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CLINICAL ARTICLE

Prevention of striae gravidarum with cocoa butter cream

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ABSTRACT

Objective: To determine whether cocoa butter cream is effective in preventing striae gravidarum. **Methods:** This randomized, double-blind, placebo-controlled trial enrolled 300 pregnant women: 150 women received cocoa butter cream and 150 women received a placebo cream. The women were followed-up from 16 weeks of pregnancy to delivery to assess the development of striae gravidarum. Maternal height, weight, and abdominal girth were recorded at each visit. After delivery the placenta was weighed, and anthropometry and Apgar scores of the neonate were recorded. **Results:** The 2 groups had similar clinical parameters at booking. Striae gravidarum developed in 44% of patients using cocoa butter cream compared with 55% of those using placebo; the difference was not significant ($\chi^2 = 2.8$, $df(1)$, $P = 0.09$). Striae gravidarum were more common among younger women and those with large neonates. However, no relationship was found between development of striae and body mass index. **Conclusion:** Cocoa butter cream does not prevent striae gravidarum. In Afro-Caribbean women, development of striae is related to young age of the mother and large neonates.

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1. Introduction

Striae gravidarum (SG) or stretch marks of pregnancy are common and can be disfiguring. They occur in all racial and ethnic groups, but are more common in dark skinned [1], young, primigravid, and obese women [2]. SG usually begin to appear in the second half of pregnancy and occur as pigmented marks in all quadrants of the abdomen. Many creams have been used to prevent SG, but most have been found to be ineffective [3]. A cream containing *Centella asiatica* tested in clinical trials was found to be effective and resulted in a 60% reduction in SG in one study [4,5]. However, this product is not readily available in most countries. Cocoa butter (from *Theobroma cacao*) is readily available in Jamaica, where the plants are grown for cocoa drink and chocolate for export. Many cocoa butter products are readily available for use to prevent stretch marks, but their efficacy has not been confirmed.

The aim of the present study was to determine whether a cream containing cocoa butter was more effective than a placebo cream for preventing abdominal SG.

2. Materials and methods

Women were recruited from the University Hospital of the West Indies Antenatal Clinic, Mona Kingston, Jamaica, to this randomized

double-blind placebo-controlled trial. The study was approved by the University of the West Indies Ethics Committee. The women were counseled and informed about the study at booking for prenatal care at about 12–15 weeks of pregnancy, where they were informed that their care would not be compromised if they decided not to participate. The women were also given the phone number of the Dean (an independent provider), whom they could contact if they had any problems with participation. Informed consent was obtained from the participants.

Inclusion criteria were primigravidas and multigravidas with no stretch marks.

Women who were taking steroids and women with medical illnesses that caused stretch marks were excluded. Women with a twin pregnancy or polyhydramnios were also excluded.

Three hundred women were enrolled before 16 weeks of pregnancy; 150 women were given 473 mL of cocoa butter cream, and 150 women received 473 mL of placebo cream. The women were assigned cocoa butter cream or placebo using a table of random numbers and the containers were numbered accordingly. The women and the researchers were blinded to the allocation. The 2 creams were manufactured locally to look identical, with removal of artificial coloring and odor, and were packaged identically.

Both creams contained water, glycerin (skin conditioner), distearyl-dimonium chloride (skin conditioner), isopropyl palmitate (emollient), cetearyl alcohol (stabilizer), propylene glycol isostearate (emollient), PPG-15 stearyl ether (1-octadecoxypropan-2-ol) emollient, hydrolyzed collagen, hydrolyzed elastin, tocopheryl acetate (vitamin E), dimethicone (skin conditioner). The study cream also contained 25% cocoa butter cream (as found in available proprietary preparations).

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The women were instructed to apply about half a cap-full of the cream to all 4 quadrants of their abdomen each day until the cream had been used up. They were asked to bring their cream containers to each visit to check for compliance. Women who used all their cream before the end of the study were not given any additional cream. The women were instructed not to discuss their outcomes with other women and not to use any other cream.

All patients were interviewed to determine demographic characteristics including age, menstrual history, medical history, and use of drugs. The height and weight of the women were measured at each visit for determination of body mass index (BMI, calculated as the weight in kilograms divided by the height in meters squared).

