

# Anxiety and Depression Among Pregnant Women in Plain and Plateaus Areas: A Cross-sectional Study

**Jiebing Chen**

Sun Yat-sen University First Affiliated Hospital Department of Obstetrics and Gynecology

**Qiaojian Zou**

Sun Yat-sen University First Affiliated Hospital Department of Obstetrics and Gynecology

**Cheng Jiang**

Health Service Center of Zayu county

**Jiaming Huang**

Sun Yat-sen University First Affiliated Hospital Department of Obstetrics and Gynecology

**Xiaochen Liu**

Sun Yat-sen University First Affiliated Hospital Department of Obstetrics and Gynecology

**Jun Zhou**

Sun Yat-sen University First Affiliated Hospital Department of Obstetrics and Gynecology

**Sha Ding**

Sun Yat-sen University First Affiliated Hospital Department of Obstetrics and Gynecology

**Ganlu Wang**

Health Service Center of Zayu County

**Shuzhong Yao** (✉ [yaoshuzh@mail.sysu.edu.cn](mailto:yaoshuzh@mail.sysu.edu.cn))

Fifth Affiliated Hospital of Sun Yat-sen University

---

## Research article

**Keywords:** Anxiety, Depression, Pregnant women, Plateau

**Posted Date:** November 2nd, 2020

**DOI:** <https://doi.org/10.21203/rs.3.rs-99089/v1>

**License:**  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

---

# Abstract

**Background:** Perinatal anxiety and depression can severely damage both maternal and infant's health and result in negative effects. In this study, we investigated the current state of anxiety and depression among pregnant women in Tibet and Guangzhou and identified its risk factors, which would provide guidance for clinical daily work.

**Methods:** From September 2018 to May 2019, 169 pregnant women in Tibet and 199 of them in Guangzhou were selected. Zung's Self Rating Anxiety Scale (SAS) and Self-Rating Depression Scale (SDS) were used to assess the degree of anxiety and depression, respectively. All the data were collected by the questionnaire.

**Results:** The SAS and SDS scores in Guangzhou were  $42.4 \pm 8.5$  and  $48.0 \pm 9.5$  respectively, while the same score became  $46.6 \pm 8.0$  and  $54.7 \pm 8.9$  in Tibet. Scores of pregnant women in Tibet were significantly higher than in Guangzhou ( $P < 0.05$ ). Trimester, nationality, delivery times and educational experience were considered to be influence factors for anxiety and depression among pregnant women.

**Conclusions:** Pregnant women living in plateaus areas of China have higher SAS and SDS scores than in plain areas, especially for those with a low level of educational experience. More attention should be paid in future work.

## Background

Previous research demonstrated that gestation can lead to obvious changes in the body appearance and the internal hormonal environment of pregnant women, resulting in significant alterations both physically and psychologically(1). The transformation from a woman to mother is not only the converting of social identities, but the upcoming social responsibilities. Additionally, during this special period, pregnant women are often reported as lack of self-confidence and are susceptible to the bad sides of their lives(2, 3). All those factors contribute to the prevalence of anxiety and depression during pregnancy(1, 4).

As reported by an earlier study, up to 8.5–16% of all pregnant women suffer from different degrees of depression and 4.9% of pregnant women can be diagnosed as major depression(2). At the same time, it is estimated that the prevalence of anxiety among pregnant women ranges from 4 to 39% in different regions(5, 6). These perinatal mood disorders including anxiety and depression disorders can not only increase the probability of obstetrical complications in pregnant women, such as preterm birth, low birth weight, fetal growth restriction, adverse perinatal outcome and birth defects, but also intensify the risk of postpartum depression(7–13).

Tibet is located on the Qinghai-Tibet plateau in southwest China. The economic development level of Tibet ranks relatively low in all China's provinces and people living in Tibet plateau usually have poor medical facilities and environment(14). In addition, the unique demographic composition and religious

environment in Tibet lead to the lack of previous literature on the health status and quality of life of this population. Studies investigating perinatal mood disorders among this population are scarce as well.

In this study, we analyzed the situation of perinatal mood disorder including depression and anxiety between Tibet plateau and Guangzhou City, which represents the plain areas of China, thus contribute to improving the psychological state of pregnant women and ensure safety of maternal and offspring in Tibet plateau.

## Methods

### Design

The cross-sectional, observational study recruited pregnant women from September 2018 to May 2019 at the obstetric outpatient departments in two different tertiary care hospitals in Linzhi City, Tibet, China and the First Affiliated Hospital of Sun Yat-sen University in Guangzhou, China.

