Fat Burning Strategies with Exercise and Nutrition by Matt Lovell

Intuitively, having a low proportion of body fat would seem to be advantageous for athletic endeavour, increasing the efficiency of power transfer from respiring muscle. Reducing excess weight will increase the resulting speed of movement (at a given power output) for actions such as throwing, running, hitting or lifting. In addition, adipose tissue is a metabolically active organ that uses the body's resources and is associated with several adverse health outcomes.

Many sports have a need for a low-fat mass. Weight-categorized sports, load-bearing activities, and sports judged on the aesthetics of performance are all influenced by the weight of the individual.

The act of losing fat, however, represents a delicate balance between providing adequate energy for performance while maintaining a necessary calorie deficit. Many areas of metabolism must be considered to maximise the use of fat as an efficient energy substrate whilst taking into consideration the energy systems and nutritional requirements specific to an individual athlete.

Unless affected by a specific deficiency, nutrition alone cannot increase fat loss or improve performance. It is rather a lack of nutrition or energy deficit that stimulates fat burning, while training stimuli induce adaptations when adequate rest is taken and precursors are available for repair. Therefore, nutrition must be a part of an integrated strategy to support training while undertaking necessary insults to achieve fitness and fat-loss goals.

This chapter will review current trends and opinions in the world of nutrition and exercise science, to propose recommendations for an integrated training and nutrition strategy with the aim being to optimise fat loss.

Exercise and Fat Loss

During exercise, the use of carbohydrate or FAs represents a compromise between the greater energy available from complete FA oxidation (9 Kcal.g-1 as opposed to 4Kcal.g-1 from carbohydrate) and the greater power production made possible from carbohydrate utilisation (Frayn, 2003). Carbohydrate oxidation is faster and therefore starts to dominate fat oxidation as exercise intensity increases. Therefore, longer durations of lower intensity exercise are likely to rely more on fat, while shorter, higher intensity activity depends more on carbohydrate.

Although it's accepted that low intensity, prolonged exercise depends most heavily on fat for fuel, sprinters are commonly amongst the leanest athletes in sport, despite doing less overall work in a typical training session. Elite sprinters typically show body fat percentages between 6-7%, and exhibit significantly lower body fat percentages than Sub-Elite competitors (Kumagai, et al., 2000). Whether a greater capacity for high intensity exercise augments leanness, or whether Elite performance is made possible by lower body fat, is debatable. However, even in Sub-Elite athletes, average exercise intensity rather than work output is more strongly associated with leanness, even if supported by higher energy (and carbohydrate) intakes (Yoshioka, et al., 2001). Clearly the situation is more complex than first appears...

High Intensity Exercise

Whilst sprinting uses mainly glycolysis and the phospho-creatine systems for energy provision, high-intensity exercise has been seen to better induce the body's synthesis of mitochondria; the power-plants of the cell (Gibala, et al., 2006; Mahoney, Parise, Melov, Safdar, & Tarnopolsky, 2005). This has been accredited with the increased Excess Post exercise Oxygen Consumption, or EPOC seen in sprinters (Borsheim & Bahr, 2003; Lee, Ha, & Lee, 1999). Essentially, this increases the energy consumed in recovery following a training session, which seems to be greatly contributed to by fat oxidation. This rise in metabolic rate is seen most following exercise at very high intensities (supra-maxima - i.e. above what is usually possible on a prolonged aerobic-fitness test) (Borsheim & Bahr, 2003). High intensity compared to lower intensity training has been seen to cause a nine-fold increase in skin-fold reduction, despite a lower energetic cost of exercise (Tremblay, Simoneau, & Bouchard, 1994). So, although high-intensity exercise must be predominantly carbohydrate fuelled, Basal Metabolic Rate can be increased, maximising fat oxidation and increasing daily energy expenditure.

Submaximal Exercise

There is no escaping the fact however, that long bouts of endurance exercise represent an effective way to increase the duration and therefore the work output of training. Increasing energy expenditure is still the most important factor in fat loss. If these longer bouts of exercise are performed at submaximal exercise intensities, then both the total energy expended, and the relative proportion of energy derived from fat will increase (Frayn, 2003). Endurance training is also a major stimulus for adapting to fatty acid oxidation, increasing the subsequent capacity for fat oxidation during submaximal exercise (Kiens, Essen-Gustavsson, Christensen, & Saltin, 1993). Steady state training, between 60 and 80% VO2max will also decrease reliance on carbohydrate utilisation for a given exercise intensity, increasing importance of fat oxidation (Hawley, Brouns, & Jeukendrup, 1998; Jeukendrup, Mensink, Saris, & Wagenmakers, 1997; Jeukendrup, Saris, & Wagenmakers, 1998). Therefore, during exercise submaximal exertion plays an integral role in fat-loss, despite imposing a lesser post-exercise stimulus.

