



Published in final edited form as:

*Obstet Gynecol.* 2012 July ; 120(1): 44–51. doi:10.1097/AOG.0b013e31825b87ae.

## Effect of Vaginal Lubricants on Natural Fertility

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### Abstract

**Objective**—Over-the-counter vaginal lubricants have been shown to negatively affect in vitro sperm motility. The objective of this study was to estimate the effect of vaginal lubricant use during procreative intercourse on natural fertility.

**Methods**—Women aged 30–44 years with no history of infertility who had been trying to conceive for less than 3 months completed a baseline questionnaire on vaginal lubricant use. Subsequently, women kept a diary to record menstrual bleeding, intercourse, and vaginal lubricant use and conducted standardized pregnancy testing for up to 6 months. Diary data were used to determine the fertile window and delineate lubricant use during the fertile window. A proportional hazards model was used to estimate fecundability ratios with any lubricant use in the fertile window considered as a time-varying exposure.

**Results**—Of the 296 participants, 75 (25%) stated in their baseline questionnaire that they use vaginal lubricants while attempting to conceive. Based on daily diary data, 57% of women never used a lubricant, 29% occasionally used a lubricant, and 14% used a lubricant frequently. Women who used lubricants during the fertile window had similar fecundability to those women who did not use lubricants (fecundability ratio 1.05, 95% CI: 0.59, 1.85) after adjusting for age, partner race, and intercourse frequency in the fertile window.

**Conclusion**—Lubricants are commonly used by couples during procreative intercourse. Lubricant use during procreative intercourse does not appear to reduce the probability of conceiving.

### INTRODUCTION

Vaginal lubricants intended for use during sexual activity are readily available for purchase through drug stores, large retail chains, and the internet. Women use vaginal lubricants to

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**Financial Disclosure:** The authors did not report any potential conflicts of interest.

moderate the amount of vaginal wetness (1). In the United States it is estimated that 62% of women have used a lubricant during sexual activities and 25.3% have used a lubricant during the previous month (2). Among couples trying to conceive, incidence of vaginal dryness appears to be increased, and 26% of couples will use lubricants while trying to conceive (3).

Commonly used vaginal lubricants have been shown to negatively affect sperm motility in vitro. Over-the-counter lubricants including Astroglide, KY Jelly, and Replens have been shown in multiple studies to adversely affect sperm motility at a variety of concentrations (4–8). One study showed sperm to be immotile after 15 minutes of exposure to these lubricants (8). While a spectrum of lubricant concentrations have been studied, the in vivo concentration of lubricant in ejaculate deposited at the top of the vagina during intercourse is unknown.

As vaginal lubricants have been shown to affect sperm motility in vitro, it is possible that vaginal lubricant use during intercourse may negatively affect natural fertility by inhibiting fertilization. For this reason, couples, who are trying to conceive, are advised not to use common vaginal lubricants during procreative intercourse (9). The objective of this study was to estimate the effect of vaginal lubricant use during procreative intercourse on natural fertility.

## MATERIALS AND METHODS

This study is a secondary analysis of data obtained from “Time to Conceive,” a time-to-pregnancy study, designed to estimate the association between markers of ovarian aging and natural fertility. The original study and secondary analysis were approved by the institutional review board of the University of North Carolina. Data from women enrolled between April 2008 and December 2010 are included in this analysis. A full description of the study design, exclusion, and inclusion criteria have been previously published (10). Briefly, English-speaking women between 30 and 44 years of age, who were attempting to conceive for 3 months or less or were about to start trying to conceive, were eligible for participation in the study. Women were recruited through community flyers, mass emails, and print advertising and screened for eligibility in a telephone interview. Women with a history of infertility, polycystic ovary syndrome, pelvic inflammatory disease, endometriosis, pelvic radiation, or with a partner with a history of infertility were excluded from participation.

After informed consent was obtained, eligible women completed a questionnaire, which queried information on demographics, medical, surgical, obstetric, gynecologic and menstrual history, behaviors, partner demographics, height and weight, and pregnancy history. Women were queried about their vaginal lubricant use while trying to conceive, including frequency of use and type of lubricant. Women, who were determined to be eligible while using contraceptives, were enrolled and completed the questionnaire in the menstrual cycle immediately after cessation of birth control.

