Quality of Life in Women with Polycystic Ovary Syndrome after a Program of Resistance Exercise Training

Qualidade de vida em mulheres com síndrome de ovários policísticos após um programa de treinamento de exercício resistido

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Abstract

Purpose Aerobic exercises may improve quality of life (QoL) in women with polycystic ovary syndrome (PCOS). However, there is no data on the effect of resistance exercise training (RET) programs on the QoL of women with PCOS. Thus, this study aimed to assess the effect of a 16-week RET program on QoL in PCOS women.

Methods This 16-week case-control study enrolled 43 women with PCOS (PCOS group, PCOSG) and 51 healthy pre-menopausal controls aged 18 to 37 years (control group, CG). All women underwent a supervised RET program for 16 weeks, and were evaluated in two different occasions: week-0 (baseline), and week-16 (after RET). Quality of life was assessed using the 36-Item Short Form Health Survey (SF-36).

Results Testosterone reduced significantly in both groups after RET ($p < 0.01$). The PCOSG had improvements in functional capacity at week-16 relative to week-0 ($p = 0.02$). The CG had significant improvements in vitality, social aspects, and mental health at week-16 relative to week-0 ($p \leq 0.01$). There was a weak correlation between social aspects of the SF-36 domain and testosterone levels in PCOS women.

Conclusion A 16-week RET program modestly improved QoL in women with PCOS.

Keywords
- strength training
- polycystic ovarian syndrome
- exercise therapy
- aerobic exercise

Resumo

Objetivos Exercícios aeróbicos podem melhorar a qualidade de vida (QV) de mulheres com síndrome dos ovários policísticos (SOP). No entanto, não há dados sobre o efeito de um programa de treinamento de exercício resistido (TER) sobre a QV destas mulheres. Assim, este estudo teve como objetivo avaliar o efeito de um programa de TER de 16 semanas na QV em mulheres com SOP.

Métodos Estudo caso-controle com 16 semanas de duração, para o qual foram incluídas 43 mulheres com SOP (grupo com SOP, GSOP) e 51 controles saudáveis com

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idade entre 18 a 37 anos (grupo de controle, GC). Todas as mulheres foram submetidas ao protocolo TER supervisionado por 16 semanas, e foram avaliadas em dois momentos: na semana 0 (linha de base), e na semana 16 (após TER). A qualidade de vida foi avaliada pelo 36-Item Short Form Health Survey (SF-36).

Resultados Houve redução significativa da testosterona em ambos os grupos após o TER ($p < 0,01$). O GSOP obteve significativa melhora na capacidade funcional na semana 16 em relação à semana 0 ($p = 0,02$). O GC apresentou significativa melhora no escore do domínio vitalidade, aspectos sociais e saúde mental na semana 16 em relação à semana 0 ($p \leq 0,01$). Houve uma fraca correlação entre os aspectos sociais de domínio SF-36 e o nível de testosterona em mulheres com SOP.

Conclusão a aplicação de um programa de treinamento físico resistido durante 16 semanas resultou em melhora modesta da QV de mulheres com SOP.

Palavras-chave
- treinamento de força
- síndrome do ovário policístico
- terapia por exercício
- exercício aeróbico

Introduction

Polycystic ovary syndrome (PCOS) affects ~ 5 to 10% of females who are of reproductive age.[1] Typical PCOS women show acanthosis nigricans, raising the possibility that they were insulin resistant.[2] Hyperandrogenism occurs in ~ 80 to 85% of patients with PCOS, and manifests as hirsutism, obesity, acne, seborrhea, alopecia, and virilization.[3] These clinical manifestations can lower self-esteem and reduce quality of life (QoL).[4] Patients are often depressed or have other affective disorders, and this is a frequent cause of reduced mental well-being and poor QoL.[5,6]

A change in lifestyle is considered the first line of treatment for obese women with PCOS as a nonpharmacological treatment.[7] However, programs that require drastic changes in lifestyle with rapid weight reduction are rarely sustained; sustained weight reduction is best achieved in a gradual and continuous manner.[8,9] Physical exercise also leads to greater social participation, resulting in better biopsychophysical well-being and improved QoL.[10] Physical activity is associated with lower depression in women with PCOS,[11] and is likely to be beneficial to their mental health.[12] A controlled randomized study used a program of diet only, diet and aerobic exercise, or diet and combined aerobic-resistance exercise for 20 weeks of intervention for overweight and obese women with PCOS and showed that dietary restriction alone and combined with exercise had similar benefits to improve depression and QOL.[13] Furthermore, in women with PCOS, the practice of resistance exercise increases the basal metabolism and promotes an increase in lean mass,[14] improves insulin sensitivity,[15,16] and promotes a decrease in lipid levels, as well as a reduction in blood pressure and an improvement in glucose metabolism.[17,18] In women with PCOS, the preservation of lean mass is important for the promotion of weight reduction and the increase in basal metabolism,[19] so regular physical exercise has significant benefits for these women. The objective of the present study was to assess the effect of a resistance exercise training (RET) program on the QoL of women with PCOS.

