Ovidius University Annals, Series Physical Education and Sport / SCIENCE, MOVEMENT AND HEALTH
Vol. XV, ISSUE 2 Supplement, 2015, Romania
The journal is indexed in: Ebsco, SPORTDiscus, INDEX COPERNICUS JOURNAL MASTER LIST,
DOAJ DIRECTORY OF OPEN ACCES JOURNALS, Caby, Gale Cengace Learning, Cabell's Directories

Science, Movement and Health, Vol. XV, ISSUE 2 Supplement, 2015
September 2015, 15 (2, Supplement): 510-514
Original article

THE EFFECTS OF A STRUCTURED TRAINING PROGRAM BASED BOTH ON GYM EXERCISES AND AQUATIC FITNESS IN WOMEN AFFECTED BY METABOLIC SYNDROME

PASSALIA ANNUNZIATA[1], SUDANO MAURIZIO[2], BIANCALANA VINCENZO[1]

Abstract

Aim. In recent years Metabolic Syndrome (MS) has become a leading cause of morbidity and mortality in industrialized countries,overwhelming infectious diseases, traumas and smoke-related diseases. The core of metabolic interactions in MS is not fully understood yet, but it is well known that individualized physical exercise is effective in contrasting such abnormalities, when prescribed at the same care intensity of a traditional drug therapy.

Methods. In our study we verified the impact of two different types of physical exercise (gym and swimming pool) on MS parameters. Enrolled patients underwent a series of measures: blood tests (fasting glycemia, total cholesterol, HDL cholesterol, and triglycerides), anthropometric tests (weight, height and BMI) and functional tests ($V'O_{2max}$, Handgrip, Sit and reach test, Walkingspeed and Near tandem balance). All patients gave their informed consent.

Results. At the end of a twelve months program all considered variables improved, with the exception of $V'O_{2max}$ test.

Conclusions. Metabolic Syndrome is strictly linked to visceral obesity, giving a major burden to increasing cardiovascular risk. Also, a large body of published data has given a robust evidence on the relevance of physical activity in reducing the progression to T2 diabetes, cardiovascular morbidity and total mortality.

Keywords: Metabolic Syndrome, aquatic fitness, physical exercise

Introduction

In industrialized countries Metabolic Syndrome (MS) has surpassed infectious diseases and smoke-relates diseases as a cause of morbidity and mortality. MS is a cluster of physiological, biochemical, clinical, and metabolic factors that directly increases the risk of atherosclerotic cardiovascular diseases, T2 Diabetes Mellitus, and all cause mortality. The subtle metabolic interactions at its core are not fully understood yet, but the "obesity epidemic" in the shape of visceral adiposity excess is a major driving factor. Over years, there have been several definitions of MS, and diagnostic criteria includingabdominal obesity, raised blood pressure, dysglycemia, raised triglycerides and low HDL-cholesterol. All definitions show the central role of abdominal obesity, despite Adult Treatment Panel III (ATP III) (Expert Panel on Detection, E., and Treatment of High Blood Cholesterol in Adults, 2001) has claimed the reduced applicability of this parameter in some populations. Therefore, International Diabetes Federation (IDF) has developed a new definition of MS, where obesity is defined by threshold values according to geographic areas (Alberti, Shaw, 2005).

According to American Heart Association and National Heart, Lung and Blood Institute (AHA/NHLBI) (Grundy, Cleeman, Daniels, 2005), the diagnosis is possible when three ATPIII criteria out of five are present. Thence, the reported prevalence of MS can differ according to ethnic origins, gender and age of populations enrolled. MS is more prevalent in women, and is strictly linked to the severity of obesity and is age-related.

MS is a state of chronic low grade inflammation as a consequence of interplay between genetic andenvironmental factors such as insulin resistance, visceral adiposity,atherogenic dyslipidemia, endothelial dysfunction, geneticsusceptibility, elevated blood pressure, and hypercoagulable state.The "obesity epidemic" is principallydriven by an increased consumption of calories-densefood and reduced physical activity.Long-term lifestyle changes can improve the unhealthy pattern of this syndrome and anactive lifestyle is a pivotal point of this strategy. A large body of data supports this concept: sedentarity determines a 2.5 fold increase in coronary risk, and when physical activity is increased, a dose-response effect on reduction of risk is observed. Broadly speaking, the beneficial effect is better documented in subjects who perform physical activity more than two times a week. For example, the frequency of physical activity sessions affects lipid pattern more than the absolute intensity of sessions. Three training sessions/week lower LDL-C and increase HDL-C, by a documented effect on Lipoprotein Lipase and Muscle Carnitinepalmitoyltransferase. The Insulin Resistance

