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Health-promoting lifestyle and associated factors among polycystic ovary syndrome: a cross-sectional study

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Abstract

Objective

The object of this study was to investigate the status of health-promoting lifestyle and associate factors in patients with polycystic ovary syndrome.

Design, setting and participants

A cross-sectional survey using a structured questionnaire was conducted among patients with polycystic ovary syndrome, between December 2020 to May 2021. Using the t-test, Bivariate Correlation and One-way ANOVA test compare the sociodemographic variables, health-promoting lifestyle scores of PCOS patients; Multiple stepwise linear regression was conducted to assess risk factors associated with the health-promoting behavior of PCOS patients.

Measures

Health-promoting lifestyles were measured by the HPLP-II scale.Sociodemographic characteristics questionnaire were age,education level,living resistance,marital status,occupation,weight,height,body mass index(BMI),waist circumference(WC) etc.Anxiety was measured via Zung's Self-Rating Anxiety Scale (SAS),Depression

status was assessed using zung's self-rating depression scale(SDS),Self-Efficacy was estimated using the Managing Chronic Disease 6-Item Scale(SECD6).

Results

Among the participants, only 18.4% of the patients had an excellent level of health-promoting lifestyle behavior and 63.9% had a low level of health-promoting behavior. In this survey, PCOS patients had a low level in health-promotion lifestyle (66.60±10.95), the highest score in all dimensions of spiritual growth(14.49±4.88), whereas physical activity(6.93±4.02)was executed worst. Multiple regression analysis indicated that the main influence factors for the participants were anxiety(B=1.985,p<0.05),depression(B=1.985,P<0.05),self-efficiency （B=0.36,P=0.01）and education level（B=0.43,P＜0.01).The model showed 40.56% of variance being shared with the dependent and independent variables (R2 =40.56, F=15.87, p<0.001).

Conclusion

The healthy-promoting lifestyle is worst among patients with PCOS.Improving negative emotions, enhancing behavior awareness and self-management should be an effective intervention strategies to increase PCOS-related health-promoting lifestyle behavior.

Trial registration number

ChiCTR2000034572

Strengths and limitations of this study

► This study is the first attempt to use the t-test, Bivariate Correlation and One-way ANOVA test to investigate the status of health-promoting lifestyle and associate factors in patients with polycystic ovary syndrome.

► The recruitment were done through real-world recruited PCOS patients by convenience sampling from the outpatient department of the affiliated hospital of Zunyi Medical University in China, suggesting feasibility of applying the screening

tool to investigate the status of health-promoting lifestyle and associate factors in PCOS patients.

► The participants were not randomly selected, hence it was not a representative sample of PCOS patients in Zunyi.

► Due to the cross-sectional nature of this study, the findings can only indicate associations between health-promoting lifestyle and associated factors in PCOS patients.

Introduction

Polycystic ovary syndrome (PCOS) is the most common endocrine disorder, affecting4%–18% of women of reproductive age[1].The main features of PCOS include hyperandrogenism, menstrual dysfunction, anovulatory, polycystic ovaries, and more than 80% of PCOS are overweight or obese[2,3].Furthermore, PCOS increases the risk of additional complications, such as type 2 diabetes, metabolic syndrome, and abdominal obesity[4,5] The treatment in PCOS includes lifestyle interventions (dietary, exercise, behavior, or combined), surgical and pharmacological options. However, compared with the other two treatments, lifestyle management may be preferable and present a cost-effective initial treatment strategy[6].International PCOS guidelines also recommend lifestyle management as the first-line treatment for patients with PCOS[7]. A large number of studies reported the beneficial effects of lifestyle management in PCOS,such as optimizing healthy weight,decreasing underlying hormonal disturbances,prevention future metabolic and reproductive complications, and improving quality of life[7]. Unfortunately, it seems that the strong recommendation of a healthy lifestyle has little effect on patients, as many of them fail to adopt and maintain healthy behaviors. A recent study indicates that 44% of PCOS patients engage in a high level of physical activity, only 13%patients long term maintain healthy behavior[11].

Although several previous studies have reported the importance of life management among PCOS patients[11], these studies did not describe the status of

multidimensional life management with PCOS clearly, the greatest quantity studies only a single dimension of behavior assessment, mainly nutrition intake and physical activity. Compared with these one-sided assessments, the Health-Promoting Lifestyle Profile II (HPLP-II) provides a multidimensional estimation of health-promoting behavior. Previous research has revealed that participants following health-promoting lifestyles were healthier and suffered less from the pains of diseases[14]. However, in current research, only one study describes the health-promoting lifestyles among the PCOS, and their results suggest that health-promoting lifestyles were at a moderate level, the physical activity is lowest in subscales[15], but while this study did not investigate which factors account for the phenomenon.Furthermore, PCOS patient's negative impact is always underestimated and dominates women's life, however, no research has reported the relationship between health-promoting behavior and negative emotion in patients with PCOS.Accordingly,finding the factors that influence health-promoting behaviors is important to improving patients' health behaviors to lower the risk of long-term complication for patients with PCOS.There is a paucity of information associated with the multidimensional assessment of health-promoting lifestyle PCOS among women of the reproductive age group in China.The factors that impact participants' health-promoting behavior have not been explored.

The purpose of this study was to identify the status of health-promoting lifestyle behaviors in patients with polycystic ovary syndrome and to validate the risk factors associated with health-promoting lifestyle behaviors.

Methods

Study design and participants

This was a cross-sectional observational study that recruited PCOS patients by convenience sampling from the outpatient department of the affiliated hospital of Zunyi Medical University in China.Women aged 18 years or older, having been diagnosed by a physician with PCOS were included in the study. Patients who were

the inability to read and/or understand the questionnaires used in the study were excluded from the study. Informed consent was received before initiating the survey. The study was conducted from December 2020 to June 2021 and was approved by the ethical committee of the hospital ([2019]1-028).

Sample size calculation

The sample size calculation approach by events per variable(EPV), in which the sample size was calculated assuming p, the proportion of the population with PCOS, and the number of predictors, K. Based on the above assumptions and eq.N= EPV.K/p(k=6,p=0.18), Only when the EPV is at least 10 can the result be robust.the sample size was 333,to allow the attrition rate ,the final sample size was 366.

Patient and public involvement

No patient involved.

Measures

Primary outcome

Health-promoting lifestyles were measured by the HPLP-II scale. this scale contains 52 items in 6 subscales:nine questions on nutrition,eight questions on physical activity, eight questions on stress management,nine questions on interpersonal relationships, nine questions on health-related responsibility,nine questions on spiritual growth. Based on a 4-point Likert scale from1 to 4,including never, sometimes, often, and usually.The total score of HPLP-II ranges from 52 to 208, a separate score can be calculated for each area.A higher score means more health-promoting behavior [16], and a lower score indicates a worse level of a healthy lifestyle.The HPLP II has categorized 3 levels:excellent,moderate,and weak health lifestyle performance, representing above 75% of the highest scores,between 50% and 75%,and scores below 50%, respectively[17].

Secondary outcome

Sociodemographic characteristics questionnaire were age,education level,living resistance,marital status,occupation,weight,height,body mass index(BMI),waist

circumference(WC) etc.Anxiety was measured via Zung's Self-Rating Anxiety Scale (SAS),Depression status was assessed using zung's self-rating depression scale(SDS),Self-Efficacy was estimated using the Managing Chronic Disease 6-Item Scale(SECD6).

Statistical analysis

Epidata was used to access and verify the validity of the data. Using SPSS18.0 to analyze data.Descriptive statistics have been presented as frequencies and mean(SD). The bivariate correlations, k-independent samples, Two-sample t-test, and One-Way ANOVA were used to compare varying variables and health-promoting lifestyles differences of PCOS patients.A multiple stepwise linear regression was validated to examine risk factors of health-promoting behavior.All tests were two-sided, with α= 0.05.

Results

Sample characteristics

Of the 381 questionnaires distributed and returned, ten lacked key variables, while five lacked more than 20% of the variables. This left 366 to be considered for an effective return rate of 95.9%.

The sample comprised 351 patients with PCOS. Demographic information for the study sample is presented in table1.The mean of the participants' age was 25.56(SD=4.01);The average BMI of the participants was 23.33(SD=4.35); The average WC of the participants was 84.17(SD=9.43).Almost all participants (n=366, 85.79%) had received at least a middle school education(over 9 years in duration). More than half of the participants were single (n=366, 85.79%).The average SAS scale of the participants was 51.32(SD=7.24).The average SDS scale of the participants was 50.54(SD=7.82).The average self-efficiency scale of the participants was 6.18(SD=3.59).(Table 1)

Table1 Demographic characteristics among the PCOS patients(N=366)

Variable	Categories	Mean (SD)	Frequency (N)	Percentage (%)
Age		25.56(4.01)		
BMI		23.33（4.35）		
WC		84.17（9.43）		
Living residence	city		198	54.09
	countryside		168	45.9
Marital status	Single		196	53.55
	Married		140	38.25
	Widowed/divorced		77	21.04
Education	Elementary		52	14.21
	Middle school		78	21.31
	High school		68	18.58
	College		168	45.91
Occupation	Employed		111	30.23
	Unemployed		98	26.78
	Student		87	23.77
	Other		67	18.31
Years of PCOS	< 1years		163	44.54
	1-3years		125	34.15
	4-6years		68	18.58
	> 7years		10	2.73
Whether there is a need for pregnancy	Yes		177	48.36
	No		189	51.64
SDS scale		51.32(7.24)		
SAS scale		50.54(7.82)		
Self-efficacy		6.18(3.59)		

scale

Total HPLP II mean was 66.60±10.95.The average score of spiritual growth(13.49±7.88) was the highest on the subscales , but the average score of physical activity is the lowest (6.93±4.02).Table 2 indicates the average item score for each subscale. (Table 2)

Table 2 PCOS patients HPLP II Total and Subscales' Mean Scores (N=366)

	M（SD）	min	max	Highest and Lowest obtainable score
Healthy responsibility	9.26(3.96)	2	25	9-36
Nutrition	11.59(4.46)	1	25	9-36
Interpersonal relations	13.58(4.85)	1	29	9-36
Spiritual growth	14.49(4.88)	3	27	9-36
Stress management	10.96(3.94)	0	22	8-32
Physical activity	6.93(4.02)	0	18	8-32
Total HPLP score	66.60(10.95)	28	134	52-208

NOTE:HPLP=Health-Promoting Lifestyle Profile II; M=mean; SD=standard deviation; min=minimum; max=maximum.