### Participants

In Tibet, 169 pregnant women who met the following inclusion criteria were selected: (1) 18 years old and above, (2) a confirmed intrauterine pregnancy by ultrasound, (3) never been diagnosed with mental illness and other neurological disorders, (4) no psychotropic pharmaceuticals taken during the past three months, (5) volunteered to participate in the present survey. The excluding criteria for this study were: (1) those with serious audiovisual disorders that may affect their understanding and answers to the questionnaires, (2) with a history of severe mental and/or physical diseases, (3) long term using antipsychotics, (4) unwilling to participate in this study, and (5) those with other hereditary diseases. Simultaneously, 199 pregnant women in the First Affiliated Hospital of Sun Yat-sen University in Guangzhou were selected based on the same criteria described above.

### Measures

The sociodemographic data were collected using a questionnaire compiled by researchers. All interviews were conducted in a private area, and the participants' family members were not present during the interviews. The basic information collected included the name, age, level of education, ethnicity, expected date of delivery, total monthly family income, history of delivery, including artificial and natural abortion history, delivery times and complications during pregnancy.

The levels of anxiety and depression of the pregnant women were quantified by using Zung's Self Rating Anxiety Scale (SAS), and Self-Rating Depression Scale (SDS)(15). Both SAS and SDS were used for the first time in 1965. Both of them consist of 20 items, each scored on a 4-point Likert scale. The score ranged from 1 (none or a little) to 4 (most or always) and was based on the level experienced by the pregnant women in the preceding week. Participants were classified according to the SAS score as normal (0–50), mildly anxious (50–59), moderately anxious (60–69), and severely anxious (> 70)(16).

Pregnant women with a SDS score of 53 to 62 were considered to be mildly depressed, meanwhile a score of 63 to 72 as moderately depressed and a score of 73 or more as severely depressed.

### **Quality control**

Our investigators consisted of trained and experienced nurses who conducted face-to-face interviews with the participants in this study. This can ensure the authenticity and accuracy of this survey. Before starting with the survey, the investigators informed the participants of the purpose of and methods to be used in the present study, and the principle of confidentiality, after which the participants signed an informed consent form. After completion, all questionnaires were assessed to verify their integrity. Double proofreading and uniform coding of the results were also used to control the quality of the questionnaires and the data.

### **Statistical analysis**

All statistical analyses were performed through Statistical Package for Social Sciences (SPSS) 22.0 and the level of significance was set as  $p < 0.05$ . Frequency distributions and rates were used to summarize and show the results. Univariate and multivariate analyses were used to analyze the data.

### **Ethical Aspects**

The study has been approved by the Ethics Committee for Clinical Research and Animal Trials of the First Affiliated Hospital of Sun Yat-sen University(#178–2020, Jun-2,2020).

## **Results**

### **Analysis of social demographic data between two groups**

In our study, 168 pregnant women from Tibet and 199 women from Guangzhou were included. From Table 1 we can learn that in Guangzhou, the majority of the respondents were Han nationality, ranging from 23–46 years of age, of which 26.7% of them were elderly pregnant women (> 35 years old). On the other hand, the majority of interviewees in Tibet were Tibetan nationality, ranging from 18–49 years of age, and of which elderly pregnant women accounted for only 8.3% of the total. Besides, 88.9% of pregnant women in Guangzhou have received regular college education or above, while this became 46.2% in Tibet.

Table 1  
Social demographic data of pregnant women in Guangzhou and Tibet.

<b>Variables</b>	<b>Guangzhou(n = 199)</b>	<b>Tibet(n = 169)</b>
	N(%)	N(%)
<b>Age (Years)</b>		
< 25	6(3.0%)	31(18.3%)
25–29	59(29.6%)	72(42.6%)
30–34	81(40.7%)	52(30.8%)
> 35	53(26.7%)	14(8.3%)
<b>Nationality</b>		
Han nationality	194(97.5%)	48(28.4%)
Other nationality	5(2.5%)	121(71.6%)
<b>Educational experience</b>		
Primary school or below	0(0%)	45(26.6%)
High school	22(11.1%)	46(27.2%)
Bachelor degree	141(70.8%)	76(45.0%)
Postgraduate and above	36(18.1%)	2(1.2%)
<b>Employment situation</b>		
Employed	159(79.9%)	107(63.3%)
Unemployed	40(20.1%)	62(36.7%)
<b>Family monthly income</b>		
< 10000 yuan	29(14.6%)	83(49.1%)
10000–19999 yuan	84(42.2%)	59(34.9%)
20000–29999 yuan	52(26.1%)	21(12.4%)
> 30000 yuan	34(17.1%)	6(3.6%)
<b>Payment model</b>		
Self-paying	55(27.6%)	55(32.5%)
Health insurance	144(72.4%)	114(67.5%)

\* Including but not limited to gestational diabetes mellitus, gestational hypertension, thyroid disease and so on.