[1] Dipartimento di Scienze Biomolecolari. Scuola di Scienze Motorie – Sezione Scienze Motorie e della Salute. Urbino (PU), ITALY
[2] Servizio Integrato Territoriale (SIT) Struttura Dipartimentale Complessa di Endocrinologia e Diabetologia. Urbino (PU), ITALY
E-mail address: annunziata.passalia@uniurb.it

Received 28.03.2015 / Accepted 15.04.2015

Ovidius University Annals, Series Physical Education and Sport / SCIENCE, MOVEMENT AND HEALTH
Vol. XV, ISSUE 2 Supplement, 2015, Romania
The journal is indexed in: Ebsco, SPORTDiscus, INDEX COPERNICUS JOURNAL MASTER LIST, DOAJ DIRECTORY OF OPEN ACCES JOURNALS, Caby, Gale Cengace Learning, Cabell's Directories

Atherosclerosis Study (Petersen, Pedersen, 2005) has demonstrated in subjects with Type 2 Diabetes a direct relationship between activity-driven energy expenditure and better insulin sensitivity, irrespective of moderate (<6 mets) or intense(>6 mets) level of activity.

With the aim to reduce the global burden of cardiovascular risks, we should identify subjects with SM, who show a two-fold increased risk for major cardiovascular events, and a three-fold increased risk for T2 diabetes. Therefore, subjects with MS can be targeted with proper physical training programs, as recommended by International Diabetes Federetion (IDF), the American College of Sports Medicine (ACSM), and World Health Organization (WHO) (International Diabetes Federation, 2005; ACSM's Guidelines for Exercise Testing and Prescription, 2010; World Health Organization, 2010).

The objective of our study was to evaluate in a small group of women the effects of a double fitness strategy (gym and aquatic fitness) on the typical markers for MS.

Methods

The intervention group was constituted by10 women who had been diagnosed with metabolic syndrome since one year or more (age 40-60 y.). They were free from muscular-skeletal diseases, central nervous system diseases or cardiovascular diseases. No subject was a smoker and their sedentarity state was been lasting for one year or more. All participants gave their written informed consent, according to bioethics panel's procedures of University of Urbino. The study lasted twelve months.At baseline all subjects had a medical history, a physical examination with measurements of anthropometric variables (height, weight, waist/hip ratio and BMI), and a psycho attitudinal test. Blood and urine samples for routine hematochemical tests were also taken. All subjects were evaluated for their aerobic capacity, muscular strength and resistance.

The assessment of physical activity was obtained by the International Physical Activity Questionnaire (IPAQ) (Craig, et al., 2003). All subjects were given also the ITALIAN SF-36 questionnaire with the aim to evaluate the level of perceived health status. The choice of tests was made according to the best published papers.

Physical exercise was performed during three scheduled sessions/week: two sessions in a gym and one in a swimming pool. The subjects were also encouraged to walk freely under the supervision of a tutor specifically trained for counseling to subjects with MS. The aim was to each at least 10.000 steps/day, evaluated by a pedometer. Moreover, the level of perceived exertion (RPE) was evaluated by the Borg Scale.

During gym sessions, endurance training was done by different devices (bike, recline, treadmill), prescribed at a workload between 50% and 80% of VO_2Reserve (VO_2R), or the Heart Rate Reserve (HRR), which is equivalent to a value between 12 and 16 of the Borg Scale.

Resistance training was performed with the intent to stimulate great muscle groups (special attention for core strength/power, shoulder, upper-back muscles, pectorals, grip strength, and hip/quadriceps) at a growing intensity, from 60% to 80% 1-RM. Finally, training sessions ended with exercises aimed to improve balancing abilities and muscular flexibility.
Aquatic activities were done at a moderate intensity, with the intent to improve participants' general fitness.

