Fueling Endurance Training: A Comprehensive Macronutrient Guide

Introduction

Endurance training (whether you're preparing for a 5K or a full marathon) demands not just dedication to miles, but also a commitment to proper nutrition. Think of your body as a high-performance engine – it needs the right fuel to run efficiently, recover, and adapt. A balanced intake of carbohydrates, proteins, and fats, along with adequate hydration and micronutrients, will help you **fuel performance and recovery**. This guide breaks down each macronutrient's role in endurance training, updated daily recommendations, optimal timing strategies, and tips on eating enough (yes, even a *calorie surplus* can be crucial) to power your training. The tone here is both motivational and professional – because fueling your body well is both an art and a science. Let's dive in and learn how to eat to *go the distance*.

Carbohydrates: Power Your Performance

Carbohydrates are the primary energy source for endurance exercise, truly the runner's best friend. They are stored in your muscles and liver as glycogen – the critical fuel that keeps you going during those long runs and intense workouts. When you train hard, your body taps into these glycogen stores; if they run low, you'll likely hit the dreaded "wall" (also known as bonking) where fatigue and loss of pace set inpmc.ncbi.nlm.nih.gov. To train and race at your best, you need to proactively fill and refill your carbohydrate tank. Here's how to make carbs work for you:

- **Role in Training:** Carbs provide the quick, efficient energy that endurance athletes rely on. At higher intensities (typically above ~65–70% VO_2max), your body shifts to burning mostly carbohydrates because they yield more energy per unit of oxygen than fatspmc.ncbi.nlm.nih.gov. In simple terms, carbs are high-octane fuel. Adequate carb intake delays fatigue by preserving muscle glycogen; conversely, *exhaustion of carb stores is linked to fatigue, reduced work capacity, and impaired concentration*pmc.ncbi.nlm.nih.gov. This is why runners carb-load and use sports drinks – to avoid running out of this critical fuel mid-race.

- **Daily Needs (Based on Training Volume):** Endurance athletes should calibrate their carbohydrate intake to their training load. General guidelines recommend about **5–7 grams of carbs per kilogram of body weight per day** for moderate training (~1 hour of moderate exercise per day, such as 5K/10K preparation), and **6–10 g/kg/day** for heavier training loads (~1–3 hours/day, as often seen in half-marathon or marathon prep). In periods of very high-volume or intense training (elite marathoners or ultra-endurance

training, >4 hours exercise per day), needs can reach **8–12 g/kg/day**pmc.ncbi.nlm.nih.govbetterhealth.vic.gov.au. For example, a 70 kg (154 lb) runner in marathon training might target ~500g of carbs per day. These amounts ensure your glycogen stores are consistently topped up. On lighter training days or rest days, you can scale carbs down a bit, but during hard training blocks, **don't skimp on the carbs!**

- **Pre-Workout Fueling:** Timing your carb intake can dramatically improve your training quality. Before key workouts or races, eat a carbohydrate-rich meal or snack to start with full fuel stores. Aim for roughly **1–4 grams of carbohydrate per kg** of body weight in the **1–4 hours pre-exercise** windowpmc.ncbi.nlm.nih.gov. The exact amount and timing depend on your tolerance – e.g., ~1 g/kg if it's only one hour out (a small snack like a banana and half a bagel), up to 3–4 g/kg if you have a larger meal 3-4 hours prior (like a bowl of oatmeal with fruit and honey). This pre-workout carb intake provides readily available energy and spares your glycogen for later in the workout. Also, keep that pre-run meal low in fiber and fat to avoid gastrointestinal issues during exercisegermanjournalsportsmedicine.com. Hydrate alongside your pre-run fuel (more on hydration later).

