In vitro effects of coital lubricants and synthetic and natural oils on sperm motility

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Objective: To evaluate the effects of coital lubricants and oils on sperm motility.
Design: Comparative prospective in vitro study.
Setting: University Andrology laboratory.
Patient(s): Twenty-two normozoospermic donors.
Intervention(s): Semen samples were incubated in modified human tubal fluid (mHTF) control and in 10% Pre-Seed, Astroglide, and KY products (Sensitive, Warming, and Tingling) and baby, canola, sesame, and mustard oils. Total and progressive sperm motility was evaluated before and at 5, 30, and 60 minutes of incubation.
Main Outcome Measure(s): Sperm motility.
Result(s): Control samples exhibited no significant decrease in sperm motility. Pre-Seed showed a slight (~4%) but significant drop in progressive motility after 30 minutes. Total and progressive sperm motility significantly declined under Astroglide, KY products (Sensitive, Warming, and Tingling) and sesame oil incubation. Canola oil significantly decreased total motility after 30 minutes and progressive motility after 5 minutes of incubation. Similarly, baby oil decreased total motility after 60 minutes and progressive motility after 5 minutes. After initial decline, total and progressive sperm motility under Pre-Seed and canola and baby oils remained high. Exposure to mustard oil caused persistent hyperactivation of sperm in each sample with no decrease in motility.
Conclusion(s): Sesame oil and synthetic coital lubricants impaired sperm motility and may hamper fertility. Pre-Seed and canola, mustard, and baby oils showed no deleterious effect and may be considered sperm-friendly coital lubricants. Mustard oil exposure resulted in hyperactivation of sperm and needs to be studied further. (Fertil Steril® 2014;101:941–4. ©2014 by American Society for Reproductive Medicine.)
Key Words: Sperm, motility, coital, lubricants, oils

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Couples trying to conceive are faced with many options when considering a coital lubricant. There are an increasing number of commercial products available to help alleviate vaginal dryness or dyspareunia (1–3), but there is concern regarding the possible negative effects of these lubricants on fertility. Studies have demonstrated that surgical gels (4–7), saliva (8, 9), olive oil (8, 10), and commercially marketed coital lubricants, such as Astroglide, Replens, Lubrins, and KY jelly are detrimental to sperm motility and chromatin integrity (5, 6, 8, 10–13). Baby and canola oils have shown minimal effects on sperm motility (8, 10).

There is much uncertainty regarding the ideal fertility-preserving coital lubricant. Commercial coital lubricants have been wrongly perceived to maintain fertility. A survey of 900 trying-to-conceive (TTC) couples showed that vaginal dryness was twofold higher in TTC couples than in the general population. The survey also revealed that sexual intimacy was negatively affected because of vaginal dryness constantly in 11%, often in 35%, and occasionally in 42% of TTC couples. Vaginal dryness also increased with 19% of TTC couples experiencing numerous and 57% experiencing occasional episodes. About 30% of TTC couples knew not to use lubrication, whereas 26% of couples often or always used lubricants. Of these couples, 40% used KY jelly and 19% used Astroglide (14), which are known to be spermicidal. Pre-Seed has been introduced as a sperm-friendly coital lubricant for TTC couples having no deleterious

Received February 21, 2013; revised December 4, 2013; accepted December 16, 2013; published online January 23, 2014.
R.S.S. has nothing to disclose. T.H.W. has nothing to disclose. C.A.K. has nothing to disclose. K.R.C. has nothing to disclose.
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Fertility and Sterility® Vol. 101, No. 4, April 2014 0015-0282/$36.00

http://dx.doi.org/10.1016/j.fertnstert.2013.12.024

effects on sperm motility and chromatin integrity in vitro (13, 15, 16). Newer KY products, such as Sensitive, Warming, and Tingling, have been marketed, but their impact on fertility remains to be investigated. Many couples in different settings and other regions of the world use other resources to relieve vaginal dryness or discomfort during intercourse. An example of this is the use of mustard oil as a topical and intravaginal antimicrobial agent/lubricant in sex workers in Bangladesh (17). In this study we evaluated three new KY products (Sensitive, Warming, and Tingling) and two new vegetable oils (Sesame and Mustard) along with previously tested coital lubricants and oils (Pre-Seed, Astroglide, and baby and canola oils) for their effect on sperm motility in vitro.

