T.C.
YEDITEPE UNIVERSITY
INSTITUTE OF HEALTH SCIENCE
DEPARTMENT OF PHYSIOTHERAPY AND REHABILITATION

EFFECTS OF PROGRESSIVE RESISTANT EXERCISE TRAINING ON PHYSICAL, PSYCHOSOCIAL STATE AND PELVIC FLOOR DISTRESS LEVEL IN WOMEN WITH POLYCYSTIC OVARY SYNDROME

MASTER THESIS

ESRA KARACAN, PT.

ISTANBUL – 2022

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APPROVAL

This thesis has been deemed by the jury in accordance with the relevant articles of Yeditepe University Graduate Education and Examinations Regulation and has been approved by Administrative Board of Institute with decision dated ……. and numbered ……..

Prof. Dr. Bayram Yılmaz

Director of Institute of Health Sciences

DECLARATION

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree except where due acknowledgment has been made in the text.

ESRA KARACAN

DEDICATION

This thesis dedicated to my beloved, always supportive family; my mother Nebiye Karacan, my father Mustafa Karacan, and my dear brother İbrahim Eren Karacan.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF GRAPHICS

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

PCOS	Polycystic Ovary Syndrome
PCOM	Polycystic Ovarian Morphology
PRT	Progressive Resistance Training
ESHR	European Society of Hormone and Reproductive Endocrinology
ASRM	American Society of Reproductive Medicine
AES	Androgen Excess Society
NIH	National Institute of Health
ACSM	American Society of Sports Medicine
FSH	Follicle Stimulating Hormone
LH	Luteinizing Hormone
SHBG	Sex Hormone Binding Protein
P	Progesterone
VAT	Visceral Adipose Tissue
BMI	Body Mass Index
WHR	Waist Hip Ratio
HDL	High-Density Lipoprotein
LDL	Low-Density Lipoprotein
IR	Insulin Resistance
DM	Diabetes Mellitus
FMS	Functional Movement Screen
NYPAE	New York Posture Analysis
VAS	Visual Analog Scale
PFDI	Pelvic Floor Distress Inventory
HRQoL	Health Related Quality of Life
PCOSQ	Polycystic Ovary Syndrome Questionnaire
OC	Oral Contraception
RM	Repetition Maximum
RCT	Randomized Controlled Trial
SD	Standard Deviation

ABSTRACT

Karacan, E. (2022) Effects of Progressive Resistance Exercise Training on Physical, Psychosocial State and Pelvic Floor Distress Level in Women with Polycystic Ovary Syndrome. Yeditepe University, Institute of Health Science, Department of Physiotherapy and Rehabilitation MSc thesis, Istanbul.

Polycystic Ovary Syndrome (PCOS) is one of the most common heterogeneous endocrine disorders in women of reproductive age. Progressive Resistance Training (PRT) has proven effects on the musculoskeletal system by increasing muscle strength and density and reducing bone mineral density loss. Its positive effects on insulin resistance also positively reduce the risk of metabolic disorders such as type 2 diabetes and metabolic dysfunction. PRT may have similar effects on PCOS and is still under investigation as an exercise prescription. This study aims to investigate the effects of PRT on PCOS further. A total of 40 volunteers participated in the study and were divided into two groups randomly. The study group received 12 week-PRT, and the control group only received routine treatment. Outcome measurements included anthropometrics, functional (e.g., functional movement system (FMS), and posture analysis), psychological (health-related quality of life, PCOSQ), pelvic floor distress level (PFDI), and ultrasound measurements. Independent Samples T-Test and linear regression analysis were performed to compare inter-and intra-group differences. Changes in menstrual cycle status (p:0.059) and ovarian volume (p:0.057) were not significantly different. In the study group, there were statistically significant differences between the first and last test findings in body mass index (p:0.0014), waist circumference (p:0.007), skinfold measurements in triceps (p:0.008), suprailiac (p:0.003), body fat percent (p:0.002), and FMS scoring (p:0.001). The pain reduction in the ovarian (p:0.001) and lumbal (p:0.001) regions based on the visual analog scale scores of the study group was statistically significant. There was a statistically significant difference in the colorectal-anal distress (p:0.007) subgroup of PFDI-20 in the study group. In the study group, the psychosocial and emotional (p:0.002), fertility (p:0.006), obesity and menstrual disorders (p:0.002), coping (p:0.002) PCOSQ domain scores, and the total score (p:0.003) after treatment significantly increased. This study shows that 12-week controlled PRT may provide better treatment-oriented results on clinical outcomes in women with PCOS when used with routine treatments.

Key Words: polycystic ovary syndrome, progressive resistance training, insulin resistance

ABSTRACT (TURKISH)

Karacan, E. (2022). Polikistik Over Sendromlu Kadınlarda Progresif Dirençli Egzersiz Eğitiminin Fiziksel, Psikososyal Durum Ve Pelvik Taban Distres Düzeyi Üzerine Etkileri. Yeditepe Üniversitesi Sağlık Bilimleri Enstitüsü, Fizyoterapi Ve Rehabilitasyon ABD., Yüksek Lisans Tezi. İstanbul.

Polikistik over sendromu (PCOS), üreme çağındaki kadınlarda en sık görülen heterojen endokrin bozukluklardan biridir. Kas-iskelet sistemi üzerinde etkileri kanıtlanmış olan progresif dirençli egzersiz eğitiminin (PRT), kas kuvvetini ve yoğunluğunu arttırdığı ve kemik mineral yoğunluğu kaybını azalttığı belirtilmiştir. PRT'nin özellikle insülin direncine olan olumlu etkisinin metabolik bozuklukların (tip 2 diyabet ve metabolik işlev bozukluğu vb.) riskini azaltmada ve iyileşmesinde olumlu rolü vardır. PRT, PKOS için de benzer faydalar sağlayabilecek bir egzersiz reçetesi olarak hala araştırılmaktadır. Bu çalışma, PRT'nin PCOS üzerinde etkilerini araştırmak amacıyla yapılmıştır. Çalışmaya toplam 40 gönüllü dahil edildi ve gönüllüler rastgele iki gruba ayrıldı. Çalışma grubu 12 hafta PRT alırken kontrol grubu sadece rutin tedavi aldı. Sonuç ölçümleri, antropometrik, fonksiyonel (örn. fonksiyonel hareket taraması (FMS), postur analizi), yaşam kalitesi (PCOSQ), pelvik taban distres leveli (PFDI) ve ultrason ölçümlerini içermekteydi. Gruplar arası ve grup içi farklılıkları karşılaştırmak için bağımsız örneklemler T-Testi ve doğrusal regresyon analizi yapıldı. Menstrüel siklus durumu (p:0.059) ve yumurtalık hacmindeki (p:0.057) değişiklik gruplar arasında anlamlı farklılık göstermedi. Çalışma grubunda ilk ve son test bulguları arasında, beden kitle indeksi (p:0,0014), bel çevresi (p:0,007), triceps (p:0,008), suprailiak (p:0,003) skinfold ölçümleri ve vücut yağ yüzdesi (p:0,002) ve FMS skoru (p:0.001) arasında istatistiksel olarak anlamlı farklılık vardı. Çalışma grubunda müdahale sonrası yumurtalık (p:0.001) ve lumbal (p:0.001) bölge ağrılarında görsel analog skalaya göre azalma ve PFDI-20'nin kolorektal-anal distres (p:0.007) alt grubu skorunda azalma istatistiksel olarak anlamlıydı. Ayrıca çalışma grubunda, PCOSQ alt grupları olan psikososyal ve duygusal (p:0,002), doğurganlık (p:0,006), obezite ve menstrüel bozukluklar (p:0,002), başa çıkma (p:0,002) skorlarında ve toplam (p:0,003) skorda PRT sonrasında istatistiksel olarak anlamlı artış saptandı. Bu çalışmanın sonuçlarına göre, rutin tedavilerle birlikte kullanıldığında 12 haftalık kontrollü progresif direnç egzersizlerinin PKOS'lu kadınlarda klinik sonuçlar üzerinde tedaviye yönelik daha iyi sonuçlar sağlayabileceğini söylenebilir.

Anahtar Kelimeler: Progresif direnç eğitimi, polikistik over sendromu, insülin direnci

1. INTRODUCTION AND PURPOSE

Polycystic Ovary Syndrome (PCOS) is one of the most common endocrine disorders in women of reproductive age [1,7]. PCOS is characterized by hyperandrogenism, menstrual disorder (chronic oligo/anovulation), and Polycystic Ovarian Morphology (PCOM) [2,7]. PCOS prevalence is similar in all populations, with 6-10 percent [11].

The etiology of PCOS is not completely clear. Many factors such as genetic dysfunctions, lifetime environmental changes (intrauterine or postnatal adulthood), exercise, and physical activity affect the clinical course of the disease [32]. PCOS is a heterogeneous disease affecting many systems and should be considered in associated symptoms and comorbidities. PCOS is often associated with abdominal adiposity, insulin resistance, obesity, metabolic disorders, and cardiovascular risk factors [1,7,19]. Although Insulin Resistance (IR) has not yet been formally admitted in the diagnostic criteria of PCOS, it is closely related to the etiology and clinical features of PCOS [16-17], and it engages 75 percent of the thin women and 95 percent of the obese women [36,37]. Due to these effects, PCOS increases the risk of cardiovascular disorders such as Diabetes Mellitus (DM), hypertension, venous thromboembolism, infertility, pregnancy-related complications, and endometrial cancer [17,46,47]. It has also been shown that the characteristics and comorbidities in women with PCOS negatively affect psychological outcomes such as anxiety, depression, and quality of life [7-13].

PCOS Treatment approaches are determined based on the clinical features. The main objectives are metabolic disorders, hyperandrogenism, reproductive treatments, and improving the psychological and emotional state [7]. As treatment approaches, non-pharmacological approaches (e.g., exercise, diet), pharmacological approaches (e.g., combined oral contraceptives, metformin, anti-androgen agents), infertility treatment (e.g., pharmacological, surgical, in vitro fertilization), and surgical and cosmetic therapies are used. PCOS management varies based on the patient's expectations and goals, symptoms, etiological causes, and clinical course. However, the main goals of treatment are to cure metabolic disorders, hyperandrogenism, obesity, and insulin resistance, reproductive treatments, and improve the psychological and emotional state [7].

Lifestyle interventions are recommended as the first-line therapy for PCOS in recent evidence-based recommendations, and physical activity and exercise are the important

components of lifestyle interventions [7,35]. However, there is no consensus on the prescription for PCOS in the literature yet, and more studies are needed on the type, intensity, and duration of exercises. It is thought that regular physical activity contributes to a better anthropometric and androgenic profile and decreases the risk of hypertension, diabetes mellitus, cancer, and obesity by decreasing mortality and morbidity rates [65-68]. The abdominal fat ratio is reduced, muscle capillarity increases, and glucose transport function and regulation are modulated with exercise [71,73,80].

Resistance exercise is usually used as an appropriate approach to improve muscle fitness (muscle strength, endurance, and strength), to facilitate everyday activities physiologically and constructively manage, reduce, and intercept chronic disorders such as osteoporosis, Type 2 diabetes, and metabolic syndrome [80,81,102]. The load rate will gradually increase when the additional gain is desired with resistance exercise, called Progressive Resistance Exercise (PRT). PRT training is designed individually to increase muscle strength and hypertrophy. It is also known in the literature that the progressive model of resistance exercises has a therapeutic effect due to various metabolic, endocrine, and neurochemical effects [80]. In addition, adaptations that occur in the body after resistance exercises are affected by changes in hormone concentrations depending on various variables such as applied volume, intensity, and intervals. PRT increases muscle strength and improves androgen excess and body composition by reducing body fat and increasing lean body mass and muscle strength. Thus, resistance exercises are recommended for developing better health status in women with PCOS [7]. Skeletal muscle is the tissue that is most affected by the disorders in glucose metabolism, and impaired metabolic signaling of insulin in skeletal muscle contributes to systemic insulin resistance. The skeletal muscle is also an excellent repository for insulin action [31]. In addition, androgens are known to increase skeletal muscle mass and strength [43,44]. In women with PCOS influenced by androgen excess, exercise approaches that actively involve skeletal muscle may be considered, given the syndrome's effects on skeletal muscle.

In the literature, various studies compared PCOS and non-PCOS women, and according to their outcomes, a higher rate of muscle strength was reported in women with PCOS [105,106]. Also, Kogure et al. mentioned that the benefit of resistance exercises was associated with hyperandrogenism [44]. Also, the etiology of PCOS is closely related to body composition [32]. The literature also mentioned that body image, weight gaining,

and body composition are the factors that negatively affect women with PCOS for psychological and physical reasons parameters [49,52,64,107,108,109]. The changes in body composition with PRT may suggest improvement in PCOS. Increased insulin sensitivity may reduce the increased androgen synthesis in PCOS, preventing follicular development arrest and menstrual dysfunctions [1,19,32]. In addition, the population with PCOS is in the risk group for adipose tissue dysfunction. Improvement in visceral composition can be achieved with PRT [28,32,33].

PRT is thought to have an essential role in reducing the risk of metabolic disorders such as type 2 diabetes, and metabolic dysfunction, mainly due to its effect on insulin resistance [78-84]. PRT is routinely used as a treatment or a supportive method in these diseases. The beneficial effects of resistance exercise are well recognized in the diabetes mellitus population, and the Diabetes Mellitus Association recommends it as a treatment method [81]. Likewise, studies in the literature show the effects of PRT in women with PCOS. However, the studies show that few PCOS populations use PRT though it affects the musculoskeletal system, metabolic system, and PCOS-related symptoms (such as insulin resistance). The studies investigated the resistance exercise in women with PCOS, and they have seen some significant outcomes of anthropometric, hormonal, cardiovascular, and fitness variables (i.e., body composition, androgen levels, blood glucose levels, endocrine response, reproductive functions, sexual function, quality of life, depression, and anxiety). Kogure et al. [70], Vizza et al. [78], and Almenning et al. [117] have reported improvement in body composition. Ramos et al. [113] have found increasing functional fitness and quality of life. Lara et al. [55] have investigated sexual function, and most of these studies indicated improvement in androgen levels.

Additionally, PRT might be effective in treating patients because it can reduce long-term health expenditures and improve insulin resistance. Research has offered that it is a potential intervention in PCOS with some evidence-based beneficial effects [104]. Furthermore, the need for further study was noted for a complete consensus on exercise prescription.

This study, which is the first to provide progressive resistance exercise training with a program consisting of calisthenic exercises, was planned to investigate the effects of PRT on physical parameters, psychosocial state, and pelvic floor distress level in PCOS women aged 18-40.

2. STUDY BACKGROUND AND LITERATURE REVIEW

2.1. Definition

Polycystic ovary syndrome (PCOS) is one of the most common endocrine disease in women of reproductive age. It is a heterogeneous disease characterized by a combination of signs and symptoms of androgen excess (hirsutism and / or hyperandrogenemia) and ovarian dysfunction (oligo-ovulation and / or polycystic ovarian morphology (PCOM)) [1,2]. Infertility is the main problem among women with PCOS that may be a result of high levels of androgen hormones produced by the ovary and adrenal gland. Others comorbidities of PCOS could often be an increased risk of abdominal adiposity, insulin resistance, obesity, metabolic disorders, and cardiovascular risk factors [3,4]

In 1935, Stein and Leventhal published their study that first described PCOS, which was defined as a combination of hirsutism, absence of menstruation, chronic anovulation and difficulty in fertility, weight gain, and ovarian cysts [5]. In 1990, World Health Organization (WHO) included sclerocystic ovary syndrome and Stein-Leventhal syndrome as well as 'E28.2 Polycystic ovary syndrome' among ovarian dysfunction disorders. (ICD10)

The European Association of Human Reproduction and Embryology / American Society for Reproductive Medicine (ESHRE/ASRM), an international consensus group in 2003, recommended to exclude some cases for diagnosis of PCOS (These are Cushing's syndrome, hyperprolactinemia, androgen-producing tumors) [4].

Definition of the ESHRE/ASRM (Rotterdam) is commonly used and an accepted PCOS classification. The Rotterdam criteria suggest that any woman who exhibits at least two of the three characteristics can be diagnosed with PCOS: 1) clinical and/or biochemical hyperandrogenism, 2) ovulatory dysfunction, and 3) PCOM [4].

In its 2006 report, the Androgen Excess PCOS Society (AE-PCOS) argued that hyperandrogenism (combination of biochemical or clinical and chronic anovulation or polycystic ovaries) is an indispensable condition for PCOS [4].

The National Institute of Health (NIH) stated that hyperandrogenism and ovulation dysfunction should be present, but ovarian morphology is not mandatory [6]

The National Institute of Disease Prevention Institutes, sponsored by the Evidence-Based Methodology Workshop on Polycystic Ovary Syndrome in 2012 proposed to define a specific phenotype (Table2.1.) while maintaining the aforementioned diagnostic criteria [6].