- **During Training (Intra-Workout):** For short workouts under an hour, extra carbs during the session aren't usually needed – your glycogen stores will cover itpmc.ncbi.nlm.nih.gov. But when you're going longer than about 60–90 minutes (think long runs, intense track workouts, or any race half-marathon and up), *intra-workout fueling* becomes important. Consuming carbohydrates during exercise helps maintain blood glucose and delays fatigue. A common recommendation is **~30–60 grams of carbs per hour for exercise lasting 1–2.5 hours**pmc.ncbi.nlm.nih.gov. For very long sessions beyond ~2.5 hours (such as marathon long runs or the marathon race itself), you can **increase to 60–90 grams of carbs per hour**pmc.ncbi.nlm.nih.gov if your gut tolerates it. This can be achieved with sports drinks, gels, chews, or other easily digestible carb sources. For example, drinking a sports beverage with ~6-8% carbohydrate or taking an energy gel every 30-45 minutes can supply ~30-60g/hour. Practice your race-day fueling in training to find the products and timing that sit well with you. Proper fueling during long runs keeps your energy steady so you can finish strong instead of crawling home.

- **Post-Workout and Recovery:** After you finish a hard or long workout, your muscles are primed to replenish glycogen – this is often called the "glycogen window" or part of the post-exercise recovery window. Aim to refuel with carbohydrates as soon as possible, ideally within 30 minutes to 2 hours after exercise, to jumpstart recovery. A good target is **about 1.0–1.2 grams of carbohydrate per kilogram** of body weight in the first hour or two post-exercisepmc.ncbi.nlm.nih.gov. For a 70 kg athlete, that means ~70–85g of carbs (for instance, a recovery smoothie with fruit or a couple of bananas with a sports bar). Pairing carbs with some protein in this recovery meal enhances glycogen re-synthesis and muscle repair – for example, a 3:1 or 4:1 ratio of carbs to protein is

often recommended for endurance recovery. In fact, adding protein can accelerate glycogen restoration when carb intake is on the lower sidepmc.ncbi.nlm.nih.gov, though if you already ingest ~1.2 g/kg/hour of carbs post-workout, you're likely maximizing glycogen refueling via carbs alone. Bottom line: **prioritize a carb-rich snack/meal after tough sessions** (think chocolate milk, yogurt with granola and fruit, or a turkey sandwich and sports drink), and include some protein (about 20–25g, see Protein section) to aid muscle recovery while refilling your energy stores.

- **Quality Carb Sources:** All carbs are not equal, and endurance athletes should focus on nutrient-rich sources for overall health and sustained energy. **Complex carbohydrates** and **whole foods** provide not only fuel but also vitamins, minerals, and fiber. Great choices include whole grain breads and pasta, brown rice, quinoa, oats, potatoes and sweet potatoes, beans and lentils, fruits, and starchy vegetables. These should form the foundation of your daily diet, especially in the early phases of training and for main mealsfile-hnjh24lt4sngv5uouijsjkbetterhealth.vic.gov.au. However, there is also a place for **quick-digesting carbs** (even those "refined" sugars) in an endurance athlete's fueling plan: before or during workouts, or in the immediate recovery window, easily digestible carbs like white bread, rice, ripe bananas, pretzels, sports gels, energy chews, or sports drinks can be very usefulbetterhealth.vic.gov.aubetterhealth.vic.gov.au. They are light on the stomach and rapidly absorbed to provide immediate energy. For example, many marathoners will consume white rice or pasta with a little lean protein as their pre-race dinner (low fiber, high carb), or sip a sports drink and eat a gel during long runs. **Experiment with various carb sources** during training to see what gives you the best energy and gastrointestinal comfort. Come race day, rely on the tried-and-true options your body likes. Remember: carbohydrates truly are the endurance athlete's fuel for both **performance and recovery**[**betterhealth.vic.gov.au**](betterhealth.vic.gov.au) – treat them as a priority in your nutrition plan.

