

Is Red Correlated to Hormones During Pregnancy?

KATSINOI PANAGIOTA¹, EUGENIA P. KOUKI², HARIKLIA PROIOS¹

Abstract

The color red has been linked to sex differences especially in women whose ratio of estrogen to progesterone is increased in the second to third trimester. In this study, we propose that similar increase in hormonal ratios may implicitly be associated with red color preference in pregnant women when choosing clothes, objects for child rearing and self. Our hypothesis was that women with higher ratio of estrogen to progesterone will have a red color preference for these items. Six hundred and ninety-five pregnant women completed the census study comprising of eleven multiple choice and open questions regarding color preference. The Chi-squared test of independence revealed a preference of red in women of the second and third trimester, as related to choosing products for child rearing [$\chi^2(24)=57.7, p<0.05$] and self [$\chi^2(24)=56.6, p<0.05$], as well as choosing favorite color [$\chi^2(24)=64.5, p<0.05$]. This preference may be attributed to the ratio of estrogens to progesterone, which increases and is maintained at a high level in the second and third trimester of pregnancy. These findings contribute insight into pregnant women and cognitive states with regard to color perception.

Keywords: red, hormonal ratio, estrogens, progesterone, pregnancy

Introduction

It is supported that many primates pick their mates according to color preference. For instance, the rhesus macaques are attracted to the males with the most intense red characteristics (Waitt et al., 2003). Similar investigations in humans show differences with regard to sex. Women with reddish facial features or who often wear red are more attractive to males (Elliot & Niesta, 2008; Stephen & McKeegan, 2010; Elliot & Pazda, 2012; Prokop & Hromada, 2013). Red color preference as it is linked to menstrual cycle has also been discussed in the literature. Specifically, women during ovulation reveal a reddish face (Jones et al., 2015; Lynn, McCord, & Halliwell, 2007). Accordingly, they also prefer to wear red at peak fertility (Beall, & Tracy, 2013; Elliot, & Niesta, 2008).

Color preference has been associated with the hormonal activity and this was the motivation for this work (Eisenbruch, Simmons, & Roney, 2015; Durante & Haselton, 2008; Puts et al., 2012). A recent study (Eisenbruch, Simmons, & Roney, 2015) examined women's color choices as related to ratio of estrogen to progesterone. This ratio predicts the fertility period within the menstrual cycle. Positive correlations were found between the estrogens to progesterone ratios and women's preference to wear red during fertile days.

The aforementioned findings are consistent with those of Roney & Simmons (2013), who supported that libido in women increases with the rise of estradiol and decreases with the rise of progesterone. Women are more attractive during ovarian phase (Puts et al., 2012; Dixson, 2015), although estrogen levels increase during the luteal phase. Consequently, it is the interaction of estrogen - progesterone that determines in which phase of the menstrual cycle a woman will be more attractive (Puts et al., 2012).

When the ratio of estrogen to progesterone increases during a normal menstrual cycle, so does the desire of women to choose red. This ratio also increases during the second half of pregnancy, especially in the third trimester, when the secretion of estrogen continues to rise and the secretion of progesterone remains stable

¹Department of Educational & Social Policy, University of Macedonia, Thessaloniki, Greece

²School of Psychology, Aristotle University of Thessaloniki, Greece

Corresponding author:

Hariklia Proios, Department of Education & Social Policy, University of Macedonia, 156 Egnatia Avenue, 54636, Thessaloniki, Greece

Email: hproios@uom.gr

Telephone Number: +30 6947206466, 2310 891630

or slightly decreases (Boroditsky, Reyes, Winter, & Faiman, 1978; De Hertogh, Thomas, Bietlot, Vanderheyden, & Ferin, 1975). Conclusively, corresponding hormonal levels during pregnancy are expected to influence women's preference of red color. Max Lüscher (1989), cites that the glandular and hormonal activity during pregnancy may be associated with women's preference towards a specific color. In this study, we investigated preference of red in pregnant women, as related to hormonal activity. We hypothesize that from the second trimester of pregnancy and until the end of this, women will tend to wear red and choose items of such color more often.

Methodology

Participants

The survey involved 695 pregnant women aged 16 years and over. Specifically, 29.6% of them were between 25 to 31 years, 26.8% were from 32-39 years, 7.2% from 16 to 24 years and the remaining 1.4% were over 40 years old. In regard to pregnancy weeks, 46.1% of respondents were in the third trimester of pregnancy (28th to 42nd week), 40.8% in the 2nd trimester (13 to 27 weeks) and the remaining 13.1% in the first trimester of pregnancy (1 to 12 weeks). The majority of participants (94.6%) had a normal pregnancy. The demographics collected in the present study are limited to pregnancy trimester, pregnancy normality and age group, and were only used for the purpose of clearly describing the sample.

