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Original Article

Anthropometric and body composition analysis of infertile women with polycystic ovary syndrome

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الملخص

أهداف البحث: لتقييم مكونات الجسم، والملف الشخصي للجسم البشري للنساء المصابات بالعقم اللاتي تم تشخيصهن بمتلازمة المبيض المتعدد التكيسات، والتحقق في الإصابة والعلاقة النسبية لمكونات دهون الجسم ومتلازمة المبيض المتعدد التكيسات.

طرق البحث: أجريت دراسة مراقبة الحالة في المستشفى على مجموعة مكونة من ١٣٢ من المريضات مع أو بدون متلازمة المبيض المتعدد التكيسات. تم استخدام تحليل المقاومة الكهربائية البيولوجية لتسجيل مكونات الجسم مثل إجمالي الدهون بالجسم، والدهون بالأحشاء، والدهون تحت الجلد، ومكونات عضلات الهيكل العظمي وتوزيعها في الجذع، والساقين والذراعين بالإضافة إلى ضغط الدم. كما تم تسجيل الملف الشخصي للجسم البشري ويتضمن مؤشر كتلة الجسم، ووزن الجسم المثالي، ومحيط الخصر، ومحيط الورك ونسبة الخصر إلى الورك.

النتائج: متوسط عمر الإصابة لمتلازمة المبيض المتعدد التكيسات كانت ٢٩. ٧٤ ±٣,٣٢عاما وكانت الغالبية منهن في الأعلى إلى العالي جدا لفئة الدهون بالأحشاء مع ارتباط كبير. وإجمالي توزيع الدهون بالجسم، وكامل الدهون تحت الجلد، وللجذع، والذراع والساق كانت أعلى بكثير في متلازمة المبيض المتعدد التكيسات. كما كان معدل مؤشر كتلة الجسم، ومحيط الخصر والورك لمجموعة متلازمة المبيض المتعدد التكيسات ٢٨,٢±٦,٠٨، ٩٧,٤٤±١٥,١١سم، ١٠٩,٢٢±١٧,٣٩سم على التوالي. وأظهرت النتائج أيضا زيادة ملحوظة في ضغط الدم الانبساطي والمتوسط لمرضى متلازمة المبيض المتعدد التكيسات بالمقارنة بمجموعة التحكم.

الاستنتاجات: أظهرت الدراسة مستويات عالية لمؤشر كتلة الجسم، وتوزيع الدهون بالجسم، ومحيط الخصر والورك، وضغط الدم الانبساطي والمتوسط، والدهون بالأحشاء، وزيادة غير متكافئة في مستوى الدهون الشاملة وتوزيعها

الكلمات المفتاحية: القياسات البشرية؛ مكونات الجسم؛ العقم؛ متلازمة المبيض المتعدد التكيسات؛ مؤشر كتلة الجسم

Abstract

Objectives: To evaluate the body composition and anthropometric profile of infertile women who have been diagnosed with polycystic ovary syndrome (PCOS) and to investigate the incidence of PCOS and to examine body fat composition as a risk factor for this disease.

Methods: This hospital-based case controlled study was conducted on a cohort of 132 patients with and without PCOS. Bioelectrical impedance analysis was used to record body composition parameters, such as total body fat, visceral fat, subcutaneous fat, skeletal muscle composition and their distribution in the trunk, legs and arms, as well as blood pressure. Anthropometric profile parameters, including body mass index (BMI), ideal body weight (IBW), waist circumference, hip circumference and waist-to-hip ratio, were also recorded.

Results: The mean age of incidence of PCOS was 29.74 ± 3.32 years (OR 1.417), and most of the cohort exhibited high to very high visceral fat with significant correlation ($p < 0.001$). Total body fat distribution and whole, trunk, arm and leg subcutaneous fat were

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significantly higher in patients with PCOS ($p < 0.001$). The mean BMI, waist and hip circumference of the PCOS group were 28.2 ± 6.08, 97.44 ± 15.11 cm and 109.22 ± 17.39 cm, respectively. The results also indicated significant increases in DP and MAP (OR 1.528) in patients with PCOS compared to the control group ($p < 0.001$).