Protein: Building Blocks for Recovery and Adaptation

Protein is often associated with strength training, but it's just as critical for endurance athletes. While carbs fuel your run, **protein rebuilds and fortifies your body** afterwards. Endurance training places repeated stress on muscles (think of all those eccentric contractions during running), and adequate protein helps repair microtears, build new enzymes and mitochondria, and even supports your immune system. Getting enough protein ensures you come back stronger session after session, rather than breaking down from the training load. Here's how protein factors into your endurance nutrition strategy:

- **Role in Training:** The primary role of protein for an endurance athlete is **muscle repair, recovery, and adaptation**. Each run or workout creates some muscle fiber damage; protein provides the amino acids needed to repair those fibers and to build new muscle proteins, making your muscles more resilient over time. Sufficient protein also supports the synthesis of enzymes that aid aerobic metabolism and helps maintain other tissues

(like tendons and immune cells) that get stressed with heavy training. In short, protein is your body's construction material to rebuild **stronger** between workouts. Without enough protein, you might experience excessive muscle soreness, slower recovery, and even loss of lean muscle mass over a long training cycle. Additionally, endurance exercise can sometimes cause a small amount of muscle protein to be burned as fuel (especially if glycogen is low), so providing a steady supply of dietary protein helps minimize any muscle breakdown during prolonged training.

- **Daily Protein Requirements:** Endurance athletes have higher protein needs than sedentary folks, mostly to cover those constant repair and remodeling processes. Current sports nutrition guidelines from groups like the Academy of Nutrition and Dietetics (AND), Dietitians of Canada (DC), and the American College of Sports Medicine (ACSM) recommend **~1.2–2.0 grams of protein per kilogram of body weight per day** for athletespmc.ncbi.nlm.nih.gov. The International Society of Sports Nutrition (ISSN) is in a similar ballpark, suggesting about 1.4–2.0 g/kg/daypmc.ncbi.nlm.nih.gov. Endurance athletes typically aim for the lower-to-middle end of that range (around 1.2–1.6 g/kg) while strength athletes might be toward the upper endpmc.ncbi.nlm.nih.gov. For example, a 70 kg runner should target roughly 84–112 g of protein per day (which might look like ~20-25 g of protein in four meals or snacks spread through the day). There is some evidence that during especially heavy training (for instance, during a high-mileage marathon training block or during a training camp with dramatically increased volume), temporarily bumping protein toward the higher end (~1.8-2.0 g/kg) could be beneficial to support greater recovery needspmc.ncbi.nlm.nih.govpmc.ncbi.nlm.nih.gov. However, intakes above ~2.0 g/kg/day consistently haven't shown additional performance benefit for endurance athletespmc.ncbi.nlm.nih.gov – your body can only use so much protein, and excess beyond that might just be burned for energy or excreted. So aim for the recommended range and focus on consistency. Notably, these athlete recommendations are roughly **double** the protein RDA for the general population (0.8 g/kg), highlighting how important protein is when you're training hardpmc.ncbi.nlm.nih.gov.

- **Optimal Protein Timing and Distribution:** *When* you eat protein can matter just as much as how much. Rather than loading all your protein in one meal, it's best to **distribute protein evenly across the day**, including around your workouts. Research shows that muscle protein synthesis (the process of rebuilding muscle) is elevated for up to 24 hours after exercise and is maximized by protein intake during this windowpmc.ncbi.nlm.nih.gov. Aim to consume **0.25–0.3 g/kg of a quality protein** (roughly 15-25 grams for most people) **within 0–2 hours after exercise**pmc.ncbi.nlm.nih.gov to kickstart recovery. This amount provides about 10 grams of essential amino acids, including the key amino acid leucine, which is enough to maximally stimulate muscle repair pathwayspmc.ncbi.nlm.nih.gov. If you prefer, consuming that protein **immediately before** exercise can be similarly effective for muscle recovery as having it right after – choose the timing that suits your schedule and stomach comfortpmc.ncbi.nlm.nih.gov. In addition to the post-workout window, try to

