UNDERSTANDING WEIGHT, NUTRITION & HYDRATION

JUDO NEW SOUTH WALES Wellbeing

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The over-arching aim of providing nutrition education is to ensure that athletes have sufficient knowledge to take charge and feel that they have some control over their nutritional needs and how to fulfil these. It is not intended to replace the dietician but rather to ensure that those athletes that do not choose to use one, for whatever reason, still have a base level of knowledge to make informed choices. For those who do seek the assistance of a dietician/nutritionist, the knowledge will enable athletes/carers to have meaningful conversations and will help them to play an 'active' role in determining their needs. It may also help them identify if the level of service they are being provided meets their needs.

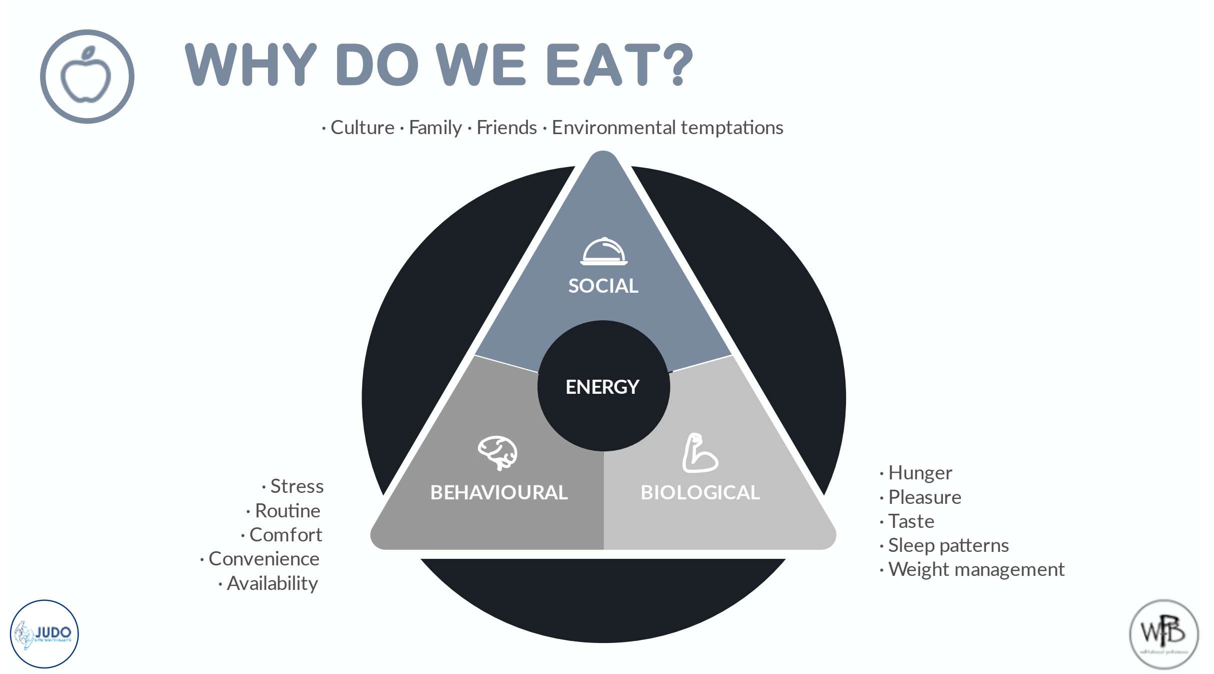
WEIGHT, NUTRITION & HYDRATION

AIM:

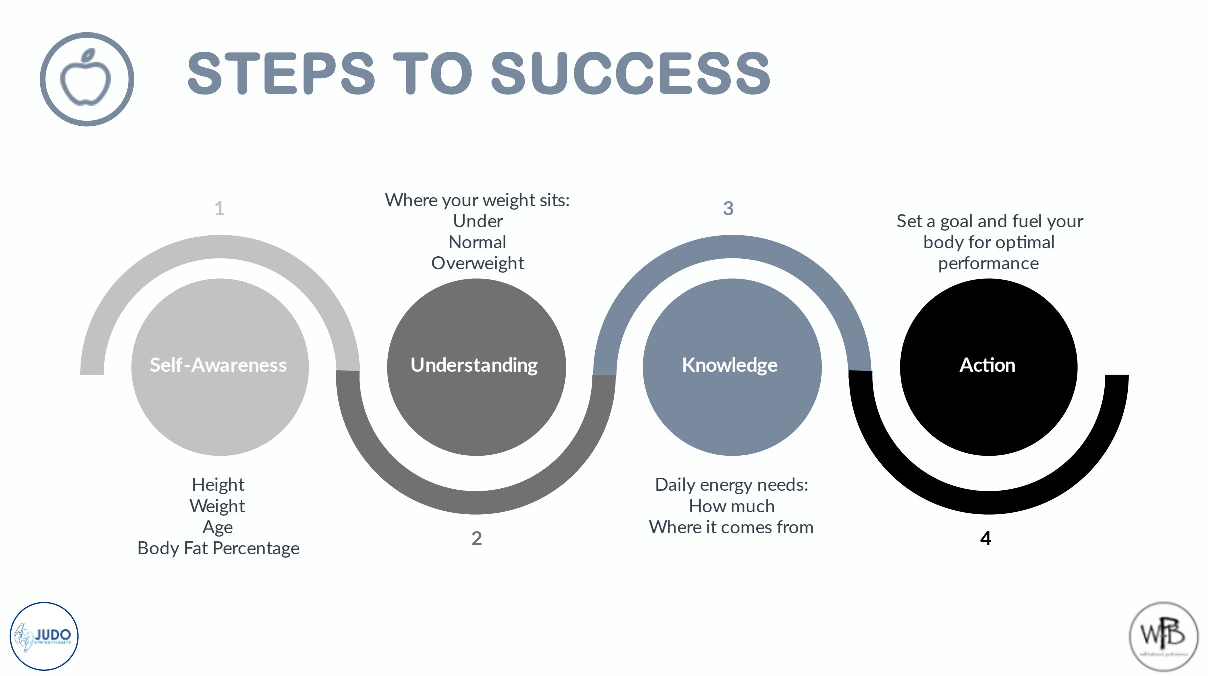
To educate athletes/carers in basic nutrition information in order for them to feel better informed; to enable and improve self-determination regarding food choices, and to ensure sufficient knowledge to have constructive discussions with sports dieticians/nutritionists and coaches.

LEARNING OUTCOMES:

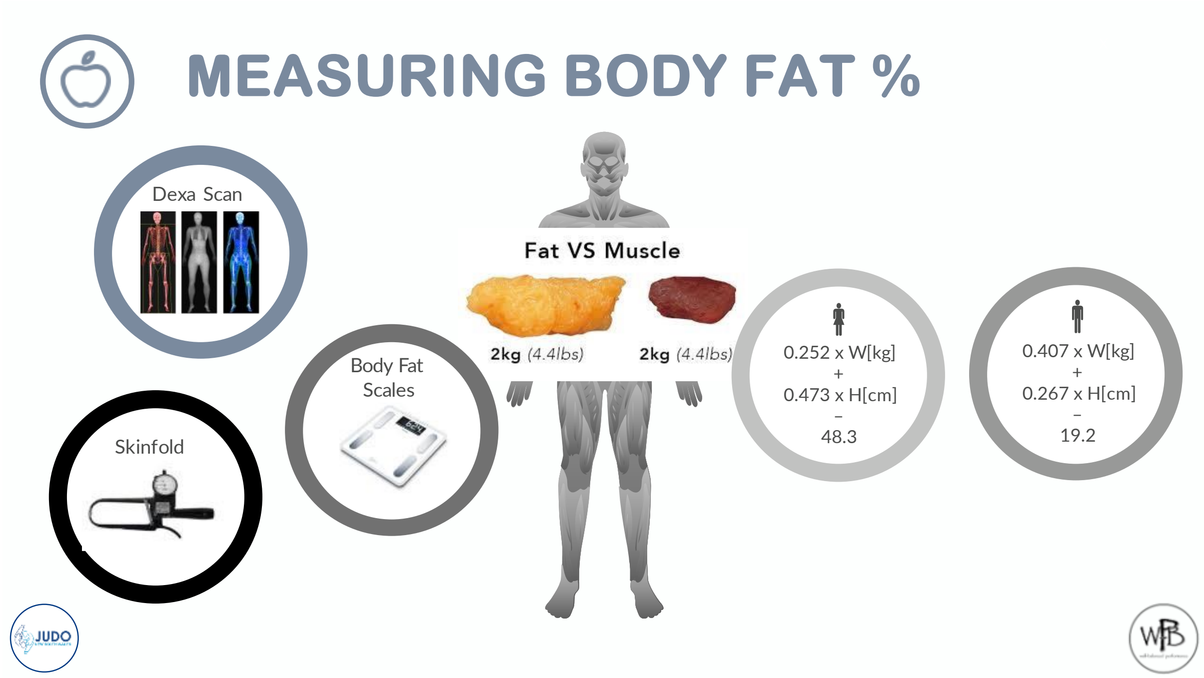
- Identify 3 ways athletes can understand their body composition and why this knowledge is useful.
- Describe what BMI is and its limitation as a measure of body composition for athletes.
- Explain what BMR is and calculate own (approx.) BMR.
- Calculate own daily calorie requirements based on BMR and activity level.
- Explain the impact of physical activity levels on daily energy expenditure.
- List the three macronutrients and briefly explain their importance.
- Explain how the balance of macronutrients is important to energy requirements and weight.
- Describe one way to calculate macronutrient ratios.
- Explain what micronutrients do in the body.
- Explain the importance of hydration and the impact of dehydration on performance.
- Name one potential complication of prolonged negative energy imbalance.
- Feel more in control of nutrition needs leading into competition.
- Describe 3 important weigh-in considerations.



