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RESEARCH ARTICLE

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## HORMONAL CONTRACEPTION AND THE RECOGNITION OF SEXUAL RECEPTIVITY BY FACIAL EXPRESSION

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### ABSTRACT

The possible influence of exogenous sex hormones present in hormonal contraceptives on the recognition of emotions by facial expression may interfere with interpersonal relationships. The objective of this study was to test the agreement between women with and without oral hormonal contraceptive (OC) use on the perception of sexual receptivity by facial expression, a complex social emotion. A total of 135 women participated in the study, 30 with and 105 without OC use, all older than 18 (Mean age 40.3). The volunteer participants completed an online form containing the Sexual Receptivity by Facial Expression (SRFE) scale images. The scale data were observed as means, with no significant differences between the groups. The results corroborate data from the literature regarding the interference of OC use on female emotional processing. Although without statistically significant differences, women using OC tend to agree less with the presence of sexual receptivity in facial expressions. In situations of clinical cases regarding altered female perception, the use of OC is a data to be investigated.

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## INTRODUCTION

Women's social life, satisfaction, and overall health are directly impacted by fluctuations in sex hormones during the menstrual cycle. Hormonal changes after puberty in women have been a topic of scientific interest, with studies spanning the entire menstrual cycle and impacts on cognitive functions and emotion and reward processing (Hornung, *et al.*, 2020; Munk *et al.*, 2018). Evidence from animal studies and other neuroscientific findings suggest that fluctuations in sex hormone concentration have organizational and activation effects in various areas of the human brain and may interact with neurotransmitter systems, interfering with the execution of cognitive and emotional tasks, which would explain the differences observed in men and women in such activities (Marful *et al.*, 2021; Kimming *et al.*, 2021; Guapo, 2013). The impacts of the fluctuation of female sex hormones on cognitive functions are less than on emotion processing. Emotion processing involves components of attention, recognition, and reactivity. Impairments in the accuracy of emotional recognition are associated with the greater presence of progesterone in the luteal phase, increasing the agility of response to aversive stimuli and emotional memory. Hormonal changes may mediate the perception of social stimuli (Hornung *et al.*, 2020; Osório *et al.*, 2018).

In the literature on emotional recognition, differences in cortical activation are reported for female and male faces depending on the phase of the menstrual cycle in women (Guapo, 2013). The advent of hormonal contraceptives (HC) is an important historical and social milestone for women. They began to have greater control over their sexuality and pregnancy. Since the wide use of hormonal contraceptives (HC) by women in the 1970s, many studies have shown inconsistent results about their effects. The main consensus on the positive aspects of HC use is pregnancy prevention, and the stabilization of the menstrual cycle for some women (Hasegawa *et al.*, 2022; Malta *et al.*, 2020; Junqueira *et al.*, 2008). By interfering with sex hormone levels, the purpose and outcome of HC use is pregnancy prevention. However, other effects are observed; HC users report lower levels of vaginal lubrication (which may cause genital pain) and/or acne. The alteration of female sex hormones is also related to reduced sexual desire (Pereira *et al.*, 2022; Fiurašková *et al.*, 2022; Kimmig *et al.*, 2021; Osório *et al.*, 2018). The multifaceted nature of female sexuality is influenced by physiological, psychological, and relationship factors, each of which can be affected by HC use. Public health in Brazil supports and encourages the widespread use of HC within family planning programs, and it is one of the most widely used and easily accessible contraceptive methods in the country. The reports on greater sexual satisfaction of women using HC are mainly due to the security and autonomy in their own lives by having the choice of conception. However, there is concern among professionals for adverse effects experienced by many women,

ranging from lack of desire and health issues to cognitive changes (Hasegawa *et al.*, 2022; Pereira *et al.*, 2022; Malta *et al.*, 2020; Osório *et al.*, 2018; Kimming *et al.*, 2021). The influence of exogenous and endogenous hormonal variations on emotion and cognition is observed, although not conclusive. References indicate that hormonal fluctuations play a more important role in recognizing emotional expressions than the menstrual cycle phase. The use of OC can modulate the perception of satisfaction in relationships, preferences and partner choice. Even without biochemical data from the participants, observing the accounts of women with and without CO use may contribute evidence to the body of science in this field (Hornung *et al.*, 2020; Guapo, 2013). Sexual receptivity is a complex social and sexual emotion, an emotional state of openness to sexual approach in a diversity of motivations. It corresponds to the initial steps of the courtship process, when the recognition of expressions that signal a higher probability of acceptance of the approach is important for success in this type of social interaction (Teixeira & Assumpção Jr., 2022).

