air pollution, and increased geographical distance from the equator [10-12].

Vitamin E

Vitamin E is a family of tocopherol and tocotrienol compounds naturally found in plant foods. Vitamin is best known as a fat-soluble antioxidant. Key food sources of vitamin E are vegetable oils, nuts, seeds, and fortified foods [10-12].

Selenium

Selenium is an antioxidant nutrient. It is a cofactor for the antioxidant enzyme glutathione peroxidase and functions to chemically restore vitamin C’s antioxidant ability. Selenium is also a component of many selenoproteins that function in many ways including to support immunity and control inflammation. The most reliable food sources of selenium are organ meats, muscle meats, and seafood but selenium can be found in grains, dairy, fruits, and vegetables [10-12].

Zinc

Zinc is necessary for the functioning of numerous enzymes making it important for the synthesis of DNA and proteins, immunity, vitamin A transport, taste perception, wound healing, gene expression, insulin activity, and several other body functions. Food sources of zinc are shellfish including oysters, meats, organ meats and to a lesser extent whole grains and fortified cereals [10-12].

Micronutrient	DARVS Function	Sources
Vitamin A	Immunity, antioxidant (provitamin A)	Previtamin A: Liver, egg yolk, fortified milk, cheese, and butter. Provitamin A: Spinach, apricot, cantaloupe, squash, carrot, pumpkin, and sweet potato.
Vitamin C	Water-soluble antioxidant	Citrus fruits, berries, kiwis, melons, cruciferous vegetables, and peppers.
Vitamin D	Immunity, pro-differentiation	Fatty fish, cod liver oil, mushrooms, egg yolk, butter, and fortified foods. Self-synthesis from sunlight exposure.
Vitamin E	Fat-soluble antioxidant	Vegetable oils, nuts, seeds, and fortified foods.
Selenium	Antioxidant, anti-inflammatory, immunity	Meats, seafood, grains, dairy, fruits, and vegetables.
Zinc	Immunity, vitamin A transport.	Shellfish, meats, whole grains, and fortified foods.

Table 2: Diet planning for micronutrients.

Additional diet planning considerations

A healthy diet should also be adequate in fluid/water and include whole fresh foods from across the food groups: grains, vegetables, protein and protein-like foods, dairy and dairy-like foods and beverages, fruits, and sources of liquid oils [9]. Adequate fluid intake from water, green and herbal teas, and fluid rich foods like fruits and vegetables supports optimal body functioning through proper hydration and functioning of detoxification systems in the body. Consuming whole fresh plant foods will provide an abundance of nonessential yet health promoting plant (phyto) chemicals. The broad categories of phytochemicals are phytosterols, polyphenols, terpenes, and thiols. Phytochemicals with key DARVS properties are found in three of the four categories: polyphenols, terpenes, and thiols. Polyphenols are a broad group of phenolic compounds including subgroups of curcuminoids, chalcones, flavonoids, lignans, simple phenolic acids, stilbenes, and tannins. Terpenes include the subgroups of carotenoids and limonoids. Thiols are organosulfur compounds and include the subgroups of glucosinolates and indoles. There are hundreds of beneficial phytochemicals in whole fresh plant foods. Key DARVS phytochemicals are shown in table 3. These include curuminoid polyphenols from cumin and turmeric, quercetin a polyphenol flavonoid in fruits and vegetables, catechins like epigallocatechin gallate, also a polyphenol flavonoid abundant in green tea, and resveratrol, a stilbene polyphenol found in the skins of red grapes and berries [10,13].

DARVS Property	Dietary Component
Antiviral	Vitamin: D Mineral: Zinc Phytochemicals: Polyphenols and limonoid terpenes.
Antioxidant	Vitamins: C and E Minerals: Selenium and zinc Phytochemicals: Polyphenols and carotenoid terpenes.
Anti-inflammatory	Vitamin: A Fatty Acids: EPA, DHA, and ALA Phytochemicals: Polyphenols, limonoid terpenes and indole thiols.
Pro-Immune	Vitamins: A, D, B ₆ , B ₁₂ and folate Minerals: Iron and zinc Phytochemicals: Indole thiols.
Detoxification	Fluid, dietary fiber from whole plant foods, some essential micronutrients, and some phytochemicals like limonoid terpenes and glucosinolate thiols.