While it is easy to think that we eat to fuel our body's needs, the reality is there is a lot more to our desire to eat than simply providing enough energy to get through our day. On top of our physical need for energy, many more social, behavioural, and biological reasons drive our desire to eat. These additional factors can lead us to have a positive or negative relationship with food. This can be particularly complicated for weight-based sports athletes. Today's session isn't going to discuss our relationship with food, but if you or your athlete has an issue with this, it is important to seek appropriate medical advice.



As athletes, your key 'tools of trade' are your body and your mind, and like any good 'tradie', you need to understand your tools and how they work. For athletes, particularly in weight-based sports, this means knowing your best weight category for your size and shape, getting there (if you're not already there), and maintaining it.



Understanding your body composition (lean body mass vs body fat percentage) is the first step in determining whether you are in the right weight category. Comparing your body fat percentage (BF%) vs recommendations (e.g. American Council of Exercise) may help inform if you are in the best division for your body type. For example, a 175cm male athlete weighing 70kg with a 6% BF% who fights U66kg may consider building more muscle and fighting U73kg to save a challenging weight cut. A different 175cm male athlete weighing 70kg with an 18% BF% who fights U73kg may consider losing some body fat to sit at 68kg, enduring a 3% weight cut for weigh-ins and fighting U66kg.

There are several options for determining body composition:

- A dexa scan is a more accurate, accessible method for athletes to understand their body composition. Google "dexa scan near me" and research their reviews and pricing (~$100-150) to find a provider. They are a good investment if you have questions about your weight.
- Skin fold testing conducted by dieticians/nutritionists/exercise physiologists is also an option. Still, their reliability can be inconsistent and is dependent on the skill of the person conducting the test.
- Body fat scales can also indicate body fat percentage but are less reliable than the above two options and can vary based on hydration levels, equipment quality, etc.

Failing any of the above options, equations can be used to calculate body fat, but they are just an estimate based on the general population, not athletes. For an online calculator for different equations, go to https://www.ecalculator.co/calc/lbm-calculator. Please see the equation below to understand how one of the calculations works.

For equations in this session, I have provided an example for a male and female athlete to assist you in following along:

- Female: Weight: 65kg Height: 170 cm Age:22 years
- Male: Weight: 75kg Height: 175 cm Age:24 years

Boer Formula:

Used to calculate lean body mass and, therefore, body fat percentage. Follow the steps in blue.

Women:

	0.252	**x**	______	W(kg)	=	______		← 1	*E.g*	*0.252*	*x*	*65.0*	*=*	*16.38*
						+								*+*
	0.473	**x**	______	H(cm)	=	______		← 2		*0.473*	*x*	*170*	*=*	*80.41*
						–								*–*
						48.3								*48.3*
						=								*=*
	Lean Body Mass			LBM(kg)		______								*48.49*
						3↑								
______	W(kg)	–	______	LBM(kg)	=	______ *	BF(kg)	← 4		*65.0*	*–*	*48.49*	*=*	*16.51*
* ______	BF(kg)	÷	______	W(kg)	=	______	**BF%**	← 5		*16.51*	*÷*	*65.0*	*=*	*25.4%*

Men:

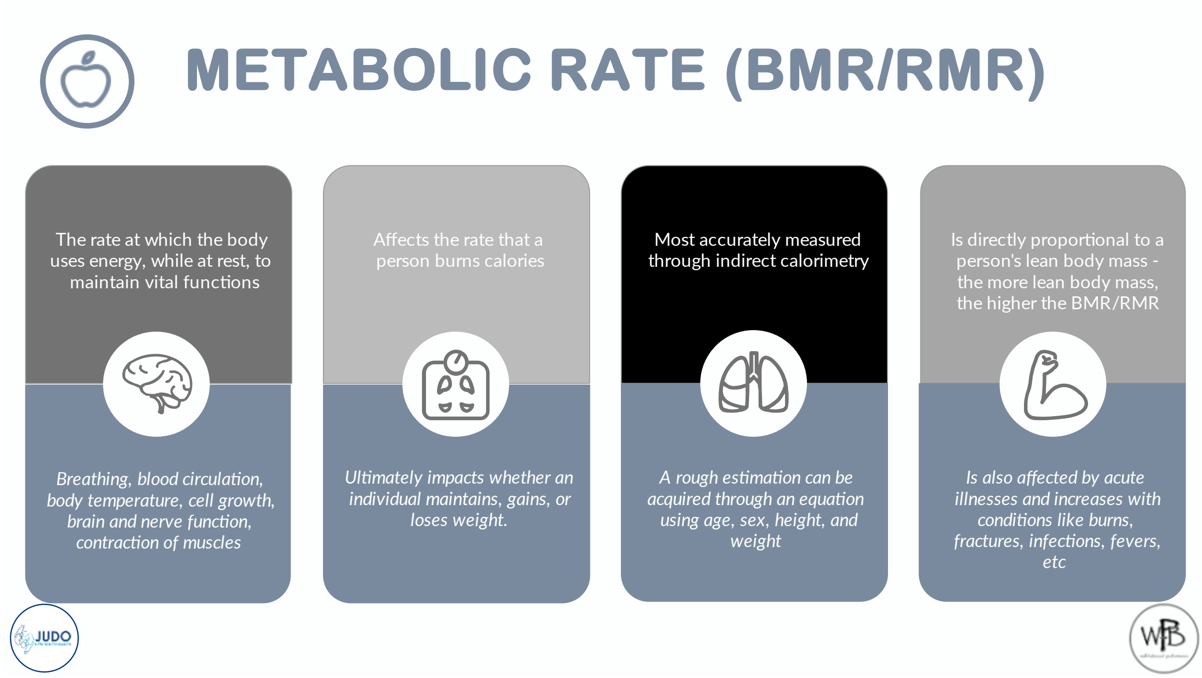
	0.407	**x**	______	W(kg)	=	______		← 1	*E.g*	*0.407*	*x*	*75.0*	*=*	*30.525*
						+								*+*
	0.267	**x**	______	H(cm)	=	______		← 2		*0.267*	*x*	*175*	*=*	*46.725*
						–								*–*
						19.2								*19.2*
						=								*=*
	Lean Body Mass			LBM(kg)		______								*58.05*
						3↑								
______	W(kg)	–	______	LBM(kg)	=	* ______	BF(kg)	← 4		*75.0*	*–*	*58.05*	*=*	*16.95*
* ______	BF(kg)	÷	______	W(kg)	=	______	**BF%**	← 5		*16.95*	*÷*	*75.0*	*=*	*22.6%*

BODY FAT PERCENTAGE[2]

	Women	Men
Essential fat	10-12%	2-5%
Athletes	14-20%	6-13%
Fitness	21-24%	14-17%
Acceptable	25-31%	18-25%
Obese	32% plus	26% plus

Body fat is essential to survival – fat protects your internal organs, provides you with necessary energy stores in times of peril, and more. "Essential fat" means the minimal amount of fat required for survival – Anything less than this amount would mostly likely result in organ failure, but even approaching this amount of body fat is dangerous.

Athletes will often have a lower body fat percentage than physically fit people because having less fat improves their athletic performance. However, when body fat percentages dip too low, athletic performance suffers and immune function declines.



Our metabolic rate is measured using either our basal metabolic rate (BMR) or our resting metabolic rate (RMR). These are the rate at which the body uses energy while at rest to maintain vital functions such as breathing, blood circulation, controlling body temperature, cell growth, brain and nerve function, and contraction of muscles. This measure is important as your body requires a certain amount of energy to exist, even before any activity/exercise considerations. Inadequately fuelling your body to account for your everyday metabolic needs can cause significant health problems longer-term. This can be particularly apparent in weight-based athletes.

