



Nutrition and training in Taekwon-Do as a Vegan Athlete

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Taekwon-Do is a rigorous physical activity. For an athlete to excel in Taekwon-Do he or she requires a diet rich in macronutrients: protein, carbohydrates and fats as well as micronutrients: vitamins and minerals (*It should also be noted that dietary habits and choices not only impact on a Taekwon-Do student's training regime they also play a significant role in the quality of life, health and longevity of the student*). There is a great deal of information that promotes an animal-based diet as the best means to achieve optimal nutrition for athletic endeavors as well as day to day living. This paper will outline how a vegan (or plant based) diet can also provide the * full spectrum of macro and micro nutrients (including protein, iron and calcium) required for proper health, the energy demands for everyday living and training in Taekwon-Do. While there are no publicly acknowledged elite vegan Taekwon-Do athletes many other sports include athletes that have achieved remarkable success on a vegan diet. Several examples are jujitsu world champion David Meyer, MMA champion Mac Danzig, ultra marathon's greatest runner Scott Jarek, basketball star Kyle Irving, soccer great Alex Morgan, European power lifting champion Patrick Baboumian, world surfing champion Tia Blanco, Olympic gold snowboard medalist Hanah Teter, and tennis icons Novak Djokovic and Venus Williams.

Diet and Nutrition

The term diet is loosely interpreted as the food and drink one consumes on a regular basis to meet one's nutritional needs for life. The Webster dictionary defines nutrition as the sum of the processes by which an animal or plant takes in and utilizes food substances. *Nutrition is what we need for survival, diet is how we choose to get it.* While athletes (like most people) understand the importance of diet it seems as if the elements of proper nutrition, the role they play in well-being and how to meet the daily requirements set by nutritionists and doctors (in particular protein) are a mystery. This paper will review macronutrients and micronutrients, the typical food sources for each and a synopsis of the roles both play in our daily lives.

Macronutrients

- Carbohydrates - Wholegrain cereals (oats, brown rice, pasta, grainy bread), root vegetables
- Protein - Fish, chicken, lean meat, eggs, legumes, nuts, seeds, dairy products, tofu
- Unsaturated fats - Nuts, seeds, fish, olive oil, avocado
- Carbohydrate is the main nutrient that fuels moderate to high intensity exercise. Fat can fuel low-intensity exercise for long periods of time. Protein is generally used to maintain and repair body tissues and is not normally used to power muscle activity.
- One gram of carbohydrates provides 4 calories of energy ~ one gram of protein 4 calories ~ one gram of fat 9 calories
- * Vitamin B12 is an essential nutrient that helps keep your bodies nerve and blood cells healthy. It is mostly found in animal-based foods. Bacteria in the colon produces B12 but B12 can only be absorbed in the small intestine. While a vegan diet can be challenging to meet B12 requirements it can be achieved through fortified foods, nutritional yeasts and supplements. A vegan must make extra effort to ensure he/she consumes an adequate amount of B12 each day.

Calories:

A typical male requires 2500 calories a day while a typical female requires 2200 calories a day. Athletes require can require the consumption of 20% more calories per day. The difference in calorie needs is primarily due to the basal metabolic rate of both sexes. Basal metabolic rate, known as BMR, is the rate at which the body expends energy to maintain essential life functions while at complete rest. As men typically have 30% more muscle than women they burn more calories at rest.

Carbohydrates:

Carbohydrates are the most important source of energy for your body. Digested carbohydrates are converted to glucose for energy production in cells, tissues and organs. Excess glucose is stored in the liver as glycogen for use when required. The actual process of energy creation is beyond the scope of this paper but briefly energy production is reliant on adenosine triphosphate glucose (ATP). ATP is the primary energy-carrying molecule that powers cellular processes. Glucose creates ATP in a cell's mitochondria through a process called cellular respiration.

For the intrepid reader here is the cellular respiration equation.



The Harvard University School of public health has cited unprocessed or minimally processed whole grains, vegetables, fruits and beans as the healthiest sources of carbohydrates. An athlete's diet should consist of 55%-65% carbohydrates.

