Dehydration in Taekwon Do

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Some may question the relation ship between dehydration and Taekwon Do. You may ask whether this topic is truly relevant to martial arts, in particular to our art, the Chang Jun style of Taekwon Do. But what may not be relevant to some practitioners of Taekwon Do can certainly be relevant to others. Many topics can be considered relevant to Taekwon Do and relevance needs to be decided by the individual practitioner. Dehydration is a topic of great relevance to me, as I will demonstrate in my paper and the evidence suggests it may be of greater importance to other practitioners than many realise.

What inspired me to do a thesis on a physiological aspect of Taekwon Do?

On 25th of January 1985, at the age of 14, I attended my first Taekwon Do class in Mosgiel. That night, in a class of twenty people, even at that age I discovered that I sweated vast quantities more than anyone else. Throughout the years of training I did not pay much attention to this and didn't rehydrate properly. I noticed that when I was training hard I would become very tired I noticed and my performance suffered at times because of this.

Many mini-experiments have been conducted on myself and other people to test outcomes of these experiments on different people – not always an attractive or intelligent thing to do, many people may think. But the purpose of carrying out an experiment is that the outcome is unknown; we were naïve enough to believe that no harm could occur because of carrying out such experiments.

Training sessions involved such activities as fluid fasting, wearing wetsuits under Do Boks, covering ourselves in vasoline to prevent sweating, training in the midday sun, over-hydrating, taking substances to promote fluid loss and other various tests over long periods of time.

When I met my wife, Nicky McCarthy, who is a registered dietitian, five years ago, she observed the intensity of a Taekwon Do training session and stated in no uncertain terms that she thought I was an idiot, as I didn't drink anything. My fluid intake has since improved and correct prevention of dehydration has followed.

The ITF Encyclopaedia states (pg 25, no 12) 'Adherence to these basic principles is what makes Taekwon Do a martial art, an aesthetic art, a science and sport'. This statement refers to Taekwon Do as a *sport* and a *science*. Dehydration has been a topic of much interest in sports science for many years, as it is an aspect that has been shown to improve the performance of athletes in their chosen sport.

The key aspects of dehydration in Taekwon Do will be explained in my thesis. The purpose of many of the crazy experiments really comes down to how you can improve the way you feel and train by simply looking after your fluid intake.

Dehydration

The human body has complicated mechanisms when it comes to fluid loss. During rest, water and electrolyte balance will occur from evaporation from the skin and respiratory tract and excretion from the kidneys and large intestine. Water loss accelerates during exercise when sweating increases to prevent overheating. Electrolytes including sodium, chloride, potassium, magnesium and calcium are also lost in sweat. The environmental temperature, body size and metabolic rate all affect the fluid balance equation.

Dehydration (also called hypohydration) is the removal of water (hydor in Ancient Greek) from an object. When it relates to humans, it is the condition of the human body when it contains an insufficient volume of water. When this happens, levels of electrolytes, which are normally tightly regulated by the body, become imbalanced, affecting the function of the body's cells. In particular, hypernatraemia (hyper=high, na=sodium, aemia= in the blood) can occur, where the concentration of sodium in the body's fluids is too high.

Initial symptoms of dehydration include headaches (similar to those experienced during a hangover), dizziness, low blood pressure and blurred vision. Dehydration impairs the ability of your heart to work hard and your body's ability to regulate temperature. It can also affect mental function and coordination which are particularly important for a sport such as Taekwon Do. Symptoms usually occur once approximately 2% of the body's weight normal fluid volume is lost. Athletes can suffer reduced performance of up to 50%. If rehydration does not happen, and increased water loss continues dehydration can become very severe. Losses of more than 15% of the body's fluid volume are usually fatal. While it is unlikely that Taekwon Do practitioners will become so severely dehydrated that it kills them, it is likely that many are

suffering from reduced performance as a result of mild dehydration. This is particularly true for people who dehydrate to make weight categories below their usual weight.

Dehydration in Taekwon Do

It is possible to work out your exact fluid requirements in different training and competition situations by weighing yourself before and after exercise. A 1kg loss in weight equates to a loss of 1 litre of body fluid (via sweat and breathing). The amount drunk during exercise should be recorded and added to the amount of fluid lost. This is the total volume of fluid required for similar training sessions. To make the results more accurate, it is important to weight yourself in light, dry clothing with sweat dried off the body. It is also important to use the same set of scales and make sure they are on a firm, flat surface.

