Nutrition to fuel training in Taekwon Do

Thesis for Grading to IV Dan

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As part of the requirement to grade to 4th Dan, I decided to focus my thesis on sports nutrition as this is something I can use to help myself and others in everyday life. As I'm passionate about Tae Kwon Do, I wanted to find out how I could use food to improve my performance and physique.

Additionally, from the age of about 30, I've begun to notice that I am more prone to injury and that my body is taking longer to recover each time, compared to when I was in my teens or early twenties.

I am hoping that as part of my investigation into sports nutrition, I may be able to help prevent further injuries or assist with the healing process for any injuries I may incur in the years ahead.

While the points of this thesis may be relevant to any sort of sports training, my main goal is to relate it specifically to training in Taekwon Do. As such, from herein on in, while the terms "training", "exercise", or similar may be applicable to many, if not all other sports, in the context of this thesis, it is intended to refer specifically to training in "ITF Taekwon Do".

There are several topics I'm hoping to cover which include but are not limited to; the various varieties of food and nutrient types, digestive health, hydration, weight, bone health, fatigue and recovery, as well as the management and benefits of each.

The Ministry of Health highlights poor diet as the leading cause of death in New Zealand,***** which is why everyone, not just those training in Taekwon Do or any other sports, should continually incorporate a healthy and balanced diet in their lives, as well as regular exercise.

Nutrition is one of the means by which to aid in countering the negative impact of an exercise-induced injury. While the exact effectiveness of many nutrients in assisting the prevention and repair of exercise-induced injuries varies widely, it is evident that deficiencies in energy, protein and other nutrients are major contributors.

There are several main nutrient types that our bodies require in large quantities and can be found in various food groups. These can be defined as Carbohydrates, Proteins, Fats, Fibre & Fluids.

The below is a list which includes some of the foods that contains each of these nutrient types:

Carbohydrates

Carbohydrates can be found in the following food types:

- Fruits and vegetables – The MoH (Ministry of Health) advises we should have at least 5+ serves of everyday for good health (3+ serves of vegetables, 2+ of fruit)
- Breads and cereals - recommended 6+ serves of per day
- Legumes (Peas and beans etc) - recommended at least 1 serve of per day

Note: Foods high in sugar such as lollies and fizzy drinks are also classified as carbohydrates, however due to their excessive sugar content, they should be consumed in moderation.

Fibre

Fibre is a nutrient that passes straight through the digestive system and keeps us feeling full without providing calories, plus they help keep the digestive system healthy and are recommended to prevent bowel cancer.

Fibre can be found in the following foods:

- Fruits
- Vegetables
- Breads
- Cereals

Fats

Fats contain a very high concentrated form of energy, making it very easy to consume too many calories when eating foods containing fat.

There are 2 main types of fats, saturated and non-saturated.

Saturated Fats are 'bad' fats and should be consumed in moderation. These types of fats are known to block arteries and can be found in the following food types:

- Dairy foods such as butter, cream and cheese
- Fatty meats such as beef, pork and lamb
- Processed meats such as salami, sausages, as well as chicken skin

Non-saturated (aka unsaturated) fats on the other hand, are 'good' fats as they help break down the build-up of saturated fats. Non-saturated fats can be found in the following foods and should be consumed regularly:

- Salmon
- Almonds
- Avocado
- Oils such as canola, olive, sunflower and soybean
- Flax seeds

The MoH recommends that between 30-33% of our daily energy intake come from fat. Saturated fat should be no more than 12% of the daily intake.

Protein

Protein is a nutrient required for repair and growth of body tissue. It can be found in the following food types:

- Animal foods
- Meat
- Seafood
- Poultry
- Eggs
- Dairy products

The MoH recommends that protein provides 11-15% of our daily energy intake.

Hydration

It is recommended that we should also consume about 6-8 large glasses of water every day in order to maintain adequate hydration.

Hydration is hugely important when training and too much or too little can have dire consequences. Water in our bodies helps to regulate blood flow, blood temperature and the ability to contract our muscles.

When we exercise, water and sodium are lost through our skin in the form of sweat in order to try and cool our bodies down as they heat up during a workout.

A loss of hydration can affect an athlete's performance due to increased heart rate and temperature. In extreme cases, this can severe consequences or even death as the body is unable to perform its normal functions.

Conversely, too much hydration can not only lead to discomfort, but in extreme cases it can dilute the blood causing sodium levels to become dangerously low. This is known as hyponatraemia which can also be fatal.

