Personality and Individual Differences 50 (2011) 315–317

Contents lists available at ScienceDirect

Personality and Individual Differences

journal homepage: www.elsevier.com/locate/paid

Short Communication

Hormonal birth control use and relationship jealousy: Evidence for estrogen dosage effects

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ARTICLE INFO

Article history:
Received 11 May 2010
Received in revised form 7 September 2010
Accepted 8 September 2010
Available online 13 October 2010

Keywords:
Estrogen
Self-reported jealousy
Hormone-based contraception
Evolutionary psychology

ABSTRACT

Women who use hormonal contraceptives have been shown to report higher levels of jealousy than women who are regularly cycling. Here, we extend these findings by examining if self reported levels of jealousy vary with the dose of synthetic estrogen and progestin found in combined oral contraceptives in a sample of 275 women. A univariate ANOVA analysis revealed that higher levels of ethinyl estradiol were associated with significantly higher levels of self-reported jealousy. There was, however, no relationship between combined oral contraceptive progestin dose and reported jealousy levels. When controlling for age, relationship status, mood, and combined oral contraceptive progestin dose the results for ethinyl estradiol were maintained. A test for the interaction between the jealousy sub-scale items (reactive, possessive, and anxious jealousy) was however non-significant: ethinyl estradiol dose thus does not affect one type of jealousy more than another but rather affects overall jealousy. The implications of these findings are discussed in the context of their evolutionary consequences on mate choice and relationship dynamics.

1. Introduction

Combined oral contraceptives (COC) are composed of a synthetic version of estrogen (ethinyl estradiol) and progesterone (progestin) (South-Paul, Lewis, & Matheny, 2008). They function through interfering with the hypothalamic-pituitary-ovarian feedback loop by hindering follicular growth, via a process which suppresses natural hormones and therefore prevents ovulation from occurring (Frye, 2006). As a result, compared to women who are spontaneously cycling, women who use COC have lower serum estrogen and progesterone levels (Basu et al., 1992).

Since the introduction of hormonal contraception in the early 1960s, use has become widespread (Groves, Mosher, Lepkowski, & Kirgis, 2009). The ongoing development of new formulations has allowed for both physiological and behavioral side-effects associated with the use of COC to greatly diminish. Despite this there remains a number of prominent physical risk factors associated with the use of COC such as venous thrombosis (e.g. Vandenbrouke et al., 2001) and myocardial infarction (e.g. Tanis et al., 2001). Typically, the investigation of the influence of COC on mental health has focused on changes in mood and on psychological well-being (e.g. Sanders, Graham, Bass, & Bancroft, 2001); however, more recent studies suggest that COC use might also influence depressive symptoms (Kulkarni, 2007) and sexual function (Wallwiener et al., 2010). In addition, there is evidence that the use of COC may have important repercussions on mate choice and mating dynamics. For instance, it is well-documented that women who use hormonal contraceptives do not exhibit the same patterns of behavior or preferences as regularly-cycling women (e.g. Roberts, Gosling, Carter, & Petrie, 2008).

The fact that COC are widely used (Groves et al., 2009) and come in different doses presents a unique opportunity to study the effects of hormones on female behavior. Here we aim to test if there are differences in patterns of jealousy based on the use of different concentrations of COC. To date, only one study has explored jealousy in relation to the use of hormonal contraception. That is, Geary, DeSoto, Hoard, Skaggs Sheldon, and Lynne Cooper (2001) showed that the intensity of jealousy response of women using hormonal birth control pills was higher than that of non-users. In addition, relative to non-users, a larger percentage of women on hormonal contraceptives reported that their partner's sexual infidelity would be more upsetting than their partner's emotional infidelity. Geary et al. (2001) also found that, in women who were regularly cycling, relative to other cycle stages, higher absolute levels of estrogen in cycle week two predicted greater emotional reactions to sexual infidelity. This finding suggests a role for estrogen in facilitating jealousy response.

The current medical literature classifies COC with an ethinyl estradiol dose of 20 μg as an 'ultra-low dose', while a 'low dose' pill

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0191-8869/$ - see front matter © 2010 Elsevier Ltd. All rights reserved.
doi:10.1016/j.paid.2010.09.012

is typically considered to have an ethinyl estradiol concentration between 30 μg and 35 μg (e.g. Poindexter, 2000; Rosenberg, Meyers, & Roy, 2000). In the present research, we used the existing medical classification 'ultra-low' and 'low' dose as categories for comparison within this research project. We predicted that jealousy responses, although certainly influenced by a wide variety of factors, may be moderated by estrogen levels and that the use of COC with higher concentrations of ethinyl estradiol will be associated with stronger jealousy responses. We also sought to examine what role COC progestin dose had on self-reported jealousy response.