Stimuli and Procedure

We constructed a questionnaire for the sole purpose of this study and was not otherwise validated. However the questions were reviewed by a team of academic psychologists and linguists for clarity and language accuracy. The questionnaire was administered online. We posted the link leading to the questionnaire on the following online discussion groups: "Parents, Pregnancy, Baby", "Parents cycle Mommy group / mothers group", "Greek moms Videos", "Pregnancy-Childbirth-Breastfeeding", "Breastfeeding Pregnancy Childbirth. Drama maternity assistant", "Pregnant & New Mother", "Mama 365", "Attica: Support Group Breastfeeding & Maternity", "Pregnancy & Motherhood", "Pregnancy - Gynecology", "Masters & Teachers", "Teachers, Primary Education", and "Support Group for Pregnant Women" through the social networking sites. Participants clicked on the internet link https://docs.google.com/forms/d/1XWMKssUEb_FyJyfnkKU6QvvmeglzhMm92L

wl9-GsZK0/edit and gained access.

The questionnaire included a total of 11 questions, part of which addressed aspects of participants' pregnancy: "In which pregnancy week are you?" (item 1), "Is everything normal in your pregnancy?" (item 2), "What is the gender of the child?" (item 5) and "Pick your age group" (non-numbered item). The remaining 7 were designed to investigate preference of red color: "Describe what you were wearing when you learned that you are pregnant." (item 4), "What is your favorite color?" (item 7), "Describe the maternity clothes you bought or would like to buy during your pregnancy." (item 8), "What color would you prefer the products of child rearing to be (stroller, baby bassinet, car seat)?" (item 9), and "Do you wear red during pregnancy?" (item 10). Images of the responses available were provided when possible, so that participants are provided with the chance of visually turning to red. With regard to the questions "How did you feel when you discovered that you were pregnant?" (item 3), "How are you feeling right now?" (item 6), and "How do you feel when wearing red?" (sub-question in item 10), the available answers included faces in red and blue, that represented emotions (The questionnaire was translated in English, and is displayed in Appendix, page 62). All three questions included the same following emotions: Disappointed, Satisfied, Sick, Troubled, Sad, Angry, Excited, Scared. Emotions were presented twice, once in red color, and once in blue. The purpose of these seven questions was to examine whether pregnant women would consistently prefer the red faces over the blue ones. The color chosen for the background of the questionnaire was neutral, so that the respondents were not led to selecting specific answers. The responses were collected online and analyzed.

Results

The analysis of the responses was made through the SPSS program and evaluated in accordance with the Pearson χ^2 criterion, in order to test statistical significance between pregnancy weeks and other variables.

Results demonstrated a statistically significant correlation between pregnancy weeks and favorite color, with women in the second trimester showing a greater preference for red than the rest [$\chi^2(24)=64.5$, $p<0.05$]. Namely, a total of 75 women reported red as their favorite color. Thirty eight out of these 75 participants were in the second trimester, 24 were in the third and 13 in the first trimester.

Similarly, a statistically significant correlation was found between pregnancy weeks and preferred color of maternity clothes. Pregnant women in the second trimester preferred red clothes over other colors [$\chi^2(24)$

=56.6, $p < 0.05$]. Specifically, 31 women reported that the clothes they bought or the clothes they would prefer purchasing were red. Fifteen out of 31 were in the second trimester, 10 in the third trimester and just 6 in the first trimester of pregnancy.

Statistically significant correlation was found between pregnancy weeks and preferred color of products for child rearing, with women in the third trimester showing a greater preference for red than those in the second and first trimester [$\chi^2(24) = 57.7, p < 0.05$]. Specifically, 90 women chose the color red, out of which, 42 were in the third trimester, 32 in the second trimester and the remaining 16 in the first trimester.

Finally, there was a statistically significant correlation between pregnancy weeks and wearing red during pregnancy, since most pregnant women reporting that they wore red during their pregnancy were in the second trimester [$\chi^2(2) = 30.0, p < 0.05$] followed by those in the third trimester. Again fewer women showing preference for red were in the 1st trimester.

Most women reported that positive emotions emerged when they discovered that they were pregnant (79.6%). Likewise, the majority reported positive emotions as far as their current emotional state is concerned (66.4%). However, there was no statistically significant preference of the color of the faces, with red faces being picked by the participants as often as the blue ones. In addition, most women reported positive emotion when wearing red (77%), but no significant difference was found as to the choice of the color of faces.

