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Theoretical Review

ORAL CONTRACEPTION AND ROMANTIC RELATIONSHIPS – FROM THE LAB TO THE REAL WORLD

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ABSTRACT

We review recent evidence that suggests that hormonal contraceptives may influence the dynamics of sexual relationships and the human pair-bond. Hormonal contraception likely has positive effects on cementing the pair-bond by decoupling sex from conception. However, changes in women's evolved mate preferences associated with initiation or discontinuation of hormonal contraception may alter attraction to her partner, with potentially negative consequences for relationship satisfaction. We describe the evidence for such changes produced by laboratory studies, including prospective experimental designs, and how the consequences of such changes are being explored beyond the laboratory. In view of the growing prevalence of modern hormonal contraceptive methods across the globe, further study of such effects is urgently required.

Key words: *mate choice, the pill, attractiveness, sexual desire, libido; relationship satisfaction*

INTRODUCTION

If ethology is defined as the study of the biology of behaviour within an evolutionary framework and if one of its core philosophies is to begin with observation (Tinbergen 1963), then studies of the effects of hormonal contraception on human mate preferences

would not, at first sight, appear to be of direct interest to ethologists. First, hormonal contraceptives are a modern invention; indeed, they had barely arrived on the scene when Tinbergen wrote his seminal paper. Second, at least to date, the vast majority of studies that have been conducted have taken place under closely controlled laboratory conditions, a far cry from the principle of beginning with observation and description. However, we believe both that this work is relevant to ethologists and that ethologists can bring their requisite skills and interests to contribute to growing understanding of the influence of modern hormonal birth control on human behaviour.

In fact, speculation about the influence of modern birth control on human behaviour dates at least as far back as 1970. In his book *Love and Hate*, Eibl-Eibesfeldt (1971) discusses the effect of oral contraception (“the pill”) on the dynamics of the human pair-bond. He points out that sexual behaviour is not only concerned with reproduction, but also that “in human beings in particular the maintaining of a bond between the sexes by means of the sexual relationship plays an exceptional role which is without parallel in the animal kingdom” (p.151), suggesting that the occurrence of a sustained, sexually fulfilling relationship, including during non-fertile parts of the menstrual cycle, is essential to cement the pair-bond over the course of at least 14 years, the time it takes to cooperatively raise a child to sexual maturity. Furthermore, he goes on to consider the influence of the pill within the contemporary context of the debate about the views and teaching of the Roman Catholic church, which argues that sexual intercourse without the possibility of conception runs contrary to nature and should therefore be prohibited (p.151-155). He argues that “the debate ... suffers from the fact that the function of sexuality in maintaining the bond between partners is not recognised by the religious authorities who make decisions” (p.153). In particular, he suggests that one of the benefits of the pill is that it can accommodate the “hypersexualisation” of men, that is, the evolved male sexual drive, without contributing to increasing population size. Other proponents of the pill would, of course, also highlight the liberating effect of birth control on the expression of women’s sexual drive, which is no less the result of evolutionary pressures. Both of these effects would, then, have positive consequences for maintenance of the pair-bond over time.

We concur with this view, and appreciate the enormous impact that hormonal contraception has had on societal change over the past half-century. However, despite these significant benefits, a growing body of work indicates that hormonal contraception may have other, perhaps more subtle, effects on women’s mate preferences, and that these may in turn influence both the formation and subsequent sexual dynamics of the human pair-bond. These discoveries were originally made in studies conducted in the laboratory, and have since been replicated and extended. In this particular case, we think it unlikely that such effects would have been discovered by observational or descriptive work because, outside of the lab, in real life, use of hormonal contraceptives is associated with a variety of socio-economic variables such that their effects would be comprehensively disguised. Even in the lab, the first evidence for an effect on mate preference was a serendipitous one, as we will describe. However, now that the effects are known in principle, as a result of a series of experiments, we think that ethologists interested in human mating and sexual relationships are well-placed to explore how

these effects play out in the milieu of the real world, and we hope this paper may stimulate this.

To this end, we begin by briefly summarising the laboratory evidence for effects of hormonal contraception on women's mate preferences. We then describe some recent efforts that have been made to explore whether and how these effects play a measurable role in real life relationships. As one example, we focus on the ways in which these findings may provide new insights into the controversial question of whether hormonal contraception reduces women's sexual desire.