Experiment

To determine whether dehydration could be an issue in Taekwon Do if practitioners do not pay aware to correct and adequate hydration, I carried out an experiment at training. Seven Taekwon Do practitioners of different ages, ranks and weights (including one female) were weighed before a 90 minute training session. The session consisted of high impact:

line work
pad work
paddle work
sparring drills
fitness work (including running, press ups and sit ups)

Subjects did not take in any fluid or urinate during the session and were weighed using good quality electronic scales on a hard, flat surface. They were lightly clothed and wore dry clothes (ie not soaked in sweat) for both weigh ins.

Subject	Gender	Rank	Age	Initial weight	Post-training weight	Fluid lost
1	M	III Dan	35	87.0kgs	85.5kgs	1.5L
2	M	II Dan	39	103.7kgs	102.8kgs	0.9L
3	M	I Dan	17	51.5kgs	50.9kgs	0.6L
4	F	I Dan	14	47.8kgs	47.8kgs	0.0L
5	M	2nd Kup	23	66.5kgs	65.7kgs	0.8L
6	M	10th Kup	19	60.7kgs	60.2kgs	0.5L
7	M	10th Kup	21	79.4kgs	78.5kgs	0.9L

The loss of fluid ranged from zero to 1.5litres depending on age, weight, sex and fitness levels. I thought that rank might influence the amount of fluid lost because higher ranks could increase the level of effort thrown towards the session, but this was not a clear outcome of the experiment. If fluid replacement was not adjusted correctly to suit the individuals, it is likely that subjects 1, 2 and seven would be more drained and fatigued than the others. Subject four would possibly feel affected if rehydration was followed at the same levels as other subjects. She could end up drinking more than necessary and end up with a stomach full of fluid or needing to urinate excessively.

Given the fluid losses over the group in that session, it shows how some students have the potential to become dehydrated. This shows what different needs students will have making the correct choice in fluid intake in relation to making weight at a weigh in, or rehydrating at a grading, camp or seminar. Even to make the most of the fast explosive use of your systems in a sparring bout at a tournament. Instructors, coaches and students themselves would benefit from having a good idea of how much fluid you have lost and will require for recovery.

Weighing yourself is probably a bit extreme before and after sessions to decide on fluid intake but perhaps every now and again as your weight and fitness levels change it would be beneficial to do this to get an indication of what you require as a minimum.

Why do we need fluids?

- Fluids are essential for regulating your body's temperature, and to transport nutrients and oxygen around the body.
- By drinking an adequate volume of water you can meet your water needs and reduce your risk of heat illness.
- Performance can be improved by preventing or reducing dehydration.
- Sports drinks provide a good way of consuming carbohydrates that may be needed for extended periods of exercise

The body is not good at signalling when you need to drink during exercise. Often by the time you are thirsty, your body is already partially dehydrated. It is therefore essential to have a plan to maintain an adequate fluid intake. Using a fluid plan during training will influence how well you can train and will give you the opportunity to practise your fluid plan for competition.

You cannot train your body to get used to dehydration – I've tried that. But you can train yourself to drink regularly before, during and after exercise to prevent dehydration.

Guidelines to reduce the risk of dehydration

Baseline fluid needs depend on your body size. Most people require a minimum of 1500-2000mls of fluid each day from food and drink, more in hot conditions or when exercising. Before training it is important to drink as much fluid as is comfortable in the half hour before training. Usually 300-500mls, your urine should be pale in colour.

During training you need to drink the same amount as your body is losing. As shown above, the amount of fluid lost is very individual. Your fluid intake should be spread out over time, for example drinking approximately 250ml every 15 minutes if you calculate that you lose 1litre in an hour's training. Because Taekwon Do is structured differently to many sports e.g. running, cycling, kayaking, practitioners will need to work in with this, for example drinking when the instructor or examiner permits or between events at a tournament or grading.

What about fluid needs after training?

After you exercise you need to drink the equivalent of 1.5 times the amount of body weight you have lost to restore fluid balance. This allows for the fluid that you will continue to lose because of urination. Once again, you can use your before and after training weights to work out your recovery fluid needs.

Hints to help you replace your fluid losses after exercise

- Have drink bottles ready with the volume of fluid you need to replace to replace losses. Start drinking these as soon as you finish your session
- Have a variety of drinks, for example, one bottle with cold water and another with a sports drink
- Ask one of your team-mates or instructor that you train or compete with to remind you to drink

Over-hydration

Fluid replacement is definitely beneficial, but as the saying goes, can you have too much of a good thing? Hyponatraemia (hypo=low, Na=sodium, aemia=blood) is the technical term for low levels of sodium in the blood, caused in athletes by drinking excess amounts of fluid

without adequate electrolytes. Symptoms occur in stages and include weakness, disorientation, seizures and finally coma if the condition is not reversed.