Resistance Exercise

If fat-loss, rather than weight loss is the goal, this can be supported and maintained by gaining lean mass. Basal Metabolic Rate is proportional to lean mass (Cunningham, 1980), meaning resistance exercise is particularly relevant for fat loss, while the energetic costs of exercise, and recovery will be increased following hypertrophy. In addition, resistance exercise is also a powerful stimulus for fat loss and can increase heart rate for sustained periods. The magnitude of heart rate elevation induced by resistance exercise is frequently within a range that stimulates fat loss, while resistance exercise incurs a high-energy cost proportional to the size of the load and number of repetitions completed. "Metabolic Perturbations" caused by resistance exercise have been shown to cause large EPOC demands, increasing energy consumption for several hours' post exercise, which have been postulated to be caused by increased lactate metabolism, glycogen resynthesis, increased catecholamine action and energetic demands of heat dissipation (Binzen, Swan, & Manore, 2001). Such energy demands are greater than those of low intensity aerobic exercise (Borsheim & Bahr, 2003). Mitochondrial biogenesis is also a likely contributor (Gibala, et al., 2000; Gibala, et al., 2006).

Nutrition to Support Exercise for Fat Loss

One of the most important indicators of nutritional status is insulin, produced from the pancreas in response to elevated blood sugar (Berg, Tymoczko, Stryer, & Stryer, 2007). Its actions are opposed by molecules including adrenalin and glucocorticoids, released during starvation and exercise. Insulin indicates the "fed state" and promotes carbohydrate utilisation or storage (Gulliford, Bicknell, & Scarpello, 1989; Maughan, Burke, & Coyle, 2004). Carbohydrate and fat vie for dominance as fuel within the body. The use of these two fuels is reciprocal to a degree, with each metabolic pathway inhibiting the functions of the other. In the fed state, the presence of carbohydrate can reduce the propensity of circulating fat to become the body's predominant fuel. In starvation (or in response to exercise with little available carbohydrate) the hormonal and nutritional state of the body encourages fat-oxidation while decreasing carbohydrate utilisation. Stress hormones such as cortisol and adrenalin are released, encouraging the release and use of Fat as a fuel. Fat released during exercise also results in the expression of the enzyme PDK4 that further increases the body's reliance on fat, decreasing glycolytic flux (Randle 1986).

Carbohydrate Fuelled Training

Performance in sports with intermittent, intense bursts of activity is particularly responsive to carbohydrate feeding, enhancing glycogen utilisation (Febbraio, Keenan, Angus, Campbell, & Garnham, 2000). High GI (HGI) carb feeding will optimise glycogen use and resynthesis but a problem arises when we consider fat-loss. The reduced fat oxidation from HGI feeding reduces the potential for fat-loss (Wee et al., 2005). Carb fuelled training also increases EPOC. (Ferreira, G. A., et al 2016).

Depleted State Training

Training whilst fasted has been observed to maximise the proportion of fat oxidised, but may pose practical and ethical problems (de Bruijne, Altszuler, Hampshire, Visser, & Hackeng, 1981; Norum, 1965). As well as optimising fat oxidation during exercise, the cellular signalling induced by depleted state training can upregulate systems to cope with a low carbohydrate and low energy environment. Cellular levels of the signalling molecule cAMPK are increased (Wojtaszewski, et al., 2003). This indicator of low energy then upregulates transcription of enzymes involved in fatty acid metabolism, while also stimulating mitochondrial biogenesis to support compromised energy-provision (Zong, et al., 2002). As submaximal, steady state exercise (50-70 % VO2max) is reliant on fat rather than carbohydrate, a role for fasted, submaximal training emerges for fat loss. Carbohydrate fuelling is less of a concern for lower intensity exertion (Lambert, Speechly, Dennis, & Noakes, 1994), meaning that regular, fasted endurance exercise presents an efficient means of both burning fat, and inducing training adaptations to optimise fat loss. Protein intake during this period may need to be increased due to catabolic effects and increased gluconeogenesis, but such a strategy has been observed to prevent losses of lean mass in the face of energy deficits in athletes (Pikosky, et al., 2008).