Conclusion: This study exhibits higher levels of BMI, body fat distribution, waist and hip circumference, diastolic and mean blood pressure, visceral fat, and a disproportionate increase in the level of global fat and its distribution.

Keywords: Anthropometry; Body composition; Body mass index; Infertility; PCOS

Introduction

Approximately 10–15% of reproductive aged females are affected by a complex endocrine disorder, polycystic ovary syndrome (PCOS).[1] PCOS is associated with multiple factors and has a complex pathogenesis that adversely affecting the health of women.[2] It is known to cause endocrine abnormalities, such as the release of gonadotropin-releasing hormone (GnRH), leading to increased LH secretion and decreased FSH levels. It is also known to affect the hypothalamus–pituitary–ovarian axis and ovarian stromal thecal hyperfunctioning, resulting in chronic oligo-anovulation and hyperandrogenism, leading to not only biochemical but also metabolic and reproductive dysfunction.[3] Adolescents diagnosed with PCOS are also diagnosed with menstrual irregularities, increased waist circumference (WC), impaired glucose tolerance (IGT), subclinical atherosclerosis characterized by visceral fat changes and epicardial fat thickness.[4,5]

A retrospective cross-sectional study on the prevalence of PCOS carried out in Oman at Sultan Qaboos University Hospital (SQUH) reported a frequency of 7.0%. The overall incidence of PCOS was 2.8 per 1000 patients in 2010. The prevalence was higher among women in the age group of 25–34, especially in the Muscat region, followed by the Dhakliya and Al Batinah regions. The study concluded that the prevalence and diagnosis rate was almost similar to that in global population.[6]

Some studies support a higher risk of developing obesity due to impaired metabolic function in women with PCOS, and the incidence differs from country to country depending on lifestyle, environmental and dietary factors.[7,8] However, the relationship between PCOS incidence and body composition, especially in infertile women, has not yet been studied. Therefore, this case-control study was designed with the aim of investigating the differences, relative risk and correlation between the incidence of PCOS and anthropometric factors, as well as body composition.

Materials and Methods

Materials

The study data were collected using an Omron HBF 375 Karada Scan Body Composition Monitor–Body Fat Analyser to analyse body composition; an OMRAN Digital BP apparatus was used to measure systolic pressure (SP) and diastolic pressure (DP).

Study participants

This case-control study examined equal numbers of infertile women diagnosed with PCOS and not diagnosed with PCOS from a total of 132 women visiting Al-Bushra Medical Specialty Complex, Muscat for infertility treatment in 2016. PCOS was defined in accordance with the Rotterdam criteria.[9] Criteria for excluding patients from this study included women with hypothyroidism, hyperthyroidism, liver failure, hyperprolactinemia, adrenal hyperplasia and diabetes. Women receiving oral contraceptives, hypoglycaemics and anti-dyslipidaemics were also excluded from the study.

Methods

Anthropometric profile

All subjects involved in the study underwent physical examination to assess height, weight, waist and hip circumference, total body fat, total skeletal muscle, distribution of fat, body mass index (BMI) and Ideal Body weight (IBW); the parameters were calculated following standard procedures and the instructions supplied with the digital body composition analyser.[10,13] Hypertension and prehypertension was defined as 140/90 mmHg and 120/80 mmHg, respectively.[11]

Assessment of body composition

Body composition and weight were measured in a standardized way[12] following the instructions supplied with the Omron Body Composition analyser.[13] This instrument is approved by the FDA for use in research involving adults and children.

Medical ethics

This study was approved by the Institutional Ethics Committee and the study centre. Data were collected only from the patients who provided written consent after the objectives were specified and assurances of privacy, anonymity and confidentiality were given. Every patient was given the liberty to withdraw from the study at any time.

Statistical analysis

Each case was given a case number, and the information collected in this study was entered directly into SPSS version 19 (SPSS Inc. Chicago, IL, USA) and was analysed using descriptive statistics such as the mean and standard deviation for continuous numerical data; for categorical data, percentage-frequency distributions were used. Means were compared between groups using the t test, and medians were compared using the post hoc Tukey C test. Logistic

regression was used to correlate metabolic factors, waist circumference and PCOS diagnosis. p values of less than 0.05 were considered statistically significant.

