

---

Author	Mayo, Melissa Jane
Title	The effects of exercise-induced weight loss on metabolic risk factors and fat distribution in young obese males
Institute	Thesis (Ph.D.) National Institute of Education, Nanyang Technological University
Year	2002
Supervisor	Dr. Bala

---

## ABSTRACT

Two studies were conducted to investigate the responses of young obese Singaporean males (BMI > 30 kg.m<sup>2</sup>, body fat > 25%, age 18 to 21 years) to 4-months of Basic Military Training (BMT) in the Singapore Armed Forces.

**Study 1:** The effects of large exercise-induced weight loss on anthropometric measures of fat distribution and risk factors for disease. **Methods:** 20 obese males (mean age 19.8 ± 0.6 y) were evaluated before (pre-training) and after (post-training) BMT. FFM, fat mass and % body fat were determined from skinfold measurements. Fat distribution was determined from circumference measures taken pre - and post-training using standard methods. A blood sample was collected after an overnight fast to determine plasma lipid, insulin and glucose levels. **Results:** Subjects lost 12.7 ± 4.1 kg (P<0.001) from pre- to post training, which was attributable to a reduction in fat mass (P<0.001), as FFM was unchanged. Significant changes were observed in the measures of body fat distribution. Both WC and HC decreased (P < 0.01), the reduction in WC (13.7%) being greater than the reduction in HC (7.7%) as reflected by the decrease in WHR (P < 0.001). The weight loss significantly reduced plasma levels of total cholesterol, LDL-C and Apo B (all P < 0.001). However, there was no association between the improvement in disease risk and the loss of abdominal fat.

**Conclusions:** Large exercise induced weight losses are associated with maintenance of FFM. The significant reduction in WHR observed after training indicates a greater mobilization of upper body fat although a preferential loss of fat from this region may not be related to changes in cardiovascular risk factors.

**Study 2:** The effects of exercise-induced weight loss on metabolic risk factors and fat distribution in young obese males. **Methods:** 28 obese males (mean age 19.3 ± 1.6 y) were evaluated for 4-months prior to BMT to provide control data. 20 of these subjects were then examined before (pre-training) and after (post-training) BMT, and 4-months following the completion of training (final). FFM, fat mass and % body fat were determined by dual X-ray absorptiometry. Fat distribution was determined from a CT scan taken at the level of the L4 - L5 vertebrae. A blood sample was collected after an overnight fast to determine plasma lipid, insulin and glucose levels followed by a 2-hour OGTT. RMR was measured using indirect calorimetry after an overnight fast, and diet and activity information collected from 3-day

recalls. **Results:** *Control.* Subjects gained  $1.6 \pm 3.5$  kg ( $P < 0.05$ ) which was attributable to a 4% increase in fat mass ( $P < 0.01$ ). All other measures including fat distribution, blood metabolites, activity levels, dietary intake and RMR remained constant. *Training.* During BMT activity levels increased 33% ( $P < 0.001$ ) and dietary intake increased 10% ( $P < 0.06$ ) compared to the control period. Following BMT subjects lost  $13.4 \pm 3.7$  kg ( $P < 0.001$ ) from pre- to post training which was attributable to reductions in both fat mass (89%,  $P < 0.001$ ) and FFM (11%,  $P < 0.01$ ). WC and HC decreased ( $P < 0.01$ ), and there were equivalent reductions in CT measured IA fat (41%,  $P < 0.001$ ) and abdominal subcutaneous fat (43%,  $P < 0.001$ ) depots. The weight loss significantly reduced fasting plasma levels of total cholesterol, LDL-C, TG, glucose and insulin and decreased insulin and glucose responses to the OGTT (all  $P < 0.001$ , except fasting glucose  $P < 0.05$  and glucose AUC  $P < 0.01$ ). Decreases in IA fat were not related to the improvements in these metabolic measures, although an upper-body pattern of fat distribution was found to be an important marker of metabolic complications. From pre- to post-training FFM was reduced  $1.49 \pm 2.2$  kg ( $P < 0.01$ ) and RMR decreased  $138 \pm 164$  kcal.day<sup>-1</sup> ( $P < 0.01$ ) but these decreases were smaller than those reported following equivalent weight loss through diet. *Final.* With the cessation of training, physical activity levels were reduced 15% ( $P < 0.01$ ) with no change in dietary intake compared to BMT. Subjects regained  $3.7 \pm 5.2$  kg ( $P < 0.01$ ) of body weight which comprised entirely of fat mass ( $P < 0.001$ ) and there was no change in FFM or RMR. Of the metabolites measured only the increase in total cholesterol was significant ( $P < 0.01$ ) but increases in fat mass and abdominal subcutaneous fat were independent predictors of the deterioration in all disease risk factors measured with weight gain. **Conclusions:** Large exercise-induced weight loss may have a more beneficial effect on the health of obese subjects than diet induced weight loss of the same magnitude due to smaller decreases in FFM and RMR, greater reductions in total abdominal fat and greater improvements to measures of carbohydrate metabolism. Such effects should reduce disease risk and the eventual weight regain that typically follows diet-induced weight loss. In these subjects reductions in IA fat were neither preferential nor related to changes in disease risk which may have been a factor of their initial fat distribution pattern. Subjects with abdominal obesity at baseline maintained increased amounts of abdominal fat throughout the study which may contribute to long term health risks for these individuals. The recidivism highlights the challenges of instilling long-term lifestyle changes when a lack of education affects compliance. The changes noted here may hamper future weight loss and facilitate additional weight gain for the same pre-training lifestyle.