European Journal of Sport Science, 2021
Vol. 21, No. 1, 107–117, https://doi.org/10.1080/17461391.2020.1736180

ORIGINAL ARTICLE

Influence of organised sports practice during adolescence on health of adult women with special emphasis on participation in aesthetic sports

C. MAYOLAS-PI[1,2,3], S. SITKO[2,3], M. A. OVIEDO-CARO[3,4], J. BUENO-ANTEQUERA[3,4], J. REVERTER-MASIÀ[3,5], M. FRANCÍN-GALLEGO[3,6], F. J. SARASA-OLIVÁN[3,7], & A. LEGAZ-ARRESE[1,2,3]

[1]*Section of Physical Education and Sports, Faculty of Health and Sport Sciences, University of Zaragoza, Zaragoza, Spain;* [2]*Faculty of Health and Sport Sciences, University of Zaragoza, Zaragoza, Spain;* [3]*Research group Movimiento Humano, Universidad de Zaragoza, Zaragoza, Spain;* [4]*Physical Performance & Sports Research Center, Department of Sports and Computer Science, Section of Physical Education and Sports, Faculty of Sports Sciences, Universidad Pablo de Olavide, Seville, Spain;* [5]*Section of Physical Education and Sports, Faculty of Education, Psychology and Social Work, University of Lleida, Lleida, Spain;* [6]*Health Sciences Faculty, Universidad San Jorge, Campus Universitaro Villanueva de Gállego, Villanueva de Gállego, Spain &* [7]*Podium, Medical Center of Sports Medicine, Zaragoza, Spain*

Abstract
This study aimed to assess the differences in psychosocial health and cardiometabolic risk during adulthood in women based on previously organised sport (OS) participation during adolescence and current activity levels, with emphasis on participation in aesthetic sports. The study included 1947 women aged 18–55 years who were categorised into four groups: 355 aesthetic athletes during adolescence, 494 non- aesthetic athletes during adolescence, 791 non-athletes during adolescence with similar current levels of physical activity (PA) to OS groups and 307 currently inactive non-athletes during adolescence. Participants answered questionnaires regarding sport participation, psychosocial health and cardiometabolic risk. The results show that non-athletes during adolescence who are currently inactive reported significantly lower psychosocial health and higher cardiometabolic risk scores. Women with currently homogenous PA levels ($\chi^2 = 0.514$) reported similar physical quality of life (QoL), exercise addiction, anxiety and depression symptoms regardless of participation in OS during adolescence ($P > .05$), except aesthetic athletes who reported the worst sleep and mental QoL. Very high training volumes in aesthetic athletes did not influence psychological outcomes and cardiometabolic risk in adulthood compared to lower training volumes. In conclusion, the effects of PA during adulthood appear to be powerful enough to induce beneficial adaptations in health outcomes that match those observed in women who participate in OS during adolescence, except for aesthetic sports participants, who show a high risk of lower quality of sleep in adulthood. PA should be promoted in adults and especially women who have not participated in OS during adolescence.

Keywords: *Physical activity, aesthetic sports, psychosocial health, quality of life, cardiometabolic risk*

Highlights
- The effects of PA during adulthood appear to be powerful enough to induce short-term beneficial adaptations in health outcomes that match those observed in women who started training during adolescence.
- Doing aesthetic sports in adolescence is associated to poorer sleep and mental QoL outcomes when compared to other sports, although better psychosocial health outcomes are usually reported when comparing this activity to low PA levels.
- Gender-specific preventive programs for women that practise aesthetic sports are needed in order to minimise the negative long-term health consequences of these sport disciplines.

Introduction

Adolescence is an important time frame in terms of acquisition and development of lifestyle behaviours, which are linked to adulthood health (Souza et al., 2017). Among these behaviours, researchers highlight the importance of participating in organised

Correspondence: Sebastian Sitko Calle Domingo Miral, s/n, 50009 Zaragoza, Universidad de Zaragoza, Spain. E-mail: 685492@unizar.es

sport (OS) (Howie, McVeigh, Smith, & Straker, 2016), defined as physical activity (PA) that is directed by adult or youth leaders and involves rules and formal practice and competition (Logan & Cuff, 2019).

OS participation may decrease cardiovascular risk as it has been associated with improvements in habits such as eating behaviours, smoking and excessive alcohol consumption (Howie et al., 2016) and increases in PA (Marques, Ekelund, & Sardinha, 2016). OS participation plays an important role in better cardiovascular and cardiorespiratory fitness and in decreases in obesity risk (Logan & Cuff, 2019). PA in youth is also associated to lower BMI and lower rates of occurrence of arterial hypertension and type 2 diabetes mellitus (Fernandes & Zanesco, 2010).

Scientific evidence supports the fact that certain habits and psychosocial disorders that appear during adolescence can persist throughout adulthood (McPhie & Rawana, 2015). Adolescents are at high risk of developing mental health disorders (McPhie & Rawana, 2015), poorer subjective sleep (Brand et al., 2017), worse quality of life (QoL) (Brand et al., 2017), eating disorders (Bar, Cassin, & Dionne, 2016), and higher levels of anxiety and depression symptoms (McDowell, MacDonncha, & Herring, 2017). The importance of maintaining PA during adulthood is crucial as it favours better mental health and other healthy behaviours (Jewett et al., 2014; Souza et al., 2017). Evidence suggests that, although some components of sport activities may protect against mental health disorders, others appear to increase the risk (Logan & Cuff, 2019).

The existence of gender differences in OS participation during adolescence is well known and it is suggested that girls are less involved in OS than boys (Howie et al., 2016). Furthermore, although PA in adult men was higher in subjects who practiced organised sports as 3–18 years old, in women only the PA performed as 12–18 years old predicted the self-reported PA in young adulthood (Telama et al., 2014). The real influence of OS practice during adolescence on health outcomes of adult women is unclear (Fernandes & Zanesco, 2010; Sabiston et al., 2016), because normally it is difficult to observe how gender differences influence the results.

Women report higher prevalence of psychosocial problems than men (Brand et al., 2017; McPhie & Rawana, 2015), a finding that is commonly seen during adolescence. Girls show poorer subjective sleep (Brand et al., 2017), worse QoL (Brand et al., 2017), more eating disorders (Bar et al., 2016), and higher levels of anxiety and depression symptoms (McDowell et al., 2017) than boys. Previous evidence also supports the fact that certain habits and psychosocial disorders that appear during adolescence can persist throughout adulthood (McPhie & Rawana, 2015).