Fat Adaptation

The reciprocal relationship between fat and carbohydrate metabolism also occurs chronically via transcriptional regulation of enzymes involved in these areas of metabolism. "Fat adaptation" is the process of increasing the enzymatic capacity for fat oxidation following adopting a low carbohydrate/high-fat diet. The effects of this strategy on increasing fat oxidation are unequivocal, with as little as 5 days' fat adaptation being seen to decrease RER values, indicating increased reliance on fatty acids at a given exercise intensity (Burke, et al., 2002). This would theoretically optimise fat loss. However, when possible performance benefits are considered the evidence is not so clear. Protocols have been evaluated to assess the effectiveness of fat adaptation on varying intensities of exercise. Despite restoring glycogen levels after a period of fat adaptation with 1-2 days of high carbohydrate feeding, the results indicate that fat adaptation still decreases the capacity for carbohydrate utilisation and impairs high intensity performance in athletes (Havemann, et al., 2006). However, with sprinting aside, this strategy doesn't seem to impair exercise with submaximal time-to-exhaustion not being significantly affected, while it is possible that medium intensity exercise may actually be enhanced (Lambert, et al., 1994). It is unlikely this would be of benefit for endurance athletes however, who typically sustain power outputs of 80-90% maximum for a number of hours. Considering training for optimising fat loss, fat adaptation may have a role as part of an integrated training strategy, augmenting fat oxidation from endurance exercise, while not compromising anything other than sprint performance. In addition, the effects are reversible and subsequent glycogen storage may even be enhanced following supercompensation (Burke & Hawley, 2002). Obviously, the demands of a specific athlete must be considered if using this strategy and dietary regimens suitably periodised to prevent a possible negative impact on high intensity performance.

Considerations of Glycemic Index (GI)

If pre-exercise fuelling is deemed necessary to complete an endurance session, for example if suffering from the effects of weight loss, low GI feeding prior to exercise may offer a compromise with between depleted state, and carbohydrate fuelled training. Many studies have found Low GI meals promote FA oxidation and carbohydrate sparring in subsequent endurance exercise compared to High GI, possibly by reducing circulating levels of insulin (Coyle, 1995; Rahkila, Soimajarvi, Karvinen, & Vihko, 1980; Stevenson et al., 2006; Wee et al., 2005). This can complement endurance training adaptations to increased FA utilisation, while still permitting high intensity, carb-dependent exercise (Girandola & Katch, 1976). In addition, Low GI foods also aid weight-regulation by inducing feelings of satiety (Brand-Miller, Holt, Pawlak, & McMillan, 2002), helping an athlete to reduce their energy intake.

Timing and Cycling Carbohydrate Intake

Training adaptations are enhanced by ingestion of carbohydrate after exercise. Not only is the muscle more receptive to carbohydrate uptake and glycogen resynthesis through increased activity of GLUT4 receptors, but the induced insulin release exerts a powerful anabolic/anti-catabolic effect that supports adaptation. It would therefore seem reasonable to recommend most daily carbohydrate be consumed following exercise to minimise the inhibitory effect on fatty acid oxidation that would occur if consumed beforehand. Combined with the increased potential for glycogen synthesis, it is less likely this carbohydrate will act as a substrate for de novo lipogenesis. This reflects current consensus in sports nutrition, with guidelines of the International Olympic Committee recommending as much as 57% of an athlete's daily carbohydrate requirement be consumed within the first four hours after exercise (Burke, Kiens, & Ivy, 2004). It is therefore advantageous, if pursuing fat loss goals, to refuel for subsequent intense training sessions by limiting carbohydrate intake to post-training recovery meals. This will still allow a carbohydrate intake adequate for an athlete's bodyweight to be ingested, while losing fat. However, submaximal exercise will most effectively stimulate fat loss if undertaken when fasted; meaning recovery from the preceding training sessions can also be compromised with a lower carbohydrate intake. Recovery should be supported with smaller quantities of lower GI carbohydrate than recommended for performance.