Fats:

Fats are the primary macronutrient used during low to moderate exercise (light jogging, step sparring practice, light bicycling). Additionally, fats ease inflammation, stabilize heart rhythms, help to absorb vitamins and minerals, improve blood cholesterol levels, and play a number of other beneficial roles. Fats are converted to energy through a process referred to as lipolysis. An athlete's diet should be roughly 15%-25% fat. While it seems, fat is everywhere in the discussion on health it's important to understand that monosaturated and polysaturated fats are the "good fats" saturated fat (found in animal food) the "okay fats" and trans fats, typically found in processed foods, are the "bad fats". "Bad fats" increase LDL (low density lipoprotein) in your blood. This contributes to plaque buildup in arteries leading to heart disease and stroke. *In 2017 Harvard University School of Public Health concluded that monosaturated and polysaturated fats are predominantly found in foods from plants, such as vegetable oils, nuts, and seeds. A vegan with a well-balanced diet and an omega 3 supplement, if required, will be in great form.*

Protein:

The word "protein" can contribute to a simplified view of nutrition, where the focus is solely on protein intake without considering the broader context of a balanced diet. This can lead to unhealthy dietary habits and a lack of understanding of the importance of the other macronutrients carbohydrates and fats.

Proteins are large complex molecules comprised of smaller molecules called amino acids. Amino acids are organic compounds made of carbon, hydrogen, oxygen and/or sulfur. Amino acids are the building blocks of proteins: proteins are the building blocks of muscle mass. There are 20 amino acids in total. When protein is digested it is broken down to its constituent amino acids which are then drawn into the blood stream by transporter molecules and deposited into cells for storage or work and/or teaming up with other amino acids. Proteins participate in virtually every process within cells. Many proteins are enzymes that catalyze(speed up) biochemical reactions and are vital to metabolism. Proteins also have structural or mechanical functions, such as actin and myosin in muscle for muscle contraction and the proteins in the cytoskeleton, which form a system of scaffolding that maintains cell shape. Other proteins are important in cell communication, immune responses, and the cell cycle. Protein is found in all vegetables, grains, legumes, dairy products as well as animal foods. An athlete's diet should be anywhere from 15% to 30% percent protein based.

The Limiting Factor of plant protein

Animal protein provides what is commonly referred to as complete protein because it contains all nine amino acids that cannot be produced by the human body. There are 20 amino acids in total. Animal protein contains all essential amino acids in sufficient levels while plant-based foods typically contain all amino acids but at varying levels. *This varying level is referred to as the limiting factor and can make the protein less valuable to the body.* This can be remedied by combining various foods throughout the day to meet the appropriate amino acid intake for optimum health. Despite the limiting factor of plant-based protein consumption the American Dietetic Association (ADA) found in a 2009 study that a plant-based diet can meet the requirements for daily protein (amino acids). An assortment of plant proteins eaten, over the course of a day can, provide all essential amino acids and ensures adequate nitrogen retention and use in healthy adults. (Nitrogen retention refers to the process by which an organism, like a human or plant, retains nitrogen for the purpose of building and maintaining tissues).

In 2015 EPIC-Oxford further analyzed the dietary intakes and blood levels of amino acids in various diet groups of adult men. The study included 98 men for each diet group (vegan, lacto-ovo, pescos, and meat-eater) and referenced the US Recommended Daily Allowances 1989 study for amino acids. Participants followed their diet for several years.

The study results (below) confirm the ADA's 2009 study that a plant-based diet fulfills the daily protein requirements.