Results

Validation of the study design

Overall, this was a very good model for predicting PCOS because the Omnibus test of model coefficients showed a highly significant chi-square value of 41.688 (p-value <0.001). In addition, the Nagelkerke R-squared value was found to be 0.682, implying that 68% of the variation in the outcome variable is explained by the predictors in the model. Altogether, as a model, we found arm subcutaneous fat, leg subcutaneous fat, mean arterial pressure, and age to be the most significant predictors of PCOS.

Body fat composition

Most of the patients (86%) in the control group exhibited normal visceral fat; in contrast, 62.9% of the PCOS population exhibited normal visceral fat, 7.69% had high visceral fat, and 22.58% had very high visceral fat. A Chi-square analysis showed significant ($p = 0.004$) differences in visceral fat content between the cases and the control group. Based on these results, visceral fat is elevated in the high and very high category of patients with PCOS and is significantly ($p < 0.001$) correlated with the incidence of PCOS (Tables 1 and 2). The results shown in Tables 1 and 2 show that the total body fat distribution in patients diagnosed with PCOS is significantly ($p < 0.001$) higher than that in the control group. The odds ratio showed a 36.6% increase in risk of developing PCOS in patients having higher total body fat. Highly significant ($p < 0.001$) correlations were recorded between the incidence of PCOS and total subcutaneous fat ($r = 0.296$), trunk subcutaneous fat ($r = 0.244$), arm subcutaneous fat ($r = 0.309$) and leg subcutaneous fat ($r = -0.293$).

Skeletal muscle composition

Based on the results shown in Table 2, there is a highly significant ($p < 0.001$) negative correlation (-0.339) between total skeletal muscle and the incidence of PCOS. A significant ($p < 0.001$) positive O ($r = 0.318$) correlation was found between trunk skeletal muscle and PCOS. According to Table 1, 81.42% of patients with PCOS had lower skeletal muscle distribution; this value compares with 42.18% of the population in the control group. No significant difference was found between the cases and the control group.

Anthropometric profile

As depicted in Table 1, PCOS is a common disorder in reproductive-aged women between 25 and 30 years, followed by women aged 31–35 years. These results show that there is a significant ($p < 0.001$) difference in the age of incidence of PCOS. Table 2 shows a 1.417-fold increase in the risk of developing PCOS compared to the control. A highly significant ($p < 0.001$) correlation ($r = 0.355$) was observed between the incidence of PCOS and BMI, with a higher mean BMI (28.2 ± 6.08 kg/m^2) compared to that (24.12 ± 4.69 kg/m^2) of the control group. The percentage of women with normal BMI in the PCOS group (35.48%) is approximately half that of women in the PCOS group (60.93%), and 41.93% were obese compared to 10.93% of women in the control group (Table 1), and a significantly ($p = 0.002$) higher number of obese and overweight women were seen in the PCOS group. The mean hip circumference in PCOS patients was 109.22 ± 17.39, a value that was significantly ($p < 0.001$) higher than that (99.02 ± 14.97 cm) of women in the control group. Furthermore, 9, 39, 11 and 5 had normal, medium, large and extra-large hip circumference respectively in PCOS patients compared to 30, 24, 10 and nil found to be with normal, medium, large and extra-large hip circumference respectively of women in the control group (Tables 1 and 2).

Blood pressure

Our results showed (Table 1) an insignificant difference in systolic pressure between the control and PCOS case groups. However, a highly significant ($p < 0.001$) difference was recorded for diastolic and mean blood pressure. Mean arterial pressure was higher in patients with PCOS than in patients in the control group. The odds ratio calculated for mean arterial pressure (MAP) in the PCOS patients was 1.528 times higher than that in the control group. A significant ($p < 0.001$) correlation was found between SP ($r = 0.396$) and DP ($r = 0.27$) (Table 2).