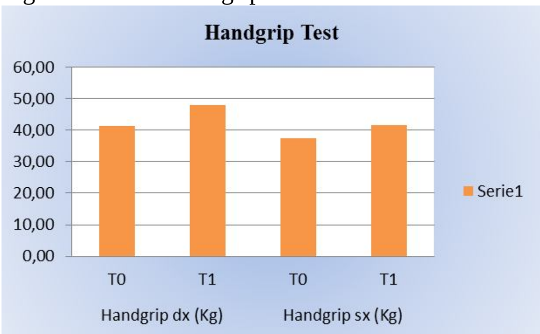
Statistical analysis

All variables were evaluated to detect any significant difference between T0 and T1 in every single subject. Student t-test for paired couples was performed, with a significativity (p) level fixed at <0.05.

Results

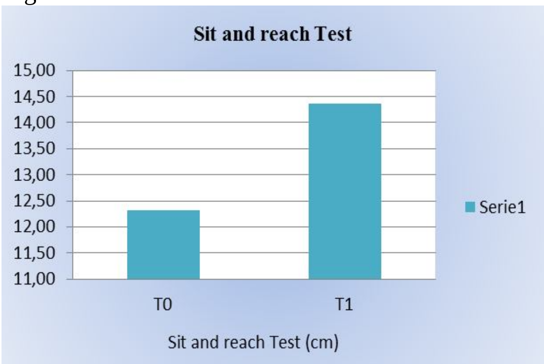
Functional tests

Fig.1 - Bilateral Handgrip



From T0 to T1 handgrip test showed a significant improvement both for right upper limb ($p<0.002$) and left upper limb ($p<0.03$).

Fig.2 - Sit and reach



The flexibility of lumbar area and thigh posterior muscles showed a statistically significant improvement from T0 to T1 ($p<0.006$)

Fig.3 - Walking Speed

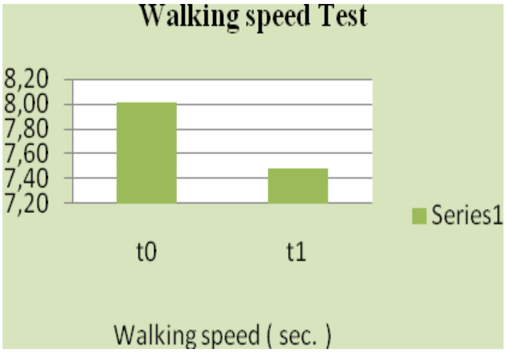
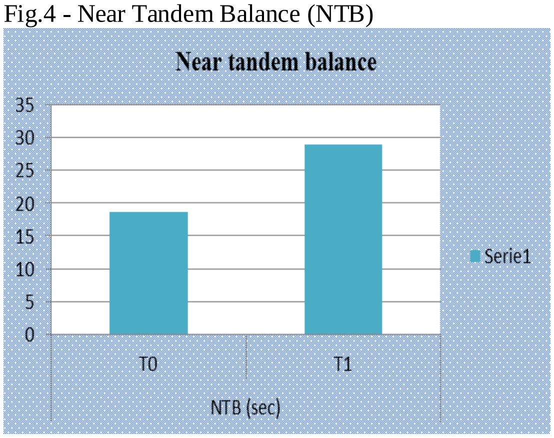


Fig.4 - Near Tandem Balance (NTB)



Both parameters showed a significant improvement from T0 to T1 (Walking speed % Var. – 6.57% , NTB % Var. = 52.68%).