include a similar 20–30g protein dose in other meals throughout the day. For instance, you might have eggs or Greek yogurt at breakfast, chicken or tofu at lunch, a protein smoothie or bar as a snack, and fish or beans at dinner. Spreading protein into **4-5 feedings of ~0.3 g/kg** every **3-5 hours** is a proven strategy for maximizing muscle protein synthesis over the course of the daypmc.ncbi.nlm.nih.gov. This steady supply of amino acids helps your body continuously repair and adapt. And don't neglect **pre-sleep protein**: having a casein-rich snack like cottage cheese or a protein shake before bed can provide amino acids during the night to support overnight muscle repair. While protein timing isn't *quite* as critical as carb timing for fuel, these nuances can add up to better recovery over weeks and months of training.

- **Protein During Exercise:** Endurance athletes typically don't need to consume protein during workouts under normal circumstances – carbs and fluid take center stage there. However, for **very prolonged or intense endurance events** (think ultramarathons, full Ironman triathlons, or back-to-back hard sessions), a small amount of protein during exercise may help reduce muscle breakdown. The ISSN suggests that about **0.25 g/kg of protein per hour**, when combined with carbs, can mitigate muscle damage in exhaustive endurance eventspmc.ncbi.nlm.nih.gov. For a 70 kg athlete, that's roughly 17-18 g protein per hour (for example, some ultra-endurance sports drinks include a bit of protein, or athletes might consume amino acid supplements or real food like bites of an energy bar). In marathon training, which is usually not *quite* as extreme, you might not need intra-workout protein, but some runners do take in a small amount on very long runs (e.g., a few bites of a protein bar during a 3-hour run) to curb hunger and potentially aid recovery. In any case, **protein during efforts <2-3 hours is usually optional** – focus on carbs – but know that it *doesn't hurt performance* to have some, and it might speed recovery for the toughest workoutspmc.ncbi.nlm.nih.gov. Always test any protein-containing fuel in training to ensure it sits well with you.

- **Quality Protein Sources (Animal and Plant):** The good news is that endurance athletes can meet their protein needs from a wide variety of foods – both animal-based and plant-based. **High-quality proteins** are those that provide all the essential amino acids (EAAs) your body cannot produce on its own. Animal sources are typically complete proteins and rich in the amino acid leucine (which is a key trigger for muscle building). Excellent options include lean meats (chicken, turkey, lean beef), fish (which has the bonus of healthy fats), eggs, and low-fat dairy products like milk, Greek yogurt, and cottage cheese. Whey protein (from milk) is a particularly fast-digesting source great for post-workout shakes, whereas casein (in dairy) digests more slowly and is ideal before sleep. In fact, **dairy-based proteins may have a slight edge** in stimulating muscle protein synthesis due to their high leucine content and fast absorptionpmc.ncbi.nlm.nih.gov. But plant-based athletes can absolutely hit their protein goals as well – it just takes a bit of variety and quantity. **Soy** (tofu, tempeh, edamame, soy milk) is a complete plant protein that has been shown to effectively stimulate muscle repair similar to animal proteinspmc.ncbi.nlm.nih.gov. Other plant proteins like legumes (beans, lentils, peas), whole grains (quinoa, oats), nuts, and seeds are nutritious and

contribute protein; however, they might be low in one or two essential amino acids. By **combining different plant foods** (for example, rice with beans, or peanut butter on whole grain bread), you can get a complete amino acid profile. If you follow a vegetarian or vegan diet, aim for the higher end of the protein range (since plant proteins can be a bit less bioavailable) and focus on **varied sources**: lentil or chickpea curries, bean burritos, quinoa bowls with tofu, pea or soy protein shakes, etc. As long as total protein intake is sufficient and diverse, plant-based diets can support endurance performance well. The key is consistency – give your body the building blocks it needs daily, and you'll recover better and get stronger after each run.

