UNIVERSITI PUTRA MALAYSIA

EFFECT OF MIXED RESISTANCE AND ENDURANCE TRAINING ON BODY COMPOSITION, CARDIO RISK FACTORS AND FITNESS IN INACTIVE MALE IRANIAN STUDENTS

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By

MOHAMMAD REZA ESMAELZADEH TOLOEE

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

December 2011

Dedicated to my parents

To my beloved wife Anita

To my cute son, Parsa

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Doctor of Philosophy

EFFECT OF MIXED RESISTANCE AND ENDURANCE TRAINING ON BODY COMPOSITION, CARDIO RISK FACTORS AND FITNESS IN INACTIVE IRANIAN MALE STUDENTS

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Mohammadreza Esmaelzadeh Toloee

December 2011

Chairman: Associate Prof. Soh Kim Geok, PhD

Faculty: Educational Studies

Several studies have shown a positive association between regular physical activity and reduction of cardiovascular diseases. However, the relationship among the types of physical activity and risk factors (such as; triglyceride, TG, LDL, HDL, CPR and IL-6 levels) in inactive young people remain unclear. The objective of this research was to examine the effects of mixed resistance and endurance training on body composition, cardio risk factors and fitness in inactive male Iranian students.

Fifty four healthy inactive students aged 18-24 yrs (inactive men) were assigned into four groups: 1) mixed resistance and endurance training (MTG) (n=13), 2) endurance training (ETG) (n=13), 3) resistance training (RTG) (n=14) or 4) control (CG) (n=14). All the training groups (MTG, ETG and RTG) performed the special exercise program assigned to them until 8 weeks (3 days per week). The MTG performed resistance training which consists of the following exercises: l) the leg

press 2) leg extension, 3) seated leg curl 4) abdominal 5) chest press 6) seated row with 50% to 80% 1RM (three sets of 10-12 repetition). This was followed by 30-minutes of endurance training (jogging, fartlek and running) with 60% -85% HRmax. The ETG participated in aerobic exercise training protocol (jogging and running in track and fartlek with %55-%85 HRmax). The RTG performed resistance training program which consists of the following exercises: 1) leg press, 2) leg extension, 3) seated leg curl, 4) back extension, 5) abdominal, 6) chest press, 7) seated row, 8) lat pull down, and 9) triceps pushdown with 50% to 80% 1RM (three sets of 10-12 repetition). The CG continued the same routine activity that they had used prior to becoming a study participant. Pre and post tests measures included: VO_2max, one repetition maximum, weight, waist and hip circumferences, body composition, blood cardio risk factors (LDL, VLDL, HDL, Triglyceride, Cholesterol, glucose, insulin, CRP and IL-6).

Significant improvements were reported for variables such as High Density Lipoprotein ($p=0.01$), VO_2max, skeletal muscle mass ($p=0.001$), and upper and lower body strength ($p<0.05$) among the MTG subjects. Better blood profiles were also observed in this group with a significant decrease in HOMA-ir ($p=0.02$) and Interleukin-6 ($p=0.01$). The MTG was also displayed to have significant reduction in body fat percentage ($p=0.001$). For the ETG, the variables that showed significant improvement were HDL ($p=0.03$), fasting blood glucose ($p=0.03$), interleukin-6 ($p=0.01$), VO2 max ($p=0.001$), body fat percentage ($p=0.001$), and Heart Rate (HR) during rest, exercise, and recovery ($p<0.05$). The RTG showed the least improvement as compared to the MTG and ETG. The variables of this group that

showed significant improvement were HOMA-ir ($p=0.01$), insulin level ($p=0.04$), skeletal muscle mass ($p=0.01$), and upper and lower body strength ($p<0.01$).

The results of this study show that mixed resistance and endurance training improves some cardio risk factors, cardiorespiratory fitness, upper and lower body strength, and body composition in healthy inactive students. While resistance training significantly improved upper and lower body strength only and endurance training significantly improved cardio risk factors, cardiorespiratory fitness.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

KESAN KOMBINASI LATIHAN RINTANGAN DAN LATIHAN DAYA TAHAN TERHADAP KOMPOSISI BADAN, RISIKO PENYAKIT JANTUNG DAN KECERGASAN DALAM KALANGAN PELAJAR LELAKI IRAN YANG TIDAK AKTIF

Oleh

MOHAMMADREZA ESMAELZADEH TOLOEE

Disember 2011

Pengerusi: Prof. Madya Soh Kim Geok,PhD

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ABSTRAK

Beberapa kajian menunjukkan bahawa terdapat hubungan yang positif di antara akiviti fizikal dengan kadar pengurangan penyakit jantung. Walau bagaimanapun, perkaitan antara jenis aktiviti fizikal dan risiko penyakit (seperti: *Triglyceride (TG), Low Density Lipoprotein (LDL), High Density Lipoprotein (HDL), C Reactive Protein (CRP)* dan *Interleukin 6 (IL-6)* terhadap remaja kurang aktif masih samar. Tujuan kajian ini adalah untuk menguji kesan kombinasi latihan rintangan (MT) dan daya tahan terhadap komposisi badan, risiko penyakit jantung, dan tahap kecergasan dalam kalangan pelajar lelaki Iran yang tidak aktif.

