Ringkasan

Pengaruh Latihan Fisik Aerobik terhadap Indeks Massa Tubuh, Asam Lemak Bebas Darah dan Kadar Leptin Darah pada Mahasiswi Universitas Negeri Semarang

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Angka kegemukan terus meningkat di seluruh dunia, tidak hanya di negara maju seperti Amerika Serikat dan negara Eropa namun juga di Indonesia. WHO tahun 2003 melaporkan sekitar 300 juta orang dewasa menderita kegemukan. Kegemukan sering kali dianggap hanya jelek secara kosmetik dan menunjukkan kemakmuran, namun kelebihan berat badan memicu munculnya berbagai penyakit berbahaya.

Kegemukan diketahui merupakan faktor resiko dari beberapa penyakit seperti diabetes, hipertensi dan penyakit kardiovaskuler, oleh karena itu kegemukan harus dihindari. Kegemukan bergantung dari keseimbangan antara jumlah energi yang masuk (makanan yang masuk) dengan energi yang dikeluarkan. Kelebihan energi disimpan dalam bentuk lemak di jaringan lemak sehingga menyebabkan peningkatan berat badan.

Penurunan berat badan dapat diperoleh melalui pengurangan masukan energi atau latihan fisik atau keduanya. Latihan fisik sering kali meningkatkan nafsu makan dan latihan fisik tanpa disertai pengendalian masukan makanan dapat meningkatkan kegemukan.

Latihan fisik aerobik (LFA) menggunakan lemak (trigliserida) sebagai sumber energi dan LFA merupakan metode ideal untuk mengurangi massa jaringan lemak dan menurunkan berat badan. LFA bergantung pada ambang anerobik (*anerobic treshold*), dimana latihan fisik yang melampaui ambang ini menjadi anerobik, menggunakan karbohidrat (glukosa) selain asam lemak sebagai sumber energi. Latihan anerobik tidak dapat dipakai untuk menurunkan berat badan.

Ambang anerobik (*anerobic treshold*) dapat ditentukan dengan mengukur VO_2 maks. Batasan tersebut berbeda secara individual dan berbeda pada atlit yang terlatih dengan non atlit yang tidak terlatih. Ambang anerobik pada non atlit berkisar antara 55–70% VO_2 maks., sedangkan pada atlit (balap sepeda) berkisar antara 75–85% VO_2 maks.

Penelitian saat ini bertujuan untuk menentukan dosis efektif LFA yang dapat menurunkan berat badan. Dosis yang dipilih adalah 50% dan 70% VO_2 maks. dengan asumsi bahwa dosis tersebut masih berada pada batas normal non atlit dan diduga 70% VO_2 maks. merupakan dosis yang lebih efektif.

Penelitian ini menggunakan rancangan *the randomized control group preand post test design*. Populasi berasal dari mahasiswi, sehat, tidak terlatih, di Program Studi Kesehatan Masyrakat, Tata Busana dan Tata Boga Universitas Negeri Semarang semester 3 yang memenuhi kriteria sebagai berikut: kegemukan (IMT > 25 %), umur 18-22 tahun dan tidak ada kelainan fisik yang menghambat keikutsertaan di dalam latihan fisik. Mahasiswi yang sesuai dengan kriteria

tersebut diambil 24 orang dan dibagi secara acak menjadi 3 kelompok; kelompok 1 (kontrol), kelompok 2 (LFA dosis 50% VO_2 maks.), dan kelompok 3 (LFA dosis 70%VO_2 maks.).

Variabel yang diukur antara lain: indeks massa tubuh (IMT) mewakili pengukuran kegemukan, asam lemak bebas (ALB) mewakili jumlah asam lemak yang dipecah untuk suplai energi dan kadar leptin darah (KLD) mewakili pengukuran massa jaringan lemak. LFA diduga dapat menurunkan ketiga variabel.

Hasil yang diperoleh adalah sebagai berikut :

Kelompok 1:
IMT : rerata pre-test = 27.1258 kg/m^2, rerata post-test = 27.0784 kg/m^2
ALB : rerata pre-test = 0.70821 µEq/mL, rerata post-test = 0.68184 µEq/mL
KLD : rerata pre-test = 3.9337088 ng/mL, rerata post-test = 3.9608163ng/mL

Kelompok 2:
IMT : rerata pre-test = 27.3112 kg/m^2, rerata post-test = 25.9933 kg/m^2.
ALB : rerata pre-test = 0.783945 µEq/mL, rerata post-test = 0.4493325 µEq/mL
KLD : rerata pre-test = 3.9081863 ng mL, rerata post-test = 2.8494313 ng/mL

Kelompok 3:
IMT : rerata pre-test = 27.3415 kg/m^2; rerata = 26.724 kg/m^2
ALB : rerata pre-test = 0.7281597 µEq/mL, rerata post-test = 0.5562282 µEq/m
KLD : rerata pre-test = 4.0212087 ng/mL, rerata post-test = 3.4102487 ng/mL

Kelompok 2 dan 3 melakukan latihan 3 kali seminggu selama 6 minggu.
Beda antara hasil pengukuran sebelum dan seudah perlakuan disebut nilai delta dan kemudian rerata dari nilai delta tersebut dihitung sebagai berikut :

Kelompok 1: rerata Δ IMT = 0.0474 kg/m^2; rerata Δ ALB = 0.02637 µEq/mL; rerata Δ KLD = 0.0271075 ng/mL.