Percentage of RDA of Essential Amino Acid Intakes in Adult Vegan Men			
Amino Acid	Intake g/day	RDA g/day	Percentage of RDA
Isoleucine	2.47	1.29	191
Leucine	4.33	2.85	152
Valine	2.95	1.63	181
Histidine	1.52	0.95	160
Lysine	2.82	2.58	109
Methionine+Cysteine	1.72	1.29	133
Phenylalanine	4.79	2.24	214
Threonine	2.19	1.36	161
Tryptophan	0.77	0.34	226

Micronutrients

- Vitamin A - Milk, cheese, eggs (yolk), orange and yellow fruits and vegetables
- Vitamin B - Legumes, wholegrain cereals, nuts, seeds, green leafy vegetables
- Vitamin C - Citrus fruits, broccoli, strawberry, parsley, cabbage
- Vitamin D - Citrus fruits, broccoli, strawberry, parsley, cabbage
- Vitamin E - Olives and olive oil, avocado, wholegrain cereals
- Iron - Lean meat, green leafy vegetables, legumes
- Calcium - Dairy products, almonds, tahini, green leafy vegetables
- Magnesium - Nuts, seeds, whole grains, legumes, green leafy vegetables
- Zinc - Lean meat, chicken, fish, sunflower and pumpkin seeds
- Selenium - Brazil nuts, wheat germ, sunflower seeds, oats

Micronutrients

Vitamins and food minerals are called *micronutrients* because they are only needed in minuscule amounts by the body each day. The World Health Organization refers to these substances as “magic wands” that enable the body to produce enzymes, hormones and other substances essential for proper growth and development. Some micronutrients have a specialized role, while others fulfill a broad range of functions. Vitamin A is needed for healthy eyesight and

gums, we need vitamin B for energy production, nervous system health and for proper digestion to convert our food into fuel. Vitamin C helps build a healthy functioning immune system. We need vitamin D for strong bones and immune function while vitamin E is a powerful antioxidant that protects body tissue from damage caused by substances called free radicals. Vitamin K is important for blood clotting.

As well as vitamins there are essential minerals that play important roles in the body such as iron which is needed for red blood cell production, calcium for strong healthy bones and teeth, magnesium for nervous system health, and zinc for healthy skin, reproductive and immune function. Selenium is also an important mineral which acts as an antioxidant to protect the body from chronic diseases and premature aging and to fight inflammation.

Legumes, vegetables (including green leafy vegetables), and fruits are rich in micronutrients. All micronutrients (with the exception of B12) can be easily obtained through a plant-based diet. Iron and calcium are often touted as areas of concern for a vegan diet but as we will see later in this paper a plant-based diet can meet the daily requirements. B12 cannot be obtained through a plant-based diet because plants do not produce B12. (While the body produces B12 in the colon B12 is absorbed in the small intestine) Certain algae and seaweed may contain vitamin B12 due to microbes associated with them, but the amount and bioavailability can vary. Fortified foods and B12 supplements have proven themselves as reliable sources of B12 and capable of supporting optimal health.



The infographic is titled "The Best VEGAN SOURCES OF IRON" and is divided into four categories: Fruits & Veggies, Beans (cooked), Nuts & Seeds, and Grains (cooked). Each category lists various food items with their corresponding iron content in mg/cup. A small "Vegan Program" logo is visible in the bottom right corner of the infographic.

Fruits & Veggies mg/cup		Beans (cooked) mg/cup	
● Apricot, dehydrated	7.51	● Soybeans	8.84
● Heart of palm, canned	4.57	● Tofu	6.65
● Potatoes, baked, skin	4.08	● White beans	6.62
● Swiss chard, cooked	3.95	● Lentils	6.59
● Peas	3.84	● Black turtle	5.27
● Raisins	3.10	● Kidney	5.20
● Figs	3.02	● Chickpeas	4.74
● Mushrooms, white	2.71	● Adzuki	4.60
● Spinach	2.70	● Lima	4.49
● Avocado	1.04	● Tempeh	4.48
● Kale	1.00		

Nuts & Seeds mg/cup		Grains (cooked) mg/cup	
● Pumpkin seeds	11.38	● Amaranth	5.17
● Sunflower seeds	9.13	● Buckwheat	3.74
● Cashews	8.22	● White rice	2.77
● Almonds	5.78	● Quinoa	2.76
● Hazelnuts	5.40	● Barley	2.09
● Chestnuts	5.24	● Oat bran	1.93
● Pistachios	4.96	● Bulgur	1.75
● Macadamia nuts	4.94	● Wheat pasta	1.52
● Walnuts	3.40	● Millet	1.10
● Brazil nuts	3.23	● Brown rice	1.03
● Pecans	2.76		