Discussion

This study was carried out to determine the body composition of infertile women with PCOS and to compare the relevant factors to those in women without PCOS. The results of our study are encouraging and indicate new ways of treating body fat in PCOS patients. PCOS is a common disorder in reproductive-aged women between 25 and 30 years, and the mean age of incidence of PCOS was 29.74 ± 3.32 years; this value represents a 1.417-fold higher risk of PCOS compared to the control group, similar to the results of a previous report.[14]

Excess abdominal adipose tissue initiates metabolic and endocrine irregularities that impair insulin action, and this interacts with the progression of hyperandrogenism, leading to impaired glucose uptake, which again increases the deposition of visceral fat, independently of body mass index.[15,16] Our results are on the higher side of numbers observed in similar studies because we observed a higher percentage of women in the high to very high visceral fat category. These results are supported by the highly significant ($p < 0.001$) correlation between the incidence of PCOS and elevated waist ($r = 0.345$) and hip ($r = 0.302$) circumferences. More PCOS patients were in the category of having a large or extra-large hip circumference than in previous studies, which reported that increased waist and hip circumference are associated with increased incidence of PCOS.[17,18]

The results showed that the total body fat distribution in patients who have been diagnosed with PCOS was

Table 1: Stratified comparative analysis of the body composition, blood pressure and anthropometric profile of control and PCOS patients.

Factors	Category	Total	Control	Case	Level of significance
Age					
18–24		30	29	1	Chi-square = 47.9
25–30		56	16	40	Degrees of freedom = 4
31–35		31	9	22	Probability = 0.000
36–40		12	9	3	
≥41		3	3	–	
Visceral fat					
≤9%	Normal	94	55	39	Chi-square = 11.0
10–14%	High	17	3	14	Degrees of freedom = 2
≥15	Very high	14	5	9	Probability = 0.004
Total body fat					
21–32.9	Normal	50	37	13	Chi-square = 18.4
33–38.9	High	44	18	26	Degrees of freedom = 2
≥39	Very high	36	11	25	Probability = 0.000
Skeletal muscle					
<24.3%	Low	79	26	53	–
24.3–30.3%	Normal	51	38	13	
30.4–35.3	High	0	0	0	
≥35.4	Very high	2	2	0	
BMI					
<18.5%	Underweight	5	4	1	Chi-square = 15.2
18.5–25%	Normal	66	40	22	Degrees of freedom = 3
25–30	Overweight	26	13	13	Probability = 0.002
>30	Obese	35	9	26	
Blood pressure profile					
Systolic blood pressure mmHg					
<120	Normal	41	23	18	Chi-square = 4.09
120–130	Prehypertension	50	23	27	Degrees of freedom = 3
131–140	Mild hypertension	18	5	13	Probability = 0.251
>140	Moderate hypertension	12	6	6	
Diastolic blood pressure mmHg					
<80	Normal	49	36	13	Chi-square = 22.1
80–90	Prehypertension	69	25	42	Degrees of freedom = 3
91–100	Mild hypertension	4	1	3	Probability = 0.000
>100	Moderate hypertension	6	0	6	
Mean arterial pressure mmHg					
<93	Normal	41	30	11	Chi-square = 18.8
93–95	Prehypertension	30	16	14	Degrees of freedom = 3
96–100	Mild hypertension	24	6	18	Probability = 0.000
>100	Moderate hypertension	31	10	21	
Waist circumference					
<80 cm	Normal	23	21	2	
>80 cm–<88 cm	Overweight	36	17	19	
≥88 cm	Obese	72	27	45	
Hip circumference					
66–96	Small	39	30	9	Chi-square = 19.9
96–119	Medium	63	24	39	Degrees of freedom = 3
119–137	Large	21	10	11	Probability = 0.000
137–154	Extra-large	5	–	5	
Waist/Hip ratio					
<0.76	Low risk	18	15	3	Chi-square = 16.2
0.76–0.83	Moderate risk	15	10	5	Degrees of freedom = 3
0.84–0.9	High risk	35	10	25	Probability = 0.001
>0.9	Very high risk	64	31	33	

The results were analysed using the chi-square test in comparison with the control group. p values of less than 0.05 were considered statistically significant.

significantly ($p < 0.001$) higher than that in the control group, and majority were in the high to very high category. Highly significant ($p < 0.001$) correlations were recorded between the incidence of PCOS and total subcutaneous fat, trunk subcutaneous fat, arm subcutaneous fat and leg subcutaneous fat. These results are similar but are at the higher end of the range found in studies measuring adipose tissue depots using ultrasound.[19] Our results showed a correlation

Table 2: Comparative analysis of the anthropometric profile and body composition of control and PCOS patients.