Ematochemical parameters

Fig. 5 - Total Cholesterol

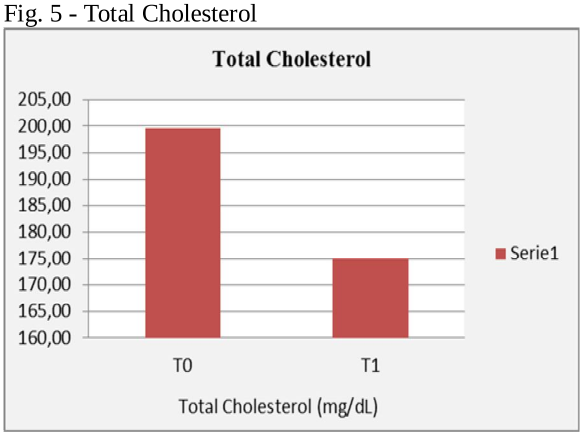


Fig.6 – LDL-C

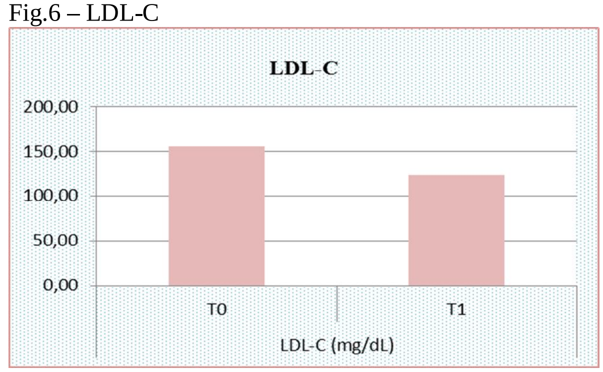


Fig.7 – HDL-C

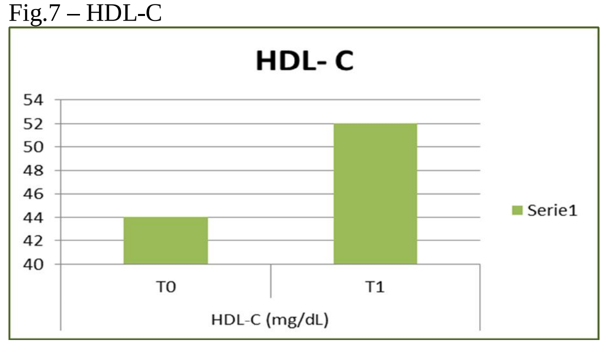
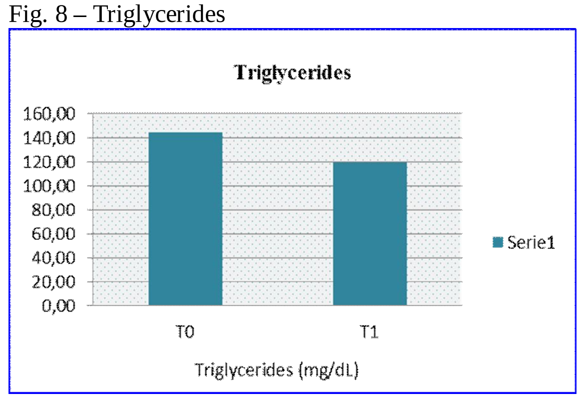
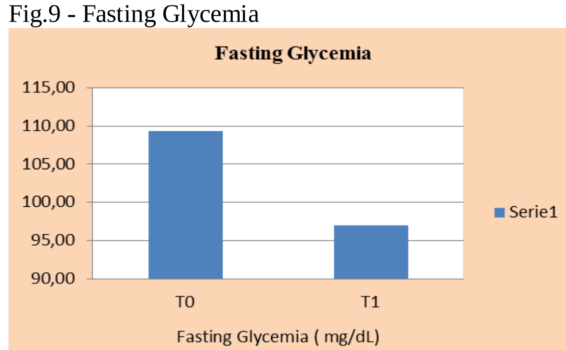


Fig. 8 – Triglycerides



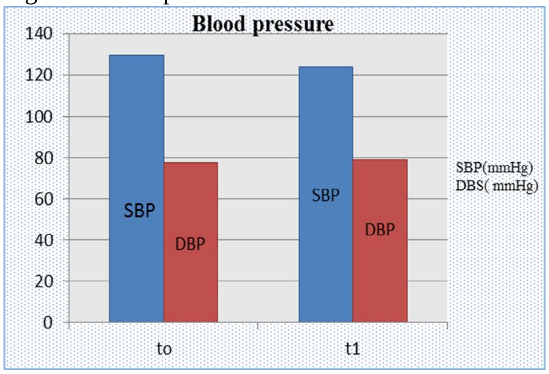
All variables studied did improve from T0 to T1 (Significativity tests: Total Cholesterol $p < 0.02$, LDL-C $p < 0.006$, HDL-C $p < 0.001$, Triglycerides $p < 0.05$).