Researchers have been particularly interested in psychosocial outcomes of female aesthetic sports athletes. Aesthetic sports are classified as weight-sensitive sports, a category in which physical appearance is a fundamental component of judging criteria. Evidence suggests that aesthetic athletes are at increased risk of developing psychosocial health problems (Bruin, Oudejans, & Bakker, 2007; Lanfranchi, Maïano, Morin, & Therme, 2014). These sports require complex coordination and high training volumes (Bruin et al., 2007), which are related to the early specialisation commonly seen in these sport disciplines. This can produce insufficient sleep, burnout, higher injury rates and eating disorders (LaPrade et al., 2016), which can result in negative health outcomes in adulthood (Sundgot-Borgen, Danielsen, & Klungland-Torstveit, 2012). Furthermore, aesthetic sports are linked to increased risk of disordered eating (Bar et al., 2016), anxiety and depression symptoms (Schaal et al., 2011), poor sleeping habits and daytime sleepiness (Silva & Paiva, 2016) in its participants. It has also been suggested that some of these health disorders during the athletic career can result in negative health outcomes in adulthood (Sundgot-Borgen et al., 2012). Regarding training volume, female aesthetic elite athletes are at high risk of negative health outcomes (Krentz & Warschburger, 2013; Lanfranchi et al., 2014). However, the effects of different training volumes in aesthetic sports during adolescence on psychosocial health and cardiometabolic risk in adulthood remain unknown.

Taking the above literature into account, the objectives of this study were: (a) to assess the differences in psychosocial health and cardiometabolic risk in adult women according to participation in OS during adolescence and current PA levels, (b) to assess the influence of aesthetic sports practice during adolescence on psychosocial health and cardiometabolic risk in adult women, and (c), to assess whether training volume in aesthetic sports influences these variables. It was hypothesised that OS practice during adolescence could improve several psychosocial health and cardiometabolic risk factors in adult women but participants of aesthetic sports could present higher prevalence of anxiety and depression symptoms and sleep disorders than women who practised other sports (Schaal et al., 2011; Silva & Paiva, 2016; Sundgot-Borgen et al., 2012), especially with high training volumes (Krentz & Warschburger, 2013; Lanfranchi et al., 2014).

Materials and methods

Subjects and procedures

An invitation to participate in the study was sent via e-mail to aesthetic and non-aesthetic sport clubs and federations. The invitation included a brief and clear introduction to the study, an explanation of the anonymous and voluntary nature of participation and a link to the online survey. Each participant was suggested to invite same-aged women with no past OS experience. The project was also made known through media coverage, including radio and social media. Participants answered an online survey which included questionnaires validated for these populations and described below. The data collection was completed in May 2017. There was no time limit to complete the forms. The questionnaires took an average of 40 min to complete, and the internet design prevented missing data as participants could not skip questions or leave them half answered. A random subsample of 63 female athletes and 46 non-athletes during adolescence filled in another form before the main study with the purpose of validating questions related to sport practice during adolescence, sociodemographic status and training during adulthood. The recruitment of these subjects was similar to that of the larger subsequent study. That predesigned questionnaire was applied two times, with a 10 d interval. The test-retest reliability was high (from 0.82–0.93) and women who participated in the pilot study were not included in the final assessment. Participants gave their informed consent for the scientific use of the data. The research complied with the Spanish law of data protection, the International Ethical Guidelines for Health-related Research Involving Humans and was approved by the Committee on Biomedical Ethics of the Aragón Government (PI17/0252).

Participants were 2758 potentially eligible women (Figure 1). No current presence of chronic diseases and an age frame of 18–55 were chosen as inclusion criteria. Women who complied with these requirements were categorised into four groups according to participation in OS during adolescence and PA levels in adulthood: 'aesthetic athletes', 'non-aesthetic athletes', 'non-athletes currently similar PA' and 'non-athletes currently inactive'. For the purpose of this study, the adolescent population was defined as aged 11–17 years in relation to the World Health Organization data (WHO, 2018). As inclusion criteria in the athlete's groups, a minimum OS practice of 2 h per week for at least

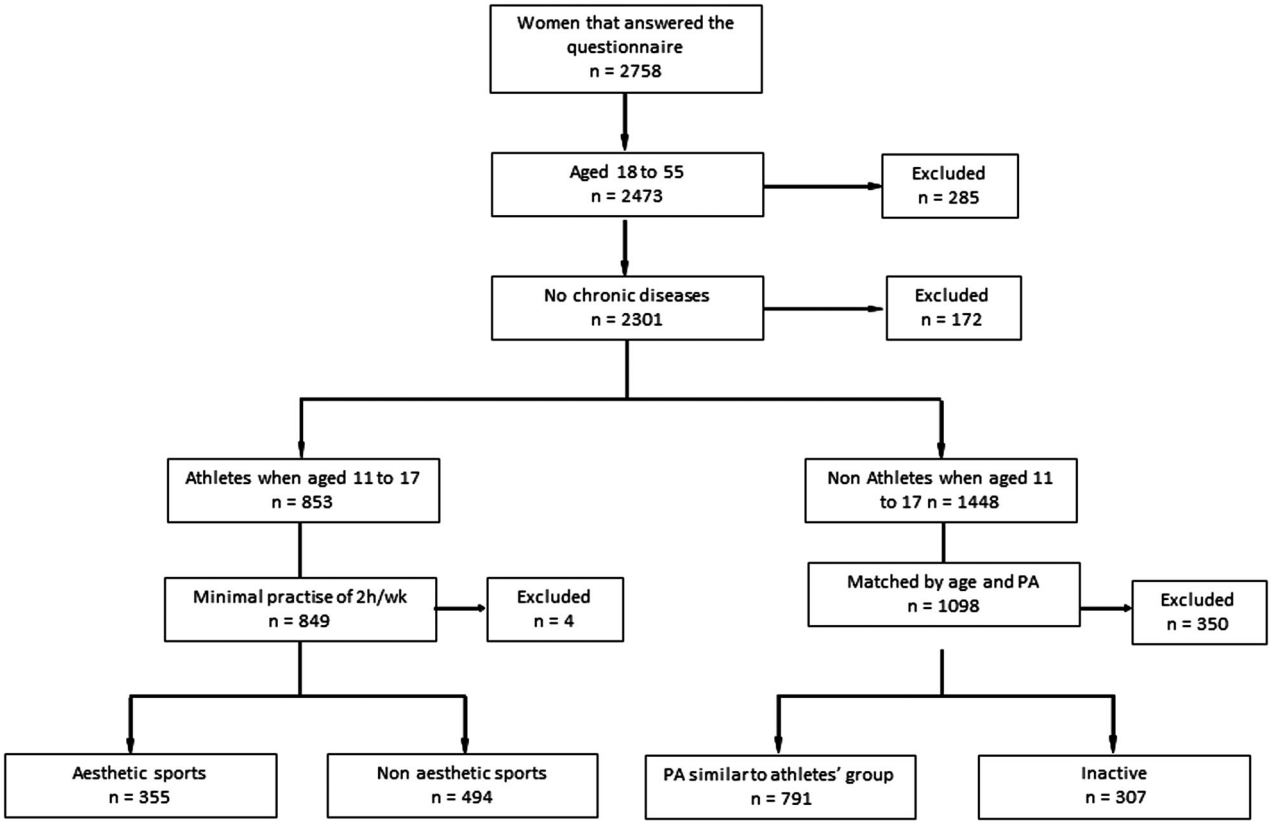

Figure 1. Flow diagram of the selection of participants and definitive group composition.