Methods

Enrollment and Patient Selection

This a non-randomized trial of 16 weeks with women enrolled from the community (aged 18 to 37 years) as controls, and women with PCOS who were recruited from the Endocrine Gynecology Outpatient Clinic of the University Hospital at Faculdade de Medicina de Ribeirão Preto, Universidade de São Paulo. The enrollment period was from August 2010 to December 2013. Polycystic ovary syndrome was diagnosed according to the criteria of the Rotterdam Consensus,[1] and was based on the presence of at least two of the following conditions: oligomenorrhea or amenorrhea; clinical and/or biochemical signs of hyperandrogenism; and polycystic ovaries detected by pelvic ultrasound. Women with non-classical congenital adrenal hyperplasia, thyroid dysfunction, hyperprolactinemia, or Cushing's syndrome were excluded. Clinical hyperandrogenism was based on the Ferriman & Gallwey index, and biochemical hyperandrogenism was based on the increased level of total testosterone. Women in the control group had regular menstrual cycles, and were recruited using posters placed at health stations in the city of Ribeirão Preto.

All enrolled women had body mass index (BMI) values of 18 to 39.9 kg/m^2, and did not engage in any regular physical activity. Women with systemic diseases that would contraindicate physical activity, users of medications that interfered with the hypothalamus-pituitary-ovary axis, smokers and pregnant women were excluded. This study was approved by the local Ethics Committee, and is derived from a previously published study.[20] All women gave written informed consent.

A total of 350 women were initially invited to participate, and were informed about the nature of the research. One hundred and forty-five women met the inclusion criteria, but 21 did not participate due to scheduling problems, professional commitments, or the use of hormonal medications. Thus, 124 women came to the hospital, responded to the initial questionnaire, and performed the exams. One hundred and fifteen women attended the initial RET. Twenty-one of them did not complete the study due to pregnancy or more

than 8 missed sessions. The study results are based on the analysis of 43 women with PCOS and 51 women without PCOS (controls).

Anthropometric and Clinical Measurements

All tests were administered to the PCOS and control groups in two different occasions to allow for intra- and intergroup comparisons: before initiation of the RET (week-0), and after completion of the 16-week RET (week-16).

For blood collection, women were sent to the laboratory after a 12-hour fast for measurement of fasting glucose, total testosterone, androstenedione, insulin, homeostatic model assessment for insulin resistance (HOMA-IR), blood pressure, body weight, height, waist circumference, and a transvaginal ultrasound examination. After these procedures, women were sent to a room where they responded to the Physical Activity Readiness Questionnaire (PAR-Q), an instrument used to screen subjects with diseases (especially cardiovascular conditions) that limit physical activity. This is a self-reporting questionnaire that contains seven dichotomous questions, and is recommended by the American College of Sports Medicine before the initiation of physical activity programs. Application of the PAR-Q is considered to involve a minimum standard of pre-participation assessment, because a single positive response indicates the need for medical evaluation.[21]

Next, the women were sent to a room where they responded to the validated 36-Item Short Form Health Survey (SF-36)[22] to assess the QoL in the presence of a single rater (FKPR). This is an abbreviated multidimensional instrument used for generic assessment of perceived health status, which consists of 36 items that evaluate physical and mental health statuses. The results of each domain range from 0 (the worst status) to 100 (the best status).[22,23]

Exercise Program

The women first participated in a protocol of adaptation and learning of resistance exercises that have been accepted for publication elsewhere (Medicine & Science in Sports & Exercise, 2015, in press). In summary, this consisted of 3 series of 10 repetitions of each exercise for a period of 2 weeks, or 6 sessions of adaptation of 50 minutes. The training load for each patient was determined after the period of adaptation by a 1 repetition maximum (1-RM) test[24] that was performed on 2 days with 4 exercises per day, with a 48-hour interval between days. The three exercises were: extensor chair (lower limb), bench press (trunk), and barbell curl (upper limb). The criterion of overload duplication was adopted; thus, if a subject performed the 3 series of 10 repetitions with 30 kg, the initial overload for the 1-RM execution was 60 kg.

