Obesity Medicine 8 (2017) 15–22

Contents lists available at ScienceDirect

Obesity Medicine

journal homepage: http://www.journals.elsevier.com/obesity-medicine

Metabolic syndrome in retired soccer players: A pilot study

Angeliki Panayiotoglou [a, b, 1], Maria G. Grammatikopoulou [a, c, d, *, 1], Maria I. Maraki [e], Michael Chourdakis [c], Konstantinos Gkiouras [f], Xenophon Theodoridis [a], Sousana K. Papadopoulou [a], Konstantinos Famisis [g], Maria N. Hassapidou [a]

[a] Department of Nutrition & Dietetics, Alexander Technological Educational Institute, Thessaloniki, Greece
[b] Department of Nutrition, AHEPA University Hospital, Thessaloniki, Greece
[c] Laboratory of Hygiene, Department of Medicine, Faculty of Health Sciences, Aristotle University, Thessaloniki, Greece
[d] PAOK Football Club, Thessaloniki, Greece
[e] Department of Nutrition & Dietetics, Harokopio University, Athens, Greece
[f] Laboratory of Clinical Pharmacology, Department of Medicine, Faculty of Health Sciences, Aristotle University, Thessaloniki, Greece
[g] Department of Physical Education & Sports Science, University of Thessaly, Greece

ARTICLE INFO

Article history:
Received 9 June 2017
Received in revised form
5 September 2017
Accepted 12 September 2017

Keywords:
Retirement
Sports
Ageing
Nutrition
Obesity
Football
Athletes
Body weight

ABSTRACT

Objectives: Retirement from professional sports engagement is associated with reduced physical activity, physical pain, depression, obesity and ischemic heart disease; however, whether in particular, soccer players experience metabolic abnormalities after retirement is currently unknown. Therefore, the aim of this pilot cross-sectional study was to investigate the prevalence of metabolic syndrome (MetS) and its associates in retired professional soccer players (RSP), compared to controls.
Methods: Twelve retired elite soccer players and 12 non-athletes, matched for age and body mass index, participated in a case-control study. Anthropometric and blood pressure measures and fasting blood samples were taken and analyzed. Dietary intake was assessed using food records, while other data on health status and lifestyle were also obtained.
Results: Prevalence of MetS was indifferent between groups. Among RSPs, those with MetS had gained significantly more weight since retirement, and exhibited greater body fatness (% of body weight), Fat Mass Index (FMI) and energy intake. RSPs who gained more than 12 kg after retirement from soccer (80.0% of RSPs) were in a greater risk for developing MetS, whereas none of those who gained less than 12 kg ($n = 7$) was diagnosed with MetS. Among RSPs, those with MetS had approximately triple chances of skipping breakfast daily and smoking, and eightfold more chances of eating right before their night sleep. Overall, a greater proportion of RSPs with MetS had familial overweight ($P = 0.03$) and experienced problems during sleeping ($P = 0.028$). Each increase per 1 kg/m^2 in the FMI almost doubled the chances of having MetS (OR: 1.9, 95% CI: 1.1–3.4, $P = 0.025$).
Conclusions: RSPs should focus on attaining a healthy body weight after retirement (via moderate exercise and neutral energy balance), in order to minimize the chances of developing MetS.

1. Introduction

It is commonly accepted that practicing sports, especially when performed professionally, acts protectively against disease (Haskell et al., 2007). On the other hand, retirement is associated with decreased physical activity (Slingerland et al., 2007) and in former athletes, this post-retirement inactivity has been associated with physical pain, depression, injuries and ischemic heart disease (Ginot et al., 1987; Meir et al., 2007; Schwenk et al., 2007; Nicholas et al., 2007). As far as soccer players are concerned, retirement has also been associated with the development of osteoarthritis (Turner et al., 2000). Rosenbloom and Bahns (2006) opined that the prevalence of metabolic syndrome (MetS) in former athletes is reduced, due to the improved glucose tolerance and insulin sensitivity of athletes, a finding verified in a recent study among elite Finish athletes (Laine et al., 2016). Undoubtedly, the type of sport

* Corresponding author: Laboratory of Hygiene, Dpt. of Medicine, Aristotle University of Thessaloniki campus, Thessaloniki, GR 54124, Greece.
E-mail address: mariagram@auth.gr (M.G. Grammatikopoulou).
[1] AP and MGG had equal contribution in the manuscript.

http://dx.doi.org/10.1016/j.obmed.2017.09.004
2451-8476/

performed is of cardinal importance, since several strength sports in particular are associated with an increased prevalence of MetS, even during competition years (Guo et al., 2013).

Arliani and associates (2014) recently examined the post-retirement health of Brazilian soccer players and showed that in their majority, participants had gained a great amount of body weight with 78% of them becoming overweight and 4% developing obesity, post-retirement. Additionally, the majority of former athletes endure daily pain, caused by injuries inflicted during their careers and treated with injections (Arliani et al., 2014; Schmitt et al., 2004), further limiting their ability to sustain adequate levels of physical activity. According to Dey et al. (2002), it is actually the present-day physical activity that modulates the risk factors for coronary artery disease among former athletes, after retirement from active sports participation.

The majority of published studies on the MetS use either general population samples or diabetic patients, with the latter being a convenient sample for MetS research, already fulfilling one of the syndrome's criteria (diabetes). On the other hand, studies on the prevalence of MetS and its associated parameters among retired athletes, are scarce. In this context, the aim of the present cross-sectional case-control pilot study was to assess the prevalence of MetS in retired professional soccer players (RSPs) compared to controls and define the dietary, anthropometric and life-style characteristics associated with MetS.