Nutrition and subscale, there was a statistical difference between the Marital status groups,education, years of PCOS. When one-way Tukey variance analysis is performed,the mean scores of the patients married of marital status had higher than the patients between the single and Widowed/divorced(p= 0.01).the mean scores of the patients1-3 years of PCOS had higher than those in <1years and 4-6years and>7years.nutrition scores were higher in university graduates(11.14±4.95) than those in Elementary school(8.54±4.45) graduates and Middle school graduates(9.75±2.64) and High school graduates (10.24±3.39)(p=0.03). (Table3)

Table 3 Associations and Differences of HPLP II Mean Scores with Demographic Variables (N=366)

Variable	Categories	Healthy responsibility	Nutrition	Interpersonal relations	Spiritual growth	Stress management	Physical activity	Total HPLP score
Living residence	city	7.91(3.11)	9.45(3.43)	11.5(3.72)	11.97(4.26)	9.72(4.09)	5.31	55.86(15.67)
	countryside	7.98(3.19)	10.09(3.63)	12.96(4.58)	13.52(4.39)	10.11(3.95)	5.00	59.56(15.21)
	P value	0.92[a]	0.67[a]	0.13[a]	0.11[a]	0.66a	0.64[a]	0.27[a]
Marital status	Single	7.63(3.23)	9.35(3.09)	12.58(4.74)	12.94(4.41)	10.17(4.04)	5.5(2.78)	58.17(16.11)
	Married	9.33(3.06)	15(5.57)	8.67(7.51)	14.33(10.02)	8(4.58)	9.33(5.86)	64.67(13.56)
	Widowed/ divorced	8.41(2.99)	10.56(3.52)	12.50(3.35)	12.82(3.96)	9.82(3.98)	4.29(2.65)	58.62(12.51)
	P value	0.41[b]	0.01[b]	0.32[b]	0.85[b]	0.65[b]	0.008[b]	0.02[b]
Education	Elementary	7.42(2.62)	8.54(4.45)	11.21(4.99)	12.38(4.13)	9.15(5.71)	4.13(2.45)	52.83(18.07)
	Middle school	7.54(3.33)	9.75(2.64)	12.08(4.99)	12.49(4.32)	9.54(3.86)	4.62(3.09)	56.02(12.92)
	High school	8.14(1.95)	10.24(3.39)	12.57(3.41)	13.57(4.50)	10.37(3.76)	5.71(3.2)	60.66(16.23)
	College	8.32(3.55)	11.14(4.95)	13.29(4.39)	13.62(4.72)	10.71(2.06)	6.71(3.13)	63.79(12.64)
	P value	0.79[c]	0.03[c]	0.49[c]	0.48[c]	0.55[c]	0.011[c]	0.003[c]
Occupation	Employed	8.48(3.54)	9.91(4.43)	12.91(4.99)	12.17(4.88)	10.26(4.36)	5.65(3.29)	59.38(19.57)
	Unemployed	8.33(2.55)	11.33(3.35)	13.47(4.47)	13.6(3.96)	10.93(4.56)	5.13(2.64)	62.79(13.04)
	Student	7.81(3.50)	9(3.05)	12.67(4.28)	13.62(4.14)	9.57(3.50)	5.62(2.89)	58.29(13.98)
	Other	7.54(2.80)	10(3.10)	11.19(3.62)	12.62(4.55)	9.58(3.81)	4.19(2.94)	55.12(13.73)
	P value	0.72[b]	0.29[b]	0.35[b]	0.65[b]	0.7[b]	0.29[b]	0.4[b]
Years of PCOS	< 1years	8.5(2.12)	8.5(2.12)	18(4.24)	18(4.24)	16(5.66)	4.08(2.16)	73.08(10.61)
	1-3years	6.67(1.15)	10.34(3.48)	13(3.61)	11.33(3.57)	12(4.36)	5.5(3.16)	58.84(13.50)
	4-6years	7.54(3.17)	9.24(3.69)	12.07(4.41)	13.09(4.64)	9.73(3.67)	7(1.41)	58.67(15.57)
	> 7years	9(3.12)	10(4.58)	12.68(4.08)	12.4(3.92)	7.76(4.33)	6(2.65)	57.84(15.45)

	P value	0.14[c]	0.002[c]	0.3[c]	0.34[c]	0.25[c]	0.018[c]	0.015
Whether there is a need for pregnancy	Yes	7.76(3.28)	10(3.19)	11.87(3.75)	13.41(4.87)	10.15(3.99)	5.63(3.13)	58.82(17.06)
	No	6.28(2.95)	10.07(3.77)	12.83(4.77)	12.54(3.68)	9.85(4.13)	4.54(2.75)	56.07(13.07)
	P value	0.45[a]	0.08[a]	0.32[a]	0.36[a]	0.75[a]	0.03[a]	0.012

Note：a=T;b=F;c=x2;HPLP-II:Health-Promoting Lifestyle Profile II

In physical activity,the married group had significantly higher physical activity scores (9.33± 5.86) than the patients between the single group (5.5± 2.78) and Widowed/divorced(4.29±2.65).The higher the degree, the higher the physical activity score(p=0.011). the mean scores of the patients 4-6 years (7±1.41)of PCOS had higher than those in<1years (4.08±2.16) and 1-3 years(5.5±3.16) and > 7years(6±2.65)(p=0.018).The group who did not need for pregnancy had significantly lower physical activity scores (4.54±2.75) than those who needed for pregnancy (5.63±3.13) (p=0.03). (Table3)

Pearson correlation coefficient was used to describe the correlations between the variables.As shown in Table 4, age, WC, BMI,self-efficiency, depression, and anxiety were significantly correlated with HPLP-II (P<.05).Moreover, there was a statistically significant positive correlation between HPLP-II and age,WC,BMI,and self-efficiency(P<.01).On the other hand, Negative correlations were found between HPLP-II and depression and anxiety.These results suggest that higher age,wc,self-efficiency and BMI,lower depression, and anxiety are significantly correlated with poor HPLP-II. (Table 4)

Table 4 Associations and Differences of HPLP II Mean Scores with Demographic Variables (N=366)

Variable	Healthy responsibility	Nutrition	Interpersonal relations	Spiritual growth	Stress management	Physical activity	Total HPLP score
Age	0.14	0.79**	0.79**	0.76**	0.78**	0.75**	0.28**

BMI	0.09	0.01	0.01	0.14	-0.11	0.03	0.02**
WC	-0.18*	-0.08	-0.09	-0.12	-0.24*	-0.13	-0.18*
Depression scores	-0.24	-0.25*	-0.36**	-0.38**	-0.37**	-0.27**	-0.41**
Anxiety scores	-0.24*	-0.28**	-0.40**	-0.33**	-0.35**	-0.30**	-0.42**
Self-efficiency	0.07	0.12	0.15	0.27**	0.28**	0.15	0.79**

**:p＜0.01；*:p＜0.05

A multiple regression analysis was conducted for the variables that significantly correlated HPLP-II score to anxiety(B=1.985,p＜0.05),depression(B=1.985,p＜0.05),self-efficency(B=0.36,P=0.01) and education level(B=0.43,P＜0.01). (Table5).The model showed 40.56% of variance being shared with the dependent and independent variables (R2 =40.56, F=15.87, p<0.001).

Table5 Multivariate analysis (forward stepwise) of predictors for health-promoting behavior (HPLP-II score)

Mode		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		R^2
		B	Std. Error	Beta			Lower Bound	Upper Bound	
1	(Constant)	115.48	8.79		13.13	0.00	98.12	132.74	
	Anxiety	-1.08	0.19	-0.42	-5.66	0.00	-1.45	-0.69	25.7
2	(Constant)	134.24	10.92		12.29	0.00	112.12	154.81	
	Anxiety	-0.69	0.23	-0.27	-2.95	0.00	-1.15	-0.25	28.7
	Depression	-0.71	0.26	-0.26	-2.7	0.01	-1.17	-0.191	

					9				
3	(Constant)	113.92	13.61		8.37	0.00	87.32	140.72	
	Anxiety	-0.61	0.23	-0.24	-2.61	0.01	-1.07	-0.17	
	Depression	-0.72	0.25	-0.26	-2.86	0.01	-1.17	-0.23	34.6
	Self-efficacy	0.37	0.15	0.18	2.43	0.02	0.05	0.65	
4	(Constant)	114.83	11.24		9.78	0.00	79.14	139.13	40.56
	Anxiety	-0.59	0.23	-0.23	-2.59	0.02	-1.07	-0.17	
	Depression	-0.70	0.25	-0.26	-2.76	0.01	-1.17	-0.23	
	Self-efficacy	0.36	0.14	0.17	2.41	0.018	0.05	0.65	
	Education level	0.43	0.21	0.23	3.23	0.00	0.03	0.56	

Note:Dependent Variable: The scores of HPLP-II;HPLP-II=Health-Promoting Lifestyle Profile II

Figure 1 shows depression patients scored higher on HPLP-II scale scores compared to No-depression patients ($p < 0.01$). anxiety patients scored higher on HPLP-II scale scores compared to No-anxiety patients ($p < 0.01$).

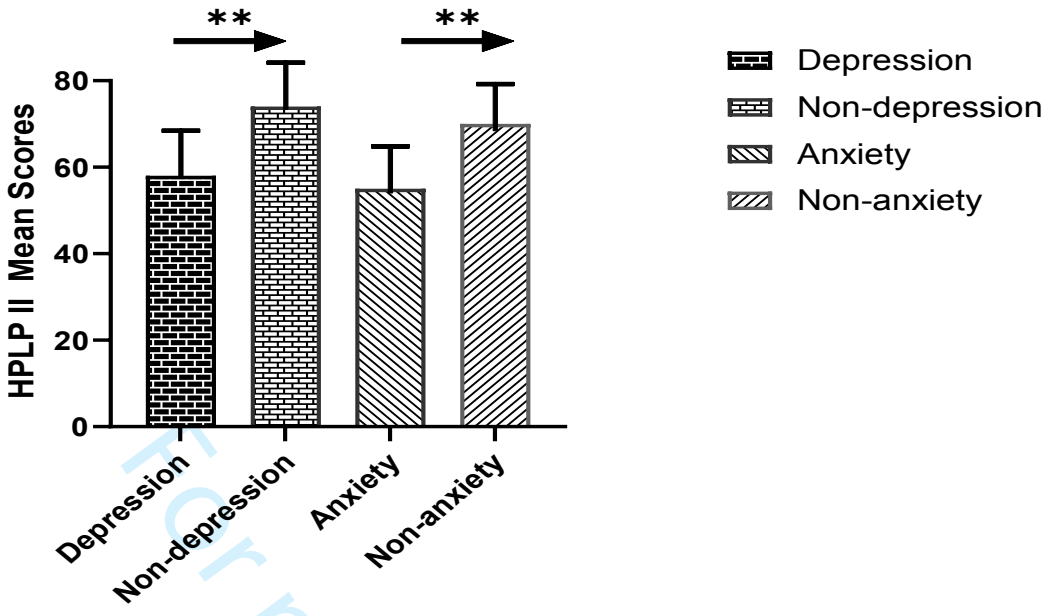

Figure 1 Mean and distribution of the health-promoting lifestyle scores in depression vs non-depression and anxiety vs non-anxiety among PCOS patients(N=366)

Note:**=p＜0.05

Discussion

In present study,it was found that PCOS patients had a low-level health-promoting lifestyle (66.60±10.95).Only 18.4% of the patients had a higher level of health-promoting lifestyle and 63.9% had a low level of health-promoting lifestyle.[15]Yet differences were found in another study conducted in Nanjing, China, in which PCOS patients had a moderate level of healthy-promote lifestyle,this phenomenon does not occur in patients with PCOS.previous studies[18-20]have also shown that college students, nursing students or cardiovascular patients have a moderate level scores in health-promoting lifestyle.There may be many reasons for this phenomenon:First,Patients with PCOS are younger and sensitive to body-image. Self-image disorders (hair, acne and obesity) may reduce the initiative and enthusiasm of patients in life management[21, 22].Second,women with polycystic ovary syndrome feel lack of information about their condition. A previous study conducted among PCOS women at Taif city, where 34% had received knowledge through health

education [23, 24].Although the present study cannot confirm that the awareness rate of health-promoting lifestyle is directly related to incorrect healthy-promote lifestyle behavior,this low awareness rate could influence their risk of healthy-promote lifestyle behavior.