Discussion

Women in the 2nd and 3rd trimester of pregnancy reported a significant preference of red color, which was not reported by women in the first trimester, thus confirming our initial hypothesis. Consistent with previous research concerning ovulation period (Eisenbruch, Simmons & Roney, 2015; Durante & Haselton, 2008; Puts et al. 2012), this preference may be attributed to the ratio of estrogen to progesterone, which increases from the 16th week of pregnancy and its high level is maintained until the end of pregnancy. This increased ratio of estrogen to progesterone is similar to the increase observed during ovulation.

The majority reported that positive emotions when they discovered that their pregnancy. The participants picked red and blue faces to report emotions equally often in all eight emotions. Positive emotions concerning their current emotional state were also reported by the majority, with no differences between picking red and blue faces. In addition, most women reported positive emotional states when wearing red. No significant

difference was found, concerning the choice of the color of faces in the aforementioned reports of all eight emotions, as well. This is consistent with the findings of Buechner, Maier Lichtenfeld, and Schwarz (2014). Their study supports that a red or blue emotionally loaded non-human face (such as those displayed in our questionnaire) has no effect on the drawing participants' attention.

Due to certain limitations of this study, one should interpret our findings with reserve. Firstly, online recruitment of participants made homogenous distribution of the sample impossible. That is, women in the 1st trimester were not equally represented as women in the other two trimesters. Additionally, the sample was collected online and consequently, hormonal levels could not be monitored directly. However, we did observe statistically significant increase in preference of red color in women, whose estrogen to progesterone ratio is expected to be increased (2nd and 3rd trimester).

As mentioned before, the literature addressing preference of red color during pregnancy to date is limited. Although this highlights the originality of our research, further investigation is suggested. The replication of this work using a control group of non-pregnant women ovulating in comparison to pregnant women would confirm whether changes in color preference can be attributed to hormonal changes observed in the second half of pregnancy. It is also suggested that further research on the topic should incorporate direct observation of the hormone levels of both groups. In any case, the present study may be the beginning of the investigation of a topic that has not yet been studied and which is of great interest, as it will highlight the role hormones in pregnant women's cognition and perception of color.

References

Beall, A. T., & Tracy, J. L. (2013). Women are more likely to wear red or pink at peak fertility. *Psychological Science*, 0956797613476045.

Boroditsky, R. S., Reyes, F. I., Winter, J. S., & Faiman, C. (1978). Maternal serum estrogen and progesterone concentrations preceding normal labor. *Obstetrics & Gynecology*, 51(6), 686-691.

Buechner, V. L., Maier, M. A., Lichtenfeld, S., & Schwarz, S. (2014). Red-take a closer look. *PLoS one*, 9(9), e108111.

De Hertogh, R., Thomas, K., Bietlot, Y., Vanderheyden, I., & Ferin, J. (1975). Plasma levels of unconjugated estrone, estradiol and estriol and of HCS throughout pregnancy in normal women. *The Journal of Clinical Endocrinology & Metabolism*, 40(1), 93-101.

Dixson, A. (2015). Human sexuality and the menstrual cycle: comment on Havlíček et al. *Behavioral Ecology*, 26(5), 1261-1261.

Durante, K. M., Li, N. P., & Haselton, M. G. (2008). Changes in women's choice of dress across the ovulatory cycle: Naturalistic and laboratory task-based evidence. *Personality and Social Psychology Bulletin*.

Eisenbruch, A. B., Simmons, Z. L., & Roney, J. R. (2015). Lady in Red: Hormonal Predictors of Women's Clothing Choices. *Psychological science*, 26(8), 1332-1338.

Elliot, A. J., & Niesta, D. (2008). Romantic red: red enhances men's attraction to women. *Journal of personality and social psychology*, 95(5), 1150.

Elliot, A. J., & Pazda, A. D. (2012). Dressed for sex: Red as a female sexual signal in humans. *PLoS One*, 7(4), e34607.

Jones, B. C., Hahn, A. C., Fisher, C. I., Wincenciak, J., Kandrik, M., Roberts, S. C., Little, A. C., & DeBruine, L. M. (2015). Facial coloration tracks changes in women's estradiol. *Psychoneuroendocrinology*, 56, 29-34.

Lüscher, M. (1990). *The Lüscher color test*. Simon and Schuster.

Lynn, B. M., McCord, J. L., & Halliwell, J. R. (2007). Effects of menstrual cycle and sex on progesterone hemodynamics. *American Journal of Physiology: Regulatory, Integrative, and Comparative Physiology*, 292, R1260-R1270.

