

FUELLING THE ATHLETE

AN EXPERT REFRESHER

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Energy is delivered to the body through the carbohydrates, fats, and protein in our diet, otherwise known as macronutrients. Each food source contains macronutrients (often a combination of all three) with differing amounts of calories. All three macronutrients are needed in your diet, regardless of your activity levels, to maintain optimal health. The ratios of these macronutrients will then vary day to day depending on the energy requirements and demands of that day to support health and performance.

ATP: OUR ENERGY CURRENCY

As an overview, carbohydrates contain 4 calories per gram, proteins contain 4 calories per gram, and fats contain 9 calories per gram. These macronutrients get converted to energy in the form of adenosine triphosphate (ATP) via different metabolic pathways. Recreational and grassroots athletes should be made aware that ATP is otherwise known as our energy currency, and it is the creation of ATP that provides us energy.

ATP cannot easily be stored in the body, and what is stored gets used within a few seconds, so our bodies need to continually create ATP to support movement. The body converts nutrients to ATP via two pathways: aerobic metabolism and anaerobic metabolism. Most often, it is a combination of both pathways that supply the fuel needed for exercise; however, as exercise intensity increases, anaerobic metabolism becomes the predominate fuel source.

When it comes to performance, such as high intensity bursts or interval training, carbohydrates are the most efficient fuel source, due to their chemical structure and oxygen content, allowing for greater energy to be delivered to the working muscles. Protein is primarily used by the body for building and repairing tissues rather than movement, whereas fats are broken down via beta oxidation and provide lasting amounts of ATP (several hours or even days) when oxygen is present.

As sports nutritionists, we need convey the critical role carbohydrates play in optimizing performance due to the decrease in oxygen availability when exercise intensity rises. Murray & Rosenbloom's 2018 paper in Nutrition Reviews¹ provides a great overview of the fundamentals of glycogen metabolism for coaches and athletes.

CARBOHYDRATE PERIODIZATION FOR THE GRASSROOTS ATHLETE

Carbohydrate periodization is primarily practiced amongst professional athletes, but it can also have applications for grassroots athletes. In simple terms, it means adjusting the amount of carbohydrates in your diet based on training demands. The idea is to find your baseline carbohydrate intake for an easy training or rest day and scale up or down carbohydrate intake to reflect the intensity of training.

It is important to focus on consuming complex carbohydrates from sources like wholegrains, fruits, vegetables, and legumes, as they provide essential nutrients and fibre for overall health. For further reading on carbohydrate periodisation, please see Anderson et al's work ², which provides insight to the traffic light system. When presenting carbohydrate periodization, ensure athletes are aware that lower carbohydrate days doesn't mean no carbohydrates.

		TYPICAL LOADS	BREAKFAST	DURING TRAINING	LUNCH	SNACK(S)	DINNER
MD	MD+2	No training	MEDIUM 0.5-1.0g/kg	NO TRAINING	MEDIUM 1.0g/kg	MEDIUM 0.5-1.0g/kg	MEDIUM 1.0g/kg
	MD-4	75-80min TD 5000m HSR <100m PM resistance training	MEDIUM 1.0g/kg	NO CHO	HIGH 1.5-2.0g/kg	MEDIUM 0.5-1.0g/kg	MEDIUM 1.0g/kg
	MD-3	80-90min TD 6500m HSR 300-600m	MEDIUM 1.0g/kg	NO CHO	HIGH 1.5-2.0g/kg	MEDIUM 0.5-1.0g/kg	MEDIUM 0.5-1.0g/kg
	MD-2	<70min TD <4500m HSR <100m	LOW 0.5g/kg	NO CHO	HIGH 1.5-2.0g/kg	MEDIUM 0.5-1.0g/kg	MEDIUM 0.5-1.0g/kg
	MD-1	<60min TD <3000m HSR <50m	HIGH 2.0g/kg	HIGH 60g/h	HIGH 2.0g/kg	HIGH 1.5g/kg	HIGH 2.0g/kg
MD	MD	90min TD 11km HSR 1000m	HIGH 2.0g/kg	PRE-MATCH MEAL HIGH 2.0g/kg	DURING GAME HIGH 60g/h	POST-MATCH HIGH 1.2g/h for 3h	
	MD+1	Starters (>60min) Recovery session	HIGH 2.0g/kg	HIGH 60g/h	HIGH 2.0g/kg	HIGH 1.5g/kg	HIGH 2.0g/kg
MD+1	MD+1	Non-starters (<30min) 70min TD 6500m HSR 1200m	MEDIUM 0.5-1.0g/kg	NO CHO	MEDIUM 1.5-2.0g/kg	MEDIUM 0.5-1.0g/kg	MEDIUM 0.5-1.0g/kg

