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EXERCISE IN OBESE PCOS

Affect-regulated exercise: an alternative approach for lifestyle modification in overweight/obese women with polycystic ovary syndrome

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Abstract

Objective: Affect-regulated exercise (''ARE'') is an alternative approach to guide exercise intensity based on feeling of pleasure. The aim of this study was to analyze if overweight/obese women with polycystic ovary syndrome (PCOS) meet the American College of Sports Medicine (ACSM) recommendation regarding to exercise intensity to improve health status during a single bout of ''ARE".

Methods: A sample of 14 overweight/obese women with PCOS (18–34 years) performed a single bout of ''ARE'' (40 min of aerobic exercise on outdoor track). The Feeling Scale (FS) was used to guide ''ARE'' intensity/pace maintaining an affective valence between ''good'' and ''very good'' during all time. Heart rate (HR), speed, % of HR at first and second ventilatory threshold (VT_1 and VT_2) and time spent at moderate (64–76% of HR_{max}) and vigorous (77–95% of HR_{max}) intensity during ''ARE'' were measured with a global positioning system (GPS) device.

Results: Volunteers exercised at 73% (68–78%) of HR_{max}, 5.8 (5.2–6.2) km/h, 93.4% of HR at VT_1 (89.3–98.2) and 80.5% of HR at VT_2 (75.3–84.6) and spent >80% of time at moderate intensity.

Conclusions: Overweight/obese women with PCOS met the ACSM recommendation regarding exercise intensity to improve health status when exercised between ''good'' and ''very good'' of FS. Thus, ''ARE'' may be an interesting approach to be used in clinical practice regarding to exercise prescription and/or physical activity advice.

Keywords

Adherence, affect, affective response, exercise, obesity, polycystic ovary syndrome

History

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Introduction

Lifestyle modification is recommended as the first-line therapy for women with polycystic ovary syndrome (PCOS) [1]. Exercise is a crucial component of lifestyle intervention by promoting several benefits on body composition [2–5], cardiovascular [2–4,6], metabolic [3,5–8], reproductive [9–12] and psychological [13,14] health of women with PCOS. However, the long-term adherence to exercise is a challenge [15]. The Amsterdam ESHRE/ASRM-Sponsored 3rd PCOS Consensus [16] stated as ''knowledge gaps/recommended future directions for research'' the following topics: (i) ''Further research is required on determinants of increasing participation and compliance in lifestyle programs...'', and (ii) ''Research is required to optimize lifestyle interventions...minimizing drop-outs of participating women''.

Feeling of pleasure during exercise is an important factor for physical activity participation and compliance [17–19]. This is consistent with the hedonic theory of motivation [20], which suggests that when some activity performed by the subject is perceived as pleasurable, probably, will be repeated. Williams et al. [21] observed that individuals that showed feeling of pleasure to a moderate exercise at baseline reported more minutes of physical activity 6 and 12 months later.

The Feeling Scale (FS) [22] is a practical tool used to measure the affective responses during exercise [18,23]. Rose & Parfitt [24] proposed a method that participants regulate their exercise intensity using the affective response and observed that when middle-aged sedentary women exercised feeling ''good'' and ''fairly good'' achieved a moderate intensity. Parfitt et al. [25] using the same intensities in healthy active female observed that they exercised at vigorous exercise intensity. Those results indicate that when exercise intensity is guided using the same anchors (''good'' and ''fairly good'') the physiological responses seem to be influenced by sample characteristics. It is important to highlight that in both studies the volunteers met the intensities recommended by the American College of Sports Medicine (ACSM) [23] to improve health status.

No data is available on the physiological responses during affect-regulated exercise (''ARE'') in women with PCOS. The aim of this study was to analyze if overweight/obese women with PCOS meet the ACSM [23] recommendation regarding to exercise intensity to improve health status during the ''ARE''.