MATERIALS AND METHODS

This study was approved by the Institutional Review Board of the SUNY Upstate Medical University, Syracuse, New York, and the authors have no conflict of interest. After informed consent, semen samples from 22 healthy normozoospermic donors (mean age 25.9 ± 4.2 years) were collected by masturbation after a sexual abstinence of 2–5 days. After liquefaction at 37°C for 30 minutes, the semen sample was evaluated according to the World Health Organization criteria (18). Semen samples were washed by centrifugation on a two-layer (35% and 90%) discontinuous-density gradient (Isolate). The washed sperm pellets were resuspended in 1.5 mL modified human tubal fluid (mHTF). Initial motility and count were obtained by placing 10 μL of the washed sperm sample on a Makler counting chamber. The desired concentration of spermatozoa (20×10^6/mL) was adjusted in mHTF for further division into aliquots. The following prewarmed (37°C) coital lubricants and oils were adjusted to 10% concentration (v/v) in mHTF aliquots containing washed sperm: Pre-Seed (ING Fertility), Astroglide (purified water, glycerin, propylene glycol, polyquaternium-15, methylparaben, propylparaben; BioFilm), KY Sensitive (water, propylene glycol, hydroxyethylcellolose, benzoic acid, polysorbate-60, tocopheryl acetate), KY Warming (propylene glycol, polyethylene glycol-8, hydroxypropylecullulose, tochopherol), KY Tingling (glycerin, propylene glycol, maltodextrin, honey, methylparaben, sucralose), baby oil (Johnson & Johnson), canola oil, sesame oil, and mustard oil. The 10% concentration of each lubricant was chosen on the observation that the same concentrations of lubricants are potentially present after intercourse and ejaculation (13, 16). Other published studies tested coital lubricants in the range (v/v) of 5%–30% (7, 8, 10, 12). The contents of each aliquot were thoroughly mixed and incubated for 1 hour at 37°C. An untreated aliquot of mHTF sperm suspension served as the control. The total and progressive sperm motility was evaluated before incubation (0 min) and at 5, 30, and 60 minutes of incubation in coital lubricants and oils. These intervals were selected on the findings that the sperm with in vivo fertilizing potential spend very little time in seminal plasma and motile sperm are generally found in the cervical mucus within 1.5 minutes after intercourse. The ability of sperm to penetrate cervical mucus is rapidly and irreversibly degraded within 35 minutes, and a majority of the penetrable sperm enter cervical mucus within 15–20 minutes from ejaculation (19, 20). Similar intervals for motility evaluations have been used in other studies (5, 7, 8, 10). All sperm motility evaluations were performed microscopically in duplicate with the use of Makler counting chambers (Sefi Medical Instruments) by a single trained technician.