Iron:

Iron is one of the essential heavy metals for human nutrition, and it is a vital element for human life. It makes up just 0.0003% to 0.0005% of your body weight. Iron plays critical roles in oxygen and electron transport, DNA synthesis, cell division, energy production and hormone production. Iron is found in two different forms, heme(ferrous) and non heme (ferric). Heme iron, present in meats, poultry and seafood, is more readily absorbed and has a higher bioavailability than non-heme iron. Non-heme iron, mainly found in plant sources such as beans, nuts, dark chocolate, legumes, spinach, and fortified grains, has about half the bioavailability of heme iron. Non-heme iron is harder to absorb than heme iron primarily because it is subject to absorption

inhibitors in the food matrix. These inhibitors include phytates, tannins, and polyphenols.

RECOMMENDED DAILY INTAKE OF IRON				
Age	Male	Female	Pregnancy	Lactation
Birth to 6 months	0.27 mg*	0.27 mg*		
7–12 months	11 mg	11 mg		
1–3 years	7 mg	7 mg		
4–8 years	10 mg	10 mg		
9–13 years	8 mg	8 mg		
14–18 years	11 mg	15 mg		
19–50 years	8 mg	18 mg	27 mg	9 mg
51+ years	8 mg	8 mg		
* Adequate Intake (AI)				

Calcium:

Calcium plays a significant and diverse role in the body. It is necessary for contracting muscles, forming and strengthening bones and teeth, conducting nerve impulses throughout the body, clotting blood, maintaining a normal heartbeat, as well as other important processes. Dr. Walter Willett, chair of the Department of Nutrition at Harvard T.H. Chan School of Public Health and the World Health organization recommend daily requirements are roughly 500mg. Athletes should add an additional 100-200 mg of calcium.

Calcium Content of Some Common Foods

Food Source	mgs	Food Source	mgs
Almonds, 1 oz	80	Kale, (raw/steamed)	180
Artichokes, (raw/steamed)	51	Kohlrabi, (raw/steamed)	40
Beans, (kidney, pinto, red)	89	Mustard greens, 1 cup	138
Beans, (great northern, navy)	128	Oatmeal, 1 cup	120
Beans, (white)	161	Orange, 1 large	96
Blackstrap molasses, 1 Tbsp	137	Prunes, 4 whole	45
Bok choy, (raw/steamed)	158	Raisins, 4 oz.	45
Broccoli, (raw/steamed)	178	Rhubarb, (cooked) 1 cup	105
Brussels sprouts, (raw/steamed)	56	Rutabaga, (raw/steamed)	72
Buckwheat pancake	99	Sesame seeds (unhulled) 1 oz...381	
Cabbage, (raw/steamed)	50	Spinach (raw/steamed)	244
Cauliflower, (raw/steamed)	34	Soybeans,	73
Collards, (raw/steamed)	152	Soymilk, fortified	150
Corn tortilla	60	Tofu, firm	258
Cornbread, 1 piece	28	Turnip greens, 1 cup	198
Figs, (5 medium)	135	Whole wheat bread, 1 slice	17

Sources: *Back to Eden*, Jethro Kloss; *Health Nutrient Bible*, Lynne Sonberg; website: veggiepower.ca/caltable.htm, chart by Brenda Davis, R.D.

Conclusion

“A nutritive vegan diet can be designed to achieve the dietary needs of most athletes satisfactorily”

D. Rogerson National Library of Medicine September 2017

Study after study has shown that the necessary nutrients including protein, calcium and iron can be obtained from a plant-based diet for individuals, athletes and world champions training under the most strenuous of conditions. B12 consumption must be carefully considered. As well, vitamin D, Omega 3 fat, iron and zinc should also be closely looked at to ensure adequate amounts are consumed each day. With a thoughtful approach to nutrition a Taekwon-Do student can participate in this wonderful martial art as a vegan and even strive for the highest levels of accomplishment.