In the present study, we found significant relationships between negative emotional scores(depression and anxiety score) and healthy-promote lifestyle behavior. This may be the reason as reproductive and metabolic disorder deteriorates, menstrual disturbances becomes more severity, and patients may due to negative emotions and unable to carry out a healthy lifestyle[25].The present study also indicates that NO-depression patients scored higher on HPLP scale scores compared to depression patients.No-anxiety patients scored higher on HPLP scale scores compared to anxiety patients. So this may explain why the more serious negative emotions, the lower HPLP-II scores. Chang et al. Study[26]also found significant relationships between negative emotions and health-promoting behaviors. However,in current study, a few studies explore the relationship between negative emotion and health-promoting behaviors among patients with PCOS. Therefore, there is an urgent need to take necessary steps to neutralize and improve the negative emotion to enhance the health-promoting behaviors of PCOS patients by this study results.

In the present study, there was a significant relationship(positive) between the self-efficacy and the mean scores of health-promoting behavior total score. We also observed the self-efficiency was a low level(6.18±3.59) in patients with PCOS. The reasons for this phenomenon may be that with the participants is younger, lowered performance and self-management ability, the lack of ability to balance work(study or family) and health-promoting behavior, but the direct reason may lake of motivation. A [27]previous study indicated that self-efficacy is a central component, a significant outcome variable, and an important indicator for deciding health education programs, a major part of behavior change processes, and a precondition for a successful self-management of chronic diseases . People who have greater self-efficacy are thought to perceive fewer barriers to behavior change and goal attainment [28],

mediated by the implementation of self-management to pursuit the desired goal. This maybe explains the less self-efficiency and the lower health-promoting behavior scores in our study. Moreover,preious studies indicate that through improved self-efficacy have led to improved lifestyle behaviours in chronic conditions such as bipolar disorder,chronic obstructive pulmonary disease,stroke ,chronic kidney disease,cardiovascular disease,cancer and diabetes[29-31].Therefore, there is an urgent need for further research to assess and enhancement of the PCOS patient's self-efficacy and life management intention to change before health-promoting behaviors implementation is an important consideration when undertaking health behavior change.

The findings of the present study showed that the higher the education level of patients with polycystic ovary syndrome, the better their healthy lifestyle behavior. This reveals that the patient's education level is a significant factor for providing the means to change and maintain healthy behavior.PCOS is a chronic disease that requires long-term management, enhancing health education for patients with low education levels may help prevent the occurrence of long-term complications and reduce the number of hospitalization.

To the best of our knowledge, our study is the first survey to identify the status of health-promoting lifestyle behaviors in patients with polycystic ovary syndrome and to validate the risk factors associated with health-promoting lifestyle behaviors.But, this study had some limitations,first,the participant selection was limited to patients only used a convenient sampling from one hospital in China.Second, participants reported the measures themselves,there was a possibility that healthy-promoting behavior was under or over reported as the answer relied on participants' perception.

Conclusion

In summary, the study found that patients with polycystic ovary syndrome had a low level of health promotion lifestyle.Moreover,our research suggests that four main factors(depression,anxiety,self-efficiency,and education)play a critical role in

health-promoting behavior of PCOS patients.Therefore,future research should take out-of-hospital extended services to be involved actively in improving lifestyle factors and modifying barriers in the promotion of health among PCOS patients of all ages.The results of the present study fill an information gap and provide some preliminary insights for designing life management protocol and health-promoting behavior interventions.

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Contributors

LianHong Wang and YunMei Guo conceived the study and obtained funding. Ying liu ,Xin Yan,Rui Ding,Huiwen Tan coordinated data collection. YunMei Guo analysed and interpreted the data, wrote the first draft. LianHong Wang and YunMei Guo revised the draft further for intellectual consent. All authors read and approved the final manuscript.

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Competing interests

None declared.

Patient consent for publication

Not required.

Ethics approval

The study received official approval from the Ethical Committee of the affiliated hospital of zunyi medical university(NO.[2019]1-028).All participants had obtained informed consent. All participants were informed that they were free to withdraw from the study at any point.

Provenance and peer review

Not commissioned; externally peer-reviewed.

Data availability statement

No data are available. The ethical approval and participant consent for this study do not allow sharing of data beyond the research

team.

Supplemental material

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5
Bias	9	Describe any efforts to address potential sources of bias	*5*
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	5
		(*b*) Describe any methods used to examine subgroups and interactions	5
		(*c*) Explain how missing data were addressed	5
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	5
		(*e*) Describe any sensitivity analyses	5
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6
		(b) Give reasons for non-participation at each stage	6
		(c) Consider use of a flow diagram	6
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6
		(b) Indicate number of participants with missing data for each variable of interest	6
Outcome data	15*	Report numbers of outcome events or summary measures	6
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	6
		(*b*) Report category boundaries when continuous variables were categorized	6
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	6
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	7
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	8
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	9
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	11

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Factors affecting the adoption of health-promoting behaviours in patients with polycystic ovary syndrome: a cross-sectional study

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Abstract

Objective This study aimed to investigate health-promoting lifestyle status and associated risk factors in patients with polycystic ovary syndrome.

Design cross-sectional study

Setting This study was conducted at a tertiary hospital in Guizhou, China from December 2020 to June 2021.

Participants A total of 366 participants (18-45 years)diagnosed with polycystic ovary syndrome were recruited from the outpatient departments.

Measures

Sociodemographic characteristics were collected ,and health-promoting behaviours were measured using the Health-Promoting Lifestyle Profile scale (HPLP-II scale).Anxiety status was measured using the Zung's Self-Rating Anxiety Scale (SAS),depression status using the Zung's self-rating depression scale(SDS),and self-efficacy using the Managing Chronic Disease 6-Item Scale(SECD6).Multiple stepwise linear regression was conducted to assess the risk factors associated with the health-promoting behaviours of the study participants.

Results

Only 13.20% of the participants had an optimal health-promoting lifestyle,and 63.70% had minimal health-promoting behaviours (88.54±17.44).The highest score in all dimensions was spiritual growth(16.68±4.98), while physical activity(12.71±2.68)was the lowest.Multiple regression analysis revealed that the main factors influencing the development and maintenance of health-promoting behaviours among participants were education (B=10.788,P＜0.001),depression(B=-0.377,P＜0.001),anxiety(B=-0.333,P＜0.001) and self-efficacy(B=0.938,P=0.002).The model showed 74.40% variance shared between the dependent and independent variables (R^2 =74.40, F=264.633, P<0.001).

Conclusion

Health-promoting behaviours are minimal among patients with polycystic ovary syndrome,and improving negative emotions and enhancing behavioural awareness and self-efficacy are necessary to increase the adoption of health-promoting behaviours among patients with PCOS.

Trial registration number: ChiCTR2000034572

Strengths and limitations of this study

► This study represents the first attempt to investigate health-promoting lifestyle status and associated risk factors in patients with polycystic ovary syndrome.

►This study assessed multidimensional health-promoting behaviours in patients with polycystic ovary syndrome, not only nutrition or physical activity

► Recruitment was done by convenience sampling from the outpatient department of the affiliated hospital of Zunyi Medical University in China, suggesting the feasibility of applying the screening tool to investigate health-promoting lifestyle status and associated risk factors in patients with polycystic ovary syndrome.

► The participants were not randomly selected;hence,this is not a representative sample of patients with polycystic ovary syndrome in Zunyi.

► Due to the cross-sectional nature of this study, the findings can only indicate association,not causality, between health-promoting behaviours and possible risk factors in patients with polycystic ovary syndrome .

Introduction

Polycystic ovary syndrome (PCOS) is the most common endocrine disorder, affecting 4%-18% of women of reproductive age[1].The main features of PCOS include hyperandrogenism, menstrual dysfunction, and anovulatory polycystic ovaries.More than 80% of patients with PCOS are overweight or obese[2, 3].Furthermore, PCOS increases the risk of additional complications, such as type 2 diabetes, metabolic syndrome, and cardiovascular diseases [4, 5].Treatment for PCOS includes lifestyle interventions (dietary, exercise, behavioural, or combined intervention) and surgical and pharmacological options. However, lifestyle management is preferable and presents a cost-effective initial treatment strategy[6].Moreover,international PCOS guidelines recommend lifestyle management as the first-line treatment[7].

Many studies have reported the beneficial effects of lifestyle management in PCOS,such as optimising healthy weight,decreasing underlying hormonal disturbances,preventing future metabolic and reproductive complications, and improving the quality of life[8-10]. Unfortunately, despite the recommendation of healthy lifestyle changes,many patients fail to adopt and maintain healthy behaviours.

A recent study indicated that 44% of PCOS patients engage in high level physical activity, and only 15% maintain healthy behaviours in the long term[11].

Although several studies have reported the importance of lifestyle management among PCOS patients[12, 13], these studies did not clearly describe multidimensional life management with PCOS.Most studies focused on only one dimension of behaviour assessment, mainly nutritional intake and physical activity. Compared with these one-sided assessments, the Health-Promoting Lifestyle Profile II (HPLP-II) provides a multidimensional estimation of health-promoting behaviourr. Previous research has revealed that participants following health-promoting lifestyle recommendations were healthier and suffered less pain[14]. However, only one study described health-promoting lifestyles in relation to PCOS, and their results suggest that health-promoting lifestyles were at a moderate level, with physical activity being the lowest in subscales[15].However, this study did not investigate which factors accounted for the phenomenon.Furthermore, the negative emotional impact of PCOS on patients is always underestimated;yet,no research has reported the relationship between health-promoting behaviours and negative emotions in patients with PCOS.Therefore, identifying factors that influence health-promoting behaviours is important to improve these behaviours and lower the risk of long-term complications in patients with PCOS.There is a paucity of data on the multidimensional assessment of health-promoting lifestyles among women of reproductive age with PCOS in China, and factors that impact health-promoting behaviours have not been explored.

This study aimed to identify health-promoting behaviours among patients with PCOS and validate the risk factors associated with health-promoting behaviours.

Methods

Study design and setting

This is a cross-sectional observational study in which patients with PCOS were recruited by convenience sampling from the outpatient department of the affiliated hospital of Zunyi Medical University located in Zunyi City ,Guizhou Province,China.

It is a general hospital with 2,800 beds and provides healthcare to approximately 12 million residents in this district. On average, the daily number of clinical patients is 8000. The study was conducted from December 2020 to June 2021 and approved by the ethical committee of the hospital ([2019]1-028).

Sample size calculation

The sample size was calculated by events per variable (EPV), assuming that p is the proportion of the population with PCOS, and K is the number of predictors. Based on the above assumptions and the equation N = EPV.K/p(k=6,p=0.18), the result is robust only when the EPV was at least 10. The sample size was calculated as 333. To allow for the attrition rate, the final sample size was 366.

Participants criteria and data collection

Patients who visited the outpatient department of the affiliated hospital of Zunyi Medical University from December 2020 to June 2021 were consecutively included in this study.Women of reproductive age (18-45 years) who met the Rotterdam criteria were included.Two of the following three criteria were required: oligo/anovulation,hyperandrogenism,and polycystic ovaries on ultrasound[16].Otherwise,eligible patients who refused to participate were excluded.Patients who could not read and/or understand the provided questionnaires were excluded from the study.