THE LABORATORY EVIDENCE

The serendipitous discovery to which we referred earlier occurred in a study (Wedekind et al., 1995) which set out to explore whether humans could discriminate genetic dissimilarity in body odour, in the same way that female mice had previously been shown to discriminate dissimilar mates by differences in urinary odour (Yamazaki et al., 1976, 1979). The study focused on genetic dissimilarity at the major histocompatibility complex (MHC), a gene complex involved in immune response and now known to influence human mate preferences (Havlicek and Roberts, 2009). Wedekind et al. (1995) did indeed find evidence that women could discriminate and prefer the axillary odours of men who were relatively MHC-dissimilar, but only when those women 'sniffers' were not using oral contraceptives (OC, we mean the combined pill, a formulation containing both synthetic estrogen (ethinyl estradiol) and progesterone (progestins), which is the most commonly used form of hormonal contraception). In contrast, a subsample of women who were using OC exhibited quite the opposite effect, preferring the odours of MHC-similar men. In a follow-up study (Wedekind and Furi, 1997) using a different methodology, non-users were again shown to exhibit disassortative preferences (i.e. for MHC-dissimilarity), while in OC users this correlation was not found and there was a statistical tendency towards preference for MHC-similarity. Although these results were indicative, they were based on relatively small sample sizes (18 OC users) and the study design was correlational. Thus, it is possible that other differences between the groups of non-users and OC users, such as relationship status, socioeconomic status or sexual restrictiveness, might be responsible for the reported effects (Havlicek and Roberts, 2009; Roberts et al., 2008).

To test this, Roberts et al. (2008) conducted a larger and longitudinal study in which the preferences of women participants were tested both before and after initiating OC use. A control group of non-using women were also tested twice according to the same methodology. In this study, the preference for MHC-dissimilarity among non-users was not replicated, although an association was found with relationship status. However, across the pre- and post-initiation tests, OC users showed a significant increase in preference for MHC-similarity, which was not evident in the control group, suggesting that the initiation of OC use had altered women's odour preferences.

Others have questioned whether OC use might alter other kinds of mate preference beyond those associated with body odour. Jones et al. (2005) found that facial preferences for cues of health were higher in the non-fertile phase than the fertile phase of the menstrual cycle, in pregnant than non-pregnant women, and in OC users

compared with non-users. They suggest that greater preference for such health cues in these groups of women may mean that attraction is associated with benefits such as low risk of infection at times when the immune system is relatively weak (e.g. pregnancy), or at times in which women's hormonal profile resembles that experienced during pregnancy (luteal phase, OC use).

A further series of studies have found OC-associated effects for traits associated with masculinity, which is likely associated with dominance. Several studies have reported that women's attractiveness judgments for masculine male faces (Jones et al., 2008; Penton-Voak et al., 1999) and dominant men's odour (Havlicek et al., 2005) are higher at the fertile stage of the menstrual cycle. However, at least for facial masculinity, a similar change across time is not found in OC users (Penton-Voak et al., 1999). Preference for masculinity in voices is also weaker among OC users than non-users (Feinberg et al., 2008).