To examine these issues, we used Buunk's typology for jealousy. Buunk (1991,1997) distinguishes between three types of jealousy: reactive, possessive, and anxious. Reactive jealousy refers to the degree to which an individual experiences negative emotions as a result of their partner's emotional or sexual infidelity. Possessive jealousy refers to the degree of effort an individual invests to prevent their partner from coming into contact with opposite-sex individuals. Lastly, anxious jealousy refers to cognitively generated experiences of anxiety, worry, and distrust which relate to one's partner's infidelity. We used Buunk's typology because, in contrast to many of the other dichotomous definitions of jealousy, it places jealousy response on a continuum from healthy to unhealthy.

2. Methods

2.1. Participants

Participants in the study were 275 women (Age: $M = 22.6$, $SD = 2.89$, range = 17–35 years) who had been using combined oral contraceptives for at least three months. Participants were recruited by word of mouth and from a large European university. Those from the university took part in exchange for course credit. All research was conducted via an online website.

2.2. Measures

Participants were first asked to report their age, relationship status, and to complete the PANAS-X mood scale (Watson & Clark, 1994). They then were asked to report the brand name of their hormonal birth control pill, the duration of time they had been using it (in months), and to report the precise dose of synthetic hormones in each pill. To do this, participants were specifically instructed to look at their prescription pill box. Of the total sample, 199 participants reported to be using low-dose COC, while 76 reported that they were using the more recently introduced ultra-low-dose COC. Values for progestin herein ranged from 50 μg to 3000 μg.

Participants then completed a jealousy scale developed by Buunk (1997). This scale contains 15-items, five for each of the respective sub-types of jealousy (overall jealousy scale: *Cronbach's* $\alpha = 0.87$; anxious sub-scale: *Cronbach's* $\alpha = 0.90$; sexual sub-scale: *Cronbach's* $\alpha = 0.70$; preventive sub-scale: *Cronbach's* $\alpha = 0.79$). Participants responded to statements on a 1–5 scale with higher scores indicating higher levels of distress.

2.3. Statistical analyses

Mean scores for the total jealousy scale and for each of the subscales were computed. The relationships between ethinyl estradiol dose and jealousy as well as between progestin and jealousy were first tested via a single univariate ANOVA with both ethinyl estradiol and progestin as factors. We subsequently assessed the relationship between ethinyl estradiol dose and jealousy using a mixed-model ANOVA with jealousy sub-scale as a within-subjects factor, estrogen group as a between-subjects factor. Following this, the same analysis was performed with age, mood, relationship status, and progestin concentrations included as covariates.

3. Results

The influence of ethinyl estradiol and progestin concentration on the overall jealousy scale was first examined via a univariate ANOVA with ethinyl estradiol and progestin as between-subjects factors. This revealed a significant effect ($F(1,262) = 9.75$, $p = 0.02$) of ultra-low versus low ethinyl estradiol concentrations on jealousy response (Fig. 1), but not of progestin dose ($F(1,263) = 2.10$, $p = 0.148$).

The effect of ethinyl estradiol was maintained ($F(1,258) = 7.42$, $p = 0.007$) when entered into a mixed-model ANOVA containing age, relationship status, mood, and COC's progestin concentration as between-subject control variables, and jealousy type as a within-subjects factor. The model also indicated that mood ($F(1,258) = 18.8$, $p < 0.001$) and age ($F(1,258) = 5.05$, $p = 0.026$) had significant effects on jealousy, with happier and older participants reporting lower levels of jealousy. Relationship status ($F(1,258) = 1.26$, $p = 0.26$) and progestin concentration ($F(1,258) = 0.75$, $p = .39$) did not have a significant influence on the model.

A test of the within-subjects contrasts between jealousy types indicated that the three types of jealousy were significantly different from one another ($F(2,516) = 6.56$, $p = 0.002$). Mean scores for reactive, possessive, and anxious jealousy were 3.82 (SE: 0.67), 2.13 (SE: 0.94), and 1.78 (SE: 0.71).

The interaction between COC ethinyl estradiol dose and jealousy sub-scale was not significant ($F(2,516) = 0.676$, $p = 0.51$). There was also no difference in participant age ($\chi^2 = 21.83$, $p = 0.24$) or the proportion of individuals in a relationship ($\chi^2 = 0.12$, $p = 0.73$) between estrogen groups.

