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Hormonal contraceptive use in smokers: Prevalence of use and associations with smoking motives

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HIGHLIGHTS

- Cross-sectional study on hormonal contraceptives (HCs) and smoking motives (SMs)
- Among female smokers, HC use was prevalent (current = 48%; history = 85%).
- SMs were highest in follicular phase, followed by HC users and then luteal phase.
- Additional research is needed to explore the causality of HC use and SMs.

ABSTRACT

Introduction: While endogenous sex hormones influence smoking-related outcomes, little is known about the role of hormonal contraceptives (HCs). This is despite dated estimates suggesting that HC use is prevalent among female smokers. Therefore, we sought to update estimates of the prevalence of HC use among female smokers and explore the association of HC use with various smoking motives (SMs).
Methods: This online cross-sectional survey recruited female smokers between the ages of 18–35. Survey questions assessed smoking behavior, SMs, use of HCs, and menstrual cycle regularity.
Results: Participants (n = 734) were, on average (± standard deviation), 20.7 ± 2.7 years old and smoked 7.3 ± 6.7 cigarettes/day. The majority of females reported a history of HC use (85%) and half reported current use (48%). Cyclical HC users (n = 227) scored significantly lower on three SMs compared to naturally-cycling women in the follicular phase (n = 62) and significantly higher on 15 SMs compared to naturally-cycling women in the luteal phase (n = 29). Women on cyclical HCs differed from women on long-acting HCs (n = 128) on two SMs. Further, the naturally-cycling women in the follicular phase scoring significantly higher on 15 SMs compared to those in the luteal phase.
Discussion: These observations indicate that HC use remains prevalent in female smokers and may influence SMs. Additional research should replicate these observations and explore the implications on smoking cessation outcomes.

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1. Introduction

Sex hormones, specifically progesterone and estradiol, have been shown play a significant role in addictive behaviors in preclinical research (Carroll & Anker, 2010; Lynch & Sofuoglu, 2010). In clinical research, menstrual phase is often used as a proxy to examine effects of sex hormones. A recent meta-analysis with 36 studies concluded that withdrawal, and, possibly, craving, is significantly higher during the luteal phase as compared to the follicular phase (Weinberger, Smith, Allen, et al., 2015). However, the effect of menstrual cycle and/or sex hormones on smoking cessation outcomes is mixed. Follicular phase is more favorable for quitting when nicotine replacement therapy is used (Carpenter, Upadhyaya, LaRowe, Saladin, & Brady, 2006; Franklin & Allen, 2009), while the luteal phase is more favorable when nicotine replacement therapy was not used (Allen, Bade, Center, Finstad, & Hatsukami, 2008; Mazure, Toll, S a, Wu, & O'Malley, 2011). Yet others have observed no difference by menstrual phase (Epperson, Toll, Wu, et al., 2010). An additional study observed that increasing levels of progesterone during treatment with nicotine patch, but not varenicline, was associated with a higher likelihood of subsequent smoking abstinence (Saladin, Gray, Carpenter, Baker, & McClure, 2014). Together, these data suggest that sex hormones may influence smoking-related symptomatology and, possibly, cessation outcomes. Because of the nature of these studies, this work has focused on premenopausal women who have regular, natural menstrual cycles. Incidentally, women on hormonal contraceptives were excluded from these research studies, despite the popularity of hormonal contraceptives. Therefore, the role of hormonal contraceptives in smoking-related outcomes is less known.