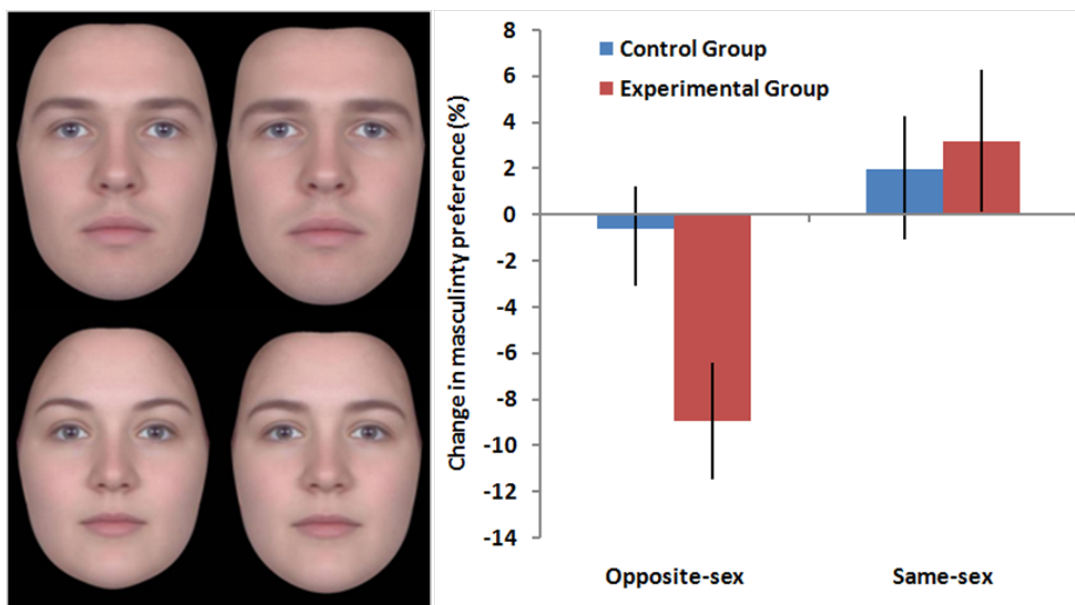


Figure 1: Initiation of OC use and preference for facial masculinity. Women were tested before and after initiating OC use (experimental group) and compared with non-users tested across a similar 3 month period (control group). Left: Example stimuli of feminized (left) and masculinized (right) male and female faces (participants saw an interactive continuum of such faces). Right: Change in women's percentage preference for facial masculinity (\pm 1 s.e.m) in opposite-sex (experimental group N = 18, control group N = 37) and same-sex (experimental group N = 16, control group N = 36) faces. Reprinted from Little et al. (2013).

Little et al. (2013) conducted a study to check whether OC use actually alters facial preference for masculinity, following the same within-participants design as was used for odour preferences by Roberts et al. (2008). Both before and after OC initiation, women judged the attractiveness of male and female faces which were digitally manipulated across a masculinity-femininity continuum. As suggested by the earlier studies, Little et al. (2013) found that women's preferences for male facial masculinity decreased after

OC initiation, while there was no change across a similar time period (about 3 months) in women who were not using OC (Figure 1). Furthermore, in the women who began OC use, there was no corresponding change in their masculinity preferences in same-sex (i.e. women's) faces, indicating that the OC-induced change was specific to mate preference judgments rather than a change in general face preference.

Taken together, these studies indicate that OC use alters women's mate preference judgments. The first set of studies suggest that OC use may increase preference for genetic similarity, and it has been argued that this may occur due to similarity in hormonal levels between OC use and pregnancy, a time when mate-searching is of low benefit and associations with kin would be adaptive (Wedekind et al., 1995). The second set similarly indicate that OC use is associated with preferences normally experienced when women are not actively mate-searching, or when they particularly favour direct benefits of mate choice, such as higher levels of paternal investment (Little et al., 2013).

Perhaps such changes are relatively innocuous while women remain single, but clearly they have potential to influence the physical characteristics of a partner women eventually choose. If OC use subsequently changes, women's attraction to their partner may also alter (Roberts et al., 2008). Furthermore, in a similar way, if already-partnered women initiate or discontinue OC use, these studies suggest that women's attraction to their partners may alter. Because these possibilities have the potential to influence both initial partner choice and subsequent attraction to the partner, and because attraction is critical to the maintenance of a satisfying sexual relationship, these experimental studies suggest that OC use could ultimately influence the stability of pair-bond relationships (Roberts et al., 2010). Below we summarize the existing research which has examined this possibility.

BEYOND THE LABORATORY

The first study to examine the impact of the aforementioned lab based findings on 'real world' relationships was that of Roberts et al. (2012). This study was based on the evidence that OCs altered odour preferences towards MHC similarity (Roberts et al., 2008), coupled with the findings that odour plays a key role in women's mate choice (Havlicek et al., 2008) and that women paired with relatively MHC-similar men report reduced in-pair attraction, as well as greater desire for, and even likelihood to have, an extra-pair relationship (Garver-Apgar et al., 2006). Although Garver-Apgar et al. did not report OC use by the women in their study, it led to Roberts et al.'s (2012) prediction that, because OC use increases relative preference for MHC-similarity, OC use should also influence aspects of relationship quality.