one year was required, excluding hours dedicated to physical education. Those who did 1 h a week out of school were excluded because it could not be verified whether they reached the recommended activity levels. In the end, the study included 355 aesthetic athletes and 494 non-aesthetic athletes. In order to be included in the aesthetic athlete group, previous participation in sports like rhythmic gymnastics, artistic gymnastics, figure skating, synchronised swimming or ballet was required. On the other hand, women who did not participate in OS during their adolescence were categorised in two groups based on PA levels in adulthood. 'Non-athletes currently similar PA' was composed by women with current levels of PA similar to those seen in the athletes' group, and had equal proportions of subjects with high, moderate or low PA levels according to the International Physical Activity Questionnaire (IPAQ) ($\chi^2 = 0.514$) when compared with the athlete groups. 'Non-athletes currently inactive' group was composed by women with currently low PA levels (<600 MET- minutes/week) and who had been physically inactive because they did not reach the minimal World Health Organization PA recommendations. After matching both groups according to age and PA, 791 women were included in the non-athletes currently similar PA group and 307 women were included in the non-athletes currently inactive group.

Measured aspects

Participation in sports during adolescence. The following question regarding participation in sport was asked (Fernandes & Zanesco, 2010): "Outside school, were you engaged in any organised or supervised sport activities in clubs for at least one year from 11 to 17 years of age? Other physical activities such as dance types (e.g. ballet) are also included". If the answer was affirmative, the participants indicated the sports category and training volume (hours per week). The study team later coded the sports as aesthetic or non-aesthetic. The answer allowed for a categorisation of the aesthetic sport athletes into four groups according to their weekly sport practice: low (≤3.5), average (3.6–10.5), high (10.6–17.4) and very high (≥17.5) following the instructions of Merglen, Flatz, Bélanger, Michaud, and Suris (2014).

Sociodemographic status. Data related to gender, age and presence of chronic disease (McMahon et al., 2017) was gathered together with the main sociodemographic variables such as the size of the municipality of residence, education level, marital status, number of children, employment situation, and income level (Munguía-Izquierdo et al., 2017).

Health status

Quality of life. Version 2 of the Short-Form 12 Health Survey questionnaire was used to assess health-related QoL, and it has shown good psychometric properties (Cronbach's α from 0.78 to 0.85) (Vilagut et al., 2008). Self-reported QoL has been found to be a good predictor of illness and wellbeing. The 12 items of this questionnaire assess eight health dimensions and two summary components: physical and mental health (range 0–100). Higher scores indicate better functioning. In the current study, the scale showed good internal consistency with a Cronbach's alpha of 0.83.

Quality of sleep. The Pittsburgh Sleep Quality Index, which has shown satisfactory psychometric properties (Cronbach's $\alpha = 0.81$) was used (Hita-Contreras et al., 2014). It consists of 19 self-rating questions that offer values of seven components scored from 0 to 3: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping medications and daytime dysfunction. These component scores are then summed to yield a global score (range 0–21), with higher scores indicating poorer sleep quality and ranges >5 qualifying as 'poor sleepers'. In this study, the Cronbach's alpha was 0.70.

Psychological symptoms. Anxiety and depression symptoms were evaluated with the Hospital Anxiety and Depression Scale (HADS). Internal consistency was measured with Cronbach's α, which was 0.84–0.85 (Herrero et al., 2003). This questionnaire consists of seven items related to anxiety and seven items related to depression. Each item is scored from 0 to 3, indicating that a person can score between 0 and 21 for anxiety or depression. Higher scores indicate higher symptoms. Exercise addiction risk was evaluated with the Exercise Addiction Inventory (EAI) (range of 6–30), which has shown satisfactory psychometric properties (Cronbach's $\alpha = 0.70$) (Sicilia, Alías-García, Ferriz, & Moreno-Murcia, 2013). Higher scores indicate higher levels for addiction risk. In this study, alpha was 0.69 in HADS and 0.82 in EAI.

Behavioural cardiometabolic risk factors. Physical inactivity, fitness, unhealthy diet and tobacco and alcohol consumption were established as behavioural cardiometabolic risk factors by following criteria from the World Health Organization. Additionally, body mass index based on self-reported values of weight and height was measured. Overall fitness was

evaluated using the international fitness scale, which has shown satisfactory reliability and validity with Kappa coefficients ranging from 0.54–0.65 (in the current study, Cronbach's $\alpha = 0.84$) (Ortega et al., 2011). This scale ranges from 1 to 5, with higher scores indicating better fitness. Smoking was assessed by revised Fagerstrom nicotine dependence questionnaire, which has shown acceptable levels of validity with Cronbach's $\alpha = 0.69$ (in the current study, $\alpha = 0.81$) (Korte, Capron, Zvolensky, & Schmidt, 2013). Scores can range from 0 to 16, with lower scores indicating lower dependence. Alcohol consumption was calculated with the self-reported standard alcohol units as in previous studies (Stockwell et al., 2000). The assessment was made through the sum of products and calculated by multiplying the frequency of consumption of beer, wine and spirits by standard alcohol units, with a standard alcohol unit being equivalent to 10 g of pure alcohol. A 14-point Mediterranean Diet Adherence Screener was used. It consisted of 12 questions related to eating frequency and 2 questions regarding habits of eating characteristic Mediterranean food items. This questionnaire has been shown to be a valid instrument to evaluate adherence to the Mediterranean diet (Schröder et al., 2011). Scores range from 0 to 14, with higher scores indicating better adherence.

Current PA levels were established by the short version of the IPAQ. Satisfactory reliability and validity of IPAQ in different countries has been shown previously (Craig et al., 2003). The IPAQ calculates PA levels as MET-minutes/week and classifies subject PA levels as low (less than 600 MET-minutes/week), moderate (600–3000 MET-minutes/week), or vigorous (more than 3000 MET-minutes/week) (Craig et al., 2003).

