A "Mini-Fast with Exercise" Protocol for Fat Loss

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Abstract

From the standpoint of promoting leanness, exercise is of most value if oxidation of stored fat is maximized during and following the exercise sessions. Bahadori has proposed that this can best be achieved if prolonged exercise of moderate intensity is performed during a 12-14 hour "mini-fast" that entails skipping a meal; if subsequent food consumption features low-fat foods, the fat stores expended during and after the exercise will not be fully repleted by dietary fat. Thus, prolonged compliance with such a regimen should lead to steady loss of body fat until a much leaner equilibrium body composition is attained. The feasibility and efficacy of this strategy has been examined in an open pilot study. Participants were asked to perform prolonged, moderate-intensity aerobic exercise at least 3-5 times weekly, nesting each exercise session within a 12-14 hour mini-fast. No restrictions were placed on daily calorie consumption, but low-fat, low-glycemic-index food choices were recommended. Of the 34 subjects originally enrolled, 27 returned for follow-up evaluations at 6 and 12 weeks. During the 12 week study, the average fat loss in these 27 subjects – 7.4 kg - corresponded to one-quarter of their baseline fat mass. Fasting insulin levels likewise fell by 25%. The rate of fat loss was at least as great in the second 6 weeks as in the first, suggesting that fat loss might have persisted for some time if the study had been prolonged. This protocol, combining elements of exercise training, fasting, and low-fat eating, is both sustainable and healthful, and in reasonably compliant subjects may have considerable potential for promoting and maintaining leanness and insulin sensitivity.

Exercising for Fat Loss

Although regular exercise is invariably invoked as an aid to weight control, the context in which exercise is conducted is rarely considered. The benefit of exercise for weight control reflects its ability, not to burn calories per se, but to promote selective utilization of stored fat. This is best achieved if exercise is conducted during the post-absorptive phase (when insulin is at basal fasting levels), if the exercise is of moderate intensity and prolonged duration, and if no food is consumed for several hours after the exercise, so that the relatively selective oxidation of fat triggered by the exercise (reflected in a post-exercise reduction in respiratory quotient) can be prolonged.[1, 2] A brief fast following exercise is rendered more feasible by accelerated hepatic fatty acid oxidation, sometimes reflecting in post-exercise ketosis, which is associated with appetite suppression;[3-5] it may be feasible to potentiate this hepatic fat oxidation with appropriate supplementation.[6] It stands to reason that, if daily exercise is conducted in a way that optimizes oxidation of stored fat, and if subsequent meals are low in fat so that this oxidized fat is not immediately replaced (but a satisfying repletion of glycogen stores is achieved), a daily negative fat balance can be achieved that will persist until a new equilibrium is reached at a much lower body fat content.[1, 2, 7]

Such a strategy could also be expected to have an acute ameliorative impact on the elevated intramyocellular triglyceride stores that underlie muscle insulin resistance in the insulin resistance syndrome[8-13] – while of course invoking other mechanisms, such as GLUT4 induction, whereby exercise per se promotes insulin sensitivity.[14, 15] Indeed, moderate intensity exercise during fasting metabolism has been found to have the greatest impact on intramyocellular lipids.[8, 9] Improved muscle insulin sensitivity can be expected to down-regulate insulin secretion, and diurnal insulin secretion can then be minimized if meals are moderate in glycemic index. Arguably, minimizing diurnal insulin secretion in the context of a low fat intake is a rational strategy for fat loss, inasmuch as insulin acts in various ways to oppose fat oxidation.[16]

The "7 Step" program of Bahadori and colleagues is a weight loss regimen, now gaining popularity in Austria and Central Europe, that was developed to exploit these insights.[17] Its most novel feature may be described as "mini-fast with exercise": during every 24 hours, there is a 12-14 hour fast within which is nested a session of prolonged, moderate-intensity aerobic exercise. Meals are not calorically restricted, but foods that are low in both fat and glycemic index are recommended. If participants choose to exercise in the morning, they skip breakfast and do not eat until noon. If they choose to exercise at noon, they skip lunch. If they choose to exercise in the evening, they eat an early light dinner, and then wait at least two hours to exercise (so that fasting insulin levels are restored); no food is consumed between the exercise and bedtime. (A variant of this latter strategy is to eat no dinner at all; several volunteers in the study described below adopted this approach on their own initiative.) To optimize the flexibility of this regimen, participants are allowed to switch the time of their exercise session from day to day. The "7 Step" program incorporates other features – including heavy intakes of non-caloric fluids (especially during the mini-fasts), stress reduction techniques, and psychological counseling – but it seems likely that the "mini-fast with exercise" and the prudent dietary advice are primarily responsible for its weight loss benefits, whereas the ancillary measures may aid compliance.

