



Original Article

Risk factors for the formation of striae gravidarum in women in Jiangsu Province of China

Ping Ren ^{a,1}, Weibo Zhao ^{a,1}, Xu Dai ^b, Ximei Wang ^a, Jinjin Yu ^a, Yan Yuan ^{a,**}, Yibo Wu ^{a,*}^a Human Reproductive and Genetic Center, Affiliated Hospital of Jiangnan University, 200 Huihe Road, Wuxi, Jiangsu, 214000, PR China^b Department of Obstetrics, Fourth Affiliated Hospital of Harbin Medical University, 37 Yiyuan Road, Harbin, Heilongjiang, 150000, PR China

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ABSTRACT

Objective: We study the risk factors that affect the formation of striae gravidarum in women in Jiangsu Province of China under current living habits.**Materials and methods:** This sample is based on 400 primiparas from obstetric of the Affiliated Hospital of Jiangnan University in Wuxi from February 2017 to October 2017. Among them, there are 200 pregnant women with striae gravidarum and 200 without striae gravidarum. Striae gravidarum predictors were selected such as age, height, pre-pregnancy BMI, postpartum BMI, daily sitting time, weight gain during pregnancy, fetal weight, and diet on maternal.**Results:** (1) The pregnant women who had striae gravidarum were generally lower in height than those who did not have striae gravidarum and had a higher BMI index than those who did not have striae gravidarum before and after childbirth. (2) In the pregnant women who have had striae gravidarum, the incidence of abdominal striae gravidarum in sedentary women is significantly lower than those in non-sedentary women, the incidence of striae gravidarum in legs is higher than those in non-sedentary women, and no significant difference in hip striae gravidarum. (3) In all pregnant women who have striae gravidarum, abdomen striae gravidarum tend to be lighter and leg striae gravidarum tends to be heavier in sedentary women, but no significant effect on the hip. (4) Regular consumption of honey, milk, trotters, freshwater fish, eggs, and tremella can reduce the incidence of striae gravidarum.**Conclusion:** The lifestyle and eating habits have a certain influence on the formation and severity of stretch marks.© 2019 Taiwan Association of Obstetrics & Gynecology. Publishing services by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Striae gravidarum (SG) mainly refers to the “fine lines” of skin produced by women during pregnancy. It is a linear skin lesion of the dermis that occurs during pregnancy. It is mainly distributed in the abdomen, hip, and legs of women. About 60–90% of pregnant women suffer from SG in first-time mothers [1]. The specific reasons for this are not yet clear. Although such fine lines will not cause dysfunction of the body, their permanent existence will affect the appearance of the body, causing great distress to young women [2]. With the improvement of living standards in recent years,

women's demands for beauty have become higher and higher, and the demand for reducing or avoiding SG has become increasingly strong. At present, the main cause of SG is the change of hormone levels and changes in skin tension [3]. Some studies suggest that estrogen and epinephrine may affect the formation of SG, and some studies believe that elastin and fibrillin play a key role in the formation of SG.

SG cause different incidences in different regions. There have been studied in France about the prevalence and risk factors of SG in local women, the results showed that, apart from conventional influencing factors, different ethnic groups, social status and other factors can also affect SG [4]. Considering the differences in living habits and physical fitness between Chinese and European women, this experiment aims to explore the high-risk factors that affect the occurrence and severity of SG in the women in southern Jiangsu Province of China.

The southern of Jiangsu Province is rich in resources and has a long history. The local residents are mainly ethnic in East Asia. Their

List of abbreviations: SG, Striae gravidarum; BMI, Body Mass Index.

* Corresponding author. Fax: +86 0510 85808820.

** Corresponding author. Fax: +86 0510 85808820.

E-mail addresses: yuanyan_su@foxmail.com (Y. Yuan), moliaty@aliyun.com (Y. Wu).

¹ These authors contributed equally to this work.

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lifestyle and eating habits are self-contained and influence the constitution of residents in southern Jiangsu. Its geographic location is adjacent to the international metropolis of Shanghai, and the economy is relatively prosperous. Residents live in the upper-middle level and women are engaged in mental work. The average height of women is about 161 cm, which is significantly lower than that of European women. This study aims to understand the factors that affect the development of SG based on the daily life habits of pregnant women. At the same time, under the dietary conditions in southern Jiangsu Province, based on the theory of “Estrogen” and “Collagen” of SG, the consumption of foods rich in estrogen and collagen was investigated to study the effect on the production of SG, in order to instruct women a better preparation for pregnancy in the future.