MD: match day, TD: total distance, HSR: high speed running, CHO: carbohydrate

LOW CHO INTAKE

MEDIUM CHO INTAKE

HIGH CHO INTAKE

Image: This example of carbohydrate periodization table uses a traffic light system and shows how professional football players periodise their carbohydrate intake based on their energy needs for the day or the following day.

DIETARY SOURCES OF CARBOHYDRATES

When talking through real food examples, grassroots athletes might find it helpful to understand the variance of energy between carbohydrate sources. Carbohydrates can be known as simple or complex or high or low in GI (glycaemic index) respectively.

The glycaemic index is a scale of 1-100 that ranks carbohydrate-based foods on their overall blood glucose level effect. Foods low in GI are absorbed slower than foods higher in GI. Sometimes these foods with a lower GI (such as fruit and bread) will be

described as nutrient dense, as they provide other nutrients. and/or can offer additional fibre. Conversely, foods (such as sugar and energy drinks) that are high in GI and classed as nutrient poor as they solely provide carbohydrates, with no other useful nutrients. Athletes should prioritise foods low in GI to maximise the micronutrients in their diet. However, there may be a place for foods higher in GI around training to limit gut issues³.

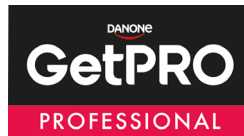
GUT SENSITIVITY AND TIMING OF MEALS

Commonly, low GI, high fibre meals are recommended for a healthy diet. However, these foods take the body longer to process and so may lead to gastrointestinal issues if consumed too close to exercise. Everyone's gut sensitivity is different, and the intensity of your workout will also impact the incidence of gastrointestinal issues. As a rule of thumb, consuming a meal high in carbohydrate with moderate protein, fat and fibre 2-4 hours before your moderate to low intensity training, should limit the incidence of gastrointestinal issues.

Any meal consumed 1-2 hours before exercise means less time for digestion, and so recreational athletes should prioritise options lower in fat and fibre but high in carbohydrate. If exercising at a high intensity within ~ 1 hour of eating, foods higher in GI may help limit the incidence of gastrointestinal issues. This is because when we exercise, our bloodstream is diverted away from the gut and to the

working muscles, meaning the digestion of food is slowed. Refer to the joint position of the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine for a summary of carbohydrate intakes for athletes before and during exercise⁴.

Fuelling is an important component of nutrition for all athletes, but we can't think about fuelling in isolation; advice should be delivered as part of a wider framework that we sometimes refer to as the 'Three Rs'. Following exercise, the 3 Rs (refuelling, repairing, and rehydrating) can be a useful tool for athletes to think about their nutritional needs and the strategies for meeting them before, during and after exercise. The ideal strategy is dependent upon a myriad of factors and solutions, which may require experimentation and working with a qualified nutritionist. It is important athletes are aware that no one size fits all.



TAKE HOME POINTS

- Energy comes from the carbohydrates, fats and protein in our diet.
- Sufficient carbohydrates are essential when it comes to performance.
- Glycogen stores are limited (~500g) highlighting the importance of topping up stores if exercising at high intensities or for long durations (>80mins), when the aim is to maximise performance.
- Periodising carbohydrate doesn't mean no carbohydrate! The amount you need is dependent upon your individual goals and activity levels.
- The closer you are to exercising, opt for foods higher in GI and lower in fibre, fat and protein to limit gastrointestinal issues.
- Glycogen is king when it comes to performance!

REFERENCE LIST

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