

# Critical Mass User Manual

## Resting Metabolic Rate (RMR)

This is the quantity of calories your body consumes during a 24 hour period, at rest. This is of vital importance, for it determines your fat utilization. The percentage of fat utilization relative to carbohydrate utilization is greatest at lower activity, and during rest. Therefore the higher the resting metabolic rate, the more fat calories are utilized. Since the organs, heart, diaphragm, intestines, liver, brain etc remain the same size, the only variable that influences RMR is the addition or loss of lean muscle tissue. Maintenance or an increase in lean muscle tissue is critical to ongoing success in terms of fat loss, since this will maintain or increase RMR. Muscle tissue loss creates a scenario of diminishing returns.

## Resting Metabolic Rate (RMR) table

Percentage of Calories utilized by the systems of the body.	
Liver	27%
Brain	19%
Heart	7%
Kidneys	10%
Skeletal Muscle	18%
Other Organs	19%

The above values are an average. The goal is to increase the role skeletal muscle plays in the equation above.

## Eating to Retain Lean Muscle & Spare the RMR

Firstly lean muscle is comprised of protein, which in turn is comprised of the following 20 amino acids

Name	Gluconeogenic	Ketogenic	Properties
Alanine	yes		
Arginine	yes		Essential
Asparagine	yes		
Aspartic Acid	yes		
Cysteine	yes		Essential
Glutamic Acid	yes		
Glutamine	yes		
Glycine	yes		
Histidine	yes		Essential
Isoleucine	yes	yes	Essential
Leucine		yes	Essential
Lysine		yes	Essential

Methionine	yes		Essential
Phenylalanine	yes	yes	Essential
Proline	yes		
Serine	yes		
Threonine	yes	yes	Essential
Tryptophan	yes	yes	Essential
Tyrosine	yes	yes	Essential
Valine	yes		Essential

Firstly, essential amino acids are critical; with them all the other amino acids may be manufactured, so it is important to eat foods that supply an adequate level of amino acids, especially essential amino acids. But this is not enough. If the food combinations you eat do not consist of all the amino acids, then the lacking amino acid becomes the limiting amino acid, and significantly affects the absorption of all the other amino acids, and further increases nitrogen loss through deamination. This is the reason that being a vegetarian is a complete farce, and patently unhealthy. One can not obtain the necessary protein required from vegetables alone.

### Below is a list of the Essential Amino Acids

Isoleucine
Leucine
Lysine
Threonine
Tryptophan
Methionine
Histidine
Valine
Phenylalanine

Below is a list of Limiting amino acids in various foods:

Protein Source	Limiting Amino Acid
Rice	Lysine
Maize	Lysine, Tryptophan
Wheat	Lysine
Legumes	Methionine, Cysteine
Beef	Phenylalanine, Tyrosine
Egg, Chicken	None, The standard reference for absorbable protein
Milk, Whey	Methionine, Cysteine

To optimize amino acid utilization when eating the foods above, it would be wise to supplement the amino acids in the right hand column, or add foods that contain these amino acids to the meal.