At 26 and 36 weeks of pregnancy and at delivery the number of stretch marks was assessed using the 4 quadrant technique of Davey [6] with a simplification by Fletcher (unpublished), which involved using a pictorial chart to aid the providers in using Davey's technique (Fig. 1). Digital photographs were taken of the abdomen of some women, so that the assessment could be verified by a second researcher. The digital photographs (Fig. 2) were taken until the researchers were confident that there was a consensus of the striae scoring system by different observers. Over 100 digital photographs were taken, and the variation in assessment was minimal.

At delivery, the Apgar score, weight, head circumference, crown–rump length, and crown–heel length of the neonate were assessed, and the placenta was weighed. Any adverse event occurring during the pregnancy was also noted.

On the basis of a previous study using *Centella asiatica*, we hypothesized that there would be 20% difference in the proportion of patients developing SG in the placebo group compared with the cocoa butter group. It was calculated that a sample size of 100 would be adequate at 90% power and 5% significance level to yield this hypothesized difference. However, an additional 50 women were enrolled in each group to account for women who might not complete the trial.

Striae gravidarum were assessed by assigning a score that ranged from 0 (no striae) to 4 (severe striae). The mean values of the SG assessment scores at visits at 16 weeks and 26 weeks of pregnancy were considered baseline, and the mean score at the visit at 36 weeks of pregnancy and delivery were considered post-treatment scores. The outcome variable, development or worsening of striae, was dichotomized and coded as 1 (worsening striae) if the difference between post-treatment score and baseline score was greater than 0 and coded as 0 if the difference between the post-treatment score and baseline score was less than or equal to zero. Differences in odds of worsening striae by assignment group adjusting for neonatal and maternal covariates were explored using logistic regression. Likelihood ratio tests were used to determine which predictors would be included in the final model. An intention-to-treat analysis technique was used. For regression analyses, a case-wise approach was used to handle missing data (i.e. all subjects with a missing value for a



Fig. 2. Digital photograph used to assess stretch marks.

variable were excluded from the analysis). $P < 0.05$ was considered significant.

3. Results

The results of the demographic analysis are summarized in Table 1. The mean booking weight, height, and BMI were similar in the 2 groups. The mean age at enrollment was higher in the group that used cocoa butter cream but the difference was not significant ($P = 0.21$). Eighteen patients had used other creams before enrolling in the study to prevent SG: 10 in the cocoa butter group and 8 in the control group. These women were included in the data analyses.

The patients also had similar mean outcome variables during the study (Table 2), with similar striae scores at 16 weeks, at 26 weeks, and at delivery. The striae scores were significantly greater in the controls at 36 weeks compared with the cocoa butter group (0.8 ± 1.0 vs 0.5 ± 0.9 ; $P < 0.05$, Fig. 3); however, fewer patients in the group that used cocoa butter had striae at completion of the study (44%) than in the control group (55%) ($\chi^2 = 2.8$, $df(1)$, $P = 0.09$).

There was no relationship between skin color and the occurrence of SG. However, there were no white women in the study; all of the

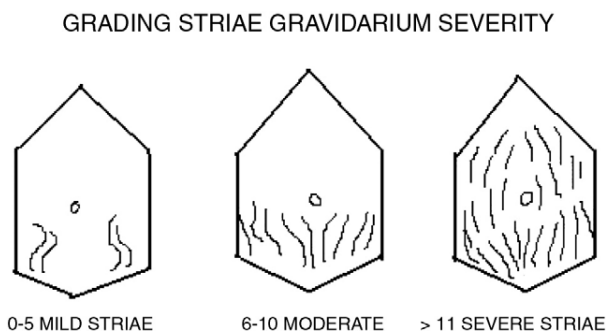


Fig. 1. Pictorial chart used to help assess stretch mark scores.