Kelompok 2: rerata Δ IMT = 1.3179 kg/m^2; rerata Δ ALB = 0.3346125 µEq/mL; rerata Δ KLD = 1.058755 ng/mL.

Kelompok 3: rerata Δ IMT = 0.6175 kg /m^2; rerata Δ ALB = 0.1719314 µEq/mL; rerata Δ KLD = 0,6096 ng/mL.

Nilai delta kemudian dilakukan analisis homogenitas, normalitas, ANOVA satu arah dan uji t berpasangan secara statitik. Hasil analisis statistik menunjukan bahwa latihan fisik 50% VO_2 maks. secara bermakna lebih efektif dalam menurunkan IMT, ALB dan KLD bila dibandingkan dengan 70% VO_2 maks. Sebuah temuan yang bertolak belakang dengan dugaan semula, karena latihan fisik 70% VO_2 maks. pada subyek yang kegemukan dan tidak terlatih telah melampaui ambang anerobik (*anaerobik treshold*), sehingga latihan yang dilakukan sebagian menjadi anerobik.

Penurunan IMT yang diperoleh hanya sedikit, dimana subyek masih berada pada kisaran kegemukan (> 25 kg/ m^2). Fenomena ini diduga karena durasi perlakuan yang pendek (hanya 6 minggu).

Kondisi perlakuan tidak sepenuhnya ideal: subyek penelitian tidak tinggal dalam suatu tempat yang sama, namun pada beberapa tempat yang berbeda, sehingga tidak mungkin dapat mengendalikan masukan kalori dan aktivitas fisik lain di luar latihan fisik yang diberikan.

Summary

The Effect of Aerobic Physical Exercise on Body Mass Index, Blood Free Fatty Acid and Blood Leptin Levels in Semarang University Female Students

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The incidence of obesity is increasing world-wide, not only in affluent countries such as the United States and European countries but also in Indonesia, so much so that a WHO 2003 report stated that an estimated 300 million adult people suffer from obesity. Although obesity is often regarded just as a cosmetically undesirable, harmless variation of bodyweight (BW) and even a sign of wealth and prosperity, it is presently regarded as a disease.

Obesity is a known risk factor of more serious conditions such as diabetes, hypertension and cardiovascular diseases, and is thus a condition that must be avoided. Obesity depends on the balance between energy intake (food consumption) and energy expenditure. Whenever energy intake exceeds its expenditure, the excess energy is stored as fat in fatty tissues, thus increasing BW.

BW reduction can be accomplished by either reducing energy (calorie) intake or by physical exercise or both. Physical exercise often results in increased appetite, and without controlling food intake may even results in an increased BW.

Aerobic physical exercise (APE) uses fats (i.e. fatty acids) as an energy source and is thus the ideal method to decrease fat tissue mass and reduce BW. APE depends on a threshold known as anaerobic threshold, beyond which physical exercise become anaerobic, using carbohydrates (glucose) instead of fatty acids as an energy source. Thus anaerobic physical exercise cannot be used as a means to reduce BW.

The anaerobic threshold can be determined by measuring VO_2 max. The threshold varies between different individuals and also depends whether the said person is a trained athlete or an untrained non-athlete. For non-athletes the anaerobic threshold varies between 55% to 70% VO_2 max, while in trained athletes (in this instance elite cycling athletes) the measured threshold is higher namely between 75% to 85% VO_2 max.

The objective of the present study was to determine the effective APE dose to decrease BW. The dose chosen was 50% and 70% VO_2 max assuming that these doses still lie within the range of normal non-athletes and with the expectation that 70% VO_2 max will be the more effective dose.

The experimental design used was the Randomized Control-Group, Pretest-Posttest Design. The population studied were healthy, untrained, female, 3rd semester students studying in the Public Health, Fashion Design and Culinary Study Program, Semarang State University, fulfilling the following criteria: overweight (body mass index: > 25 Kg/m^2), age 18-22 years and showing no physical abnormalities that prevent them to participate in the prescribed physical exercise. From all students meeting those criteria, 24 were taken and randomly

divided into 3 groups: group 1 (control), group 2 (APE at 50% VO_2 max.) and group 3 (APE at 70% VO_2 max.). The variables measured were body mass index (BMI) as a measure of obesity, blood free fatty acid level (FFA) as a measure of fatty acid degraded to supply energy, and blood leptin level (LL) as a measure of fatty tissue mass. It is expected that APE would reduce all 3 variables.
The obtained results were as follows.