The next step in determining your nutrition needs is understanding how much fuel your body will need to lose, maintain or gain weight. It’s important for athletes to know how much energy your body needs to survive (your metabolic rate) and how much additional energy it needs to fuel your activities.

Indirect calorimetry is the best determiner for this analysis; however, it's not always easily accessible and requires specialised equipment. Some places that conduct dexa scans will also do indirect calorimetry testing. If specialised testing isn't an option, various equations can calculate the metabolic rate. Whilst not 100% accurate, they can provide a basis for understanding your fueling and energy needs. As they may under/overestimate, they're helpful as a guide, and it's important to monitor outcomes and adjust calorie requirements as required.

Metabolic rate is directly proportional to a person's lean body mass. In other words, the leaner body mass a person has, the higher their MR. MR is also affected by acute illnesses and increases with conditions like burns, fractures, infections, fevers, etc. Athletes who build muscle will also increase their metabolic rate – the inverse also being true; a loss in muscle mass will reduce their metabolic rate.

Metabolic rate, therefore, is not a 'one-time' measure but should be assessed depending on any changes in the athlete's needs. Metabolic rate is expressed in terms of calories.

The following is a selection of equations that can be used to measure metabolic rate. Equations more suited to athletes because of their higher lean body mass have been provided along with an equation commonly used for the general population (in case parents are interested for themselves).

An online calculator for the Mifflin St Jeor, and Cunningham equations can be found at https://www.inchcalculator.com/rmr-calculator/. Click on advanced options to choose which equation you would like to use, and remember to change the height and weight settings to metric. Please see below if you would like to understand how the calculations work.

Weight Based Equation

Considered one of the more accurate equations for recreational athletes and is used when you don't know your body fat percentage. Follow the steps in blue.

Women:

11.9	**x**	______	W(kg)	**=**	______	←	**1**	*E.g*	*11.9*	*x*	*65.0*	*=*	*773.5*
					+								*+*
5.85	**x**	______	H(cm)	**=**	______	←	**2**		*5.85*	*x*	*170*	*=*	*994.5*
					–								*–*
8.1	**x**	______	A(yrs)	**=**	______	←	**3**		*8.1*	*x*	*22*	*=*	*178.2*
					+								*+*
			Sex		0								*0*
					+								*+*
					29.17								*29.17*
					=								*=*
					______	**MR**	*(determines minimal calorie requirement)*						*1,618.97*
					4↑								

Men:

11.9	**x**	______	W(kg)	**=**	______	←	**1**	*E.g*	*11.9*	*x*	*75.0*	*=*	*892.5*
					+								*+*
5.85	**x**	______	H(cm)	**=**	______	←	**2**		*5.85*	*x*	*175*	*=*	*1,023.75*
					–								*–*
8.1	**x**	______	A(yrs)	**=**	______	←	**3**		*8.1*	*x*	*24*	*=*	*194.4*
					+								*+*
			Sex		190.3								*190.3*
					+								*+*
					29.17								*29.17*
					=								*=*
					______	**MR**	*(determines minimal calorie requirement)*						*1,941.32*
					4↑								

Cunningham Equation

Considered as accurate as the weight based equation for recreational athletes and is used when you know your body fat percentage or lean body mass. Follow the steps in blue.

Men/Women:

(1 – ______) BF%	**x** ______ W(kg)	**=** ______ LBM	← **1**	*E.g*	*(1-25.4%)*	*x*	*65.0*	*=*	*48.49*
		500							*500*
		+							*+*
22	**x** ______ LBM	**=** ______	← **2**		*22*	*x*	*48.49*	*=*	*1066.78*
		=							*=*
		______ **MR**	*(determines minimal calorie requirement)*						*1,566.78*
		3↑							
				E.g	*(1-22.6%)*	*x*	*75.0*	*=*	*58.05*
									500
									+
					22	*x*	*58.05*	*=*	*1277.1*
									=
									1,777.1

Mifflin-St Jeor Equation

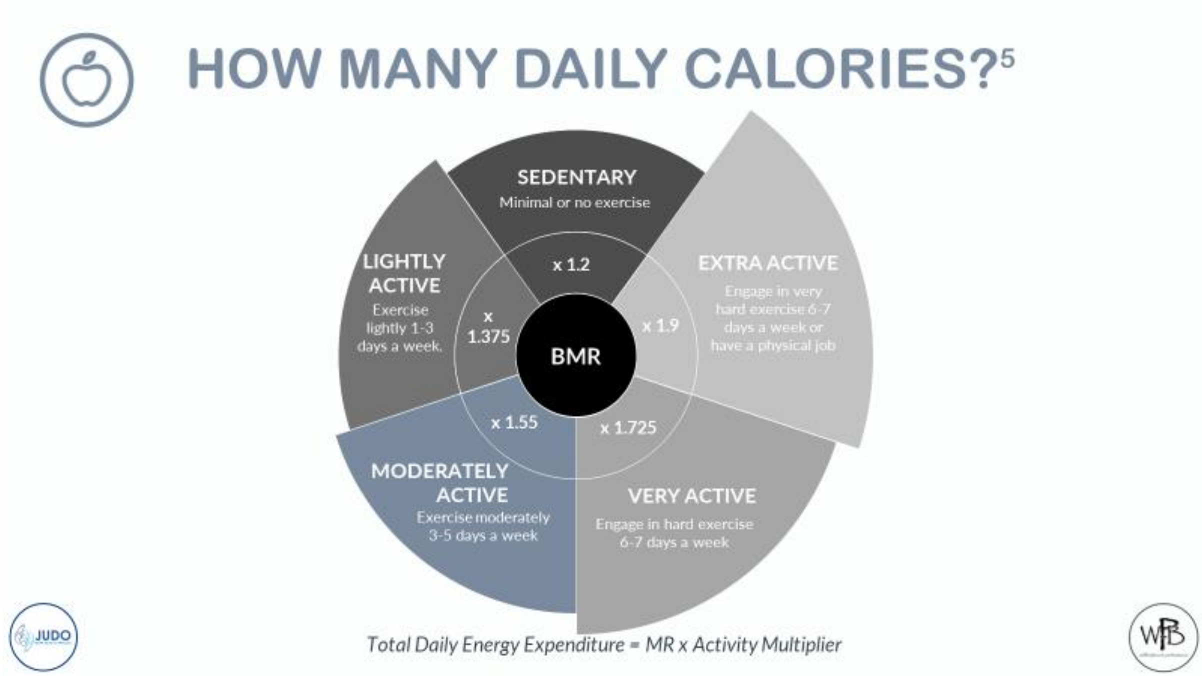
Considered one of the more accurate equations suited for the general population and used when you don't know your body fat percentage. Follow the steps in blue.

Women:

			-161		*E.g*					*-161*
			+							*+*
10	**x** ______	W(kg)	**=** ______	← **1**		*10*	*x*	*65.0*	*=*	*650*
			+							*+*
6.25	**x** ______	H(cm)	**=** ______	← **2**		*6.25*	*x*	*170*	*=*	*1062.5*
			–							*–*
5	**x** ______	A(yrs)	**=** ______	← **3**		*5*	*x*	*22*	*=*	*110*
			=							*=*
		MR	______	*(determines minimal calorie requirement)*						*1,441.5*
			4↑							

Men:

			5		*E.g*					*5*
			+							*+*
10	**x** ______	W(kg)	**=** ______	← **1**		*10*	*x*	*75.0*	*=*	*750*
			+							*+*
6.25	**x** ______	H(cm)	**=** ______	← **2**		*6.25*	*x*	*175*	*=*	*1093.75*
			–							*–*
5	**x** ______	A(yrs)	**=** ______	← **3**		*5*	*x*	*24*	*=*	*120*
			=							*=*
		MR	______	*(determines minimal calorie requirement)*						*1,728.75*
			4↑							



Once the metabolic rate is known, the next step is to apply a factor based on the calories burned during daily activities (based on your lifestyle) to determine your Total Daily Energy Expenditure (TDEE) and, therefore, your daily calorie requirements:

- Sedentary (S). If you get minimal or no exercise, multiply your MR by 1.2.
- Lightly active(LA). If you exercise lightly one to three days a week, multiply your MR by 1.375.
- Moderately active (MA). If you exercise moderately three to five days a week, multiply your MR by 1.55.
- Very active (VA). If you engage in hard exercise six to seven days a week, multiply your MR by 1.725.
- Extra active (EA). If you engage in very hard exercise six to seven days a week or have a physical job, multiply your MR by 1.9.