Statistical Analysis

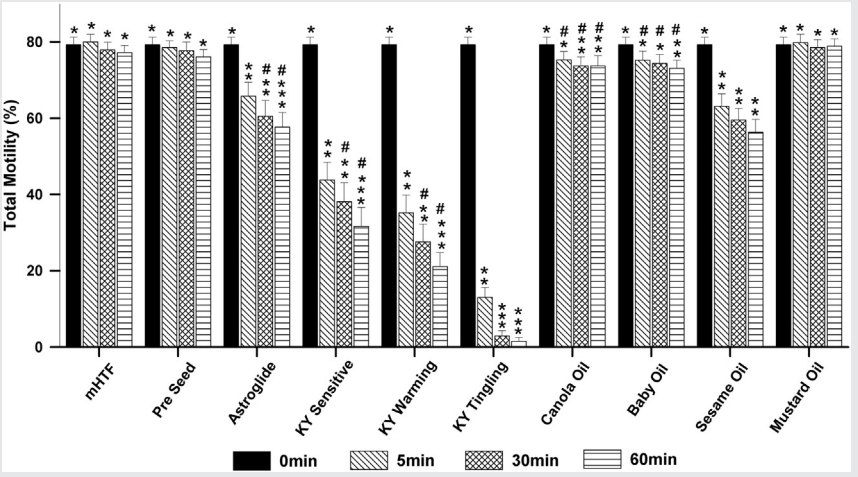
The motility data were analyzed with the use of repeated-measures analysis of variance, and the Holm-Sidak method was used to determine differences among treatment groups. The Sigma Stat program (Systat Software) was used for statistical analysis.

RESULTS

No significant decline ($P=.206$) in percentage total and progressive sperm motility was observed in mHTF (control) over 60 minutes, indicating that the incubation conditions did not affect sperm motility. The results for total and progressive sperm motility are shown in Figures 1 and 2. Commercial coital lubricants caused a remarkable decrease in sperm motility, except for Pre-Seed, which exhibited no significant decline ($P>.229$) in total sperm motility after 60 minutes of incubation. However, Pre-Seed showed a minimal but significant ($P<.01$) decline in progressive sperm motility after 30 (~4%) and 60 (~7%) minutes of incubation. Astroglide induced pronounced reduction ($P<.001$) in total and progressive motility in a time-dependent manner. Exposure to KY lubricants (Sensitive, Warming, and Tingling) resulted in immediate decline ($P<.001$) in both total (range 36%–66%) and progressive (range 43%–69%) sperm motility within 5 minutes of incubation. Sperm motility continued to decline significantly under KY lubricants over 60 minutes of incubation ($P<.001$), KY Tingling being the most detrimental to sperm by inhibiting motility to negligible levels.

Sperm incubation in oils showed variable motility results. Canola oil showed a significant ($P=.003$) drop (~6%) in total motility after 30 minutes and in progressive sperm motility (~5%) after 5 minutes; however, no further significant decline in either motility was observed during the incubation. Baby oil showed a very slight (~6%) but significant decrease ($P<.02$) in total motility after 60 minutes of incubation. Progressive sperm motility in baby oil decreased (~7%; $P<.001$) after 5 minutes of incubation, and no further decline in progressive motility was observed. Sesame oil showed a continuous decline in both total and progressive sperm motility over the course of 60 minutes; however, the motility readings were not significantly different ($P>.05$) after the initial 5 minutes of incubation. Exposure of sperm to mustard oil showed very interesting results. No decline in either total or progressive sperm motility was observed ($P=.32$). These motility results were similar to the control sample; however, the motility pattern was different. Incubation under mustard oil caused persistent hyperactivation of sperm in each of the 22 individuals, and this phenomenon was not observed in any other lubricant or oil in this study.

FIGURE 1



Total sperm motility after incubation in coital lubricants and oils. *Asterisks* (*) on bars denote significant differences ($P<.05$) within treatment groups. *Hash signs* (#) on bars denote nonsignificant differences ($P>.05$) within treatment groups. Data are shown as mean ± SEM. mHTF = modified human tubal fluid.