2. Materials & methods

Twenty-four adult Greek males (47 ± 4.9 years old) participated in the study, forming two groups. The first group ($n = 12$, mean age 46.7 ± 4.5 years) consisted of RSPs that had been playing professionally for at least 17 years, at the same elite level. The control group ($n = 12$, mean age 47.3 ± 5.5 years) was formed by people who had never exercised systematically. RSP participants were recruited from the association of retired PAOK FC soccer players and had retired for a mean of 8.2 years ago. Controls were volunteers selected randomly through friends and acquaintances of the researchers. PAOK FC is a popular soccer team, based in Thessaloniki, founded in 1923 from Greek immigrants who relocated to Thessaloniki from Istanbul. The team is competing both in the Greek premier league, as well as in UEFA competitions. Subjects of both groups were inhabitants of the Thessaloniki metropolitan area, in Northern Greece and exercised -at the time of the study-for less than 2 h per week. None of the participants had been diagnosed with diabetes.

The study protocol was approved by the University of Ioannina, as part of a postgraduate thesis. Collected data were handled according to the guidelines of the Helsinki Declaration and informed consent was obtained from all participants. Funding for the assays performed in the present study was provided by the Postgraduate Course on Nutrition offered by the University of Ioannina, in Greece.

2.1. Assays

Fasting blood samples were obtained for the measurement of glucose (FG) and lipids levels [total cholesterol (TC), high- and low density lipoproteins (HDL-C and LDL-C) and triglycerides (TG)]. FG and serum lipid levels were measured with an AutoAnalyzer (Architect 8000c, Abbott).

Blood pressure was measured twice and the mean of the recorded values were used in the analyses. A Mastermed A2 sphygmomanometer (Mastermed, Germany) was used, with the subjects in a sited, relaxed position, according to the US Preventive Services Task Force guidelines (Siu, 2015).

The Castelli index, a common atherogenic risk indicator, was calculated as the TC/HDL-C ratio (Millán et al., 2009; Lemieux et al., 2001). Non-HDL cholesterol (TC minus HDL-C), was used to determine the non-HDL/HDL ratio, a predictor of cardiovascular disease (Millán et al., 2009). Additionally, TG−glucose index (TyG), was calculated as a marker of insulin resistance (IR) (Du et al., 2014).

2.2. Anthropometric indices

Body weight (BW) was measured early in the morning by the same experienced physician, with a Seca 761 scale (Seca, Germany), that was calibrated daily. Subjects' height was also recorded with a Seca 202 stadiometer (Seca, Germany). Waist (WC) and hips circumferences were measured with a non-extensible anelastic tape, according to the WHO STEPwise Approach to Surveillance (STEPS) (WHO, 2008), the first in a horizontal plane, midway between the inferior margin of the ribs and the top of the iliac crest, and the latter around the widest portion of the buttocks. Waist-to-hips ratio and Body Mass Index (BMI=Weight [kg]/Height^2[m]) were calculated for each participant. Overweight was defined as $25 \leq BMI < 30$ kg/m^2 and obesity as BMI$\geq$30 kg/m^2, according to the World Health Organization cut-offs (WHO, 2000). Another parameter, the index of central obesity (ICO) (Parikh et al., 2007), reflecting the ratio of WC to the height, was also determined, as a reliable tool for MetS (Parikh et al., 2009). ICO cut-offs ranging between 0.51−0.58 were indicative of a healthy BW accumulation (Parikh et al., 2007), whereas ICO greater than 0.58 was determined in participants with increased visceral adiposity. Birth weight was also recorded for all subjects and as far as the RSP group was concerned, body weight before retirement from their athletic career was additionally reported.

Body composition was assessed with two methods, bioelectrical impedance analysis (BIA) and skinfold thickness, with the use of a Maltron 907 bioelectrical impendence analyser (Maltron International Ltd, Essex, UK) and a Harpenden set of calipers (Baty International, West Sussex, UK), respectively. For the skinfold thickness method, measurements on the biceps, triceps, subscapular and iliac crest were recorded three times on each site, on the right side of the body, and the median recorded value of each site was applied at the Durnin and Womersley (1974) equations for adult men. Fat Mass Index (FMI), was calculated as the total fat mass [kg], divided by the height^2 [m], of each participant (Schutz et al., 2002). Additionally, Visceral adiposity Index (VAI) (Amato et al., 2010), was computed for all participants, as $VAI = [WC/39.68+(1.88 \times BMI)] \times (TG/1.03) \times (1.52/HDL\text{-}C)$.

2.3. Diagnosis of MetS

Participants were screened for MetS in accordance to the International Diabetes Federation (IDF, 2006). In particular, MetS was diagnosed in those with central obesity (WC ≥94 cm) (Pouliot et al., 1994), additionally exhibiting two of the following criteria: 1) serum TG ≥150 mg/dL (1.7 mmol/L), or specific treatment for hypertriglyceridemia, 2) serum HDL <40 mg/dL, 3) systolic BP >130 mmHg or diastolic BP ≥85 mmHg, and 4) FG levels ≥100 mg/dL (5.6 mmol/L), or previous type 2 diabetes diagnosis.

For comparison of the IDF criteria, the prevalence of MetS was additionally diagnosed according to the National Cholesterol Education Program (NCEP) Adult Treatment Panel III (ATPIII) revised criteria (Grundy et al., 2005), in participants fulfilling three or more of the following criteria: 1) WC ≥102 cm, 2) BP >130/85 mmHg, 3) TG >150 mg/dl, 4) HDL-C <40 mg/dl, and 5) FG >100 mg/dl.

The IDF definition was selected as the most suitable tool for worldwide use, considered the platinum standard of established criteria (IDF, 2006), since it is the only one based on race-specific WC cut-offs.