MR			**Factor**		**TDEE**
________	**x**	S	1.2	=	________
		LA	1.375	=	________
		MA	1.55	=	________
		VA	1.725	=	________
		EA	1.9	=	________

E.g (Using weight-based equation result, rounded)

1,620 x 1.55 = 2,511

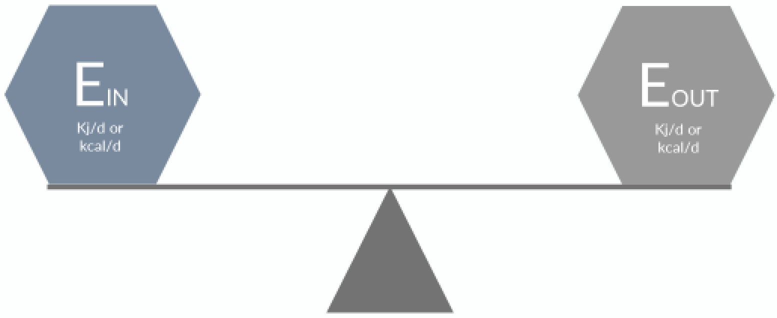
identified as 'Moderately Active': x2 judo, x2 S&C sessions p.w

1,940 x 1.725 = 3,347

identified as 'Very Active': x3 judo, x4 S&C sessions p.w

Whilst a more active person will burn more calories than a sedentary person, the overall impact of physical activity is only a relatively smaller proportion of overall daily energy expenditure; 15% - 30%. Exercise (and compulsive exercising) is not enough to lose weight. If you want to lose weight by reducing body fat, losing 1 kilo of fat requires a 7,700 calorie deficit. (1kg/week = -1,100 calories/day). If you don't have a difference of 1,100 calories a day between your metabolic rate (the minimum energy needed) and your TDEE, realising a 1kg loss/week isn't realistic (and will negatively impact health and performance). A more realistic goal may be 0.5kg/week = 550 calorie deficit/day. Always aim to only ever be in mild (10-20%) to moderate (20-30%) calorie deficit when losing weight; otherwise, seek the help of a Qualified Health Professional to assist with your weight reduction.

ENERGY BALANCE & WEIGHT[6]

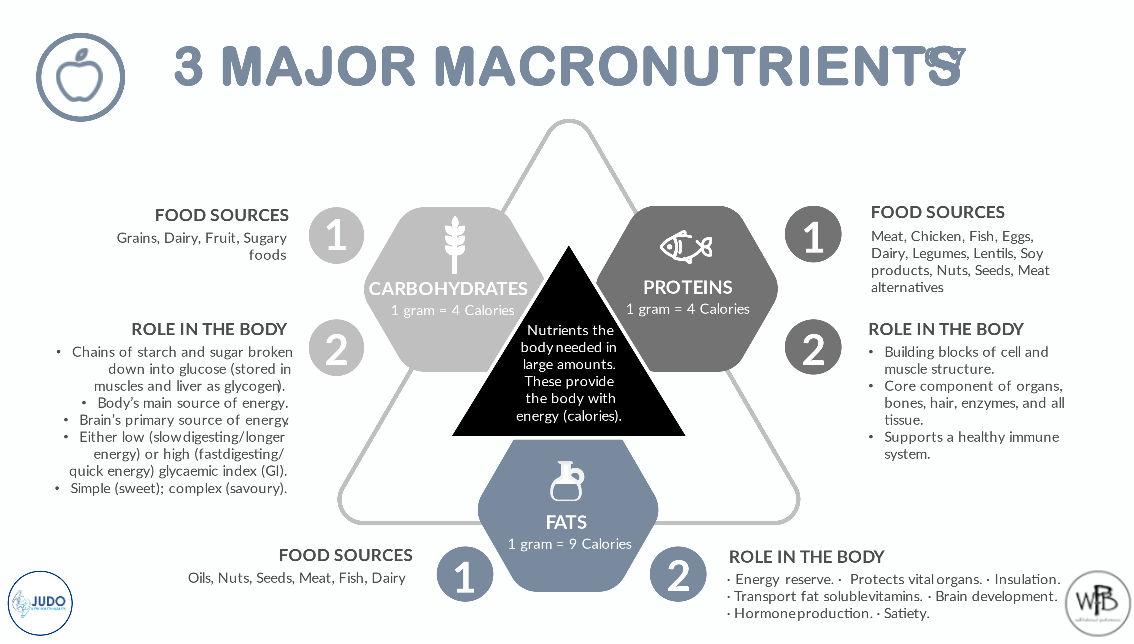


If $E_{IN} > E_{OUT}$ = increase in body mass (weight gain)
If $E_{IN} < E_{OUT}$ = reduction in body mass (weight loss)

The body metabolises about 90-95% of energy intake (the rest is lost in waste). Regardless of the type of diet used, weight gain and weight loss still boils down to "energy in" vs "energy out". If the balance is more energy in, the result is an increase in body mass (weight). If the balance is more energy out, the result is a decrease in body mass (weight). It's important to remember that energy out is all energy expenditure – not just physical activity.

THE FOOD PYRAMID

The food pyramid and associated recommended daily serves of the different food groups may be helpful for the general public in knowing how to eat a balanced diet, but it's not as helpful for athletes who must also try and maintain a weight range. Weight-based athletes need to understand macronutrients and how they relate to fueling energy requirements and weight.



The body needs macronutrients in large amounts to have a supply of energy. Macronutrients supply energy measured in calories, and the amount varies between the macronutrients. Each gram of carbohydrate and protein provides four calories of energy, whereas a gram of fat provides nine calories of energy (so are considered more 'energy dense').

Carbohydrates are the body's main source of energy. Carbs, when digested, get broken down into glucose, converted to glycogen, and stored in the muscles and liver for instant use. They are the main fuel during high-intensity exercise and spare protein (to preserve muscle mass during exercise). Carbs are the fuel for the central nervous system (including your brain!), and 75% of carbs are burned just to fuel these. Carbs are found in many food sources: grains (choose mostly whole grains for added benefits); dairy (choose low-fat or non-fat most often); fruit (choose whole fruits more often than fruit juices). Glycaemic Index (GI) refers to how quickly the body uses the particular carb for fuel – low GI, slow digesting and longer energy; high GI, fast digesting and quick energy. Knowing this is important when considering timing of energy needs, particularly for training/competition. Carbs are also considered simple (think sweet flavours) or complex (think savoury flavours).

Proteins are the body's building blocks and form tissue structure (part of organ tissues, muscle, hair, skin, nails, bones, tendons, ligaments and blood plasma), part of cell plasma membranes. They are involved in metabolic, transport, and hormone systems; make up enzymes that regulate metabolism; support a healthy immune system and are involved in acid/base balance to maintain a neutral environment in our bodies. Beyond 'meat', protein can be found in many food sources: legumes (beans), lentils, soy products (such as tofu), peanuts and nuts, whole grains (quinoa, oats, brown rice), seeds, meat alternative products, and some vegetables. Protein provides amino acids, which are the building blocks of cell and muscle structure. There are 20 types of amino acids, nine of which are essential.

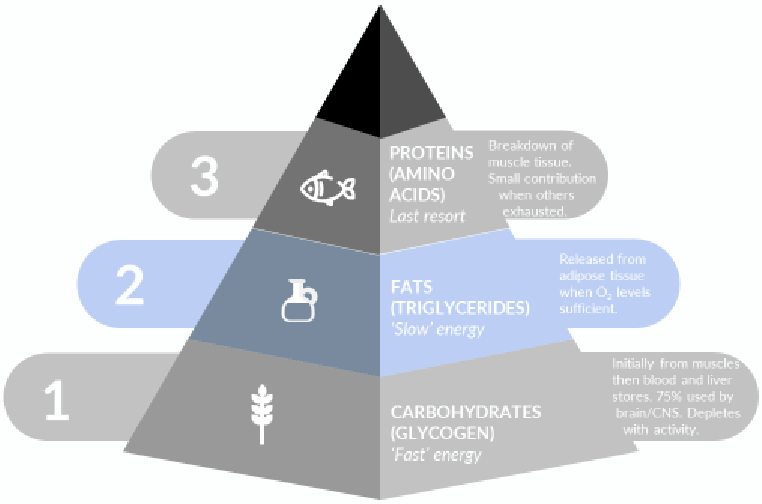
Fats play an important role in energy reserve, protecting vital organs, insulation, brain development, hormone production and transportation of fat-soluble vitamins. Food sources include oils, nuts, seeds, meat, fish, dairy, and avocado. Fats have the highest calorie count per gram, meaning that they require more energy to burn, but at the same time, they help increase feelings of satiety (feeling full).

Alcohol is a separate calorie source. A gram of pure alcohol has seven calories, nearly as calorie-dense as pure fat.

CLASSIFICATION OF FOODS[9]

Foods are classified according to the macronutrient with the highest percentage value. However, foods are rarely made up of only one macro – often, is it two or three. Whilst these other macros aren't important from a classification perspective, they are vital when determining a daily intake of calories and can't be 'forgotten' as part of the equation. If the food isn't labelled with the amount of respective macro's, the Calorie King website is good to find the information.