The body's processes that regulate fluid volumes and electrolyte (including sodium) concentrations are highly effective so consuming so much water that plasma electrolytes become imbalanced is difficult under normal circumstances. Marathon runners who lose 3-5 litres of sweat and drink only 2-3 litres of water have been shown to maintain normal plasma concentrations of sodium, chloride and potassium. Even distance runners who run 25-40km in a day in warm weather and do not salt their food do not usually develop electrolyte deficiencies. Another experiment had subjects consume only 30% of normal potassium intake while losing 3-4 litres of sweat per day for 8 consecutive days and still the study participants maintained normal electrolyte levels.

However, there have been exceptions to these rules. Craig Barret, a New Zealand distance walker, collapsed at the 1998 Kuala Lumpur Commonwealth Games with an electrolyte imbalance; it is unclear whether this was due to inadequate or excessive fluid consumption. A case study of two runners who completed an ultra-marathon race (160km) revealed that their blood sodium concentrations had decreased from normal values of 140mmol/litre to 123mmol/litre and 118mmol/litre. One of the runners experienced a full body seizure and the other became disoriented and confused. Examinations of the runners' fluid intakes during the event suggested that they had diluted their bodies' sodium levels by consuming fluids that contained too little sodium.

While a 160km road race cannot be compared directly to even an intense Taekwon Do black belt grading or seminar, these cases demonstrate the importance of planning fluid intakes and not just addressing these in a haphazard manner. The ideal solution to prevent both hypernatraemia (dehydration) and hyponatraemia (over-hydration), is to replace water at the rate that it is being lost and to add sodium to the fluid if very large volumes need to be consumed. The problem with the latter approach is that sports drinks with concentrations of no more than 25mmol/litre of sodium are too weak to prevent sodium dilution, but stronger concentrations are often not well tolerated. Usually this is not a problem though, because we also get salt (sodium) from food, so as long as we eat before and after exercise, hyponatraemia is extremely unlikely to occur.

Making weight in Taekwon Do

Need to lose three kilos in two days? Or one kilo two hours before weigh in? This is not a rate of weight loss recommended by dietitians as safe, nor is it going to result in long-term weight change. This is too common a scenario for athletes who compete in sports with weight divisions, such as Taekwon Do, whereby even if the weight is slightly over the level allowed for entry into a category, the sportsperson will be disqualified from competing. This provides a powerful motivation to achieve the desired weight, even if it means resorting to unsafe weight loss practices.

Dehydration is the main chosen method for fast weight loss before weigh in for Taekwon Do. Officials have reported a variety of desperate efforts by competitors to lose those final necessary kilos, including drastic dehydration, spitting and forced nose bleeds. In order for dietitians, medical personnel and coaches to assist competitors to make weight safely it is important to be familiar with the rules and specific constraints of the tournament regarding weight divisions/ restrictions as well as the typical practices of athletes to reduce body mass.

Weight divisions

ITF sparring weight categories

	Senior and veteran (18yrs +)		Junior (15-17yrs)		Intermediate (11-14yrs)		Peewee (<11yrs)	
	Male	Female	Male	Female	Male	Female	Male	Female
Micro (kg)	00-54	00-52	00-52	00-42	00-35	00-35	00-25	00-30
Light (kg)	54-63	52-58	52-58	42-48	35-44	35-43	25-35	30-35
Middle (kg)	63-71	58-63	58-63	48-53	44-52	43-51	35-45	35-40
Heavy (kg)	71-80	63-70	63-70	53-60	52-60	51-58	45-55	40-48
Hyper (kg)	80-95	70-85	70-80	60-70	60-75	58-70	55-70	48-55
Hyper+ (kg)	95+	85+	80+	70+	75+	70+	70+	55+

A variety of sports share weight restrictions in a similar fashion to Taekwon Do. The intention of weight categories is to even the playing field for sports where the larger individual will generally have a clear advantage. It would be expected that an athlete who has greater muscle mass and longer reach can generate more power and speed or be more competitive in combative sports than a smaller and lighter opponent. Thus, matching individuals of similar body weight should theoretically make these sports safer and fairer. The reality is that athletes will dehydrate or otherwise achieve rapid weight loss to make a lower weight division or to avoid disqualification, hoping to recover between weigh in and the competition and then to

compete with a weight advantage over a smaller opponent. Of course, since most athletes go through a similar procedure, there is typically little advantage achieved. However, the atypical athlete who does not lose weight acutely for the weigh in may worry that they will be at a disadvantage or disqualified according to tournament rules. So this is the one factor along with other elements such as competing against competitors of higher rank and experience, that clearly adds to the stresses and complexities of competing in Taekwon Do tournaments. Making the competitor go through extreme dehydration methods to make weight in the long and short term is extremely risky and affects performance, therefore much thought has to be put into this issue before the tournament time comes around.