Data collection was conducted face-to-face by two well-trained researchers. After selecting patients with PCOS according to the Rotterdam criteria, a researcher explained the study's nature and purpose and the survey procedures to the patients. Written informed consent was obtained from all participants before the study.We collected data on physical and psychological characteristics,as well as

sociodemographics from the enrolled participants.The second researcher assessed the patients for health-promoting lifestyle, self-efficacy, depression, and anxiety.

Measures

The self-administered questionnaire included questions on demographic characteristics (self-designed) and instruments to evaluate depression, anxiety，self-efficacy and health-promoting lifestyles.c

Sociodemographic characteristics

The sociodemographic characteristics questionnaire was used to obtain information on age,education level,living residence,marital status,occupation,weight,height,BMI and waist circumference.Weight was measured with light clothing and without shoes. Height was measured without shoes using a stadiometer. BMI was calculated based on height and weight.Waist circumference (WC) was measured in centimeter using plastic tape at the midpoint between the costal margin and the iliac crest in the mid-axillary line in the standing position at the end of a gentle expiration[17].

Health-Promoting Lifestyle

We evaluated health-promoting lifestyles using a health-promoting lifestyle profile. This scale consists of six dimensions and 52 items, including health responsibility (9 items), nutrition (9 items), physical activity (8 items), interpersonal relationships (9 items), stress management (8 items), and spiritual growth (9 items). Each item in the questionnaire was answered using a four-point Likert scale with 1, 2, 3, and 4 corresponding to never, sometimes, often, and routinely, respectively. Total scores ranged from 52 to 208, with higher scores representing better health-promoting behaviours [18]. The total HPLP II score was further classified into three levels: poor for the range 52-90, moderate for the range 91-139, good for the range 140-168, and excellent for the range 169-208 [19].

Depression status

We evaluated depressive symptoms using the Zung Self-Rating Depression Scale (SDS) [20], which has been used in previous studies and is widely used in clinical

settings to assess the subjective severity of depressive symptoms [21, 22]. This scale comprises 20 questions scored on a Likert scale of 1-4 (1, none or a little of the time; 2, some of the time; 3, a good portion of the time; 4, most of the time). The total raw score ranged from 20 to 80, with higher scores representing more severe depressive symptoms. Based on previous studies, we defined the morbidity cut-off point on the SDS as 50 [23]. Patients with SDS scores >50 were categorised into the "depressed group," and displayed moderate or severe depressive symptoms. Patients with SDS scores≤49 were categorised into the "non-depressive group."

Anxiety status

Anxiety symptoms were measured using the Zung Self-rating Anxiety Scale (SAS) [24]. The SAS consists of 20 self-reported items on anxiety symptoms. Some of the items were symptomatically positive and rated on a 4-1 scale (a little of the time, some of the time, a good part of the time, and most of the time). Others were symptomatically negative and rated on a 1-4 scale. A standardised scoring algorithm was used to define anxiety symptoms, with a total score range of 20-80, higher scores represented more severe anxiety symptoms. Owing to the scale's good reliability and validity, it has been widely used in China and other countries [25]. Anxiety was defined as having SAS scores ≥ 50 points [26].

Self-efficacy

We evaluated self-efficacy using the Self-Efficacy for Chronic Disease 6-item Scale (SECD6), which consists of six items with a 10-step Likert scale ranging from 1 (not at all confident) to 10 (totally confident). The scale is interpreted by calculating a mean score over at least four of the six items, thus allowing a maximum of two missing item responses. Means range from 1 to 10, with higher values indicating higher self-efficacy [27]. The SECD6 has good internal consistency, with a Cronbach's α of 0.91[28].

Statistical analysis

EpiData (The Epidata Association,Odense,Demark)was used to assess and

verify the validity of the data ,and SPSS18.0 was used to analyse the data. Descriptive statistics were presented as frequencies and mean±standard deviation.Univariate analysis of sociodemographic characteristics, health-promoting behaviours, and subscale scores was conducted using independent sample t-test, rank-sum test, and one-way analysis of variance (ANOVA). Pearson correlation was used to assess age, BMI, depression, anxiety,self-efficacy, and health-promoting behaviour(health responsibility, physical activity, nutrition, interpersonal relationships, stress management,and spiritual growth). Multiple stepwise linear regression was performed to examine the risk factors for health-promoting behaviours. All tests were two-sided, with $\alpha = 0.05$.

Patient and public involvement

Through literature review and clinical observation, we proposed the research questions, and explored health-promoting behaviours among patients with PCOS and validate the risk factors associated with health-promoting behaviours. During the study, the research team recruited PCOS patients to participate in the study through the principles of disclosure and informed consent. None of the participants helped recruit and conduct the research. After the study, the research results will be shared with policy-makers to help promote the health-promoting behaviours of patients with PCOS. The findings will also be shared with the participants as a guide to improve their health-promoting behaviour.

Results

The sample comprised 366 patients with PCOS. Demographic information for the study sample is presented in Table1.The mean age of participants was 25.56 (SD=4.01), the average BMI was 25.68 (SD=5.24), and the mean WC was 84.17 cm (SD=9.43).Almost all participants (n=366, 85.79%) had received at least a middle school education(over nine years of education). More than half of the participants were single (n=366, 53.55%).The average SDS scale of the participants was 51.32 (SD=7.24), the average SAS scale was 50.54 (SD=7.82), and the average self-efficacy

scale was 6.18 (SD=3.59) (Table 1).

Table1 Demographic characteristics of participants

Variable	Categories	Mean （SD）	Frequency (N)	Percentage (%)
Age		25.56(4.01)		
BMI		25.68（5.24）		
WC		84.17（9.43）		
Living residence	city		198	54.09
	countryside		168	45.90
Marital status	Single		196	53.55
	Married		140	38.25
	Widowed/divorced		77	21.04
Education	Elementary		52	14.21
	Middle school		78	21.31
	High school		68	18.58
	College		168	45.91
Occupation	Employed		111	30.23
	Unemployed		98	26.78
	Student		87	23.77
	Other		67	18.31
Years of PCOS	< 1years		163	44.54
	1-3years		125	34.15
	4-6years		68	18.58
	> 7years		10	2.73
Whether there is a need for pregnancy	Yes		177	48.36
	No		189	51.64
SDS scale		51.32(7.24)		
SAS scale		50.54(7.82)		
Self-efficacy scale		6.18(3.59)		

Table 2 shows the average item score for each subscale (Table 2). The mean total HPLP II was 88.54±17.44. The average score for spiritual growth (16.68±4.98) was highest on the subscales, but that for physical activity was lowest (12.71±2.68).

Table 2 PCOS patients HPLP II Total and Subscales' Mean Scores (N=366)

	M（SD）	min	max	Highest and Lowest obtainable score
Healthy responsibility	13.81(3.39)	9	24	9-36
Nutrition	14.68(4.28)	9	27	9-36
Interpersonal relations	16.33(5.29)	9	32	9-36
Spiritual growth	16.68(4.98)	9	31	9-36
Stress management	14.32(4.15)	8	30	8-32
Physical activity	12.71(2.68)	8	22	8-32
Total HPLP score	88.54(17.44)	60	168	52-208

NOTE:HPLP=Health-Promoting Lifestyle Profile II; M=mean; SD=standard deviation; min=minimum; max=maximum.

In terms of nutrition , there were statistical differences among the marital status,education, and years of PCOS groups. When one-way Tukey variance analysis was performed,the mean scores of married patients were higher than those of patients who were either single or widowed/divorced(p= 0.012).The mean scores of the patients with 1-3 years duration of PCOS were higher than those of patients with <1, 4-6 ,and>7years duration.Nutrition scores were higher in university graduates(17.52±4.08) than in high school graduates (12.79±3.42),middle school graduates(11.48±3.86) and elementary school graduates (10.32±4.27)(P=0.043). (Table3)

Table 3 Associations and Differences of HPLP II Mean Scores with Demographic Variables (N=366)

Variable	Categories	Healthy responsibility	Nutrition	Interpersonal relations	Spiritual growth	Stress management	Physical activity	Total HPLP score
Living residence	City	13.58(3.39)	14.93(4.60)	16.31(5.35)	16.94(5.07)	14.72(4.34)	12.45(2.51)	88.89(18.08)
	Countryside	14.33(3.29)	14.48(3.56)	17.32(5.23)	16.85(4.91)	14.65(4.02)	12.82(2.87)	90.43(16.38)
	P value	0.165[a]	0.444[a]	0.846[a]	0.914[a]	0.918[a]	0.371[a]	0.429[d]
Marital status	Single	13.63(3.58)	13.34(4.14)	16.49(5.25)	16.89(4.94)	14.69(4.33)	12.51(2.57)	87.65(17.09)
	Married	14.26(3.02)	16.25(4.42)	17.09(5.55)	16.82(5.09)	14.79(4.13)	15.61(2.76)	94.82(18.21)
	Widowed/divorced	13(2.94)	12.25(6.70)	14.50(2.38)	18.75(6.29)	13.25(2.22)	11.14(2.16)	82.89(20.30)
	P value	0.449[b]	0.012[b]	0.558[b]	0.757[b]	0.781[b]	0.038[c]	0.013[b]
Education	Elementary	13.58(3.15)	10.32(4.27)	16.44(5.10)	17.23(5.29)	14.73(3.93)	10.27(2.58)	82.57(15.30)
	Middle school	14.04(3.16)	11.48(3.86)	17.36(5.51)	17.44(5.26)	13.48(5.05)	11.60(2.84)	85.10(15.16)
	High school	14(3.14)	12.79(3.42)	16.57(4.86)	17.50(6.01)	14.64(4.36)	12.85(2.57)	88.35(20.29)
	College	15.90(3.64)	17.52(4.08)	16.60(5.51)	16.46(4.62)	15.04(4.27)	15.69(2.65)	97.21(18.00)
	P value	0.924[c]	0.043[b]	0.913[b]	0.721[b]	0.449[b]	0.011[b]	0.036[b]
Occupation	Employed	13.83(3.55)	14.94(4.35)	16.72(5.40)	16.50(4.56)	14.55(4.10)	12.83(2.28)	89.38(16.94)
	Unemployed	13.95(3.14)	15(4.71)	16.60(5.52)	16.85(5.36)	14.80(5.00)	12.75(2.63)	89.95(18.14)
	Student	13.62(3.77)	14.98(3.94)	16.93(5.91)	17.24(5.29)	14.98(4.19)	12.76(3.15)	90.50(19.41)
	Other	14.00(2.98)	14.24(4.06)	16.40(4.71)	17.12(5.22)	14.58(4.14)	12.08(2.54)	88.42(16.54)
	P value	0.958[b]	0.656[c]	0.972[b]	0.884[b]	0.96[b]	0.46[b]	0.953[b]
Years of PCOS	< 1years	13.65(3.27)	14.16(4.22)	16.62(5.25)	17.06(5.33)	14.71(4.06)	12.68(2.74)	88.88(17.27)
	1-3years	14.54(3.62)	17.83(4.51)	16.48(5.37)	16.23(4.67)	14.31(4.16)	15.40(2.47)	94.79(17.72)
	4-6years	12.67(2.81)	13.83(4.17)	16.67(5.96)	17.83(3.25)	15.67(4.76)	10.83(2.56)	87.50(19.35)
	> 7years	11.75(2.63)	13.12(2.31)	16.25(6.02)	18.00(3.83)	17.75(7.93)	9.14(2.58)	86.01(21.70)
	P value	0.185[b]	0.028[c]	0.599[b]	0.428[b]	0.416[b]	0.042[b]	0.011[c]