Metabolic activity of fat and muscle

Adipose tissue is no longer seen purely as an energy store with the importance of fat as an endocrine organ now far better understood and accepted. In the obese and overweight, the release of cytokines and systemic inflammatory characteristics induced by adipose tissue can exacerbate the metabolic imbalance caused by obesity, deregulating the relationship between carbohydrate and fat metabolism (Ahima, 2006). Insulin resistance resulting from excessive levels of circulating fat inhibits fatty-acid uptake, further increasing circulating levels. This, coupled with the continued presence of carbohydrate, combining aspects of the fed and starved states, serves to further raise insulin levels while simultaneously blunting sensitivity via down-regulation of insulin receptors. Cortisol release from adipose tissue has been seen to induce obesity in transgenic mice (Morton, et al., 2004), while high levels are associated with increasing adiposity in even healthy humans (Westerbacka, et al., 2003). Increasing adiposity can also induce resistance to leptin and adiponectin that can further disrupt appetite regulation and metabolic regulation (Calabro & Yeh, 2007). Dysregulated stress-hormone release sets off a self-perpetuating pathological cycle, while such inflammation can cause other disorders such as atherosclerosis, immune disorders and possibly even cancer (Calabro & Yeh, 2007). It is therefore important for health that we prevent adipose tissue reaching this pathological "critical mass". While these concerns are based mainly on the health risks to overweight populations, the potentially harmful effects of adipose tissue are plain to see, and the point at which adiposity becomes deleterious to health and athletic performance is not clearly defined. This is another reason to pursue fat loss, or prevent fat accumulation in athletes.

Conversely, increasing lean mass may have more benefits than simply improving athletic efficiency. Muscle is also an endocrine organ, lending the name "myokines" to the inflammatory mediators secreted. The endocrine actions of muscle have been proposed to counteract the harmful actions of adipose tissue and may provide mechanisms for treating overweight individuals by increasing lean mass (Lopez-Soriano, Chiellini, Maffei, Grimaldi, & Argiles, 2006). Muscular release of IL6, for example, increases 100 times post exercise, which in healthy athletic populations may then yield an anti-inflammatory effect to counteract catabolism, while enhancing insulin sensitivity (Pedersen & Febbraio, 2008). In addition, muscle tissue is involved in the production of molecules which control the transcriptional activity of fats, the PPARs. The muscle specific PPAR? has been observed to improve fatty acid metabolism by decreasing LDL cholesterol levels and also to enhance athletic adaptation.

Supplementation for Fat Loss

A vast array of food and supplement components are sold to support fat loss. While many may have a sound physiological rationale for such action, some simply don't work. These are some of the food based ones I use with clients and my own training. This list isn't exhaustive and doesn't include obvious supplement based fat loss support, things such as aminos, CLA, gugglesterones, and BCAAs.

Berberine

Has a lipid lowering and moderate fat burning effect in obese subjects (5lb in 12 weeks). It may also have other positive effects on bone mineral density. There's 500mg in each serving of metabolic optimizer.

Turmeric (curcumin)

This one's interesting as curcumin can assist insulin signalling and inflammation. This golden gem of a spice might actually be a great addition to a body re-composition programme. Partly through aiding an increase in lean mass and positively affecting the catabolic anabolic balance. It probably affects inflammatory signalling mechanisms from the adipose tissue itself which will help regulate appetite and metabolism. (Meydani M, Hasan ST 2010). There's also a daily dose in the metabolic optimizer.

Green Tea

Green tea contains caffeine, a stimulant and thermogenic agent, which helps to increase energy expenditure (Hoffman et al. 2006). Green tea also contains Catechins, reported to increase aspects of cardiovascular health. Indeed, intervention studies using extracts containing similar amounts of catechins to 5-6 cups of green tea, (200-300mg of the catechin EGCG), have demonstrated efficacy in maintaining cardiovascular and metabolic health, as well as anti-diabetic effects (Wolfram, S. 2007). You guessed it.

Cocoa

Cocoa powder is rich in polyphenols, and thus, may contribute to the reduction of lipid peroxidation. Cocoa inhibits LDL oxidation and reduces thrombotic tendency, as well as improving the clearance and transport of lipids through increasing levels of the "good" HDL cholesterol particles (Mursu et al. 2004;Wan et al. 2001). The effects of this has been seen to include reduced blood lipids, reduced risks factors associated with cardiovascular disease and improved cholesterol levels (Ding et al. 2006;Shahkhalili et al. 2001).