Weight loss and competitive success

Most athletes in weight division sports think weight loss behaviours are important in their success in the sport – does research verify this? A large amount of research has been conducted in this area. 70% of high school wrestlers interviewed from nine rural schools in the United States claimed that losing weight during the season was 'very important' for winning (Marquart & Sobal 1994).

Potential negative consequences of weight loss

Most weight-category sports e.g. Taekwon Do, boxing, wrestling, are based on anaerobic energy utilisation, with an emphasis on muscle power. Rapid weight loss by athletes in these sports is typically achieved by drastic body fluid changes. The goal is to reduce weight through loss of fluid rather than lean tissue, then to recover fluid losses before the start of competition. In addition, they intend to maintain physical performance and health while making weight or at least are able to recover their performance to pre-weight loss levels after the weigh-in. There is evidence that at least some athletes do not achieve these goals and in fact experience impairment of performance or health.

How should I correctly make weight for tournaments?

The reality is that if you, as the competitor, have to take drastic action to rapidly lose fluid before weigh in so that you are in a particular weight category, you and your coach/instructor have neglected an important part of your preparation for your tournament. You need to be aware of your weight in building up to an event so that you can avoid this very unhelpful stress in the final day or so before the tournament. Practitioners who struggle to get their weight into

the correct weight category would be advised to seek the help of a sports dietitian at least two months before an event.

Which fluids are best?

There are many choices of fluids available to athletes. Consider what you need the fluid to do, as well as taste, price, stomach comfort and availability when choosing the most appropriate drink. Remember that techniques such as flying kicks can stir up the stomach.

Sports drinks

Sports drinks are specifically designed to efficiently replace fluid, carbohydrate and sodium lost during exercise. For high intensity exercise, in a tournament situation or when exercising for longer than one hour a sports drink can be beneficial. Good sports drinks contain 4-8g of carbohydrate and 500-700mg sodium per 100ml.

Most sports drinks meet recommendations for carbohydrate levels but not all are even close to meeting the recommended concentration of sodium. So when choosing a sports drink, pick one that meets your specific needs. If you are able to eat within a short time of exercising -before, during and/or after exercise – the sodium level of the sports drink is not as important. However, in ultra endurance exercise, and in hot conditions where you may be sweating heavily it is best to choose a sports drink with the recommended level of sodium, to guard against hyponatraemia (see section on overhydration). Drinks with higher levels of carbohydrate can increase the risk of dehydration as they reduce fluid absorption, which could be a complication particularly if beginning a tournament or event already in a dehydrated state.

There are many different brands and flavours of sports drinks available. If deciding to use a sports drink for an event, it is a good idea to trial several beforehand during training, so that you can choose one that you like and that you tolerate well. Nutrition information, such as carbohydrate and sodium content, is available on the Nutrition Information Panel, which all New Zealand foods and drinks are required to have on their label.

Water

Water is cheap, readily available and easily accessible. It is a good option when training for less than 90 minutes or when you are not exercising continously and are able to eat e.g. between events at tournaments or gradings. When exercising continuously for longer periods

or for highly intense activity, water is not the best option as it does not contain carbohydrate and sodium. The taste of water may not encourage people to drink it and the lack of sodium can promote urination before total rehydration occurs.

Fruit juice, soft drinks and cordials

These usually contain 8-12g carbohydrate per 100ml so are too strong to be quickly absorbed. They are better suited to recovery. If you use the drinks before, during or after exercise you should dilute them so that they do not contribute to dehydration. The main sugar in fruit juice is called fructose, which is not rapidly absorbed. In addition, fructose has to be metabolised in the liver, so it is slow to replace carbohydrate in the muscle. These drinks also do not contain appropriate amounts of sodium for hydration before, during or after training (although this is not a problem if eating food in addition to drinking).

Milk and liquid meal replacements

These drinks provide carbohydrate, protein, vitamins, minerals (including electrolytes) and a small amount of fat. They have a role before and after exercise. Liquid meal replacements are usually well tolerated and can be useful for teams who are travelling to national and international tournaments and the like.