Variables	Guangzhou(n = 199)	Tibet(n = 169)
Trimester		
First trimester	95(47.7%)	39(23.1%)
Second trimester	91(45.7%)	71(42.0%)
Third trimester	13(6.6%)	59(34.9%)
Pregnancy complications*		
Yes	22(11.1%)	28(16.6%)
No	177(88.9%)	141(83.4%)
History of abnormal pregnancy		
Yes	43(21.6%)	14(8.3%)
No	156(78.4%)	155(91.7%)
Pregnancy times		
1	78(39.2%)	73(43.2%)
2	61(30.7%)	69(40.8%)
≥ 3	60(30.1%)	27(16.0%)
Delivery times		
0	99(49.7%)	81(47.9%)
1	91(45.7%)	70(41.4%)
≥ 2	9(4.6%)	18(10.7%)
* Including but not limited to gestational diabetes mellitus, gestational hypertension, thyroid disease and so on.		

### Comparison of mood disorders between two groups

As shown in Table 2, the SAS and SDS scores of pregnant women from Tibet were statistically significantly higher than those from Guangzhou (both  $P < 0.001$ ). What's more, based on the SAS and SDS evaluation system, 42.6% and 69.2 of pregnant women in Tibet experienced anxiety and depression respectively, while in Guangzhou, only 19.1% and 30.2% of pregnant women faced the same question.

Table 2  
A comparison of the SAS and SDS scores between the two areas

Area	SAS score( $\bar{x} \pm s$ )	SDS score( $\bar{x} \pm s$ )
Guangzhou (n = 199)	42.4 $\pm$ 8.5	48.0 $\pm$ 9.5
Tibet (n = 169)	46.6 $\pm$ 8.0	54.7 $\pm$ 8.9
t	4.831	7.001
P	< 0.001	< 0.001

### Factors influencing anxiety and depression among pregnant women in Guangzhou and Tibet

To identify risk factors for anxiety and depression in pregnant women, univariate regression analysis was used, and those factors with a P value < 0.05 would be included in multivariate regression analysis. In Guangzhou, as shown in Tables 3,4 and 7, we found that pregnant women in the first trimester had higher SAS score than the second trimester and those with the delivery times more than twice had higher SDS score, while pregnant women of Han nationality had high SAS and SDS score. For pregnant women in Tibet, educational experience were considered to be a risk factor for SAS and SDS scores. Women with the educational experience of primary school and below had a significantly higher SAS and SDS score than those with bachelor degrees and above (Tables 5, 6 and 8).

Table 3  
Univariate analysis of anxiety for pregnant women in Guangzhou.

Variables	Groups	SAS score( $\bar{x} \pm s$ )	OR	P
Age	< 25 (control)	48.3 $\pm$ 9.6	1	-
	25 ~ 29	42.0 $\pm$ 8.0	-6.363	0.082
	30 ~ 34	42.0 $\pm$ 9.4	-6.343	0.079
	> 35	42.9 $\pm$ 7.6	-5.409	0.141
Nationality	Han nationality	42.6 $\pm$ 8.5	8.385	<b>0.029</b>
	Other nationality (control)	34.3 $\pm$ 6.4	1	-
Educational experience	High school and below (control)	41.7 $\pm$ 8.7	1	-
	Bachelor degree and above	42.5 $\pm$ 8.5	0.810	0.675
Employment situation	Employed (control)	42.1 $\pm$ 8.6	1	-
	Unemployed	43.6 $\pm$ 8.1	1.463	0.332
Family monthly income	< 10000 yuan (control)	40.6 $\pm$ 8.1	1	-
	10000–19999 yuan	43.3 $\pm$ 8.2	2.702	0.143
	20000–29999 yuan	41.8 $\pm$ 9.2	1.132	0.567
	> 30000 yuan	42.6 $\pm$ 8.7	2.001	0.354
Payment model	Self-paying	43.7 $\pm$ 8.7	1.706	0.207
	Health insurance (control)	42.0 $\pm$ 8.4	1	-
Trimester	First trimester	43.9 $\pm$ 9.2	3.041	<b>0.015</b>
	Second trimester (control)	40.9 $\pm$ 7.4	1	-
	Third trimester	41.9 $\pm$ 9.2	1.016	0.684
Pregnancy complications	No (control)	42.1 $\pm$ 8.4	1	-
	Yes	45.2 $\pm$ 8.9	3.087	0.109
History of abnormal pregnancy	No (control)	42.4 $\pm$ 8.7	1	-
	Yes	42.7 $\pm$ 7.8	0.319	0.829
Pregnancy times	1	43.1 $\pm$ 9.1	2.310	0.113
	2 (control)	40.8 $\pm$ 7.8	1	-
	$\geq 3$	43.2 $\pm$ 8.3	2.388	0.123

