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

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FPP 2011 45
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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
EFFEKT OF MIXED RESISTANCE AND ENDURANCE TRAINING ON
BODY COMPOSITION, CARDIO RISK FACTORS AND FITNESS IN
INACTIVE IRANIAN MALE STUDENTS

By

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December 2011

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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$_2$max, 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$_2$max, 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

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ABSTRAK

Beberapa kajian menunjukkan bahawa terdapat hubungan yang positif di antara aktiviti 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: 1) 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_{2}max, (IRM), 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_{2}max (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_{2}max (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.
ACKNOWLEDGEMENTS

My first and foremost debt of gratitude is to the Almighty God since there is just too much of His blessings in this life to count and as I pray to Him in my time of happiness and sorrows. I would like to extend my gratitude to people who have helped me directly and indirectly in the completion of this thesis. Its completion would not have been possible without their contributions and unfailing support. First and foremost, I would like to express my indebtedness to my supervisor Associate Professor Dr. Soh Kim Geok for her invaluable guidance, patience, support and encouragement. Her guidance and comments have given this research depth and detail. I would also express my deepest appreciation and heartfelt thanks to Associate Professor Dr. Muhammad Nazrul Hakim Abdullah for him insightful remarks and guidance, and to Professor Dr. Bahaman Bin Abu Samah for him comments and invaluable guidance and advice. My special thanks to Associate Professor Dr. Abolfazl Hashemi Chelvi and co-worker in clinical lab, who helped me for measurement of biochemistry markers. I acknowledge the support of the Sport Campus of Shomal Marash in Amol and especially its director, Dr. Boromand in providing the gym and sport lab. In my study I have been blessed with a friendly and cheerful group of fellow students and I thank them too.

Lastly, I would like to express my most sincere gratitude and love to my parents, my brothers and sisters, my wife, Anita and my son, Parsa, for their support and patience during my Ph.D program because without their patience as well as encouragement, many obstacles on the way could not have been easily overcome.
I certify that an Examination Committee has met on 22th. Dec. 2011 to conduct the final examination of Mohammadreza Esmaelzadeh Toloe 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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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.

MOHAMMADREZA ESMAELZADEH TOLOEE

Date: 22 December. 2011
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