Continue Table 3 Associations and Differences of HPLP II Mean Scores with Demographic Variables (N=366)

Variable	Categories	Healthy responsibility	Nutrition	Interpersonal relations	Spiritual growth	Stress management	Physical activity	Total HPLP score
Whether there is a need for pregnancy	Yes	13.72(3.26)	14.61(3.49)	16.97(5.22)	16.89(5.05)	14.62(4.21)	15.29(2.48)	92.10(17.35)
	No	15.99(3.53)	11.93(4.05)	16.27(5.43)	16.92(4.97)	15.79(4.25)	10.93(2.78)	87.83(17.71)
	P value	0.614[a]	0.22[a]	0.393[a]	0.972[a]	0.747[d]	0.024[d]	0.017[d]

Note：a=T;b=F;c= Kruskal Wallis Test;d=Mann-Whitney U;HPLP-II:Health-Promoting Lifestyle Profile II

In terms of physical activity,married patients had significantly higher physical activity scores (15.61±2.76) than single (12.51± 2.57) and widowed/divorced patients(11.14±2.16).The higher the educational degree, the higher the physical activity score(P=0.011). The mean scores of the patients with 1-3 years duration of PCOS(15.40±2.47) were higher than those of patients <1(12.68±2.74) ,4-6(10.83±2.56),and >7years(9.14±2.58)(P=0.042) duration of PCOS.Participants who did not desire pregnancy had significantly lower physical activity scores (15.29±2.48) than those who did (10.93±2.78) (P=0.024). (Table3)

As shown in Table 4, age, WC, BMI,self-efficacy, depression, and anxiety were significantly correlated with HPLP-II (P<0.05).Moreover, there was a statistically significant positive correlation between HPLP-II and age,BMI,and self-efficacy(P<0.01).This suggests that HPLP-II is significantly negatively correlated with WC, depression ,and anxiety (Table 4)

Table 4 Associations and Differences of HPLP II Mean Scores with Demographic Variables (N=366)

Variable	Healthy responsibility	Nutrition	Interpersonal relations	Spiritual growth	Stress management	Physical activity	Total HPLP score
Age	0.013	0.051	0.79**	0.76**	0.78	0.75**	0.28**
BMI	0.033	0.041	0.07	0.09	-0.038	0.03	0.06**
WC	-0.056*	-0.009	-0.01	-0.02	-0.066*	-0.001	-0.15*
Depression scores	-0.19*	-0.36*	-0.41**	-0.42**	-0.42**	-0.106	-0.49**
Anxiety scores	-0.26*	-0.32**	-0.41**	-0.35**	-0.38**	-0.30*	-0.46**
Self-efficiency	0.27*	0.44	0.43	0.42**	0.38**	0.20**	0.53**

**:p＜0.01； *:p＜0.05

Table 5 shows the results of stepwise multiple linear regression analysis which revealed that education (B=10.788,P＜0.001),depression(B=-0.377,P＜0.001)，anxiety(B=-0.333,P＜0.001) and self-efficacy(B=0.938,P=0.002) were factors associated with health-promoting behaviours .The model showed 74.40% variance shared between the dependent and independent variables (R^2 =74.40,F=264.633.,P<0.001).

Table5 Multivariate analysis (stepwise) of predictors for health-promoting behavior (HPLP-II score)

Model	Variable	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		R^2	F	P
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound			
1	Education	13.346	0.466	0.833	28.617	0.000	12.429	14.263	69.50	418.955	0.000
2	Education	12.153	0.481	0.759	25.266	0.000	11.207	13.099	72.40	374.285	0.000
	Depression	-0.473	0.074	-0.191	-6.352	0.000	-0.62	-0.327			
3	Education	11.622	0.482	0.725	24.116	0.000	10.674	12.57	73.80	341.125	0.000
	Depression	-0.363	0.076	-0.146	-4.752	0.000	-0.513	-0.213			
	Anxiety	-0.367	0.079	-0.14	-4.616	0.000	-0.523	-0.21			
4	Education	10.788	0.545	0.673	19.793	0.000	9.717	11.86	74.40	264.633	0.000
	Depression	-0.377	0.076	-0.152	-4.986	0.000	-0.525	-0.228			
	Anxiety	-0.333	0.079	-0.127	-4.203	0.000	-0.489	-0.177			
	Self-efficacy	0.938	0.298	0.1	3.142	0.002	0.351	1.525			

Figure 1 shows that depressed patients had higher HPLP-II scale scores than non-depressed patients (P<0.01). Patients with anxiety scored higher on the HPLP-II scale than those without anxiety (P<0.01).

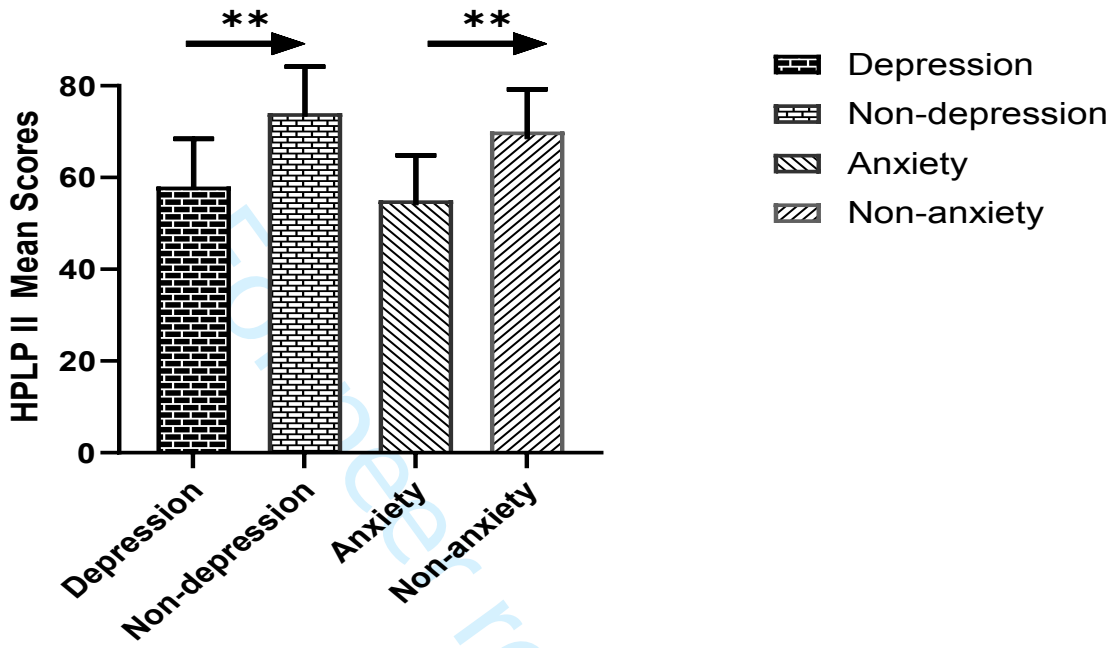

Figure 1 Mean and distribution of the health-promoting lifestyle scores in depression vs non-depression and anxiety vs non-anxiety among PCOS patients(N=366)

Note:**=p＜0.05

Discussion

In the present study,we found that patients with PCOS had minimal health-promoting lifestyle behaviours (88.54±17.44).Health-promoting behaviours are reportedly optimum in only 13.2% of the patients and minimal in 63.7%.[15].However, in another study conducted in Nanjing, China, patients with PCOS had a moderate level of health-promoting behaviours.Previous studies[29-31]have also shown that college students, nursing students ,or cardiovascular patients had moderate health-promoting lifestyle behaviours scores,possible because patients with PCOS are younger and more sensitive to body-image. Self-image disorders (hair, acne and obesity) may reduce the initiative and enthusiasm of patients for lifestyle management[32, 33].Moreover,women with PCOS often lack information about their condition. In a

previous study conducted on women with PCOS in Taif city, 34% of participants had acquired knowledge through health education [34, 35].Although the present study could not confirm a direct relationship between the awareness rate about health-promoting behaviours and low levels of these behaviours, a low awareness rate may be a risk factor.

In the present study, we found significant relationships between negative emotional scores(depression and anxiety scores) and health-promoting lifestyle behaviours. This may explain why reproductive and metabolic disorders deteriorate and menstrual disturbances become more severe in patients with negative emotions, making them unable to imbibe health-promoting behaviours[36].The present study also shows that non-depressed patients had higher HPLP scale scores than depressive patients,and non-anxious patients had higher HPLP scale scores than anxiety patients .Chang et al. also found significant relationships between negative emotions and health-promoting behaviours[37]. However, only a few studies have explored the relationship between negative emotions and health-promoting behaviours among patients with PCOS. Therefore, there is an urgent need to address negative emotions to encourage health-promoting behaviours in patients with PCOS .

There was a significant positive association between self-efficacy and the mean HPLP score in the present study. We also observed low self-efficacy scores (6.18±3.59) in patients with PCOS, probably because younger participants have lower performance and self-management ability and cannot strike a balance between work (study or family) and maintaining health-promoting behaviours. However, the direct reason may be a lake of motivation. A previous study has demonstrated that self-efficacy is a central component, a significant outcome variable, an important indicator for deciding on health education programs, a major part of behavioural change processes, and a precondition for successful self-management of chronic diseases[38] . People with greater self-efficacy are thought to perceive fewer barriers to behavioural change and goal attainment [39], mediated by the implementation of self-management to pursue their desired goal. This may explain the low self-efficacy

and health-promoting behaviour scores in our study. Moreover,previous studies have indicated that improved self-efficacy leads to improved lifestyle behaviours in other chronic conditions such as bipolar disorder,chronic obstructive pulmonary disease,stroke ,chronic kidney disease,cardiovascular disease,cancer and diabetes[40-42].Therefore, there is an urgent need for further research to assess and enhance the self-efficacy and lifestyle management of PCOS patients before the implementation of health-promoting behaviours

In our study, higher education levels of patients with PCOS were associated with better health-promoting behaviours.This shows that educational level is a significant factor in developing and maintaining healthy behaviour.Since PCOS is a chronic disease that requires long-term management, enhancing health education for patients with low education levels may help prevent the occurrence of long-term complications and reduce the number of hospitalisations.

The strengths of our study are that it is the first survey to identify health-promoting lifestyle status in patients with PCOS and validate the associated risk factors.Moreover, we assessed multidimensional health-promoting behaviors in patients with PCOS, not only nutritional intake or physical activity. However, this study had some limitations. First, participant selection was performed by convenience sampling from only one hospital in China.Second, participants self-reported the measures, thus their answers are subject to reporting bias. Third,the cross-sectional nature of the study hinders our ability to make causal inferences regarding risk factors and diseases that exist concurrently.Finally, the reliability and validity of HLPL-II in patients with PCOS was not verified, which might have resulted in biased results. In a subsequent study, we will continue to complete the construction and verification of a specific scale to evaluate the multidimensional health behaviors of patients with PCOS.

Conclusion

In summary, we found that patients with PCOS had minimal health-promoting behaviours.Moreover,our research suggests that four main

factors(depression,anxiety,self-efficacy,and education)play critical roles in adopting health-promoting behaviours in patients with PCOS.Therefore, future studies should focus on web-based hospital services to help evaluate and improve patients' negative emotions and enhance patients' awareness of behavioural change and self-efficacy to improve their lifestyles.The present study results fill an information gap and provide some preliminary insights for designing life management protocols and health-promoting behavioural interventions.