While trying to conceive, women completed a study diary, which was designed to collect daily information on vaginal bleeding, intercourse, cervical mucus score (optional), pregnancy test results, and vaginal lubricant use. Women were asked to complete the diary daily until pregnancy was detected or 3 menstrual cycles had passed. In addition, women were provided with free home pregnancy tests (sensitivity (lowest level of detection) = 20 mIU hCG/ml) and instructed to use them at the time of missed menses. Women were instructed to inform study staff of a positive pregnancy test. Women were provided a free pregnancy ultrasound to encourage notification of pregnancy results. Women who did not

report a positive pregnancy test were contacted at 3 and 6 months after the study visit. Women were followed until a positive pregnancy test or until 6 months of attempt following the study visit.

### Statistical Analysis

Initially we classified lubricant use by frequency of lubricant use as recorded on the baseline questionnaire: never, occasionally, frequently/every time. Univariable analyses were conducted comparing lubricant users to non-lubricant users. Subsequently data from the daily diary was used to categorize women by actual lubricant use. Women were classified as never users if they never recorded lubricant use in their diary; occasional users if they used lubricants in fewer than 50% of intercourse days; and frequent users if they used lubricants on at least 50% of intercourse days. Concordance between lubricant use as recorded in the baseline questionnaire and in the daily diary was compared using the kappa statistic (11). Univariable analyses were repeated using the daily diary classification of lubricant use.

Subsequently we analyzed the extent to which lubricant use varied by time in the menstrual cycle (during or outside of the fertile window) and by cervical mucus score using only the data from women who used a lubricant during at least one act of intercourse. Information from the diary on days of menstrual bleeding and pregnancy test results were used to estimate the fertile window. Ovulation was assumed to have occurred 14 days prior to first day of menses or first positive home pregnancy test, with the fertile window designated as extending from 5 days before to 3 days after day of ovulation based on the standard days method (12). A generalized chi-square test adjusted for multiple observations per woman was employed 1) to compare lubricant use during the fertile window to lubricant use outside of the fertile window and 2) to compare lubricant use by cervical mucus score (13). This generalized chi-square tests for independence of the row and column variables in two-way tables, taking into account the multiple observations per woman. Ten women who used lubricants also recorded information on cervical mucus.

Initially a discrete-time proportional hazards model was created to estimate the association between self-reported lubricant use (as recorded in the baseline questionnaire) and fecundability (14). This model accounts for both the right censoring and left truncation (due to women enrolling in the 1,2,3 or 4th cycle of pregnancy attempt) present in the data. A fecundability ratio (FR) less than 1.0 suggests reduced fecundability. Pregnancy was defined by the report of a positive home pregnancy test. Maternal age was collapsed into 3 categories for modeling (30–34, 35–37, 38–44 years of age). To adjust for potential confounding, covariates associated with both the exposure of lubricant use (Table 1) and the outcome of fecundability : age, partner race (White versus Other), hormonal contraceptive use in the prior year, and education level, were added to the model. The final model included age and partner race after other covariates through backward selection with threshold for inclusion in model set to  $p=0.1$ .

Subsequently, a discrete-time proportional hazard model with time-varying lubricant use was created to analyze the effect of any lubricant use during a given cycle (as recorded in the daily diary) on probability of pregnancy in that cycle. Finally, to estimate whether lubricant use during the fertile window affected probability of pregnancy in that cycle, a proportional hazards model with time-varying covariates was created with any lubricant use in the fertile window considered as the exposure. The adjusted models included the covariates: age, partner race, and intercourse frequency in the fertile window in the given cycle.

Using a sample size of 275, the maximum detectable fecundability ratio (FR) is 0.64, assuming an expected rate of lubricant use at 25% with 80% power and 0.05 level of

significance. Note that the rate of lubricant use from the diary data is higher than 25%, which would provide more power to detect differences in FR. Statistical analyses were performed with SAS version 9.2 (SAS Institute, Cary, NC, USA).

