



## EAT TO CLIMB MINA LESLIE-WUJASTYK

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# PRINCIPLES

KATHERINE CHOONG ON NORDIC FLOWER (L1+L2), FLATANGER, NORWAY. @ KEITH SHARPLES





# ENERGY EAT TO PERFORM

### Why is energy such an important concept in nutrition?

Energy is the foundation of good nutrition and provides the basic opportunity for us to use our bodies for things like climbing. Optimising nutrition should begin first and foremost with ensuring that there is enough energy in the system. For example, there is no point in speculating about ideal macronutrient ratios or meal composition if there is not enough energy going in.

To be able to maximise our performance in climbing and the adaptations gained from any training, energy availability for climbing and training must also be maximised. This is a longterm view; the ability to respond physiologically and become a better athlete is dependent on the quality, intensity and volume at which we can expose our body to a stimulus - climbing, or training for climbing, in this case. This will be greater, both long and short term, if energy is not a limiting factor in our sessions or in recovery from sessions. Recovery, both within and between sessions, is a crucial part of this picture. Better and faster recovery means higher quality, more volume and more intensity is possible in a given time frame, and thus greater adaptation and progression over time. Not only will our physiological adaptation be maximised with this approach, but when we have more available energy to practise the sport, we also get more time to hone the technical elements.

The basic premise of this perspective on energy, and nutrition in general, is to think about what can be added rather than taken away. Try to steer towards a mentality of boosting your system, and away from the reductionist approach of minimum effective dose. In many sports, and particularly in climbing, this may require a paradigm shift from what has been the sport's cultural norm for some time.

#### **Energy systems in climbing**

So, how is energy used when we climb? There are three main energy pathways in our cells that are used when exercising. They all have different ways of making ATP (adenosine triphosphate), a unit of energy, which our muscles can then use to create force. Which pathway is most dominant will depend on the intensity and duration of the effort in that moment: climbing can be lower intensity and continuous, or shorter, higher-intensity bursts of effort, or a combination of both of those things. It is not an on/off switch between these different systems but more of an interchangeable dominance depending on demand.

#### → Phosphocreatine system (PCr)

The PCr system is the fastest way to get energy as it uses readily available creatine phosphate in a cell to create ATP. It is fast but limited in availability and slow to replenish. The PCr system is used in short, hard bursts of effort, especially in the first ten seconds. Think about maximal-effort moves, or a deadlift or a sprint.

#### → Anaerobic glycolysis

In anaerobic glycolysis, the cell uses glucose (from carbohydrate) to create ATP when no oxygen is present and the intensity demand is high. This system will take over dominance from the PCr system after the initial burst and it can sustain energy provision for up to two minutes. Think about hard boulder problems or a series of challenging moves on a route.

#### → Aerobic glycolysis

Aerobic glycolysis uses both carbohydrate and fat to create ATP in the presence of oxygen. This is the most sustainable and efficient way to create energy but requires lower intensities of effort. Think about walking to the crag, easier sections of climbing or recovering between bouts of higher-intensity work.

The objective intensity at which we switch energy system dominance is also dependent on our strength and fitness; one person may complete a certain climb with aerobic system dominance, while another might be using more of their anaerobic pathways on the same climb. This is dependent on our aerobic threshold (the maximum intensity at which we could indefinitely continue using aerobic glycolysis to create ATP), particularly in the forearms as these are often the limiting muscle groups for climbing performance. This threshold, when describing the use of the finger flexors in climbing, has been coined *critical force.*!

#### **Energy intake**

The energy used by the body to climb – and for everything else that goes on behind the scenes to exist and function – has to come from somewhere: food. *Energy intake* describes the energy value of the food that we eat. *Energy availability* describes the amount of energy intake we need to allow our body to function optimally – before accounting for the energy needs of exercise. This is discussed in more detail in chapter 11. Making sure there is enough energy availability is crucial for our health and performance. It is the starting point in terms of understanding what we need from the food we eat and how we can use nutrition to feel and perform better.