Factors	Study group	Mean ± Std. deviation	Level of significance (2-tailed) 't' test	Exp (B) odds ratios	95% Confidence interval of the difference		Pearson correlation
					Lower	Upper	
Age (Years)	Control	28.24 ± 7.983	0.161	1.417	−3.606	0.606	0.123
	PCOS	29.74 ± 3.325	0.162		−3.616	0.616	
Height (cm)	Control	159.11 ± 6.35	0.414	—	−1.287	3.105	−0.072
	PCOS	158.2 ± 6.4	0.414		−1.287	3.105	
Weight (kg)	Control	60.67 ± 12.67	0.001	—	−12.274	−3.235	0.286
	PCOS	68.43 ± 13.45	0.001		−12.273	−3.237	
Waist circumference (cm)	Control	84.83 ± 19.23	0.001	1.071	−18.585	−6.635	0.345**
	PCOS	97.44 ± 15.11	0.001		−18.599	−6.621	
Waist/Hip ratio	Control	0.85 ± 0.2	0.08	0.724	−0.114	0.0065	0.345**
	PCOS	0.9 ± 0.13	0.08		−0.114	0.0066	
BMI	Control	24.12 ± 4.69	0.001	—	−6.001	−2.178	0.355**
	PCOS	28.2 ± 6.08	0.001		−6.0102	−2.169	
Hip circumference (cm)	Control	99.02 ± 14.97	0.001		−15.844	−4.566	0.302**
	PCOS	109.22 ± 17.39	0.001		−15.832	−4.579	
Systolic BP (mmHg)	Control	124.49 ± 14.1	0.723		−5.646	3.927	0.396**
	PCOS	125.34 ± 13.03	0.723		−5.653	3.933	
Mean Arterial Pressure (mmHg)	Control	92.77 ± 8.73	0.002	1.528	−8.88	−1.988	0.032
	PCOS	98.2 ± 10.68	0.002		−8.87	−1.998	
Diastolic BP (mmHg)	Control	76.92 ± 7.57	0.001	0.991	−11.589	−3.853	0.270**
	PCOS	84.64 ± 13.46	0.001		−11.566	−3.876	
Ideal Body Weight (kg)	Control	55.78 ± 4.55	0.424		−0.929	2.196	0.334**
	PCOS	55.15 ± 4.52	0.424		−0.929	2.196	
Total Body fat %	Control	32.53 ± 5.56	0.001	1.366	−7.772	−2.734	−0.070
	PCOS	37.78 ± 8.57	0.001		−7.819	−2.686	
Visceral fat %	Control	5.47 ± 4.23	0.001	0.96	−5.559	−1.721	0.346**
	PCOS	9.1 ± 6.5	0.001		−5.582	−1.699	
Whole subcutaneous fat %	Control	27.97 ± 5.67	0.001	0.56	−6.799	−2.898	0.296**
	PCOS	32.82 ± 5.65	0.001		−6.799	−2.898	
Trunk subcutaneous fat %	Control	25.08 ± 7.82	0.001	1.295	−6.568	−1.847	0.244**
	PCOS	29.29 ± 5.72	0.001		−6.569	−1.845	
Arm subcutaneous fat %	Control	44.79 ± 11.66	0.005	1.154	−8.793	−1.603	0.309**
	PCOS	49.99 ± 8.93	0.005		−8.788	−1.608	
Leg subcutaneous fat %	Control	40.42 ± 7.6	0.001	0.608	−9.965	−3.025	−0.293**
	PCOS	46.92 ± 12.05	0.001		−9.971	−3.019	
Whole Skeletal muscle %	Control	25.6 ± 4.84	0.001		0.992	3.574	−0.339**
	PCOS	23.32 ± 2.17	0.001		0.987	3.579	
Trunk skeletal muscle %	Control	19.75 ± 3.05	0.001		1.055	3.014	0.318**
	PCOS	17.71 ± 2.62	0.001		1.055	3.014	
Arm skeletal muscle %	Control	26.73 ± 5.1	0.602		−4.0803	7.0136	−0.046
	PCOS	25.26 ± 22.19	0.603		−4.122	7.056	
Leg skeletal muscle %	Control	36.05 ± 4.54	0.459		−12.469	5.663	0.065
	PCOS	39.45 ± 36.95	0.460		−12.551	5.744	