Statistical procedures

Data analysis was performed using IBM Statistical Package for the Social Sciences (IBM SPSS Statistics, v. 20.0 for WINDOWS) software. Descriptive analyses are presented as mean ± standard deviation or percentage. Kolmogorov–Smirnov tests were used to check for normal distributions. Descriptive statistics and ANOVA were used to examine differences in the variables recorded for the groups. Bonferroni correction was used to adjust the calculated *P*-values to prevent type I error caused by the multiple comparisons. Analysis was adjusted for potential confounding factors in associations between PA and mental health such as size of municipality of residence, education level and employment situation (Munguía-Izquierdo et al., 2017). Chi-square test was used to analyse differences in PA levels and sociodemographic variables. In addition, ANOVA was used to compare the variables of the aesthetic sports athletes with different types of training volume. Pearson's correlations were used to analyse associations between different health values, training frequency and current PA in aesthetic athletes. For all statistical analyses, the level of significance was set at $P < .05$.

Results

Table I presents the comparison among the main study variables of the women's groups. Non-athletes currently inactive reported significantly lower psychosocial health, higher anxiety and depression symptom levels and lower physical and mental QoL than other groups ($P < .05$). Among women with currently similar PA groups, non-athletes during adolescence showed similar psychosocial levels and cardiometabolic risk in adulthood to non-aesthetic athletes. Aesthetic athletes showed significantly higher training volume when aged 11–17 and the worst sleep quality of all groups.

Table II shows the differences in variables among aesthetic athletes according to their training volume (hours per week). In the current study, higher training volumes were associated with few differences in health outcomes.

Table III shows the correlations between health variables and weekly aesthetic sports practice during adolescence and PA during adulthood. It can be observed that health variables are more correlated to PA during adulthood than to aesthetic sports training volume during adolescence, except for anxiety symptoms.

Discussion

This was the first study to assess the relationship between psychosocial health and cardiometabolic risk in women with current similar levels of PA who had performed different types and amounts of PA during adolescence. The main findings of the study were that: (a) physical QoL, anxiety and depression symptom levels in women are related to current PA, but are independent of the participation in OS during adolescence, (b) in women with current similar levels of PA, past participation in aesthetic sports is related to worse mental QoL and sleep, and (c) in aesthetic athletes, psychosocial health and cardiometabolic risk were not associated with different training volumes, except for physical QoL, which was related to very high training volumes (≥17,5 h/wk) and anxiety symptoms, which correlated negatively with the training volumes.

Table I. Sociodemographic status, training, psychosocial health and cardiometabolic risk among women based upon previous sport participation during adolescence and current activity levels.

	Organised sports during adolescence		Non-organised sports during adolescence	
	Women currently similar PA		Women currently inactive	
	Aesthetic athletes ($n = 355$)	Non-aesthetic athletes ($n = 494$)	Non-athletes ($n = 791$)	Non-athletes ($n = 307$)
Age	26.6 ± 8.4	27.2 ± 8.6	27.4 ± 7.0	27.9 ± 8.0
Sociodemographic status (%)				
Education level (non-university studies)	34.6	25.5*	30.3*#	44.3*#+
Employment situation (employees)	44.2	43.1	55.0*#	49.2#
Income level (<1200 €/mo)	59.0	54.1	62.0	57.4
Marital status (single)	81.9	83.2	81.2	74.2#
Number of children (≤1)	89.9	89.3	91.8	84.7+
Size of municipality of residence (<100,000 inh)	40.3	41.7	44.7*	37.1*#+
Training				
Volume 11–17 (h/wk)	8.2 ± 6.7	5.0 ± 2.8*	0.0 ± 0.0*#	0.0 ± 0.0*#+
PA adult (MET-min/wk)	3148 ± 2915	3206 ± 3083	3100 ± 2857	257 ± 190*#+
PA adult (h/wk)	4.3 ± 5.4	4.2 ± 4.5	4.0 ± 4.0	0.3 ± 0.8*#+
Psychosocial health				
Quality of life (0-100)				
Physical Functioning	53.0 ± 6.8	54.0 ± 6.2	54.1 ± 6.0	49.5 ± 9.3*#+
Role Physical	49.6 ± 12.5	50.7 ± 12.3	51.1 ± 11.6	49.3 ± 13.0
Bodily Pain	50.2 ± 9.0	52.1 ± 8.1*	53.3 ± 7.7*	50.2 ± 10.2#+
General Health Perceptions	48.9 ± 9.4	50.0 ± 8.5	50.3 ± 8.2	45.8 ± 9.6*#+
Vitality	51.8 ± 10.2	53.4 ± 9.2	53.6 ± 8.8*	51.1 ± 9.8#+
Social Functioning	47.2 ± 10.4	48.5 ± 9.5	48.9 ± 9.3*	45.4 ± 10.5#+
Role Emotional	41.1 ± 18.6	43.5 ± 17.7	43.7 ± 17.9	40.0 ± 19.0#+
Mental Health	46.8 ± 9.6	48.0 ± 9.0	48.6 ± 8.8*	46.4 ± 9.4+
Physical QoL	53.7 ± 9.1	54.7 ± 8.6	55.2 ± 9.3*	51.6 ± 11.2*#+
Mental QoL	40.8 ± 19.5	43.8 ± 17.5*	44.7 ± 17.5*	37.5 ± 18.6*#+
Sleep (0-21)	5.6 ± 3.1	5.0 ± 2.9*	4.8 ± 2.9*	5.1 ± 2.9*
Anxiety (0-21)	9.6 ± 2.6	9.8 ± 2.9	9.5 ± 2.9	10.4 ± 3.0*#+
Depression (0-21)	9.5 ± 2.0	9.5 ± 2.4	9.6 ± 2.3	10.6 ± 3.0*#+
EAI (6-30)	15.3 ± 5.1	16.0 ± 5.1	15.3 ± 4.7	10.9 ± 4.5*#+
Cardiometabolic risk				
BMI ($kg \cdot m^{-2}$)	21.8 ± 3.2	22.5 ± 4.0*	22.1 ± 3.2	22.9 ± 4.1*+
AMD (0-14)	7.6 ± 1.9	7.9 ± 2.0	7.8 ± 1.9	7.3 ± 2.0#+
PC (1-5)	3.4 ± 0.7	3.3 ± 0.7	3.2 ± 0.7*#	2.7 ± 0.6*#+
Alcohol (SAU/wk)	3.5 ± 6.4	4.6 ± 6.6*	4.5 ± 7.9*	4.2 ± 8.5
Tobacco (0-16)	0.7 ± 1.8	0.5 ± 1.6	0.6 ± 1.6	0.9 ± 2.2#

Note. Values are the mean ± SD or percentage.
Abbreviations: PA, physical activity; MET, metabolic equivalent; QoL, quality of life; EAI, exercise addiction index; BMI, body mass index; AMD, adherence to the Mediterranean diet; PC, physical condition; SAU, standard alcohol units.
Chi-square test or ANOVA: *$P < .05$ significantly different from aesthetic athletes during adolescence; # $P < .05$ from non-aesthetic athletes during adolescence; + $P < .05$ from non-athletes during adolescence currently similar PA than aesthetic group. Covariates: size of municipality of residence, education level and employment situation.