4. Discussion

Our findings demonstrate that COC ethinyl estradiol dose influences women's self-reported jealousy. This result is in line with Geary et al. (2001) finding, which indicated that high levels of circulating estrogen play a role in jealousy. Previous research suggests that estrogen is intimately involved in emotional behavioral outcomes (Fink, Sumner, Rosie, Grace, & Quinn, 1995; Steiner, Dunn, & Born, 2003). The other key finding of this study is the lack of a relationship between synthetic progesterone dose and reported jealousy. Despite that both animal and human literature

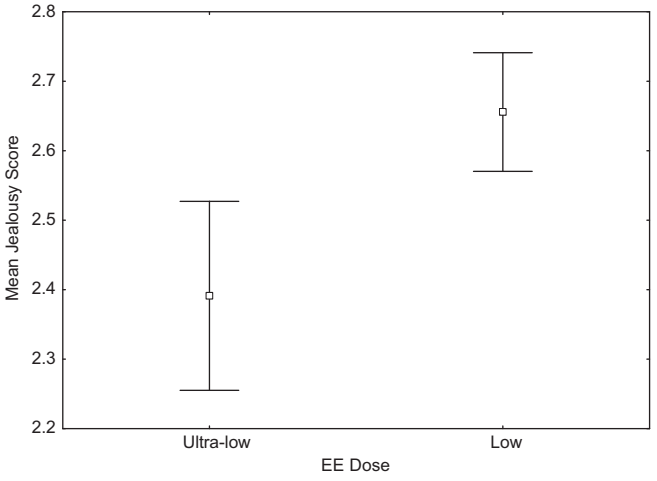

Fig. 1. Comparison of the mean (±standard error) jealousy scores for participants in relation to EE dose classifications.

indicates that progesterone levels may regulate behavioral affiliative motivation (e.g. Maner, Miller, Schmidt, & Eckel, 2010; Taylor, 2006), and one might have predicted that by extension may also regulate jealousy behavior, we find no evidence to support this idea based on users of different COC progestin concentrations.

These findings are important for three reasons. The first is a practical point: when considering designs for future research on, for example, female mate choice and preferences, it may be important not just to distinguish between contraceptive pill users and non-pill users, but also between those pill-users on ultra-low and low ethinyl estradiol concentrations. Furthermore, our result draws attention to the effect size of the many studies which have been conducted by simply comparing pill and non-pill users without reference to ethinyl estradiol dose: depending on the proportion of ultra-low versus low dose users within such studies, effect sizes may have been under- or overestimated.

Secondly, increased jealousy response could be seen as a negative side-effect of estrogen which has received little attention. Although there is an existing push towards developing COC with lower levels of ethinyl estradiol, this is largely due to the physical side-effects which result from higher ethinyl estradiol concentrations rather than its behavioral side-effects (Poindexter, 2000). With the exception of studies focusing on female mood changes (e.g. Oinonen & Mazmanian, 2002; Joffe, Cohen, & Harlow, 2003) and effects on mate preferences (see below), studies which document additional behavioral variables associated with COC have lagged behind those investigating physical outcomes. Although this study does not speak towards the benefits of hormonal contraceptive pill use, of which there are many, it seems that women, and perhaps pharmaceutical providers, are not fully aware of the range of potential psychological side-effects associated with pill use and more specifically brand choice.

Thirdly, this study supplements the existing literature which suggests that hormonal oral contraceptive pill use may influence female mate choice preferences and relationship dynamics. For example, evidence indicates that, relative to non-pill users, women on COC show no or weaker preferences for masculine faces and voices (Little, Jones, Penton-Voak, Burt, & Perrett, 2002; Feinberg, DeBruine, Jones, & Little, 2008), and a decreased preference for genetic dissimilarity in partners (Roberts et al., 2008; Havlicek & Roberts, 2009). It may be that pill-associated changes in preferences for masculinity and genetic dissimilarity are mediated not just by the absence of an estrus phase but also by COC ethinyl estradiol and progestin concentrations. Finally, the leveling effect that oral contraceptives provide compared with hormonal fluctuations across normal cycles may alter important temporal patterns in jealousy and responsiveness within pair-bonds. Since we find that women using low-dose COC report higher levels of jealousy compared to those using ultra-low doses, it may mean that these women suffer to a greater extent in forming and maintaining a pair bond.

A potential limitation of our correlation design is that the causation of our findings could run in the opposite direction. However, despite the potential for self-selecting differences between women using low and ultra-low concentrations, women in our sample did not significantly differ in age or relationship status. Moreover, there are no clear medical guidelines according to which doses of COC should be prescribed. However, following Roberts et al.'s (2008) methodology for attributing cause to behavioral consequences of COC use, future studies that make use of a within-subjects design (e.g. measuring changes in behavior as women switch from one brand of COC to another) are necessary to fully rule out the possibility that a third unmeasured variable may explain the reported relationship between COC dose and reported jealousy. The current study provides a useful starting point for future investigations into the potential for COC concentration mediated behavioral effects.

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