Variables	Groups	SAS score( $\bar{x} \pm s$ )	OR	P
Delivery times	0	43.1 $\pm$ 9.4	1.662	0.180
	1 (control)	41.5 $\pm$ 7.3	1	-
	$\geq 2$	44.3 $\pm$ 9.2	2.836	0.341

Table 4  
Univariate analysis of depression for pregnant women in Guangzhou.

Variables	Groups	SDS score( $\bar{x} \pm s$ )	OR	P
Age	< 25 (control)	55.6 $\pm$ 9.5	1	-
	25 ~ 29	46.5 $\pm$ 8.2	-9.142	<b>0.025</b>
	30 ~ 34	48.7 $\pm$ 9.9	-6.890	0.086
	> 35	47.7 $\pm$ 10.0	-7.960	0.051
Nationality	Han nationality	48.3 $\pm$ 9.3	11.017	<b>0.010</b>
	Other nationality (control)	37.3 $\pm$ 11.9	1	-
Educational experience	High school and below	51.6 $\pm$ 9.8	4.049	0.059
	Bachelor degree and above (control)	47.5 $\pm$ 9.4	1	-
Employment situation	Employed (control)	47.5 $\pm$ 9.5	1	-
	Unemployed	50.0 $\pm$ 9.3	2.555	0.129
Family monthly income	< 10000 yuan (control)	47.2 $\pm$ 12.0	1	-
	10000–19999 yuan	49.0 $\pm$ 8.4	1.760	0.391
	20000–29999 yuan	46.4 $\pm$ 9.4	-0.78	0.724
	> 30000 yuan	48.7 $\pm$ 9.9	1.478	0.539
Payment model	Self-paying	49.6 $\pm$ 9.8	2.244	0.137
	Health insurance (control)	47.4 $\pm$ 9.4	1	-
Trimester	First trimester	48.9 $\pm$ 9.8	2.124	0.451
	Second trimester	47.3 $\pm$ 9.3	0.536	0.850
	Third trimester (control)	46.7 $\pm$ 8.8	1	-
Pregnancy complications	No (control)	47.9 $\pm$ 9.4	1	-
	Yes	48.6 $\pm$ 10.8	0.727	0.736
History of abnormal pregnancy	No (control)	47.8 $\pm$ 9.1	1	-
	Yes	48.6 $\pm$ 10.8	0.747	0.649
Pregnancy times	1	48.0 $\pm$ 8.7	2.316	0.150
	2 (control)	45.7 $\pm$ 9.1	1	-
	$\geq 3$	50.3 $\pm$ 10.5	4.595	<b>0.008</b>

Variables	Groups	SDS score( $\bar{x} \pm s$ )	OR	P
Delivery times	0 (control)	47.5 $\pm$ 9.1	1	-
	1	47.9 $\pm$ 9.8	0.424	0.758
	$\geq 2$	54.6 $\pm$ 8.3	7.109	<b>0.032</b>

Table 5  
Univariate analysis of anxiety for pregnant women in Tibet.