Stretching exercises were first performed, followed by a series of 8 repetitions of the exercise, with the same load used in the process of adaptation, and a series of 3 repetitions with a 10% increase in overload separated by 1-minute intervals. The test of each exercise was started by gradually increasing the overload to a maximum of 10% until the woman was able to perform a repetition with the maximum weight possible. There was a 3-minute resting period between each 1-RM, with a maximum of 3 attempts.[24] Thus, the training load for each woman was determined after the last 1-RM test, and the RET was started during the next session.

The RET consisted of 4 microcycles of 4 weeks each. Intensity increased and volume decreased each week. Under the supervision of physical educators (RCS and GSK), the women stretched the following muscles: ischiotibial, quadriceps, calf adductors and abductors, arm flexors and extensors, and trunk flexors and extensors. Women were sent in pairs to an apparatus for the execution of the exercises, with one woman performing the exercise and then resting while observing the other woman exercise. These sessions consisted of a series of 10 repetitions of the exercise without overload (as a form of warm-up), followed by the execution of the exercise with the load set by the 1-RM test. Each pair of women exercised one muscle group at a time. Muscle groups of the upper and lower parts of the body were exercised alternately to allow muscle recovery between exercises[25] according to the following protocol: bench press; extensor chair; front pulley; leg curl; side elevation; leg press; triceps pulley; standing plantar flexion or calf flexion in the leg press; barbell; and abdominals.

Linear periodization is a traditional load pattern used for training that refers to a continual increase in the level of demand on a muscle as it becomes able to produce more force or becomes more resistant.[25] Linear force periodization is implemented by reducing the volume and increasing the intensity during the training period, a variation shown to increase muscle strength.[14]

Load periodization for each RET microcycle was established. The first microcycle was executed in 3 series of 15 repetitions, with the first week at 60% of maximal force; the second week at 65%; the third week at 70%; and the fourth week at 65% of maximal force. The second microcycle was executed in 3 series of 12 repetitions, with the first week at 65% of maximal force; the second week at 70%; the third week at 75%; and the fourth week at 70% of maximal force. The third microcycle was executed in 3 series of 10 repetitions, with the first week at 70% of maximum force; the second week at 75%; the third week at 80%; and the fourth week at 75% of maximal force. The fourth microcycle was executed in 3 series of 8 repetitions, with the first week at 75% of maximal force; the second week at 80%; the third week at 85%; and the fourth week at 80% of maximal force. The trainers (RCS and GSK) monitored subject compliance with the exercise program in diaries.

SF-36 Instrument

The SF-36 involves aspects such as functional capacity, limitations of physical aspects, pain, general health status, vitality, social aspects, emotional aspects, and mental health. It is a multidimensional questionnaire, and its scores vary from 0 to 100, with zero being the worst and 100 being the best QoL for each domain.[26]

Statistical Analysis

Age and height were analyzed by Student's *t*-test. The mixed-effects linear regression model (random and fixed effects) was used for comparisons. This model is used for analysis of data in which the responses are grouped and the

assumption of independence between observations in the same group is inadequate. The assumption of these models is that their residues have normal distributions, with a mean of 0 and constant variance (σ^2). For variables that did not satisfy this assumption, a logarithmic transformation was used for the response variables. Spearman Correlation Coefficient was performed to assess the influence of testosterone on SF-36 domains. This procedure was performed using the PROC MIXED feature of SAS® 9.0 software (SAS Institute Inc., Cary, NC, USA). The post-test for orthogonal contrasts was used for comparisons. The level of significance was set at 0.05 in all analyses.

Results

Baseline Characteristics

Ninety-four women completed the study, 43 in the PCOS group, and 51 in the control group. ►**Table 1** shows the anthropometric and clinical characteristics of these 2 groups at baseline (before initiation of the RET). As expected, the PCOS group had higher levels of testosterone ($p = 0.02$) and androstenedione ($p = 0.02$). There were no other significant differences between these two groups.