## RESULTS

339 women were enrolled in TTC during the time period. 43 women were excluded from this analysis for the following reasons: lubricant question not included on early version of questionnaire (N=30), declined to answer (N=6), infertile (attempting to conceive for more than 11 cycles) at start of study (N=5), and lost to follow up (N=2). Of the 148 women entering the study on their first cycle of pregnancy attempt, 30.4% conceived after 1 cycle, 57.4% conceived after 3 cycles and 69.6% conceived after 6 cycles. Using the full sample of 296, the adjusted Kaplan-Meier estimates of pregnancy give similar results to these rates of conception. Of the 296 women, 36.8% did not conceive during the study period and were censored. Of the 148 women who entered the study during their first cycle of attempt, 72.7% of lubricant users conceived by the 6th cycle of attempt and 68.0% of non-users conceived by the 6th cycle of attempt.

Of the 296 women, 75 (25%) stated in their baseline questionnaire that they use vaginal lubricants while attempting to conceive. The most commonly reported lubricants included Astroglide (20% of lubricant users) and KY Jelly (44% of lubricant users). Pre-seed was reported by 9% of lubricant users. Lubricant use was reported as occasional in 44% of users, frequent in 31% of users, and every time in 24% of users. One participant did not provide information on frequency of use.

Lubricant users (as self-designated in baseline questionnaire) are compared to non-lubricant users in Table 1. In general, lubricant use tended to vary by education level with non-lubricant users tending to be less educated and regular lubricant users more educated ( $p=0.05$ ). A history of hormonal contraceptive use in the year preceding attempts to conceive was most common among occasional lubricant users ( $p=0.05$ ).

176 women completed daily diaries while trying to conceive in which they recorded days with intercourse and lubricant use. The women who completed daily diaries were similar to those women who did not keep daily diaries on all measures (age, race, education level, currently smoking, hormonal contraceptive use in previous year, body mass index, history of dysmenorrhea, partner's age, reported intercourse frequency (per week), partner race, and partner education level) except parity, with women completing the diary more likely to be nulliparous ( $p=0.02$ ). Women who recorded lubricant use in their daily diary were divided into 2 groups: occasional lubricant users (lubricants used in fewer than 50% of days of intercourse) and frequent users (lubricants used on at least 50% of days of intercourse). Based on daily diary data, 57% of women never used a lubricant, 29% occasionally used a lubricant, and 14% used a lubricant frequently. A comparison of lubricant use as recorded in the baseline questionnaire to use in the daily diary revealed moderate concordance (kappa statistic=0.46, 95% CI: 0.35–0.52). 74% (92/124) of women that reported that they never use lubricants, never recorded use of a lubricant in their daily diary; 23% (28/124) occasionally used a lubricant, and 3% (4/124) regularly used lubricants.

Comparing lubricant users to non-lubricant users, as recorded in the daily diary, some differences were noted (Table 2). Frequent lubricant users tended to be younger than never lubricant users ( $p=0.04$ ). 92% of frequent lubricant users were less than 35 years of age, while 69% of never users were less than 35 years of age. 15% of never users were over 38 years of age, compared to 4% of frequent users. As seen in the baseline questionnaire data, lubricant use differed by education level, with lubricant users being more highly educated

women ( $p=0.05$ ). Lubricant use also tended to differ by partner ethnicity ( $p=0.06$ ) with lubricant users being more likely to have a partner that was non-Hispanic White. 84% of regular lubricant users partners were White, compared to 68% of non-lubricant users.

Among users of lubricants, lubricant use did not vary significantly based on time in the cycle. Lubricants were used in 26.1% of acts of intercourse during the fertile window and 24.5% of acts of intercourse outside of the fertile window. During the first cycle of enrollment, women appeared equally likely to use lubricants during the fertile window (35.5% of acts of intercourse) compared to outside of the fertile window (33.6% of acts of intercourse)( $p=0.76$ ). We did not observe an association between cervical mucus score and lubricant use ( $p=0.28$ ). Also, the maximum cervical mucus score did not differ in the first cycle among lubricant users and non-users ( $p=0.49$ ). However, among lubricant users only 21 acts of intercourse had a cervical mucus score recorded on the same day.