Method

Sample

A total of 400 samples, including 200 with SG and 200 without SG, were acquired from pregnant women who were parturition in the Department of Obstetrics, Affiliated Hospital of Jiangnan University, Wuxi, from February 2017 to October 2017. Inclusion criteria: primipara, term birth, monocyosis, no obvious fetal abnormalities, no skin disease, no history of major trauma in the abdomen, hip and legs, no plastic history in the abdomen, hip and legs. Then, in the form of an anonymous questionnaire, investigate the age, height, pre-pregnancy and postpartum BMI, daily sitting time, weight gain during pregnancy, fetal weight, eating habits, etc. The present study was approved by the Ethics Committee of the Affiliated Hospital of Jiangnan University (Wuxi, China), and consent was obtained from each patient.

Method

According to whether there are SG, pregnant women is divided into two groups, then analysis whether age, height, pre-pregnancy BMI (Body Mass Index), postpartum BMI, daily sitting time, weight gain during pregnancy, fetal weight and other factors affect the production of SG. According to the date, the average daily sitting time of all pregnant women was about 5.9 h, those who have a daily sitting time greater than the average value are referred to be “sedentary”, and those who have a daily sitting time less than the average value is called “non-sedentary”. In the pregnant women who have SG, the region where the SG appeared (belly, hip, and legs) is further counted, analyze whether daily sitting time affects the appearance of SG at different regions. In order to allow statistical analyses, patients were divided into two groups according to the expression rate of SG through the assessment of more than three normal vision adults: mild SG (less than half the region covered by SG), Severe SG (more than half the region covered by SG), then analysis whether the extent of SG at different regions is

related to the daily sitting time. Questionnaires were used to investigate the dietary habits of women in southern Jiangsu and to count the amount or frequency of foods rich in estrogen and collagen consumed weekly to determine whether the production of SG is related to such foods. Through consulting relevant data and questionnaire surveys, it is known that the foods rich in estrogen in the women's daily diet in southern Jiangsu include honey, trotters, milk, freshwater fish, kelp, etc., and collagen-rich foods include eggs, animal liver, chicken feet, tremella and so on. After analyzing the statistical results of the survey, according to the daily food cooking methods in the southern Jiangsu Province, the amount of food consumed per week was calculated, in order to compare whether this food has an effect on the appearance of stretch marks.

Statistical analysis

All computations were performed with Excel version 2010. During statistical analysis, paired measurement data were analyzed by Independent-Samples T test and enumeration data were analyzed by χ^2 test, $P < 0.05$ was considered to indicate a statistically significant difference.

Result

1. Comparison of the women with SG and without SG. The height of the pregnant woman with SG is generally lower than that of women without SG, the average height of the women with SG was 160.81 ± 2.93 cm, while the women without SG was 161.86 ± 4.28 cm. The BMI of pregnant woman with SG before and after childbirth is higher than that of women without SG, Pre-pregnancy BMI was 21.04 ± 1.78 in pregnant woman with SG, and 27.05 ± 2.14 after delivery, the pre-pregnancy BMI was 20.06 ± 1.80 in the women without SG and 25.5 ± 2.58 after the delivery. The data are statistically significant ($P < 0.05$). However, there was no statistical difference in maternal age, daily sitting time, weight gain during pregnancy, and fetal weight (Table 1).
2. The relationship between daily sitting time and SG. Among the pregnant women who have developed SG, the effects of sedentary and non-sedentary on the different parts of the pregnant woman have a statistically significant difference. The incidence of abdominal SG in sedentary pregnant woman was significantly lower than that of non-sedentary women. The incidence of SG in legs was higher than that of non-sedentary women. There was no significant difference in the production of SG in the hip (Table 2).
3. The relationship between daily sitting time and the extent of abdominal SG. The daily sitting time have a statistically significant effect on the severity of abdominal SG, among the women who have abdominal SG, the severity of the sedentary crowd tend to be lighter (Table 3).