Carnitine

Carnitine plays an essential role in fatty acid oxidation in muscle, being required for transport of fatty acids into the mitochondrial matrix, the site of oxidation in the "power-stations" of cells. In addition, several studies have observed carnitine supplementation improving indices of recovery in athletes, reducing circulating levels of muscle damage, as well as suppressing increases in ammonia levels (Broad, Maughan, & Galloway 2008; Volek et al. 2002). Recovering properly from exercise will enhance the capacity for high intensity work that leads to optimal fat-loss (Tremblay, Simoneau, & Bouchard 1994; Yoshioka et al. 2001). Carnitine supplementation has also been seen to increase testosterone levels (Kraemer et al. 2006). These are hormonal changes frequently associated with improved body composition, increased lean muscle and a lower percentage body-fat.

Apple-Cider Vinegar

Apple-cider vinegar has been seen to improve the serum lipid profile in normal and diabetic rats by decreasing circulating levels of fats (triglycerides), "bad" (LDL) cholesterol, and increasing circulating "good" (HDL) Cholesterol, known to aid fat metabolism (Shishehbor et al. 2008). This may be of great value in managing weight loss and diabetes in humans.

Chilli

Animal and human studies have indicated that the consumption of chilli-containing meals increases energy expenditure and fat oxidation, which may help to reduce obesity and related disorders. One such study showed that regular consumption of chili may attenuate postprandial insulin levels, reducing excessive fat-storage (Ahuja et al. 2006).

Cinnamon

Animal and human studies have indicated that the consumption of Cinnamon increases energy expenditure and fat oxidation, while reducing the propensity of the body to store fat, particularly by regulating insulin levels following meals (Jia et al. 2009;O'Keefe, Gheewala, & O'Keefe 2008).

Yerba Mate

Yerba mate extract has potent anti-obesity effects in vivo and in animal studies, exhibiting marked reduction of adiposity, and restoring serum levels of triglycerides, LDL cholesterol, and glucose in rats (Arcari et al. 2009). Additionally, yerba mate has shown a modulatory effect on the expression of several genes related to obesity. However, care should be taken regarding doping regulations, and batch testing carried out with a creditable anti-doping lab due to the risk of contamination with less stringently controlled herbals.

Alpha-lipoic Acid

Alpha-lipoic acid (alpha-LA), a cofactor of mitochondrial enzymes, acts as a genetic switch that affects the activity of genes involved in fat metabolism. Alpha- LA decreases activity of the gene-regulating cell signal AMPK in the hypothalamus, as well as increasing the activity of the PPAR transcription factors that lead to the expression of lipoproteins needed for the effective clearance and transport of fatty acids. This has caused profound weight loss in rodents by reducing food intake and enhancing energy expenditure (Kim et al. 2004;Pershadsingh 2007).

Grapefruit

Grapefruit juice has been consistently shown to augment the properties of insulin involved in glucose disposal, increasing the appropriate intake of sugar into muscle tissue (Owira & Ojewole, 2009), while opposing the fat-storing properties of insulin. Studies in humans (both in-vivo clinical trials and ex-vivo experiments) have shown an ability of grapefruit juice to prevent insulin-mediated fat storage and increase fat breakdown (Dallas, Gerbi, Tenca, Juchaux, & Bernard, 2008; Fujioka, Greenway, Sheard, & Ying, 2006).

Black Pepper

Black Pepper is a potent antioxidant, supporting many of the body's own mechanisms to combat oxidative damage. It has been observed to be particularly effective in this role when used to treat oxidative stress resulting from obesity and a high fat diet, raising activities of superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), glutathione-S-transferase (GST) and reduced glutathione (GSH) in the liver, heart, kidney, and intestine (Vijayakumar, Surya, & Nalini 2004).

MCTs (medium chain triglycerides as found in coconut fat)

MCTs increase fat transport into mitochondria as these smaller molecules can circumvent the CPT1 transporter protein, passively diffusing across the mitochondrial membrane where they are oxidised. Studies support replacement of dietary fat with MCTs being effective at increasing fat oxidation at rest and in exercise, increasing BMR in athletes (Hawley, et al., 1998; Jeukendrup, Thielen, Wagenmakers, Brouns, & Saris, 1998).