Fats: Long-Lasting Fuel and Vital Support

Dietary fats often don't get the spotlight in sports nutrition the way carbs and proteins do, but they play an indispensable role in an endurance athlete's diet. Fat is a rich energy source, crucial for low-to-moderate intensity exercise and for supporting overall health. Each gram of fat packs 9 calories (more than double the energy of carbs or protein), and even a lean athlete carries tens of thousands of calories worth of fat fuel in their body storespmc.ncbi.nlm.nih.gov. This means fat can provide energy for the *long haul*. However, using that fat for fuel is slower and requires plenty of oxygen, so your body leans on fat more during easy to moderate efforts and on carbs during high-intensity effortspmc.ncbi.nlm.nih.gov. Beyond energy, fats are needed for **hormone production, vitamin absorption, and cell structure**. So, let's give fats the attention they deserve in your training diet:

- **Role in Training:** Fat is the primary fuel for longer-duration, lower-intensity exercise. On your easy aerobic runs and long slow miles, a higher proportion of energy comes from fat metabolism (spareing glycogen for when you need a burst of speed). Endurance training actually enhances your ability to burn fat efficiently, which is one reason your aerobic base training is so important. That said, during races or hard workouts at higher intensity, your body *cannot release energy from fat quickly enough* to meet all the demands, so carbs become the dominant fuel. Some athletes experiment with high-fat or "ketogenic" diets to become even more fat-adapted. While this can increase the amount of fat your body uses, it **comes at a cost**: you lose the ability to push hard intensities fueled by carbspmc.ncbi.nlm.nih.gov. For most endurance athletes focused on performance, a very high-fat, low-carb diet is not ideal, as it limits the capacity to train and race at peak pacespmc.ncbi.nlm.nih.gov. So, think of fat as your *slow-burn energy* that complements carbs. It's especially useful on long endurance efforts and ultra-distance events where intensity is lower. But equally important, **fat is vital for recovery and health**: it provides essential fatty acids that reduce inflammation and it's needed to absorb fat-soluble vitamins (A, D, E, K) that keep your body functioning optimallypmc.ncbi.nlm.nih.gov. In summary, fat fuels your longer efforts and supports many bodily processes – it's the endurance athlete's friend, as long as you balance it well with carbs for the high-intensity work.

- **How Much Fat to Eat:** In contrast to carbs and protein, fat intake for athletes is not typically prescribed per kilogram of body weight. Instead, it's usually given as a percentage of your overall calories. General recommendations are that **about 20–35% of your total daily calories** should come from fatbetterhealth.vic.gov.au. For athletes, it's important **not** to restrict fat too low – consistently eating less than ~20% of your calories from fat can lead to deficiencies in essential fatty acids and fat-soluble vitaminspmc.ncbi.nlm.nih.govpmc.ncbi.nlm.nih.gov, and might hurt your health and recovery. On the flip side, a very high-fat diet (>50-60% of calories) might crowd out the carbs you need for quality workouts. So aim for a middle ground. For example, if you're consuming ~3000 calories during marathon training, about 600-900 calories from fat (which is ~67-100 grams of fat) would be within the recommended range. Exactly where you fall in that range can depend on personal preference and how your body handles different macronutrient ratios. Some endurance athletes naturally eat on the higher carb/lower fat end (e.g., 60% carbs, 20% fat) especially when carb-loading, whereas in base training they might be closer to 50% carbs, 30% fat. The key is to get **enough** fat to support health without displacing carbohydrates unduly. Also remember that fat is calorie-dense; if you're struggling to eat enough calories to meet a high training load, incorporating more healthy fats (like oils, nut butters, etc.) can be an effective way to increase energy intake without having to eat a huge volume of food.