Energy intake from food is measured in kilocalories (kcals) and, although it would be great to offer a simple answer for how much we need to eat, it is something that is constantly in flux. There are methods that

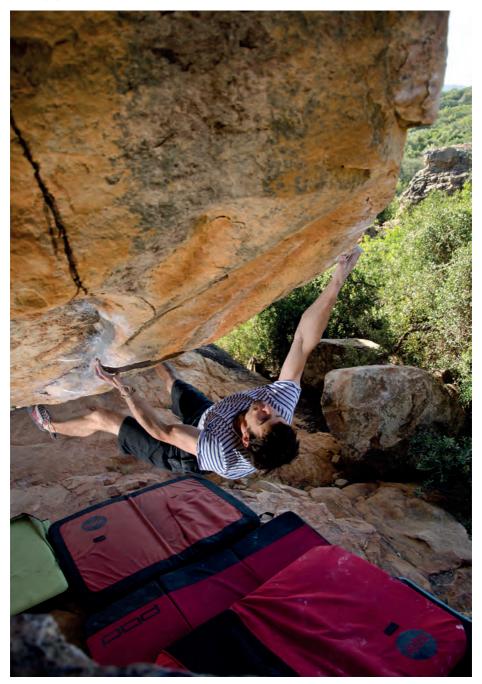
can be used to estimate our needs, but that is all they are, estimations. If they are used, it must be as a starting point rather than as an absolute figure to stick to. The energy needed for any given day or period of time will be highly dependent on multiple factors such as our activity level and relative fitness, body temperature, environment (for example, altitude) and previous food intake, as well as body size, composition, age and biological sex.

As a very general concept, if we eat less than we expend, weight loss may occur (fat and muscle loss), and if we eat more than required then we might gain weight (fat, or muscle if training stimulus is present). This 'calories in versus calories out' concept is widely used to describe the balance of energy between consumption and expenditure within the body and, while it does have foundation based on the rule of thermodynamics, it oversimplifies what is going on in the body and can be misleading if followed too rigidly in practice.

By this rule, as mentioned above, any deviation from perceived energy balance the matching of estimated input and output - would result in weight loss or gain. Due to the flux of both sides of this equation, and the elaborate physiology of the body, it can be more complex than this. It is helpful to think of energy intake requirements as a range rather than an absolute figure. For example, increasing energy intake may lead to increased climbing energy and output, and up-regulation of certain bodily functions (thus increasing one side of the equation unknowingly) rather than weight gain, and, conversely, a reduction in intake may lead to down-regulation of certain bodily functions and reduced energy in climbing, rather than immediate weight loss.

i A calorie is the amount of energy needed to raise the temperature of 1 gram of water by 1°C. A kilocalorie is 1,000 calories. In practice, and in this book, these terms are used interchangeably, with the informal term 'calorie' representing kilocalories.

#### EAT TO CLIMB



DAVID MASON ON BLACK SHADOW, ROCKLANDS, SOUTH AFRICA. @ NICK BROWN

The body is highly adaptable and dynamic, especially in an athletic population, making it key not to distil these concepts down too much. This is compounded by the reality that measuring both intake and output of energy is very difficult and often inaccurate. Nuance and flexibility, alongside knowledge, are vital in gaining a functional and optimal approach to energy intake.

#### Measuring energy needs

In an ideal world, methods with higher accuracy such as indirect calorimetry – a non-invasive method that measures gas exchange – would be used to measure base-level energy needs, but, in a real-world situation, this is not always possible. As a starting point, resting energy expenditure (REE) can be calculated more practically by using one of a number of equations, depending on the availability of measurements and

metrics. One way these equations differ from each other is that some consider body composition – relative amounts of fat and fat-free mass - while others do not. In an athletic population, such as climbers, where muscle mass (part of fat-free mass) is often higher than in the general population, an equation that takes into account body composition (if known) will likely be more accurate. Muscle mass is more metabolically active than fat mass and, as such, having more of it will mean a higher energy expenditure even at rest. In the case of climbers with higher muscle mass, equations that do not include body composition will often come out with a lower estimate than those that do due to this difference, leaving the climber with a concept of their energy needs that may be too low. Figure 2 presents the three equations found to have the most reliability in athletes and climbers, along with an example.2

Figure 2: Example equations for measuring REE."

The following examples use a 30-year-old male climber; 180 centimetres tall, weighing 80 kilograms with a fat-free mass of 68 kilograms (15 per cent body fat).