A Pilot Clinical Assessment of a "Mini-Fast with Exercise" Protocol

To assess the utility and feasibility of the "mini-fast with exercise" strategy for achieving loss of body fat, a 12 week open clinical study has been conducted at Oasis of Hope Hospital, Tijuana, Mexico, employing volunteers from the hospital's own staff. 34 subjects were enrolled, of whom 27 returned for follow-up evaluations at both 6 and 12 weeks. Weight, percentage body fat, and serum levels of insulin and glucose were assessed at baseline, 6 weeks, and 12 weeks.

Near-infrared interactance (Futrex 5000) was employed for body fat determination; although this technique is not as precise as underwater densitometry, it is highly reproducible and is a convenient means for measuring changes in body composition over time.[18, 19] At the 6 and 12 week evaluations, the volunteers completed questionnaires assessing their compliance with the protocol over the preceding 6 weeks.

One week prior to the initiation of the study, prospective participants were given a half-hour lecture explaining the protocol and a 5-page handout which summarized it. The volunteers were asked to exercise at least 3-5 days weekly, in the context of a mini-fast as explained above. Exercise in which the subject supports his own weight – e.g. brisk walking, jogging, stair climbing, treadmills, elliptical gliders – was recommended, and the volunteers were asked to gradually increase the duration of their exercise sessions to around 45 minutes, as their bodies became acclimated to the exercise. Guidance on food choices was also provided; consumption of fatty animal products was particularly discouraged, whereas consumption of whole natural foods moderate in both fat content and glycemic index was strongly encouraged. Moderate alcohol consumption was explicitly permitted.

Those who chose to participate returned a week later for the baseline evaluation. For the 27 subjects who subsequently completed the study, average baseline values were as follows: age – 37.8; weight – 90.2 kg; BMI – 32.2; waist – 108.2 cm; percentage body fat – 32.7; fasting insulin – 13.2 IU/ml. 10 of the subjects were females and 17 were males.

At the conclusion of the 12 week study, weight loss averaged 4.2 kg. More impressively, fat loss averaged 7.4 kg – corresponding to a 25% reduction in initial fat mass (29.5 kg). This was associated with a 25% reduction in fasting insulin, presumably indicative of a worthwhile improvement in insulin sensitivity. Average reduction in waist circumference was 7.9 cm. All of these changes were of high statistical significance ($p<0.01$ by T-test). The full results are summarized in Table 1.

These findings are particularly impressive in light of the fact that the subjects were not supervised during the study; the only guidance they received was provided by the introductory lecture and accompanying handout. Moreover, the questionnaires revealed that a number of the subjects were only intermittently compliant with the regimen; this suggests that even better results could be expected in highly compliant subjects. Indeed, the most enthusiastic of the male volunteers lost 20 kg of fat (while proclaiming that he felt so much better on this regimen), and a 40-year-old female lost 14.1 kg of fat.

In light of claims that, absent concurrent caloric restriction, exercise is not effective for promoting weight loss in women – presumably because it induces a compensatory increase in calorie intake[20] – it is encouraging to note that fat loss averaged 5.4 kg - nearly a half kilogram per week – in the 10 women who completed the study.

Table 1. Summary of Results

Variable \ Time	Baseline	Week 6	Week 12
Weight (kg)	90.2 ± 18.7	87.1 ±17.6 *	86.0 ± 18.0†
Body Fat (%)	32.7 ± 4.3	29.8 ± 5.3 *	25.7 ± 6.1**
Waist (cm)	108.2±14.5	102.9 ± 15.0*	100.3 ± 14.2**
Insulin (IU/ml)	13.2 ± 6.6	9.0 ± 4.2*	9.9 ± 6.4†

Values are mean ± SD for the 27 subjects who completed the study. *p<0.0005 week 6 vs. baseline; **p<0.0005 week 12 vs. week 6; † p<0.01 week 12 vs. baseline

Intriguingly, fat loss during the second half of the study was slightly (though not significantly) greater than during the first half; with most weight loss protocols, weight loss is most rapid in the initial weeks. This finding suggests that fat loss had not plateaued, and may have persisted for some weeks if the study had been extended.

These results demonstrate that, even with minimal supervision, motivated subjects can achieve substantial progressive fat loss with the "mini-fast with exercise" strategy. Moreover, unlike most other rapid-weight-loss protocols, this approach is sustainable and healthful. It does not require calorie-counting or carbohydrate avoidance, and encourages consumption of whole natural foods that are low in fat and high in fiber. Furthermore, rodent studies provide some grounds to suspect that meal-skipping protocols may have neuroprotective, cardioprotective, and longevity-enhancing benefits, even when there is no net reduction in calorie intake.[21-23] Clinically, meal skipping has been associated with reduced risk for colorectal cancer in several epidemiological studies,[24-27] and serum lipid profiles and plasma levels of acute-phase reactants tend to improve during the month of Ramadan in observant Moslems.[28-31] Not surprisingly, the selectivity with which fat is utilized during submaximal exercise increases during Ramadan.[32]

With respect to the long-term sustainability of this regimen, it may be noted that the first author has followed this regimen for 12 years and, at age 56, maintains a body fat under 5%, having lost approximately two-thirds of his initial body fat. Presumably, as body fat stores decline and fat becomes less available for oxidation, there will be a compensatory increase in calorie intake (and fat intake) during meals, such that body fat content eventually plateaus at a considerably reduced level.