After adjusting for age and partner race, women, who at baseline reported frequently using lubricants while trying to conceive, did not differ in their fecundability compared to reported never users of lubricants (FR 1.23, 95% CI: 0.76,2.00). Further analysis to estimate the effect of actual lubricant use (as recorded in the daily diary) in a given cycle on probability of pregnancy in that cycle was consistent with the analysis of baseline data (FR 1.21, 95% CI: 0.73, 2.01) after adjusting for age, partner race and intercourse frequency in the fertile window. To further delineate the affect of lubricant use on fertility, lubricant use during the fertile window was examined. Women, who used lubricants during the fertile window, had similar fecundability to those women who did not use lubricants (FR 1.05, 95% CI: 0.59, 1.85) after adjusting for age, partner race, and intercourse frequency in the fertile window (Table 3).

A sensitivity analysis was conducted in which women who used Pre-seed were coded as non-lubricant users, and acts of intercourse in which Pre-seed was used were coded as intercourse without a lubricant. Fecundability ratios in the sensitivity analysis did not differ significantly from those reported in the primary analysis. The FR and 95% confidence intervals for lubricant use at any time in a given cycle are 1.21 (95% CI: 0.73, 2.01) (Table 3) in the primary analysis and 1.30 (95% CI: 0.77, 2.20) in the sensitivity analysis. For the analysis on lubricant use during the fertile window in a given cycle, the primary analysis yields the FR and 95% confidence intervals 1.05 (95% CI: 0.59, 1.85) and the sensitivity analysis yields 1.14 (95% CI: 0.62, 2.12).

## DISCUSSION

In this prospective cohort study, we found that 25–43% of couples, who were trying to conceive, use lubricants. Intended lubricant use during procreative intercourse versus actual lubricant use differed with women being more likely to use lubricants than they initially reported. Lubricant users tended to be younger, more highly educated, and have non-Hispanic White partners. Finally, lubricant use did not appear to harm natural fertility, as measured by the probability of conceiving naturally in a given cycle.

One quarter of the women stated that they would use a lubricant while trying to conceive. However, 43% of women used a lubricant during one or more acts of procreative intercourse. Data on lubricant use is limited especially among women, who are trying to conceive. In a cross-sectional study of 1922 heterosexual women aged 18–60 years in the United States, 61% of women reported having used a lubricant and 25% had used a lubricant in the past month (2). In a study of 900 couples that were trying to conceive, Ellington et al reported that 26% of the couples used lubricants (3). This previously reported prevalence of lubricant use is similar to the rate we found when we simply queried women about their

general use of lubricants during procreative intercourse. However, the cumulative incidence of lubricant use is notably higher when women are prospectively followed.

While most self-reported non-users will never use lubricants, some will eventually use lubricants while trying to conceive. If a couple uses a lubricant once over a 6 month period, they would likely consider themselves non-users. This finding is of value to future research on lubricants. Modifiable behaviors such as tobacco use, alcohol intake, and lubricant use may change during a woman's attempts to conceive. For these exposures, clarification of the reference date for the exposure (at cessation of contraception, at time of conception, etc.) is important for interpretation. When lubricants are the "exposure", the exposure should be repeatedly measured and the analysis should allow for a time-varying exposure.

Based on in vitro data, we hypothesized that lubricants would harm fertility. However, we were concerned that an association between lubricant use and fecundability might be confounded by inherent differences in lubricant users. We hypothesized that lubricants themselves might not be a cause of reduced fertility, but a marker of a less fertile woman. We assumed that women with good cervical mucus would be the least likely to use lubricants but the most likely to conceive (15). Contrary to our assumption, we did not observe an association between cervical mucus scores and lubricant use although power was limited.

We also were concerned that lubricant use would vary based on timing of the intercourse during the menstrual cycle. If lubricants are harmful, but never used during the fertile window, one might not observe reduced fecundability among lubricant users. To address this, we looked specifically at lubricant use during the fertile window. When focusing on lubricant use during the fertile window, we also did not find a negative association between lubricant use and fecundability.