The results were analysed using Student's t test followed by a post-hoc Tukey C test in comparison with a control group of patients. Logistic regression analysis was used to correlate factors and the diagnosis of PCOS. p values of less than 0.05 were considered statistically significant.

**The Pearson Chi-Square test shows a very significant association at the 0.01 level (2-tailed).

between increased amounts of upper body fat, subcutaneous fat in the trunk, arm and legs and decreased insulin sensitivity that was higher than that reported in a recent study.[16,20] Our results also showed a significantly higher trunk/peripheral fat ratio ($p < 0.001$) in infertile PCOS patients than that reported in a previous study.[17]

A case control study reported a higher prevalence of androgen-related fat distribution, improved muscle strength in the biceps, and lower limb and handgrip strength in PCOS patients without improving skeletal muscle ratio.[21] Our results support those of the previous study in that we found a significant ($p < 0.001$) negative correlation between total skeletal muscle and the incidence of PCOS and a lower total skeletal muscle percentage compared to the control group. It has also been noted that patients with PCOS were in a lower category of skeletal muscle distribution compared to the population in the control group, and these results support those of a study that found significantly lower total skeletal muscle in a PCOS group compared to a control group.[22] Lower skeletal muscle distribution in the PCOS group, which is associated with infertility, can reduce insulin sensitivity, as reported in 2014.[17]

We observed a highly significant ($p < 0.001$) correlation between the incidence of PCOS and BMI. The mean BMI of the PCOS group was higher than that of the control group, and the prevalences of overweight and obesity were significantly ($p = 0.002$) higher in women with PCOS, showing a similar relationship between PCOS incidence and BMI.[23] In our study, the prevalences of overweight, obesity and central obesity were significantly higher in women with PCOS. These observations support the findings in several studies, which have shown that increased BMI directly and significantly increases the incidence of PCOS.[16,21] A higher percentage of PCOS patients were in the category of large and extra-large circumference than was reported previously in women only having PCOS.[19] These results also supports the results of previous studies reporting that increased waist and hip circumferences increase the incidence of PCOS and associated complications involving infertility.[24]

A cross-sectional study of 84 patients with PCOS reported higher levels of arterial stiffness, thickness of the carotid intima-media due to hyperlipidaemia and insulin resistance, thereby increasing diastolic function[25] and elevated diastolic blood pressure.[26] Similarly, we noted a highly significant ($p < 0.001$) increase in the diastolic and mean blood pressures of PCOS patients. The odds ratio for the mean arterial pressure of PCOS patients was 1.528-fold higher than that of a control group, supporting the findings of these studies.

A limitation of this study is that this study was carried out over a period of only six months and involved patients attending only one private hospital in Muscat. Further consideration of the influence of lifestyle factors, such as dietary intake, physical activity and sedentary behaviour, to the elevated prevalence of obesity in patients with PCOS would assist in determining the aetiology of variations in body fat composition.

Conclusions

Taken together, the results of this study indicate that infertile women with PCOS have a higher percentage of visceral fat, waist circumference, hip circumference, total body fat, total subcutaneous fat, trunk subcutaneous fat, arm subcutaneous fat, leg subcutaneous fat, trunk/peripheral fat ratio, BMI, and elevated diastolic blood pressure than do women PCOS alone, as reported in earlier studies. Similarly, we noted a lower level total skeletal muscle mass and its distribution as compared with women only having PCOS.

Recommendation

It is evident that PCOS, especially in infertile women, is a complex condition; therefore, we recommend further studies that involve more patients, hospitals and regions and extending the study period to observe concrete outcomes and their possible implementation in practice.

Conflict of interest

The authors have no conflict of interest to declare.