Table 1
Factors affecting SG formation [n (%)].

	n	Age (year)	Height (cm)	pre-pregnancy BMI
With SG	200	26.69 ± 4.01	160.81 ± 2.93	21.04 ± 1.78
Without SG	200	26.85 ± 5.19	161.86 ± 4.28	20.06 ± 1.80
P value		0.808	0.045	<0.001
	postpartum BMI	daily sitting time (h)	weight gain during pregnancy (Kg)	fetal weight (Kg)
With SG	27.05 ± 2.14	5.86 ± 2.06	15.46 ± 3.88	3337.8 ± 384.97
Without SG	25.5 ± 2.58	5.955 ± 2.19	14.09 ± 3.99	3225.9 ± 424.81
P value	<0.01	0.339	0.149	0.053

Table 2
The effect of sedentary on Striae gravidarum [n (%)].

	n	Abdominal SG (178)		Hip SG (72)		Leg SG (46)	
		With SG	Without SG	With SG	Without SG	With SG	Without SG
sedentary	92	71 (0.77)	21 (0.23)	32 (0.35)	60 (0.65)	31 (0.34)	61 (0.66)
non-sedentary	108	100 (0.93)	8 (0.07)	40 (0.37)	68 (0.73)	15 (0.14)	93 (0.86)
P value		0.002025055		0.740611094		0.000908664	

- The relationship between daily sitting time and the degree of SG in the hip. Whether pregnant woman are sedentary have no statistically significant effect on the severity of the SG in the hips (Table 4).
- The relationship between daily sitting time and the degree of leg SG. Whether the pregnant woman are sedentary have a statistically significant effect on the severity of SG in legs, among the women who have leg SG, the severity of the sedentary crowd tend to be heavier (Table 5).
- The relationship between daily diet and SG. The results of the study showed that people with regular consumption of honey, milk, trotters, freshwater fish, eggs, and tremella had a low incidence of SG. Among them, those who consumed 50 g or more of tremella per week had the lowest rate of SG, about 24%. Followed by trotters and honey, those who consumed about 1000 g of trotters per week had the rate of SG about 27% and who consumed about 10 g of honey per week had the rate of SG about 34% (Table 6).

Discussion

It is currently believed that the appearance of SG is due to the gradual stretching of the skin with the expansion of subcutaneous tissue (fat and muscle) during pregnancy [5], causing damage to the connective tissue of the dermis layer, destruction of collagen fibers and elastic fibers, resulting in the stretching and elasticity of the lesion to be weakened [6,7], eventually lead to streaked skin lesions. SG generally do not cause obvious symptoms to the body, most of them only show "itchiness" at the beginning, and pale bloody stripes appear on the surface of the skin, which can be accompanied by tightness and discomfort. As the gestational age gradually increases, some SG appear as brown scar-like striae and discomfort disappears. After delivery of the baby, maternal organs gradually return to their pre-pregnancy state, but the SG gradually deteriorate and fade, eventually becoming white or silver stripes

Table 3
Effect of sedentary on the severity of abdominal Striae gravidarum [n (%)].

	n	Abdominal SG	
		mild	severe
sedentary	81	46 (0.57)	35 (0.43)
non-sedentary	97	32 (0.33)	65 (0.67)
P value		0.001431162	

Table 4
Effect of sedentary on the severity of Striae gravidarum in the hip [n (%)].

	n	Hip SG	
		mild	severe
sedentary	31	14 (0.45)	17 (0.55)
non-sedentary	41	18 (0.44)	23 (0.56)
P value		0.916077411	

[8,9], perpetual presence in the female body surface, which will seriously affects the appearance. According to the SG is mainly related to fat and muscle tissue, this study focused on investigating the daily habits related to maternal fat and muscle formation, and comparing the possible effects of different lifestyles on the high incidence areas of SG.

According to the results of this study, maternal age, daily sitting time, weight gain during pregnancy, and fetal weight have no significant effect on the production of SG. By comparing the occurrence of SG in women of different heights, it was found that the average height of women without SG was significantly higher than that of women with SG. Then we concluded that short stature was one of the risk factors for the occurrence of SG in women in Southern Jiangsu. The BMI index had a significant effect on the development of SG during pregnancy and after childbirth. The BMI index was significantly higher in pregnant women with SG and was a risk factor for the occurrence of SG.

Although the results of this experiment show that daily sitting time has no significant effect on the production of SG, however, based on the location of women's SG is not a single, and today's social mental labor is increasingly dominating, daily sitting time continues to extend, this article further compares the correlation of the occurrence rate and the severity of SG in different parts of the pregnant woman between who are "sedentary" and "non sedentary" in the maternal groups who have developed SG. The results showed that the incidence of abdominal SG in "sedentary" pregnant woman was significantly lower than in "non sedentary" mother, the incidence of SG in the leg was higher than that in "non sedentary" pregnant woman, however, the incidence was not significantly different in the hip of pregnant woman. In all pregnant woman who have SG on the abdomen, the severity of the "sedentary" crowd tend to be lighter, and in all the women who have SG on the legs, the severity in the "sedentary" crowd tend to be heavier, but there were no significant difference in the hip.