To date, research conducted on the role of hormonal contraceptives and smoking-related outcomes has been focused on oral contraceptives (OCs), specifically. First, a cross-sectional study observed women who used oral contraceptives were at 2.42 (95% CI: 1.87–3.14) higher odds of current smoking compared to nonusers among women of reproductive age in the Fourth Korean National Health and Nutrition Examination Survey (Lee, Ko, & Park, 2013). Next, three studies have observed faster nicotine metabolism in OC users compared to nonusers (Benowitz, Lessov-Schlaggar, Swan, & Jacob, 2006; Berlin, Gasior, & Moolchan, 2007; Chenoweth, Novalen, Hawk, et al., 2014), which suggests OC users may experience greater smoking reward (Sofuoglu, Herman, Nadim, & Jatlow, 2012) and have more adverse smoking-related symptomatology (e.g., craving) (Rubinstein, Benowitz, Auerback, & Moscicki, 2008). Greater smoking reward in OC users has been demonstrated by our prior work in which OC users reported greater smoking satisfaction compared to nonusers during ad libitum smoking (Hinderaker et al., 2015) and by Masson and Gilbert who observed a greater reduction in anxiety after smoking a cigarette in OC users compared to nonusers (Masson & Gilbert, 1999). Further, OC users have greater cardiovascular response (e.g., heart rate) to smoking or stress than nonusers (Davis, 1999; Davis & Matthews, 1990; Emmons & Weidner, 1988; Masson & Gilbert, 1999). The data on cessation-related symptomatology is mixed. While one study of adolescent smokers observed significantly greater craving in OC users compared to nonusers during smoking cessation (Dickmann, Mooney, Allen, Hanson, & Hatsukami, 2009), we observed significantly lower craving in adult OC users compared to nonusers during acute smoking abstinence in a laboratory-based study (Hinderaker et al., 2015). These observations suggest that use of OCs may play a role in motives for smoking via an effect on smoking reward and smoking-related symptomatology. However, to date, no published data are available on the effect of long-acting hormonal contraceptives (e.g., depot medroxyprogesterone acetate injection or hormonal implants) in smoking-related outcomes. Thus, it is unknown how other types of hormonal contraceptives may influence motives for smoking.

In general, hormonal contraceptives protect against pregnancy by preventing ovulation, which results in an alteration in the cyclical pattern of progesterone and estradiol (Rivera, Yacobson, & Grimes, 1999). Based on data from the 2002 and 2004 Behavioral Risk Factor Surveillance System, an estimated 33% to 41% of women who smoke and are of reproductive age used some form of hormonal contraception (McClave, Hogue, Brunner Huber, & Ehrlich, 2010). The most popular type of hormonal contraceptive was oral contraceptives (26.9%), followed by the injectable progesterone commonly marketed as Depo-Provera® by Pfizer (6.6%). The prevalence of other forms of hormones (e.g., vaginal ring [NuvaRing®], transdermal patch [Xulane®], hormonal intrauterine device [Mirena®]) were not reported. This work has limitations including a lack of detail regarding type of hormone (e.g., the dose and the type of oral contraceptive is not reported) and the figures are dated by more than 10 years. Despite these limitations, these data suggest use of hormonal contraceptives is popular in smokers. Therefore, additional work is needed to identify current prevalence of use, as well as additional detail regarding the type of hormonal delivery used.

In sum, while there is biological plausibility for hormonal contraceptives (HCs) affecting smoking-related behaviors and dated estimates suggest a high prevalence of use of hormonal contraceptives in premenopausal smokers, the literature is currently lacking in terms of detailed and current estimates of prevalence and exploration into the relationship between different types of hormonal contraceptives and smoking-related outcomes. Therefore, using an online-delivered cross-sectional survey, we pursued two aims. In Aim 1, we estimate the current prevalence in the use of different types of HCs. In Aim 2, we explore differences in motives for smoking between women using HCs as compared to naturally-cycling (NC) women. In Aim 2, we hypothesized that women on cyclical HCs would differ from women using long-acting HCs, as well as from NC women by menstrual phase. These data will provide the necessary groundwork to begin addressing this nearly absent line of research.

2. Methods

2.1. Study sample

From June to August 2016, we recruited female and male smokers via Facebook advertising, though this analysis was limited to the female smokers who completed that survey. Advertisements were limited to those who live in the United States and were between the ages of 18 and 35 years, given clinical recommendations that women over the age of 35 who smoke should not use combination oral contraceptives (Frieden, Harold Jaffe, James Stephens, et al., 2013). Upon clicking on the advertisement, a REDCap (Harris et al., 2009) (Research Electronic Data Capture) webpage, hosted by the University of Minnesota, appeared. REDCap is a secure, web-based application designed to support data capture for research studies by providing an intuitive interface, audit trails, and automated export procedures (Harris et al., 2009). This webpage contained a description of the study and informed consent for participation in the screening survey. Upon providing informed consent, potential participants completed a five-item survey to assess eligibility. After completion of the eligibility survey, participants provided an email address and were told they would receive an invitation to the full survey within three business days if they were eligible to participate.

Study staff reviewed each screening survey to ensure eligibility was met. Eligibility included the following: female between the ages of 18 and 35, established smoker (defined as ≥ 100 cigarettes smoked in lifetime) with current use reported at ≥ 1 cigarette per day in ≥ 4 of last 30 days. REDCap also recorded the IP address of each survey taker. To avoid duplicate study participants, any survey respondents that contained both a duplicate email address and IP address, in combination, were excluded. Upon confirmation of eligibility, study staff emailed study participants an invitation to the full survey.