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Competing interests

None declared.

Data availability statement

No data are available. The ethical approval and participant consent for this study do not allow sharing of data beyond the research team.

Author contributions

LianHong Wang and YunMei Guo conceived the study and obtained funding. Ying liu, Xing Yan, Rui Ding, and Huiwen Tan coordinated data collection. YunMei Guo analyzed and

interpreted the data and wrote the first draft. LianHong Wang and YunMei Guo revised the draft further for intellectual content. All authors read and approved the final manuscript.

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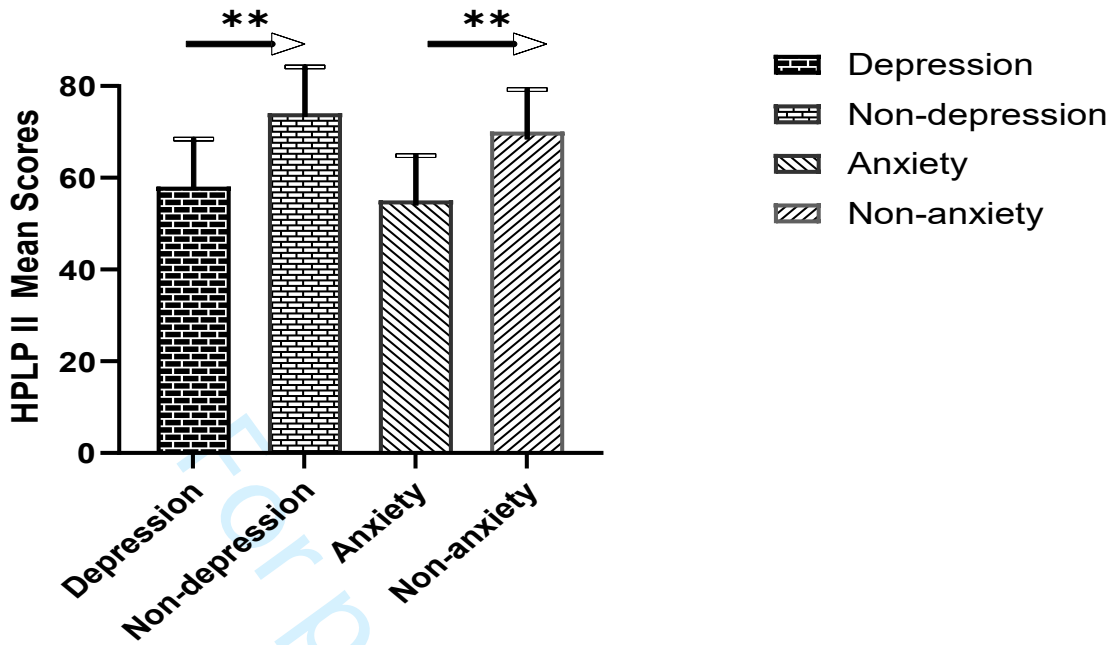

Figure 1 Mean and distribution of the health-promoting lifestyle scores in depression vs non-depression and anxiety vs non-anxiety among PCOS patients(N=366)

Note:**=p＜0.05

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6
Bias	9	Describe any efforts to address potential sources of bias	*5*

Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8
		(*b*) Describe any methods used to examine subgroups and interactions	8
		(*c*) Explain how missing data were addressed	8
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	8
		(*e*) Describe any sensitivity analyses	8
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	5
		(c) Consider use of a flow diagram	5
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6
		(b) Indicate number of participants with missing data for each variable of interest	6
Outcome data	15*	Report numbers of outcome events or summary measures	6
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	6
		(*b*) Report category boundaries when continuous variables were categorized	6

		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	6
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	7
Discussion			
Key results	18	Summarise key results with reference to study objectives	19
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	17
Generalisability	21	Discuss the generalisability (external validity) of the study results	17
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	19

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Factors affecting the adoption of health-promoting behaviors in patients with polycystic ovary syndrome: a cross-sectional study

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Factors affecting the adoption of health-promoting behaviors in patients with polycystic ovary syndrome: a cross-sectional study

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Abstract

Objective This study aimed to investigate health-promoting lifestyle status and associated risk factors in patients with polycystic ovary syndrome.

Design cross-sectional study

Setting This study was conducted at a tertiary hospital in Guizhou, China from December 2020 to June 2021.

Participants A total of 366 participants (18-45 years) diagnosed with polycystic ovary syndrome were recruited from the outpatient departments.

Measures

Sociodemographic characteristics were collected, and health-promoting behaviors were measured using the Health-Promoting Lifestyle Profile scale (HPLP-II scale). Anxiety status was measured using the Zung's Self-Rating Anxiety Scale (SAS), depression status using the Zung's self-rating depression scale (SDS), and self-efficacy using the Managing Chronic Disease 6-Item Scale (SECD6). Multiple stepwise linear regression was conducted to assess the risk factors associated with the health-promoting behaviors of the study participants.

Results

Only 13.20% of the participants had an optimal health-promoting lifestyle, and 63.70% had minimal health-promoting behaviors (88.54±17.44). The highest score in all dimensions was spiritual growth (16.68±4.98), while physical activity (12.71±2.68) was the lowest. Multiple regression analysis revealed that the main factors influencing the development and maintenance of health-promoting behaviors among participants were education (B=10.788, P<0.001), depression (B=-0.377, P<0.001), anxiety (B=-0.333, P<0.001) and self-efficacy (B=0.938, P=0.002). The model showed 74.40% variance shared between the dependent and independent variables (R^2 =74.40, F=264.633, P<0.001).

Conclusion

Health-promoting behaviors are minimal among patients with polycystic ovary syndrome, and improving negative emotions and enhancing behavioral awareness and self-efficacy are necessary to increase the adoption of health-promoting behaviors among patients with PCOS.

Trial registration number: ChiCTR2000034572

Strengths and limitations of this study

► The health-promoting lifestyle profile scale was used to measure health-promoting

behaviors in PCOS patients

► This study allows the examination of relationships between health-promoting behaviors and social demographic data, negative emotion, as well as self-efficacy in patients with PCOS.

► All participants were recruited from a single regional hospital, making it difficult to generalize the findings.

► This study used a cross-sectional design; therefore, a causal relationship could not be established.

Introduction

Polycystic ovary syndrome (PCOS) is the most common endocrine disorder, affecting 4%-18% of women of reproductive age[1].The main features of PCOS include hyperandrogenism, menstrual dysfunction, and anovulatory polycystic ovaries. More than 80% of patients with PCOS are overweight or obese[2, 3].Furthermore, PCOS increases the risk of additional complications, such as type 2 diabetes, metabolic syndrome, and cardiovascular diseases [4, 5].Treatment for PCOS includes lifestyle interventions (dietary, exercise, behavioral, or combined intervention) and surgical and pharmacological options. However, lifestyle management is preferable and presents a cost-effective initial treatment strategy[6]. Moreover, international PCOS guidelines recommend lifestyle management as the first-line treatment[7].

Many studies have reported the beneficial effects of lifestyle management in PCOS, such as optimizing healthy weight, decreasing underlying hormonal disturbances, preventing future metabolic and reproductive complications, and improving the quality of life[8-10]. Unfortunately, despite the recommendation of healthy lifestyle changes, many patients fail to adopt and maintain healthy behaviors. A recent study indicated that 44% of PCOS patients engage in high level physical activity, and only 15% maintain healthy behaviors in the long term[11].

Although several studies have reported the importance of lifestyle management among PCOS patients[12, 13], these studies did not clearly describe multidimensional life management with PCOS. Most studies focused on only one dimension of behavior assessment, mainly nutritional intake and physical activity. Compared with these one-sided assessments, the Health-Promoting Lifestyle Profile II (HPLP-II) provides a multidimensional estimation of health-promoting behavior. Previous research has revealed that participants following health-promoting lifestyle recommendations were healthier and suffered less pain[14]. However, only one study described health-promoting lifestyles in relation to PCOS, and their results suggest that health-promoting lifestyles were at a moderate level, with physical activity being the lowest in subscales[15].However, this study did not investigate which factors accounted for the phenomenon. Furthermore, the negative emotional impact of PCOS on patients is always underestimated; yet, no research has reported the relationship between health-promoting behaviors and negative emotions in patients with PCOS. Therefore, identifying factors that influence health-promoting behaviors is important to improve these behaviors and lower the risk of long-term complications in patients with PCOS. There is a paucity of data on the multidimensional assessment of health-promoting lifestyles among women of reproductive age with PCOS in China, and factors that impact health-promoting behaviors have not been explored.

This study aimed to identify health-promoting behaviors among patients with PCOS and validate the risk factors associated with health-promoting behaviors.

Methods

Study design and setting

This is a cross-sectional observational study in which patients with PCOS were recruited by convenience sampling from the outpatient department of the affiliated hospital of Zunyi Medical University located in Zunyi City, Guizhou Province, China. It is a general hospital with 2,800 beds and provides healthcare to approximately 12 million residents in this district. On average, the daily number of clinical patients is

8000. The study was conducted from December 2020 to June 2021 and approved by the ethical committee of the hospital ([2019]1-028).

Sample size calculation

The sample size was calculated by events per variable (EPV), assuming that p is the proportion of the population with PCOS, and K is the number of predictors. Based on the above assumptions and the equation $N = EPV \cdot K/p$ ($k=6$, $p=0.18$), the result is robust only when the EPV was at least 10. The sample size was calculated as 333. To allow for the attrition rate, the final sample size was 366.

Participant selection criteria and data collection

Patients who visited the outpatient department of the affiliated hospital of Zunyi Medical University from December 2020 to June 2021 were consecutively included in this study. Women of reproductive age (18-45 years) who met the Rotterdam criteria were included. Two of the following three criteria were required: oligo/anovulation, hyperandrogenism, and polycystic ovaries on ultrasound[16]. Otherwise, eligible patients who refused to participate were excluded. Patients who could not read and/or understand the provided questionnaires were excluded from the study.

Data collection was conducted face-to-face by two well-trained researchers. After selecting patients with PCOS according to the Rotterdam criteria, a researcher explained the study's nature and purpose and the survey procedures to the patients. Written informed consent was obtained from all participants before the study. We collected data on physical and psychological characteristics, as well as sociodemographics from the enrolled participants. The second researcher assessed the patients for health-promoting lifestyle, self-efficacy, depression, and anxiety.

Measures

The self-administered questionnaire included questions on demographic characteristics (self-designed) and instruments to evaluate depression, anxiety，self-efficacy and health-promoting lifestyles.

Sociodemographic characteristics

The sociodemographic characteristics questionnaire was used to obtain information on age, education level, living residence, marital status, occupation, weight, height, BMI, and waist circumference. Weight was measured with light clothing and without shoes. Height was measured without shoes using a stadiometer. BMI was calculated based on height and weight. Waist circumference (WC) was measured in centimeter using plastic tape at the midpoint between the costal margin and the iliac crest in the mid-axillary line in the standing position at the end of a gentle expiration[17].

Health-Promoting Lifestyle

We evaluated health-promoting lifestyles using a health-promoting lifestyle profile. This scale consists of six dimensions and 52 items, including health responsibility (9 items), nutrition (9 items), physical activity (8 items), interpersonal relationships (9 items), stress management (8 items), and spiritual growth (9 items). Each item in the questionnaire was answered using a four-point Likert scale with 1, 2, 3, and 4 corresponding to never, sometimes, often, and routinely, respectively. Total scores ranged from 52 to 208, with higher scores representing better health-promoting behaviors[18]. The total HPLP II score was further classified into three levels: poor for the range 52-90, moderate for the range 91-139, good for the range 140-168, and excellent for the range 169-208[19].