Phenotype A	Phenotype B	Phenotype C	Phenotype D
• Androgen Excess • Ovulatory Dysfunction	• Androgen Excess • Polycystic Ovarian Morphology	• Ovulatory Dysfunction • Polycystic Ovarian Morphology	• Androgen Excess • Ovulatory Dysfunction • Polycystic Ovarian Morphology

Table 2.1. Phenotypes of PCOS

2.2. Prevalence

Studies using diagnostic criteria by the NIH have shown the prevalence of PCOS to be 4 percent to 9 percent [8,9,10]. Another study showed that the overall prevalence of PCOS was 6 percent according to NIH criteria, and this prevalence was 10 percent when Rotterdam or AE PCOS criteria were applied. [11]. A study report showed, comparatively, the prevalence of PCOS in the same sample to be 17.8 percent using the Rotterdam (ESHRE/ASRM) criteria and 8.7 percent using the NIH criteria [12]. The Rotterdam criteria have been demonstrated to consistently expand the prevalence of PCOS compared with the NIH criteria [13]. It has been consistently shown that the prevalence of PCOS is increased according to the Rotterdam criteria compared to the NIH criteria [13]. In a study in Turkey, investigating the prevalence of PCOS according to three existing diagnostic criteria systems, the prevalence was found to be 6.1 percent according to the NIH criteria, 19.9 percent according to the Rotterdam criteria, and 15.3 percent in accordance with the AE-PCOS criteria [14].

The characteristic features of PCOS precipitate to assorted phenotypes. The phenotypic distribution of PCOS in studies with extensive neutral cohorts is 40-45 percent for phenotype A and phenotype B combined, ~ 35 percent for phenotype C, and ~ 20 percent for phenotype D [15].

2.3. Etiology and Pathogenesis

The etiology of PCOS is not completely clear, although it is a common endocrine and reproductive disorder. Genetic and environmental factors are thought to have an impact on the development of polycystic ovary syndrome and its various symptoms.

There are links to familial aggregation based on genetics, and familial aggregation and twin studies support this [16]. For example, having PCOS in a mother or sister in the family increases the individual's risk of PCOS and PCOS-related symptoms. In addition, identical twins are twice as likely to develop PCOS as fraternal twins [16]. Numerous genetic studies have identified more than 100 genes (e.g., CYP11A, VNTR, CAPN10) associated with PCOS. It was also found that elevated gene expression of DENND1A.V2 might play a role in the PCOS phenotype by initiating androgen production in theca cells [18]. Withal, any distinct gene has been identified for PCOS, which is considered a complex polygenetic disorder [17,18,19].

Although genetic studies promote to a greater understanding of the pathophysiology of PCOS, lifetime environmental changes, including intrauterine or postnatal adulthood, may explain the heterogeneous phenotype of PCOS and there are studies offering them an epigenetic constituent as the essential source of development [20]. Epigenetic trails, like DNA methylation, histone modifications, and non-coding RNA editing alter the structure of chromatin independent of changes in DNA sequence, conferring a different program of gene expression. Because plasticity ability of epigenome of a cell is excellent and it can be reprogrammed, epigenetic modifications dynamically and reversibly control gene expression [21]. Cell can alter lifelong with epigenetic reprogramming and environmental factors has been instrumental in the conservation and construction of epigenetic marks. Increasing evidence suggests that similar to other common metabolic disorders (DM2, obesity etc.), PCOS may be a compound disorder with epigenetic and environmental factors such as exercise, diet and other lifestyle conditions [21,22].

It is thought that a combination of genetic predisposition and environmental factors affect the PCOS development. These environmental factors are lifestyle changes such as sedentary life, unbalanced diet and stress, and hormonal and metabolic disorders. It has been suggested that the effects of lifestyle changes on the epigenome are lifelong in women with PCOS [22]. The hormonal and endocrine disorders of PCOS alter the development of follicles in the ovaries and clinically, that can cause ovulatory

dysfunctions and infertility. On the other hand, clinical conditions impact on embryo through intrauterine environmental changes such as androgen excess and metabolic syndrome. Also, epigenetic reprogramming that may trigger developmental PCOS during fetal life or associated clinical changes after birth, is affected by them [20,21,22].

2.3.1. Menstrual dysfunction and androgen excess

PCOS is under the influence of neuroendocrine abnormality [1,23], In a normal menstrual cycle, immature oocytes transform into oocytes under the influence of follicle stimulating hormone (FSH) and ultimate maturation occurs with the effect of luteinizing hormone (LH) [24]. Whereas in PCOS, rising gonadotropin-releasing hormone (GnRH) increases the frequency and amplitude of LH release more than FSH. The circulating LH/FSH ratio increases, and this increase leads to a dysfunction in follicle development. In addition, progesterone reduces the inhibition of the GnRH pulsation frequency, and an increase in androgen production begins in the theca cells of the ovarian follicles [1,23,25].

In PCOS, oligo-anovulation is observed in the early antral period due to the cessation of follicle development [1,2]. Normal ovulation occurs by the action of gonadotropins released from the hypothalamic-pituitary axis on the developing follicles [24]. In PCOS, Anti-Mullerian Hormone (AMH) levels raise with the increase of AMH production from the granulosa cells of an increasing number of small antral follicles. Increasing AMH level causes FSH resistance by decreasing FSH sensitivity in follicles and prevents the development of primordial follicles. In addition, AMH inhibits the aromatase enzyme and prevents the conversion of androgens to estrogen and contributes to hyperandrogenism [23,25].

Hypersecretion of LH and insulin-like growth factor 1 (IGF-1), causes excess androgen hormone secretion from theca cells. Increased androgen hormones further impair follicular maturation by promoting the initiation of primordial follicle growth and increasing the number of growing small antral follicles. Ultimately, it leads to hyperandrogenism, which results in the arrest of follicular development [23,26]. (Figure 2.2)

It is also exacerbated the effects (the direct effect of insulin on theca cells via the insulin receptor and the indirect effect via the IGF-1 receptor) of insulin on theca cells, by overstimulation of theca cells by LH [28,29].

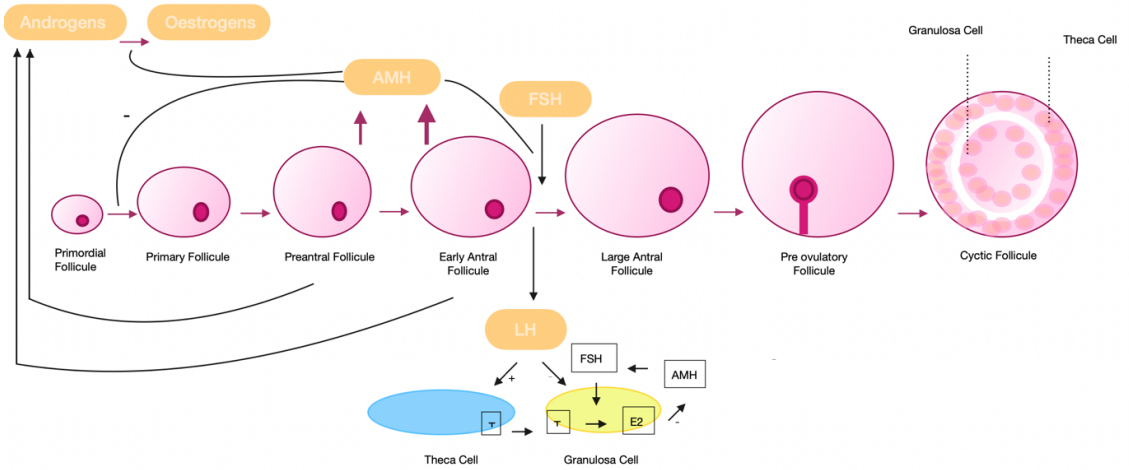


Figure 2.2. PCOS ovarian follicular maturation arrest

2.3.2. Insulin resistance, hyperandrogenism and adipocyte dysfunction

Insulin resistance (IR) associated with PCOS has a selective resistance mechanism that affects metabolic and mitogenic, signaling pathways [27]. The effects of insulin on theca cells are exacerbated by LH overstimulation of theca cells [28,29]. This mechanism of action occurs through its direct effect on theca cells through high-affinity insulin receptors in the follicular membrane and its indirect effect through the IGF-1 receptor, causing a defect in the metabolic pathway [29].

Hyperandrogenism is an important feature of PCOS and is included in all diagnostic criteria. Also, in PCOS, IR and hyperandrogenism often accompany each other. IR might reproduce endogenous androgens in women with PCOS [1,28]. The increase in insulin contributes to hyperandrogenism by directly stimulating ovarian androgen secretion, as well as by decreasing the synthesis of sex-hormone binding globulin (SHBG) from the liver and increasing the level of free testosterone. (Figure 2.3)

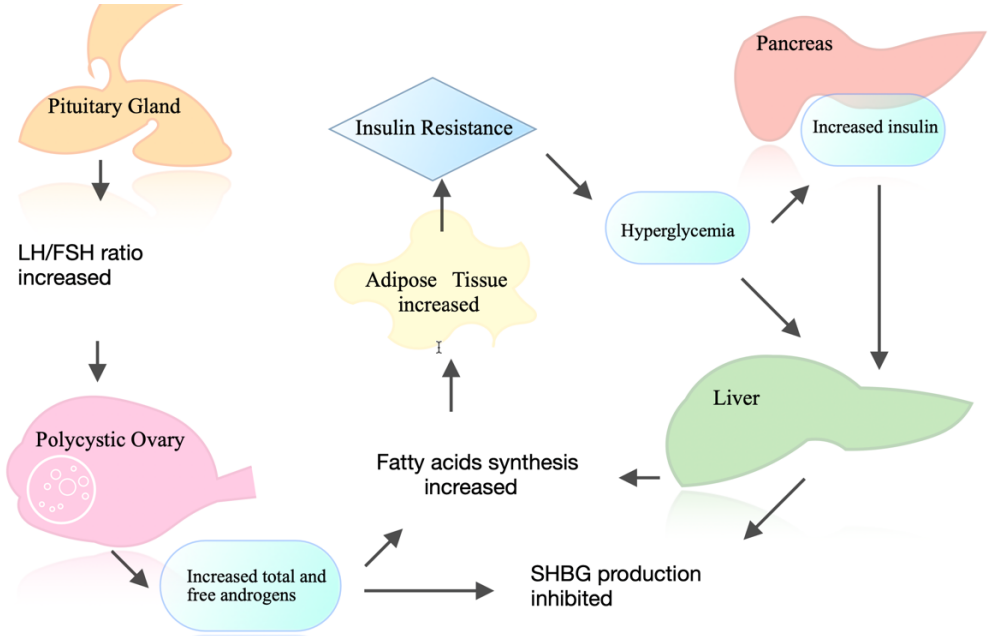


Figure 2.3. Insulin resistance in PCOS

It is thought to be closely related to androgen levels of visceral adipose tissue in women with PCOS [30]. It has been demonstrated that androgens stimulate visceral fat deposition and cause adipocyte dysfunction. Abdominal adipose tissue increases, and IR induce androgen synthesis. This again causes a higher inflammation and visceral fat [30,32]. (Figure 2.3)

Furthermore, approximately 70 percent of women with PCOS have intrinsic insulin resistance in adipose tissue beyond the expected insulin resistance associated with body mass, and peripheral insulin resistance may be the result of adipocyte dysfunction. Moreover, adipose cells generate agents such as leptin and adiponectin to modulate androgenic hormones. In some PCOS patients, elevated serum leptin inhibits the aromatization, improves high androgen levels. Also, adiponectin rises insulin sensitivity [33,34].

In studies, it has been stated that mitochondria are disrupted by various mechanisms and contribute to skeletal muscle insulin resistance caused by hyperandrogenism with a decrease in glucose uptake [31]. Extracellular signal-regulated kinase (ERK) 1/2 activation values in skeletal muscle tissue and insulin response were found to be increased in women with PCOS compared to women without PCOS. Increased (ERK) 1/2 activation inhibits serine phosphorylation of the insulin receptor

substrate. This suggests that (ERK) 1/2 activation may have a role in the normal feedback mechanism in insulin signaling and may contribute to insulin resistance in PCOS [29]. (Figure 2.4) Furthermore, in PCOS, serine phosphorylation of the insulin receptor and insulin receptor substrate1 (IRS1) is increased in skeletal muscle, impairing insulin signaling [30]. (Figure 2.4)

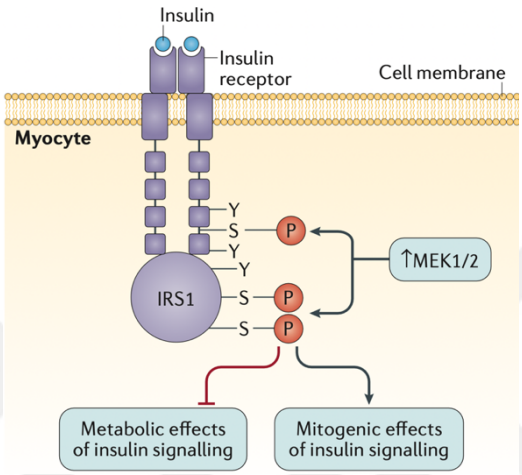


Figure 2.4. Mechanism of insulin resistance in skeletal muscle in PCOS [1]

2.4. Clinical Features of PCOS

PCOS is a multifactorial disease according to the intensity of its clinical features [1]. Every criterion in the diagnosis of PCOS produces different clinical results on its own. For example, androgen excess can appear as hirsutism, acne and alopecia in clinic. Also, chronic ovulatory dysfunction may cause failure in fertilization and endometrial hyperplasia and/or carcinoma. Isolated PCOM is linked with the risk of ovarian hyperstimulation syndrome only during ovulation induction [1,7,32,35].
Generally, a patient with PCOS complies the more criteria, has the more severe phenotype [7,15]. (Figure 2.1)

2.4.1. Associated Symptoms and Co-morbidities

PCOS is often associated with abdominal adiposity, insulin resistance, obesity, metabolic disorders, and cardiovascular risk factors [1].

IR has not yet been formally admitted in the diagnostic criteria of PCOS, but it is closely related to the etiology and clinical features of PCOS [16-17] and it interests 75 percent of thin women, and 95 percent of obese women [36,37]. Women with PCOS, who are fairly insulin resistant, show worse reproductive and metabolic characteristics than women with PCOS who are not insulin sensitive. Various studies said that the interaction between PCOS and visceral adipose tissue might be the result of a chain reaction in which hyperandrogenism promotes visceral adiposity [28,29,30]. It can also further facilitate androgen secretion in the ovaries and adrenal glands [32].

Studies have shown an increased incidence of metabolic syndrome, gestational diabetes mellitus, and DM2 in premenopausal women with PCOS. [41,42]. The incidence of metabolic syndrome is more in the PCOS population in accordance with healthy women of the same weight [39]. The women with PCOS in phenotypes faced with hyperandrogenism, it has been associated with more severe insulin resistance and a worse lipid profile [35,40]. The metabolic features of PCOS also effect ovulatory functions [30]. (Comparing chronic oligo/a-menorrhea and regular cycles)

PCOS was also found to be a risk group in terms of cardiometabolic complications and increased cardiovascular disease (CVD). Long-term increased risks of the disease include cardiovascular disorders such as hypertension (HT), venous thromboembolism. Moreover, PCOS increases the risk of complications in pregnancy and endometrial cancer. Also 40% of women with PCOS suffer from infertility [46-48].

Psychosocial disorders such as anxiety, depression, mood disorders [49-52] and sexual dysfunctions [52-55] are common in women with PCOS. However, the etiology of mood disorders and psychosexual dysfunction in PCOS is still unclear.

In addition, symptoms such as pelvic floor dysfunctions [56-58], urinary incontinence [60,61], pelvic floor muscle weakness [61,62] have also been reported in women with PCOS.

2.5 Management of PCOS

Since PCOS is a multisymptomatic chronic disorder, treatment approaches are determined according to clinical features. The main goals of treatment focus on metabolic disorders, hyperandrogenism, also reproductive treatments or strategies to improve psychological and emotional state are preferred according to the patient's expectation [7].

Treatment approaches used in management of PCOS include: pharmacological approaches (combined oral contraceptives, metformin, anti-androgen agents, etc.), infertility treatment (pharmacological, surgery, in vitro fertilization, etc.), surgical and cosmetic therapies [7]. Withal, lifestyle interventions consisting of diet, exercise, and behavioral strategies are played a significant role in the management of PCOS [7,35].
The Australian Alliance's evidence-based guidelines for the evaluation and management of PCOS in women of reproductive age, first published in 2011 and then updated again in 2018[7,35]. The guideline likewise emphasized the importance of lifestyle changes in PCOS management and emphasized multidisciplinary care and patient education [7]. Guidelines suggested that the management of PCOS should include diet and exercise and such lifestyle changes, as first-line therapy. (Before or along with pharmacological treatment.) It was highlighted that to protect the healthy weight and improve hormonal statement, sustaining overall quality of life throughout life is essential. Patients' education, multidisciplinary approach, and lifestyle interventions were found important [7,35].

Losing weight and maintaining a healthy weight is important for women with PCOS, as excess weight and obesity can worsen the condition and increase risk factors in the PCOS population. In the etiology of PCOS, it has been observed that excess weight increases reproductive and metabolic problems and affects psychological health.

Despite IR has not yet formally admitted in the diagnostic criteria of PCOS, it interests 75 percent of thin women and 95 percent of obese women [36]. With or without weight gain, it negatively affects the pathogenesis of PCOS and leads to a vicious circle. Exercise might improve IR and studies have offered that it is a potential intervention in PCOS with some evidence-based beneficial effects [63]. Weight loss, diet, and exercise can reduce IR, correct hyperinsulinemia and menstrual abnormalities, increase ovulation rates, and help treat infertility.

It has been confirmed by several studies that exercise might improves the metabolic components related to PCOS. (Hypertension, IR, high sugar level etc.) Studies have also indicated that lifestyle management, including exercise interventions, may evolve PCOS independent from losing weight [64].