Before starting a training session, you should ensure you're adequately hydrated. While you don't want to be uncomfortable by drinking too much, you should aim for pale and abundant urine beforehand.

There is a simple calculation that can be used to ensure adequate hydration is obtained during exercise as outlined below:

- **Fluid loss = Weight before – Weight after**
  Example: 70kg – 69kg = 1kg
  Note: A 1kg weight loss during exercise equals a 1 litre fluid loss.
- **Sweat loss = Fluid lost + Fluid consumed**
  Example: 1 litre + 1.5 litres = 2.5 litres
- **Sweat rate = Sweat loss (litres) divided by number of hours of exercise**
  Example: 2.5 (litres)/3 (hours) = 0.83 litres/hour or 830ml/hour

It's important to note that fluid loss may vary between training intensity and temperature, so it's recommended to repeat the process of calculating this loss during different training sessions and environments to see a pattern being formed. Plain water is ideal for low to moderate intensity training of an hour or less, however as the intensity and/or length or training increases, you may want to consider sports drinks for rehydration as they also contain essential electrolytes (eg. Sodium and Potassium) and carbohydrates.

Low fat milk is also ideal for recovery as it not only rehydrates, but it also contains valuable protein and calcium.

Bone Health

As students of Taekwon Do, we place a great deal of stress on our joints and skeletal structure. We perform a lot of jumping and flying techniques, as well breaking boards. All of these actions may place harsh impacts on our bodies if not performed in the correct manner.

As we age, it becomes increasingly important to look after our bones. That is because there is a continual process of bone regeneration taking place in adulthood which slows down as we age. This causes bone density to decrease as a result. Once this decreases to a certain point, it is known as Osteoporosis.

There are 2 main ingredients which are required to maintain good health but also to prevent Osteoporosis from occurring later in life.

Calcium is one important ingredient in bone health. It is recommended that adults consume at least 500 mg per day and preferably sourced from food, although supplements can assist if required. At least 2 servings daily of dairy products are considered sufficient.

In order for calcium to be absorbed proficiently however, Vitamin D is also required. This is naturally made by the skin when exposed to sunlight, however again supplements may be taken if there is a deficiency.

In addition to diet, bone density and muscle strength can also be maintained through exercise, in particular weight bearing exercises such as running and jumping.

Jumping is something we perform regularly in Taekwon Do. A lot of our techniques are performed flying or jumping, both in training and sometimes during our patterns, however they also performed as part of specialty breaking.

It is for this reason that I consider Taekwon Do to be fundamental in promoting effective bone health.

Suggestions for a healthy diet

Ensure you eat breakfast - You may have heard people say that breakfast is the most important meal of the day. There is a lot of truth to this statement. There are many benefits to having a healthy breakfast, including improved attention, mental performance and memory as well as helping to maintain a healthy weight. **

Skipping breakfast can increase the likelihood of being heavier. Eating breakfast will help you feel full for longer and can help prevent you from snacking on high fat, high sugar choices later in the day, which is what can happen if your blood sugar levels drop and your body is craving a quick sugar fix. Breakfast should include foods high in fibre and protein such wholegrain breads, poached or scrambled eggs and fruit.

While it's important to maintain a healthy diet consistently, this becomes even more important during intensive training. As a Taekwon Do practitioner, I find myself going through periods of moderate training at various times but that increases to intense vigorous training leading up to various goals such as tournaments and gradings.

It's also really important that either maintaining, gaining or losing weight is done in a safe manner and not too rapidly. As such, energy intake from food must match training load as precisely as possible. It's during intense times that it's easy to push ourselves hard physically and to forget the importance of other areas of our health and wellbeing such as nutrition, recovery and rest.

I won't touch too much on the recovery and rest aspects since they're not within the scope of this thesis and could easily form the basis of an entire thesis themselves, except to say that it's equally important to ensure that athletes obtain sufficient rest and sleep in order to prevent physical and metal fatigue.

Fatigue

Fatigue can manifest itself in many ways including tiredness, poor quality sleep, depression, weight loss, loss of appetite, muscle soreness and reduced performance.