In vitro studies have shown that lubricants can harm sperm motility. However, in our study, lubricant use during intercourse did not appear to reduce fecundability. We propose three possible theories to explain this discrepancy. First, lubricants, as used during vaginal intercourse, could remain on the external genitalia and lower vagina and not in the upper vagina, where the sperm are deposited. Second, while lubricants may be toxic to sperm, sperm deposited at the top of the vagina during intercourse rapidly move into the cervix (16), likely minimizing any exposure to lubricants present. Third, lubricants could promote fertility by enabling more frequent acts of intercourse. It is important to stress that this is a study of lubricant use during intercourse. These results should not be generalized to lubricant use during vaginal sonography, pelvic examination, or intrauterine inseminations.

This study does have limitations. The fertile window was broader than classically described, spanning a 9 day period instead of 6 days (17). The broader window was designed to accommodate for possible error in the definition of the day of ovulation, which was defined by the calendar method (12). Thus it is possible that lubricant use during the fertile window may not have been during a fertile time period. Also, this study used an epidemiologic measure of fertility, fecundability, and not a clinical measure of fertility or infertility. However, one could presume that reduced fecundability would lead to infertility (lack of conception by 12 months) if the exposure persisted over 12 months. Third, from this study we conclude that lubricants do not harm fertility; however, one cannot conclude that lubricants have no effect on fertility. Future, larger studies may confirm or reject our observed, non-significant, positive association between lubricants and fecundability. Fourth, women, who used lubricants during their fertile window may have had episodes of intercourse in the fertile window in which they did not use a lubricant. To address this weakness, future studies could examine the effect of lubricants using a day specific

probability of pregnancy model, which uses each act of intercourse as the unit of observation. Finally, it should be noted that this study is a secondary analysis of *Time to Conceive* data. The study is of "older" reproductive age women and thus the findings, especially prevalence of lubricant use, may not be generalizable to younger women.

The strengths of this study include its prospective study design and repeated measures of lubricant use. Use of a self-administered, online daily diary allowed for privacy. This approach was valuable because participants are more likely to report sensitive information in a self-administered questionnaire (18). Daily information on bleeding, intercourse, lubricant use, and ovulation testing allowed us to look at the relationship between cervical mucus and lubricant use and to differentiate lubricant use within or outside of the fertile window. As lubricant use varied during follow-up, our analysis of cycle-specific lubricant use, appears most appropriate. It is unlikely that lubricant use has residual effects that would persist outside of the given episode of intercourse. The study also collected information on type of lubricant, allowing for a sensitivity analysis in which users of Pre-seed, a lubricant which does not appear to effect in vitro sperm motility (19), were coded a lubricant non-users. Finally the extensive nature of our questionnaires allowed for assessment and adjustment for potential confounders.

In conclusion, lubricants are used by approximately one in four couples during procreative intercourse. Lubricant use does appear to vary by female age and education level among pregnancy planners. While in vitro studies have shown that lubricants diminish sperm motility, this study of in vivo use of lubricants did not find evidence of reduced fecundability among lubricant users. This study would suggest that lubricant use during procreative intercourse does not appear to have a negative effect on natural fertility. A randomized trial would be needed to confirm these findings.

## Acknowledgments

Supported by grants NIH R21 HD060229, 5 K12 HD050113 (UNC WRHR), and T32ES007018.

The authors thank Dr. Donna Baird for contributing to the initial study design and analysis.

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**Table 1**Baseline Characteristics by Self-Reported Lubricant Use Frequency as Reported at Enrollment (n=295<sup>\*</sup>)