The main novelty of the current study was the comparison of women with similar current levels of PA that differed in participation in OS in the adolescence. According to the results and contrarily to the initial hypothesis, women with current similar levels of PA report equal physical QoL, anxiety and depression symptom and cardiometabolic risk levels regardless of the participation in OS during adolescence. The fact that similar current psychosocial and cardiometabolic health values were reported in both groups allows to isolate the importance of current PA levels on health outcomes, regardless of past participation in OS. Research that has attempted to connect PA during adolescence and health outcomes in adult women is scarce and contradictory. Furthermore, when groups with the same adult PA levels are compared, health outcomes remain the same regardless of past participation in PA (Herman, Hopman, & Craig, 2010; Munguía-Izquierdo et al., 2017).

Contrary to this, other studies suggest that PA during adolescence may have a positive impact on

Table II. Training, psychosocial health and cardiometabolic risk among women who practiced aesthetic sports according to weekly sport practice developed during adolescence.

	Weekly aesthetic sport practice during adolescence			
	Low ≤ 3.5 h/wk	Average 3.6-10.5 h/wk	High 10.6-17.4 h/wk	Very high ≥ 17.5 h/wk
Training				
Volume 11–17 (h/wk)	2.7 ± 0.5	5.8 ± 1.5*	14.0 ± 1.7*#	23.4 ± 6.0*#+
PA adult (MET-min wk)	2749 ± 3528	3199 ± 2591	2585 ± 2617	2756 ± 2077
PA adult (h/wk)	3.7 ± 3.9	4.5 ± 5.0*	4.4 ± 5.9	4.3 ± 6.2
Psychosocial health				
Quality of life (0–100)				
Physical Functioning	52.4 ± 6.6	52.4 ± 7.6	54.4 ± 5.8	53.2 ± 4.7
Role Physical	47.5 ± 13.2	50.4 ± 12.0	50.6 ± 12.5	45.2 ± 14.3 #
Bodily Pain	49.1 ± 9.6	50.8 ± 8.7	50.4 ± 9.9	47.0 ± 9.5 #
General Health Perceptions	45.6 ± 8.9	49.0 ± 9.3	50.3 ± 9.3 *	48.7 ± 10.0
Vitality	50.2 ± 10.3	52.6 ± 10.2	50.3 ± 9.6	51.3 ± 10.8
Social Functioning	45.6 ± 10.7	47.3 ± 10.4	48.7 ± 9.1	47.1 ± 11.9
Role Emotional	37.8 ± 20.7	41.9 ± 17.4	39.7 ± 19.9	42.3 ± 19.1
Mental Health	45.1 ± 9.9	47.6 ± 8.9	45.5 ± 11.0	47.6 ± 11.0
Physical QoL	52.5 ± 9.7	53.7 ± 9.4	55.8 ± 7.6	50.6 ± 9.5 +
Mental QoL	35.0 ± 21.0	42.1 ± 18.9	40.3 ± 19.6	42.9 ± 21.7
Sleep (0–21)	5.9 ± 3.0	5.7 ± 3.0	5.0 ± 3.2	5.8 ± 3.4
Anxiety (0–21)	10.5 ± 3.2	9.6 ± 2.4	9.4 ± 2.6	9.2 ± 2.7
Depression (0–21)	9.7 ± 2.3	9.5 ± 1.9	9.5 ± 1.9	9.2 ± 2.1
EAI (6–30)	14.9 ± 4.4	15.2 ± 5.4	15.5 ± 4.6	15.0 ± 4.6
Cardiometabolic risk				
Age	26.3 ± 9.1	26.2 ± 8.2	25.7 ± 7.8	29.3 ± 8.5
BMI ($kg \cdot m^{-2}$)	22.1 ± 3.8	22.0 ± 3.2	20.8 ± 2.5	22.1 ± 3.8
AMD (0–14)	7.6 ± 2.1	7.5 ± 1.9	7.4 ± 1.7	7.3 ± 1.7
PC (1–5)	3.0 ± 0.7	3.5 ± 0.7 *	3.4 ± 0.7 *	3.3 ± 0.6
Alcohol (SAU/wk)	3.8 ± 7.0	4.2 ± 7.4	1.7 ± 3.6	2.3 ± 4.7
Tobacco (0–16)	0.6 ± 1.5	0.8 ± 1.9	0.4 ± 1.4	1.0 ± 2.5

Note. Values are the mean ± SD.

Abbreviations: PA, physical activity; MET, metabolic equivalent; QoL, quality of life; EAI exercise addiction index; BMI, body mass index; AMD, adherence to the Mediterranean diet; PC, physical condition; SAU, standard alcohol units.

* $P < .05$ significantly different from aesthetic sports ≤ 3.5 h/wk; # $P < .05$ from aesthetic sports 3.6–10.5 h/wk; + $P < .05$ from aesthetic sports 10.6–17.4 h/wk.

psychosocial health and cardiometabolic outcomes during adulthood. As an example, PA in the adolescence was related to better health outcomes (Howie et al., 2016), lower levels of depression over time (McPhie & Rawana, 2015), and lower rates of occurrence of arterial hypertension and type 2 diabetes mellitus in adulthood (Fernandes & Zanesco, 2010). Moreover, adolescents who consistently participate in team sports during high school score lower depression scores (Sabiston et al., 2016), better fight obesity, and appear less likely to smoke cigarettes and use other illegal drugs in adulthood (Logan & Cuff, 2019). These contradictory findings may be because, unlike in this study, current PA levels were not measured and PA was assessed only during adolescence. Comparing adult health outcomes of groups with different current PA levels, as done in the aforementioned research, may render equivocal results as the lack of matching for current PA is a significant confounding factor that does not allow the establishment of the real influence of past PA on current health markers. Furthermore, the inclusion of a control group that did not participate in OS during adolescence and is currently inactive is crucial as it allows the determination of the benefits of both current and past PA. In our study, the control group showed high cardiometabolic risk scores and poor mental health outcomes, findings that have been associated with lower OS participation during adolescence in previous studies (Logan & Cuff, 2019).

Evidence around the relationship between psychosocial health and cardiometabolic outcomes in active adult women that performed different levels of PA during adolescence is scarce. The immediate benefits of PA during adolescence have been consistently reported in the literature in both girls and boys, and several aspects of mental health during adolescence ameliorate consistently with PA (Brand et al., 2017; Lang et al., 2016; McDowell et al., 2017). These

Table III. Pearson's correlations among main variables, training volumes during adolescence and PA levels during adulthood in aesthetic athletes.