#### ten Haaf (2014) - weight-based (doesn't account for lean mass):

REE (kcals/day) =  $(11.936 \times \text{weight in kg}) + (587.728 \times \text{height in m}) - (8.129 \times \text{age in years}) + (191.027 \times \text{sex} (M=1; F=0)) + 29.729$ 

(191.02/ × Sex (M=1; F=0)) + 29./29

Example REE = 11.936 x 80 + 587.728 × 1.8 - 8.129 × 30 + 191.027 × 1 + 29.279 = 1,989 kcals/day

#### De Lorenzo (1999) - weight based (doesn't account for lean mass):

REE (kcals/day) =  $-857 + (9.0 \times \text{weight in kg}) + (11.7 \times \text{height in cm})$ 

**Example REE** =  $-857 + (9 \times 80) + (11.7 \times 180)$ 

= 1,969 kcals/day

#### ten Haaf (2014) - fat-free-mass based (accounts for lean mass):

REE (kcals/day) =  $(22.771 \times FFM \text{ in kg}) + 484.264$ 

**Example REE** =  $(22.771 \times 68) + 484.264$ 

= 2,033 kcals/day

ii While many older, well-known equations such as the Harris-Benedict and Mifflin-St Jeor are still frequently used, a 2023 systematic review and meta analysis by O'Neill et al. into the accuracy of prediction equations in athletes recommends the use of the 2014 ten Haaf equation, and a 2023 study by Chmielewska et al. suggests that the De Lorenzo and ten Haaf equations are the most reliable for sport climbers.

If body fat percentage information is available, the results of REE equations can also be checked against energy availability thresholds. These are the thresholds under which a person is likely to have dysfunction – both health and performance – due to insufficient energy availability. The thresholds are currently understood to be no lower than 30 kilocalories per kilogram of fat-free mass for women, and no lower than 9–25 kilocalories per kilogram of fat-free mass for men.<sup>3</sup>

For the example individual in figure 2, this means ensuring that their daily intake – **not** including calories for any activity or

Figure 3: Total energy expenditure.

#### **EXERCISE ACTIVITY THERMOGENESIS**

- → The energy cost of exercise, such as climbing or training.
- → Varies depending on the intensity and volume of exercise.

### NON-EXERCISE ACTIVITY THERMOGENESIS (NEAT)

- → The energy cost of non-exercise activity, such as standing, walking or working.
- → Varies depending on the intensity and volume of occupational activity and general lifestyle.

#### THERMIC EFFECT OF FEEDING

- → The energy cost of digesting food.
- → Varies depending on the amount and composition of food.

#### **RESTING ENERGY EXPENDITURE (REE)**

- → The energy cost of background basic bodily functions at rest, such as breathing, pumping blood around the body, maintaining a stable body temperature and hormone production.
- → Varies depending on age, height, body mass, body composition and biological sex.

exercise as these must be added on top – must ideally not be below 1,700 kilocalories.

It is worth mentioning that these equations are quite dated and lack reliability, but we do not currently have new options. They offer starting points, estimates for our baseline energy needs; the energy required by our body to perform basic bodily functions such as breathing, pumping blood around the body, maintaining a stable body temperature and hormone production. Any activity, however small or large, must be added on top of this, adding yet another layer of estimation (see figure 3, adapted from Hills et al., 2014). 5

There are some estimations in the literature for the energy cost of climbing, but these values can vary a lot depending on the relative difficulty of the climb, our ability relative to that difficulty, our familiarity with the climb and how steep the climb is. Bear in mind that these numbers are all rough estimates and are therefore open to a reasonable level of inaccuracy, especially in sports such as climbing where energy needs vary so wildly and our understanding of them is not concrete.

Given that there isn't a gold-standard way to determine the energy requirements of climbing in all its varieties and forms, a very simple (but also very rough) way to estimate the energy needs of a day is to use what is called a physical activity level (PAL) multiplier. This essentially multiplies the REE value. For example, a restful day with no exercise at all might have a multiplier of 1.2 (remember, the REE alone represents zero activity, just basal requirements at full rest), a light climbing day might use a multiplier of 1.3 or 1.4, and so on. These multipliers must include all activity in the day, not just climbing. Consider any other activities such as dog walking, running or cycling to work as well.

Using this strategy of estimation, our

example climber might use something like this to get some starting ideas around his energy intake levels:

Rest day (full rest) = PAL of 1.1-1.3

**Light day** (a light climbing session) = PAL of 13-15

**Moderate day** (one or more high-intensity or longer-duration sessions) = PAL of 1.5–1.7

**Heavy day** (high-demand day with multiple high-intensity and/or longer-duration sessions) = PAL of 1.7+

And using his REE from the ten Haaf equation (which accounts for lean mass), the resulting figures would look something like this:

**Rest day** = 2,236-2,643 kcals

**Light day** = 2,643-3,050 kcals

Moderate day = 3,050-3,456 kcals

Heavy day = 3,456+ kcals

These are really rough ranges, but they can provide a starting point from which our example climber can then experiment. Bear in mind that the body is dynamic and adaptable, so these numbers will vary over time and in different situations even for one person. It's a constantly changing conversation.