Variables	Groups	SAS score( $\bar{x} \pm s$ )	OR	P
Age	< 25	47.3 ± 8.0	-0.599	0.818
	25 ~ 29	46.2 ± 9.3	-1.694	0.473
	30 ~ 34	46.5 ± 6.7	-1.343	0.581
	> 35 (control)	47.9 ± 5.5	1	-
Nationality	Han nationality (control)	44.6 ± 7.0	1	-
	Other nationality	47.4 ± 8.3	2.798	0.040
Educational experience	Primary school and below	49.4 ± 8.5	4.589	<b>0.002</b>
	High school	46.8 ± 6.9	1.965	0.179
	Bachelor degree and above (control)	44.9 ± 7.9	1	-
Employment situation	Employed (control)	45.7 ± 7.9	1	-
	Unemployed	48.2 ± 8.1	2.421	0.058
Family monthly income	< 10000 yuan	46.5 ± 8.1	2.161	0.527
	10000–19999 yuan	46.7 ± 8.7	2.278	0.511
	20000–29999 yuan	47.4 ± 5.6	3.065	0.413
	> 30000 yuan (control)	44.4 ± 8.7	1	-
Payment model	Self-paying (control)	45.3 ± 8.5	1	-
	Health insurance	47.3 ± 7.7	2.020	0.125
Trimester	First trimester (control)	45.0 ± 9.3	1	-
	Second trimester	47.4 ± 7.7	2.359	0.141
	Third trimester	46.8 ± 7.4	1.780	0.283
Pregnancy complications	No (control)	46.6 ± 8.0	1	-
	Yes	47.3 ± 7.9	0.750	0.676
History of abnormal pregnancy	No	46.7 ± 8.0	1.563	0.486
	Yes (control)	45.2 ± 8.9	1	-
Pregnancy times	1	46.2 ± 7.6	0.385	0.773
	2 (control)	45.8 ± 8.4	1	-

Variables	Groups	SAS score( $\bar{x} \pm s$ )	OR	P
	$\geq 3$	50.0 $\pm$ 7.7	4.175	<b>0.022</b>
Delivery times	0 (control)	45.6 $\pm$ 8.1	1	-
	1	47.1 $\pm$ 8.0	1.485	0.255
	$\geq 2$	49.4 $\pm$ 7.3	3.858	0.065

Table 6  
Univariate analysis of depression for pregnant women in Tibet.

Variables	Groups	SDS score( $\bar{x} \pm s$ )	OR	P
Age	< 25 (control)	57.0 ± 8.7	1	-
	25 ~ 29	54.1 ± 8.9	-2.844	0.138
	30 ~ 34	54.2 ± 9.2	-2.769	0.172
	> 35	54.9 ± 7.6	-2.065	0.472
Nationality	Han nationality (control)	52.8 ± 9.6	1	-
	Other nationality	55.5 ± 8.5	2.657	0.079
Educational experience	Primary school and below	56.8 ± 8.5	3.925	<b>0.018</b>
	High school	56.0 ± 9.1	3.099	0.058
	Bachelor degree and above (control)	52.9 ± 8.7	1	-
Employment situation	Employed (control)	54.1 ± 9.2	1	-
	Unemployed	55.9 ± 8.2	1.810	0.202
Family monthly income	< 10000 yuan	55.1 ± 9.0	4.302	0.255
	10000–19999 yuan	54.4 ± 9.1	3.595	0.348
	20000–29999 yuan	55.2 ± 8.4	4.345	0.294
	> 30000 yuan (control)	50.8 ± 8.7	1	-
Payment model	Self-paying (control)	53.4 ± 9.5	1	-
	Health insurance	55.4 ± 8.5	1.975	0.176
Trimester	First trimester (control)	53.6 ± 9.9	1	-
	Second trimester	56.0 ± 8.5	2.431	0.170
	Third trimester	54.0 ± 8.6	0.372	0.839
Pregnancy complications	No (control)	54.5 ± 8.9	1	-
	Yes	55.4 ± 8.9	0.967	0.631
History of abnormal pregnancy	No (control)	54.7 ± 9.0	1	-
	Yes	54.7 ± 8.3	-0.010	0.997
Pregnancy times	1 (control)	54.1 ± 9.4	1	-
	2	55.2 ± 8.9	1.072	0.475

Variables	Groups	SDS score( $\bar{x} \pm s$ )	OR	P
	$\geq 3$	55.3 $\pm$ 7.4	1.214	0.546
Delivery times	0 (control)	54.1 $\pm$ 9.6	1	-
	1	55.4 $\pm$ 8.5	1.272	0.383
	$\geq 2$	55.0 $\pm$ 6.9	0.880	0.705

Table 7  
Multivariate analysis of anxiety and depression for pregnant women in Guangzhou.

Variables	Groups	SAS			SDS		
		OR	95% CI	P	OR	95% CI	P
Nationality (control = Other nationality)	Han nationality	8.101	0.632 ~ 15.571	<b>0.034</b>	10.972	2.609 ~ 19.335	<b>0.010</b>
Trimester (control = Second trimester)	First trimester	2.944	0.528 ~ 5.361	<b>0.017</b>			
	Third trimester	0.749	-4.139 ~ 5.637	0.763			
Delivery times (control = 0)	1				0.795	-1.885 ~ 3.475	0.559
	$\geq 2$				6.998	0.609 ~ 13.387	<b>0.032</b>

Table 8  
Multivariate analysis of anxiety and depression for pregnant women in Tibet.