Proper Integration of Exercise and Diet is the Key

It is generally acknowledged that, regardless of how weight loss is achieved, regular exercise is required for this weight loss to be conserved over the long term. Thus, studies show that almost all subjects who maintain a substantial weight loss for 5 years or more engage in regular and substantial physical activity while attempting to moderate their intake of fatty foods.[33] Therefore, most people who are not blessed with "lean genes" and who have ready access to the rich Western diet will need to make an abiding commitment to exercise if they wish to remain healthfully lean throughout life. If you are going to take the considerable trouble to exercise regularly, why not perform that exercise in a way that optimizes its favorable impact on body fat and insulin sensitivity? It is the appropriate *interaction* of exercise and eating habits that promotes leanness. Studies which evaluate the body composition impacts of exercise or diet in isolation are of limited interest or utility.

It bears emphasis that the protocol tested here involves realistic amounts of exercise. None of the participants in the study – including the ones who lost the most substantial amounts of fat – claimed to have exercised more than an hour daily, and most of them had at least two "rest days" per week. Brisk walking was the most common exercise employed, and few of the participants attended a gym. Thus, this protocol should be feasible for most people who are willing and able to do moderate intensity aerobic exercise – even those who have limited time availability and don't have access to sophisticated gym equipment. As regards meals, participants were encouraged to consume as much food as they wished, except of course during their mini-fasts. All emphasis was placed on the *type* of food consumed, and an effort was made to instill positive attitudes toward the low-fat whole foods that sustain health. It is inherently easier to control the types of food one eats than the quantity; many succeed in following vegetarian or Kosher diets throughout their lives, whereas few can maintain the discipline of calorie-counting for more than a few months. Thus, the protocol tested here may be viewed as a sustainable lifestyle. A currently popular American TV series is regaling viewers with the exploits of overweight volunteers who lose massive amounts of weight by engaging in several hours of vigorous exercise daily while consuming semi-starvation diets. Yet for most people, such a regimen would be both impractical and unsustainable. It would actually be a lot more impressive and meaningful to watch people cutting their body fat in half while holding down a full-time job, raising a family, and enjoying their meals.

A potential "Achilles heel" of this strategy is that some people may have insufficient appetite control or self-discipline to avoid food consumption during the mini-fast periods. With respect to appetite, pre-exercise administration of "hepatothermic supplements", as described previously,[6, 34] may aid appetite control in the post-exercise period by boosting the efficiency of hepatic fatty acid oxidation; supplemental carnitine should improve cofactor saturation for carnitine palmitoyltransferase-I, while hydroxycitrate administration could be expected to alleviate the malonyl-coA-mediated allosteric inhibition of this enzyme. The profound appetite suppression achieved after several days of fasting or strict carbohydrate avoidance – which is key to the (temporary) success of protein-sparing fasting or the Atkins diet regimen – may reflect, at least in part, hepatic satiety signals associated with an increase in hepatic ketogenesis.[5, 35-37] It may be feasible to trigger such signals much more rapidly through prolonged exercise accompanied by hepatothermic supplementation in the context of post-absorptive metabolism. The first author can attest that he tends to be hungrier at noon-time on days in which he has eaten breakfast and not exercised, than on days in which he has done morning exercise, taken supplemental hydroxycitrate/carnitine, and fasted all morning. The impact of such supplementation on compliance with mini-fasts merits examination in controlled studies.

Although prolonged moderate intensity exercise is the most effective way to achieve selective utilization of stored fat as energy substrate *during* the exercise, recent evidence suggests that incorporating brief repeated episodes of high-intensity work into such a protocol – "interval training" - can have a more substantial long term impact on body composition, presumably because muscle capacity for fat oxidation is boosted by the high intensity intervals;[38, 39] this effect may be mediated by increased activation of AMPKα2, which in turn boosts expression of PGC-1α, a "master switch" for mitochondrial biogenesis.[40] Also, this strategy might be associated with greater fat oxidation during the post-exercise period, owing to greater glycogen depletion during exercise. Future studies should determine whether interval training can amplify the results of a "mini-fast with exercise" strategy.

In conclusion, further evaluation of the "mini-fast with exercise" strategy is evidently warranted. Such studies should determine how feasible it is for motivated subjects to adopt this regimen as a continuing lifestyle, and the extent to which body fat can be reduced by long-term compliance.

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