In previous studies, the scale on the perception of sexual receptivity by facial expression (SRFE) showed good internal consistency, with no significant differences in the perception of men and women for both sets of images, indicating that both genders signal and perceive in the facial expression the availability to the other (Teixeira & Assumpção Jr., 2022). In this study we aim to verify whether the use of hormonal contraceptives alters the evaluation of sexual receptivity by facial expression, comparing a sample of women who declare the use of OC and another sample of women who do not use any type of hormonal contraceptive (NOC). Despite the inconsistencies in the data present in the literature, we hypothesize that the use of OC may affect the perception of sexual receptivity by facial expression in the evaluation of women. The study observes the fundamental ethical principles of research involving human beings and was approved by the Ethics Committee on Research with Human Beings of the Institute of Psychology of the University of São Paulo (REC of IPUSP, opinion number 5.507.623 and CAAE 88199218900005561).

## METHOD

**Participants:** A total of 135 cisgender women, all over the age of 18 years ( $M=40.3$  years old,  $SD 12.1$ ), with heterosexual orientation, participated in the study described here. To standardize the sample, for this study only the data referring to women who indicated use of oral hormonal contraceptive (OC:  $N=30$ ), and a group of women without use of any type of hormonal contraceptive (NOC:  $N= 105$ ) were used.

containing questions about age, education, marital status, sexual orientation, work and use of hormonal contraceptives and the type of HC, and period of the menstrual cycle at the moment (Teixeira & Assumpção Jr., 2022).

**Procedure:** An online application was carried out, from an invitation in social networks. The online form contained questions about characterization, items indicating social class, and face images. Participants had to register a valid e-mail address, accepted only once, and consent to participate in the research after reading the Informed Consent Form (ICF). Participants who indicated yes to hormonal contraceptive use answered related questions (if they menstruated, how many weeks had they menstruated); those who indicated no to hormonal contraceptive use were directed to the remaining items of the questionnaire. Each item of the form had to be answered before the next item could be presented, thus avoiding incomplete questionnaires.

**Data Analysis Plan:** The sample data were described in terms of frequency, mean, standard deviation and variance. The F test was applied to verify the difference in variances and the Ttest to compare the mean of the groups, "which tells us if the means are equal between the groups" and proves or not our hypothesis (Meyer, 1983). For the statistical analyses, R-Studio was used, which is a programming language with a license for free use, an integrated set of software resources for data manipulation (Software R 4.2.2, rcmdr, psych, dplyr and rstatix [R CORE TEAM *et al.*, 2013]).

## RESULTS

From the data collected up to May 2022, 105 women without contraceptive use (NOC: Mean Age 43.2 years; 59.52% married; 60.00% postgraduate; 90.48% working), and 30 women with oral contraceptive use (OC: Mean Age 31.10 years; 63.33% single; 53.33% postgraduate; 86.77% working) participated. Another 16 participants were excluded from this study due to injectable hormonal contraceptive and intrauterine device (IUD-Mirena) use. The majority of the CO group is composed of more young, unmarried women than the NOC group. In both groups, most of the women work and receive from one to eight minimum wages (the current Brazilian minimum wage is equivalent to about US\$ 272.00). Of the participants using OC ( $N=30$ ), almost all of the group were using combined pills (Brasil, 2002). For the 50-image set of the scale, no significant differences were found in the variance and average ratings for the total female participants  $M (N=135)$ , and between the OC ( $N=30$ ) and NOC ( $N=105$ ) groups for the SRFE scale.

**Table 1. Average ratings of agreement regarding sexual receptivity in the images.**

Group	N Image	Average	Minimum	Maximum	SD	Variance
M	50	204.25	50	349	11.45	131.11
NOC	50	206.76	54	347	11.17	124.69
OC	50	198.25	51	341	12.05	145.28
<i>Female Images</i>						
M	25	101.25	25	175	8.54	72.96
NOC	25	102.78	25	175	8.31	69.03
OC	25	95.90	26	169	9.20	84.60
<i>Male Images</i>						
M	25	101.62	25	174	7.71	59.42
NOC	25	103.98	29	172	7.46	55.66
OC	25	93.37	25	166	8.23	67.67

Constructed by the Author: Group M = Average rating of women for the RSEF scale

**Instrument:** - Scale of Perception of Sexual Receptivity by Facial Expression - SRFE: it is composed of 50 image items, 25 photographs of a male face and 25 photographs of a female face, in different expressions of sexual receptivity, the respondents indicate on a 7-point Likert scale their agreement as to sexual receptivity in the image (SD Strongly Disagree; D Disagree; SD Somewhat Disagree; Neither Agree nor Disagree; SASomewhat Agree; A Agree; SAStrongly Agree). Questionnaire of sociodemographic characterization,

F test rejects the Hypothesis that the variances are different ( $F=0.74$ ; with  $p > 0.05\%$ , being  $T=0.40$ ) (Table 1). When looking only at the assessments of the female face images, although the OC group shows lower mean agreement with sexual receptivity in the images, there are no significant differences between the groups in the assessment of the sexual receptivity scale by facial expression ( $F=0.73$ ; with  $p > 0.05\%$ , being  $T=0.67$ ). In the assessments of the male face images, the assessment of sexual receptivity in the images by the female OC

group also achieved lower mean agreement compared to the NOC group, although with no statistically significant differences ( $F=0.88$ ; with  $p > 0.05\%$ , being  $T=0.47$ ). Due to the small number of the sample ( $N=20$ ) when separating by indication of cycle period, since 10 participants could not inform in which week of the cycle they were, it is not possible to make further statistical analysis, but the qualitative observation of these data do not point to tendencies of response according to the phase of the menstrual cycle.