Authors' contributions

Chitme conceptualized the study and analysed and interpreted the data. Eman contributed to the design and conducted the study. All other authors were involved in collecting the data and in writing the initial draft of the article. All authors have critically reviewed and approved the final draft and are responsible for the content and the similarity index of the manuscript.

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References

1. Burchall G, Linden MD, Teede H, Piva TJ. Hemostatic abnormalities and relationships to metabolic and hormonal status in polycystic ovarian syndrome. **Trends Cardiovasc Med 2011**; 21(1): 6–14. http://dx.doi.org/10.1016/j.tcm.2012.01.001.
2. Tharian K, Warner J. Polycystic ovarian syndrome in adolescent girls. **Paediatr Child Health 2011**; 21(7): 309–314. http://dx.doi.org/10.1016/j.paed.2015.03.008.
3. Afb llahbadia GN, Merchant R. Polycystic ovary syndrome and impact on health. **Middle East Fertil Soc J 2011**; 16(1): 19–37.
4. Bouzas IC, Cader SA, Leão L, Kuschnir MC, Braga C. Menstrual cycle alterations during adolescence: early expression of metabolic syndrome and polycystic ovary syndrome. **J Pediatr Adolesc Gynecol 2014**; 27(6): 335–341. http://dx.doi.org/10.1016/j.jpag.2014.01.002.
5. Dokras A. Cardiovascular disease risk in women with PCOS. **Steroids 2013**; 78(8): 773–776. http://dx.doi.org/10.1016/j.steroids.2013.04.009.
6. Al Khaduri Maha, Al Farsi Yahya, Al Najjar Tasneem Abdullah Awadh, Gowri Vaidyanathan. Hospital-based prevalence of polycystic ovarian syndrome among Omani women. **Middle East Fertil Soc J 2014**; 19(2): 135–138.
7. Hoeger KM, Oberfield SE. Do women with PCOS have a unique predisposition to obesity? **Fertil Steril 2012**; 97(1): 13–17. http://dx.doi.org/10.1016/j.fertnstert.2011.11.026.
8. Cakir E, Doğan M, Topaloglu O, Ozbek M, Cakal E, Vural MG, Yeter E, Delibasi T. Subclinical atherosclerosis and hyperandrogenemia are independent risk factors for increased epicardial fat thickness in patients with PCOS and idiopathic hirsutism. **Atherosclerosis 2013**; 226(1): 291–295. http://dx.doi.org/10.1016/j.atherosclerosis.2012.11.004.
9. Rotterdam ESHRE/ASRM-Sponsored PCOS Consensus Workshop Group. Revised 2003 consensus on diagnostic criteria and long-term health risks related to polycystic ovary syndrome. **Fertil Steril 2004**; 81(1): 19–25.
10. Dou P, Ju H, Shang J, Li X, Xue Q, Xu Y, Guo X. Application of receiver operating characteristic curve in the assessment of the value of body mass index, waist circumference and percentage of body fat in the Diagnosis of Polycystic Ovary Syndrome in childbearing women. **J Ovarian Res 2016**; 9(1): 51. http://dx.doi.org/10.1186/s13048-016-0260-9.
11. Kim JJ, Hwang KR, Choi YM, Moon SY, Chae SJ, Park CW, Kim HO, Choi DS, Kwon HC, Kang BM, Lee BS, Cho SH, Kim TJ, Kim T, Kim MJ, Park HY. Complete phenotypic and metabolic profiles of a large consecutive cohort of untreated