Vitamin's D, B12 and folate can all assist with reducing fatigue which can be found in the following foods or from supplements if diet is inadequate:

- Vitamin D: Fatty fish, eg. Tuna and salmon, Soy milk and Orange Juice
- B12: Fish, meat, poultry and milk products
- Folate: Asparagus, eggs, Brussel sprouts, broccoli, citrus fruits, leafy greens and beetroot

It's also important to ensure athletes are eating often enough and not skipping meals. This can also be a major contributor to fatigue. Even if trying to keep weight down due to a particular weight category for sparring at a tournament for example, it is important to maintain eating at regular intervals. Instead of skipping meals, a much safer method is to eat less more often and eat foods with lower calories.

A carbohydrate rich meal such as chicken pasta, a sandwich or cereal with low fat milk should be consumed 1-4 hours before exercise, or alternatively a smaller carbohydrate rich snack such as fruit and yoghurt, a honey sandwich, creamed rice, smoothie or a cereal bar with fruit should be consumed 1-2 hours before training.

Additional carbohydrates should also be consumed during training if it's at high intensity for more than an hour and aim to have a carbohydrate meal or snack within 30 minutes after training to assist with recovery.

Other things to consider in order to combat fatigue include:

- Ensure diet is varied and you're not eating the same things every day
- Adequate iron levels, which can be sourced from foods such as red meat, green vegetables, and grains
- Adequate hydration
- Sufficient sleep (at least 7 hours per night for most people, or 9-10 hours for athletes enduring intense training)
- Ensure that caffeine intake isn't excessive

The Glycaemic Index (GI)

The Glycaemic Index (GI) is a scale that measures how quickly carbohydrates are broken down by the body and the resulting impact on blood glucose levels.

Food and drink is given a score from 1-100 as follows:

Low GI foods – 55 and under

- Heavy, dense grainy breads. E.g. Burgen, Vogel's, pumpernickel
- Rolled Oats, All-Bran, muesli
- Pulses e.g. lentils, chickpeas, kidney beans
- Grainy crackers
- Pasta, instant noodles, egg noodles
- Milk, yoghurt, low fat icecream
- Fresh Apples, under ripe bananas, kiwifruit, oranges, peaches

Medium GI foods – 56 to 69

- Wholemeal bread, pita bread, crumpets,
- fruit bread
- Breakfast cereals, Bran flakes
- Basmati rice, brown rice, couscous
- New potatoes
- Fresh: apricots, mango, pawpaw,
- pineapple, ripe bananas
- Raisins, sultanas

High GI foods – 70 and above

- French bread, English muffins, bagels, scones
- White rice, jasmine rice
- Baked, mashed potato
- Pumpkin, swede
- Sport drinks, jelly sweets, honey, glucose
- White crackers, rice crackers

Foods containing carbohydrates that break down slowly and supply glucose to the body at a steady rate have a low GI, compared with those that break down quickly and release glucose rapidly have a high GI. Foods that have a low GI are considered to be healthy as they stabilise blood sugar levels.

Despite significant research, there is still much debate on the effects of GI foods and their associated performance in relation to sports however opting for foods with a low GI prior to training is thought to be beneficial as it will provide sustained energy release throughout the training session.

As mentioned earlier, carbohydrates should be avoided during training unless it's at a high intensity and for more than hour. If that is the case, and it is deemed necessary, then high GI foods such as the following may consumed at a rate of 30-60g/hour.

High GI ideas may include:
• White bread with jam or honey
• Jelly beans
• Pikelets or crumpets
• Sports drinks and bars
• Sports gels taken with water

Post exercise, it is important to replenish carbohydrates, in order to allow muscles to recover. Unless you're exercising every day, the GI levels aren't terribly important, however if you are (or more than once a day) then higher GI foods such as sports drinks, ripe bananas and a honey or jam (white bread) sandwich are recommended.

It's also important to note that the actual impact of a food on your blood sugar levels is determined not only by the GI of that food but also by the quantity of that food. The combination of different foods consumed together can also affect the overall GI of the meal. These two factors together are known as "Glycaemic Load".

Protein

Proteins are made up of 22 amino acids, of which 8 can only come from certain foods and not produced by the body. These amino acids are used by the body to convert into proteins to make new connective tissue, cell membranes and muscle cells, amongst other various things.

The primary role of protein is for growth and repair but can also be used for energy, similar to carbohydrates and fats.