- **Timing Considerations:** Unlike carbs and protein, **fat timing around workouts is less critical** – in fact, you generally *want* to **limit high-fat foods immediately before exercise**. Fat delays gastric emptying (i.e., it digests slowly), which can cause discomfort if you eat a very fatty meal right before a run. Thus, your pre-run meals should be relatively low in fat. Save the bacon and sausage for after the race! During exercise, fat is not something you consume (with the exception of ultra-endurance events where people might eat real foods like nuts or peanut butter sandwiches during a 6-hour run, but even then carbs remain the priority fuel). Most sports nutrition products during exercise avoid fat for quicker absorption. The main timing aspect with fat is to ensure you **spread your fat intake through the day** in your regular meals to meet your needs. Also, if you are doing a special protocol like carb-loading before a marathon, you might temporarily reduce fat intake in those 1-2 days in order to eat higher carbs (since you have only so many calories you can ingest)pmc.ncbi.nlm.nih.gov. Similarly, on race morning or big workout mornings, stick to low-fat carb-rich foods so that your meal digests quickly. Beyond those scenarios, incorporate fats normally – for example, include some healthy fats in your post-workout meal (like avocado or a drizzle of olive oil) which can help satiety and provide nutrients, once you've gotten your immediate carbs and protein in.

- **Healthy Fat Sources:** Focus on **quality fats** that support your training and overall wellness. Unsaturated fats are the heart-healthy type that also reduce inflammation – these should make up the bulk of your fat intake. Great sources include avocados, olive oil and olives, nuts (almonds, walnuts, cashews, etc.), seeds (chia, flax, pumpkin seeds), and nut/seed butters. Fatty fish like salmon, tuna, and mackerel are especially beneficial

because they provide omega-3 fatty acids, which have been shown to reduce inflammation and may even aid recovery and joint health. Including fish a couple times a week or using fish oil supplements if needed can help ensure you get those omega-3s. Plant-based athletes can get omega-3s from flaxseeds, chia seeds, walnuts, or algae-based supplements. In contrast, try to **moderate saturated fats** (found in butter, high-fat dairy, fatty cuts of meat, and coconut oil). Some saturated fat in the diet is fine – and dairy in particular can be a useful recovery food – but too much saturated fat at the expense of unsaturated fats isn't ideal for long-term health. Completely avoiding fat is neither practical nor healthy, but do choose fries and donuts sparingly as those come with less nutritional value. **Trans fats** (often in fried foods and packaged snacks) should be minimized as they are unhealthy. In practice, a balanced endurance diet might include things like olive oil on pasta, a handful of nuts as a snack, nut butter on toast, oily fish or avocado in a salad, etc., to reach that ~20-30% of calories from fat. These foods will not only provide energy but also help absorb vitamins and keep hormonal function in check. Remember, fat is your ally for endurance – it's the reserve tank that keeps you going when carbs run low, and it's essential for maintaining the machinery of your body.

- **Special Note – "Fat-Adapting" Strategies:** You may hear about athletes "training low" (low carb) to enhance fat burning. Indeed, training with low glycogen occasionally can upregulate fat metabolism enzymespmc.ncbi.nlm.nih.gov. Advanced athletes sometimes do morning runs before breakfast or back-to-back sessions to deliberately train in a glycogen-depleted state. While these techniques can increase your fat-burning capacity, they should be used cautiously. Performance on high-intensity workouts can suffer without carbs, and doing too much in a low-carb state may increase illness or injury risk. If performance is your goal, be careful not to chronically skimp on carbs in the name of fat adaptationpmc.ncbi.nlm.nih.gov. A common saying is "*Train low, race high*" – meaning some low-carb training can be done to stimulate adaptations, but you still want to consume plenty of carbs when racing or doing high-quality sessionspmc.ncbi.nlm.nih.govpmc.ncbi.nlm.nih.gov. For most recreational endurance athletes, simply maintaining a balanced diet with sufficient carbs and including some longer slow runs (which naturally use more fat) will provide a good fat-burning capacity without extreme dietary manipulations.