2.6. PCOS and Exercise:

Physical activity and exercise are important factors in lifestyle changes. Physical activity is defined internationally as the movement of the body to expend energy. [65]. It can be characterized as activities that increase heart rate and respiratory capacity and cause fatigue at different intensities.[66] Exercise is defined as "a subset of physical activity that is planned, structured and repetitive and with the ultimate or intermediate goal of improving or maintaining physical fitness" [66].

Considering the daily routines and cultural preferences of women with PCOS, it is recommended to include physical activity in their daily routines such as housework, professional work, transportation and to minimize their sedentary time. It is thought that regular physical activity contributes to a better anthropometric and androgenic profile [68] and reduces the risk of HT, DM, cancer, and obesity by reducing mortality and morbidity rates [69]. An increase in habitual physical activity of 2000 steps/day (regardless of physical activity status) was found related with decreased functional activity in PCOS and this was interpreted that the positive effect of habitual physical activity on PCOS, linked with low androgens [68].

Australian Alliance of PCOS Guidelines recommended the exercise prescription that include at least 150 minutes of moderate-intensity physical activity per week or 75 minutes/week of vigorous-intensity or an equivalent combination of both, including two consecutive days/week of muscle-strengthening activities [7]. It is known that obesity and increase in body-mass index (BMI) increase menstrual disorders and hyperandrogenism, and weight loss reduces clinical symptoms [76]. Exercise training is effective in improving PCOS-related metabolic risk factors such as hypertension, IR, and high glucose levels, even without weight loss [77]. Decreased insulin sensitivity is essential for obese or lean women with PCOS; It is predicted that the majority of women had varying degrees of IR [11]. Exercise training is seen as a viable approach to improve PCOS symptoms in PCOS, both obese (BMI>30) and thin (BMI<25) [78].

In the literature, it has been stated that there is a relationship among structured exercise and decreasing androgen levels [70-72]. With structural exercise, the abdominal fat ratio is reduced, muscle capillarity is increased, and glucose transport function and regulation are regulated. In PCOS, exercise may have a healing effect for abnormal emotional and endocrine responses due to stress and psychological conditions [73]. Vigorito C. et al. found that a 3-month structured exercise training might presented better cardiopulmonary functional capacity and physical fitness, insulin sensitivity and BMI and decreased CRP, in obese PCOS women, and recommended structured exercise as a therapeutic option in younger patients [74]. Giallauria F. et al. also reported that after three months of exercise, significant development in maximal oxygen uptake (VO2max) and heart rate, and a significant reduction in CRP and White blood cells. They interpreted that exercise training would improve inflammation in women with PCOS [75].

Recently, there has been an increase in studies suggesting various exercise models for PCOS such as aerobic exercise, resistance exercises, high-intensity interval training and resistance exercises. However, women with PCOS have reported getting insufficient lifestyle advice despite its potential to be beneficial [7]. The specific effectiveness of different exercise models and volumes is still indefinite, studies report that prioritized in PCOS and associated comorbidities [79].

2.7. PRT in PCOS

Resistance exercise is known as a therapeutic exercise model. It can improve muscle fitness (muscle strength, endurance and power) and effectively manage, reduce or prevent diseases and conditions such as osteoporosis, Type 2 diabetes and obesity. It is a type of exercise that can be applied to adults of all ages [80]. If the additional gain is desired with resistive exercise, resistance training should be increased gradually as the muscles become stronger and hypertrophy is achieved. (Like progressive resistance exercise training) Adults should ideally have 2-4 sets total of 8-12 repetitions per set with 2–3-minute rest interval between sets to improve muscle fitness for each muscle group. (FITT-VP, principle of Ex Rx) [80].

The effects of progressive resistance exercise training (PRT) on the musculoskeletal system, such as increasing muscle strength and density, and reducing bone mineral density loss, have been proven. In addition, adaptations in the body after

resistance exercises are affected by changes in hormone concentrations depending on various variables such as applied volume, intensity, and intervals. The tissue that is most affected by the disorders in glucose metabolism is skeletal muscle, and impaired metabolic signaling of insulin in skeletal muscle contributes to systemic insulin resistance. In addition, androgens are known to increase skeletal muscle mass and strength [43,44]. In women with PCOS who are under the influence of androgen excess, exercise approaches that actively involve skeletal muscle may be considered, given the effects of the syndrome on skeletal muscle. Insulin resistance is cited among the primary mechanisms in the etiology of PCOS. Therefore, it may be one of the important targets of therapeutic approaches for PCOS population. The skeletal muscle is also a great repository for insulin action [31]. It is thought that PRT had an essential role in reducing the risk of metabolic conditions such as DM2, metabolic dysfunction, especially thanks to its effect on IR [76]. According to the consensus statement from the American Diabetes Association, resistance exercise has been an effective method to improve similar symptoms in DM2 patients [81]. Some studies applying PRT in patients with DM2 suggest that it can significantly improve insulin sensitivity and HbA1c [76,81], and these changes have been found linked with many structural and metabolic changes in skeletal muscle [31]. There are studies in the literature suggesting that PRT may be a potential intervention in PCOS with these evidence-based beneficial effects [104], but these are few.

A recent review article provided evidence that PRT may benefit women with PCOS [81,115,116]. PRT improves hyperandrogenism, body composition, and reproductive function in women with PCOS [70,115] and it has positive effects on hormonal and physical properties [83,116]. PRT have been reported to support vitality and functional capacity [70,83]. Kogure et al. evaluated the effectiveness of PRT in increasing lean body mass 45 women with PCOS compared to 52 without PCOS, and outcome measures supported increment of muscle strength in PCOS. According to the study, it is recommended that resistance exercise may improve health and fitness in women of reproductive age, functional strength capacity [70]. Thomson et al. have presented a 20-week program, participated 104 overweight women with PCOS. There were three groups, which are diet only (DO), diet plus aerobic training (DA), and diet plus combined aerobic and resistance training (DC), and the DC group compared to the DO group significantly improved body fat percentage, fat mass and lean mass [72].

Bruner et al. have reported a 12-week pilot study in 12 women with PCOS, high abdominal obesity. The women were divided two groups: receiving aerobics plus PRT plus nutritional counseling group (n=7) and a control group (n=5) receiving nutritional counseling only and the experimental group was found to significantly increase cardiorespiratory fitness and reduce substantially subcutaneous adiposity compared to the control group [84]. In addition, there were few other studies that used strength training [117,118] aerobic training and nutrition classes with PRT [72] or prescribed PRT with nutritional advice [71] but none of these studies provided specific details for the PRT interventions. These studies outcomes have shown some changes in better in anthropometric measurements and physical activity with PRT.

According to our research, there is no other study in the literature stating that a progressive resistance exercise program consists of completely calisthenic exercises. In this study, we considered the ACSM and PCOS guidelines while creating the progressive training program [7,35,66,77,80]. It was consciously made to create the whole program from calisthenic exercises. The benefits of calisthenic exercises using bodyweight are also known in terms of muscle strength and functional status. On the other hand, a tendency to sedentary behavior is also common in women with PCOS, adding to the difficulty of maintaining patients' lifestyle interventions. It has been mentioned in the literature that body image, weight gaining and body composition are factors that negatively affect women with PCOS for psychological and physical parameters [49,52,64,107,108,109]. The exercise training program, which requires minimal equipment and provides ease of implementation, is also considered as a form that women with PCOS, can integrate into their lives and continue for a long time.

3. MATERIAL AND METHOD

3.1. Study design

Our study is a controlled two-arm study in which the results of the Exercise and Control groups are compared. The total duration of the study is 12 weeks, and the results of the pre-intervention (0. week) and post-intervention (13. week) outcome measurements were evaluated.

40 volunteer women aged 18-40 who were diagnosed with polycystic ovary syndrome (PCOS) by the examination and findings of the gynecologist and obstetrician at Yeditepe University Obstetrics and Gynecology Department between January 2020-September 2021, were referred to the Department of Physiotherapy and Rehabilitation at Yeditepe University. While calculating the effect size of the present study, a priori power analysis was performed using the statistical software package GPower. The results of the power analysis showed that 40 volunteers should be involved in the study to have good power for its purpose.

Marmara University Non-Interventional Clinical Research Ethics Committee approved all procedures prior to the baseline evaluation. (Appendix A) All participants were informed about the purpose of the study, evaluation methods, and intervention methods. A written informed consent was obtained from all participants. (Appendix B)

3.2. Participants

The present study was conducted between January 2020-September 2021 at the Research Laboratory of the Department of Physiotherapy and Rehabilitation of Yeditepe University, with 40 women (ages 18-40) diagnosed with polycystic ovary syndrome (PCOS) and referred from the Department of Obstetrics and Gynecology of Yeditepe University. Brochures and social media announcements were used to reach the participants with PCOS. Participants, whose diagnosis of PCOS was already given by a different doctor were sent to Yeditepe Obstetrics and Gynecology Clinic to get a confirmation by the physician. When the PCOS was not identified in the second examination, those participants were excluded from the study. All potential participants were evaluated based on eligibility criteria for the study. According to the evaluation eligible volunteers were randomly divided into two groups: (1) progressive resistance exercise training group, (2) control (routine treatment) group.

3.2.1. Inclusion Criteria

- Female patients diagnosed by physician with PCOS

- Women between ages 18-40

- Willingness to undergo study protocols

3.2.2. Exclusion Criteria

- Pregnant and breastfeeding women

- Cardiovascular and renal diseases

- History of hypertension or cancer

- Acute or chronic condition that will adversely affect assessment and interventions

- Already following any regular exercise program

3.3. Flow of Research

A total of 118 patients were applied to the study. After the first assessment, 2 women were excluded for health conditions, 14 people were contacted due to pandemic conditions, 10 people were removed due to the diagnosis of COVID and 36 people left without giving any reason. 14 people were excluded from the study due to their relocation to different countries and cities. (Figure 3.1)

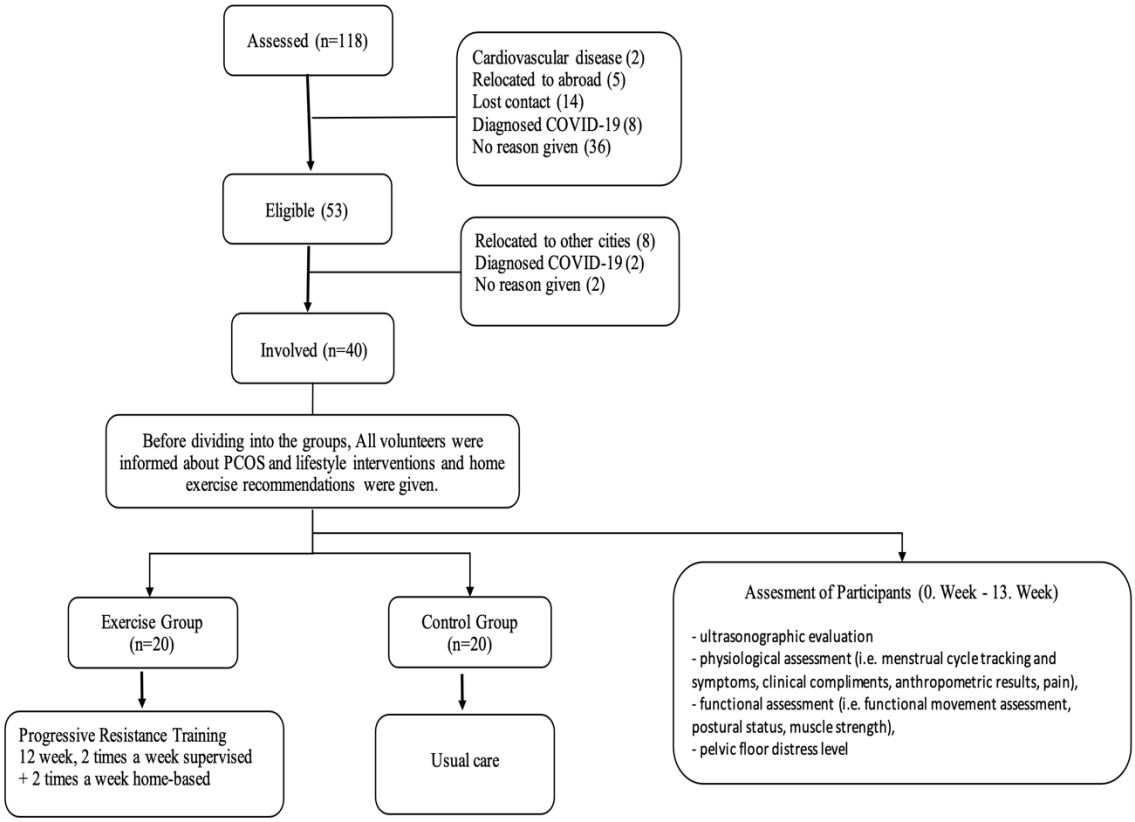


Figure 3.1. Flow chart diagram

Among the 118 volunteers, forty volunteers entered the study and were divided randomly into two groups: (1) progressive resistance exercise training group, (2) control (routine treatment) group. Clinical outcomes evaluated before and after the intervention period at weeks 0 and 13. Ultrasonography assessment, physiological assessments (anthropometric results, pain), functional assessments (functional movement assessment, postural status), menstrual cycle status, pelvic floor distress level and psychological assessment (PCOS disease-specific quality of life questionnaire) were measured and compared inter and intra groups. (Figure 3.1)

3.4. Methods

The initial test was conducted in the research room of the Yeditepe University Physiotherapy and Rehabilitation Department, and firstly, informed consent was obtained from every participant to accept clinical procedures. Afterwards, participant information which involved diet and exercise habits, menstrual cycle, taking medicine, medical

history and demographic information were taken. Consequently, physical measurements (e.g., height, weight, waist and hip circumference, skinfold measurements) and functional examinations (e.g., FMS, NYPAE) were applied. Participants were taught how to keep their menstrual cycle diary and they completed the psychological questionnaire (PCOSQ-50) and pelvic floor distress inventory (PFDI-20). Participants were also subjected to ultrasound examination by physician at Yeditepe Obstetrics and Gynecology Clinic. Post-testing was completed with the same procedure as baseline testing.

3.4.1. Assessment of Demographic Information

Participants were subjected to a form in which demographic information such as educational status, marital status, occupation and employment status, and daily living habits such as exercise, nutrition, smoking, alcohol, and caffeine intake were questioned. (Appendix C)

Education status was evaluated as primary school, high school, university, and graduate school. Marital status was evaluated as being married, single and engaged. Professional working status was evaluated as not working, working part-time, working full time.

Exercise habits were evaluated as exercising rarely, exercising 1-2 times a week, exercising 3-4 times a week; nutritional habits were evaluated as a balanced diet, fast food, vegetarian diet.

Smoking and alcohol using was answered as Yes, I do, No I do not, caffeine intake was answered as cup/day None, 1-2, 3-4, 5+.

3.4.2. Ultrasonographic Evaluation

Polycystic ovarian morphology (PCOM) is among the diagnostic criteria for PCOS and has an important place in the pathophysiology and clinical course of the disease [2,7]. Ovarian morphology evaluation was done by transabdominal or transvaginal ultrasound as standard method. The ultrasound device gave the appearance of PCOM in patients with at least 25 small follicles (between 2 mm and 9 mm) in the ovary, and the ovary size was divided into normal size 10 ml. The PCOM evaluation was based on the Rotterdam criteria [2]. Ovarian volume was calculated on the basis of a simplified formula for a prolate ellipsoid of ovarian volume, as a traditional, practice often cited method. (0.5 × length × width × ovary thickness) [85,86]

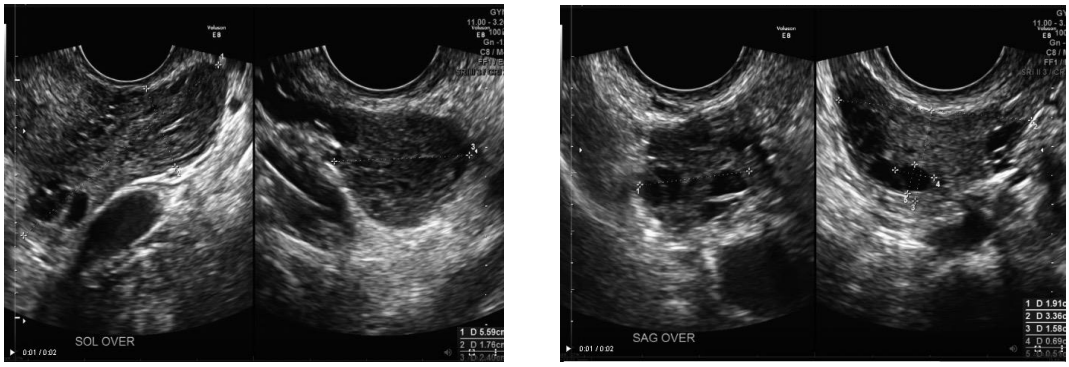


Figure 3.2. Ultrasound imaging of polycystic ovary

3.4.3. Physiological Outcome Measurements

3.4.3.1. Anthropometric Measurements

Anthropometric measurements were used to interpret visceral adipose tissue, which is an important determinant of obesity-related health risks such as cardiovascular and metabolic disorders and plays a role in the etiology of insulin resistance. These included waist-hip ratio (WHR), body mass index (BMI), body fat percentage, skinfold measurements.