Korean women with polycystic ovary syndrome. **Fertil Steril 2014**; 101(5): 1424–1430. http://dx.doi.org/10.1016/j.fertnstert.2014.01.049.
12. Ezeh U, Pall M, Mathur R, Azziz R. Association of fat to lean mass ratio with metabolic dysfunction in women with polycystic ovary syndrome. **Hum Reprod 2014**; 29(7): 1508–1517.
13. Omron Healthcare Co., Ltd., 53, Kunotsubo, Terado-Cho, Muco, Kyoto, 617–0002, Japan. http://www.omronhealthcare-ap.com/resources/HBF-375.pdf.
14. Luo X, Xu L. Association of fat distribution with metabolic syndrome in patients with polycystic ovary syndrome. **Nan Fang Yi Ke Da Xue Xue Bao 2012**; 32(9): 1325–1327.
15. Vilmann LS, Thisted E, Baker JL, Holm JC. Development of obesity and polycystic ovary syndrome in adolescents. **Horm Res Paediatr 2012**; 78(5–6): 269–278. http://dx.doi.org/10.1159/000345310.
16. Sprung VS, Jones H, Pugh CJ, Aziz NF, Daousi C, Kemp GJ, Green DJ, Cable NT, Cuthbertson DJ. Endothelial dysfunction in hyperandrogenic polycystic ovary syndrome is not explained by either obesity or ectopic fat deposition. **Clin Sci (Lond) 2014**; 126(1): 67–74. http://dx.doi.org/10.1042/CS20130186.
17. Lim SS, Davies MJ, Norman RJ, Moran LJ. Overweight, obesity and central obesity in women with polycystic ovary syndrome: a systematic review and meta-analysis. **Hum Reprod Update 2012**; 18(6): 618–637.
18. Svendsen PF, Nilas L, Nørgaard K, Jensen JE, Madsbad S. Obesity, body composition and metabolic disturbances in polycystic ovary syndrome. **Hum Reprod 2008**; 23(9): 2113–2121.
19. Borruel S, Fernández-Durán E, Alpañés M, Martí D, Alvarez-Blasco F, Luque-Ramírez M, Escobar-Morreale HF. Global adiposity and thickness of intraperitoneal and mesenteric adipose tissue depots are increased in women with polycystic ovary syndrome (PCOS). **J Clin Endocrinol Metab 2013**; 98(3): 1254–1263. http://dx.doi.org/10.1210/jc.2012-3698.
20. Mario FM, do Amarante F, Toscani MK, Spritzer PM. Lean muscle mass in classic or ovulatory PCOS: association with central obesity and insulin resistance. **Exp Clin Endocrinol Diabetes 2012**; 120(9): 511–516. http://dx.doi.org/10.1055/s-0032-1309006.
21. Kogure GS, Silva RC, Picchi Ramos FK, Miranda-Furtado CL, Lara LA, Ferriani RA, Dos Reis RM. Women with polycystic ovary syndrome have greater muscle strength irrespective of body composition. **Gynecol Endocrinol 2015**; 31(3): 237–242. http://dx.doi.org/10.3109/09513590.2014.982083.
22. Lerchbaum E, Schwetz V, Giuliani A, Obermayer-Pietsch B. Influence of a positive family history of both type 2 diabetes and PCOS on metabolic and endocrine parameters in a large cohort of PCOS women. **Eur J Endocrinol 2014**; 170(5): 727–739.
23. Glintborg D, Andersen M, Hagen C, Frystyk J, Hulstrøm V, Flyvbjerg A, Hermann AP. Evaluation of metabolic risk markers in polycystic ovary syndrome (PCOS). Adiponectin, ghrelin, leptin and body composition in hirsute PCOS patients and controls. **Eur J Endocrinol 2006**; 155(2): 337–345.
24. Sam S, Scoccia B, Yalamanchi S, Mazzone T. Metabolic dysfunction in obese Hispanic women with polycystic ovary syndrome. **Hum Reprod 2015**; 30(6): 1358–1364. http://dx.doi.org/10.1093/humrep/dev073.
25. Rees E, Coulson R, Dunstan F, Evans WD, Blundell HL, Luzio SD, Dunseath G, Halcox JP, Fraser AG, Rees DA. Central arterial stiffness and diastolic dysfunction are associated with insulin resistance and abdominal obesity in young women but polycystic ovary syndrome does not confer additional risk. **Hum Reprod 2014**; 29(9): 2041–2049. http://dx.doi.org/10.1093/humrep/deu180.
26. da Silva AM, de Andrade AC, Dias BH, da Silva Medeiros MA, Rao VS, das Chagas Medeiros F. Elevated diastolic blood pressure in insulin-resistant polycystic ovarian syndrome patients. **Arch Gynecol Obstet 2014**; 289(1): 119–122. http://dx.doi.org/10.1007/s00404-013-2953-2.

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