Depression status

We evaluated depressive symptoms using the Zung Self-Rating Depression Scale (SDS)[20], which has been used in previous studies and is widely used in clinical settings to assess the subjective severity of depressive symptoms[21, 22]. This scale comprises 20 questions scored on a Likert scale of 1-4 (1, none or a little of the time;

2, some of the time; 3, a good portion of the time; 4, most of the time). The total raw score ranged from 20 to 80, with higher scores representing more severe depressive symptoms. Based on previous studies, we defined the morbidity cut-off point on the SDS as 50[23]. Patients with SDS scores >50 were categorized into the "depressed group," and displayed moderate or severe depressive symptoms. Patients with SDS scores ≤49 were categorized into the "non-depressive group."

Anxiety status

Anxiety symptoms were measured using the Zung Self-rating Anxiety Scale (SAS) [24]. The SAS consists of 20 self-reported items on anxiety symptoms. Some of the items were symptomatically positive and rated on a 4-1 scale (a little of the time, some of the time, a good part of the time, and most of the time). Others were symptomatically negative and rated on a 1-4 scale. A standardized scoring algorithm was used to define anxiety symptoms, with a total score range of 20-80, higher scores represented more severe anxiety symptoms. Owing to the scale's good reliability and validity, it has been widely used in China and other countries[25]. Anxiety was defined as having SAS scores ≥50 points[26].

Self-efficacy

We evaluated self-efficacy using the Self-Efficacy for Chronic Disease 6-item Scale (SECD6), which consists of six items with a 10-step Likert scale ranging from 1 (not at all confident) to 10 (totally confident). The scale is interpreted by calculating a mean score over at least four of the six items, thus allowing a maximum of two missing item responses. Means range from 1 to 10, with higher values indicating higher self-efficacy[27]. The SECD6 has good internal consistency, with a Cronbach's α of 0.91[28].

Statistical analysis

EpiData (The Epidata Association, Odense, Denmark) was used to assess and verify the validity of the data, and SPSS 18.0 was used to analyze the data. Descriptive statistics were presented as frequencies and mean±standard deviation.

Univariate analysis of sociodemographic characteristics, health-promoting behaviors, and subscale scores was conducted using independent sample t-test, rank-sum test, and one-way analysis of variance (ANOVA). Pearson correlation was used to assess age, BMI, depression, anxiety, self-efficacy, and health-promoting behavior (health responsibility, physical activity, nutrition, interpersonal relationships, stress management, and spiritual growth). Multiple stepwise linear regression was performed to examine the risk factors for health-promoting behaviors. All tests were two-sided, with $\alpha = 0.05$.

Patient and public involvement

Through literature review and clinical observation, we proposed the research questions, and explored health-promoting behaviors among patients with PCOS and validate the risk factors associated with health-promoting behaviors. During the study, the research team recruited PCOS patients to participate in the study through the principles of disclosure and informed consent. None of the participants helped recruit and conduct the research. After the study, the research results will be shared with policy-makers to help promote the health-promoting behaviors of patients with PCOS. The findings will also be shared with the participants as a guide to improve their health-promoting behavior.

Results

In total, 38 patients refused to participate in this study. Their reasons for refusal mainly included time pressure (N=13), fatigue (N=5), infertility (N=7), tension caused by the presence of diseases and unfamiliar environments (N=4), unplanned hospital admissions (N=6), and too many questionnaire items (N=3). The final sample comprised 366 patients with PCOS. Demographic information for the study sample is presented in Table 1. The mean age of participants was 25.56 (SD=4.01), the average BMI was 25.68 (SD=5.24), and the mean WC was 84.17 cm (SD=9.43). Almost all participants (n=366, 85.79%) had received at least a middle school education (over nine years of education). More than half of the participants were single (n=366,

53.55%). The average SDS scale of the participants was 51.32 (SD=7.24), the average SAS scale was 50.54 (SD=7.82), and the average self-efficacy scale was 6.18 (SD=3.59) (Table 1).

Table 1. Demographic characteristics of participants

Variable	Categories	Mean (SD)	Frequency (N)	Percentage (%)
Age		25.56(4.01)		
BMI		25.68(5.24)		
WC		84.17(9.43)		
Residence	city		198	54.09
	countryside		168	45.90
Marital status	Single		196	53.55
	Married		140	38.25
	Widowed/divorced		77	21.04
Education	Elementary		52	14.21
	Middle school		78	21.31
	High school		68	18.58
	College		168	45.91
Occupation	Employed		111	30.23
	Unemployed		98	26.78
	Student		87	23.77
	Other		67	18.31
Duration of PCOS	<1 year		163	44.54
	1-3 years		125	34.15
	4-6 years		68	18.58
	>7 years		10	2.73
Desire for pregnancy	Yes		177	48.36
	No		189	51.64
SDS scale		51.32(7.24)		
SAS scale		50.54(7.82)		
Self-efficacy scale		6.18(3.59)		

Table 2 shows the average item score for each subscale (Table 2). The mean total HPLP II was 88.54±17.44. The average score for spiritual growth (16.68±4.98) was highest on the subscales, but that for physical activity was lowest (12.71±2.68).

Table 2. PCOS patients HPLP II total and subscales' mean scores (N=366)

	M(SD)	min	max	Highest and Lowest obtainable score
Health responsibility	13.81(3.39)	9	24	9-36
Nutrition	14.68(4.28)	9	27	9-36
Interpersonal relations	16.33(5.29)	9	32	9-36
Spiritual growth	16.68(4.98)	9	31	9-36
Stress management	14.32(4.15)	8	30	8-32
Physical activity	12.71(2.68)	8	22	8-32
Total HPLP score	88.54(17.44)	60	168	52-208

NOTE: HPLP=Health-Promoting Lifestyle Profile II; M=mean; SD=standard deviation; min=minimum; max=maximum.

In terms of nutrition, there were statistical differences among the marital status, education, and years of PCOS groups. When one-way Tukey variance analysis was performed, the mean scores of married patients were higher than those of patients who were either single or widowed/divorced (p= 0.012). The mean scores of the patients with 1-3 years duration of PCOS were higher than those of patients with <1, 4-6, and >7 years duration. Nutrition scores were higher in university graduates (17.52±4.08) than in high school graduates (12.79±3.42), middle school graduates (11.48±3.86) and elementary school graduates (10.32±4.27) (P=0.043). (Table 3)

Table 3. Associations and differences of HPLP II mean scores with demographic variables (N=366)

Variable	Categories	Health responsibility	Nutrition	Interpersonal relations	Spiritual growth	Stress management	Physical activity	Total HPLP score
Residence	City	13.58(3.39)	14.93(4.60)	16.31(5.35)	16.94(5.07)	14.72(4.34)	12.45(2.51)	88.89(18.08)
	Countryside	14.33(3.29)	14.48(3.56)	17.32(5.23)	16.85(4.91)	14.65(4.02)	12.82(2.87)	90.43(16.38)
	P value	0.165[a]	0.444[a]	0.846[a]	0.914[a]	0.918[a]	0.371[a]	0.429[d]
Marital status	Single	13.63(3.58)	13.34(4.14)	16.49(5.25)	16.89(4.94)	14.69(4.33)	12.51(2.57)	87.65(17.09)
	Married	14.26(3.02)	16.25(4.42)	17.09(5.55)	16.82(5.09)	14.79(4.13)	15.61(2.76)	94.82(18.21)
	Widowed/divorced	13(2.94)	12.25(6.70)	14.50(2.38)	18.75(6.29)	13.25(2.22)	11.14(2.16)	82.89(20.30)
	P value	0.449[b]	0.012[b]	0.558[b]	0.757[b]	0.781[b]	0.038[c]	0.013[b]
Education	Elementary	13.58(3.15)	10.32(4.27)	16.44(5.10)	17.23(5.29)	14.73(3.93)	10.27(2.58)	82.57(15.30)
	Middle school	14.04(3.16)	11.48(3.86)	17.36(5.51)	17.44(5.26)	13.48(5.05)	11.60(2.84)	85.10(15.16)
	High school	14(3.14)	12.79(3.42)	16.57(4.86)	17.50(6.01)	14.64(4.36)	12.85(2.57)	88.35(20.29)
	College	15.90(3.64)	17.52(4.08)	16.60(5.51)	16.46(4.62)	15.04(4.27)	15.69(2.65)	97.21(18.00)
	P value	0.924[c]	0.043[b]	0.913[b]	0.721[b]	0.449[b]	0.011[b]	0.036[b]
Occupation	Employed	13.83(3.55)	14.94(4.35)	16.72(5.40)	16.50(4.56)	14.55(4.10)	12.83(2.28)	89.38(16.94)
	Unemployed	13.95(3.14)	15(4.71)	16.60(5.52)	16.85(5.36)	14.80(5.00)	12.75(2.63)	89.95(18.14)
	Student	13.62(3.77)	14.98(3.94)	16.93(5.91)	17.24(5.29)	14.98(4.19)	12.76(3.15)	90.50(19.41)
	Other	14.00(2.98)	14.24(4.06)	16.40(4.71)	17.12(5.22)	14.58(4.14)	12.08(2.54)	88.42(16.54)
	P value	0.958[b]	0.656[c]	0.972[b]	0.884[b]	0.96[b]	0.46[b]	0.953[b]
Duration of PCOS	<1 year	13.65(3.27)	14.16(4.22)	16.62(5.25)	17.06(5.33)	14.71(4.06)	12.68(2.74)	88.88(17.27)
	1-3 years	14.54(3.62)	17.83(4.51)	16.48(5.37)	16.23(4.67)	14.31(4.16)	15.40(2.47)	94.79(17.72)
	4-6 years	12.67(2.81)	13.83(4.17)	16.67(5.96)	17.83(3.25)	15.67(4.76)	10.83(2.56)	87.50(19.35)
	>7 years	11.75(2.63)	13.12(2.31)	16.25(6.02)	18.00(3.83)	17.75(7.93)	9.14(2.58)	86.01(21.70)
	P value	0.185[b]	0.028[c]	0.599[b]	0.428[b]	0.416[b]	0.042[b]	0.011[c]

Table 3 continued. Associations and differences of HPLP II mean scores with demographic variables (N=366)

Variable	Categories	Health responsibility	Nutrition	Interpersonal relations	Spiritual growth	Stress management	Physical activity	Total HPLP score
Desire for pregnancy	Yes	13.72(3.26)	14.61(3.49)	16.97(5.22)	16.89(5.05)	14.62(4.21)	15.29(2.48)	92.10(17.35)
	No	15.99(3.53)	11.93(4.05)	16.27(5.43)	16.92(4.97)	15.79(4.25)	10.93(2.78)	87.83(17.71)
	P value	0.614[a]	0.22[a]	0.393[a]	0.972[a]	0.747[d]	0.024[d]	0.017[d]

Note：a=T; b=F; c= Kruskal Wallis Test; d=Mann-Whitney U; HPLP-II: Health-Promoting Lifestyle Profile II