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Methods

Participants

A sample of 14 overweight and obese ($\geq$25 kg/m^2) women with PCOS aged 18–34 years participated in this study. PCOS diagnosis was made according to Rotterdam criteria [26]. Nonclassic congenital adrenal hyperplasia, thyroid dysfunction, hyperprolactinemia, renal or hepatic dysfunction or use of medications known to affect reproductive, cardiovascular or metabolic function within 90 days of study entry were adopted as exclusion criteria. This study was approved by the Institutional Ethics Committee (protocol 222/08) and all volunteers gave written informed consent according to the declaration of Helsinki.

Study design

The volunteers performed: (i) clinical and blood assessment (day 1); (ii) maximal exercise test (day 2); (iii) affect-regulated exercise trial (day 3; see details below). The time between each procedure was 48–72 h. Subjects were instructed to abstain from vigorous physical activity and to avoid caffeine and alcohols contain products during all study period.

Clinical and blood assessment

Patients underwent a clinical examination where body weight, height and blood pressure (BP) were measured. BP was measured according to VI Brazilian Guidelines on Hypertension [27], using a validated oscillometric device (Omron® HEM-780-E, Kyoto, Japan) [28]. Fast venous blood samples were collected between 8:00 AM and 10:00 AM after a 12 h overnight fast. Serum glucose was measured by the glucose oxidase method. Levels of total cholesterol, HDL-cholesterol and triglycerides were determined by enzymatic colorimetric assays (BioSystems®, Barcelona, Spain). LDL-cholesterol levels were calculated by using Friedewald's formula. Level of 17-hydroxyprogesterone was measured following the manufacturer's recommendations (Diagnostic Products Corporation®, Los Angeles, CA). Exclusion of nonclassic congenital adrenal hyperplasia was based on a basal morning 17-hydroxyprogesterone level less than 200 ng/dL.

Cardiopulmonary exercise test

A maximal cardiopulmonary exercise test was performed before the experimental session to measure maximal oxygen uptake (VO_{2max}) using *VO2000* VO_2 testing system (MedGraphics®, St. Paul, MN) on a treadmill (Inbrasport®, Porto Alegre, Brazil). A ramp protocol, adapted from previous studies involving women with PCOS [5,6] was used. The VO_{2max} was determined by the presence of at least one of the following criteria: (i) respiratory exchange ratio (VCO_2/VO_2) $>$ 1.1; (ii) occurrence of plateau in oxygen uptake; (iii) physical volitional exhaustion [29]. The first ventilatory threshold (VT_1) was determined when VE/VO_2 and $PETO_2$ increased, while VE/VCO_2 and $PETCO_2$ remained stable. The second ventilatory threshold (VT_2) or respiratory compensation point (RCP) was determined at moment where, VE started to change out of proportion of VCO_2 (i.e. systematic increase in VE/VCO_2) with a consequent decline on $PETCO_2$ [30].

The feeling scale

The Feeling Scale (FS) [22] was used to guide the ''ARE'' bout. Commonly used for assessment of affective response during exercise [18,23,31,32], the FS is an 11-point single-item bipolar measure ranging from +5 to −5 with verbal anchors (Figure 1). During an individual meeting with each volunteer, separate instructional set for the FS was read and explained.

FEELING SCALE	
+5	Very Good
+4	
+3	Good
+2	
+1	Fairly Good
0	Neutral
-1	Fairly Bad
-2	
-3	Bad
-4	
-5	Very Bad

Figure 1. The Feeling Scale [22].

Exercise intensity monitoring

To assess the exercise intensity in the ''ARE'' bout all volunteers used a wrist *global positioning system* (GPS) device (Garmin® Forerunner 305, Olathe, KS) with heart rate (HR) monitor. The GPS device has been used in several investigations related to the measure of human movements [33–36]. The following variables were recorded: mean speed (km/h), mean HR (% of HR_{max}) and percentage of time spent at moderate (>64–76% of HR_{max}) and vigorous (>77–95% of HR_{max}) intensities, which are recommended by the ACSM guidelines to improve health status [23]. In addition, the percentage of HR_{max} at VT_1 and VT_2 was recorded. The percentage of HR_{max}, percentage of time at moderate and vigorous intensities, and the percentage of HR_{max} at VT_1 and VT_2 during ''ARE'' bout were based on HR_{max} reached by each volunteer in the maximal cardiopulmonary exercise test.