Height and weight measurement were measured with calibrated equipment and without fine clothing and shoes, according to standard procedures [87]. BMI was calculated as the ratio between the square of both results from weight (kg) and height (cm) measurements (kg / m2)

WHR Measurement; We measured waist circumference(W) as the smallest circumference of the trunk between the 12th rib and iliac crest and the widest circumference of the hip(H). We then calculated the ratio (WHR) between the two regions [88,89]. (W/H)

Percent bodyfat is the best measure for general obesity and central adiposity is associated with a risk for chronic disease [88,89]. The body fat ratio was calculated by measuring it with the Skinfold method [90]. Measurements were applied to standard areas, including biceps, triceps, subscapular, suprailiac, and leg. We used the standard skinfold caliper and followed the standard measurement procedure [91].

Biceps: The measurement was taken from the forearm in the vertical direction, where the biceps muscle is thickest. (1 cm above the marked point for the triceps.)
Triceps: Measurements were made in the vertical direction on the posterior aspect of the midpoint of the upper arm in the sagittal plane. In the vertical plane, the acromion and the middle of the radial tip were measured.
Subscapular: Measurement was made in the diagonal direction (45º angle). The measurement point was 1-2 cm below the lower end of the scapula.
Suprailiac: Measurement was made in the diagonal direction. The measurement was made at the intersection of the tip of the Iliacus and the anterior point of the axilla.
Anterior Tight: Measurement was made in the vertical direction. The middle of the proximal of the patella and the inguinal fold were the measurement point.

Figure 3.3. Skinfold Measurements

Then, total measurements, body density, and percent body fat calculations were made. (Table3.1.)

Table 3.1. Body Fat Measurements

Body Density - Three-Site Formula (Triceps, Suprailiac, Thigh)

Body density = 1.0994921 – (0.0009929 × sum of three skinfolds) + (0.0000023 × [sum of three skinfolds]2) – (0.0001392 × age) = 1.0994921 – (0.0009929 × _____) + (0.0000023 × [_____]2) (skinfolds) (skinfolds) – (0.0001392 × _____)

Body Fat Percent from Body Density

Percent body fat = (factor ÷ body density) - (factor) = _____%

Population-specific formulas for conversion of body density to body fat percent

Population Ethnicity	Age	Gender	Body Fat %	Population *Ethnicity*
White	*8 12*	*Male*	*(5.27 ÷ BD) – 4.85*	*White*
		Female	*(5.27 ÷ BD) – 4.85*	
	13 17	*Male*	*(5.12 ÷ BD) – 4.69*	
		Female	*(5.19 ÷ BD) – 4.76*	
	18 59	*Male*	*(4.95 ÷ BD) – 4.50*	
		Female	*(4.96 ÷ BD) – 4.51*	
	60 90	*Male*	*(4.97 ÷ BD) – 4.52*	
		Female	*(5.02 ÷ BD) – 4.57*	
Black	*19 45*	*Male*	*(4.86 ÷ BD) – 4.39*	*Black*
	24 79	*Female*	*(4.86 ÷ BD) – 4.39*	
Hispanic	*20 40*	*Female*	*(4.87 ÷ BD) – 4.41*	*Hispanic*
Levels of Bodt Fatness			Levels of Bodt Fatness	
Anorexic	*15 44*	*Female*	*(4.96 ÷ BD) – 4.51*	*Anorexic*
Obese	*17 62*	*Female*	*(4.95 ÷ BD) – 4.50*	*Obese*

_Jackson, A. S., and M. L. Pollock. 1985. Practical assessment of body composition. Physician and Sportsmedicine 13:76–90.

_The McGraw-Hill Companies. American College of Sports Medicine.2000. ACSM's Guidelines for Exercise Testing and Prescription, 6th ed.

3.4.3.2. Menstruation-related Compliments

All Participants were briefed to keep a menstrual diary to see their menstrual cycle compliments. The participants' menstrual cycles were asked their last period's beginning date, and menstrual compliments were determined. (Regular cycle, oligomenorrhea and amenorrhea). The cycle bleeding duration and the cycle length were logged by the participants as the study continued. Women were also asked to write down their complaints about other menstruation related compliments experienced, like pain, cramps, spotting, mood changes, fatigue.

3.4.3.3. Pain Assessment

For pain assessment, the participants were asked to mark the painful points on the body chart and pelvic region chart and to score the pain intensity of the marked parts on a visual analog scale on a 0-10 scale [94]. In addition, participants filled out the McGill Pain Questionnaire short form which is gold standard for pain identification [95].

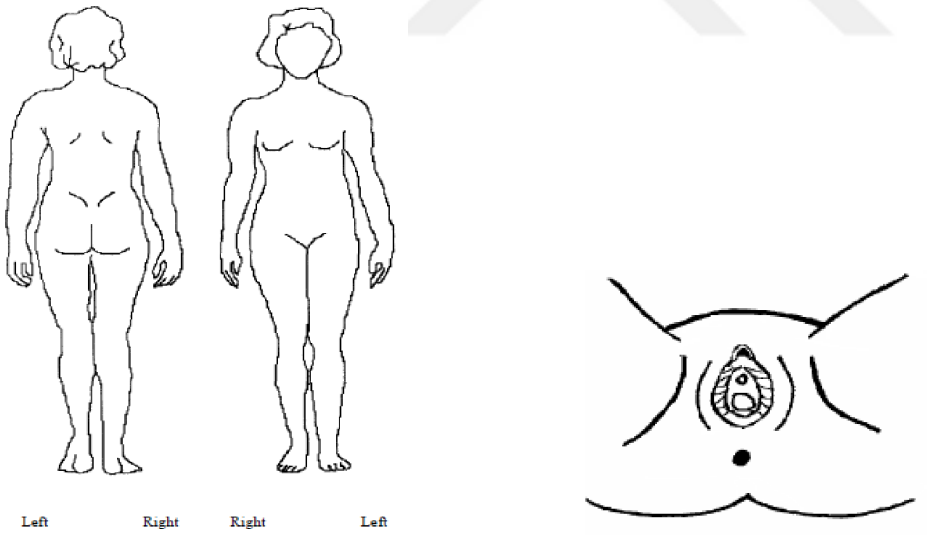


Figure 3.4. Pain body and pelvic charts

3.4.4. Functional Outcome Measurements

3.4.4.1. Functional Movement Assessment

The functional levels of the participants were analyzed with the Functional Movement System (FMS). FMS is a tool used to define body asymmetries and functional movements in detail in both diseased, healthy and athlete populations. (Appendix D) FMS consists of seven movement patterns that require mobility and stability: Deep squat, disabled stepping, lunges, active straight leg raises, trunk stability, push-ups, rotational stability, shoulder mobility. Volunteers were asked to perform these seven movement patterns, respectively, and the practitioner is given a score between 0-3 points for each pattern according to the FMS criteria, measured with a score between 0-21 points in total [96].

3.3.4.2. Detection and Evaluation of Posture Disorders

The postural evaluation was evaluated using New York Posture Analysis (NYPAD) which is a gold standard method. During the analysis, the back and side photographs of the whole body are taken against the grid mirror, and the gravity line is drawn in this photograph. Distance deviations are measured for the head region, neck, shoulder, neck/back/waist vertebrae, hip/knee/ankle joints from the line, and the final total result is calculated by giving 1-3 or 5 points for each region [97].

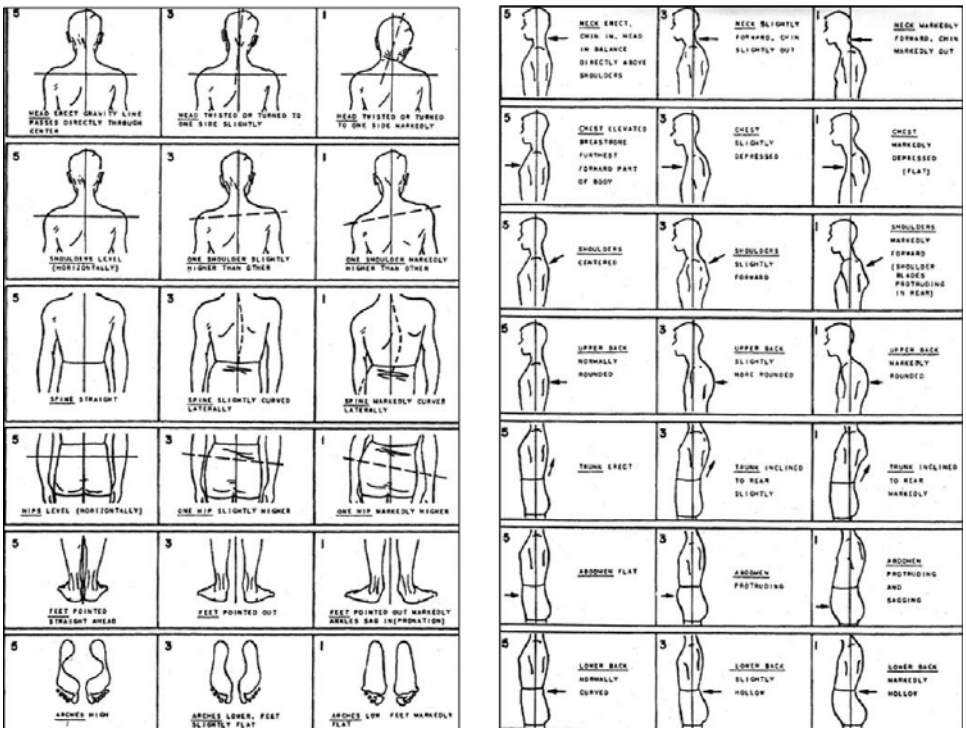


Figure 3.5. New York Posture Analysis

Figure 3.6. Posture assessment

3.4.5. Strength Measurements

Knee extension and triceps extension maximum isometric strength measurements were made for upper and lower body strength measurements. Force measurement was measured with a portable electronic dynamometer. For knee extension evaluation, the participant was placed chair with the knee was 90-degree angle. For triceps extension evaluation, the elbow joint was at a 90-degree angle. Measurements were taken three times with a one-minute repose and was accepted the highest score.

3.4.6. Analysis of Pelvic Floor Distress Level

Participants completed the Turkish version of a symptom inventory PFDI-20, which measures the degree of discomfort and distress caused by pelvic floor symptoms. (Appendix E) The inventory consists of 20 questions and three scales; each scored between 0 (low distress) and 100 (high distress). (Pelvic Organ Prolapse Inventory-8 questions, Colorectal-Anal Distress Inventory-6 questions, and Urinary Incontinence Distress Inventory-6 questions) [98].

Response scores ranging from 4 (quite) to 0 (not at all) were calculated for the PFDI-20 given to each item. For calculation, the mean value of all items for each scale was multiplied by 25, and the PFDI-20 total score was obtained by taking the sum of the three scales [98,99].

3.4.7. Evaluation of The Quality of Life

We found it important to implement the quality-of-life assessment with the disease-specific quality of life questionnaire for PCOS. We used the Turkish version of the PCOS Quality of Life Questionnaire (PCOSQ-50) to evaluate the quality of life. (Appendix F) PKOSQ-50 was developed specifically for PCOS by Nasiri-Amiri et al. [100]. It contains 50 items representing six domains: A. psychosocial and emotional, B. fertility, C. sexual function, D. obesity, and menstrual disorders, G. hirsutism and E. coping. The result was calculated by adding the scores for each question answered by choosing from the options on the 5-point Likert scale [100,101].

3.5. Interventions

All volunteers were informed about PCOS and lifestyle interventions. They were advised to be physically active in their daily life and were given home exercise recommendations.

The control group did not receive any exercise training during the study, except for exercise recommendations given at the first interview. Control group continued the routine treatment followed by the gynecologist and obstetrician during the study.

3.5.1. Progressive Resistance Exercise Training

Women in the exercise group were taken to supervised sessions by a physiotherapist in the Yeditepe University Physiotherapy and Rehabilitation Research Laboratory for four weeks, 2 days a week. Then followed eight weeks continued their exercise programs as online supervised sessions at home. Each session was approximately 60 minutes, and the study continued for a total of 12 weeks. In addition, in the first interview, all participants were asked to continue their exercise suggestions unsupervised throughout the study, and home-based programs were renewed at 4-week intervals after weekly checks. The purpose of including optional remote supervised and unsupervised home exercises in the program; It was to provide a behavioral change in individuals with PCOS and to try to adapt physical activity and exercise to their daily lives. The exercise prescription, which consists of all calisthenic exercises, is in line with PRT recommendations in literature [7,35,76,81,87].

The Progressive Resistance Exercise Training Program prescription was planned based on the recommendations of the American College of Sports Medicine for the goal of strengthening and endurance for adults [80]. Accordingly, each muscle group should ideally have a 2--3-minute rest interval between sets, with a total of 2-4 sets of 8--12 repetitions per set to improve muscle fitness [102]. (FITT-VP, principle of Ex Rx)
In order to facilitate continuous adaptation and improve health or performance in the long term, the increase in intensity and volume was made gradually improved [103]. Exercise progression was prepared by linear periodization. Linear periodization is a traditional form of load used for training, which refers to the increase in demand for muscle as it can generate more power or become more resilient. It is applied by decreasing the volume and increasing the density during the training period.

The exercise prescription consisted of calisthenic exercises using body weight and isoflex for resistance training. Exercise progression was applied by decreasing the volume and increasing the exercise difficulty. For this, 3 sets of 6 repetitions (6/6/6) completion are taken into account for the exercise in the proper form for each level. (3 sets of 6 repetitions for one-sided exercises, such as a single leg lift) 2 minutes rest is applied between sets. The participant who successfully completes the predicted number of sets and repetitions proceeds to the next level. This process continues until the participant fails to complete the number of sets and repetitions specified in the appropriate form that she has already applied. When a failure occurs, the previous level is recorded as the participant's level and training continues from this level. For example, for the push-up exercise, when the participant in the First level successfully completes the push-up exercise on the wall, which is the appropriate form, 3 sets, and 6 repetitions, he proceeds to the Second level and continues with the push-up exercise on the slope, which is the appropriate form of this level. This progress continues until the participant cannot successfully complete the proper form of the next level. For isoflex exercises, standard strength training bands (TheraBand) were used. There are different colored exercise tires for each resistance. Participants start training with resistance, where they can do 10 repetitions but cannot reach 14 repetitions.

In addition, the intensity of exercise was tried to be maintained at a submaximal level. For this, during exercise training, 5-6 / 10 fatigue value is followed according to Modified Borg Scale and this score is maintained and continues. Also, this corresponds

to the intensity of exercise that corresponds to 65-70% of the American Sports Medicine Association maximal heart rate [80].

During the program, exercise training, evaluation and applications were followed by a physiotherapist, and exercise sessions were determined according to the times when the participants were also available.

Table 3.1. PRT Exercise Program

Progressive Resistance Exercise Training Program:	
Warm-up period: (5-10min)	
Resistance Exercises: (50min)	
Side leg lift:	Hip abduction in the lateral lying position
Squat variations	From standing to lowering, the trunk is erect and the knees are deeply flexed and then rise to an upright position
Push-up variations:	Standing on arms with knees flexed in the prone position
Clamshells exercise:	Knees flexed in lateral lying position, with feet together, opening and closing the upper knee.
Calf raises exercise:	Rise on the toe tip
Lateral arm lift:	Right and left shoulder abduction
Abdominal exercises:	
Rectus abdominus	Knees flexed in the supine position and head lift
Lower abdominal	Hip flexion-extension in the supine position
Bridge exercises	Lifting the hip up from the hook position
Bird-dog exercise:	Contralateral arm and leg extension in the crawling position
Recovery period: (5-10 minutes)	