Conclusions

To optimise the energetic cost of exercise, as well as to support a high resting energy expenditure in athletes, a fat loss strategy should incorporate both long-duration submaximal exercise, performed in a depleted state, along with high-intensity exercise, fuelled with an adequate carbohydrate intake. The effects of changes in body composition seem to be self-perpetuating, as do the positive or negative health and performance effects associated with such changes. It is important therefore that body-fat is closely monitored to prevent a decline down a "slippery slope". Finally, some ergogenic aids may further support the metabolic demands of fat-loss if an energy deficit is maintained.

Some take away thoughts for the general public and PT's is this:

You must start to move your body to enjoy improved health and wellbeing. Any movement or exercise is better than none – however some exercises are more equal than others.

The following guidelines will help you tailor and refine your exercise to your needs and preferences. Remember you can still make a healthy weight with the new ways of eating we've described, but exercise is the forgiver of many sins.

Knowing whether to cut carbs, go ketotic or cycle carbs and fats is confusing. Often an approach which embraces the 'best of both' or all systems is the way to go. For purists, ketosis is an obvious route but needs periodic refeeds. Carb cycling is a great tried and tested method, running things low then raising them for performance sessions can be integrated into high performance team environments with little difficulty in the fatty players. Finally, for the general public, fasting is a perfect adjunct to maintaining a normal lean weight in the longer term.

In terms of overall health, outside of body composition targets, exercise may be one of the most important habits to employ if you want to enjoy better statistical improvements in all health outcomes – perhaps even more important than giving up smoking or alcohol. You can in my opinion be quite fat and perfectly healthy.

It should have been written into the 10 commandments – thought shalt exercise… with weights.

Key things you should be learning by now – is to adjust what you eat according to how you need to exercise and to begin exercising.

If you are new to exercise then remember, not all exercise is equal – although any exercise is better than none. The big debate in many people's minds, which can confuse them, is regarding cardio vs HIIT or resistance based training for best body composition changes.

The thing is, if you stimulate muscle tissue through resistance based or high intensity intervals (sprints and weights essentially) the muscle has to rebuild and repair and you raise EPOC – excess post exercise oxygen consumption. This is a cool phenomenon as you not only burn energy whilst you train but you continue to do so afterwards. Plus, the intense nature of the exercise process means you build more proteins in the muscle and increase your RMR through a higher lean mass. Efficient.

The flip side is steady state cardio, this is the stuff you see people doing on the cardio equipment in gyms – they tend to be overweight and they tend to stay over weight – there's a few reasons for this.
1. You only burn whilst you do the cardio and it can make you feel tired and hungry.

2. There is little or no resistance on many of these machines, unless you run them on high levels. Most people coast.
3. It doesn't stimulate muscle very well in fact it can break down muscle for energy at the same rate as fat if you don't eat right in and around the sessions or diet too hard without sufficient protein.
4. It's boring so people don't stick to it as much as they should.
For example, if I ride an exercise bike hard I'll do 600cals an hour on a resistance of around 18 out of 25 – most people will be on less than this. Then if I go and have a latte and a KitKat I'm back to square 1. I'll feel like I've earned them too.

Or I could do 20 minutes' hill sprints – of 30 seconds with 60-90 second recovery, only burn maybe 400 calories but get a hell of a kick-on metabolism wise… Throw in a few handstand press ups and you've got a session.

The trouble we face is this, not everyone can work hard enough to benefit from HIIT and resistance based metabolic training – plus if you do it right it's hard to do every day. So, I've come up with this:

The Hierarchy of Effective Exercise for Best Body Composition Changes.

Remember this: the best form of exercise is the one you most enjoy. If that's tennis, fine. If it's cross fit – then go with it. To continue to progress you need to continue to make the exercise progressive, increasing the demand or duration of the session. If you are planning your weekly training and activities, then try to include a mixture of the types of exercise below and allow some days when you do less or rest throughout your training week.

* Metabolic weights circuits; heavy weights in a circuit fashion
* HIIT 20-30 seconds as hard as you can, hill sprints as above
* Anaerobic / aerobic intervals 60-90 seconds as hard as you can
* Threshold aerobic 90 seconds plus but at anaerobic threshold
* Submaximal aerobic (steady state cardio) 60-80% maximum heart rate
* Incidental exercise; frizz bee, walking, cycling to work

Remember, a great strategy for fat loss, while maintaining performance and fitness gains, would be to mix up fasted-state, low intensity exercise (forgetting about performance) with carb-fuelled (supra)-maximal intensity interval training. Variety is the spice of life!