Effect of RET on Testosterone and Androstenedione

At week-16, the PCOS group had a significantly lower level of testosterone (88.93 ± 34.73 versus 73.24 ± 24.63 ng/dL; odds ratio, OR = 16.32, 95% confidence interval, 95%CI = 7.94 to 24.71, $p < 0.01$) and a higher level of androstenedione (120.30 ± 43.29 versus 140.08 ± 55.96 ng/mL; OR = -20.43; 95%CI = -35.31 to -5.55, $p < 0.01$). At this time, the control group also had a significant decrease in testosterone (73.94 ± 29.4 versus 62.53 ± 22.12 ng/dL; OR = 11.43; 95% CI = 3.95 to 18.91, $p < 0.01$), but no change in androstenedione (98.48 ± 32.78 versus 110.41 ± 33.24; OR = -12.51, 95%CI = -25.91 to 0.88, $p = 0.07$).

Effect of RET on Anthropometric Characteristics

Anthropometric parameters were also measured at week-16 (after the completion of the RET program). The control group had no significant changes in body weight (67.39 versus 67.25, $p = 0.70$), waist circumference (75.86 versus 75.48, $p = 0.20$), or BMI (25.99 versus 25.95, $p = 0.72$). At week-16, the PCOS group had no significant changes in body weight or BMI, but did have a significant decrease in waist circumference (80.59 ± 11.87 versus 79.35 ± 10.54 cm; OR = 0.84, 95%CI = 0.35 to 1.32, $p < 0.01$) (►**Table 2**). There was a weak negative correlation between the social domain and testosterone (r = -0.24618, $p = 0.02$).

Effect of RET on Quality of Life

The analysis of the results of the SF-36 questionnaire indicated that the PCOS group had significant improvement in the score for functional capacity at week-16 relative to week-0 (86.86 ± 13 versus 91.74 ± 11.44; OR = -4.86, 95%CI = -8.89 to -0.84, $p = 0.02$) (►**Table 3**).

Table 1 Baseline anthropogenic and clinical characteristics of subjects with and without polycystic ovary syndrome ($N = 94$)

Variable	PCOS ($N = 43$)	Control ($N = 51$)	p
	Mean ± SD (range)	Mean ± SD (range)	
Age (years)	27.8 ± 5.34 (18.33–37.77)	29.74 ± 5.26 (19.28–37.76)	0.08
Height (m)	1.60 ± 0.05 (1.46–1.68)	1.61 ± 0.06 (1.48–1.75)	0.52
Weight (kg)	71.65 ± 14.3 (50.7–104.6)	67.39 ± 14.71 (46.5–110)	0.15
BMI (kg/m^2)	27.91 ± 5.51 (19.83–38.42)	25.99 ± 5.49 (18.07–39.44)	0.08
Waist circumference (cm)	80.59 ± 11.87 (76.94–109.5)	75.86 ± 11.19 (59–108)	0.10
Testosterone (ng/dL)	88.93 ± 34.73 (30–182)	73.94 ± 29.4 (32–172)	0.02
Androstenedione (ng/mL)	120.3 ± 43.29 (34.6–242.5)	98.48 ± 32.78 (42–168.8)	0.02
Glucose (mmol/L)	96.31 ± 16.84 (73–131)	95.8 ± 17.75 (70–146)	0.53
Insulin (mU/L)	8.54 ± 6.07 (1–24.8)	5.2 ± 4.52 (1–32.9)	0.001
HOMA-IR	2.11 ± 1.79 (0.2–10.55)	1.25 ± 1.25 (0.18–7.53)	0.006

Abbreviations: BMI, body mass index; HOMA-IR, homeostatic model assessment for insulin resistance; PCOS, polycystic ovary syndrome; SD, standard deviation.

Table 2 Anthropometric data of women with PCOS at week-0, week-16 ($N = 43$)

Variable	Wk-0	Wk-16	Wk-0 versus Wk-16
	Mean ± SD (range)	Mean ± SD (range)	*p*
Weight (kg)	71.65 ± 14.3 (58.5–104.6)	71.08 ± 13.27 (51.4–105)	0.14
BMI (kg/m^2)	27.91 ± 5.51 (19.83–38.42)	27.68 ± 5.06 (19.83–38.57)	0.12
Waist circumference (cm)	80.59 ± 11.87 (64–109.5)	79.35 ± 10.54 (64.5–105)	< 0.01

Abbreviations: BMI, body mass index; PCOS, polycystic ovary syndrome; SD, standard deviation; Wk, week.

The control group had significant improvements in vitality, social aspects, and mental health at week-16 relative to week-0 respectively (65.49 ± 19.6 versus 75.29 ± 19.43; OR = -9.81, 95%CI = -14.88 to -4.74, $p \leq 0.01$; 75.00 ± 24.62 versus 84.56 ± 17.96; OR = -9.57, 95%CI = -17.22 to -1.92, $p = 0.01$; 68.2 ± 20.52 versus 72.93 ± 19.94; OR = -9.40, 95%CI = -16.70 to -2.10, $p = 0.01$) (►**Table 3**).