Table 3: Dietary components and their DARVS properties.

Overall DARVS diet plan

The overall adult DARVS diet plan is based on consuming whole fresh foods across the food groups. A balanced proportion of foods from healthy grains, colorful vegetables, protein and protein-like foods, dairy and dairy-like foods, colorful fruits, and healthy fats/oils should be planned and consumed each day. The proportions from each food group are shown in table 4 by three estimated calorie intake levels for moderately active individuals: 1,800, 2,400 and 3,000 calories. A sample 2,400 calorie DARVS diet is designed for adults and shown in table 5 with nutrient data obtained from the United States Department of Agriculture, agriculture research service [14].

Food Group	1,800 Calorie Diet	2,400 Calorie Diet	3,000 Calorie Diet
Healthy Grains	5 ounces	7 ounces	9 ounces
Colorful Vegetables	3 cups	4 cups	5 cups
Protein-Like Foods	6 ounces	8 ounces	10 ounces
Dairy-Like Foods	3 cups	3 cups	3 cups
Colorful Fruits	2 cups	3 cups	4 cups
Healthy Fats/Oils	2 tablespoons or equivalent	3 tablespoons or equivalent	4 tablespoons or equivalent
Fluids	88 fluid ounces (11 cups)	104 fluid ounces (13 cups)	120 fluid ounces (15 cups)
Extras	No more than 100 calories	No more than 150 calories	No more than 200 calories

Table 4: DARVS plan for three calorie levels.

For healthy grains, eat a variety mostly from whole grains like whole wheat, brown and wild rice, cornmeal, quinoa, barley, rye, and sorghum. For colorful vegetables and fruits, eat a variety of fresh, cooked, dried, or frozen vegetables and fruits from green, red, purple/blue, orange, yellow, and white including raw, cooked, leafy, and starchy vegetables. For fruits, consume berries, citrus, tropical, melons, grapes, and apples. For protein and protein-like foods, eat sufficient lean or low-fat meat, poultry, fish, and eggs. Protein intake can also be supported by consuming dairy foods and beverages and by combining protein-rich plant foods across grains, vegetables, legumes, and

A Dietary Approach to Reduce Viral Sickness (DARVS)