Table 1
Demographic characteristics of women at enrollment.^{a,b}

Characteristic	Control (n = 150)		Cocoa butter cream (n = 150)		P value
	No.		No.		
Age, y	122	23.8 ± 5.8	120	26.5 ± 18.2	0.12
Weight, kg	111	65.9 ± 12.8	111	68 ± 12.6	0.21
Height, cm	92	163.8 ± 7.8	92	164 ± 6.3	0.84
BMI, kg/m ²	91	24.9 ± 5	91	25.8 ± 4.7	0.21
Skin color: black	67	56.3	68	60.2	0.55
Skin color: brown	52	43.7	45	39.8	0.55
Striae gravidarum	122	55.0	120	44.0	0.09

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by the square of height in meters).

^a Values are given as mean ± SD or percentage.

^b Numbers of women for each characteristic are different because of missing values.

Table 2Comparison of outcome variables in women using cocoa butter cream and the control group.^{a,b}

Variable	Control (n = 150)		Cocoa butter cream (n = 150)		P value
	No.	No.	No.	No.	
Striae gravidarum score					
16 weeks ^c	96	0 ± 0.2	87	0 ± 0.2	1.00
26 weeks	95	0.2 ± 0.5	100	0.1 ± 0.4	0.12
36 weeks	101	0.8 ± 1.0	95	0.5 ± 0.9	<0.05
Delivery	105	1.2 ± 1.2	101	1.0 ± 1.2	0.23
Abdominal girth, cm					
16 weeks	82	89 ± 11.8	82	91.7 ± 13.5	0.17
26 weeks	85	95.4 ± 7.6	97	97.3 ± 11.1	0.18
36 weeks	97	102 ± 8.6	95	103.7 ± 9.2	0.19
Delivery	99	96.8 ± 10.1	91	101 ± 10.3	<0.05
Maternal weight, kg					
16 weeks	86	70.6 ± 15	77	70.2 ± 14.3	0.86
26 weeks	84	73.6 ± 13.5	96	74.7 ± 15.7	0.62
36 weeks	87	76.8 ± 13.8	89	78.6 ± 13.4	0.38

^a Values are given as mean ± SD.^b Numbers of women for each characteristic are different because of missing values.^c Weeks of pregnancy.

women were Afro-Caribbean with either very dark or brown skin tone.

Mean abdominal girth was similar at weeks 16 and 26, and at delivery, but was greater in the control group at week 36 of gestation (96.8 ± 10.1 vs 101 ± 10.3 ; $P < 0.05$). There were no differences in mean maternal weight or neonatal characteristics (Table 3) between the 2 groups.

Likelihood ratio tests were used to determine which of the covariates should be incorporated into a final regression model with worsening of striae as the response variable and treatment group as a fixed predictor. The results indicated that the absence of the variables “change in abdominal girth” from the full model which included these variables together with age, BMI, birth weight, and treatment group as predictors did not significantly reduce the log likelihood ($\chi^2 = 2.8$, $df(1)$, $P = 0.10$). With logistic regression the model that best predicted worsening of striae from the data included the predictors: age (OR 0.90; 95% CI, 0.83–0.98) and birth weight (OR 2.95; 95% CI, 1.20–7.27) (Table 4). There was no significant difference in the odds of developing striae by using cocoa butter cream.

There were few adverse events in the study. Three patients discontinued using the creams because of mild self-limiting allergic reactions to the cream: 1 in the cocoa butter group and 2 in the placebo group (Fig. 4).

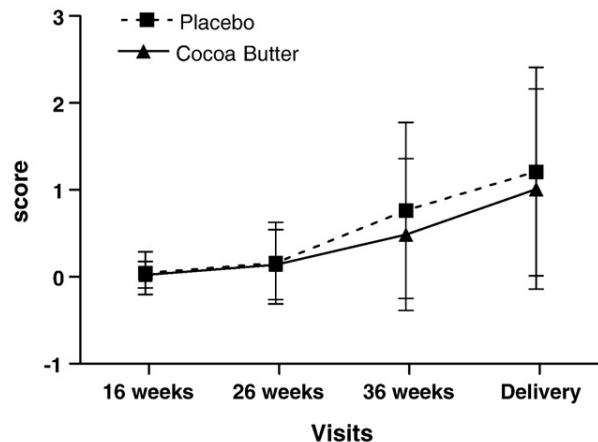


Fig. 3. Mean change in stretch mark score with time between groups. 0 = none; 1 = mild; 2 = moderate; 3 = severe.