Indeed, Roberts et al. (2012) found that women who were using OC at the time of meeting their partner reported lower levels of in-pair sexual satisfaction and attraction. Furthermore, these women tended to be more sexually dissatisfied in their relationship and, when relationship dissolution occurred, they were more likely to have been the one who had initiated it (Roberts et al., 2012). These findings are consistent with the idea that OC use may interfere with adaptive mating preferences and consequently have realizable concerns, beyond the laboratory, for the quality of romantic relationships.

Interestingly, this study also showed that women who met their partner while using OC were more satisfied with non-sexual aspects of their relationship. This may be explained, as outlined above, by the fact that OC use suppresses preferences for traits that are considered to be indicators of genetic quality. This is important because men who are relatively low in 'good gene' traits tend to possess markers of investment (Roberts & Little, 2008; Boothroyd et al., 2008). As a consequence, it may be that OC use leads to a greater relative preference for traits indicative of paternal care.

Indeed, building on their laboratory study described above, Little et al. (2013) examined whether OC induced changes in partner preferences for masculinity (a purported 'good gene' indicator) influence actual partner choice. Working with a large sample of established romantic couples, they found that partners of women who were using OC when the couple met were perceived to be less facially masculine than men whose partners were regularly cycling when the couple met. Computer generated measures of male facial masculinity yielded the same pattern of results. Together, these findings indicate that the suppression of natural preferences during OC use has an impact upon women's actual partner choice.

A further series of studies now suggests that, in addition to considering a woman's OC use during partner choice, researchers should also consider whether current OC use is congruent to the time of meeting. This "congruency hypothesis" was introduced by Roberts et al., (2013) in an effort to clarify mixed findings in the effects of OC use on women's sexual desire (or libido). The premise of this hypothesis is that the congruence between current OC use and previous use (i.e., at the time of relationship initiation) will more accurately predict levels of in-pair sexual satisfaction than current use considered in isolation. This hypothesis predicts that, if a woman's current OC use is congruent to her use at the initiation of the relationship, her current partner preference will reflect the preference she expressed when the relationship began, and thus she will report relatively higher levels of in-pair sexual desire compared to a woman whose current and previous use is incongruent. Importantly, this hypothesis argues that women could experience a decrease in partner focused sexual desire by both starting or stopping OC use, critically dependent upon her use at the initiation of the relationship (see Figure 2 for illustration). The evidence presented by Roberts et al. (2012) is consistent with this hypothesis, because they controlled for women's current use. In other words, the women in their sample were current non-users, so that women who used no hormonal contraception when they met their partner were in a congruent state, compared with those who had previously been using OC. Furthermore, in a recent study of 365 couples, congruency in hormonal contraceptive use predicted women's sexual satisfaction, both in groups of women who initially had met their partner while using hormonal contraceptives as well as in those who had not (Roberts et al., 2014a).

Preliminary research appears to suggest that the basic premise of the congruency hypothesis may extend to other aspects of intimate relationships. Cobey et al. (2013a) conducted a study to test how feelings of romantic jealousy were impacted by OC congruency. They found that women whose current and previous OC use was incongruent reported higher levels of romantic jealousy. This finding is interesting in light of other prospective research indicating that use of OC increases romantic jealousy

relative to non-fertile (but not fertile) stages of the menstrual cycle (Cobey et al., 2012), and that particular OC brands, containing higher doses of estrogen, are associated with higher levels of self-reported jealousy (Cobey et al., 2011). Taken together, these studies suggest that the influence of OCs on the expression of jealousy is multifaceted. Emerging evidence shows a similar pattern of results for mate-guarding behaviour (Welling et al., 2012), and it is therefore expected that similar relationships exist between OC use and other not yet measured relationship variables.