Below is a table outlining the estimated protein requirements for athletes:

ACTIVITY (REGULAR TRAINING 4–7 DAYS/WEEK)	GRAMS OF PROTEIN PER KG BODY WEIGHT (G/KG) PER DAY
Sedentary	0.8
Regular recreational exercise	1.0
Endurance (general training)	1.2 – 1.6
Endurance (heavy training)	1.5 – 1.7
Resistance training (steady state)	1.0 – 1.2
Adolescents or resistance athlete at start of training	1.5 – 1.7
Football and similar intensive team sports	1.4 – 1.7

Protein can be sourced from a variety of both animal and non-animal based foods which means that both vegetarians and non-vegetarians can receive an adequate amount of protein in their diet. It is recommended to include protein in every meal and snack and especially after a training session to promote recovery.

It is also for this reason that protein supplements such as shakes and bars are not usually needed as most athletes receive adequate protein from their food. This is also advantageous as they also receive the added benefit of additional nutrients from the same food.

The table below outlines examples of foods containing approximately 10g of protein:

ANIMAL FOODS	PLANT FOODS
2 small eggs	4 slices (120g) wholemeal bread
30g (1.5 slices) low fat cheese	3 cups (90g) wholegrain cereal
70g cottage cheese	2 cups (330g) cooked pasta
1 cup (250ml) low fat milk	3 cups (400g) cooked rice
35g lean beef, lamb or pork (cooked weight)	3/4 cup (150g) lentils or kidney beans
40g lean chicken (cooked weight)	200g baked beans
50g grilled fish	120g tofu
50g canned tuna or salmon	60g nuts or seeds
200g low fat yoghurt	1 cup (250ml) soy milk

Weight Management

One of the reasons that a lot of us train in Taekwon Do is for competition, otherwise known as tournaments. A large part of tournaments involves sparring, of which the divisions comprise weight categories.

Some may consider being at the heavier end of the division an advantage over lighter opponents, while some may argue that being lighter may be an advantage due to speed. Either way, some competitors may find it advantageous to either gain or lose weight rapidly leading up to competition

in order to “make their weight”. This may include methods such as severe food and fluid restriction, sauna’s, excessive exercise and even laxatives.

As mentioned earlier, this is an unsafe practice as it can compromise nutritional goals, impair performance and increase the risk for potential medical problems. As such it is recommended to maintain a fully hydrated body weight of no greater than 3-5% of one’s competitive weight.

At a basic level, weight loss is achieved by burning more calories than we consume. Our bodies convert food that we consume into energy when we exercise. Once the energy from the food we have consumed is expelled, our body starts using reserves stored in fat cells to convert into energy.

It is this burning of reserve energy from fat cells that results in weight loss, as the fat cells shrink as the molecules within them are converted into energy used to fuel our workout. While it’s necessary to eat less calories than we expend for effective weight loss, the types of food we eat are equally important due to the way our bodies process different food types. When we eat, glucose (and other sugars) are extracted first from carbohydrates as the primary source of fuel. It is released into the blood stream and used for energy. Once that source is used up, our body then starts burning fat.

It may also be worth noting that various other substances are also absorbed from our foods containing them and released into the bloodstream including protein which is absorbed by the brain, muscles and various other parts of the body and vitamins and minerals.

There is no right or wrong diet that will work for everyone as all of us are unique and we all have different body types and react differently to different foods and exercise etc, however the following is a summary of some healthy guidelines to maintaining a healthy diet and weight management:

- Successful weight loss and maintenance requires long term solutions, so be cautious of fad diets or regimes that eliminate whole food groups.
- Fuel appropriately before and during exercise as well as appropriate recovery after training in order to avoid impacting the quality or variations from training sessions.
- Consume satisfying, but low kilojoule, foods (e.g. salad, berries, soup) to add volume to meals.
- Incorporate protein into meals and snacks to support suppression of appetite and decrease the risk of muscle loss.
- Restrict the consumption of high energy foods such as soft drink, chocolate, take-aways, desserts and alcohol etc.
- Be aware of eating when not hungry, e.g. boredom and procrastination etc. This type of eating may be common when watching TV or gaming for example.

Whether you’re training for a tournament or grading, some other sport or just exercising to stay in shape, the right diet could be the difference between achieving your goals, or working against you by increasing your likelihood of developing an injury.

Goals such as weight management, good health and recovery can all be achieved, in part by eating well and adequate hydration and this becomes even more important as we age, as does exercise.

By incorporating as many of the positive ingredients and attributes stated in this thesis, it is my hope that as well benefiting myself, others may read it and take something away from it themselves that they too can use for their own benefit and assist with their training in Taekwon Do, other sports or another aspect of their life.

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