Fig.9 - Fasting Glycemia



Fasting glycemia improved from T0 to T1 in the intervention group ($p < 0.05$)

Fig. 10 - Blood pressure



Blood pressure did not show any statistically significant variation from T0 to T1

Anthropometric measures

Fig. 11 - Body Mass Index (BMI)

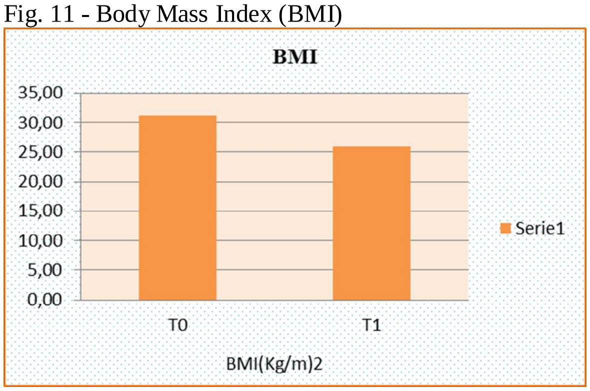
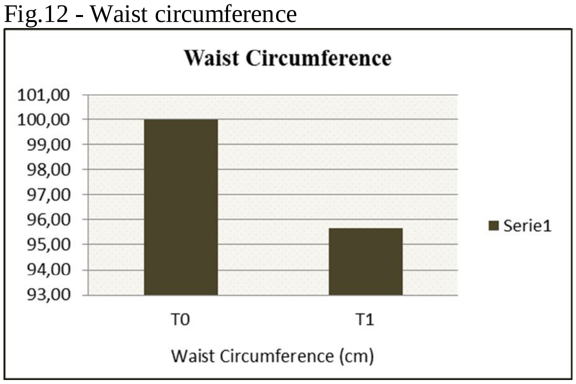


Fig.12 - Waist circumference



BMI and Waist circumference did show a significant improvement from T0 to T1 (BMI $p < 0.002$, WC $p < 0.001$).

Discuss

Are several studies that show the benefits induced by exercise in patients with metabolic diseases (Boidin, et al., 2015; Dalzill, et al., 2014).

Therefore, our study based on two different types of physical exercise (gym and swimming pool) is agreement both with the above studies that with the current scientific literature.

Conclusions

Metabolic Syndrome is strictly linked to visceral obesity, giving a major burden to increasing cardiovascular risk (Van Gaal, Mertens, De Block, 2006). Also, a large body of published data has given a robust evidence on the relevance of physical activity in reducing the progression to T2 diabetes, cardiovascular morbidity and total mortality.

The aim of our study was to evaluate the effect of a double fitness strategy in ameliorating some parameters linked to MS. This strategy has been appreciated, and all recruited patients ended the study, with no drop-outs. Most of considered variables showed a significant improvement at T1, according to the good results reported by scientific literature.

Aknowledgements

We thanks to all our participants and subjects in this study.

References

ACSM's Guidelines for Exercise Testing and Prescription. 8th ed. 2010, Baltimore (MD): Lippincott Williams & Wilkins.

Alberti KG, Shaw ZP, 2005, IDF Epidemiology Task Force Consensus Group., The metabolic syndrome-a new worldwide definition. Lancet, 2005. 366 (9491): p. 1059-1062.

Boidin M, et al., 2015, Effect of aquatic interval training with Mediterranean diet counseling in obese patients: Results of a preliminary study. Ann Phys Rehabil Med. 2015. Jul 29. pii: S1877-0657(15)00083-4

Craig CL, et al., 2003, International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc, 2003. 35(8): p. 1381-95.

Dalzill C, et al., 2014, Intensive lifestyle intervention improves cardiometabolic and exercise parameters in metabolically healthy obese and metabolically unhealthy obese individuals. Can J Cardiol. 2014 Apr;30(4):434-40.

Expert Panel on Detection, E., and Treatment of High Blood Cholesterol in Adults, 2001, Executive Summary of The Third Report of The National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, And Treatment of High Blood Cholesterol In Adults (Adults Treatment Panel III). Jama, 2001. 285 (19): p. 2486-2497.

Grundy SM, Cleeman JI, Daniels SR, 2005, American Heart Association; National Heart, Lung, and Blood Institute., Diagnosis and management of the metabolic syndrome: an American

Heart Association/ National Heart, Lung, and Blood Institute Scientific Statement. Circulation, 2005. 112: p. 2735-2752.

International Diabetes Federation, 2005, The IDF consensus worldwide definition of the metabolic syndrome. April 14, 2005: http://www.idf.org/webdata/

Petersen AM, Pedersen BK, 2005, The anti-inflammatory effect of exercise. J Appl Physiol, 2005. 98(4): p. 1154-62.

Van Gaal, LF, Mertens IL, De Block CE, 2006, Mechanisms linking obesity with cardiovascular disease. Nature, 2006. 444(7121): p. 875-80.

World Health Organization: Global recommendations on physical activity for health. Geneva: WHO; 2010.