Affect-regulated exercise trial

All ''ARE'' bouts were performed in the afternoon (between 4:00 PM and 6:00 PM) on a standard outdoor 400 m track. The volunteers were fitted with a wrist GPS device with HR monitor. After, they received the following instruction: ''We would like you to exercise for 40 min at an intensity that feel/perceive as pleasurable, maintaining an affective valence between 'good' and 'very good' during all time; you can walk and/or jog, changing the intensity at any time freely''. Participants were given 5 min to warm up, adjust themselves with the environment and choose the intensity within the affective valence specified. After the end of the ''ARE'' bout, a 5 min of cool down was performed.

Statistical analysis

The clinical and laboratory characteristics of volunteers as well as the main results (mean speed, % HR_{max}, % HR_{max} at VT_1 and VT_2 and time spent at moderate and vigorous intensity) are expressed as median (percentile 25–75). In addition, individual results regarding to mean speed and % HR_{max} are presented. Data analysis was performed using SPSS® version 19.0 (SPSS®, Chicago, IL).

Results

The clinical and laboratory characteristics of the sample are showed in Table 1.

The participants exercised at 5.8 km/h (5.2–6.2), 73.1% of HR_{max} (69–78), 54.3% of HR reserve (46–61), 93.4% of HR at VT_1 (89.3–98.2) and 80.5% of HR at VT_2 (75.3–84.6) and spent 81% (67–91%) and 17% (3–26%) of the time at moderate and vigorous intensity, respectively. Figure 2 shows the individual results of the exercise intensity monitored during the ''ARE'' bout. Regarding the mean speed, nine women exercised at a brisk walking pace (4.8–6.0 km/h) and five women at a jogging pace (>6.0–7.9 km/h) [37]. The Figure 3 shows the individual results regarding to the % of HR_{max} at VT_1 and VT_2. Only two women exercised above the VT_1 (volunteers 1 and 5); however, all women exercised bellow the VT_2.

Table 1. Clinical and laboratory characteristics of volunteers.

Variables	Median	Percentile 25–75
Age (years)	27.0	24.8–32.0
Body mass index (kg/m^2)	32.3	28.3–34.8
Ferriman–Gallwey score	6.0	5.0–8.0
Fasting glucose (mg/dL)	70.5	57.0–76.8
Total cholesterol (mg/dL)	140.5	126.3–170.3
HDL-cholesterol (mg/dL)	38.5	33.3–42.3
Triglycerides (mg/dL)	91.0	76.8–108.5
Serum total testosterone (ng/dL)	98.0	55.7–145.8
DHEAS (ng/dL)	76.6	45.5–228.0
LH (UI/L)	4.3	1.3–6.0
FSH (UI/L)	2.8	1.4–3.9
Systolic blood pressure (mmHg)	113.5	108.5–123.3
Diastolic blood pressure (mmHg)	77.5	72.0–82.2
Maximal oxygen uptake (ml/kg/min)	29.9	27.2–32.7
Ventilatory threshold (ml/kg/min)	24.3	22.2–28.6

Discussion

Our results showed that women with PCOS met the intensity threshold recommended by the ACSM [23] when exercised feeling ''good'' and ''very good'' during a single bout of aerobic exercise. Considering the data related to the exercise intensity monitoring (see Figures 2 and 3), it is possible to observe that our volunteers self-selected a moderate intensity during the ''ARE'' trial. These findings are consistent with the ''dual-mode'' model [17,18,31], which suggests that exercises performed below the VT generate homogeneous responses of pleasure with a low-moderate influence of cognitive factors (e.g. personality, self-efficacy, etc.). Despite the absence of data regarding to the analysis of different moments of the ''ARE'' bout (e.g. 10, 20, 30 and 40 min), the mean values of HR at VT_1 and VT_2, time spent at moderate intensity, and pace confirm that the volunteers exercised in a moderate intensity; even the individuals 1, 4, 5, 7 and 13, who showed a % HR_{max} equivalent to a vigorous exercise intensity [23], they exercised around the VT_1 and below the VT_2. Thus, it is possible to assume that the cardiovascular and metabolic stress imposed to the volunteers during the ''ARE'' trial was moderate.