## DISCUSSION

In this study, we sought to observe whether oral hormonal contraceptive (OC) use impacts cisgender, heterosexual women's perceptions of facial expression of complex, social, and sexual emotion, since recent literature is not consistent on the impacts of OC use on female cognition. The data observed here, although pointing to a trend toward less agreement in the perception of sexual receptivity by male and female facial expression by women using OC than those not using contraceptives (NOC), there were no statistically significant differences between the groups. The scientific literature presents ambiguity of information regarding the impact of OC use on emotion recognition by facial expression, inferring that the presence of OC would not directly impact women's perception (Kimmig *et al.*, 2021; Pilarczyk, *et al.*, 2019; Munk *et al.*, 2018). In the study by Pahnke *et al.* (2019), the authors used tasks for complex emotion recognition, comparing the assessment of women with OC use and without contraceptive use. Their results suggest that women on OC use are less accurate at recognizing complex emotions than women without contraceptive use, particularly on facial expressions of emotions that are more "difficult" to recognize. Contrary to some data in the literature, they imply that the menstrual cycle phase does not modulate emotion recognition by facial expression. Recent literature indicates hormonal fluctuation as a potential mediator of these differences in perception and controversial results among previous research. The menstrual cycle phase would not be a predictor of perceptual differences. The design of this study did not allow for more specific measures, but the 20 participants in the OC group who indicated the week of their menstrual cycle showed no response trend. The heterogeneity of the experimental groups and lack of greater control of variables and longitudinal studies are indicated as possible modulators of the divergence in research findings (Kimmig *et al.*, 2021; Munk *et al.*, 2018). In Hornung *et al.* (2020), the authors suggest that the best emotion recognition occurs during the follicular phase (increased estradiol levels). A positive correlation is reported between endogenous estradiol levels and reward sensitivity in women, and reduced ability to avoid punishment. There is evidence of a positive correlation of attractiveness of male faces in the situation of higher estradiol and progesterone, however, there is not full clarity and consistency on considerations of the role of female sex hormones on reward processing.

According to Munk *et al.* (2018), the variation in methods and difficulties in making measurements presents unreliable or generalizable data. There are many control variables in studies in this field, such as controlling at what point (early or late) in the luteal and/or follicular phase the women participating in the studies were (Kimmig *et al.*, 2021). Osório *et al.* (2018) indicate that it would be important to assess the mood state of the women when participating in these studies, because considering the premenstrual syndrome, this data may bias the results. Discussions of the possible negative impact of OC use on women's sexual desire and satisfaction relate more to the range of possible effects on individual women's experience of hormone cycling and concentrations, requiring caution and an individualized look at situations. There is little evidence to support other conclusions, such as the suggestion that estradiol-only OC has less effect on women's sexual satisfaction. Data relating to other situations, such as insufficient sleep, for example, are more relevant. However, even if for a more significant number of women the effects of CO use are imperceptible on sexual experience, it is possible that, for a small group, the effect on cognition is sufficient to modulate perception and cognition about various aspects of sexuality, including

emotional perception in social interactions, especially those aimed at affective-sexual relationships (Pereira *et al.*, 2022; Hasegawa *et al.*, 2022; Malta *et al.*, 2020; Osório *et al.*, 2018). In clinical cases in psychotherapy, when negative perception biases are observed in the meanings attributed to social situations, the most common association is mood swings. The attribution of meaning is reinforced by past references or dysfunctional beliefs that may be of family or social origin, which maintain avoidance and evasion behaviors, hindering the exposure and development of social and affective-sexual relationships, with an impact on self-esteem in general (Hasegawa *et al.*, 2022; Junqueira *et al.*, 2008). Possibly the perception of facial expression is not significantly altered by the use of OC but, considering the studies that support the hypothesis of incongruence between other data on impacts on cognitive tasks, partner selection preference, and relationship satisfaction, for women using OC, added to the information on the impacts of hormonal fluctuations and their interferences on cortical systems, we infer that individually these endogenous and exogenous hormonal articulations may significantly interfere with the social and sexual experience of women using OC.

## CONCLUSION

The described study contributes to the scientific literature regarding the impact on the recognition of emotional expressions for women using OC. It corroborates the current information that agrees with some level of interference in the recognition of social emotion by facial expression by women using OC, without being statistically significant in relation to women not using contraceptives. We reiterate the importance of health professionals considering the possible interactions that hormonal fluctuations and OC use may have on women's sexuality, this being an aspect to be explored in the psychotherapeutic context as well.

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