Figure 3.7. Bridge exercises

Figure 3.8. Clamshells exercise

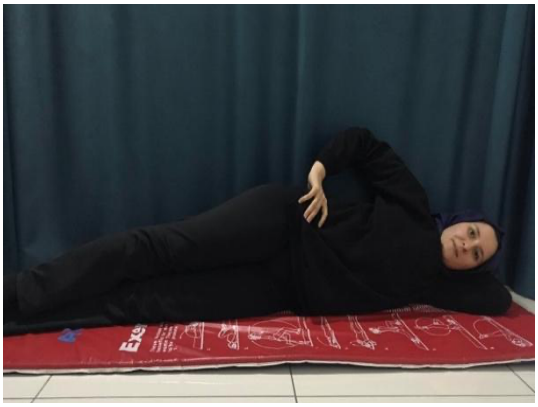


Figure 3.9. Side legs rise exercise

Figure 3.10. Bird-Dog exercise

Figure 3.11. Push-up exercises

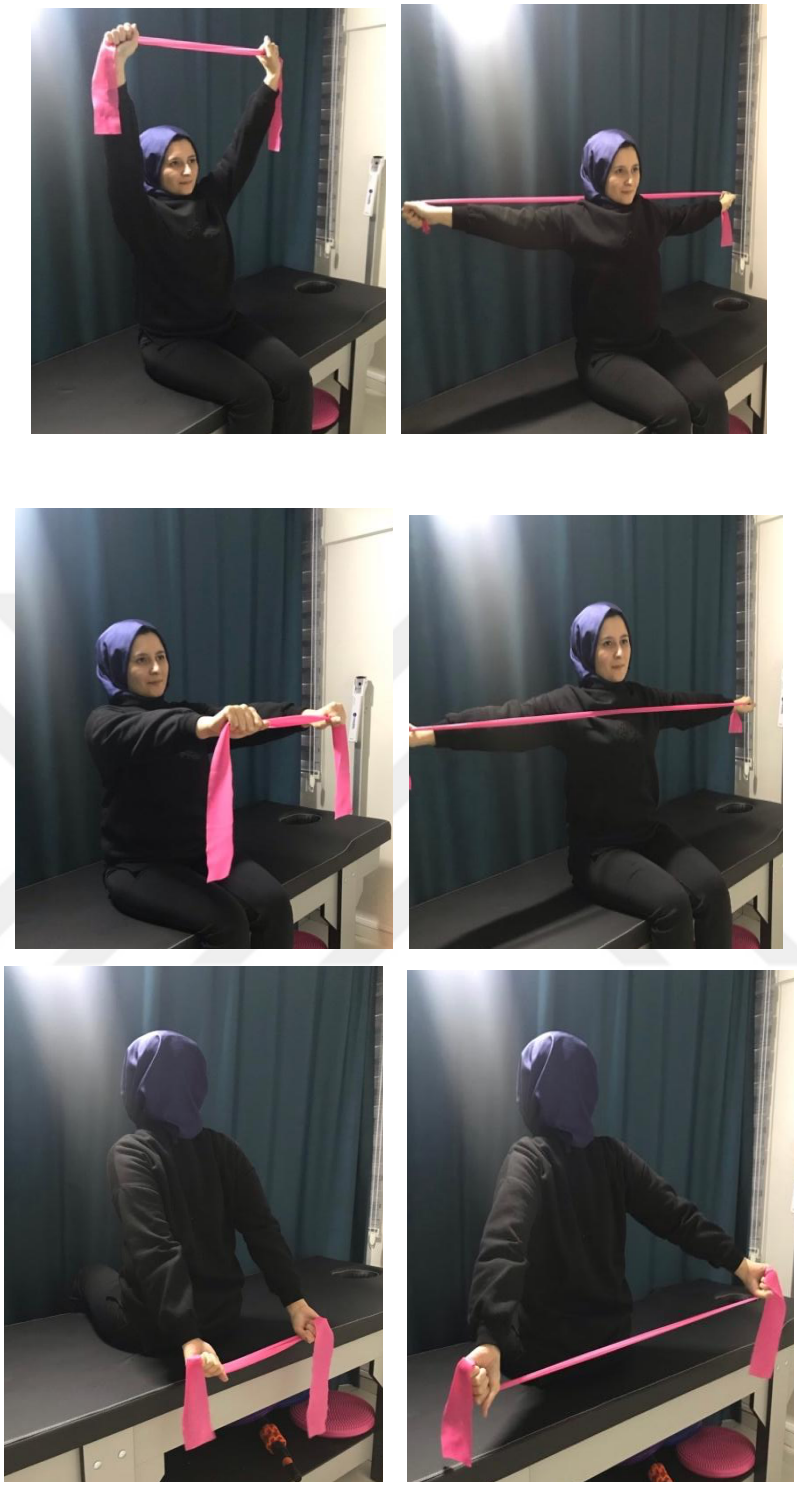


Figure 3.12. TheraBand exercise for arms

Figure 3.13. Squat exercises

3.6.Statistical Analysis

The data obtained according to the evaluation results were analyzed using SPSS 21.0. The Kolmogorov-Smirnov test was used to test the numerical variables for normality. The summary of numerical data was showed with descriptive statistical methods (mean, ± standard deviation, frequency) and ratio was used for categorical data. Independent Samples T-Test method was used for comparison between groups with the collected both before and after treatment. Also, to measure the effectiveness of the existence of the exercise, the linear regression analysis is conducted among the difference data, which is calculated by subtracting the week 0 data from the week 12 data. During linear regression analysis, a dummy variable is assigned to participants who are in the PRT (exercise) group. The significance level was accepted 0.05.

4. RESULTS

This study was conducted with 40 women with PCOS ages between 18-40 to investigate the effects of progressive resistance exercise training on physical parameters, psychosocial status, and pelvic floor distress level.

4.1. General Characteristics of The Participants

The demographic information (age, educational level, marital status, job) and health habits (exercise habit, diet, smoking and alcohol usage, caffeine intake) in the study groups were given in Table 4.1. There were no statistically significant differences according to demographic features except marital status between the two groups.

Regular medication use was taken into account, and it was similar in both groups. Seven people from the exercise group (n=20) and nine people from the control group (n=20) were using oral contraceptives. (Graphic 4.1)

Graphic 4.1. Regular Medication - Oral Contraception (OC) usage

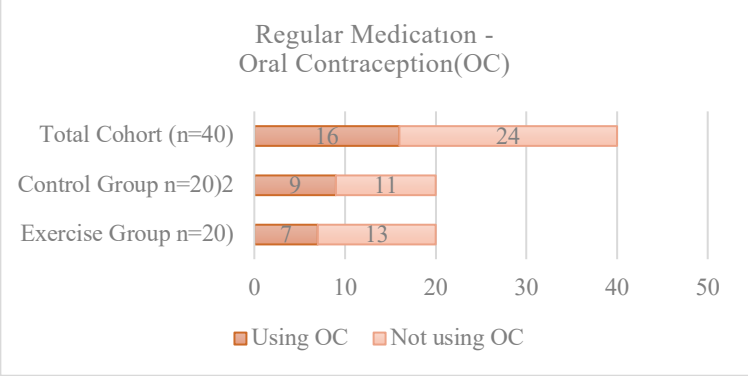


Table 4.1. The demographic features of the cohort

Demographic Features		PRT Group (n=20) (mean)		Control Group (n=20) (mean)		Total cohort (n=40) (mean)
Age (mean)		26,7		26,05		26,38
Weight (kg)		68,21		68,55		68,21
BMI (kg/m2)		24,5		24,96		24,7
Waist (cm)		78,88		78,4		78,88
Hip (cm)		105,76		153,45		105,76
WHR		0,74		0,74		0,74
Marital Status	Single	12	48%	13	52%	25
	Engaged	3	75%	1	25%	4
	Married	3	33%	6	67%	9
	Divorced	2	100%	0	0%	2
Education	High School	2	40%	3	60%	5
	College	16	53%	14	47%	30
	Higher Education	2	40%	3	60%	5
Job	Student	4	44%	5	56%	9
	Part-Time	4	57%	3	43%	7
	Full-Time	8	50%	8	50%	16
	Not Working	4	50%	4	50%	8
Exercise Habit	Rare	15	52%	14	48%	29
	Less Than 3 Times A Week	5	45%	6	55%	11
	More Than 3 Times A Week	0		0		0
Dietary Habit	Balanced Diet	15	60%	10	40%	25
	Fast Food	5	38%	8	62%	13
	Vegan	0	0%	1	100%	1
	Vegetarian	0	0%	1	100%	1
Caffeine Intake	1 cup of a day	2	67%	1	33%	3
	2 cups of a day	5	42%	7	58%	12
	3 cups of a day	7	44%	9	56%	16
	4 cups of a day	4	67%	2	33%	6
	5cupsp of a day	2	67%	1	33%	3
Alcohol Usage	No	13	46%	15	54%	28
	Yes	7	58%	5	42%	12
Smoking	No	14	44%	18	56%	32
	Yes	6	75%	2	25%	8

Data expressed as mean and percent (%). PRT: Progressive resistance exercise training BMI: Body mass index. WHR: Waist hip ratio.

4.2. Comparison of Clinical Complaints of Groups

The clinical features (hirsutism, acne, alopecia, menstruation) are present in the Table 4.2. Pre-intervention clinical complaints were similar in both groups.

Table 4.2. The clinical features of the cohort

Clinical Sign and Symptoms		PRT Group (n=20)	Control Group (n=20)	Total cohort (n=40)
Hirsutism	No	6	2	8
	Yes	14	18	32
Acne	No	3	4	7
	Yes	17	16	33
Alopecia	No	14	9	23
	Yes	6	11	17
Menstruation Cycle	Regular Cycle	6	5	11
	Oligomenorrhea	13	15	28
	Amenorrhea	1	0	1

PRT: Progressive resistance exercise training

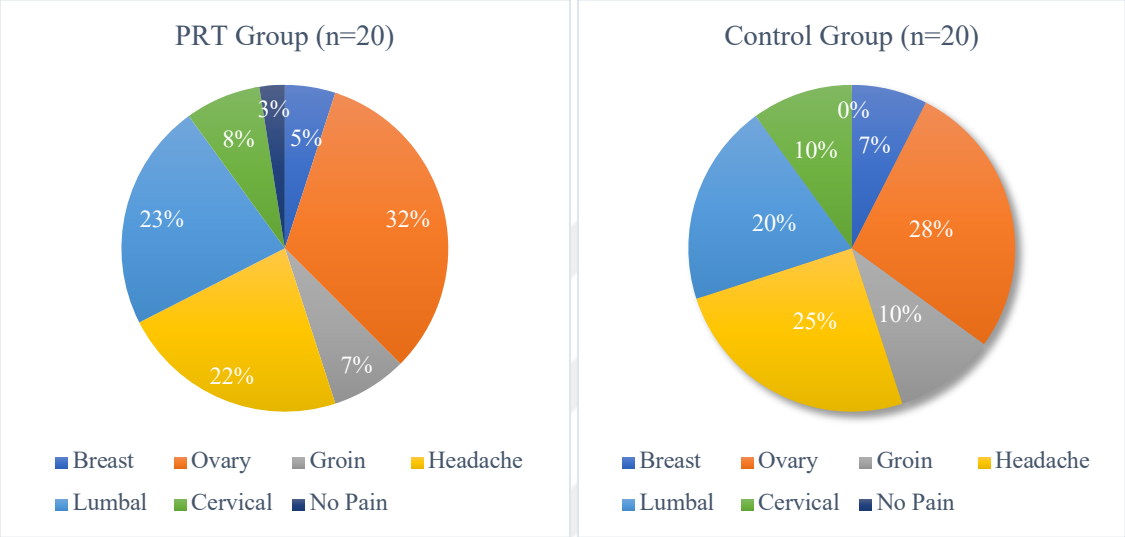
There were no statistically significant differences according to clinical complaints except menstruation cycle between the two groups. Initial menstrual cycle conditions (normal cycle, oligomenorrhea, amenorrhea) in the groups are shown in the Table 4.2.

Changes in the menstrual cycle after PRT intervention were noted as from regular cycle to oligomenorrhoea (n=1), no change (n=3), and oligomenorrhea and decreased cycle length (n=3). For women in the control group (n=20), menstrual cycle changes were found to be no change (n=4) and oligomenorrhea and cycle length increased (n=1), oligomenorrhea and cycle length decreased (n=2).

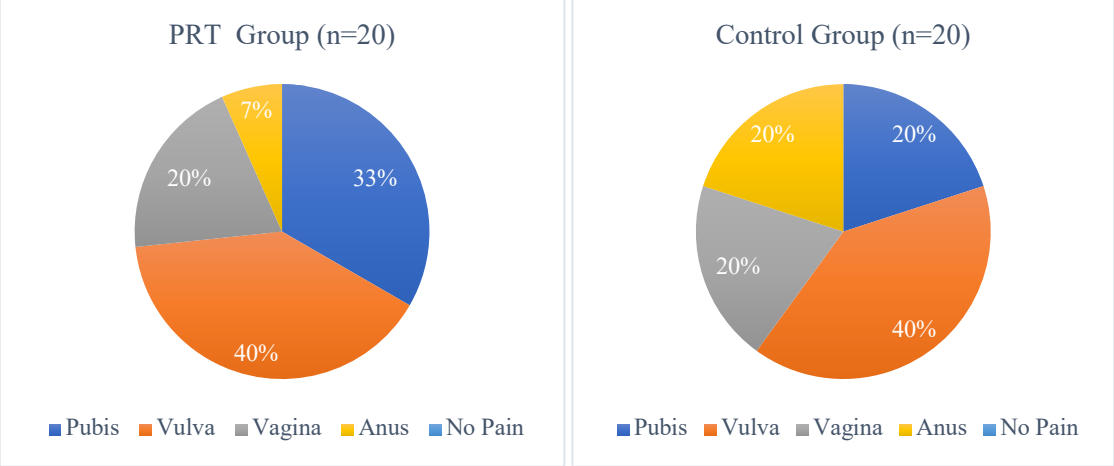
4.3. Comparison of The Differences in Pain Assessments

Participants marked their painful areas on the body chart and pelvic chart. (Appendix 3) The areas where the pain is generally felt in the exercise and control groups are shown on the Graphic 4.2 and Graphic 4.3 for body and pelvic charts.

Graphic 4.2. The pain areas according to the body chart



Graphic 4.3. The pain areas according to the pelvic chart



According to the statistical analysis results of the VAS evaluations, the pain reduction in the ovarian (p:0.01) and lumbar (p:0.01) regions of the exercise group after the intervention was statistically significant. There was also a decrease in headache (p:0.025), but it was not statistically significant. (Table 4.3)

No statistically significant results were found for pain in the pelvic region in the statistical analysis results. (Table 4.4)

Table 4.3. Comparison of the differences in body chart pain scores according to the VAS within the groups

		PRT Group		Control Group		p-value
HEADACHE VAS	BT	4,33	2,18	5,10	1,52	,383
	PT	2,78	2,05	4,90	1,73	,025
	p	0,02		0,51		
CERVICAL VAS	BT	7,00	2,00	4,75	1,50	,147
	PT	3,33	2,31	5,75	1,71	,169
	p	0,03		0,51		
BREAST VAS	BT	6,00	2,83	5,67	0,58	,844
	PT	0,00	0,00	5,67	0,58	,001
	p	0,20		*		
OVARY VAS	BT	7,69	1,93	7,00	1,48	,343
	PT	2,62	2,84	6,82	1,40	,000
	p	0,00		0,34		
LUMBAL VAS	BT	6,44	2,01	5,13	2,23	,219
	PT	2,00	1,66	5,63	1,92	,001
	p	0,00		0,45		
GROIN VAS	BT	7,25	0,96	5,83	1,47	,131
	PT	3,75	4,35	5,50	1,05	,360
	p	0,15		0,36		

PRT: Progressive resistance exercise training. VAS: Visual Analog Scale. BT: Baseline testing; PT: Post testing; Std.: Standard Deviation; *: The correlation and t cannot be computed because the standard error of the difference is 0.

Table 4.4. Comparison of the differences in body chart pain scores according to the VAS within the groups

		PRT Group		Control Group		p-value
VULVA VAS	BT	5,00	,	5,75	2,06	,766
	PT	2,00	,	5,75	2,22	,228
	p	0,02	*	1.00		
VAGINA VAS	BT	7,00	1,00	4,50	0,71	,058
	PT	2,67	1,53	4,50	0,71	,223
	p	0,07		*		
PUBIS VAS	BT	6,00	1,41	5,50	0,71	,666
	PT	3,40	2,07	5,50	0,71	,240
	p	0,12		1,00		
ANUS VAS	BT	3,00	,	3,00	0,00	N=1
	PT	2,00	,	3,50	0,71	,333
	p	*		0,50		

PRT: Progressive resistance exercise training. VAS: Visual Analog Scale. BT: Baseline testing; PT: Post testing; Std.: Standard Deviation *: The correlation and t cannot be computed because the standard error of the difference is 0.

4.4. Inter-Group and Intra-Group Evaluations of Physical and Functional Outcome Measures

Statistical analysis of physical and functional measurement results of pre and post-tests between groups are summarized in Table 4.5.

Table 4.5 Inter-group and intra-group changes on physical and functional measurements

	Exercise Group (n=20)				**Control Group (n=20)**					
	Week 0		**Week 12**		**Week 0**		**Week 12**			
	Mean	Stdev	Mean	Stdev	Mean	Stdev	Mean	Stdev	**Coefficient**	**P-Value**
Physical Outcomes										
Weight (kg)	68,21	10,84	66,89	10,81	68,55	10,24	109,2	180,51	-5,18	1,83E-08
BMI (kg/m2)	24,71	4,11	24,22	4,06	249,55	42,21	254,15	43,13	-1,9	1,43E-08
Waist (cm)	78,88	13,39	77,59	12,83	78,4	12,55	107,1	122,5	-3,73	1,07E-05
Hip (cm)	105,76	10,6	104,99	10,31	153,45	212,38	153,4	212,4	-1,45	1,94E-02
WHR	0,74	0,08	0,74	0,08	0,74	0,08	0,74	0,08	-0,03	3,15E-06
Skinfold Measurements										
Triceps (mm)	24,5	5,66	23,7	5,31	22,75	6,51	22,65	6,47	-1,4	8,97E-05
Biceps (mm)	22,66	3,97	22,54	3,96	32,55	45,53	33,35	47,7	-0,95	4,09E-04

Subscapular (mm)	18,83	5,58	18,3	5,1	17,75	5,14	24,45	28,85	-1,4	2,18E-03
Suprailiac (mm)	24,88	7,27	24,36	6,91	26	6,62	26,45	6,41	-1,93	3,75E-05
Anterior Tight (mm)	24,36	4,56	24,01	4,52	35,3	49,56	24,45	4,55	-1,05	8,02E-04
Body Density	1,04	0,01	1,04	0,01	1,04	0,01	1,04	0,01	0	9,98E-06
Body Fat %	28,00 %	4,60 %	27,60 %	4,40 %	27,80 %	4,70 %	28,10 %	4,70 %	-0,02	2,10E-06
Skinfold Three	24,58	5,29	24,02	4,97	24,34	5,42	24,52	5,33	-1,46	2,29E-06
Skinfold Total	90,86	20,46	88,9	19,11	88,93	21,26	89,8	21,23	-5,68	9,25E-06
Functional Outcomes										
NYP	37,3	6,35	48,58	10,86	39,4	7,52	40,3	8,08	20,75	1,34E-14
FMS	11,03	3,83	15,43	4,53	11,9	4,8	12,15	3,94	8,3	6,01E-12
Lower body strength(N)	238,75	29,95	345,65	46,15	242,5	29,98	249,25	46,01	96,4	8,18E-08
Upper body strength(N)	133	20,84	165,45	27,28	135	19,5	137,85	17,97	27,6	5,42E-04

Data expressed as mean ± standard deviation. PRT: Progressive resistance exercise training. BMI: Body mass index. WHR: Waist hip ratio. NYP: New York Posture Analysis. FMS: Functional Movement Screen. lbs: pounds

As a result of statistical analysis, BMI, weight, waist circumference showed statistically significant differences between the first and last test findings in anthropometric measurements, but there was no statistical difference in hip circumference. In statistical analyzes for skinfold measurements, statistically, significant differences were found in triceps, suprailiac, tight regions, and body fat %. However, there was no statistical difference in the biceps and subscapular regions.