While it can be useful to understand what makes up total energy needs, it is not wholly necessary to calculate and stick to exact numbers. This kind of approach, while informative, can lead to rigidity in eating patterns that do not serve us as individuals. The most important thing is understanding that adequate energy intake – that lies in a range not a fixed number – is key to our health and performance. Understanding some numbers as a starting point from which to experiment is a good way to go. The human

body is very good at letting us know when energy is needed, and learning to listen to the signals it sends is a skill worth cultivating (intuitive eating is discussed more in chapter 12).

#### What about genetics?

There is also the strong force of genetics to consider, and with this comes the well-established concept of homeostatic weight regulation mechanisms. One of the key components of this concept is that of a 'set point', which was considered as early as the 1950s in obesity research. This theory dictates that we each have a genetic body fat range that the brain aims to maintain and regulatory feedback systems that work to keep us within this range. So, essentially, there are physiological mechanisms at play that keep us in a range of body fatness that is genetically determined.

This is not everything and it will still interact with our environment – food availability and choices, lifestyle and activity levels – but it is a powerful part of the picture. That is why we see a hereditary element to body size and obesity and a strong drive in the direction of weight regain after weight loss. It is worth mentioning, in the context of the obesity epidemic, that the upper range of this set point appears to have weaker biological moderation than the lower ranges. In other words, it is easier to push this set point upwards and maintain weight gain than it is to lower it and/or maintain weight loss.

#### **Understanding appetite**

One of the reasons that it isn't necessary – despite temptation – to outsource all this decision-making to our conscious brain is the presence of various internal feedback systems. One such neurobiological system is that of appetite hormones.

#### **EAT TO CLIMB**



THE AUTHOR ON MECCA: THE MIDLIFE CRISIS, RAVEN TOR, UK. @ NICK BROWN

Without going too deep into this, there are many hormones at play which can affect and control our appetite; some act on our brain directly and some circulate peripherally.9 Key players here, among others, include ghrelin, cholecystokinin (CCK), peptide YY (PYY) and leptin. These homeostatic hormones stimulate the body to register hunger (ghrelin) or satiety (CCK, PYY and leptin), respectively. Ghrelin, CCK and PYY are produced in the gastrointestinal tract, whereas leptin is produced in fat cells. In a well-functioning system, these hormones reflect nutritional status and body fat stores: ghrelin will be higher in periods of food scarcity; CCK and PYY respond to nutrients in the gut (especially protein and fat), and leptin is positively correlated with the presence of fat stores.

Insulin is also an appetite regulator. Insulin in the blood rises sharply after a meal and crosses the blood-brain barrier to signal that the need for food is reduced. These hormones are all in constant flux, determined by internal biological and nutritional status, sending signals to the brain about what our body needs.

Of course, there are more layers of complexity to consider. Food palatability and sensory information registered by the brain are also at play and often have an impact on energy intake before any endocrine processes have made their mark, making food choices and interoceptive awareness highly relevant to energy intake. Exercise can also suppress appetite, further complicating the signals that we receive. Not to mention that our psychological brain – conscious and

unconscious – is not unbiased, affected as everyone is by cultural influences that dictate what a 'meal' or 'snack' *should* look like, how much a person of a certain size *should* eat and what a body, especially an athletic body, *should* look like. Appetite, it turns out, is not simply physiological but biopsychosocial.

When the complexity of all these systems – only very lightly delved into above – is considered, it seems presumptuous to think that a simple equation could give us a static, reliable number for how much to eat and when we should eat. While it might feel gratifying to calculate a number and then just stick to it, this is not the flexible, long-term approach that benefits the most successful athletes. The harder-won battle is cultivating a relationship with our body and food intake that has a high

level of interoceptive awareness combined with nutritional knowledge enabling a dynamic, flexible and responsive approach to food. Ideally, nutrition and particularly energy intake should be viewed from a position of curiosity and willingness to experiment.

Pay attention and notice how your body feels and performs, increase intake a bit, and then observe again. A trial-and-error approach in this direction will encourage a positive and collaborative relationship with food that is constantly evolving and adjusting. Best of all, it leaves you open to discover what your body is capable of with a maximised input.