## How does the body reduce RMR, through low calorie, low protein intakes?

This is complex biochemistry, but I'll try and simplify it. The body's primary energy pathway is glycolysis or the glycolytic pathway. This is when the carbohydrates you eat become useable glycogen and ATP, providing you with energy. Now if you increase your calorie expenditure through cardiovascular exercise, or decrease your calorie intake, (note: your body effectively reacts the same way to both) your body has to find an alternate fuel source, this being the Ketogenic and Gluconeogenic pathways. Now both of these pathways use amino acids and fat to create energy. On the one hand this is beneficial, as you are now burning fat, but on the other hand your body will inevitably be using amino acids that it is acquiring from skeletal muscle tissue. The Gluconeogenic pathway favors Alanine, and specifically Glutamine as its amino acids of choice to produce fuel. The problem arises in that the average diet is hopelessly inadequate to supply sufficient amino acids to fuel this process. And more importantly, your skeletal muscle amino acid pool is approximately 60% Glutamine, so if it needs it, this is where it will find it. So now the eating plan has to be designed in such a way, that there is an adequate supply of protein (amino acids), especially Glutamine, and a reduction in carbohydrate intake (the bodies primary fuel source), leaving it no option, but to use fat as a fuel source. However one can not go to extremes and eat no carbohydrates, as this creates other problems. The thyroid will attempt to slow your metabolic rate by reducing TSH (Thyroid Stimulating Hormone), causing a downward production of T4 (inactive thyroid hormone, stored in peripheral tissue), and T3 (Active thyroid hormone), which will drop body temperature and thermogenesis (the production of heat). One will notice that on any restrictive diet over time, body temperature will drop off. Carbohydrates which stimulate an Insulin response are necessary to some degree, as Insulin aids with the conversion of T4 to T3, and prevents the subsequent loss of thermogenesis. The protocol has to be designed in such a way, based on your RMR that also mitigates all these factors that can throw a spanner in the works. Remember your biochemistry and make up are the remnants of what allowed your ancestors to survive - not gaining muscle easily and accumulating fat VERY easily. This is what ensured the survival of our ancient ancestors. Hearing someone say they have a sugar craving is absurd, as the body doesn't need, or know what sugar is. Chemically, what is happening, especially during dieting, is that the pleasure centre in the brain, controlled by the dopamine pathway, wants to stimulate your appetite to eat, especially the things you enjoy. Funny how those foods you enjoy, tend to be bad for you, from a fat accumulation point of view. Your body is all about survival, and it makes you crave foods that store fat, ensuring its survival. Furthermore, restricting calories inevitably restricts nutrient intake (vitamins, minerals, trace elements). Now if the body requires these substrates to perform functions relating to the organs, the creation of neurotransmitters, hormones, enzymes etc, it will look for them where they are stored – the muscle, the same place where the amino acids are found to fuel the gluconeogenic and ketogenic pathways. And this is how the human body

reduces metabolism, by slowing the thyroid, and consuming its own muscle. This has to be avoided at all cost, if you are expected to keep the fat off. Failing to do so will result in more and more fat accumulation over time.

## The Havoc Fat plays with the Endocrine System

The accumulation of fat has a more sinister side than merely its negative impact on the cardiac system. As you accumulate fat, there is a subsequent increase in aromatase enzyme produced by fat cells. This in turn increases estrogen production, by aromatizing testosterone into estrogen, and in turn stimulating more female pattern fat deposition (in men and women). But it doesn't stop there! Testosterone production is regulated by the hypothalamus, and the hypothalamus reads circulating estrogen levels to control its production of testosterone - if estrogen levels go up testosterone comes down. Now you have even more estrogen and even less testosterone to counter it, and this is a non stop spiral downwards. Men suffer even more side effects, as high estrogen increases depression, and will naturally lead to impotence. Alcohol also plays a role in increasing estrogen production, and will accelerate the side effects mentioned above, especially beer, since it has such a high glycemic index, and will promote a lot of fat deposition. It is of vital importance for longevity and health, that one keeps the endocrine system function properly.

## A better way to eat

Assume you have performed a RMR test, and your resting metabolic rate is 2000 calories/day, and the calories burned through activity are 1000 calories/day, which equals a total of 3000 calories expended a day. Now, through a combination of increased activity and/or a reduced calorie intake, you create a deficit of 1100 calories/day. Since a kilogram of fat is 7700 calories, you should lose 1kg of fat/week. Theoretically this should hold true, but in practice it does not. How does the body's adaptive response work to eliminate this deficit? For if it did not negate the deficit, one should be able to lose weight indefinitely (which is theoretically possible). The body reacts to this deficit by dropping thermogenesis - reducing the production of thyroid hormone. Secondly, it uses up some muscle tissue, thus lowering the RMR. In the example above, the thyroid could negate about 200 calories of that deficit, which now leaves a deficit of 900/day, and the catabolism of muscle tissue (over a relatively short period of time) to the sum of 900 calories/day, which equates to a loss of approximately 10kg of muscle. Yes, the scale goes down by 10kg (of muscle), and now you plateau on the same eating plan. Now you're sitting with a Metabolic Rate (including activity) of 1900 calories/day, which includes your RMR of about a 1000. Now how do create a deficit from here? You cut your calories again to create a deficit. But creating another deficit of 1100 calories a day would mean you can only eat 800 calories a day. Again, the body responds in the same way until you have to cut more calories. How long can you carry this on before you're eating no food at all, and anything you do eat is stored as fat, because now you have a non-existent RMR?