Comparing the pre- and post-measurement findings of the FMS were demonstrated that a statistically significant difference was found in the PRT group.

According to the statistical analysis results, the results of NYPAD posture analysis in the PRT group were also statistically significant.

An increase was observed in the PRT group according to the triceps strength test results but a statistically significant increase in Knee strength was missed. According to statistical analysis, there was no change in both upper and lower body strength in the control group.

4.5. Inter-Group and Intra-Group Evaluations of PFDI-20

Table 4.6 Inter-group and intra-group changes on PFDI-20

	Exercise Group (n=20)				**Control Group (n=20)**					
	Week 0		**Week 12**		**Week 0**		**Week 12**			
	Mean	Std	Mean	Std	Mean	Std	Mean	Std	**Coefficient**	**P-Value**
Pelvic Floor Distress Inventory (PFDI-20)										
POPDI-6	10,31	10,67	8,44	9,69	8,75	8,21	8,96	9,1	-4,17	2,13 E-02
CRADI-8	20,38	14	14,33	13,78	17,26	13,38	17,26	15,59	-12,09	7,49 E-05
UDI-6	39,37	20,93	31,67	21,7	38,12	22,91	42,08	23,76	-23,33	8,62 E-06
PFDI Total	70,06	36,89	54,44	35,65	64,13	37,49	68,3	40,59	-39,59	1,02 E-06

Data expressed as mean ± standard deviation. PRT: Progressive resistance exercise training. PFDI: Pelvic floor distress inventory. POPDI: Pelvic organ prolopsus distress inventory. CRADI: Colorectal-anal distress inventory. UDI: Uriner distress inventory.

According to the statistical analysis of the PFDI test results, no statistically significant results were found in the other groups except the CRADI group. In the CRADI subgroup evaluating colorectal distress, the results were statistically significant in the PRT group compared to the pre-intervention and post-intervention results. (Table 4.6)

4.6. Inter-Group and Intra-Group Evaluations of PCOSQ-50

According to the results of the statistical analysis, PCOSQ outcome measures were found to be statistically significant in the PRT group in all subgroups, except for the Sexual functions subgroup. (Table 4.7)

The PCOSQ Sexual Function subgroup data were evaluated by only sexually active participants in the PRT and control groups.

Table 4.7 Inter-group and intra-group changes on PCOSQ-50

	Exercise Group (n=20)				Control Group (n=20)					
	Week 0		Week 12		Week 0		Week 12			
	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Coefficient	P-Value
Quality of Life - PCOSQ										
A-Psychosocial and Emotional	33,4	10,05	40,73	13,08	32,45	10,83	31,35	10,92	16,85	2,04E-10
B-Fertility	20,35	7,74	24,58	9,37	18,85	8,05	18,3	8,66	9,55	6,16E-09
C-Sexual Function	29	5,85	32,98	8,54	27,9	6,5	26,8	7,42	10,15	5,21E-13
D-Obesity and Menstrual Disorders	23,4	8,25	28,53	10,13	22,25	8,24	21	7,97	12,75	1,64E-08
E-Hirsutism	14,48	7,03	20,2	8,45	13,5	6,12	14,05	6,21	10,35	1,14E-07
G-Coping	23,03	7,49	27,65	8,52	22,2	7,88	21,45	7,99	10,75	2,12E-07
Total	143,65	30,95	174,65	47,69	137,15	28,31	132,95	27,04	70,4	2,92E-13

Data expressed as mean ± standard deviation. PRT: Progressive resistance exercise training. PCOSQ: Polycystic ovary syndrome questionnaire

4.5. Inter-Group Evaluation of Ovarian Volume Measurements in The PRT Group

Statistical analyzes of ovarian volume measurement results according to ultrasound evaluation are shown in Table 4.6. According to the statistical analysis results, there was a decrease in ovarian volume in the PRT group between before and after the intervention, but it was not statistically significant. (p:0.057)

In addition, subgroup analysis was performed by separating individuals who used OCs and those who only exercised in the PRT group. In the statistical analysis results, there was no statistically significant difference in terms of ovarian volume change between these two groups that did only exercise and exercise+OC.

Table 4.6 Comparison of ovarian volume in the PRT sub-group using OC and exercising only

		PRT GROUP	
		Mean	Std.
Ovarian volume	BT	12,60	6,97
	PT	11,47	7,87
	p	0,057	

		PRT only		PRT + OC		
		Mean	Std.	Mean	Std.	P-value
Ovarian volume	BT	10,90	3,31	14,31	9,23	,285
	PT	10,37	3,38	12,58	10,80	,546
	p	,303		,117		

Data expressed as mean ± standard deviation. PRT: Progressive resistance exercise training. PRT+OC: Progressive resistance exercise training + oral contraception. BT: Baseline testing. PT: Post testing.

4.6. Adherence to PRT intervention

Participation was assessed from control charts used to monitor supervised and un-supervised exercise sessions. Participation in the exercise program was 98% for supervised sessions and 95% for home-based exercises, in the exercise group. Participation in supervised sessions was high (98%) for participants in the program. On the other hand, participation in home-based sessions was found to be lower in the participants.

4.7. Statistical analysis

The data obtained according to the evaluation results were analyzed using SPSS 21.0. The Kolmogorov-Smirnov test was used to test the numerical variables for normality. The summary of numerical data was showed with descriptive statistical methods (mean, ± standard deviation, frequency) and ratio was used for categorical data. Independent Samples T-Test method was used for comparison between groups with the collected both before and after treatment. Also, to measure the effectiveness of the existence of the exercise, the linear regression analysis is conducted among the difference data, which is calculated by subtracting the week 0 data from the week 12 data. During linear regression analysis dummy variable is assigned to participants who are in the PRT (exercise) group.

5. DISCUSSION

The primary purpose of this study was to evaluate the effects of 12-week progressive resistant exercise training on physical parameters, psychosocial state, polycystic ovary morphology, and clinical complaints in women with polycystic ovary syndrome. We found that progressive resistance exercise training improved body composition such as body weight, body mass index, waist circumference, waist-hip ratio, skinfold body fat measurements (i.e., triceps, suprailiac, body fat percent), functional movements, disease-specific quality of life (i.e., psychosocial and emotional, fertility, obesity, and menstrual disorders, coping) and colorectal pelvic floor distress (CRADI-8 in PFDI-20) in the exercise group relative to the routine care.

Current evidence-based guidelines are the recommended lifestyle interventions, among which exercise is one of the important components, as first-line therapy for PCOS [7,35]. A recent review of articles provided evidence that PRT may benefit women with PCOS [81,115,116] and explored different prescriptions of PRT for PCOS. According to our research, the present study is the first study in the literature stating that a progressive resistance exercise program consists of completely calisthenic exercises.

The participants were evaluated with a prepared participation table in terms of adherence. The control group had very low compliance with exercise recommendations. In general, the participation rate in the exercise group was high (99%). In addition, the participation in the supervised sessions in the exercise group was better than in the home-based unsupervised sessions. The literature similarly demonstrates the need for supervision due to support in the correct and reliable implementation of exercise interventions and acquiring exercise habits. The importance of supervised and patient-centered interventions is also emphasized in the PCOS Guideline [7].

This study provided some clinically significant adjustments to the PRT intervention that may be associated with better disease management and treatment of the underlying pathology. As a result, the post-intervention evaluations of the two groups were similar. Changes such as the transition from regular cycle to oligomenorrhea (n=1), oligomenorrhea, and a decrease in cycle length (n=3) were observed in the menstrual cycle in the PRT group, and changes such as oligomenorrhea and cycle length increased (n=1), oligomenorrhea and cycle length decreased (n=2) in the control group. However, other studies [71,72,105] have shown that exercise regulates the menstrual cycle,

increases menstrual density, and improves infertility using a similar methodology (i.e., self-reported menstrual diary). Accordingly, studies should continue to investigate the appropriate PRT dosages and duration to provide the necessary improvement in women with menstrual irregularities. The variables, including the study participants' physical activity, nutrition, and stress, should be reported in detail.

The etiology of PCOS is closely related to body composition [32]. Kogure et al. (70), Vizza et al. (78), and Almenning et al. (117) have reported improvement in body composition in women with PCOS. Similarly, according to the outcome measures of this study, BMI ($p<0,05$), weight ($p<0,05$), and WHR ($p<0,05$) were significantly reduced in women with PCOS with the PRT intervention. These results were accompanied by a reduction in triceps, suprailiac, and tight skinfold measures ($p<0,05$) and a significant reduction in body fat percent-($p<0,05$). With or without weight loss, the decrease in BMI, WHR, and fat measurements and the improvement of PCOS-related symptoms are significant in terms of positive outcomes in managing the disease, which can contribute to general health. It should also be noted that these physiological data are challenging to interpret in a small-scale study. Future studies in larger cohorts that also apply precise measures of insulin resistance are needed to investigate these adaptations, including determining dose-response effects for each outcome.

In the literature, various studies compared PCOS and non-PCOS women, and according to their outcomes, a higher rate of muscle strength was reported in women with PCOS. Several studies suggested that muscle fibers may be effective in insulin resistance with the glucose mechanism. Also, it was mentioned that the benefit of resistance exercises was associated with hyperandrogenism [44]. Kogure et al. showed a more significant effect on muscle strength after resistance exercise, particularly in PCOS, than in non-PCOS women [105]. Likewise, Güzelce E. et al. reported that muscle mechanical function changes and muscle strength are associated with hyperandrogenism in women with PCOS [106]. Ramos et al. [113] have found an increase in functional fitness and quality of life. Similar to the literature, our study showed an increase in the muscle strength ($p<0,05$) of the participants and showed an improvement in their functional movements (FMS score $p<0,05$) in the PRT group. Accordingly, our study finds that postural and functional recovery after PRT motivates patients as a sustainable method. This result might be important for exercise continuity and inclusion in daily life.

However, further studies are needed to determine the clinical significance of strength adaptation in the PCOS population.

Polycystic morphology and increased ovarian volume on ultrasound are diagnostic criteria and affect clinical features and progression [2,85]. In this study, the possible effect of PRT on ovarian ultrasound volume was first investigated. The PRT exercise group compared pre-exercise and post-exercise ultrasound evaluations of polycystic ovary morphology. The change in ovarian volume in pre-and post-exercise was not statistically significant, but a decrease in ovarian volume was observed (p=0,057). Although the polycystic appearance is not statistically significant, the decrease can be interpreted in favor of PRT intervention. Redman et al. showed that aerobic exercise training decreased the number of follicles without changes in body composition or sex steroids, and they interpreted that this finding may be the result of a change in insulin sensitivity [119]. In women with PCOS, an improvement in insulin sensitivity and a decrease in ovarian volume by approximately 30% were observed after six months of metformin treatment [120]. Although there is no significant result, short-term (12 weeks) exercise training showing a decrease in ovarian volume (0.059) can be interpreted in favor of improvement. A more comprehensive exercise study may be applied to assess this finding better. In addition, the ultrasound results of the participants who used oral contraception and did not use oral contraception were compared according to the evaluation of the subgroup in the PRT group. There is no statistically significant difference.

Some studies evaluating women with PCOS stated an increase in pelvic floor muscle dysfunction [58-62]. Montezuma et al. [60] and Antônio et al. [61] have reported increased urinary incontinence frequency in PCOS. Micucci et al. [59], Antônio et al. [61], and Vassimon et al. [62] noted that pelvic floor muscle might be associated with hormone levels in women with PCOS. Some of these studies have indicated the effects of pelvic floor dysfunction on daily life in women with PCOS. In this study, patients' complaints were evaluated with the PFDI-20 questionnaire to question the positive or negative effects of resistive exercises on their complaints about the pelvic floor. Some of the patients (n=13) stated that their complaints decreased after exercise compared to pre-intervention in the exercise group. Taghavi et al. noted that it increased in women with pelvic organ prolapse and PCOS, but we observed a difference in colorectal-anal distress. Also, a statistically significant improvement was observed in the CRADI-8 subgroup (p<0,05), which evaluated the complaints of colorectal distress after PRT intervention. In

addition, the participants verbally stated that this assessment made them aware, and their complaints decreased. In later studies, a more detailed evaluation of the intervention may be recommended on the pelvic floor or support for women with PCOS.

Several studies in the literature described that women with PCOS have pain, especially in the ovarian region. Similarly, it was determined that the majority of all participants experienced headache (n=19) and pain in the ovary (n=24), the groin (n=7), lumbal (n=17), cervical (n=7), and breast (n=5) in the total cohort. Pain complaints were significantly reduced in the exercise group compared to the control group. However, this study is insufficient to associate pain and exercise with PCOS. For a more accurate interpretation of the found results, pain relief should be considered in future studies to reduce the quality of life in patients with PCOS and these complaints.

Studies conducted on women with PCOS have stated that the quality of life decreases in PCOS, as it is a life-long condition that affects all heterogeneous systems [52]. In the literature, quality of life for PCOS was seen as an essential criterion for many interventions, and clinically significant results were noted. In addition, the effects of exercise on quality of life are known in all populations. Similar to the literature, the current study observed a significant improvement in PCOSQ, a PCOS-specific quality of life assessment scale performed after exercise intervention. Psychosocial and emotional ($p<0,05$), obesity and menstrual disorders ($p<0,05$), and coping ($p<0,05$), among the subgroups of the questionnaire that deal with symptoms specific to PCOS, significantly improved. In addition, since the sexual function domain was filled only by those with an active sexual life, an evaluation was made among themselves (n=14). Although some studies reported improvement in sexual complaints, no significant difference was found in our study. In order to comment on this issue, a more detailed analysis is needed, as in the study of Lara et al. [55].

To our knowledge, this study is the first study in the literature to provide progressive resistance exercise training with a program consisting of calisthenic exercises. The calisthenic exercises provided an advantage in terms of ease of application and inclusion in the daily life of women with PCOS, and this type of exercise program may be beneficial in promoting health and improving general symptoms in women with PCOS. Adaptation to daily life may provide additional benefits, as continuity is paramount in lifestyle interventions such as exercise.

6. CONCLUSION

According to the results of our study, we conclude that 12-week supervised progressive resistance exercises may provide better outcomes in women with PCOS when used with routine treatments. Our results showed improvement in physical parameters such as BMI, WHR, andbody fat percentage, which can provide insight into PCOS-related symptoms and progression, improved functional movements, and quality of life compared to pre-intervention measurements. A decrease was detected in the clinical complaints of the participants after the exercise intervention. More significant improvement in menstrual dysfunction was seen in the exercise group. In addition, women with PCOS who complained of pain had decreased pain intensity on VAS. Pelvic floor distress levels were evaluated with the PFDI-20, and an improvement in colorectal distress level (CRADI) with exercise was observed.

Limitations

- The extended follow-up results were needed to evaluate the long-term effects of progressive resistance exercise programs.
- Oral contraceptive use was similar in both groups, but creating separate groups with larger numbers of participants might have made it easier to understand the effectiveness of exercise alone.
- We compared ultrasound evaluation only within the exercise group before and after efficacy, and with subgroup evaluation between exercise and oral contraceptive users or non-users, adding control group data would also provide insight.
- We included a small study size (n=40), which was inadequate for generalizing the results.