Variables	Groups	SAS			SDS		
		OR	95% CI	P	OR	95% CI	P
Educational experience (control = Bachelor degree and above)	Primary school and below	4.589	1.693 ~ 7.485	<b>0.002</b>	3.925	0.693 ~ 7.158	<b>0.018</b>
	High school	1.965	-0.911 ~ 4.841	0.179	3.099	-0.112 ~ 6.309	0.058

## Discussion

Compared to pregnant women from Guangzhou, those from Tibet have a higher prevalence of both anxiety and depression. Previous studies indicated that the prevalence of anxiety and depression among pregnant women in Guangzhou was the same as the average level in China. In our study, the incidence of anxiety among pregnant women from Guangzhou was 19.1%, and was consistent with previous studies in China(17). The prevalence of depression was 30.2%, while 10.1% of all was moderate depression, which was similar to the results of some studies completed in other provinces of China(17, 18). However, the incidence of anxiety and depression among Tibetan pregnant women was 42.6% and 69.2%, respectively, which was much higher than the previous studies and higher than the rest of China.

According to previous studies, the factors affecting anxiety and depression among pregnant women included age, educational experience, family income, employment situation, trimester and history of abnormal pregnancies(17, 18). We noticed that trimester was the main factor contributing to anxiety among pregnant women in Guangzhou. Women in the early stages of their pregnancy had a higher SAS score. This may be related to the changes in female hormone levels in early pregnancy, the influence of their response to an early pregnancy and the lack of knowledge on pregnancy care. What's more, the first trimester of pregnancy is the key period of fetal development, the fear of miscarriage and fetal deformities can also make them greater anxious(19).

Consistent with the results of previous study(18), delivery times is also the main factor contributing to depression among pregnant women in Guangzhou, China. Women, especially older women, that have delivered more than twice are more prone to experiencing depression during pregnancy. In our study, 67.4% of pregnant women were older than 30 years of age, including 39.6% of them were elderly pregnant women, and 20.8% of them had pregnancy complications. Pregnancy complications can increase the incidence of anxiety and depression in pregnant women. However, with the gradual opening of the second child policy in China, there will, in the future, be more elderly pregnant women. The mental health for this group of people should be paid more attention. Besides, among those pregnant women from Guangzhou, SAS and SDS scores of Han nationality were higher than those of other nationalities. However, mainland China is mainly inhabited by Han nationality and the proportion of other nationalities is very small, so we think this result is not representative.

In our study, we found that the educational experience was the main factor affecting anxiety and depression of pregnant women in Tibet. Pregnant women with a low level of education had higher SAS and SDS scores. This result is consistent with previous studies(18). Tibet is located on the Qinghai-Tibet plateau in southwest China and it has an average altitude of over 4000 meters(14). The cold and oxygen-deficient environment makes Tibet relatively backward developed among China, both economically and educationally. In our study, 26.6% of pregnant women in Tibet have only a primary school education or less. They would usually lack awareness, and their expression, understanding and acceptance ability were often lower than those with higher educational level. Therefore, most of them have limited awareness about regular prenatal examinations and the average times of their examinations were usually only one to two times. Most of the women in Tibet were unable to provide an accurate time of their last

menstrual period, making it difficult to calculate their gestation week and proceed the subsequent scheduling prenatal examinations.

Due to the limited medical facilities and environment, the propaganda of pregnancy health care knowledge in Tibet is very inadequate. The unique language and writing in Tibet restrains pregnant women from accessing enough information from the outside world, such as the Internet and books. The whole process of pregnancy lasted about 40 weeks and all the daily diet, rest, exercise, drug use and mental health care during pregnancy need professional advice. When those pregnant women in Tibet are faced with some physiological changes or pregnancy complications, their lack of relevant knowledge and external help may end up with feeling anxious and increasing mental stress, even result in anxiety, depression and other perinatal mood disorders, which can severely damage both maternal and infant's health.

To sum up, pregnant women in Tibet had higher SAS and SDS scores than Guangzhou, indicating the higher incidence rate of anxiety and depression. In future work, more attention should be paid to pregnant women in Tibet, especially those with low levels of education(17). To alleviate the problem of perinatal anxiety and depression, many attempts have been made in China and other countries. Based on previous studies, usage of anti-anxiety and anti-depression drugs would increase the incidence of eclampsia, even leading to neonatal toxicity, and fetal growth disorders(20, 21), which limit the use of these drugs. Other psychological interventions would be safer and more acceptable, such as hypnosis, cognitive behavioral therapy, music therapy, yoga and so on(22–26). However, compared with Guangzhou, the limitation of medical facilities and environment in Tibet restrain the generalization of the above therapies. It is very urgent to establish and strengthen the three-level maternal and child health care network in Tibet(7).