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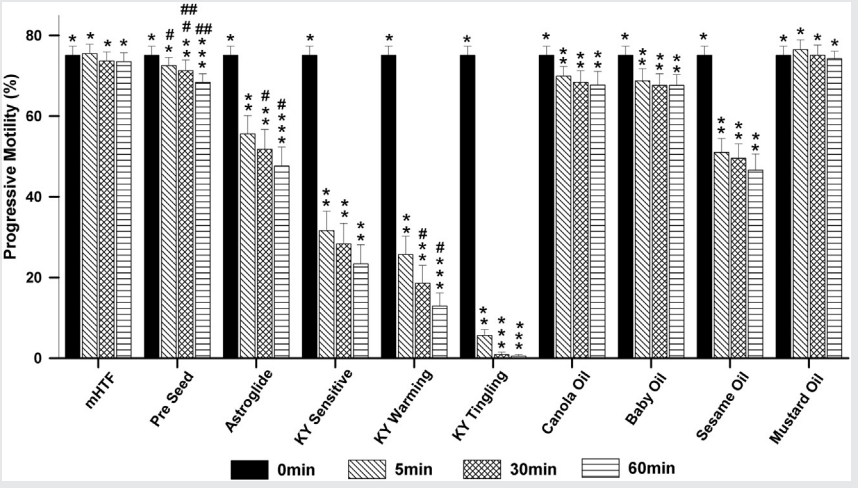
DISCUSSION

Many couples trying to conceive require a coital lubricant when suffering from vaginal dryness or discomfort during intercourse (2, 3, 14). However, couples and physicians are concerned about their effects on fertility. Present findings revealed that all commercial lubricants except Pre-Seed impaired sperm motility. The KY lubricants (Sensitive, Warming, and Tingling) were the most detrimental to sperm. The negative effect on sperm motility has been attributed to the presence of toxic chemicals, low pH, and elevated osmolality of commercial coital lubricants (5, 10, 11). Although Pre-Seed showed a slight but significant ($P<.01$) decrease in progressive sperm motility over 60 minutes of incubation, this decrease most likely would not physiologically hamper fertility. Pre-Seed is the only commercial coital lubricant formulated to relieve vaginal dryness and preserve fertility. The present results for Astroglide and Pre-Seed are in agreement with earlier studies (8, 10, 11, 13); no experimental data on the spermicidal effect of newer KY lubricants are available for comparison.

FIGURE 2



Progressive sperm motility after incubation in coital lubricants and oils. *Asterisks* (*) on bars denote significant differences ($P<.05$) within treatment groups. *Hash signs* (#) on bars denote nonsignificant differences ($P>.05$) within treatment groups. Data are shown as mean ± SEM. mHTF = modified human tubal fluid.

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Changes in total and progressive motility were variable for sperm incubated under different oils. Both total and progressive sperm motility slightly decreased after exposure to canola and baby oils; however, this decrease was not consistent. After the initial decrease, sperm motility remained stable at high levels to 60 minutes of incubation. This slight drop in motility is understandable and can be attributed to adjustment of sperm to a new microenvironment. We did not see a negative impact of canola and baby oils on sperm motility, which is in agreement with earlier findings (8, 10). This might be due to the presence of nontoxic ingredients in these oils.

Sesame and mustard oils were incorporated into the study owing to lack of information regarding their effects on sperm. Sesame oil showed an immediate drastic decline in both total and progressive sperm motility within 5 minutes of incubation. Sperm motility continued to decline nonsignificantly over the course of incubation under sesame oil. In contrast, exposure of sperm to mustard oil initiated hyperactive motility and the sperm remained hyperactive during the entire incubation period without any decline in motility. Mustard oil contains allyl isothiocyanate, an activator of transient receptor potential (TRP) A1 channel (21). The TRP channels are a group of ion channels located mostly on the plasma membrane of numerous human and animal cells (22). The presence of TRP channels in human sperm and their involvement in flagellar activity has been previously described (23). Hyperactive sperm motility observed after exposure to mustard oil in present study might be due to the activation of TRP channels. It is unknown whether this phenomenon has any impact on fertility; it warrants further research.

The present findings reaffirm the notion that not all coital lubricants and oils are alike and that individual lubricants and oils must be carefully evaluated regarding their effects on fertility. On the other hand, the coital lubricants and oils that were found to have negative effects on sperm motility should be avoided, but they also should not be considered to be effective contraceptives.

Acknowledgments: The authors are grateful to Dr. Joanna Ellington of ING Fertility, Spokane, Washington, for complimentary samples of the lubricant Pre-Seed.

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