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8. APPENDICES

Appendix A: Informed Written Consent

BİLGİLENDİRİLMİŞ ONAM FORMU

Araştırmanın Adı: Polikistik Over Sendromlu Kadınlarda Progresif Dirençli Egzersiz Eğitiminin Fiziksel, Psikososyal Durum Ve Pelvik Taban Distres Düzeyi Üzerine Etkileri

Sayın Katılımcı,
Yukarıda adı yazılı araştırmaya katılmak üzere davet edilmiş bulunmaktasınız. Bu araştırmada yer almayı kabul etmeden önce, araştırmanın ne amaçla yapılmak istendiğini anlamanız ve bu bilgilendirme sonucunda kararınızı vermeniz gerekmektedir. Aşağıdaki bilgileri lütfen dikkatlice okuyunuz, sorularınız olursa sorunuz ve açık yanıtlar isteyiniz.
Bu araştırma üreme çağındaki kadınlarda sık görülen bir hastalık olan Polikistik Over Sendromu ile ilgili tedavi yaklaşımlarına katkı sağlamak ve egzersiz eğitiminin etkilerini değerlendirmeyi amaçlanmıştır. Polikistik Over Sendromu (PKOS), adet düzensizlikleri, kıllanma artışı ve yumurtalıklarda polikistik görünüm gibi belirtileri olan ve üreme çağındaki kadınlarda en sık görülen endokrin bozukluktur. PKOS tedavisinde hastalığı iyileştirmek ve bu etkileri önlemek amacıyla medikal tedaviler (ilaç tedavisi) ve cerrahi yaklaşımlar ve bunun yanında, düzenli egzersiz, dengeli diyet ve davranış stratejilerinden oluşan sağlıklı yaşam tarzı müdahaleleri önerilmektedir. Fiziksel aktivite ve egzersizin, kilo kotrolü ve obezite üzerinde etkili olduğu, hormonal sonuçları ve genel sağlığı iyileştirdiği, diyabet, hipertansiyon, psikososyal problemlerin azaltılması ve önlenmesinde etkili olduğu ve yaşam kalitesinde artışı sağladığı bilinmektedir. Bu araştırma, PKOS'lu kadınlarda egzersiz eğitiminin tedavideki etkilerini değerlendirmeye katkı sağlayacaktır.
Araştırma Yeditepe Üniversitesi Fizyoterapi ve Rehabilitasyon Bölümü ve Yeditepe Üniversitesi Kadın Hastalıkları ve Doğum Anabilim Dalı tarafından yürütülmektedir. Araştırmaya sizin dışınızda 40 kişi katılacaktır. Öncelikle sizden kişisel bilgilerini, pelvik taban bozukluklarını ve yaşam kalitelerini değerlendiren ve yaklaşık 15 dakika süren anketleri doldurmanız istenecektir. Bu anketteki sorulara doğru cevap vermeniz çalışmanın işleyişi açısından önemlidir. Daha sonra fizyoterapist tarafından; kütle, Beden kütle indeksi hesaplaması, bel-kalça oranı (BKO), vücut yağ oranı (Skinfold Ölçümü), fonksiyonel hareket, ağrı ve duruş bozuklukları yönünden değerlendirme ölçümleri yapılacaktır. Ayrıca çalışma süresince menstrual döngü (adet döngüsü) takiplerinizi standart günlük ile yapmanız istenecektir. Çalışma ve kontrol grupları arasında tedavi öncesi ve sonrası klinik semptomları açısından oluşabilecek farkları değerlendirmek amacıyla, tüm gönüllülere tedavi sonrasında da tedavi öncesi değerlendirme ölçümleri tekrar uygulanacaktır. Çalışmaya katılan tüm gönüllülere PKOS hakkında genel bilgilendirme yapılacak ve yaşam tarzı müdahaleleri hakkında öneriler verilecektir. 40 gönüllü ile yürütülecek çalışmada gruplar arası ve tedavi öncesi-sonrası farkları karşılaştırmak için kontrol ve çalışma olmak üzere 2 ayrı grup oluşturulacaktır. Kontrol ya da çalışma grubuna gönüllülerin atanması rastgele yapılacaktır. Kontrol grubuna sadece medikal tedavisine devam ederken çalışma grubundaki gönüllülere Progresif Dirençli Egzersiz Eğitimi verilecektir ve takibi fizyoterapist tarafından yapılacaktır. Egzersiz programı 12 hafta boyunca haftada 2 gün olmak üzere ve her bir seans 60 dk

sürecek şekilde uygulacaktır. Bunun ilk 4 haftası birebir seanslar halinde, takip eden 8 hafta ise ev takipli olarak devam edecektir. Çalışma süresince tedavi uygulanabilmesi için çalışmamız sırasında uygulanacak olan egzersiz programına fizyoterapistinizin önerileri doğrultusunda dikkatle uyulması ve düzenli katılım sağlanması beklenmektedir. Aksi halde araştırmaya katılım sonlandırılacaktır.
Bunun size ve yakınlarınıza hiçbir zararı olmayacaktır. Çalışmaya katılmakla parasal yük altına girmeyeceksiniz ve size de herhangi bir ödeme yapılmayacaktır.

Bu araştırmaya katılıp katılmamakta tümüyle özgürsünüz. Gerek duyduğunuz tüm bilgileri istemeye ve doğru, açık, anlaşılır bilgi almaya hakkınız vardır. Araştırmaya katılmayı istemezseniz burada size verilen hizmet olumlu veya olumsuz şekilde etkilenmeyecektir. Gerekli gördüğü takdirde araştırmanın herhangi bir kısmında katılımcı araştırmadan çıkabilir, araştırmacı çalışmayı sonlandırabilir. Araştırmanın tüm aşamalarında kimlik bilgileriniz gizli tutulacaktır. Araştırma kapsamında elde edilen bilgiler bilimsel amaçlarla kullanılabilir gizlilik kurallarına uyulmak kaydıyla sunulabilir ve yayınlanabilir.

Araştırma ile ilgili daha fazla bilgiye ihtiyaç duyarsanız araştırmacıya esrakaracan10@gmail.com e-posta adresi veya 05309941486. numaralı telefondan ulaşabilirsiniz.

Yukarıda yer alan ve araştırmaya başlanmadan önce katılımcılara verilmesi gereken bilgileri içeren metni okudum (ya da sözlü olarak dinledim). Araştırma kapsamında elde edilen şahsıma ait bilgilerin bilimsel amaçlarla kullanılmasını, gizlilik kurallarına uyulmak kaydıyla sunulmasını ve yayınlanmasını, hiçbir baskı ve zorlama altında kalmaksızın, kendi özgür irademle kabul ettiğimi beyan ederim

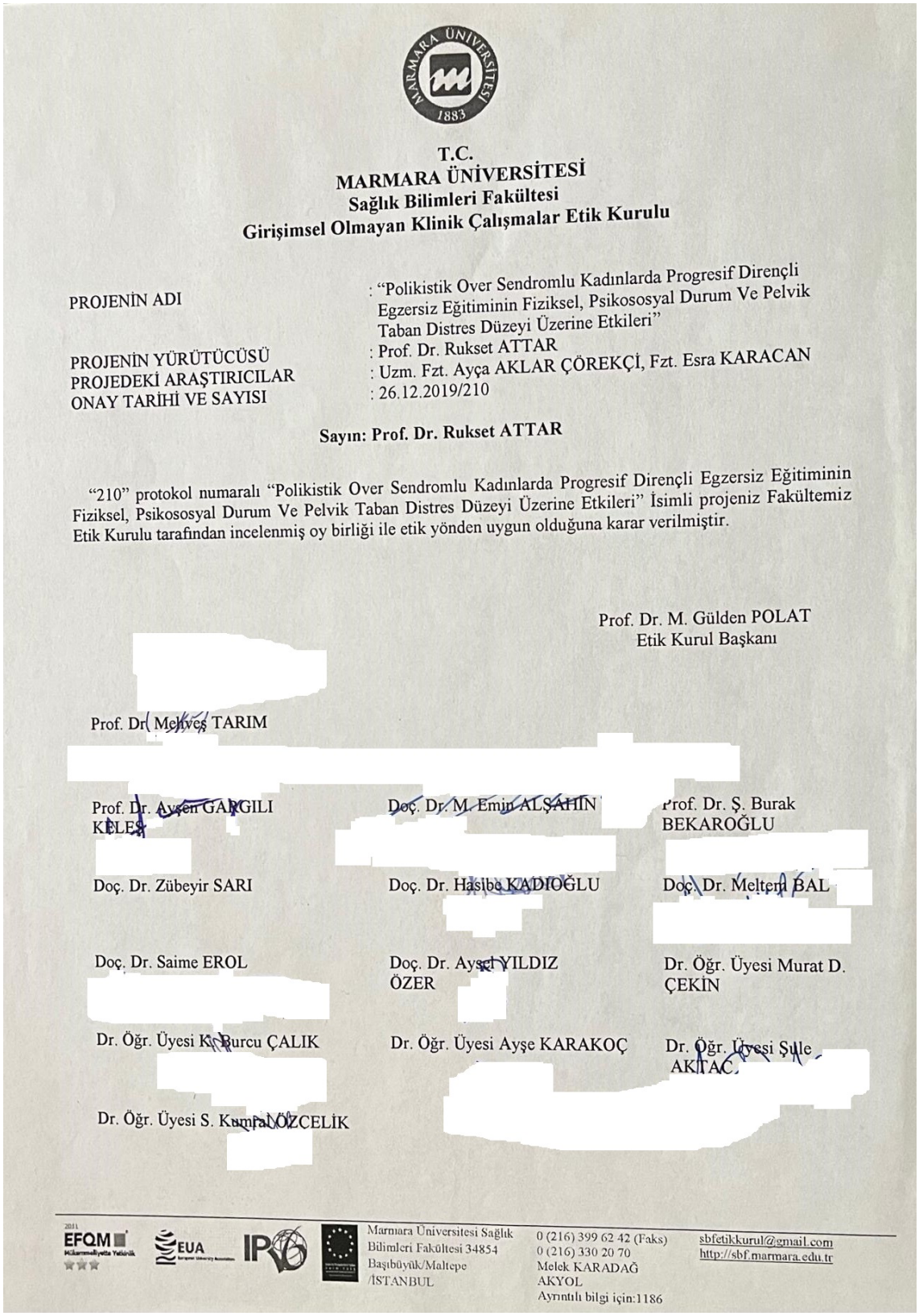
Sorumlu Araştırmacı: Prof. Dr. Rukset Attar Tel. No:
Araştırmacılar: Dr. Öğr. Üyesi Ayça Aklar, Fzt. Esra Karacan

İmza/Tarih

Katılımcının adı soyadı
İmza/Tarih

Sorumlu Araştırmacının adı soyadı

Appendix B: Ethical Committee Approval



T.C.
MARMARA ÜNİVERSİTESİ
Sağlık Bilimleri Fakültesi
Girişimsel Olmayan Klinik Çalışmalar Etik Kurulu

PROJENİN ADI : "Polikistik Over Sendromlu Kadınlarda Progresif Dirençli Egzersiz Eğitiminin Fiziksel, Psikososyal Durum Ve Pelvik Taban Distres Düzeyi Üzerine Etkileri"
PROJENİN YÜRÜTÜCÜSÜ : Prof. Dr. Rukset ATTAR
PROJEDEKİ ARAŞTIRICILAR : Uzm. Fzt. Ayça AKLAR ÇÖREKÇİ, Fzt. Esra KARACAN
ONAY TARİHİ VE SAYISI : 26.12.2019/210

Sayın: Prof. Dr. Rukset ATTAR

"210" protokol numaralı "Polikistik Over Sendromlu Kadınlarda Progresif Dirençli Egzersiz Eğitiminin Fiziksel, Psikososyal Durum Ve Pelvik Taban Distres Düzeyi Üzerine Etkileri" İsimli projeniz Fakültemiz Etik Kurulu tarafından incelenmiş oy birliği ile etik yönden uygun olduğuna karar verilmiştir.

Prof. Dr. M. Gülden POLAT
Etik Kurul Başkanı

Prof. Dr. Melveş TARIM

Prof. Dr. Ayşen GARGILI KELEŞ

Doç. Dr. M. Emin ALŞAHİN

Prof. Dr. Ş. Burak BEKAROĞLU

Doç. Dr. Zübeyir SARI

Doç. Dr. Hasibe KADIOĞLU

Doç. Dr. Meltem BAL

Doç. Dr. Saime EROL

Doç. Dr. Aysel YILDIZ ÖZER

Dr. Öğr. Üyesi Murat D. ÇEKİN

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Appendix C: Structured Questionnaire for Patient's Demographic Characteristics

DEMOGRAFİK BİLGİLER FORMU

Adı-Soyadı:

Adres:

Telefon: E-mail:

Doğum Tarihi:

Medeni Durum: ◯ Bekar ◯ Evli ◯ Ayrı ◯ Boşanmış

Eğitim: ◯ İlkokul ◯ Ortaokul ◯ Lise ◯ Üniversite ◯ Yüksek Öğrenim

Mesleğiniz:

Sigara kullanıyor musunuz?: ◯ Hayır ◯ Evet __ adet/gün __yıl

Alkol kullanıyor musunuz?: ◯ Hayır ◯ Evet __gün/hafta

Günlük aldığınız kafein miktarı(çay,kahve,meşrubat): __adet/gün

Düzenli egzersiz yapıyor musunuz?:

◯ Nadiren
◯ Haftada 1-2
◯ Haftada 3-5
◯ Hergün

Diyetiniz:

◯ Dengeli
◯ Vegan
◯ Vejeteryan
◯ Fast Food
◯Özel Diyet…
◯Diğer…

Ek hastalığınız bulunuyor mu?:……

Kullandığınız ilaçlar/dozu:……

İlk mentrurasyon yaşınız?: ___

Hala adet görüyor musunuz?: ◯ Hayır

◯ Evet ise Periyotlarınız: ◯ Hafif◯ Orta◯ Ağır

-Kaç gün sürer?

Son adetin ilk günü tarih: _____

Adet dönemi sırasında ağrınız oluyor mu?◯ Evet ◯ Hayır

Adet kanama başladığında mı başlar?: ◯ Evet◯ Hayır

Adetiniz düzenli mi?: ◯ Evet ◯ Hayır (Amenore……., Oligomenore……

Appendix D: Assessment Form

KÜTLE VE BEDEN-KÜTLE İNDEKSİ (BMI) ÖLÇÜMÜ

	İlk Değerlendirme Tarih:	Son Değerlendirme Tarih:
Boy (cm)		
Kütle (kg)		
BMI		

BEL-KALÇA ORANI (BKO) ÖLÇÜMÜ:

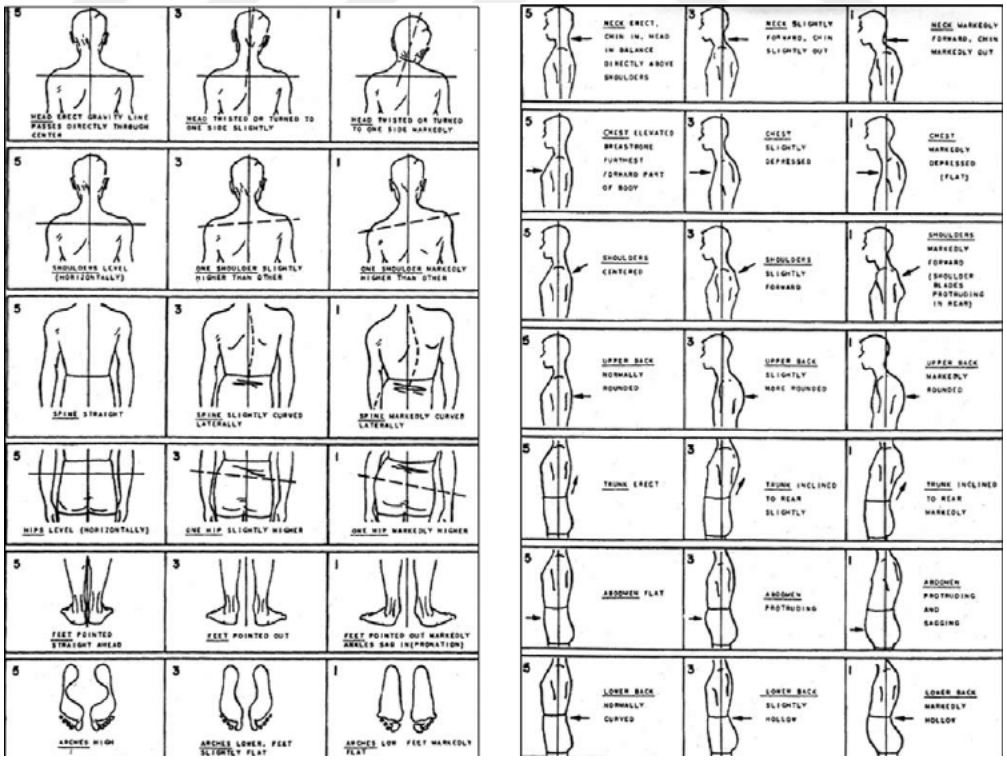
	İlk Değerlendirme Tarih:	Son Değerlendirme Tarih:
Bel çevresi		
Kalça çevresi		
BKO		

SKİNFOLD ÖLÇÜMLERİ

Bölge	İlk Değerlendirme Tarih:	Son Değerlendirme Tarih:
Biceps		
Triceps		
Supscapular		
Suprailiak		
Bacak		

POSTÜR DEĞERLENDİRMESİ

	İlk Değerlendirme Tarih:	Son Değerlendirme Tarih:
Baş Pozisyonu		
Servikal Bölge Pozisyonu		
Omuz Pozisyonu		
Torakal Bölge Pozisyonu		
Lumbal Bölgenin Pozisyonu		
Kalça Ekleminin Pozisyonu		
Diz Ekleminin Pozisyonu		
Ayak Bileği Pozisyonu		



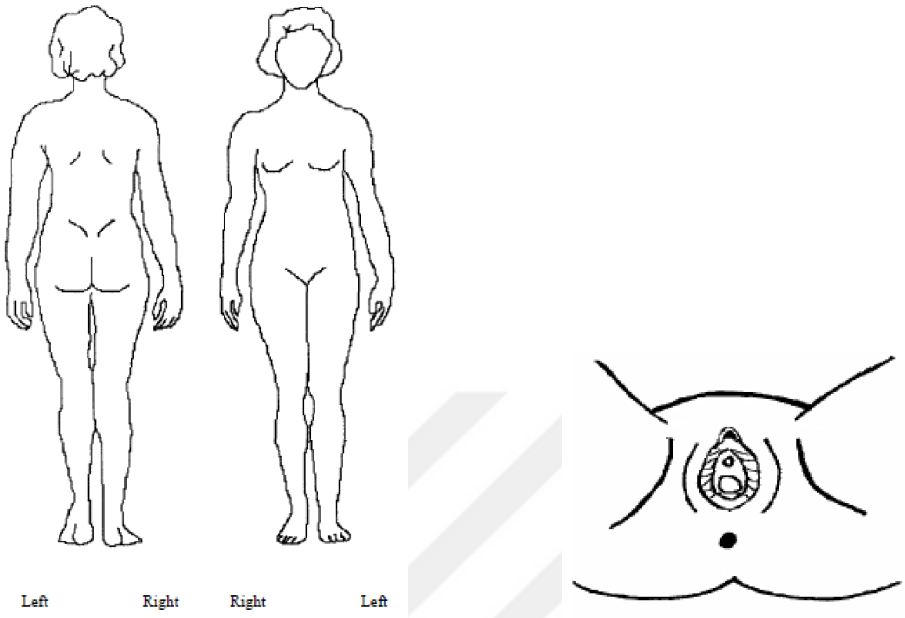
FONKSİYONEL HAREKER DEĞERLENDİRMESİ (FMS)