|  | Frequency of Lubricant Use<br>(Self-Reported at Enrollment) |              |                             | P <sup>†</sup> |
|--|---|--------------|-----------------------------|----------------|
|  | Never   | Occasionally | Frequently or<br>Every Time |                |
| Age (years)  |   |              |                             | 0.24           |
| Younger than 35  | 162 (73)  | 21 (64)      | 34 (83)                     |                |
| 35–37  | 34 (16)   | 8 (24)       | 6 (15)                      |                |
| Older than 38  | 25 (11)   | 4 (12)       | 1 (2)                       |                |
| Race   |   |              |                             | 0.46           |
| Non-Hispanic Caucasian                                   | 164 (74)  | 28 (85)      | 31 (76)                     |                |
| Other  | 57 (26)   | 5 (15)       | 10 (24)                     |                |
| Education level  |   |              |                             | 0.05           |
| Less than college degree                                 | 21 (10)   | 1 (3)        | 0 (0)                       |                |
| College degree   | 54 (24)   | 7 (21)       | 9 (22)                      |                |
| Some graduate or Masters                                 | 97 (44)   | 21 (64)      | 17 (41)                     |                |
| Complete postgraduate                                    | 49 (22)   | 4 (12)       | 15 (37)                     |                |
| Current smoker   | 3 (1)   | 1 (3)        | 1 (2)                       | 0.37           |
| Nulliparous  | 125 (57)  | 20 (61)      | 23 (56)                     | 0.93           |
| Hormonal contraceptive use in previous year <sup>‡</sup> | 97 (44)   | 21 (64)      | 15 (37)                     | 0.05           |
| Body mass index  |   |              |                             | 0.61           |
| Underweight (<18.5 kg/m <sup>2</sup> )                   | 5 (2)   | 1 (3)        | 3 (7)                       |                |
| Normal (18.5–25 kg/m <sup>2</sup> )                      | 138 (63)  | 23 (70)      | 25 (63)                     |                |
| Overweight (25–30 kg/m <sup>2</sup> )                    | 47 (21)   | 5 (15)       | 6 (15)                      |                |
| Obese (≥30 kg/m <sup>2</sup> )                           | 31 (14)   | 4 (12)       | 6 (15)                      |                |
| History of dysmenorrhea                                  | 133 (60)  | 23 (70)      | 26 (63)                     | 0.57           |
| Partner's age (years)                                    | 34 (31–38)  | 34 (31–37)   | 32 (31–35)                  | 0.14           |
| Reported intercourse frequency (per week)                | 2 (1.5–3)   | 2 (2–3)      | 2 (1–3)                     | 0.21           |
| Acts of intercourse in fertile window <sup>§</sup>       | 3 (2–4)   | 3 (2–4)      | 3 (2.2–4)                   | 0.86           |
| Partner race   |   |              |                             | 0.20           |
| Non-Hispanic Caucasian                                   | 159 (72)  | 28 (85)      | 33 (80)                     |                |
| Other  | 62 (28)   | 5 (15)       | 8 (20)                      |                |
| Partner education level                                  |   |              |                             | 0.76           |
| Less than college degree                                 | 35 (16)   | 9 (27)       | 8 (20)                      |                |
| College degree   | 69 (31)   | 7 (21)       | 13 (32)                     |                |
| Some graduate or Masters                                 | 58 (26)   | 8 (24)       | 10 (24)                     |                |
| Completed postgraduate                                   | 59 (27)   | 9 (27)       | 10 (24)                     |                |

Data are presented as median (interquartile range) or n (%).

<sup>\*</sup> One participant did not provide information on frequency of lubricant use.

<sup>†</sup>Fisher's exact tests were used for categorical variables and Kruskal-Wallis non-parametric tests were performed for the continuous variables.

<sup>‡</sup>Oral contraceptive pills, contraceptive patch, or contraceptive vaginal ring.

<sup>§</sup>As calculated using data from the daily diary (N=176).

**Table 2**

Baseline Characteristics by Self-Reported Lubricant Use Frequency as Reported in Daily Diary During Follow-up (n=175<sup>\*</sup>)