Hills et al. [38] using a simple methodological design asked to sedentary obese and non-obese individuals to walk 2 km on a grass track at a pace perceived as ''walking for pleasure'' in two

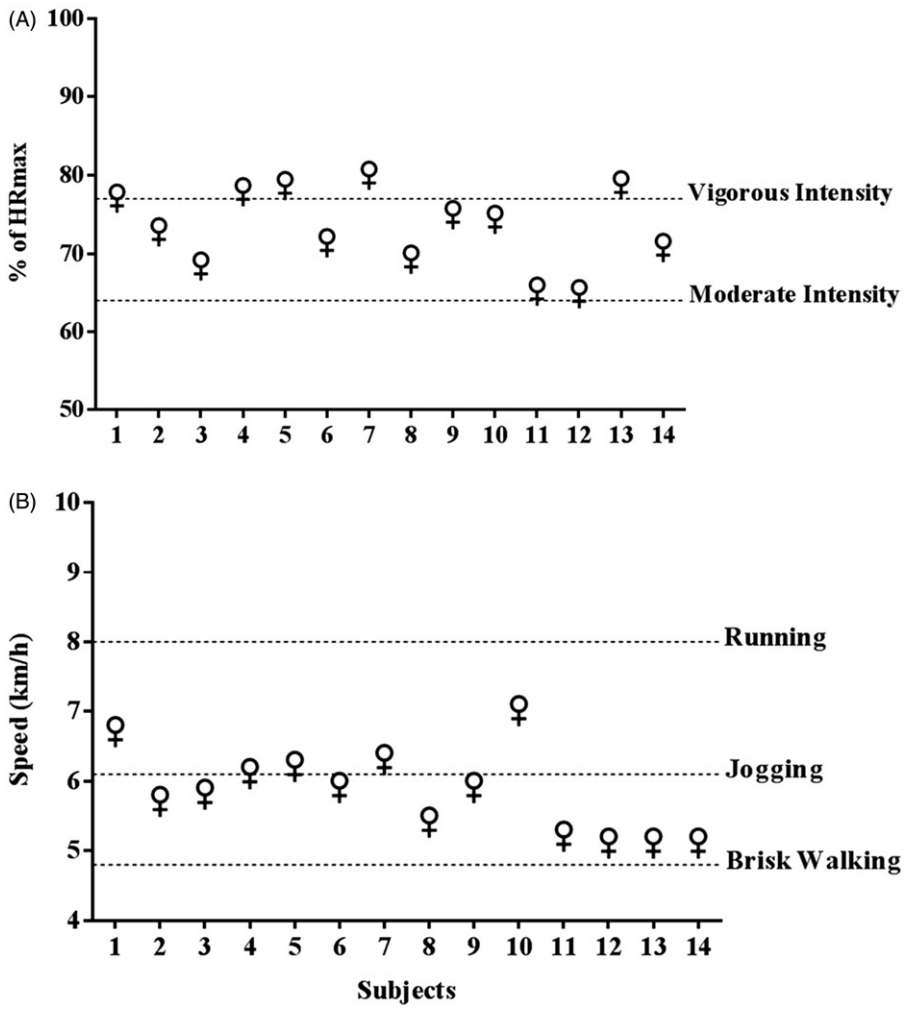

Figure 2. Individual data of the exercise intensity monitoring during the affect-regulated exercise bout. Panel A = heart rate monitoring; Panel B = exercise pace monitoring.