Table 3Neonatal outcome variables.^{a,b}

Outcome variable	Control (n = 150)		Cocoa butter cream (n = 150)		P value
	No.	No.	No.	No.	
Birth weight, kg	114	3.3 ± 3	102	3.1 ± 0.6	0.70
Head circumference, cm	112	33.7 ± 2.2	102	36.7 ± 28.8	0.27
Crown–rump length, cm	78	32.1 ± 4.4	62	32.3 ± 3.3	0.77
Crown–heel length, cm	105	52.1 ± 39.4	101	49.2 ± 3.5	0.46
Placental weight, g	110	588.5 ± 127.6	101	614.5 ± 143.2	0.16

^a Values are given as mean ± SD.^b Numbers of women for each characteristic are different because of missing values.

4. Discussion

The analysis indicates that the use of cocoa butter was not associated with a decrease in the severity of SG, when the group that received cocoa butter cream was compared with the control group. Striae gravidarum developed in 44% of patients who used the cocoa butter cream and in 55% of those who used the placebo cream. Similar findings were also reported in a recent study in which cocoa butter lotion was compared with placebo [7].

The overall incidence of SG was 50%, which is in keeping with that found in population studies (50%–61%) [4,7]. In the present study, SG was less common in older women, and more common in women who had large neonates although this was not associated with BMI. This result is similar to the findings of Thomas et al. [2], who found an association with BMI where SG was more common the higher the BMI.

Atwal et al. [8] found that teenage mothers were at the highest risk of developing SG. In fact, 20% of teenage mothers in their study had severe striae, whereas this was not found in women over 30 years. They also found that mothers with a BMI greater than 26, maternal weight gain of over 15 kg, and high neonatal birth weight were independently associated with the risk of SG formation. These comparative studies did not assess the effect of a change in abdominal girth, or how genetic predisposition affected development of SG.

The present study also assessed how skin color affected the development of SG. All of the patients in our study had black or brown pigmentation, which is representative of the clinic population. Although no white women were enrolled, we did not find an effect of skin tone on the development of striae. Chang et al. [1] found that SG were more common in non-white women. However, the rate of stretch marks in our cohort of Afro-Caribbean women (50%) was similar to the rates found in primiparous white women in the UK (53%) [8] and in Lebanon (61%) [7].

Although SG appear to be common, there has been little success in finding an effective treatment. The meta-analysis by Young and Jewell [4] found only one report that claimed success using *Centella asiatica* [5]. In another study of 50 patients [9], researchers compared massage ointment containing tocopherol, panthenol, hyaluronic acid, elastin, and methanol with no treatment. The study found that patients who used the massage oil developed fewer stretch marks. It was unclear whether it was the ointment, the massage, or a specific component of the ointment that was effective in preventing SG [9].

Table 4

Logistic regression analysis of factors that predicted development of striae gravidarum.

Development of striae	Odds ratio	Standard error	P value	95% confidence interval
Age	0.906	0.037	0.018	0.834–0.982
Cocoa butter treatment	0.703	0.328	0.451	0.282–1.756
Birth weight	2.951	1.356	0.019	1.199–7.265