Eating Enough: Caloric Surplus and Energy Availability

One of the most underrated parts of endurance nutrition is **total energy intake** – in other words, eating enough calories to meet the demands of your training. When you're increasing mileage or upping intensity, your body's energy needs can skyrocket. It's crucial to consume adequate calories so that you have an energy *surplus* available to fuel training, recovery, and even muscle growth. Training for a marathon is not the time to be on a strict weight-loss diet; in fact, being in a chronic calorie deficit can sabotage your performance and health. Let's discuss why a calorie surplus is often important during training and how to approach it:

- **Why You Need a Surplus:** In simple terms, a **calorie surplus** means you're eating more calories than you burn in a day. During heavy training, this surplus isn't about gaining a lot of body fat – it's about ensuring your body has *extra resources* to repair muscle, refill glycogen, and adapt to the training load. If you consistently eat less than you burn (a calorie deficit), you risk **Low Energy Availability (LEA)**, which can lead to a host of problems: poor recovery, fatigue, loss of muscle mass, increased injury risk, hormonal imbalances, and suppressed immune functionpmc.ncbi.nlm.nih.govpmc.ncbi.nlm.nih.gov. In endurance athletes, insufficient energy intake has been linked to slower recovery and even reduced performance (for example, low energy can decrease your VO_2max and endurance capacity). In contrast, when you eat enough – or slightly above your immediate needs – you create an optimal environment for improvement. Your body can use the surplus energy to build new mitochondria in muscle cells, synthesize enzymes and red blood cells, and generally become more efficient. **Think of food as part of your training plan**: just as you schedule rest days to allow fitness gains to occur, you need to "feed" those gains with ample calories.

- **Risks of Underfueling:** Many runners (especially those new to endurance training or those worried about weight) fall into the trap of underfueling. The scale might go down, but so can your performance. Chronically training on too few calories can cause what's known as Relative Energy Deficiency in Sport (RED-S), which affects various body systems. Signs of underfueling include constant fatigue, poor workout quality, loss of menstrual cycle in women, frequent colds or illnesses, and stress fractures or recurring injuries. *Research shows that insufficient energy intake impairs recovery and adaptation, increases injury risk, and ultimately hampers performance*pmc.ncbi.nlm.nih.govpmc.ncbi.nlm.nih.gov. In one study of male endurance athletes, those with low energy availability had lower testosterone and bone density – clear indicators of the body downregulating important functions to conserve energypmc.ncbi.nlm.nih.gov. In female athletes, low energy availability can lead to menstrual disruptions and bone loss. None of this is conducive to becoming a better runner! The takeaway: **food is fuel, not the enemy**. During training phases, it's generally better to err on the side of slightly too much than not enough. Any short-term weight loss benefit from heavy calorie restriction will be outweighed by the drop in performance and higher injury risk. As one review bluntly stated, *insufficient energy consumption negatively affects performance*pmc.ncbi.nlm.nih.gov. So if you want to run your best, you must eat enough.

- **How to Calculate Your Calorie Needs:** Determining the right calorie target can be tricky, as it varies per individual. A starting point is to figure out your **maintenance calories** (the amount you need to maintain weight given your training). This includes your basal metabolic rate (calories you'd burn at rest) plus the calories burned through daily activities and exercise. There are online calculators that estimate this, or you can consult a sports dietitian for a personalized approach. For a rough estimate, some endurance athletes use the rule of thumb of about 45–50 calories per kilogram of body

weight on heavy training days (this includes both basal needs and training) – this aligns with research suggesting energy availability should not drop below about **30–45 kcal per kg fat-free mass** (lean body mass) per day for healthgermanjournalsportsmedicine.comgermanjournalsportsmedicine.com. Once you have an idea of maintenance, consider adding a small surplus on top. A common approach is aiming for an extra **300–500 calories per day** above maintenance on training days. For example, if your calculated maintenance (with your runs included) is ~2500 kcal/day, you might shoot for ~2800–3000 kcal on days with hard workouts or long runs. This surplus ensures you're not just meeting basic needs but providing extra fuel for muscle repair and glycogen storage. Keep in mind, energy needs can vary day to day: on a rest day you might eat a bit less (perhaps closer to maintenance or even a slight deficit if weight loss is a goal), whereas on a long run day you might eat considerably more. It's normal for appetite to fluctuate with training load – listen to those hunger cues, as your body often knows when it needs more. If you find yourself hungry all the time or bonking in workouts, that's a sign you likely need to increase your calorie intake.