In short, learn the basics, by all means make some rough estimates in numbers, but don't forget to trust and listen to your body.

#### **KEY TAKEAWAYS**

- → Energy intake is a pillar of good nutrition; make optimising energy intake a priority.
- → Boost your body with the maximal effective dose for long-term progression; steer away from a reductionist approach.
- → There are three main energy systems in climbing: the PCr system, anaerobic glycolysis and aerobic glycolysis.
- → Energy expenditure (measured in kilocalories) is made up of resting energy expenditure, thermic effect of feeding, non-exercise activity and exercise activity.
- → There are some methods for calculating calorie needs, but these give just rough estimates as starting points from which to experiment.
- → Genetics and body fat 'set point' play a powerful role in weight management.
- → Appetite regulation is a complex biopsychosocial system. Using calculations and estimates for energy needs can be informative, but remember to listen to and trust your body.

#### WHAT CAN I DO?

- → Have a think about whether you eat enough calories overall on most days
- → Where can you add food in? How can you further support your body to optimise output and recovery?
- → If it feels helpful, work out some numbers so you have an idea of a rough range and track a day of food intake to see how close you are to that range.



# SHAUNA COXSEY BECOMING AN ATHLETE

Shauna needs little introduction. With 33 world cup medals to her name, 11 of them gold, and two overall world titles, she has been a force within the global competition climbing scene. Shauna generously shares her journey with nutrition and performance in a strikingly honest and open manner.

When I was 18, I decided I wanted to change my approach to being a professional climber – I wanted to be a professional athlete. Let me explain.

The pivotal moment came for me in 2012 when I broke my leg. I didn't land weirdly or anything, it just broke when I jumped down off a boulder. It was a stress fracture and a DEXA scan showed that I had low bone density. I was 48 kilograms, I knew I was pushing myself to be light and I also knew it had started to impact my health. So, there I was, with my broken leg, sitting on my sofa alone watching the London Olympics on the TV. I realised then that I wanted to be like the athletes I was watching, and not light and frail.

Growing up in our sport, I always looked up to the elite climbers before me who won medals and climbed hard. I wanted to be like them in some ways but, since my leg break, not in others. Don't get me wrong, these people were huge inspirations to me, but many of them looked different to the athletes that I saw in other sports. They didn't look like the robust, healthy, muscular men and women I was watching take medals in athletics and swimming. I didn't look like those athletes either. At that moment, my trajectory changed. I wanted to take the vibe of those Olympic athletes I was watching on the TV and bring it to my climbing. I wanted to morph from the injured climber that I was into a true athlete.

My body had sent me a strong message: low bone density is no joke. I realised that my nutrition in particular was going to play a significant role if I wanted to be a successful athlete. So, I got a coach, I got support for my mental game and I got nutritional support. I started to build a team around me and this has been fundamental for me over the years. My nutrition needed to improve; I needed to shift away from unhelpful habits and behaviours to a supportive and nourishing relationship with food. It's hard to get away from the reality

of climbing being a weight-dependent sport, it's etched into the core of what we do – we literally lift our bodies and carry them up walls. Of course moves feel easier if you take off some weight. This is a side to our sport that I think is really scary in terms of health and well-being.

From then on, I worked with dietitian Rebecca Dent to sort out my nutrition. The key thing for me was education. Learning about nutrition really helped me to understand the why behind the things Rebecca would recommend. It was the most important change for me: knowledge really is power. So, I learned about the importance of things like proteins, carbohydrates and fats for performance, as well as why I needed to increase my intake of calcium, iron and other vitamins to support my bones and overall health. We focused on a food-first approach, making sure my meals and snacks were all balanced and met the demands of my training. At the same time, we worked hard to understand my body composition through taking skinfold measures and DEXA scans so that weight wasn't our only data point.

Of course, as with all challenging changes, the journey wasn't linear. There were bumps in the road; times when I found the process easier, times when it felt really very hard. There were some key tactics that were very individual to me and really helpful. For example, breakfast has always been a challenging meal for me; I don't feel that hungry and don't like to eat at that time of day. It has always been an easy meal to skip. So, we made it predictable, logistically easy and as palatable as possible. It was the same each day, often prepared by my husband Ned so I didn't have to portion it out. I just had to turn up and eat. I still have to do this now from time to time.