Now that we have established the RMR via the Fitmate, how do we eat? Well assuming the RMR + activity calories are as above (3000 calories/day) and you decide on creating a 500 calorie a day deficit - either by eating less or exercising more or both. To create a 500 calorie/day deficit, you could lose roughly 0.5kg/week. Lets assume you did this through eating, and now you're eating 2500 calories/day. Do you think you would have the same effect if you ate 2500 calories in one meal, or over 6 meals? A pizza is less than 2500 calories a day, and I assure you, if you only ate one pizza a day you would gain fat. Firstly, there is insufficient protein to maintain skeletal muscle, so your RMR would drop to match the pizza's calorie value. Secondly, your body cannot process that many macronutrients and calories in one sitting, which would result in fat storage. Let's stop thinking about calories and food per day, but per hour. How many calories can it process? If 3 meals are better than 1, 6 would be better than 3. The key is to feed the body, eat sufficient protein to support the muscle, maintain RMR and take in adequate macro and micro nutrients. A rule of thumb is 2 grams of protein /kg of body weight, split over 5 or 6 meals, with equal amounts of protein in each meal which are spaced evenly throughout the day, starting first thing in the morning.

## Training for a Leaner Body

This may be controversial, but the facts are right in front of us. Cardiovascular exercise **DOES NOT WORK** to lose body fat long term, period!! Why is this? Let's take a hypothetical individual: female, 30 years old, 55kg, sedentary. She decides she wants to get toned (a word I hate). So she takes up running on the treadmill for an hour a day 5 days/week. Nothing else in her life changes, her diet and lifestyle remain the same. In the first week she loses 0.5kg. If she maintained her consistency 5 days a week, would she lose 25kg this year? Leaving her weighing in at 30kg? Of course not and why is this? Firstly cardiovascular activity is very efficient at chewing up muscle tissue, the steps are as follows:

1. Conversion from fast twitch muscle fiber to slow twitch muscle fiber, by acquiring mitochondria and relinquishing contractile protein. Smaller fiber, less RMR.
2. Excessive Cortisol released in response to the damage to the fiber as a result of the exercise. Cortisol acts as a natural analgesic, but severely hampers protein synthesis and muscle repair. It also damages the immune system, and ultimately will contribute to all of our deaths - so I'm not sure why anyone would do anything that would accelerate this process.
3. It has been shown, that high volume cardiovascular exercise can completely deplete satellite cells in muscle fiber, which means no new fiber can grow or existing fiber be repaired.
4. Growth Hormone levels decline with high volume cardiovascular exercise, which also hampers the repair process. Low growth hormone also accelerates aging.
5. To sum it up, you can't train all day, and you can't eat no food, but you can always build a bit more muscle, and in so doing, elevate the RMR.

Eat and train to build or maintain muscle: 3-4 half hour resistance workouts per week, trying to go progressively heavier will go a long way to increasing longevity, increasing RMR, and slowing the aging process.

## Basics of Resistance Training

1. 3-5 sessions/week not longer than 40 minutes each
2. Keep it to about 10 heavy sets per muscle group, except legs would be about 15.
3. Rest no longer than 90 seconds between sets. If your rests are too short, you probably aren't going heavy enough.
4. Start off with 3 light warm up sets prior to the first exercise. After that you will be sufficiently warmed up, no further warm up sets for that muscle group are required.
5. Keep to between 8 and 12 repetitions per set; this is the ideal rep range to stimulate growth. Higher repetitions are counterproductive, although a few heavy sets with as low as 4 repetitions to the max are fine from time to time.
6. Each muscle group should be trained only once per week, an example would be:  
Monday: Chest, Biceps. Tuesday: Back, Calves. Wednesday: Rest. Thursday: Legs, Abs. Friday: Shoulders, Triceps. Saturday and Sunday: Rest. The muscle needs adequate time to rest, and repair.

To review studies on cardiovascular vs resistance exercise visit  
<http://www.jacn.org/cgi/content/full/18/2/115>