- **Gaining, Losing, or Maintaining Weight:** Your goal during endurance training could be to maintain weight, lose a bit, or even gain muscle – but all of these require careful attention to fueling. **Calorie surplus** is usually discussed in the context of gaining muscle mass (bulking), and indeed if you are a very lean runner looking to add some strength, a surplus will help you gain a few pounds of muscle (especially if you incorporate strength training). But even if weight *gain* isn't the aim, a slight surplus ensures you're not unintentionally in deficit. If you want to **maintain weight**, you might hover around that break-even or slight surplus zone and monitor your weight weekly – if it's stable and your workouts feel good, you're in the right range. If you are trying to **lose weight** for performance (for instance, some runners aim to drop a few pounds for race season), it must be done cautiously: opt for a very small deficit (perhaps 200-300 calories below maintenance) and avoid heavy deficits during intense training blocks. It's often better to schedule weight-loss phases in the off-season or base phase, rather than when you are peaking for a race. A severe calorie cut can quickly lead to the underfueling issues mentioned above. Many athletes find that during training, their weight naturally settles at a point where they feel strong – trust that, and focus more on fueling quality and training consistency than the scale. Remember that **muscle is weight too** – sometimes runners recomposition (lose fat, gain muscle) and stay the same weight but get faster and healthier. **Use performance, recovery, and how you feel as the barometers** of whether your calorie intake is appropriate. If you're recovering well, sleeping well, and logging good workouts, you're likely fueling properly.

- **Practical Tips to Eat Enough:** Eating a lot of food (especially healthy food) can be surprisingly challenging for endurance athletes who have very high calorie needs. Here are some tips:

- **Eat frequent meals/snacks:** Instead of three huge meals, you might need 5-6 eating occasions per day. For example, breakfast, a mid-morning snack, lunch, afternoon snack, dinner, and a bedtime snack. This prevents you from feeling overly stuffed but steadily supplies energy.

- **Include calorie-dense foods:** Incorporate nuts, nut butters, olive oil, avocado, dried fruit, and smoothie shakes into your diet – these pack a lot of calories/nutrients without too much bulk. Drizzle olive oil on veggies, add peanut butter to oatmeal, throw an extra handful of walnuts into your cereal. Liquid calories like 100% fruit juice or chocolate milk can also help if you struggle to meet needs via solids.

- **Refuel immediately after workouts:** This not only aids recovery (as discussed), but it also adds to your daily calorie count. A post-run recovery drink or bar plus a meal an hour later can significantly contribute to meeting your energy needs.

- **Listen to your body:** Some days you'll be ravenous – that's okay, eat bigger portions or an extra snack. Other days when training is lighter, you might naturally not want as much. Honor those signals, while keeping an eye on overall trends.

- **Monitor weight and performance:** If you notice unintentional weight loss week after week, increase your portion sizes or add an extra snack daily. If you're gaining weight too rapidly (more than ~0.5 lb per week), you can dial back slightly. Ideally, any weight change (up or down) during training should be gradual and intentional.

  In summary, **fuel your training, don't diet through it**. As a mantra: *train hard, eat hard*. The calorie surplus (or at least adequate energy intake) is the foundation that allows carbs, protein, and fats to do their jobs effectively. By eating enough, you'll feel more energetic, hit your paces, and reduce your risk of burnout or injury. As one sports nutrition summary put it: meeting your energy requirement is the major nutritional goal for endurance athletes[germanjournalsportsmedicine.com](germanjournalsportsmedicine.com) – everything else builds on that.