I gained a solid ten kilos but with that ten kilos came some of my best performances and it was at that higher weight that I won the majority of my medals. I learned that my best strength-to-weight ratio wasn't found at my lightest weight.

In fact, if my weight started to drop again, it often came with diminished performance, tiredness and frequent illness. I knew the weight at which I was really healthy, I knew where I might perform my best but couldn't stay long, and I knew the weight at which I was too light.

The competition circuit can be intense. A lot of travelling, lots of different food cultures, hotel rooms, planes and trains. I often travelled with food to keep things as controlled and predictable as possible. The last thing any competitor wants is to go into a world cup feeling like they haven't fuelled well or, even worse, get sick. So, I took my go-to snacks, my breakfast prep and my recovery meals with me to many places around the world. Because breakfast has always been tough for me - and especially so at competitions due to added nerves I think - I had to make it particularly manageable. Not only was it super important to get it in, it had to have the right ingredients to help me perform well and be very portable. So, I used to take a hand blender and make a smoothie each morning in my hotel room with Huel, powdered peanut butter, oats, soy milk and banana; that way I knew I was giving myself the best possible preparation for the day ahead. It took the decisions away and allowed me to handle that particular meal in a mechanical fashion

Next, before the actual climbing starts at world cups there is an isolation zone where everyone warms up and waits for their turn to climb. The time spent there can vary depending on which round it is and where a competitor is ranked. It always felt like I was the person with the most snacks! There are often some provided, but not always and not necessarily what I might want. My snack game was strong, and I made sure I never ran out. When the climbing started, I didn't actually eat anything during the round but would drink Red Bull in little sips between boulders to give me a boost. I also had water with a HIGH5 solution added which contained carbohydrates



and electrolytes, as well as some backup CLIF BLOKS if I needed them. My hydration was always done really intuitively – I didn't do any measuring of sweat rates or anything, I just went on feel and that worked fine for me. Immediately after the competition round I always had a Nākd bar; it probably wasn't the absolute best nutritionally, but it was something I knew I could stomach as eating post round was rarely something I wanted to do and I ate it alongside taking some BCAAs. Later on, I would have a recovery meal that was a balance of proteins, carbohydrates, fats and vegetables.

Climbing and performing at a top level was and is my career, my livelihood and my passion. I'm lucky of course, but it came - and does come - with pressure. I've had a lot of injuries over the years and I do wonder - although of course I'll never know for sure - whether my early errors of not eating enough played a hand in how many I have had to deal with. As a professional athlete I have had to find a really fine balance between eating enough to stay healthy and progress in training while also keeping a body composition that is optimised for performance. This is not a simple task and it's been hard both physically and emotionally at times. I have many medals and I'm an Olympian but, in my eyes, my biggest achievement is that throughout it all I have kept my love for climbing to this day.

All the competing seems like a lifetime ago now, but my nutrition is still really important as

I push my body towards my outdoor climbing goals. And the newest challenge? Being a parent and all that comes with that while keeping on top of my own needs! Pregnancy and breastfeeding are whole separate topics, but to touch lightly on those areas, as other mothers out there know. they are both intense on the body! Being pregnant and then recovering post-partum came with a whole set of physical, mental and nutritional challenges. Breastfeeding my daughter was a joy and a privilege, but it also carried a huge energy cost and could be draining: I really struggled to keep my weight up when breastfeeding and training. Now we are in the toddler phase, I need to be really organised. I have less time than ever and my attention is often split. Frankie is my priority, but I need to make sure that I also pack snacks for me next to the ones I never forget for her. Parenting seems to involve keeping lots of balls in the air at once and I try my best to make sure the nutrition ball doesn't get dropped. My body certainly lets me know if it does.

Being a mother has also intensified my desire for the priorities in our climbing culture to change and change dramatically. My daughter loves climbing and I want her to grow up in a sport that champions the strong not the light, the healthy not the emaciated. I've done my best to play a role in moving our sport in this direction through my role as president of the IFSC Athletes' Commission over the last six years, but there is still a long way to go. We need to look after the athletes that are competing now, but I also feel strongly that we have a responsibility to the community as a whole and the climbers of the next generation. As with most persistent issues, there isn't a straightforward solution, but I hope that we can start to get our priorities in the right places as time moves forward. Climbing is now an Olympic sport and with that comes more exposure, more money and, ultimately, more pressure on athletes. I'd be lying if I said I wasn't worried.