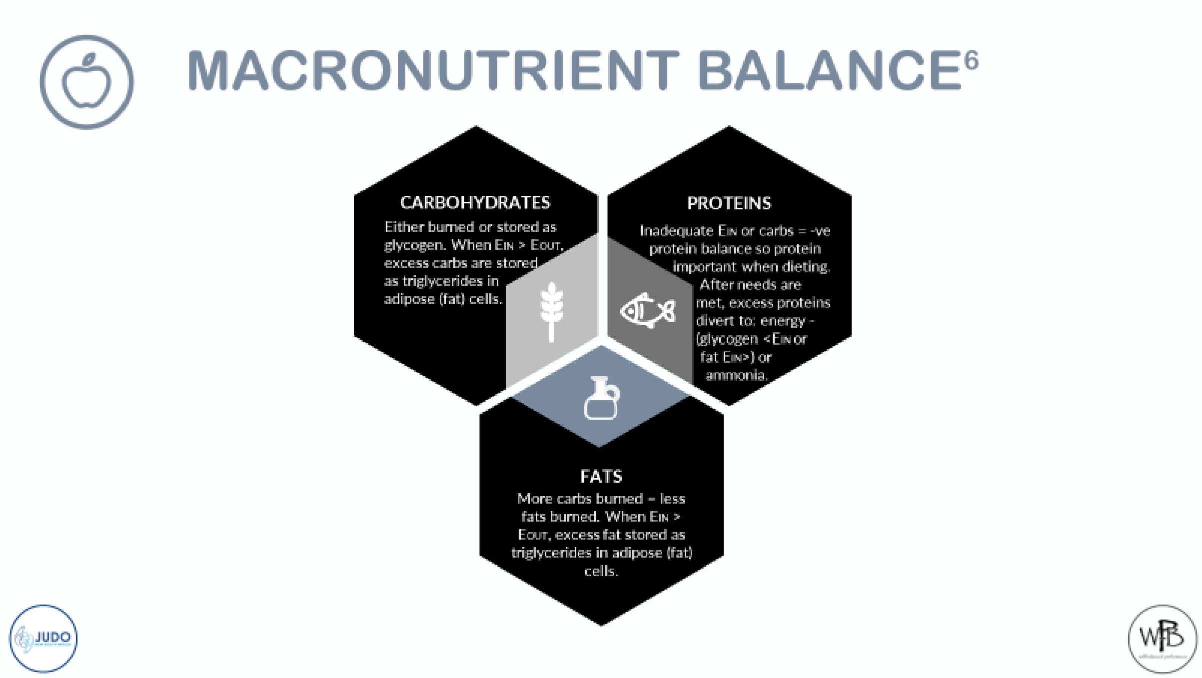
HOW WE BURN (OXIDIZE) ENERGY[6]



Carbs can be used as straight glucose or stored as glycogen in the muscles and liver and are the first 'energy blocks' used when we do some physical activity. The brain and CNS alone (without any activity) use 75% of this energy. These stores are not inexhaustible, quickly depleting depending on the energy level of the activity (90-120 mins - low to moderate intensity exercise; 20 mins – HIIT). Depletion symptoms include fatigue, low energy, sluggishness, and mental dullness. Glycogen takes ~22 hours -4 days to replenish.

Fats are stored as triglycerides and used as a secondary energy source for prolonged exercise. In the presence of adequate oxygen, fat is converted to fuel. If aerobic activities are performed at a level that doesn't leave a person breathless; oxygen intake is considered sufficient. Use of fat as an energy source usually peaks after 2-4 hours of exercise (as glycogen is used as a preference first). Adipose stores are used during lower intensity exercise.

Proteins are stored as amino acids and are the last energy source – playing only a small contribution. The body will preserve muscle protein, which performs both structural and functional roles. Protein 'burn' occurs from microtrauma (microtears in muscle). This is the same way that muscle is built as the body repairs the tears to strengthen the muscle, making it bigger.



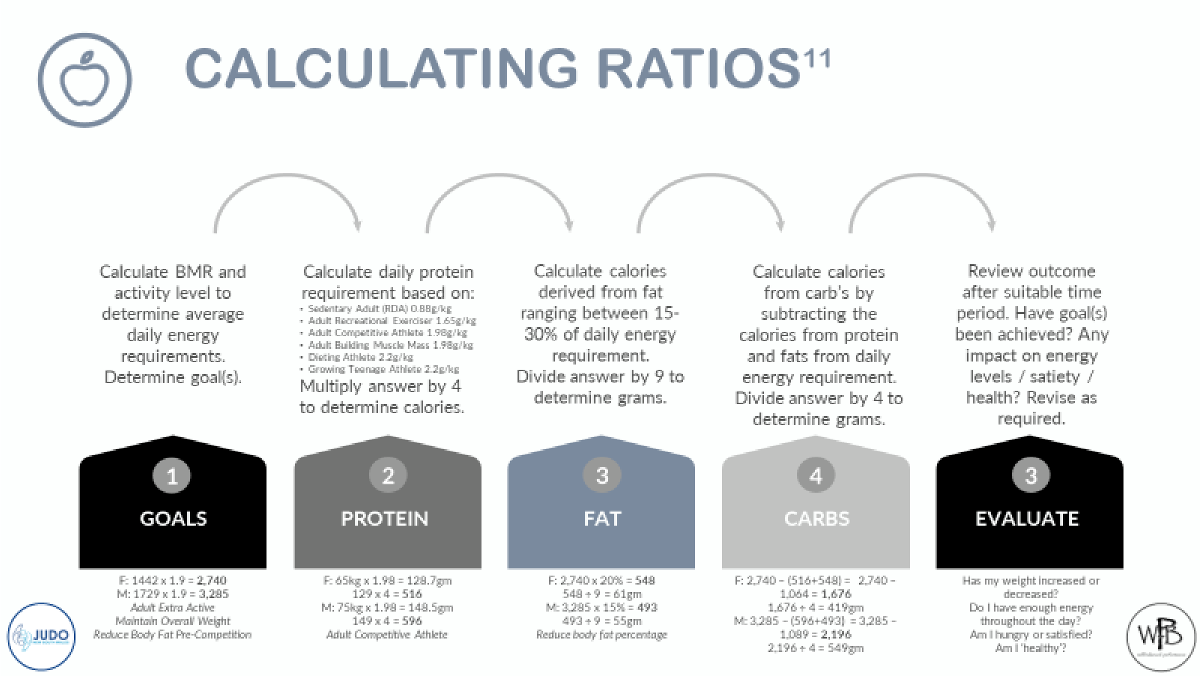
While the relationship of Ein versus Eout is the basis for weight gain/loss/maintenance, a balance of macronutrients in the diet is also essential. It depends on the specific needs of the individual. It's important to understand what happens to the body when the macro balance is not equal, and there may sometimes be good reasons why this is the case. When the Ein=Eout, regardless of the macronutrient balance, the body will stay in a steady state. Changes arise when there is an imbalance.

If Ein > Eout (any excess in any macro will be converted and stored as triglycerides in fat cells):

- once muscle and liver glycogen storage is maximised, excess glycogen production is converted and stored as triglycerides in fat cells,
- as glycogen is used preferentially as a fuel source, there is less likelihood of fats being burned, so excess fat is stored as triglycerides in fat cells,
- excess protein is diverted to energy in the form of triglycerides and stored in fat cells.

If Ein < Eout:

- glycogen stores will be depleted,
- any excess protein is converted to glycogen and burned,
- if no excess protein, the body will go into a –ve protein balance and burn muscle (probably contrary to what an athlete is trying to achieve).



Once it's known how many calories need to be consumed each day, it's important to determine where they should come from. Following is just one of the many ways to figure out the caloric ratio.

<u>Step 1:</u> Work out the daily protein requirement by using the following criteria (grams per kilogram of body weight):

- Sedentary Adult (RDA) 8.8g/kg
- Adult Recreational Exerciser 1.65g/kg
- Adult Competitive Athlete 1.98g/kg
- Adult Building Muscle Mass 1.98g/kg
- Dieting Athlete 2.2g/kg
- Growing Teenage Athlete 2.2g/kg

Multiply the answer x 4 to determine calories from protein.

<u>Step 2:</u> Determine a fat ratio (between 15-30%) depending on your body composition and overall goals. Multiply total daily calorie requirement by chosen ratio.

<u>Step 3:</u> The remainder of the calories must come from carbs. Subtract the protein and fat calories from the total daily calorie requirement, giving the calories from carbohydrates. Divide the carb calories by 4 to get the number of grams of carbs/day.

Review outcome after a suitable period of time and answer the following questions:

- Has my weight increased or decreased?
- Do I have enough energy to get through the day?
- Am I hungry or satisfied?
- Am I 'healthy'?