In terms of physical activity, married patients had significantly higher physical activity scores (15.61±2.76) than single (12.51± 2.57) and widowed/divorced patients (11.14±2.16). The higher the educational degree, the higher the physical activity score(P=0.011). The mean scores of the patients with 1-3 years duration of PCOS (15.40±2.47) were higher than those of patients <1 (12.68±2.74), 4-6 (10.83±2.56), and >7 years (9.14±2.58) (P=0.042) duration of PCOS. Participants who did not desire pregnancy had significantly lower physical activity scores (15.29±2.48) than those who did (10.93±2.78) (P=0.024). (Table 3)

As shown in Table 4, age, WC, BMI, self-efficacy, depression, and anxiety were significantly correlated with HPLP-II (P<0.05). Moreover, there was a statistically significant positive correlation between HPLP-II and age, BMI, and self-efficacy (P<0.01). This suggests that HPLP-II is significantly negatively correlated with WC, depression, and anxiety (Table 4)

Table 4. Associations and Differences of HPLP II Mean Scores with Demographic Variables (N=366)

Variable	Health responsibility	Nutrition	Interpersonal relations	Spiritual growth	Stress management	Physical activity	Total HPLP score
Age	0.013	0.051	0.79**	0.76**	0.78	0.75**	0.28**
BMI	0.033	0.041	0.07	0.09	-0.038	0.03	0.06**
WC	-0.056*	-0.009	-0.01	-0.02	-0.066*	-0.001	-0.15*
Depression scores	-0.19*	-0.36*	-0.41**	-0.42**	-0.42**	-0.106*	-0.49**
Anxiety scores	-0.26*	-0.32**	-0.41**	-0.35**	-0.38**	-0.30*	-0.46**
Self-efficiency	0.27*	0.44	0.43	0.42**	0.38**	0.20**	0.53**

**: p＜0.01； *: p＜0.05

Table 5 shows the results of stepwise multiple linear regression analysis which revealed that education (B=10.788, P<0.001), depression (B=-0.377, P<0.001), anxiety (B=-0.333, P<0.001) and self-efficacy (B=0.938, P=0.002) were factors associated with health-promoting behaviors. The model showed 74.40% variance shared between the dependent and independent variables (R^2 =74.40, F=264.633, P<0.001).

Table 5. Multivariate analysis (stepwise) of predictors for health-promoting behavior (HPLP-II score)

Model	Variable	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		R^2	F	P
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound			
1	Education	13.346	0.466	0.833	28.617	0.000	12.429	14.263	69.50	418.955	0.000
2	Education	12.153	0.481	0.759	25.266	0.000	11.207	13.099	72.40	374.285	0.000
	Depression	-0.473	0.074	-0.191	-6.352	0.000	-0.62	-0.327			
3	Education	11.622	0.482	0.725	24.116	0.000	10.674	12.57	73.80	341.125	0.000
	Depression	-0.363	0.076	-0.146	-4.752	0.000	-0.513	-0.213			
	Anxiety	-0.367	0.079	-0.14	-4.616	0.000	-0.523	-0.21			
4	Education	10.788	0.545	0.673	19.793	0.000	9.717	11.86	74.40	264.633	0.000
	Depression	-0.377	0.076	-0.152	-4.986	0.000	-0.525	-0.228			
	Anxiety	-0.333	0.079	-0.127	-4.203	0.000	-0.489	-0.177			
	Self-efficacy	0.938	0.298	0.1	3.142	0.002	0.351	1.525			

Figure 1 shows that depressed patients had higher HPLP-II scale scores than non-depressed patients (P<0.01). Patients with anxiety scored higher on the HPLP-II scale than those without anxiety (P<0.01).

Discussion

In the present study, we found that patients with PCOS had minimal health-promoting lifestyle behaviors (88.54±17.44). Health-promoting behaviors are reportedly optimum in only 13.2% of the patients and minimal in 63.7%[15]. However, in another study conducted in Nanjing, China, patients with PCOS had a moderate level of health-promoting behaviors. Previous studies[29-31] have also shown that college students, nursing students, or cardiovascular patients had moderate health-promoting lifestyle behaviors scores possibly because patients with PCOS are younger and more sensitive to body-image. Self-image disorders (hair, acne, and obesity) may reduce the initiative and enthusiasm of patients for lifestyle management[32, 33]. Moreover, women with PCOS often lack information about their condition. In a previous study conducted on women with PCOS in Taif city, 34% of participants had acquired knowledge through health education[34, 35]. Although the present study could not confirm a direct relationship between the awareness rate about health-promoting behaviors and low levels of these behaviors, a low awareness rate may be a risk factor.

In the present study, we found significant relationships between negative emotional scores (depression and anxiety scores) and health-promoting lifestyle behaviors. This may explain why reproductive and metabolic disorders deteriorate and menstrual disturbances become more severe in patients with negative emotions, making them unable to imbibe health-promoting behaviors[36]. The present study also shows that non-depressed patients had higher HPLP scale scores than depressive patients, and non-anxious patients had higher HPLP scale scores than anxiety patients. Chang et al. also found significant relationships between negative emotions and

health-promoting behaviors[37]. However, only a few studies have explored the relationship between negative emotions and health-promoting behaviors among patients with PCOS. Therefore, there is an urgent need to address negative emotions to encourage health-promoting behaviors in patients with PCOS.

There was a significant positive association between self-efficacy and the mean HPLP score in the present study. We also observed low self-efficacy scores (6.18±3.59) in patients with PCOS, probably because younger participants have lower performance and self-management ability and cannot strike a balance between work (study or family) and maintaining health-promoting behaviors. However, the direct reason may be a lake of motivation. A previous study has demonstrated that self-efficacy is a central component, a significant outcome variable, an important indicator for deciding on health education programs, a major part of behavioral change processes, and a precondition for successful self-management of chronic diseases[38] . People with greater self-efficacy are thought to perceive fewer barriers to behavioral change and goal attainment [39], mediated by the implementation of self-management to pursue their desired goal. This may explain the low self-efficacy and health-promoting behavior scores in our study. Moreover, previous studies have indicated that improved self-efficacy leads to improved lifestyle behaviors in other chronic conditions such as bipolar disorder, chronic obstructive pulmonary disease, stroke, chronic kidney disease, cardiovascular disease, cancer and diabetes[40-42].Therefore, there is an urgent need for further research to assess and enhance the self-efficacy and lifestyle management of PCOS patients before the implementation of health-promoting behaviors

In our study, higher education levels of patients with PCOS were associated with better health-promoting behaviors. This shows that educational level is a significant factor in developing and maintaining healthy behavior. Since PCOS is a chronic disease that requires long-term management, enhancing health education for patients with low education levels may help prevent the occurrence of long-term complications and reduce the number of hospitalizations.

The strengths of our study are that it is the first survey to identify health-promoting lifestyle status in patients with PCOS and validate the associated risk factors. Moreover, we assessed multidimensional health-promoting behaviors in patients with PCOS, not only nutritional intake or physical activity. However, this study had some limitations. First, participant selection was performed by convenience sampling from only one hospital in China. Second, participants self-reported the measures, thus their answers are subject to reporting bias. Third, the cross-sectional nature of the study hinders our ability to make causal inferences regarding risk factors and diseases that exist concurrently. Finally, the reliability and validity of HLPL-II in patients with PCOS was not verified, which might have resulted in biased results. In a subsequent study, we will continue to complete the construction and verification of a specific scale to evaluate the multidimensional health behaviors of patients with PCOS.

Conclusion

In summary, we found that patients with PCOS had minimal health-promoting behaviors. Moreover, our research suggests that four main factors (depression, anxiety, self-efficacy, and education) play critical roles in adopting health-promoting behaviors in patients with PCOS. Therefore, future studies should focus on evaluating and improving patients' negative emotions and enhancing their awareness of behavioral change and self-efficacy to improve their lifestyles. The present study results fill an information gap and provide some preliminary insights for designing life management protocols and health-promoting behavioral interventions.

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Competing interests

None declared.

Data availability statement

No data are available. The ethical approval and participant consent for this study do not allow sharing of data beyond the research team.

Author contributions

LianHong Wang and YunMei Guo conceived the study and obtained funding. Ying liu, Xing Yan, Rui Ding, and Huiwen Tan coordinated data collection. YunMei Guo analyzed and interpreted the data and wrote the first draft. LianHong Wang and YunMei Guo revised the draft further for intellectual content. All authors read and approved the final manuscript.

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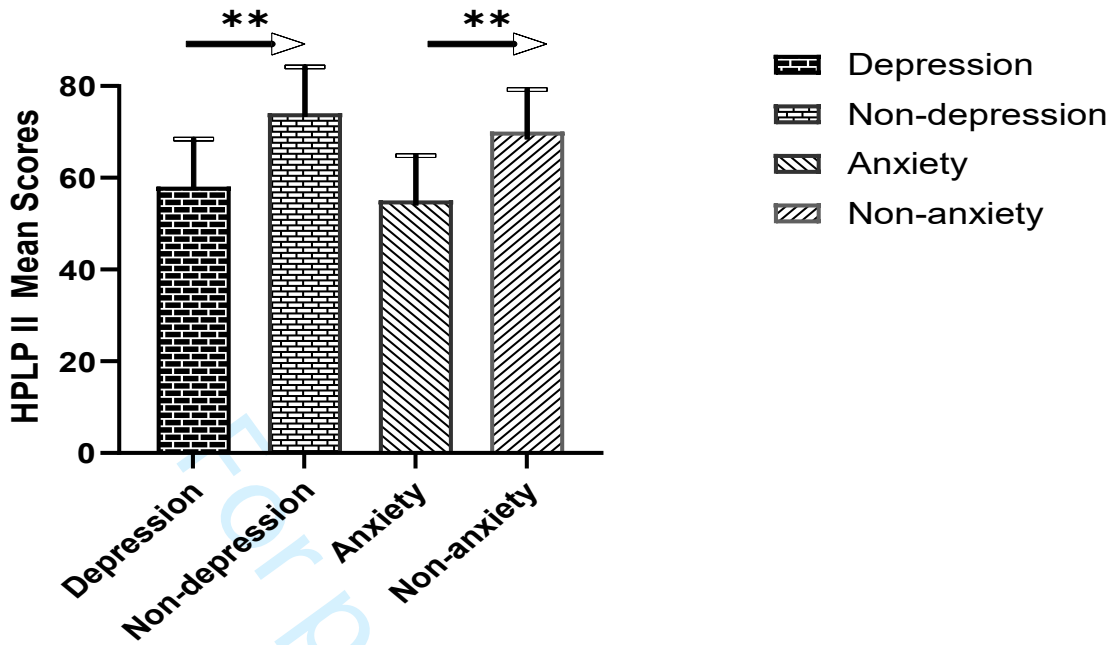

Figure 1 Mean and distribution of the health-promoting lifestyle scores in depression vs non-depression and anxiety vs non-anxiety among PCOS patients(N=366)

Note:**=p＜0.05

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6
Bias	9	Describe any efforts to address potential sources of bias	*5*

Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8
		(*b*) Describe any methods used to examine subgroups and interactions	8
		(*c*) Explain how missing data were addressed	8
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	8
		(*e*) Describe any sensitivity analyses	8
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	5
		(c) Consider use of a flow diagram	5
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6
		(b) Indicate number of participants with missing data for each variable of interest	6
Outcome data	15*	Report numbers of outcome events or summary measures	6
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	6
		(*b*) Report category boundaries when continuous variables were categorized	6

		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	6
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	7
Discussion			
Key results	18	Summarise key results with reference to study objectives	19
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	17
Generalisability	21	Discuss the generalisability (external validity) of the study results	17
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	19

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.