	Aesthetic athletes	
	Weekly aesthetic sport practice during adolescence	PA during adulthood (MET-min wk)
Quality of life		
Physical Functioning	0.099	0.150**
Role Physical	−0.062	0.098
Bodily Pain	−0.060	−0.024
General Health Perceptions	0.050	0.116*
Vitality	−0.029	0.141**
Social Functioning	0.046	0.050
Role Emotional	0.031	0.049
Mental Health	0.028	0.066
Physical QoL	−0.027	0.088
Mental QoL	0.049	0.093
Sleep	−0.063	−0.040
Anxiety	−0.130*	−0.037
Depression	−0.045	−0.078
Exercise addiction index	0.000	0.355**
Cardiometabolic risk		
BMI (kg m^{-2})	−0.002	−0.051
AMD	−0.031	0.148**
PA	0.088	–
PC	0.039	0.243**
Alcohol (SAU/wk)	−0.082	−0.111*
Tabaco (0–16)	0.016	−0.020

*$P < .05$; **$P < .01$

Abbreviations: MET, metabolic equivalent; QoL, quality of life; BMI, body mass index; AMD, adherence to the Mediterranean diet; PA, physical activity in MET-min wk; PC, physical condition; SAU, standard alcohol units.

improvements are in accordance with the commonly reported acquisition of healthy habits through PA, although boys were more active than girls in all types of PA (Howie et al., 2016; Souza et al., 2017). Our results show that women who did not participate in OS during adolescence and who are currently inactive reported significantly lower psychosocial health and higher cardiometabolic risk scores, findings that have also been reported in previous studies (Fernandes & Zanesco, 2010; Jewett et al., 2014). Interestingly, while all these results suggest that participation in sports during adolescence is positive, the negative effects derived from the lack of practice could be reversed by increasing PA during adulthood.

In line with the hypothesis of this study, past participation in aesthetic sports had a negative impact on sleep and mental QoL in adulthood in women with current similar levels of PA. These findings are linked to previous evidence, with numerous studies showing that participants in aesthetic sports experience poor sleep (Schaal et al., 2011; Silva & Paiva, 2016) and increased risk of mental health disorders (Lanfranchi et al., 2014). It is well known that longer sleep durations are associated to better QoL (Chaput et al., 2016) although it remains unclear whether sleep and QoL were related in our sample. A study that analysed sleep differences by gender (Zhang, Chan, Lam, & Yun-Kwok, 2016) suggested that women were more susceptible to emotional and behavioural problems, a finding that could make them more prone to experiencing sleep disturbances. A connection between both results may exist as the relationship between sleep quality and QoL has been previously established (Chaput et al., 2016) and, at least in the sample that composed this study, aesthetic athletes showed worse mental QoL and some of the aspects of physical QoL than other women with similar PA levels. Previous studies have established that aesthetic athletes are at increased risk of disordered eating (Schaal et al., 2011), physical appearance dissatisfaction and perfectionism (Neves et al., 2017). These findings may be related to the fact that aesthetic athletes show a high drive for thinness that may be explained by the pressure exerted by the judging criteria, which puts emphasis on body image (Schaal et al., 2011; Silva & Paiva, 2016). It has been previously reported that body dissatisfaction may be higher among aesthetic sports participants than among non-aesthetic athletes (Lombardo, Battagliese, Lucidi, & Frost, 2012), which may contribute to worse mental health outcomes and may endure into the adulthood. Finally, although participation in most types of PA is related to better body image, aesthetic sports practice may be linked to a higher self-demand regarding body image, which may be maintained throughout the entire life (Abbott & Barber, 2011).

The last finding of the study was that higher training volumes in aesthetic sports during adolescence do not relate to worse mental health in adulthood, which is contrary to previous evidence (Lanfranchi et al., 2014; Sundgot-Borgen et al., 2012) although worse results regarding physical health have also been observed in higher volumes. The improvement seen in psychosocial health markers with higher training volumes and the general benefits of an active lifestyle seem more in line with the PA benefits previously attributed to sporting activities in general (Cohen, Baker, & Ardern, 2016) than to aesthetic sports in particular (Sigvartsen et al., 2016). During adolescence, high anxiety symptom risk has been reported in girls that participate in aesthetic sports at an elite level (Schaal et al., 2011). Furthermore, the reported risk was lower in girls than participated at a non-elite

level (Lanfranchi et al., 2014). Contrarily, in our sample anxiety symptoms during adulthood correlated negatively to the training volume in aesthetic athletes during adolescence. Although there is lack of data regarding this aspect, it should be considered that elite level aesthetic sport practitioners may be under supervision of a sport psychologist, an aid that is normally not available for recreational athletes. This would result in sufficient psychological skills that would allow better anxiety management in the future. Unfortunately, to date this has not been explored in scientific studies.

Limitations

The main limitation of the current study is the retrospective nature, which can lead to problems when registering past data related to the main research subjects and the utilisation of questionnaires. These evaluation methods are known to sometimes produce response bias and inaccurate reporting associated with higher behaviour rates. However, all the questionnaires used in the current study have been previously validated for epidemiological research and are sensitive enough when used with large sample sizes as it is the case. Finally, data regarding psychological, cardiometabolic and eating disorder risk in adolescence was not gathered during the present study and thus the presence of mental health disorders that appear in adolescence and persist during adulthood could not be verified according to what has been reported in other studies (Kuula et al., 2016).

Conclusions and future directions

This has been the first study to assess the relationship between psychosocial health in women with current similar levels of PA who had performed different types of sports, with special emphasis on aesthetic sports. The effects of PA during adulthood appear to be powerful enough to induce short-term beneficial adaptations in health outcomes that match those observed in women who started training during adolescence. Doing aesthetic sports in adolescence is associated to poorer sleep and mental QoL outcomes when compared to other sports, although better psychosocial health outcomes are usually reported when comparing this activity to low PA levels. The results of this study could be used to design gender-specific preventive programs for women that practise aesthetic sports in order to minimise the negative long-term health consequences of these sport disciplines. These programs should be individualised and include a follow up after the end of the athlete's career. Initiatives that would allow early diagnosis of anxiety, sleep or eating disorders and the evaluation of physical and mental QoL should also be considered in these cases. The implementation of treatments for the negative health outcomes should be considered in these sport disciplines. The findings presented in the current study are clinically relevant as they highlight the importance of preserving and promoting PA levels in women during adulthood, mainly in those who did not participate in OS during adolescence. More longitudinal studies are needed in order to assess the true impact of PA in adolescence in subjects with similar levels of PA during adulthood.

Acknowledgements

The authors gratefully acknowledge all the subjects who participated in this study.