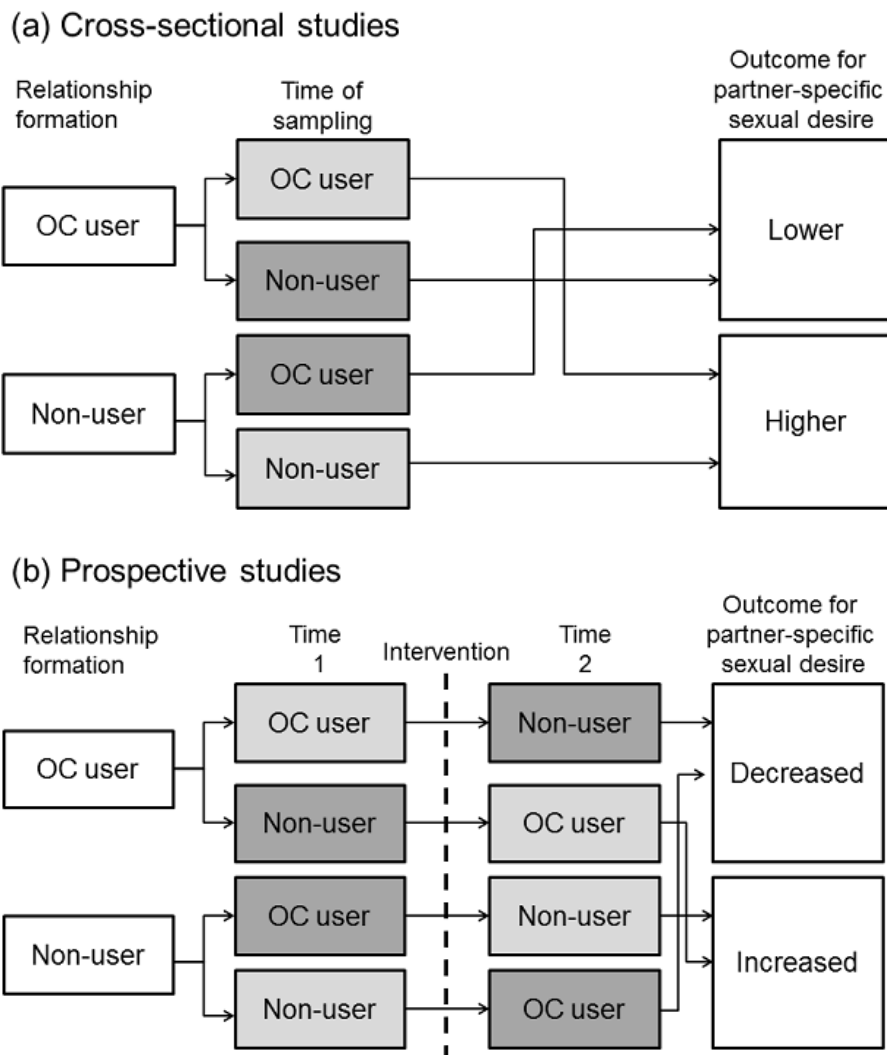


Figure 2. The congruency hypothesis. The figure shows how congruency (light grey shading) or non-congruency (dark grey) in OC use between the period in which women met their partner and the time of sampling might predict variation in partner-specific desire. (a) In cross-sectional studies, OC use during sampling may be associated with both higher and lower levels of partner-focused desire dependent on previous use during relationship formation. (b) In prospective studies, an intervention (i.e. initiating or discontinuing OC use) may induce similar mixed effects depending on use or non-use during relationship formation. Reprinted from Roberts et al. (2013).

Finally, one study has examined the real world implications of such effects on male partners. Using a prospective design, Cobey et al. (2013b) found that men perceive their female partner to be more attractive mid-cycle (near to ovulation) compared to either when non-fertile and regularly cycling, or when using OC. This finding suggests that men's perception of their female partners, and therefore possibly also male satisfaction, could also be impacted by their partner's OC use (see also Puts and Pope, 2013; Roberts et al., 2014b; but see Roberts et al., 2014a). Future studies examining a broader range of behavioural changes in male partners of women who initiate or discontinue pill use are thus warranted.

CONCLUSIONS

We have described evidence, which suggests that OC use could exert significant effects on the relationship dynamics of human pair-bonds, with consequences for millions of users and their partners. Indeed, modern forms of contraception are widely used across the world, including Asia, Latin America, and to a lesser, but still considerable extent, in sub-Saharan Africa, where the World Health Organisation estimated in 2013 that it is used by around 1 in 4 women aged 15-49. The combined pill is the most commonly used form of hormonal contraception, with, for example, about 4 in every 5 women of reproductive age in the United States having used the pill at some stage of their lives (Mosher and Jones, 2010). Against this background, these effects deserve rigorous and urgent study. We hope that our paper will stimulate ethologists to engage with this interesting area of research.

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