TDEE ________ Cal/day

2,511
3,347

Protein

________ W(kg) **x** ________ g/kg = ________ g ← 1

x
4
= ________ Cal ← 2

E.g

65	x	*1.98**	=	*128.7*
	**Adult Competitive Athlete*			x
				4
			=	*514.8*

75	x	*1.98**	=	*148.5*
	**Adult Competitive Athlete*			x
				4
			=	*594*

Fat

________ Cal/day **x** ________ % = ________ Cal ← 3

÷
9
=
________ g ← 4

2,511	x	*20%**	=	*502.2*
	**Reduce body fat %*			÷
				9
				=
				55.8

3,347	x	*15%**	=	*502.5*
	**Reduce body fat %*			÷
				9
				=
				55.8

Carbs

2 ________ Cal
+
3 ________ Cal
=
________ Cal/day – ________ Cal = ________ Cal ← 6
5↑

÷
4
=
________ g ← 7

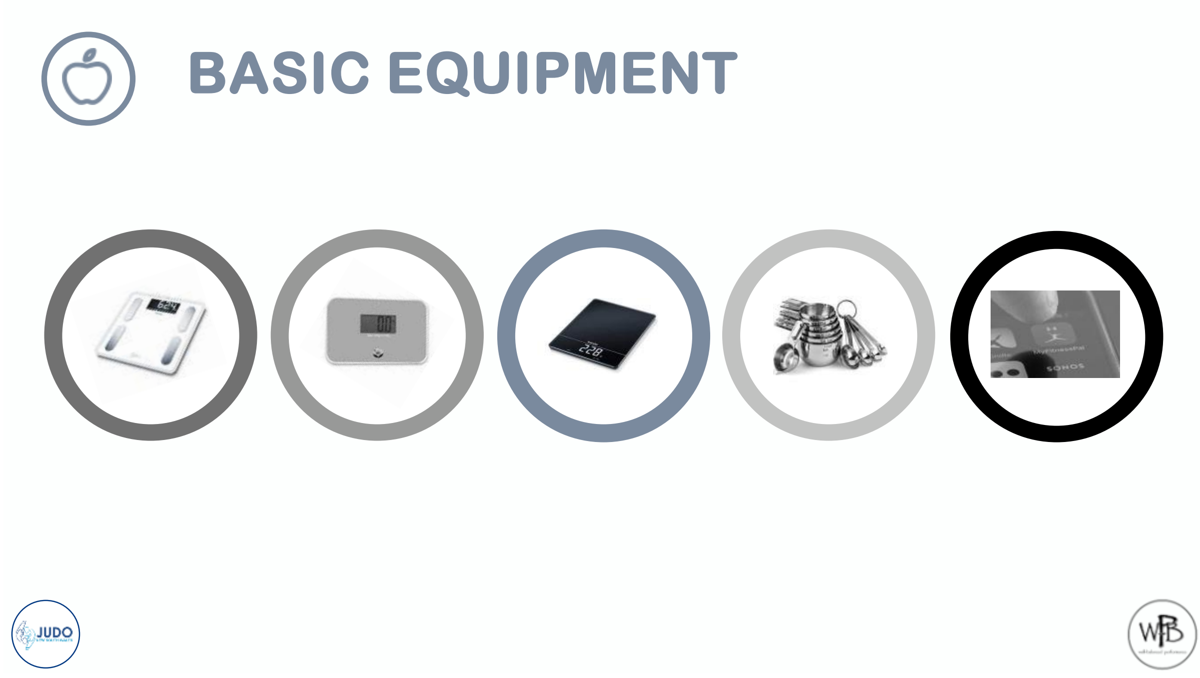
		514.8		
		+		
		502.2		
		=		
2,511	–	*1,017*	=	*1,494*
				÷
				4
				=
				373.5

		594		
		+		
		502.5		
		=		
3,347	–	*1,096.5*	=	*2,250.5*
				÷
				4
				=
				562.6

Macronutrient Example:

		Daily Goal		Meal		Balance	% Daily
	Calories	*2,511*	–	*445*	=	*2,006*	*17.7%*
	Protein	*128.7g*	–	*44.5g*	=	*84.2g*	*34.6%*
	Fat	*55.8g*	–	*8.4g*	=	*47.4g*	*15.1%*
	Carbs	*373.5*	–	*42g*	=	*331.5g*	*11.2%*
	Calories	*3,347*	–	*445*	=	*2,902*	*13.3%*
	Protein	*148.5g*	–	*44.5g*	=	*104g*	*30.0%*
	Fat	*55.8g*	–	*8.4g*	=	*47.4g*	*15.1%*
	Carbs	*562.6*	–	*42g*	=	*520.6g*	*7.5%*

Even though the meal (left) is sports dietician approved, it's important to consider the calories and how the macronutrients 'fit' into the goals/needs required, which will differ for each person.



To help manage weight and nutrition, you will ideally have a good set of bathroom scales, a smaller, lighter set of travel scales (if you travel for competition), kitchen scales, measuring cups and spoons and apps to track your progress.

WHAT TO EAT, WHEN[14,15]

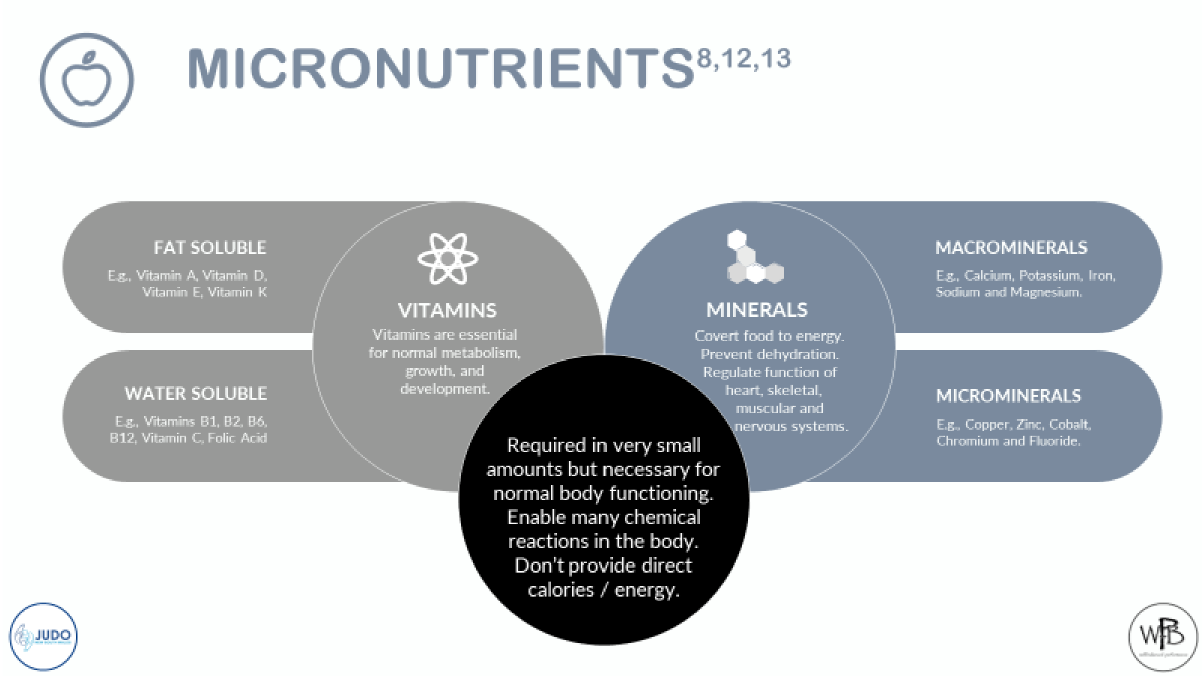
Nutrient timing is not as important as the overall calorie intake and food quality. If the training is long or intense, or if the goal is to gain muscle mass, eating before and after a workout come to be more important for recovery and energy levels.

What to eat when depends on the timing and energy requirements and the absorption of the different macros. Macros are absorbed differently. Carbs are the quickest energy: simple carbs are the fastest, and complex carbs take longer. Proteins are absorbed the second-quickest, and fat takes the longest to digest. As most foods have a combination of macros, so the digestion time depends on the ratio. The aim is to ensure sufficient glucose/glycogen levels to fuel activity. You can determine if you have used up your stores from the feeling of "hitting the wall" (fatigue) during exercise.

MACRO'S & TRAINING NEEDS[23]

Daily intake can be based on the training needs of that day. Higher training days require higher carbs than lower training or rest days. Protein is always required regardless of training status. Fat can be adjusted to meet daily calorie needs.