Previous investigations have confirmed that "sedentary" women have weaker waist and abdominal flexibility but stronger waist and abdominal muscle strength [10]. Therefore, it is inferred that "sedentary" women often have thicker abdominal fat, with the increase of the uterus, it is easier to cause breaks in the shallow elastic fibers of the dermis, which lead to a higher rate of SG. The sedentary maternal abdominal muscle strength is stronger, so the abdomen will not be over-relaxed and inflated during pregnancy, resulting in the majority of the SG in a lesser degree. The occurrence rate of SG in "sedentary" women legs is high, and it is considered to be related to "sedentary" fat accumulation in the legs. At the same

Table 5
Effect of sedentary on the severity of Striae gravidarum in the legs [n (%)].

	n	Leg SG	
		mild	severe
sedentary	21	7 (0.33)	14 (0.67)
non-sedentary	25	16 (0.64)	9 (0.36)
P value		0.038262081	

Table 6
Effect of diet on the formation of stretch mark [n (%)].

Foods consumed Weekly(g)	All women (n = 400)	Comparison between women with and without SG		p-value
		Women with SG (n = 200)	Women without SG (n = 200)	
Soy products				
1000(g)	68	42 (62%)	26 (38%)	0.071
500(g)	255	118 (46%)	137 (54%)	
100(g)	77	40 (52%)	37 (48%)	
honey				
10(g)	44	15 (34%)	29 (66%)	<0.01*
5(g)	150	26 (17%)	124 (83%)	
0(g)	206	159 (77%)	47 (23%)	
milk				
1500 (ml)	178	72 (40%)	106 (60%)	<0.01*
1000 (ml)	182	88 (48%)	94 (52%)	
500 (ml)	40	40 (100%)	0 (0%)	
0	85	45 (53%)	40 (47%)	
trotters				
1000(g)	56	15 (27%)	41 (73%)	<0.01*
500(g)	145	65 (45%)	80 (55%)	
0	199	120 (60%)	79 (40%)	
freshwater fish				
1500(g)	218	91 (42%)	127 (58%)	0.014*
700(g)	92	45 (49%)	47 (51%)	
0	90	54 (60%)	36 (40%)	
kelp				
150(g)	27	18 (67%)	9 (33%)	0.094
75(g)	101	44 (44%)	57 (56%)	
0	272	138 (50%)	134 (50%)	
eggs				
500(g)	92	37 (40%)	55 (60%)	<0.01*
250(g)	237	110 (46.5%)	127 (53.5%)	
150(g)	71	53 (75%)	18 (25%)	
chicken paws				
200(g)	31	12 (39%)	19 (61%)	0.069
100(g)	40	13 (32.5%)	27 (67.5%)	
0	329	175 (53%)	154 (47%)	
tremella				
50(g)	51	12 (24%)	39 (76%)	<0.01*
20(g)	72	30 (42%)	42 (58%)	
0	277	158 (57%)	119 (43%)	
animal liver				
1000(g)	44	19 (43%)	25 (57%)	0.401
500(g)	106	58 (55%)	48 (45%)	
0	250	123 (49%)	127 (51%)	

time, because of sparse activity in “sedentary” legs, the muscle strength of the legs is weak, thus the SG tend to be heavier.

Based on the “Estrogen” and “Collagen” theory of SG, this article also investigated the influence of daily eating habits in the South of Jiangsu on SG. Collagen is a kind of biomacromolecules protein synthesized by animal cells which is widely found in animals. It is rich in content and variety, and has a major impact on the normal function of cells, tissues and organs as well as the damage repair. Estrogen is the normal hormone of the human body and has the physiological functions of promoting and maintaining female reproductive organs and secondary sexual characteristics. In addition to the body's own secretion, estrogen can also be supplemented from the diet.