Prokop, P., & Hromada, M. (2013). Women use red in order to attract mates. *Ethology*, 119(7), 605-613.

Puts, D. A., Bailey, D. H., Cárdenas, R. A., Burriss, R. P., Welling, L. L., Wheatley, J. R., & Dawood, K. (2013). Women's attractiveness changes with estradiol and progesterone across the ovulatory cycle. *Hormones and Behavior*, 63(1), 13-19.

Roney, J. R., & Simmons, Z. L. (2013). Hormonal predictors of sexual motivation in natural menstrual cycles. *Hormones and Behavior*, 63(4), 636-645.

Stephen, I. D., & McKeegan, A. M. (2010). Lip colour affects perceived sex typicality and attractiveness of human faces. *Perception*, 39(8), 1104-1110.

Waiitt, C., Little, A. C., Wolfensohn, S., Honess, P., Brown, A. P., Buchanan-Smith, H. M., & Perrett, D. I. (2003). Evidence from rhesus macaques suggests that male coloration plays a role in female primate mate choice. *Proceedings of the Royal Society of London B: Biological Sciences*, 270(Suppl 2), S144-S146.

Figure1: Participants' age groups.

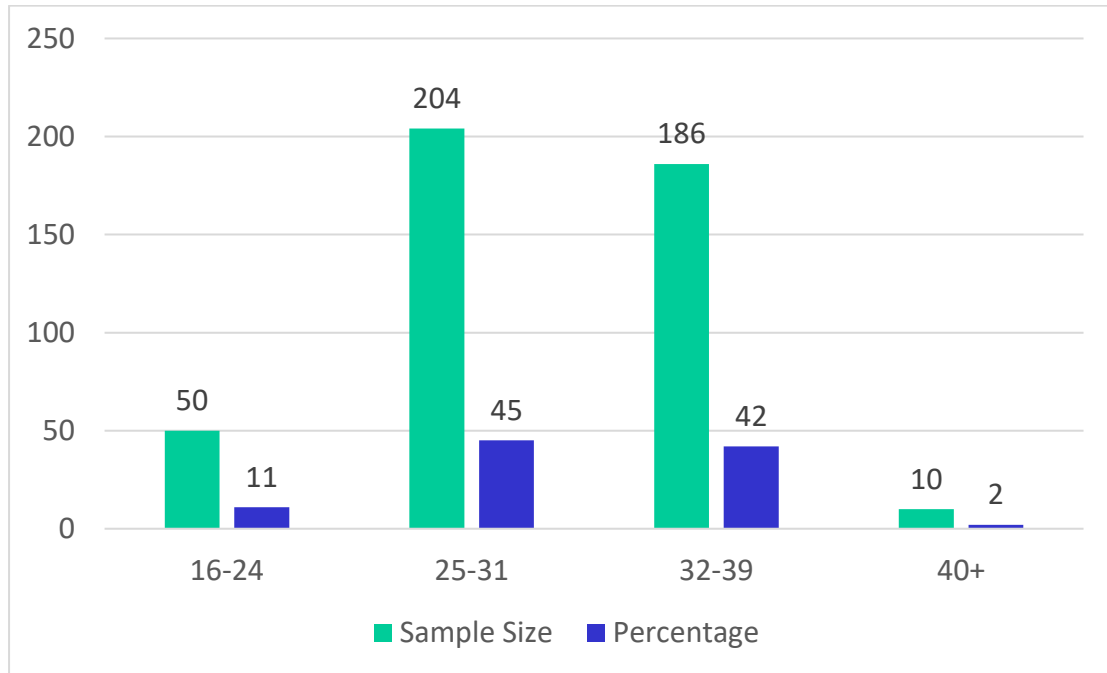


Figure2: Participants' pregnancy weeks.