	Cals	Carb (g)	Fat (g)	Pro (g)	Vit A (mcg RAE)	Vit C (mg)	Vit D (mcg)	Vit E (mg)	Se (mcg)	Zn (mg)
Egg, 1 large	74.4	0.5	5.0	6.3	90.5	0	1.24	0.96	15.6	0.63
Bread, Whole Wheat, 2 slices	181.4	31	2.5	4.5	9.0	0	0	0.4	18.5	1.27
Orange, 1 Medium	61.6	15.4	0.16	1.3	93	69.7	0.24	0	0.66	0.09
Butter, salted, 1 teaspoon	35.8	0	0	4.0	34.2	0	0	0.12	0.05	0
Green Tea, 16 fluid ounces, 2 cups	0	0	0	0	0	0	0	0	0	0
Fortified Almond Milk, 8 fluid ounces, 1 cup	36.6	1.4	2.7	1.5	105	0	2.44	6.86	0.49	0.17
Chicken, 3.5 ounces white meat	153	0	4.1	27.1	8	0	0.1	0.27	25.8	0.78
1.5 cups cooked brown rice	357	74.4	2.8	8	0	0	0	0.50	16.95	2.07
Butter, salted, 1 teaspoon	35.8	0	0	4.0	34.2	0	0	0.12	0.05	0
Mixed vegetables, 1 ½ cups	177	35.6	0	8	582	8.7	0	1.04	0.82	1.34
Mushrooms, maitake, ½ cup	11	2.5	0	0.7	0	0	9.85	0	0.77	0.26
Olive oil, 1 tablespoon	119	0	13.5	0	0	0	0	1.94	0	0
Fortified Almond Milk, 8 fluid ounces, 1 cup	36.6	1.4	2.7	1.5	105	0	2.44	6.86	0.49	0.17
Mixed berries, 1 cup	46.1	11.1	0.4	1	1.5	84.7	0	0.42	0.58	0.20
Vanilla Yogurt, 1 cup	208	33.8	3.1	12.1	29.4	2.0	2.94	0.49	12	2.03
Flaxseed, ground, 1 Tablespoon	37.4	2	3.0	1.3	0	0	0	1.4	1.78	0.30
Oats, ½ cup	153.5	27.4	2.6	5.4	0	0	0	0.17	11.7	1.48
Herbal Tea, 16 fluid ounces, 2 cups	0	0	0	0	0	0	0	0	0	0
Salmon, poached, 4 ounces	181.6	0	6.3	29.3	39.7	0	15.52	0.57	44.8	0.56
Sweet Potato, 1 medium	162	25.2	6.3	2	1150	18.2	0	2.1	0.3	0.29
Broccoli, Steamed, 1 cup	54.6	11.2	0.6	3.7	120	101.2	0	1.13	2.50	1.02
Apple, 1 medium	94.6	25.1	0.3	0.5	5.5	8.4	0	0.33	0	0.73
Walnuts, 1 ounce	185	3.9	18.5	4.3	0.3	0.4	0	0.2	1.39	0.88
TOTALS	2,402	302	75	127	2407.3	293.3	34.8	25.9	155.2	14.3
% Adult Intake	100%	50.3% Cals	28.1% Cals	21.6% Cals	267% male 344% female	326% male 391% female	232% male 232% female	173% male 173% female	282% male 282% female	130% male 179% female

Water throughout the day, 56 fluid ounces	0	0	0	0	0	0	0	0	0	0
Adult Male Recommended Intake (19-70 years)	3067	45-65% Cals	20-35% Cals	56g and 10-35% Cals	900	90	15	15	55	11
Adult Female Recommended Intake (19-70 years)	2403	45-65% Cals	20-35% Cals	46g and 10-35% Cals	700	75	15	15	55	8
Adult Tolerable Upper Intake Level (UL) (19-70 years)	n/a	n/a	n/a	n/a	3,000	2,000	100	1,000	400	40

Table 5: Sample 2,400 calorie DARVS diet.

nuts/seeds. For dairy and dairy-like foods, eat dairy products or dairy-like foods that are rich in calcium and vitamin D like low-fat milk, non-dairy milk-substitutes, yogurt, and cheese. For healthy fats, eat a variety of liquid fat sources from nuts, seeds, nut/seed butters, avocados, liquid at room temperature vegetable oils (olive, sunflower, safflower, corn, canola, soybean, etc.), and products made with vegetable oils like salad dressing. Fluid intake should promote normal body functioning and waste excretion. Fluid should be consumed from water, non-sugary and non-fat beverages like herbal teas and coffee, and fluid-rich foods like fruits and vegetables. Extras are components of the diet that may enhance flavor, texture, and aroma but not add nutritional value. Overconsumption of extras can impede nutrient adequacy and dietary balance. Thus, the intake of extras should be limited. Extras include added sugars and solid fats. Sources of added sugars in the diet are baked goods, sweets, candies, sodas, and alcoholic beverages. Sources of solid fats in the diet are butter, animal fats in high fat meats and dairy products, and tropical oils like coconut and palm oils.

Summary and Conclusion

The DARVS diet is designed from sound dietary principles to promote the correct proportions of foods and beverages across all of the foods groups. When followed consistently it has the potential to strengthen immunity, reduce viral sickness, and promote health. The DARVS diet plan includes a variety of whole fresh foods with a balanced intake of Calories, macronutrients, and specific micronutrients. The featured micronutrients (vitamins A, C, D, and E along with selenium and zinc) have antiviral, antioxidant, anti-inflammatory, and/or pro-immune properties. Consuming plenty of fluid, dietary fiber, and phytochemicals support health and detoxification as part of the DARVS.

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None.

Conflict of Interest

None.

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