Disclosure statement

All authors declare that they have no conflict of interest of any kind.

Funding

This work was supported by the University of Zaragoza, Spain (Grant Number UZ2016-BIO-03), and the Government of Aragón (Grant Number S25-D17) through the European Fund of Regional Development–Operative program FEDER Aragón 2014–2020 "*Construyendo Europa desde Aragón*". JBA was supported by the Spanish Ministry of Education (Grant Number FPU13/05130). JBA and MAOC were supported by the Government of Aragón through the European Fund of Regional Development–Operative program FEDER Aragón 2014–2020 "*Construyendo Europa desde Aragón*" (grant numbers PUI/2018-337 (JBA) and PUI/2018-336 (MAOC)). JRM was supported by Universidad de Lleida, Cátedra ASISA (Grant Number X18010).

References

Abbott, B. D., & Barber, B. L. (2011). Differences in functional and aesthetic body image between sedentary girls and girls involved in sports and physical activity: Does sport type make a difference? *Psychology of Sport and Exercise*, *12*(3), 333–342. doi:10.1016/j.psychsport.2010.10.005

Bar, R. J., Cassin, S. E., & Dionne, M. M. (2016). Eating disorder prevention initiatives for athletes: A review. *European Journal of Sport Science*, *16*(3), 325–335. doi:10.1080/17461391.2015.1013995

Brand, S., Kalak, N., Gerber, M., Clough, P. J., Lemola, S., Sadeghi Bahmani, D., … Holsboer-Trachsler, E. (2017). During early to mid adolescence, moderate to vigorous physical activity is associated with restoring sleep, psychological functioning, mental toughness and male gender. *Journal of Sports Sciences*, *35*(5), 426–434. doi:10.1080/02640414.2016.1167936

Bruin, A. K., Oudejans, R., & Bakker, F. C. (2007). Dieting and body image in aesthetic sports: A comparison of Dutch female gymnasts and non-aesthetic sport participants. *Psychology of*

Sport and Exercise, *8*, 507–520. doi:10.1016/j.psychsport.2006.10.002

Chaput, J. P., Gray, C. E., Poitras, V. J., Carson, V., Gruber, R., Olds, T., … Tremblay, M. S. (2016). Systematic review of the relationships between sleep duration and health indicators in school-aged children and youth. *Applied Physiology Nutrition and Metabolism*, *41*(6 Suppl. 3), S266–S282. doi:10.1139/apnm-2015-0627

Cohen, A., Baker, J., & Ardern, C. I. (2016). Association between body mass index, physical activity, and health-related quality of life in Canadian adults. *Journal of Aging and Physical Activity*, *24*(1), 32–38. doi:10.1123/japa.2014-0169

Craig, C. L., Marshall, A. L., Sjöström, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., … Oja, P. (2003). International physical activity questionnaire: 12-Country reliability and validity. *Medicine and Science in Sports Exercise*, *35*(8), 1381–1395. doi:10.1249/01.MSS.0000078924.61453

Fernandes, R. A., & Zanesco, A. (2010). Early physical activity promotes lower prevalence of chronic diseases in adulthood. *Hypertension Research*, *33*(9), 926–931. doi:10.1038/hr.2010.106

Herman, K. M., Hopman, W. M., & Craig, C. L. (2010). Are youth BMI and physical activity associated with better or worse than expected health-related quality of life in adulthood? The physical activity longitudinal study. *Quality of Life Research*, *19*(3), 339–349. doi:10.1007/s11136-010-9586-8

Herrero, M. J., Blanch, J., Peri, J. M., De Pablo, J., Pintor, L., & Bulbena, A. (2003). A validation study of the hospital anxiety and depression scale (HADS) in a Spanish population. *General Hospital Psychiatry*, *25*(4), 277–283. doi:10.1016/S0163-8343(03)00043-4

Hita-Contreras, F., Martínez-López, E., Latorre-Román, P. A., Garrido, F., Santos, M. A., & Martínez-Amat, A. (2014). Reliability and validity of the Spanish version of the Pittsburgh sleep quality index (PSQI) in patients with fibromyalgia. *Rheumatology International*, *34*(7), 929–936. doi:10.1007/s00296-014-2960-z

Howie, E. K., McVeigh, J. A., Smith, A. J., & Straker, L. M. (2016). Organized sport trajectories from Childhood to adolescence and health associations. *Medicine and Science in Sports Exercise*, *48*(7), 1331–1339. doi:10.1249/MSS.0000000000000894

Jewett, R., Sabiston, C. M., Brunet, J., O'Loughlin, E. K., Scarapicchia, T., & O'Loughlin, J. (2014). School sport participation during adolescence and mental health in early adulthood. *Journal of Adolescent Health*, *55*(5), 640–644. doi:10.1016/j.jadohealth.2014.04.018

Korte, K. J., Capron, D. W., Zvolensky, M., & Schmidt, N. B. (2013). The Fagerström test for nicotine dependence: Do revisions in the item scoring enhance the psychometric properties? *Addiction Behaviors*, *38*(3), 1757–1763. doi:10.1016/j.addbeh.2012.10.013

Krentz, E. M., & Warschburger, P. (2013). A longitudinal investigation of sports-related risk factors for disordered eating in aesthetic sports. *Scandinavian Journal of Medicine & Science in Sports*, *23*(3), 303–310. doi:10.1111/j.1600-0838.2011.01380.x

Kuula, L., Pesonen, A. K., Kajantie, E., Lahti, J., Andersson, S., Strandberg, T., & Räikkönen, K. (2016). Sleep and lipid profile during transition from childhood to adolescence. *Journal of Pediatrics*, *177*, 173–178.e1. doi:10.1016/j.jpeds.2016.06.026

Lanfranchi, M. C., Maïano, C., Morin, A. J., & Therme, P. (2014). Prevalence and sport-related predictors of disturbed eating attitudes and behaviors: Moderating effects of sex and age. *Scandinavian Journal of Medicine & Science in Sports*, *24*(4), 622–633. doi:10.1111/sms.12044

Lang, C., Kalak, N., Brand, S., Holsboer-Trachsler, E., Pühse, U., & Gerber, M. (2016). The relationship between physical activity and sleep from mid adolescence to early adulthood. A systematic review of methodological approaches and meta-analysis. *Sleep Medicine Reviews*, *28*, 32–45. doi:10.1016/j.smrv.2015.07.004

LaPrade, R. F., Agel, J., Baker, J., Brenner, J. S., Cordasco, F. A., Côté, J., … Provencher, M. T. (2016). AOSSM early sport specialization consensus statement. *Orthopaedic Journal of Sports Medicine*, *4*(4), 2325967116644241. doi:10.1177/2325967116644241