For the future, we hope to reduce perinatal anxiety and depression in Tibet by establishing an online education platform between local hospitals and other top hospitals in China(27). This platform will provide systematically training to local doctors and nurses through information sharing on health care of pregnant women. It will also provide professional psychological guidance for pregnant women by using online schools. Simultaneously, to meet the needs of pregnant women from different nationalities, our courses for physiology and mental health care will be available in both Mandarin and Tibetan languages. This will significantly reduce perinatal anxiety and depression in Tibet by improving their ability for self-caring. As the platform matures, the remote maternal health care courses would be expanded to more counties and villages and available by further more people and communities.

## Conclusions

In conclusion, our study shows that pregnant women in plateaus areas of China have higher SAS and SDS scores than in plain areas. Individualized and targeted mental care should be added into clinic work to prevent negative outcomes, especially for those with a low level of educational experience.

## Abbreviations

SAS: Zung's Self Rating Anxiety Scale, SDS: Zung's Self-Rating Depression Scale, CI: confidence interval, OR: odds ratio

## Declarations

### Ethics approval and consent to participate

The study has been approved by the Ethics Committee for Clinical Research and Animal Trials of the First Affiliated Hospital of Sun Yat-sen University(#178-2020, Jun-2,2020).

### Consent for publication

All participants have consented to the publication of this study.

### Availability of data and materials

The datasets generated and/or analyzed during the current study are not publicly available due to patient confidentiality reasons but are available from the corresponding author on reasonable request.

### Competing interests

All authors declare no personal or commercial conflict of interest in this study.

### Funding

Financial support was supported by Science and Technology Bureau of Linzhi City (item number: XZ2019ZRG-152).

### Authors' contributions

JC and QZ contributed to the conception and design of the research and writing of this article. CJ and JH contributed to the case collection respectively in Tibet and Guangzhou. JZ and XL contributed to quality control of all data and statistics. SD contributed to distribution of the questionnaires and follow-up with participants. GW and SY had substantial contributions to the conception and design of the research. All authors read and approved the final manuscript.

### Acknowledgements

We would like to thank the pregnant women who participated in the study. We would also like to thank the financial support from the Science and Technology Bureau of Linzhi City.

## References

1. Howard LM, Molyneaux E, Dennis CL, Rochat T, Stein A, Milgrom J. Non-psychotic mental disorders in the perinatal period. *Lancet (London, England)*. 2014;384(9956):1775-88.