	İlk Değerlendirme Tarih:		Son Değerlendirme Tarih:		Yorum:
Derin Squat					
Engelli Adım	Sağ:	Sol:	Sağ:	Sol:	
Lunge	Sağ:	Sol:	Sağ:	Sol:	
Omuz Mobilitesi	Sağ:	Sol:	Sağ:	Sol:	
Düz Bacak Kaldırma	Sağ:	Sol:	Sağ:	Sol:	
Gövde Stabilitesi (Şınav)					
Dönme Stabilitesi	Sağ:	Sol:	Sağ:	Sol:	
Toplam					

AĞRI DEĞERLENDİRMESİ

Lütfen ağrılı bölgeyi işaretleyin ve işaretlediğiniz bölgedeki ağrıyı tanımlayan kelimerli seçin ve ağrı şiddetinize 0-10 arasında puan verin. (10 hissettiğiniz en şiddetli ağrı)

Vücut Şeması & Pelvik Bölge Şeması:



McGill- Melzeck:

Lütfen aşağıda ağrınızı tanımlamak için belirtilen kelimelerden uygun olanı işaretleyiniz.				
	Yok	Hafif	Orta	Şiddetli
Zonklama				
Sızlayan				
Keskin				
İçe işleyen				
Kısıtlayan				
Kemirici				
Yakıcı				
Acıtıcı				
Yoğun				
İncitici				
Şiddetli				
Yorucu				
Tiksindirici				
Korkunç				
Dayanılmaz				

Appendix E: Pelvic Floor Distress Inventory (PFDI-20)

PELVİK TABAN DİSTRES ENVANTERİ- 20

Pelvik Organ Prolaps Distres Envanteri 6 (POPDI-6)

1. Karnınızın alt bölgesinde sıklıkla baskı hissediyor musunuz?
□Hayır; □Evet

0 **Eğer evet ise bu sizi ne kadar rahatsız ediyor mu?**

O1 o2 o3 o4

Önemsiz Az Orta Çok

2. Kasık bölgesi ve aşağısında sıklıkla ağırlık veya baskı hissediyor musunuz?
□Hayır; □Evet

0 **Eğer evet ise bu sizi ne kadar rahatsız ediyor mu?**

O1 o2 o3 o4

Önemsiz Az Orta Çok

3. Vajinal bölgenizde sıklıkla bir şişkinlik veya divan plan bir şey görüyor veya hissediyor musunuz?
□Hayır; □Evet

0 **Eğer evet ise bu sizi ne kadar rahatsız ediyor mu?**

O1 o2 o3 o4

Önemsiz Az Orta Çok

4. Büyük tuvaletinizi başlatmak veya tamamlamak izin vajina veya makat çevresine itme yapmak zorunda kalıyor musunuz?
□Hayır; □Evet

0 **Eğer evet ise bu sizi ne kadar rahatsız ediyor mu?**

O1 o2 O3 O4

Önemsiz Az Orta Çok

5. İdrarınızı yaptıktan sonra tamamlanmadığı hissini sıklıkla yaşıyormusunuz?
□Hayır; □Evet

0 **Eğer evet ise bu sizi ne kadar rahatsız ediyor mu?**

o1	o2	o3	o4
Önemsiz	Az	Orta	Çok

6. İdrar yapmanızı başlatmak veya tamamlamak için parmaklarınızla vajinal bölgedeki şişkinliğinize itme yapmak zorunda kalıyor musunuz?
□Hayır; □Evet

0 **Eğer evet ise bu sizi ne kadar rahatsız ediyor mu?**

o1	o2	o3	o4
Önemsiz	Az	Orta	Çok

Kolorektal-Anal Distres Envanteri 8 (KRADE-8)

7. Büyük tuvaletinizi yapmak için fazla ıkınma ihtiyacı hissediyor musunuz?
□Hayır; □Evet

0 **Eğer evet ise bu sizi ne kadar rahatsız ediyor mu?**

□1	o2	c3	a4
Önemsiz	Az	Orta	Çok

8. Büyük tuvaletiniz bittiğinde barsaklarınızın tamamen boşaltmadığını hissediyor musunuz?
□Hayır; □Evet

0 **Eğer evet ise bu sizi ne kadar rahatsız ediyor mu?**

o1	o2	o3	o4
Önemsiz	Az	Orta	Çok

9. Büyük tuvaletiniz normal iken, kontrolünüz dışında sıklıkla dışkınızı kaçırıyor musunuz?
□Hayır; □Evet

0 **<u>Eğer evet ise</u> bu sizi ne kadar rahatsız ediyor mu?**

O1	o2	o3	o4
Önemsiz	Az	Orta	Çok

10. Büyük tuvaletiniz yumuşak veya sıvı iken, kontrolünüz dışında sıklıkla dışkınızı kaçırıyor musunuz?
□Hayır; □Evet

0 **<u>Eğer evet ise</u> bu sizi ne kadar rahatsız ediyor mu?**

O1	o2	o3	o4
Önemsiz	Az	Orta	Çok

11. Kontrolünüz dışında sıklıkla barsaktan gaz kaçırıyor musunuz ?
□Hayır; □Evet

0 **<u>Eğer evet ise</u> bu sizi ne kadar rahatsız ediyor mu?**

O1	o2	o3	o4
Önemsiz	Az	Orta	Çok

12. Büyük tuvaletinizi yaparken sıklıkla ağrınız oluyor mu?
□Hayır; □Evet

0 **<u>Eğer evet ise</u> bu sizi ne kadar rahatsız ediyor mu?**

O1	o2	o3	o4
Önemsiz	Az	Orta	Çok

13. Kuvvetli sıkışma hissi yaşıyor ve büyük tuvaletinizi yapmak için banyoya koşturmak zorunda kalıyor musunuz?
□Hayır; □Evet

0 **<u>Eğer evet ise</u> bu sizi ne kadar rahatsız ediyor mu?**

O1 o2 o3 o4

Önemsiz Az Orta Çok

14. Büyük tuvaletinizi yapma süresince veya sonrasında barsağınızın bir parçası makattan dışarıya doğru çıktı veya şişkinleşti mi?

□Hayır; □Evet

0 **<u>Eğer evet ise</u> bu sizi ne kadar rahatsız ediyor mu?**

O1 o2 o3 o4

Önemsiz Az Orta Çok

Üriner Distres Envanteri 6 (UDE-6)

15.Sık sık idrara çıkmayı sıklıkla yaşıyormusunuz?

□Hayır; □Evet

0 **<u>Eğer evet ise</u> bu sizi ne kadar rahatsız ediyor mu?**

O1 o2 o3 o4

Önemsiz Az Orta Çok

16. Sıkıştığınızda sıklıkla idrar kaçırıyor musunuz diğer bir deyişle acil banyoya gitme ihtiyacınız oluyor mu?

□Hayır; □Evet

0 **<u>Eğer evet ise</u> bu sizi ne kadar rahatsız ediyor mu?**

O1 o2 o3 o4

Önemsiz Az Orta Çok

17. Öksürme, hapşırma veya gülme ile birlikte sıklıkla idrar kaçırmanız oluyor mu?

□Hayır; □Evet

0 **<u>Eğer evet ise</u> bu sizi ne kadar rahatsız ediyor mu?**

O1 o2 o3 o4

Önemsiz Az Orta Çok

18. Az miktarda (damlalar tarzında) idrar kaçırmanız sıklıkla oluyor mu?
□Hayır; □Evet

0 **<u>Eğer evet ise</u> bu sizi ne kadar rahatsız ediyor mu?**

O1	o2	o3	o4
Önemsiz	Az	Orta	Çok

19. İdrar torbanızı boşaltmada zorluk sıklıkla oluyor mu?
□Hayır; □Evet

0 **<u>Eğer evet ise</u> bu sizi ne kadar rahatsız ediyor mu?**

O1	o2	o3	o4
Önemsiz	Az	Orta	Çok

20. Alt karin veya cinsel bölgenizde ağrı veya rahatsızlık sıklıkla oluyor mu?
□Hayır; □Evet

0 **<u>Eğer evet ise</u> bu sizi ne kadar rahatsız ediyor mu?**

O1	o2	o3	o4
Önemsiz	Az	Orta	Çok

Appendix F: Polycystic Ovary Syndrome Questionnaire (PCOSQ-50)

PCOSQ-50 ÖLÇEĞİ

AÇIKLAMALAR

- Bu sorular sizin sağlık durumunuz ile ilgilidir. Lütfen tüm soruları nasıl hissettiğinizi en iyi şekilde derecelendirme yaparak, kutucukları işaretleyerek cevaplayınız.
- Her soru için sadece bir seçeneği işaretleyiniz. Doğru olmayan ya da hatalı olan bir cevap yoktur. Sadece sizin nasıl hissettiğinizi belirten seçeneği seçiniz.

BÖLÜM A: PSİKO-SOSYAL VE DUYGUSAL

Son dört hafta içinde ne kadar sıklıkla

		Hiçbir zaman	Nadiren	Bazen	Sık Sık	Her Zaman
1	Kötü ruh halinden muzdarip oldunuz?	☐	☐	☐	☐	☐
2	PKOS dan kaynaklı sorunlarınızdan dolayı sabırsızlık yaşadınız?	☐	☐	☐	☐	☐
3	Hastalıklarınızdan dolayı kendinizi suçladınız?	☐	☐	☐	☐	☐
4	Diğer kişiler ile ilişkilerinizde sorun yaşardınız?	☐	☐	☐	☐	☐
5	Öz güven eksikliğinden dolayı muzdarip oldunuz?	☐	☐	☐	☐	☐
6	Agresif (saldırgan) bir tutum içine girdiniz?	☐	☐	☐	☐	☐
7	Hastalıklarınızın tedavisi hakkında karamsar hissettiniz?	☐	☐	☐	☐	☐
8	Fiziksel görünümünüzden dolayı utanç hissettiniz?	☐	☐	☐	☐	☐

9	Sağlıklı kadınlara karşı farklı hissettiniz?	☐	☐	☐	☐	☐
10	Duygularınızı kontrol etmede güçlük yaşadınız?	☐	☐	☐	☐	☐
11	Çirkin ya da itici hissettiniz?	☐	☐	☐	☐	☐
12	Çabuk yorulduğunuzu hissettiniz?	☐	☐	☐	☐	☐

BÖLÜM B: DOĞURGANLIK

Son dört hafta içinde ne kadar sıklıkla

		Hiçbir zaman	Nadiren	Bazen	Sık Sık	Her Zaman
1	Çocukları görünce üzgün hissettiniz?	☐	☐	☐	☐	☐
2	Hamile kadın görünce üzgün hissettiniz?	☐	☐	☐	☐	☐
3	Kısırlıkla ilgili endişe duydunuz?	☐	☐	☐	☐	☐
4	Eğer hamile kalırsanız PKOS un tüm belirtilerine katlanacağınızı hissettiniz?	☐	☐	☐	☐	☐
5	Düşük korkusu hissettiniz?	☐	☐	☐	☐	☐
6	Gelecekte kısırlıktan endişe duydunuz?	☐	☐	☐	☐	☐

7	Boşanma ya da ayrılık korkusu yaşadınız?	□	□	□	□	□

BÖLÜM C: CİNSEL FONKSİYON ' EŞİ (PARTNERİ) OLANLAR DOLDURACAK

Son dört hafta içinde ne kadar sıklıkla

		Hiçbir zaman	Nadiren	Bazen	Sık Sık	Her Zaman
1	Kısırlık nedeniyle cinsel ilişkide kendinizi işe yaramaz hissettiniz?	□	□	□	□	□
2	Hastalıkların ilaç tedavisinin uzun vadeli etkilerinden endişe duydunuz?	□	□	□	□	□
3	Cinsellik konusunda tatminsizlik hissettiniz?	□	□	□	□	□
4	Cinsel uyarı eksikliği hissettiniz?	□	□	□	□	□
5	Cinsel ilişki sırasında kayganlık eksikliği yaşadınız?	□	□	□	□	□
6	Cinsel ilişki sırasında kayganlık eksikliği yaşadınız?	□	□	□	□	□
7	Orgazm eksikliği yaşadınız?	□	□	□	□	□
8	Cinsel soğukluk/karşılık verememeden dolayı utanç duydunuz?	□	□	□	□	□
9	PKOS kaynaklı cinsel dürtü (libido) kaybı yaşadınız?	□	□	□	□	□

BÖLÜM D: OBEZİTE VE MENSTRÜAL BOZUKLUKLAR

Son dört hafta içinde ne kadar sıklıkla

		Hiçbir zaman	Nadiren	Bazen	Sık Sık	Her Zaman
1	Aşırı kilolu olmaktan endişe duydunuz?	☐	☐	☐	☐	☐
2	Hastalıklarınızı kontrol altında tutmak için kilo verme ihtiyacı hissettiniz?	☐	☐	☐	☐	☐
3	Kilo verdikten sonra önceki kilonuza hızlıca dönmekten endişe duydunuz?	☐	☐	☐	☐	☐
4	Adetin tamamen kesilmesinden endişe duydunuz?	☐	☐	☐	☐	☐
5	Adetin uzun aralıklarla olmasından endişe duydunuz?	☐	☐	☐	☐	☐
6	Eşinize daha çekici görünmek için kilo verme isteği hissettiniz?	☐	☐	☐	☐	☐
7	Diyabet(şeker), hipertansiyon ve kalp hastalıkları gibi hastalıklardan korku duydunuz?	☐	☐	☐	☐	☐
8	Tekrarlı doktor ziyaretlerinden dolayı tedaviyi bırakma isteği hissettiniz?	☐	☐	☐	☐	☐
9	Kanser olma korkusu yaşadınız?	☐	☐	☐	☐	☐

BÖLÜM E: TÜYLENME

Son dört hafta içinde ne kadar sıklıkla

		Hiçbir zaman	Nadiren	Bazen	Sık Sık	Her Zaman
1	Yüzünüzde aşırı tüylenmeden dolayı utanç duydunuz?	☐	☐	☐	☐	☐
2	Yüzde ve vücutta aşırı tüylenmenin ilerlemesinden endişe duydunuz?	☐	☐	☐	☐	☐
3	Yüzünüzde aşırı tüylenmeden dolayı endişe duydunuz?	☐	☐	☐	☐	☐
4	İstenmeyen tüylerden kurtulduktan sonra hızla yeniden çıkmasından endişe duydunuz?	☐	☐	☐	☐	☐
5	Aşırı vücut tüylenmesinden dolayı utanç hissettiniz?	☐	☐	☐	☐	☐
6	Aşırı tüylenmeden dolayı vücudunuzu ve yüzünüzü kapatma ihtiyacı hissettiniz?	☐	☐	☐	☐	☐

BÖLÜM G: BAŞA ÇIKMA

Son dört hafta içinde ne kadar sıklıkla

		Hiçbir zaman	Nadiren	Bazen	Sık Sık	Her Zaman
1	Aile desteğinde ve hastalığı kabullenmede eksiklik hissettiniz?	☐	☐	☐	☐	☐
2	Kadın olduğunuzdan dolayı memnuniyetsizlik hissettiniz?	☐	☐	☐	☐	☐
3	Tedavi ihtiyacından dolayı çaresizlik hissettiniz?	☐	☐	☐	☐	☐

4	**Diğer kişiler ile hastalıklarınız hakkında konuşurken rahatsız hissettiniz?**	☐	☐	☐	☐	☐
5	**Diğer kişiler ile hastalıklarınız hakkında iletişim kurarken sorun yaşadınız?**	☐	☐	☐	☐	☐
6	**Kendi görünüşünüzden memnuniyetsizlik hissettiniz?**	☐	☐	☐	☐	☐
7	**Şu an/gelecekte eş olma durumunuzla ilgili memnuniyetsizlik hissettiniz?**	☐	☐	☐	☐	☐

CURRICULUM VITAE

Kişisel Bilgiler

Adı	Esra	**Soyadı**	Karacan
Doğum Yeri		**Doğum Tarihi**	
Uyruğu		**TC Kimlik No**	
E-mail		**Tel**	

Öğrenim Durumu

Derece	Alan	Mezun Olduğu Kurumun Adı	Mezuniyet Yılı
Yüksek Lisans	Genel Fizyoterapi ve Rehabilitasyon	**Yeditepe Üniversitesi**	2022
Lisans	Fizyoterapi ve Rehabilitasyon	**Bezmialem Vakıf Üniversitesi**	2018

Bildiği Yabancı Dilleri	Yabancı Dil Sınav Notu
İngilizce	80
İtalyanca	A2

Bilgisayar Bilgisi

Program	Kullanma becerisi
Office 365	Çok İyi

Bilimsel Çalışmaları

Karacan E., Akmayan Ö., Şahin F., Balıkçı A. "An Investigation of Sensory Integration Development in Terms of Piaget's Development Theory in A Rett Syndrome Case", Poster Presentation. 1st National Sensory Integration Congress with International Contrubution, 12-13 April 2019, İstanbul, Turkey.
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