Comparison of the SF-36 scores in the control and PCOS groups indicated that the control group had significantly better scores in general health status on both occasions (week-0: 58.49 versus 70.61; OR = 14.30, 95%CI = 6.26 to 22.34, $p < 0.01$; week-16: 62.7 versus 73.78; OR = 13.18, 95%CI = 5.16 to 21.20, $p < 0.01$), and vitality at week-16 (64.42 versus 75.29, OR = 11.92, 95%CI = -1.25 to 15.27, $p < 0.01$).

Discussion

The 16-week RET program improved the functional capacity domain of the SF-36 in women with PCOS. The control group had improved vitality, social aspects, and mental health domains of the SF-36 at 16 weeks.

Comparison of the two groups indicated that the PCOS group had higher baseline levels of testosterone and androstenedione, in agreement with the literature.[27] After the RET program, the PCOS group had a significantly lower level of testosterone and a significantly higher level of androstenedione. Other investigators reported an increase in testosterone level in sedentary women following participation in a physical exercise program.[28] In the present study, there was a reduction of total blood testosterone levels in the PCOS

Table 3 Results of the SF-36 questionnaire in the PCOS and control groups at week-0, week-16 ($N = 43$)

Variable	PCOS group			Control group		
	Wk-0	Wk-16	Wk-0 versus Wk-16	Wk-0	Wk-16	Wk-0 versus Wk 16
	Mean ± SD (range)	Mean ± SD (range)	*p*	Mean ± SD (range)	Mean ± SD (range)	p
Functional Capacity	86.86 ± 13 (60–100)	91.74 ± 11.44 (60–100)	0.02	87.25 ± 13.43 (50–100)	90.39 ± 10.76 (60–100)	0.10
Limitations of Physical Aspects	75.58 ± 26.44 (0–100)	84.3 ± 27.29 (0–100)	0.08	77.94 ± 31.48 (0–100)	79.41 ± 24.85 (0–100)	0.75
Pain	68.63 ± 23.17 (12–100)	74.3 ± 20.09 (10–100)	0.16	67.61 ± 21.61 (12–100)	71.12 ± 24.38 (20–100)	0.34
General Health Status	58.49 ± 17.79 (17–87)	62.7 ± 20.15 (17–100)	0.27	70.61 ± 20.83 (12–100)	73.78 ± 18.67 (27–100)	0.37
Vitality	59.53 ± 18.45 (25–90)	64.42 ± 18.65 (20–90)	0.08	65.49 ± 19.60 (25–100)	75.29 ± 19.43 (30–100)	<0.01
Social Aspects	76.16 ± 24.82 (25–100)	80.93 ± 18.14 (37.5–100)	0.26	75 ± 24.62 (25–100)	84.56 ± 17.96 (37.5–100)	0.01
Emotional Aspects	72.84 ± 31.09 (0–100)	73.62 ± 28.71 (0–100)	0.90	69.26 ± 38.79 (0–100)	80.37 ± 29.96 (0–100)	0.06
Mental Health	68.42 ± 23.92 (12–100)	72.93 ± 19.94 (12–96)	0.26	68.2 ± 20.52 (20–96)	77.59 ± 14.63 (32–100)	0.01

Abbreviations: PCOS, polycystic ovary syndrome; SD, standart deviation; SF-36, 36-Item Short Form Health Survey; Wk, week.

group and the control group, as previously demonstrated.[29,30] High-intensity force training is known to increase testosterone concentrations as an acute response.[31] However, other studies demonstrated that RET causes a significant reduction in the level of the androgen receptor in certain muscle groups. This suggests the presence of different endocrine responses to different types of exercise, and that there may also be specific responses for each type of skeletal muscle fiber.[32] In the present study, the reduction of testosterone following a 16-week RET may be explained by an increase in the level of androgen receptor due to physical exercise.[33] This response may differ according to the duration of the physical training[34] and the reduction of body fat.[35] A limitation of this study is that insulin resistance was not assessed after RET. However, it is important to highlight that basal insulin and HOMA values in the studied group were within normal levels.