	PROTEIN	FATS	CARBS
HARD TRAINING DAY	25%	15%	60%
MODERATE TRAINING DAY	25%	20%	55%
LIGHT TRAINING DAY	30%	25%	45%
NO TRAINING DAY	35%	30%	35%



Micronutrients (vitamins and minerals) are required in very small amounts. They are vital for normal body functioning. Micronutrients enable many chemical reactions in the body but don't add to our calorie count. Vitamins are essential for normal metabolism, growth, and development. Minerals are mainly needed as co-factors or to assist the function of enzymes in the body. To improve your intake of vitamins and minerals, include a wide variety of colourful foods to meet your micronutrient quota.

Vitamins are either fat soluble or water soluble. Fat soluble vitamins can last in the body from days to several months. In contrast, water-soluble vitamins usually only last a short time and are needed in continuous supply from the diet (Vit B12 and Vit C are exceptions and are stored in the liver and adrenal gland, respectively). Minerals are classified as either macro or micro based on the volume (not the size) of the mineral required. Sodium, chloride and potassium play a major role in fluid balance.

<u>Training Block: Fuel to Train</u>

- Ensure adequate energy intake
- Appropriate macro ratios to adequately fuel training needs
- Keep weight within 5% of weigh-in weight
- Ensure high levels of hydration

<u>Lead Up to Weigh In: Making Weight</u>

- Weight >3% over: consider strategies to reduce body fat levels – e.g., 'low fat' diet + exercise. (Allow sufficient time for effect [avg loss of 500g / week]).
- Weight <3% over: reduce fluid intake only within 24 hours of weigh in. Consider a low residue diet 3-4 days before weigh in.
- Taper training 1 week to increase glycogen stores.

<u>Post Weigh In: Restore Glycogen Stores</u>

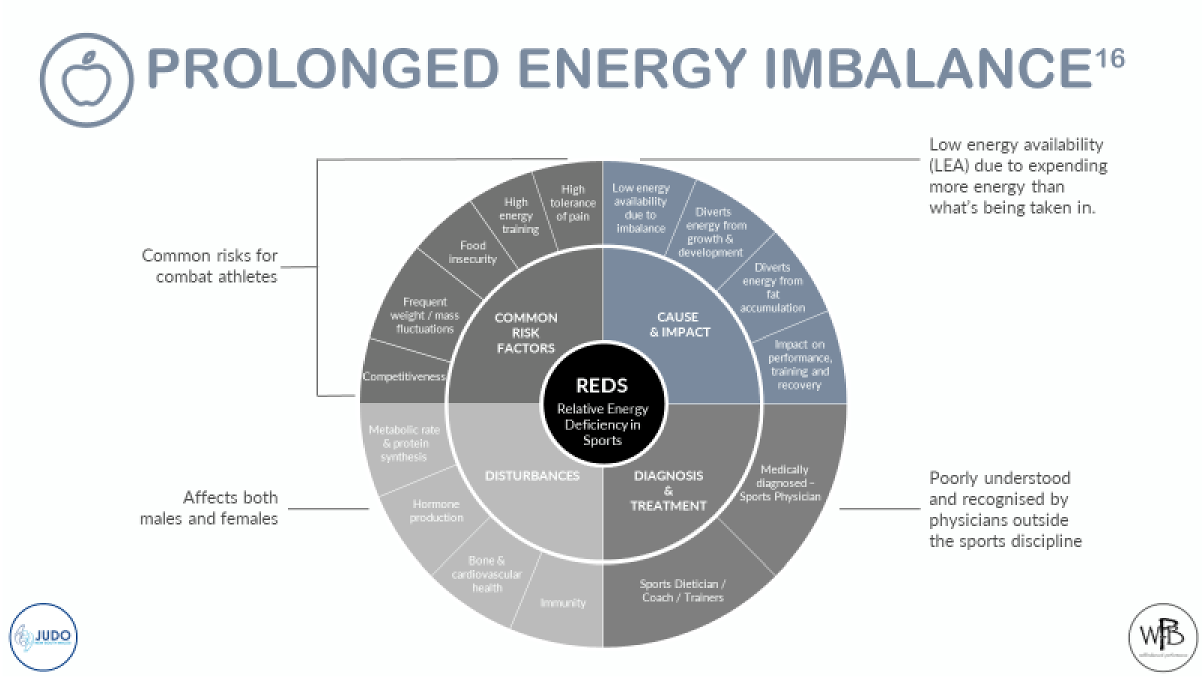
- Consume carb-rich food and drinks to ensure adequate muscle glycogen stores (7-10g/kg body mass). Consider if needing to make 5% weight check as carbs will hold water and increase weight.
- Rehydrate with fluids containing electrolytes and sodium.
- Rest to improve muscle stores further and minimise muscle damage

<u>Competition Day: Top Up Energy & Hydration</u>

- Pre-competition meal (1-4 hrs before competing). Aim:
    - Continue to top up glycogen stores via carb-rich/low fat/low protein foods.
    - Balance with minimising GI discomfort/upset.
- Increase hydration.
- Throughout the day: Continue with easily digestible carbs – food & drinks

<u>Post Competition: Fuel to Train</u>

- Ensure sufficient rehydration, particularly straight after competing.
- As competitive energy requirements are not dissimilar to regular training, return to normal dietary needs.



A complication of long-term energy deficit in athletes is a poorly recognised syndrome called Relative Energy Deficiency in Sport (RED-S). RED-S has a negative impact on many of our physiological functions: metabolic rate, protein synthesis, menstrual/erectile function, bone and cardiovascular health, and immunity. RED-S is caused by low energy availability (LEA) which occurs when expending more energy through exercise and daily activities than being taking in through diet/nutrition. LEA causes the body to adapt to sustain life – it diverts energy away from processes that aren't needed for immediate survival (e.g., growth, development, and fat accumulation). In doing this, the body's hormonal secretion is significantly altered from normal to maximise efficacy in a low energy state. While this may benefit general survival, it is not beneficial for optimal health or athletic performance.

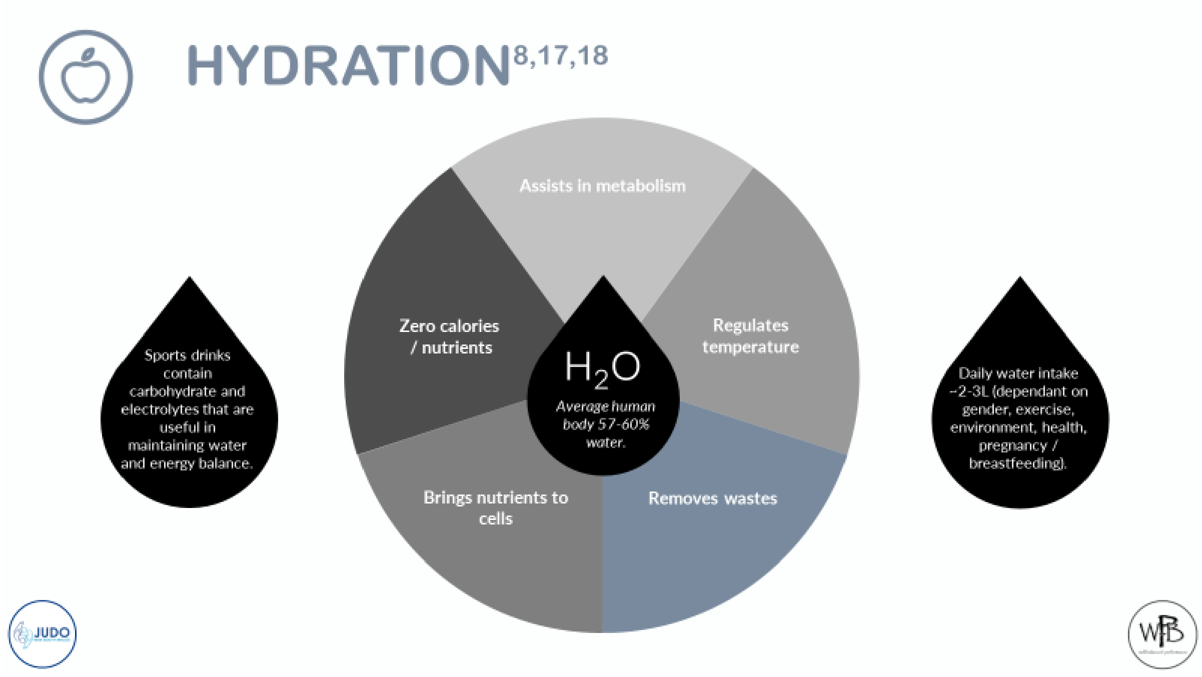
Both males and females can develop RED-S. LEA can vary in frequency, duration, and magnitude depending on the sport, gender, and diagnosis. Common risk factors for both male and female combat athletes include disordered eating behaviour and weight pressure. Trigger factors may include: performance pressure, a sudden increase in training volume, injury, teammate modelling of disordered eating behaviour, weigh-ins, a desire to be leaner to enhance performance, a dysfunctional coach-athlete relationship, and perfectionism. Coaches, trainers, and health professionals must understand risk factors and engage athletes in the appropriate screening. LEA symptoms are poorly understood outside of sports physicians. They are many and varied, mimic other disorders so RED-s is underestimated, or undiagnosed. Meanwhile, the impact on health can be significant. Early detection of at-risk athletes is vital to prevent long-term health consequences. If an athlete is exhibiting signs of RED-s, they should be referred to an appropriate healthcare provider.