2. Leight KL, Fitelson EM, Weston CA, Wisner KL. Childbirth and mental disorders. *International review of psychiatry* (Abingdon, England). 2010;22(5):453-71.
3. Ma X, Wang Y, Hu H, Tao XG, Zhang Y, Shi H. The impact of resilience on prenatal anxiety and depression among pregnant women in Shanghai. *Journal of affective disorders*. 2019;250:57-64.
4. Priya A, Chaturvedi S, Bhasin SK, Bhatia MS, Radhakrishnan G. Depression, anxiety and stress among pregnant women: A community-based study. *Indian journal of psychiatry*. 2018;60(1):151-2.
5. Goodman JH, Chenausky KL, Freeman MP. Anxiety disorders during pregnancy: a systematic review. *The Journal of clinical psychiatry*. 2014;75(10):e1153-84.
6. Sawyer A, Ayers S, Smith H. Pre- and postnatal psychological wellbeing in Africa: a systematic review. *Journal of affective disorders*. 2010;123(1-3):17-29.
7. Doktorchik C, Premji S, Slater D, Williamson T, Tough S, Patten S. Patterns of change in anxiety and depression during pregnancy predict preterm birth. *Journal of affective disorders*. 2018;227:71-8.
8. Horsch A, Gilbert L, Lanzi S, Kang JS, Vial Y, Puder JJ. Prospective associations between maternal stress during pregnancy and fasting glucose with obstetric and neonatal outcomes. *Journal of psychosomatic research*. 2019;125:109795.
9. Pinto TM, Caldas F, Nogueira-Silva C, Figueiredo B. Maternal depression and anxiety and fetal-neonatal growth. *Jornal de pediatria*. 2017;93(5):452-9.
10. Roomruangwong C, Kanchanatawan B, Sirivichayakul S, Maes M. Antenatal depression and hematocrit levels as predictors of postpartum depression and anxiety symptoms. *Psychiatry research*. 2016;238:211-7.
11. Szegda K, Markenson G, Bertone-Johnson ER, Chasan-Taber L. Depression during pregnancy: a risk factor for adverse neonatal outcomes? A critical review of the literature. *The journal of maternal-fetal & neonatal medicine : the official journal of the European Association of Perinatal Medicine, the Federation of Asia and Oceania Perinatal Societies, the International Society of Perinatal Obstet*. 2014;27(9):960-7.
12. Uguz F, Sahingoz M, Sonmez EO, Karsidag C, Yuksel G, Annagur BB, et al. The effects of maternal major depression, generalized anxiety disorder, and panic disorder on birth weight and gestational age: a comparative study. *Journal of psychosomatic research*. 2013;75(1):87-9.
13. Yang S, Yang R, Liang S, Wang J, Weaver NL, Hu K, et al. Symptoms of anxiety and depression during pregnancy and their association with low birth weight in Chinese women: a nested case control study. *Archives of women's mental health*. 2017;20(2):283-90.
14. Li Q, Yan H, Wang QL, Kang YJ, Dang SN. [Study on maternal health care status to agricultural and nomadic counties in Tibet Autonomous Region of China]. *Zhonghua liu xing bing xue za zhi = Zhonghua liuxingbingxue zazhi*. 2006;27(1):9-11.
15. Zung WW. A SELF-RATING DEPRESSION SCALE. *Archives of general psychiatry*. 1965;12:63-70.
16. Zung WW. The differentiation of anxiety and depressive disorders: a biometric approach. *Psychosomatics*. 1971;12(6):380-4.

17. Zhang Y, Muyiduli X, Wang S, Jiang W, Wu J, Li M, et al. Prevalence and relevant factors of anxiety and depression among pregnant women in a cohort study from south-east China. *Journal of reproductive and infant psychology*. 2018;36(5):519-29.
18. Hu HQ, Zhang J, Zhao W, Tian T, Huang AQ, Wang LL. [The occurrence and determinants of anxiety and depression symptoms in women of six counties/ districts in China during pregnancy]. *Zhonghua yu fang yi xue za zhi [Chinese journal of preventive medicine]*. 2017;51(1):47-52.
19. Tang X, Lu Z, Hu D, Zhong X. Influencing factors for prenatal Stress, anxiety and depression in early pregnancy among women in Chongqing, China. *Journal of affective disorders*. 2019;253:292-302.
20. Dalke KB, Wenzel A, Kim DR. Depression and Anxiety During Pregnancy: Evaluating the Literature in Support of Clinical Risk-Benefit Decision-Making. *Current psychiatry reports*. 2016;18(6):59.
21. Bernard N, Forest JC, Tarabulsky GM, Bujold E, Bouvier D, Giguère Y. Use of antidepressants and anxiolytics in early pregnancy and the risk of preeclampsia and gestational hypertension: a prospective study. *BMC pregnancy and childbirth*. 2019;19(1):146.
22. Beevi Z, Low WY, Hassan J. The Effectiveness of Hypnosis Intervention in Alleviating Postpartum Psychological Symptoms. *The American journal of clinical hypnosis*. 2019;61(4):409-25.
23. Lavender TJ, Ebert L, Jones D. An evaluation of perinatal mental health interventions: An integrative literature review. *Women and birth : journal of the Australian College of Midwives*. 2016;29(5):399-406.
24. Forsell E, Bendix M, Holländare F, Szymanska von Schultz B, Nasiell J, Blomdahl-Wetterholm M, et al. Internet delivered cognitive behavior therapy for antenatal depression: A randomised controlled trial. *Journal of affective disorders*. 2017;221:56-64.
25. Nwebube C, Glover V, Stewart L. Prenatal listening to songs composed for pregnancy and symptoms of anxiety and depression: a pilot study. *BMC complementary and alternative medicine*. 2017;17(1):256.
26. Field T, Diego M, Delgado J, Medina L. Yoga and social support reduce prenatal depression, anxiety and cortisol. *Journal of bodywork and movement therapies*. 2013;17(4):397-403.
27. Le PV, Jones-Le E, Bell C, Miller S. Preferences for perinatal health communication of women in rural Tibet. *Journal of obstetric, gynecologic, and neonatal nursing : JOGNN*. 2009;38(1):108-17.