|  | Frequency of Lubricant Use<br>(Self-Reported in Daily Diaries) |   |   | <i>p</i> <sup>†</sup> |
|--|--|---|---|-----------------------|
|  | Never  | Occasionally<br>(Fewer Than 50%<br>of Acts of<br>Intercourse) | Frequently or<br>Every Time<br>(50% or More of<br>Acts of<br>Intercourse) |                       |
| Age (years)  |  |   |   | 0.04                  |
| Younger than 35  | 69 (69)  | 34 (68)   | 23 (92)   |                       |
| 35–37  | 16 (16)  | 13 (26)   | 1 (4)   |                       |
| Older than 38  | 15 (15)  | 3 (6)   | 1 (4)   |                       |
| Race   |  |   |   | 0.97                  |
| Non-Hispanic Caucasian                                   | 74 (75)  | 37 (74)   | 18 (72)   |                       |
| Other  | 25 (25)  | 13 (26)   | 7 (28)  |                       |
| Education level  |  |   |   | 0.05                  |
| Less than college degree                                 | 7 (7)  | 5 (10)  | 0 (0)   |                       |
| College degree   | 22 (22)  | 11 (22)   | 8 (32)  |                       |
| Some graduate or Masters                                 | 44 (45)  | 29 (58)   | 8 (32)  |                       |
| Completed postgraduate                                   | 26 (26)  | 5 (10)  | 9 (36)  |                       |
| Current smoker   | 3 (3)  | 1 (2)   | 0 (0)   | 1.00                  |
| Nulliparous  | 59 (59)  | 31 (62)   | 19 (76)   | 0.34                  |
| Hormonal contraceptive use in previous year <sup>‡</sup> | 48 (48)  | 21 (43)   | 11 (44)   | 0.81                  |
| Body mass index (kg/m <sup>2</sup> )                     |  |   |   | 0.77                  |
| Underweight (less than 18.5)                             | 3 (3)  | 1 (2)   | 2 (8)   |                       |
| Normal (18.5–25)   | 61 (62)  | 30 (61)   | 15 (60)   |                       |
| Overweight (25–30)                                       | 21 (21)  | 9 (18)  | 6 (24)  |                       |
| Obese (30 or greater)                                    | 14 (14)  | 9 (18)  | 2 (8)   |                       |
| History of dysmenorrhea                                  | 59 (59)  | 31 (62)   | 17 (68)   | 0.76                  |
| Partner's age (years)                                    | 34 (31–40)   | 33 (31–37)  | 32 (31–34)  | 0.11                  |
| Reported intercourse frequency (per week)                | 2 (1.5–3)  | 2 (1–3)   | 2 (2–3)   | 0.36                  |
| Acts of intercourse in fertile window <sup>§</sup>       | 3 (2–4)  | 3 (2.5–4)   | 3 (2.2–4)   | 0.40                  |
| Partner race   |  |   |   | 0.06                  |
| Non-Hispanic Caucasian                                   | 67 (68)  | 41 (84)   | 21 (84)   |                       |
| Other  | 32 (32)  | 8 (16)  | 4 (16)  |                       |
| Partner education level                                  |  |   |   | 0.90                  |
| Less than college degree                                 | 17 (17)  | 8 (16)  | 5 (20)  |                       |
| College degree   | 28 (28)  | 16 (33)   | 5 (20)  |                       |
| Some graduate or Masters                                 | 27 (27)  | 10 (20)   | 8 (32)  |                       |
| Completed postgraduate                                   | 27 (27)  | 15 (31)   | 7 (28)  |                       |

Data are presented as median (interquartile range) or n (%).

\* 176 women had at least one cycle with all daily diaries completed. One participant did not have an episode of intercourse recorded.

† Fisher's exact tests were used for categorical variables and Kruskal-Wallis non-parametric tests were performed for the continuous variables.

‡ Oral contraceptive pills, contraceptive patch, or contraceptive vaginal ring.

§ As calculated using data from the daily diary.

**Table 3**

Comparison of Fecundability Among Lubricant Users and Lubricant NonUsers

|   | Unadjusted Analysis         |          | Adjusted for Age and Partner Race |          |
|---|-----------------------------|----------|-----------------------------------|----------|
|   | Fecundability Rate (95% CI) | <i>P</i> | Fecundability Rate (95% CI)       | <i>P</i> |
| Frequent lubricant users compared with never users as reported at enrollment            | 1.29 (0.80, 2.08)           | 0.30     | 1.23 (0.76, 2.00)                 | 0.40     |
| Lubricant use at any time point in a given cycle as recorded in the daily diary         | 1.56 (0.97, 2.52)           | 0.07     | 1.21* (0.73, 2.01)                | 0.45     |
| Lubricant use during the fertile window in a given cycle as recorded in the daily diary | 1.37 (0.80, 2.36)           | 0.25     | 1.05* (0.59, 1.85)                | 0.87     |

\* These models also adjust for intercourse frequency within the fertile window.