Milk and liquid meals are good if you have to start early or have only a small amount of time before events, such as sparring bouts that have been moved forward by event organisers. Two key benefits are that they are often well tolerated by those with 'nervous stomachs' and liquid meal replacements can be useful for those needing to eat minimal amounts to make weight at the weigh in. Some examples of milk drinks include milk smoothies, plain low fat milk, flavoured milk and milkshakes. Liquid meal replacements include Complan, Sustagen, Sustagen Sport and Ensure.

Soft drinks

Soft drinks typically contain 10-12% carbohydrate, almost no sodium and are carbonated which can cause nausea, bloating and diarrhoea. This is why they were a great substitute for the correct fluids during the infamous South Island pain weekends. Soft drinks should really be avoided because of the above effects and because they are not good at promoting hydration.

Caffeine-containing drinks

Caffeine is a stimulant, commonly found in tea, coffee, some soft drinks, energy drinks, cocoa, herbal and dietary supplement pills and some medications. Effects vary between different people based on their tolerance and their usual intake. Caffeine can spare the use of muscle glycogen as it promotes the body using fat for fuel. It can also stimulate the central nervous system, increasing alertness, reducing perception of fatigue and reducing reaction time. Possibly not a bad option a few minutes before a tournament bout. But it is important to keep in mind that caffeine promotes diuresis (increased urine production) and extra fluid may be needed to avoid dehydration. High levels of caffeine intake can disrupt coordination, produce nervousness, tremors and insomnia. So it is important to go easy on caffeinated drinks as they may produce the opposite effect than the one wanted. If deciding to use caffeine, it is important to practice during training.

Alcohol

It is no new breakthrough that alcohol is harmful to the training secrets of Taekwon Do, potentially causing performance issues on every front depending on how much you drink. While leading up to an event when you are catching up with friends it can be fun to drink alcohol, the dehydration and impaired performance you will get out of it has to make you question its use.

Summary

It is clear that dehydration affects your performance in Taekwon Do, your recovery and your health. So why would such a simple factor of health and fitness in Taekwon Do be ignored? No doubt one of life's most treasured assets is good health. Therefore, one of the great cardinal sins of mankind is his abuse of this asset. Incidentally, he who does not abuse or hurt his own body, including the hair, is defined as obedient to his parents; so described in oriental philosophy.

I have been guilty of this abuse from time to time when it comes to training, but whether it's part of an event you're training for or just knowledge of what goes on as part of your body's cooling process, meeting your fluid replacement requirements means you can achieve so much more mentally and physically.

To perform at tournament level it would be crucial not to risk the outcome by taking drastic weight loss measures and dehydrating shortly before weigh in. Like all of the physical

preparations required in Taekwon Do, planning and practising from months ahead of an event is the best method for managing weight. If this is likely to be a problem for you, there are experts who can help.

We know many elements will influence how much fluid an individual requires, so setting out a plan experimenting early on with weight loss and different fluids for replacement is important. Water will usually be adequate for fluid replacement in Taekwon Do, as it is not an ultraendurance sport. However, those who find it difficult to eat due to nerves or those who sweat excessively may benefit from using a sports drink.

Hydration has been proven to affect sports performance. Therefore, those Taekwon Do practitioners who do not pay attention to this key aspect of training may be letting their coaches, teammates and most importantly, themselves, down.

A wise man (Yubee) once said to his sons “No matter how small it is you should not do what you realise is wrong. On the other hand, you must do what is right no matter how small it may seem”.

Working out your fluid replacement requirements.

Your plan should involve your instructor or coach.

Weight before training __(a)___ minus your weight after training __(b)___ = __(c)__ weight/fluid lost.

You also need to take into account additional fluid lost during your recovery time, so multiply your answer by 1.5

(a) - (b) = (c) 1.5 x (c) = your fluid requirements for recovery

What is your fluid requirement? _____

The weight/fluid lost, **plus amount drunk during training session**, equals your approximate fluid needs for a similar training session.

What percentage of body weight did you lose? To work this out, divide your initial weight by the amount of weight lost, then multiply by 100.

(a)/(b) x 100 = percentage of body weight lost

Is this enough to affect your performance? A 2% weight loss due to fluid losses can impair performance by over 20%.

It is important to spread your fluid intake over the training session, so it can be a good idea to set yourself some targets

At the next training session, I will drink a total of _____

I will aim to drink _____mls in each break

NB One kilogram (1000g) weight loss is equivalent to one litre (1000ml) fluid loss

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