Sometimes atheltes need to change their body composition to improve their performance outcomes. Ideally, athletes looking to adjust their composition safely and prevent short and long-term health consequences should work with a multidisciplinary team (dietician/nutritionist, S&C coach, GP). Atheltes should ensure they understand, and are vigilant for, the impact of LEA on health and performance outcomes.

While RED-S requires a medical diagnosis, it's treated through a nutrition and exercise plan. This plan helps an athlete achieve an energy intake that balances how much energy the athlete burns and is based on an increased food intake and, depending on the severity of RED-S, may require a break in training. Failure to address the imbalance through food and exercise modification could result in:

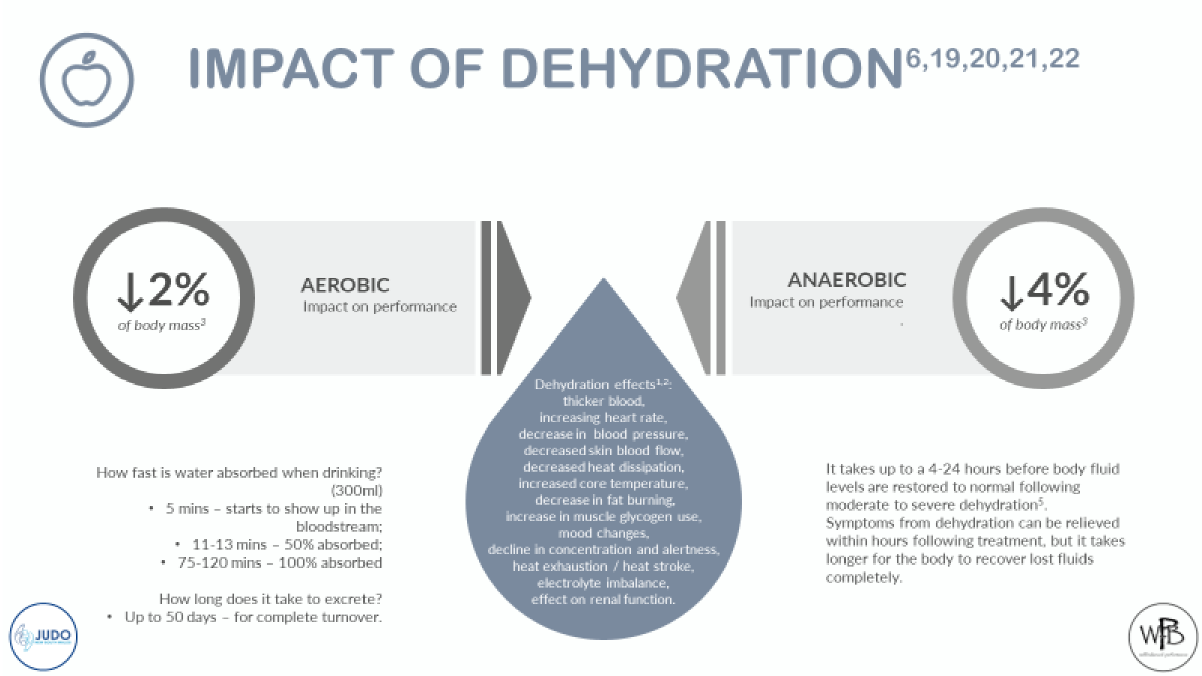
- increased risk of injury,
- greater incidence of delayed onset muscle soreness (DOMS),
- decreased muscle recovery after exercise,
- decreased immune function, and subsequent increased risk of illness, and
- a reduction in power and endurance.

It is best to consume adequate energy, carbohydrate, protein, and fat appropriate for your sport and activity. The plan should also address micronutrient deficiencies, particularly those related to bone growth, including iron, calcium, and vitamin D. RED-S is a serious health condition that often goes unnoticed until an individual has been suffering from the consequences associated with LEA for some time.



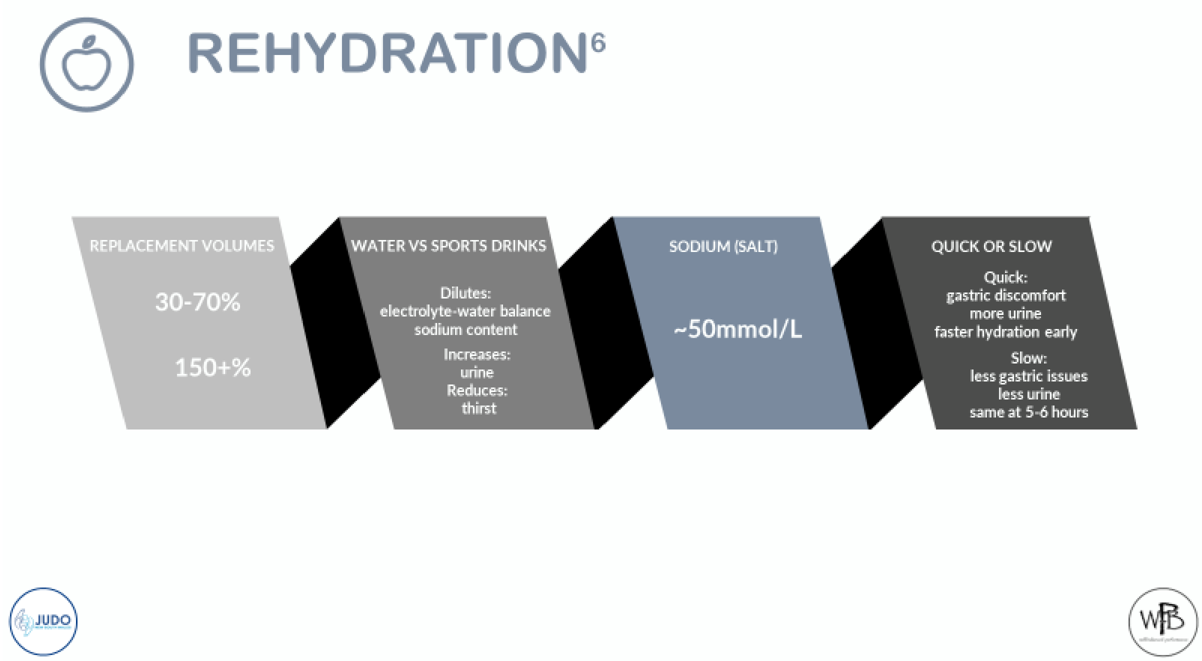
Considered by some as the 4th macronutrient, water plays a vital role in performance.The human body is made up of ~60% of water and it's required for several functions. Daily water intake is a personal preference, but guidelines recommend 2-3L/day. Many athletes underestimate the amount of water they require daily and will often turn up to training already in a fluid deficit.

A fluid loss of 2% of body mass can impact aerobic exercise performance, whereas anaerobic exercise generally takes a little longer, impacting at a 4% loss. Many of the effects caused by dehydration are also compounded by methods to 'sweat off' (sauna's/steam rooms/hot baths), so you should be cautious if using these methods. Minimising the time and impact of dehydration is a priority, and athletes will often underestimate the amount of fluid loss during training sessions. One way to more accurately measure this is to weigh yourself at the start and end of the training session.



Athletes typically replace only 30-70% of sweat losses during exercise. You should aim to replace a minimum of 150% of training losses (as you continue to sweat and lose fluid through urination) post exercise. Drinking plain water when dehydrated causes the electrolyte-water balance and sodium content in the blood to dilute, which results in increased urine production and reduced thirst. This can create an issue – you stop drinking too early as you no longer 'feel thirsty'.

The optimal sodium concentration in a rehydration beverage should be at least 50mmol/L. Whilst sports drinks can be contentious, replacing electrolytes, particularly sodium provided by these, are more beneficial than water alone when you are in fluid deficit. Eating salty foods or putting salt on meals post exercise can also help relieve this deficit. A final consideration when rehydrating is whether to drink quickly or slowly. Large volumes consumed quickly can cause gastric discomfort and cause more loss through urine production. Spacing fluid intake may minimise gastric issues; intake should be tailored to what is most palatable for you.



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All advice is general and individual weight plans should be obtained from a qualified Health Professional. If you are more than 5% above the weigh in weight, consider moving up a weight category or book an appointment with a qualified Health Professional.