Group 1: BMI mean pre-test = 27.1258 kg/m^2, mean post-test = 27.0784 kg/m^2
FFAmean pre-test = 0.70821μEq/mL, mean post-test = 0.68184 μEq/mL.
LL mean pre-test = 3.9337088 ng/mL, mean post-test = 3.9608163 ng/mL.

Group 2: BMI mean pre-test = 27.3112 kg/m^2, mean post-test = 25.9933 kg/m^2.
FFA mean pre-test = 0.783945 μEq/mL, post-test = 0.4493325 μEq/mL
LL mean pre-test = 3.9081863 ng/mL, mean post-test = 2.8494313 ng/mL.

Group 3: BMI mean pre-test = 27.3415 kg/m^2, post-test = 26.724 kg/m^2.
FFA mean pre-test = 0.7281597μEq/mL, mean post-test = 0.5562282 μEq/mL.
LL mean pre-test = 4.0212087 ng/mL, mean post-test = 3.4102487 ng/mL.

For group 2 and 3 exercises were held 3 times a week for 6 weeks.
Next, the difference between pre-test and post-test values (also called the Δ values) and their means were calculated, giving the following results:

Group 1 : mean Δ BMI = 0.0474 kg/m^2; mean Δ FFA = 0.02637 μEq/mL; mean Δ LL = 0.0271075 ng/mL.

Group 2 : mean Δ BMI = 1.3179 kg/m^2; mean Δ FFA = 0.3346125 μEq/mL; mean Δ LL =1.058755 ng/mL.

Group 3 : mean Δ BMI = 0.6175 Kg /mL; mean Δ FFA = 0.1719314 μEq/mL; mean Δ LL = 0,6096 ng/mL.

The Δ values are then subjected to statistical tests comprising of homogeneity, normality, one way ANOVA and paired t-test. The results of these statistical analysis showed that physical exercise at 50% VO_2 max is significantly more effective in reducing BM, FFA and LL as compared to that at 70% VO_2 max, a finding contrary to the expected outcome. It seems that for overweight, untrained test subjects, exercise at 70% VO_2 max already exceeds the anaerobic threshold so that for these subjects, the exercise become partially anaerobic.

It should be noted that there were only slight decreases in BMI which is in fact still within the range of overweight subjects (>25 Kg / m^2). This is probably due to the short duration of the experiment (only 6 weeks).

Finally it should be mentioned, that the condition of the experiment were not entirely ideal: test subjects did not reside in a single dormitory but in several homes, so that it is impossible to control calorie intake and other physical activities outside the prescribed exercise.

ABSTRACT

The Effect of Aerobic Physical Exercise on Body Mass Index, Blood Free Fatty Acid and Blood Leptin Levels in Semarang University Female Students

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The purpose of this study was to prove that aerobic physical exercise (APE) could decrease body mass index (BMI), blood free fatty acid (FFA), and blood leptin levels (LL). The dose chosen was 50% and 70% VO_2 max, with the expectation that APE at 70% VO_2 max would be the more effective dose.

This study used the Randomized-Control Group, Pre test- Post test design. Samples were taken from population of healthy, untrained, female, 3rd semester students studying at the Public Health, Fashion Design and Culinary Study Programs, Semarang State University, fulfilling the following criteria : overweight (BMI > 25%) 18–22 years old and showing no physical abnormalities that prevent them from participating in physical exercise. From all students meeting this criteria, 24 were taken and divided randomly into 3 groups of 8 students each, i.e. group 1 (control), group 2 (APE at 50% VO_2 max), and group 3 (APE at 70% VO_2 max), For group 2 and 3 exercises were done 3 times a week for 6 weeks .

For all 3 groups pre- and post test values of all 3 variables were measured and their means calculated. The difference between the pre-and-post test values, the so called Δ values and their means were then calculated. Next, the delta values were subjected to statistical analysis comprising of homogeneity, normality, Anova and paired t- test. The result of these statistical analysis showed that physical exercise at 50% VO_2 max was significantly more effective in reducing BMI, FFA and LL as compared to 70% VO_2 max, a finding contrary to the expected outcome. It seems that in untrained overweight subjects, the exercise at 70% VO_2 max already exceeds the anaerobic threshold so that for these subjects, the exercise became partly anaerobic.

Keywords : overweight subjects, aerobic physical exercise, VO_2 max, body mass index, free fatty acids, leptin