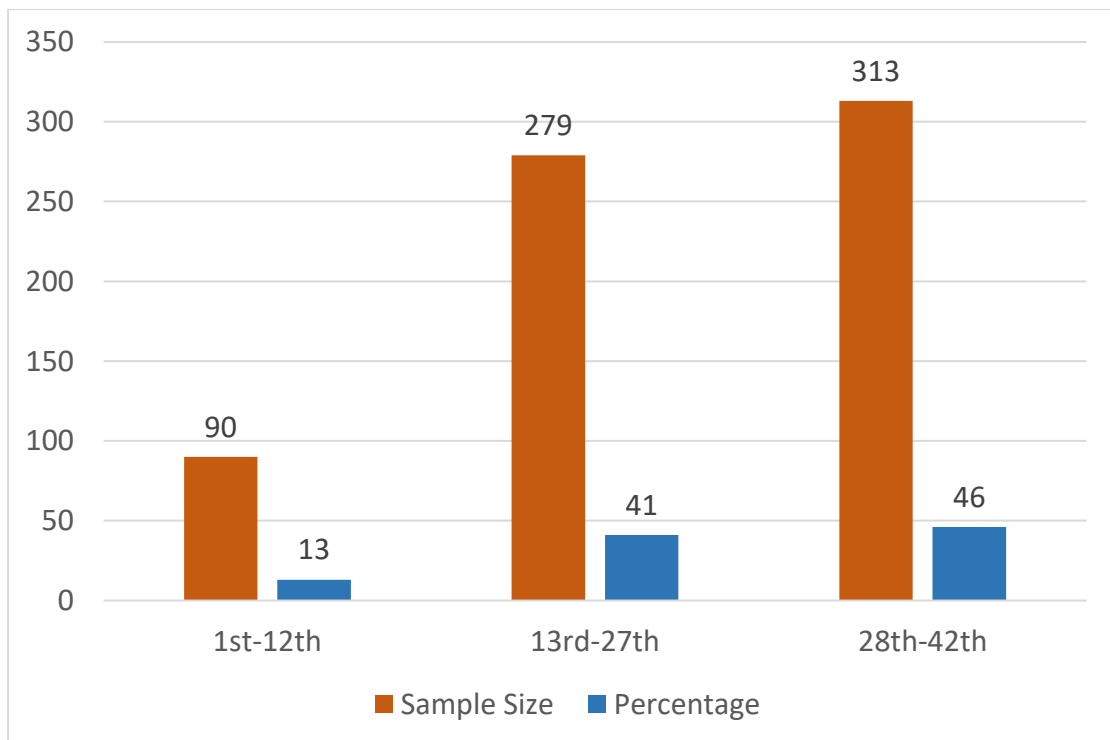


Table 1: Participants' reports about how they felt when they discovered their pregnancy.

	Troubled	Excited	Sad	Disappointed	Satisfied	Sick	Scared	Angry
Red Color	130	552	8	3	166	5	165	5
Blue colour	130	552	8	3	166	5	165	5

Table 2: Participants' reports about their current emotional state.

	Troubled	Excited	Sad	Disappointed	Satisfied	Sick	Scared	Angry
Red colour	122	424	17	4	215	29	164	20
Blue colour	122	424	17	4	215	3	164	20

Table 3. Participants' report about how they feel when wearing red.

	Troubled	Excited	Sad	Disappointed	Satisfied	Sick	Scared	Angry
Red colour	45	145	8	10	255	3	8	10
Blue colour	45	145	8	10	255	3	8	10

This questionnaire was constructed by Hariklia Proios and PanagiotaKatsinou, for the purpose of examining the emotional experiences of pregnant women. There will be no request for personal data. Please reply honestly.

- Report your age group.

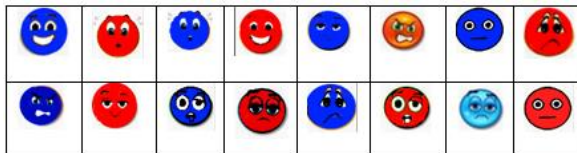
1. In which pregnancy week are you?

- 1st-12th
- 13th-27th
- 28th-42nd

2. Is your pregnancy uneventful?

- Yes
- No

3. How did you feel when you discovered that you were pregnant?



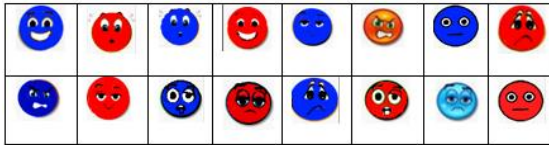
4. Describe what you were wearing when you discovered that you were pregnant.

- Concerning the type of clothes.
- Concerning the colour of clothes.
- Other reports

5. Report the gender of the child.

- Boy
- Girl
- I do not know

How are you feeling right now?



6. Which is your favorite color?



7. Describe the maternity clothes you bought or would like to buy during your pregnancy.

- Concerning the type of clothes.
- Concerning the colour of clothes.
- Other reports

8. What color would you prefer your products of child rearing to be?



9. Do you wear red during pregnancy?

- Yes
- No

10a. If yes, how often?

- Most times (5-6 times a week)
- Often (3-4 times a week)
- Sometimes (2-3 times a week)
- Rarely (once a week)

10b. How do you feel when wearing red?