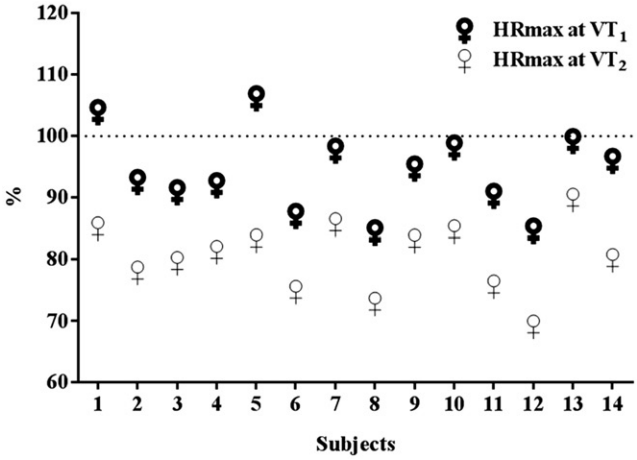

Figure 3. Individual data of the % of heart rate at first and second ventilatory threshold (VT_1 and VT_2) during the affect-regulated exercise bout.

separate trials. The obese group walked at ~70% of HR_{max}, and the non-obese group exercised at ~59% of HR_{max}. Ekkekakis et al. [39] observed that overweight/obese women showed increase of the % of HR_{max} from the beginning to the end of a self-selected exercise bout (20 min). These values varied from ~78% (5 min) to ~85% (20 min) of HR_{max}; volunteers reported a FS value of ~2 (between ''fairly good'' and ''good''). Despite the differences in methodological approaches, it is important to highlight that both studies observed that overweight/obese individuals self-select an exercise intensity which meets the ACSM recommendation [23] regarding to exercise intensity to improve health and fitness status, with a positive feeling of pleasure. Our results are in accordance with these findings of Hills et al. [38] and Ekkekakis et al. [39].

Therefore, it is plausible to speculate that the exercise intensity self-selected by the volunteers using the ''ARE'' approach proposed in our study may improve their its health and fitness status if repeated for weeks with an appropriate frequency, duration, and progression. In a previous study, Parfitt et al. [40] investigated the effects of the ''ARE'' (verbal anchor: +3 on FS, ''good'') over an eight-week training-period on cardiorespiratory fitness of previously sedentary women (18–60 years old). Participants trained three times per week during 30 min per session. After eight weeks, they improved the time to reach VT (i.e. submaximal cardiorespiratory fitness). The compliance to the exercise sessions was high (>90%). In this sense, the ''ARE'' may arise as an interesting approach for clinical practice regarding to exercise prescription or physical activity advice to improve compliance rate and minimize dropouts.

According to the hedonic theory of motivation [20], individuals who perceive physical exercise as a pleasurable practice have more chance to become and remain active for long-term. From the practical point of view, if the affect experienced during exercise could be made more positive this would result in an increase of physical activity participation [19]. More recently, Rhodes and Kates [41] confirmed the relationship between basic affect during a bout of exercise and its subsequent relationship with physical activity behavior in a systematic review. Overall, four studies identified a significant and meaningful positive correlation between affect during moderate intensity exercise and future physical activity, despite the heterogeneity in procedures, assessment of physical activity, and considerable heterogeneity in the effect size. Considering that lifestyle modification, including regular physical activity, is the first-line therapy for overweight/obese women with PCOS, we reinforce the importance of a positive affective response during the physical activity for this population.

We used a zone of pleasure between ''good'' and ''very good'' on the FS in order to: (i) ensure that the volunteers optimize their feeling of pleasure during exercise; (ii) facilitate the use of the FS to guide and control the exercise intensity. The ACSM [23] recommends the use of ''zones'' for physiological (i.e. HR and VO_2) as well as perceptual (i.e. rating of perceived exertion) parameters for prescription and monitoring of exercise intensity. From a practical point of view, a FS target between ''good'' and ''very good'' can be useful and easier to participants self-select the exercise intensity related to their feeling of pleasure. For overweight/obese individuals this is particularly relevant, given that this population shows lower pleasure ratings during exercise compared to normal-weight subjects [39,42].

In summary, the affect-regulated exercise may be an interesting approach to be used in clinical practice regarding to exercise prescription and/or physical activity advice for overweight/obese women with PCOS. Future studies are necessary to analyze the long-term effects of this approach on health and fitness status of this population.

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Declaration of interest

The authors report no conflicts of interest.

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