Lima puluh empat (54) orang pelajar yang sihat tetapi tidak aktif berumur antara 18-24 tahun (lelaki tidak aktif) telah dibahagikan kepada 4 kumpulan: 1) kombinasi

latihan daya tahan dan rintangan (MTG)(n=13), 2) latihan daya tahan (ETG)(n=13), 3) latihan rintangan (RTG)(n=14), atau 4) kawalan (CG)(n=14). Kesemua kumpulan yang menjalankan latihan (MTG, ETG, dan RTG) mengikuti program latihan yang telah dirancang sehingga 8 minggu (3 hari seminggu). Kumpulan MTG terdiri daripada senaman berikut: l) *leg press* 2) *leg extension*, 3) *seated leg curl* 4) *abdominal* 5) *chest press* 6) *seated row* dengan satu ulangan maksimum (1RM) pada kadar 50-80%. Ini diikuti dengan latihan daya tahan selama 30-minit (jogging, *fartlek*, dan larian) pada kapasiti 60-85% kadar nadi maksimum (*HRmax)*. Kumpulan ETG menjalani protokol latihan aerobik (jogging, larian, dan *fartlek* dengan kapasiti 55-85% *HRmax*). Kumpulan RTG menjalani program latihan rintangan yang terdiri daripada senaman berikut: 1) *leg press*, 2) *leg extension*, 3) *seated leg curl*, 4) back *extension*, 5) *abdominal*, 6) *chest press*, 7) *seated row*, 8) *lat pull down*, dan 9) *triceps push down* dengan 1RM pada kadar 50-80% (tiga set pada 10-12 ulangan). Kumpulan CG meneruskan rutin harian biasa yang dilakukan sebelum subjek dipilih sebagai sampel kajian. Pengukuran ujian pre dan post termasuklah: VO_2max, (*1RM)*, berat, nisbah ukur lilit pinggang dan punggung, komposisi badan, dan risiko penyakit jantung melalui ujian darah (*LDL, VLDL, HDL, TG, cholesterol, glucose, insulin, CRP* dan *IL-6*).

Keputusan yang signifikan dilaporkan bagi pembolehubah seperti HDL ($p=0.01$), VO_2max ($p=0.001$), jism otot rangka ($p=0.001$), dan kekuatan anggota atas dan bawah ($p<0.05$) dalam kalangan subjek yang menjalani latihan MTG. Profil darah yang lebih baik juga didapati dalam kalangan kumpulan ini dengan keputusan yang signifikan bagi ujian *HOMA-ir* ($p=0.02$), IL-*6* ($p=0.01$), VO_2max ($p=0.001$), peratus lemak badan ($p=0.001$), dan kadar nadi (HR) semasa rehat, latihan dan pemulihan

(p=0.05). Kumpulan RTG menunjukkan peningkatan yang paling rendah jika dibandingkan dengan kumpulan MTG dan ETG. Pembolehubah yang menunjukkan peningkatan bagi kumpulan ini adalah *HOMA-ir* (p=0.01), tahap insulin (p=0.01), jism otot rangka (p=0.01), dan kekuatan anggota atas dan bawah (p<0.01).

Keputusan kajian menunjukkan MTG membantu mengurangkan risiko penyakit jantung, meningkatkan tahap kecergasan kardiovaskular, kekuatan bahagian atas dan bawah badan dan komposisi badan dalam kalangan pelajar lelaki Iran yang sihat tetapi tidak aktif. RTG hanya memberi kesan yang signifikan dari segi peningkatan kekuatan bahagian atas dan bawah badan. Manakala, RTG secara signifikan membantu mengurangkan risiko penyakit jantung dan meningkatkan tahap kecergasan kardiovaskular.

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I certify that an Examination Committee has met on 22th. Dec. 2011 to conduct the final examination of **Mohammadreza Esmaelzadeh Toloee** on his thesis entitled "**Effect Of Mixed Resistance And Endurance Training On Body Composition, Cardio Risk FactorsAnd Fitness In Inactive Male Iranian Students"** in accordance with Universities and University College Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

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This thesis was submitted to the senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the Degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously and is not concurrently submitted for any other degree at Universiti Putra Malaysia or at any other institutions.

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MOHAMMADREZA ESMAELZADEH TOLOEE

Date: 22 December. 2011

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