In contrast, the 16-week RET increased the level of androstenedione in the PCOS group. A review of the literature was unable to identify any studies that specifically evaluated androstenedione concentration after RET, although one study reported an increase of androstenedione concentration in athletes following aerobic exercises.[36] The present study also indicated a reduction of waist circumference in the PCOS group at week-16 relative to week-0, presumably reflecting a reduction of visceral fat. Visceral fat is the main substrate of the enzyme aromatase,[37] and is directly related to the synthesis of sex steroids. Thus, the reduction of visceral fat may have reduced the amount of aromatase, thereby leading to an increase in androstenedione concentration. The observation that women with PCOS have reduced waist circumference after RET agrees with other studies that also demonstrated this benefit;[38] RET also has a positive impact on the QoL.

The present study showed that the PCOS group had improved QoL in all domains analyzed by the SF-36, although only the score for the functional capacity domain reached statistical significance. Functional capacity is a measure of the ability to carry out daily activities. Other studies have also examined the efficacy of physical exercise on the QoL in specific populations. For example, a study with women with fibromyalgia demonstrated improved strength, flexibility, cardiorespiratory function, vitality, emotional aspects, and mental health after aerobic exercise.[39,40] Another study with women with PCOS who engaged in aerobic exercise also demonstrated improvements in the functional capacity score and in the perception of health status.[41] However, there is no data on the effect of RET on the QoL of women with PCOS. Although the present study with women with PCOS employed a period of physical training similar to that used by Stener-Victorin et al,[41] the RET program of the present study consisted of exercises supervised by physical educators that were performed three times a week with a personalized resistance load. Thus, the main result of the present study is that a RET program guided by specialized professionals can improve the functional capacity of patients with PCOS.

The PCOS group also had a progressive improvement in the vitality domain, but this reached no statistical significance. The control group had a significant improvement in vitality at week-16. Previous research has also reported the positive effects of aerobic exercise, alone or in combination with RET, although no previous studies have documented improvements in the vitality domain after RET in women with PCOS. There is evidence that a combination of RET and aerobic exercise improves the vitality of women with diabetes.[42] It is possible that the use of personalized training in pairs of patients with the supervision of a professional in the present study may be responsible for this result. Indeed, a recent study demonstrated that supervised training serves as a motivating factor, and increases adherence to a physical exercise program.[43]

Most domains of the SF-36 showed no correlation with testosterone in the PCOS group, except for the social aspects domain, which showed poor negative correlation with this hormone. There is no data in the literature on the influence of testosterone levels in PCOS women on the social aspects of the SF-36 domains. However, an indirect effect of this hormone may be speculated based on the beneficial effects of antiandrogenic compounds on all SF-36 domains (physical function, physical role function, vitality, mental health, social function, and emotional role function), as previously demonstrated.[44] This indicates that lower androgen levels may be beneficial for the self-esteem of PCOS women acting positively on the domain "social aspects", which is one the best evaluated domains in questionnaires that assess QoL in women.[45]

The control group had a significant improvement of the social domain after RET; in contrast, the PCOS group had no significant improvement in this domain. There were similar findings for the mental health domain. These data agree with other data that demonstrated an improvement of these domains with different physical exercise protocols,[46] although there have been no previous studies with women with PCOS using the protocol employed in the present study.

A comparison of the control and PCOS groups indicated that the control group had better scores in the general health domain on the two occasions they were measured. These data agree with the literature, and confirm that relative to the general population, women with PCOS have lower QoL scores, especially in the domains of general health status, vitality, mental health, and social aspects.[4,47] PCOS is well-known to adversely affect various aspects of the social life and emotional status of the affected women. The interventions in the present study led to a reduction in waist circumference and an improvement in the functional capacity of women with PCOS, and this may have improved their overall sense of well-being, as well as their sexual function,[48] with a positive impact in their QoL. Indeed, a previous study indicated that BMI and waist circumference had a negative impact on the QoL of patients with PCOS.[4]

A limitation of the present study is that the lack of a control group without intervention and its design did not allow direct determination of whether cessation of physical exercise caused the observed changes in metabolism, hormones, and QoL. Physical activity has an important role, in combination with other measures, in helping women with

PCOS,[49] and these women must improve their metabolic and anthropometric parameters to resume ovulation.[50] An improvement of anthropometric parameters is highly related to an improvement in the QoL of these women.

Conclusion

Women with PCOS benefited from RET, with improvement of some SF-36 domains, after 16 weeks of the supervised exercise program. Moreover, PCOS women may benefit from exercise to improve their endocrine parameters, and RET is an effective therapeutic regimen to improve the QoL of PCOS women. Thus, supervised RET is an effective therapeutic regimen that could be incorporated into protocols for the treatment of women who have PCOS and require interdisciplinary care.

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