Logan, K., & Cuff, S. (2019). Organized sports for children, preadolescents, and adolescents. *Pediatrics*, *143*(6), e20190997. doi:10.1542/peds.2019-0997

Lombardo, C., Battagliese, G., Lucidi, F., & Frost, R. O. (2012). Body dissatisfaction among pre-adolescent girls is predicted by their involvement in aesthetic sports and by personal characteristics of their mothers. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, *17*(2), e116–e127. doi:10.1007/bf03325335

Marques, A., Ekelund, U., & Sardinha, L. B. (2016). Associations between organized sports participation and objectively measured physical activity, sedentary time and weight status in youth. *Journal of Sciences and Medicine in Sport*, *19*(2), 154–157. doi:10.1016/j.jsams.2015.02.007

McDowell, C. P., MacDonncha, C., & Herring, M. P. (2017). Brief report: Associations of physical activity with anxiety and depression symptoms and status among adolescents. *Journal of Adolescence*, *55*, 1–4. doi:10.1016/j.adolescence.2016.12.004

McMahon, E. M., Corcoran, P., O'Regan, G., Keeley, H., Cannon, M., Carli, V., … Wasserman, D. (2017). Physical activity in European adolescents and associations with anxiety, depression and well-being. *European Child & Adolescent Psychiatry*, *26*(1), 111–122. doi:10.1007/s00787-016-0875-9

McPhie, M. L., & Rawana, J. S. (2015). The effect of physical activity on depression in adolescence and emerging adulthood: A growth-curve analysis. *Journal of Adolescence*, *40*, 83–92. doi:10.1016/j.adolescence.2015.01.008

Merglen, A., Flatz, A., Bélanger, R. E., Michaud, P. A., & Suris, J. C. (2014). Weekly sport practice and adolescent well-being. *Archives of Disease Childhood*, *99*(3), 208–210. doi:10.1136/archdischild-2013-303729

Munguía-Izquierdo, D., Mayolas-Pi, C., Peñarrubia-Lozano, C., París García, F., Bueno-Antequera, J., Oviedo-Caro, M. A., & Legaz-Arrese, A. (2017). Effects of adolescent sport practice on health outcomes of adult amateur endurance cyclists: Adulthood is not too late. *Journal of Physical Activity and Health*, *14*, 876–882. doi:10.1123/jpah.2017-0010

Neves, C. M., Filgueiras Meireles, J. F., Berbert de Carvalho, P. H., Schubring, A., Barker-Ruchti, N., & Caputo Ferreira, M. E. (2017). Body dissatisfaction in women's artistic gymnastics: A longitudinal study of psychosocial indicators. *Journal of Sports Sciences*, *35*(17), 1745–1751.

Ortega, F. B., Ruiz, J. R., Espana-Romero, V., et al. (2011). The international fitness scale (IFIS): Usefulness of self-reported fitness in youth. *International Journal of Epidemiology*, *40*(3), 701–711. doi:10.1093/ije/dyr039

Sabiston, C. M., Jewett, R., Ashdown-Franks, G., Belanger, M., Brunet, J., O'Loughlin, E., & O'Loughlin, J. (2016). Number of years of team and individual sport participation during adolescence and depressive symptoms in early adulthood. *Journal of Sport and Exercise Psychology*, *38*(1), 105–110. doi:10.1123/jsep.2015-0175

Schaal, K., Tafflet, M., Nassif, H., Thibault, V., Pichard, C., Alcotte, M., … Toussaint, J. F. (2011). Psychological balance in high level athletes: Gender-based differences and sport-

specific patterns. *PLoS One*, *6*(5), e19007. doi:10.1371/journal.pone.0019007

Schröder, H., Fito, M., Estruch, R., Martínez-González, M. A., Corella, D., Salas-Salvadó, J., … Covas, M. I. (2011). A short screener is valid for assessing Mediterranean diet adherence among older Spanish men and women. *The Journal of Nutrition*, *141*(6), 1140–1145. doi:10.3945/jn.110.135566

Sicilia, A., Alías-García, A., Ferriz, R., & Moreno-Murcia, J. A. (2013). Spanish adaptation and validation of the exercise addiction inventory (EAI). *Psicothema*, *25*(3), 377–383. doi:10.7334/psicothema2013.21

Sigvartsen, J., Gabrielsen, L. E., Abildsnes, E., Stea, T. H., Omfjord, C. S., & Rohde, G. (2016). Exploring the relationship between physical activity, life goals and health-related quality of life among high school students: A cross-sectional study. *BMC Public Health*, *16*(1), 709. doi:10.1186/s12889-016-3407-0

Silva, M. R., & Paiva, T. (2016). Poor precompetitive sleep habits, nutrients' deficiencies, inappropriate body composition and athletic performance in elite gymnasts. *European Journal of Sport Science*, *16*(6), 726–735. doi:10.1080/17461391.2015.1103316

Souza, M. C., Chaves, R. N., Dos Santos, F. K., Gomes, T. N., Santos, D. V., Borges, A. S., … Maia, J. A. (2017). The Oporto mixed-longitudinal growth, health and performance study. Design, methods and baseline results. *Annals of Human Biology*, *44*(1), 11–20. doi:10.3109/03014460.2016.1165866

Stockwell, T., Chikritzhs, T., Holder, H., et al. (2000). *International guide for monitoring alcohol consumption and harm*. Geneva, Switzerland: *World Health Organization*.

Sundgot-Borgen, J., Danielsen, K., & Klungland-Torstveit, M. (2012). Female former elite athletes suffering from eating disorders during their career. A 15–20 year follow-up. *Medicine & Science in Sports & Exercise*, *44*, 267–958. doi:10.1080/02640414.2016.1258485

Telama, R., Yang, X., Leskinen, E., Kankaanpaa, A., Hirvensalo, M., Tammelin, T., & Raitakari, O. T. (2014). Tracking of physical activity from early childhood through youth into adulthood. *Medicine & Science in Sports & Exercise*, *46*(5), 955–962. doi:10.1249/MSS.0000000000000181

Vilagut, G., Valderas, J. M., Ferrer, M., Garina, O., López-García, E., & Alonso, J. (2008). Interpretation of SF-36 andSF-12 questionnaires in Spain: Physical and mental components. *Medicina Clínica*, *130*(19), 726–735. doi:10.1157/13121076

World Health Organization. (2018). *Global action plan on physical activity 2018-2030: More active people for a healthier world*. Geneva: World Health Organization.

Zhang, J., Chan, N. Y., Lam, S. P., & Yun-Kwok, W. (2016). Emergence of sex differences in insomnia symptoms in adolescents: A largescale school-based study. *Sleep*, *39*(8), 1563–1570. doi:10.5665/sleep.6022