Compared with other regions in China, the food in Southern Jiangsu is light and sweet, the traditional dishes such as tremella soup with lotus seeds, shredded kelp with soy sauce, chicken feet with pickled peppers are generally favored. Hyaluronic acid has the effect of increasing skin elasticity [11], recent studies have shown that Fungus-TFP in tremella has similar efficacy to hyaluronic acid. Tremella fuciformis is also rich in tremella polysaccharides, and tremella polysaccharides have the effect of promoting wound healing [12]. Traditional Chinese medicine believes that regular consumption of tremella can relieve constipation, maintain beauty and keep young. Previous literature surveys have concluded that

the rate of SG is between 60 and 90%. The survey showed that women who consumed about 50 g of tremella per week had a rate of about 24% of SG, who consumed 20 g of tremella had a rate of about 42%, which was significantly lower than the normal level. Honey can provide the best environment for the migration and proliferation of collagen tissue, thus promoting skin wound healing [13,14]. According to the dietary habits in southern Jiangsu, honey was eaten after being added to desserts. Surveys have shown that eating more honey also has the effect of reducing the rate of SG. According to the dietary habits in southern Jiangsu, honey is often eaten as a side dish. This investigation shows that eating more honey also has the effect of reducing the rate of SG. Kelp is rich in iodine, iodine can stimulate the pituitary, thereby reducing the secretion of estrogen. However, this study found that kelp has no significant effect on the formation of SG. The trotters and freshwater fish are rich in protein. Compared with mammals, the type I collagen contained in fish is more easily to be absorbed and plays an important role in the growth and wound healing of soft tissues [15–18]. The trotters are rich in collagen proteins, trotter is one of the most favored foods for pregnant women in southern Jiangsu during pregnancy, traditional Chinese medicine believes that trotters can promote postpartum physical recovery and have the effect of prolactin. The study shows that women who always eat trotters have a significantly lower rate of SG, the one who consume about

1000 g of trotters per week have a rate of only 27%. The rivers in southern Jiangsu are widely distributed, the residents like to eat freshwater fish, especially the fish from Taihu Lake, the traditional famous dish “steamed silver carp” is most popular among local residents. Statistical results show that women who consumed about 1500 g of freshwater fish per week had a rate of 42% for SG, and those who consumed 700 g of freshwater fish had a rate of 49% for SG, which was slightly lower than the average level. The chicken feet are similar in composition to trotters, but the collagen content is much lower than that of trotters, this study shows that it has no significant effect on the formation of SG. Soybean isoflavones are widely found in legume foods. Their structure is similar to that of estrogen and can exert estrogen-like effects [19]. Milk contains a large amount of whey protein, which is also known as complete protein, the whey protein contains a wide range of essential amino acids and is rich in content, providing the proteins that the body needs [20]. Studies have shown that whey protein also plays an important role in wound healing [21,22]. The demand for protein during pregnancy increased more than usual, not only to meet the needs of embryonic development, but also have a very important role in pregnant women's heart, breast, uterus and other organs [23]. Eggs and milk can provide a lot of high-quality protein, especially vitamin D and potassium, calcium, magnesium [24–26]. The demand for choline is also greatly increased during pregnancy, choline is essential for the development of the embryo, especially for the development of the embryonic brain [27,28]. The literature has confirmed that egg yolk contains a lot of choline and collagen [29], eat more eggs can not only promote embryonic development, but also reduce the formation of SG. Milk, soybean milk and eggs are the most common ingredients for breakfast, especially during pregnancy, most pregnant women drink at least 250 ml of fresh milk each day. The results of the survey showed that the use of soy products had no significant effect on the production of SG, but the production rate of SG in women who liked milk and eggs was reduced. Traditional Chinese medicine believes that the animal liver has the effect of protecting the liver and supplementing blood, and the Chinese diet usually eats pig liver, but the pig liver has no obvious effect on the production of SG.

With the gradual improvement of the educational level of contemporary women, the awareness of pre-pregnancy check, pregnancy care, and postpartum recovery also increases. Women who engaged in mental work have a stronger awareness of health care and have higher demands on their own image.

The study analyzed the height, weight, lifestyle and eating habits of women of childbearing age in Southern Jiangsu in a comprehensive manner, to a certain extent, the study summarized the high-risk factors of SG and related behaviors affecting the degree of SG, maybe it can provide a reference for future research.

Declarations

Ethics approval and consent to participate and consent for publication: The present study was approved by the Ethics Committee of the Affiliated Hospital of Jiangnan University (Wuxi, China), and consent was obtained from each patient.

Availability of data and material

We promise that all the data in this study is true and reliable.

Competing interests

We promise that there are no competing interests among the authors and other research institutions.

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