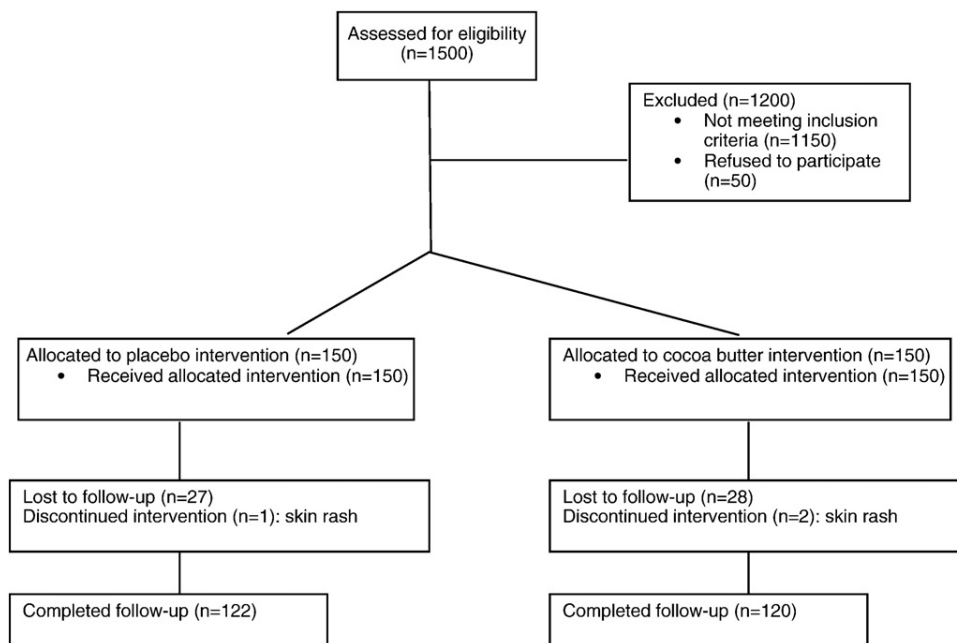


Fig. 4. Flow chart of patients through the study.

Another study found that application of topical tretinoin (retinoic acid) cream 0.1% each day for 3 months after pregnancy was successful in significantly improving the clinical appearance of pregnancy-related stretch marks [10]. However, this treatment is contraindicated in pregnancy because tretinoin is a teratogen [11,12] and, therefore, is not recommended for the prevention of SG.

Limitations of the present study are that it was not possible to verify that the patients were using the cream as instructed or whether they were sharing the cream or using other creams.

We enrolled patients at 16 weeks of pregnancy, but earlier use of the creams may have shown a difference. However, in a study using cocoa butter lotion [7], treatment was started from 12 weeks of pregnancy with a similar outcome.

In conclusion, young maternal age and high neonatal weight had the most effect on the development of SG. The cocoa butter cream appeared to be no better than the placebo for preventing SG.

5. Conflict of interest

The authors have no conflicts of interest.

References

[1] Chang AL, Agredano YZ, Kimball AB. Risk factors associated with striae gravidarum. *J Am Acad Dermatol* 2004;51(6):881–5.

- [2] Thomas RG, Liston WA. Clinical associations of striae gravidarum. *J Obstet Gynaecol* 2004;24(3):270–1.
- [3] Madlon-Kay DJ. Striae gravidarum. *Folklore and fact. Arch Fam Med* 1993;2(5):507–11.
- [4] Young GL, Jewell D. Creams for preventing stretch marks in pregnancy. *Cochrane Database Syst Rev* 2000(2):CD000066.
- [5] Mallol J, Belda MA, Costa D, Noval A, Sola M. Prophylaxis of striae gravidarum with a topical formulation. A double blind trial. *Int J Cosmet Sci* 1991;13(1):51–7.
- [6] Davey C. Factors associated with the occurrence of striae gravidarum. *J Obstet Gynaecol Brit Commonw* 1972;79(12):1113–4.
- [7] Osman H, Usta IM, Rubeiz N, Abu-Rustum R, Charara I, Nassar AH. Cocoa butter lotion for prevention of striae gravidarum: a double-blind, randomised and placebo-controlled trial. *BJOG* 2008;115(9):1138–42.
- [8] Atwal GS, Manku LK, Griffiths CS, Polson DW. Striae gravidarum in primiparae. *Br J Dermatol* 2006;155(5):965–9.
- [9] Wierrani F, Kozak W, Schramm W, Grunberger W. Attempt of preventive treatment of striae gravidarum using preventive massage ointment administration [in German]. *Wien Klin Wochenschr* 1992;104(2):42–4.
- [10] Rangel O, Arias I, Garcia E, Lopez-Padilla S. Topical tretinoin 0.1% for pregnancy-related abdominal striae: an open-label, multicenter, prospective study. *Adv Ther* 2001;18(4):181–6.
- [11] Rothman KF, Pochi PE. Use of oral and topical agents for acne in pregnancy. *J Am Acad Dermatol* 1988;19(3):431–42.
- [12] Lammer EJ, Chen DT, Hoar RM, Agnish ND, Benke PJ, Braun JT, et al. Retinoic acid embryopathy. *N Engl J Med* 1985;313(14):837–41.