Optimizing natural fertility: a committee opinion

Practice Committee of the American Society for Reproductive Medicine in collaboration with the Society for Reproductive Endocrinology and Infertility

American Society for Reproductive Medicine, Birmingham, Alabama

This Committee Opinion provides practitioners with suggestions for optimizing the likelihood of achieving pregnancy in couples/individuals attempting conception who have no evidence of infertility. This document replaces the document of the same name previously published in 2013, Fertil Steril 2013;100(3):631-7. (Fertil Steril® 2017;107:52–8. ©2016 by American Society for Reproductive Medicine.)

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Clinicians may be asked to provide advice about sexual and lifestyle practices relating to procreation. Currently, there are no uniform counseling guidelines or evidence-based recommendations available. This document will provide practitioners with recommendations, based on a consensus of expert opinion, for counseling couples/individuals about how they might optimize the likelihood of achieving pregnancy when there is no history of infertility or reason to question their potential fertility.

FERTILITY AND AGING

Fertility is defined as the capacity to produce a child. Whereas the likelihood of conception remains relatively stable from cycle to cycle within individuals, it generally is highest in the first months of unprotected intercourse or exposure to sperm and declines gradually thereafter in the population as a whole (1). Approximately 80% of couples will conceive in the first 6 months of attempting pregnancy (1). Monthly fecundability (the probability of pregnancy per month) is greatest in the first 3 months (1). Relative fertility is decreased by about half among women in their late 30s compared with women in their early 20s (2, 3).

Fertility varies among populations and declines with age in both men and women, but the effects of age are much more pronounced in women (2, 4) (Fig. 1). For women, the chance of conception decreases significantly after age 35 (5). Although semen parameters in men also decline detectably after 35 years of age, male fertility does not appear to be affected before approximately age 50 (4).

Infertility is a disease, defined as the failure to achieve a successful pregnancy after 12 months or more of regular unprotected intercourse or exposure to sperm (6). Earlier evaluation and treatment may be justified based on medical history and physical findings and is warranted after 6 months without conception for women over age 35 years due to the age-related decline in fertility (6).

FREQUENCY OF INTERCOURSE

In some cases, clinicians may need to explain the basics of the reproductive process. Information has emerged over the last decade that, at least in theory, may help to define an optimal frequency of intercourse. Whereas abstinence intervals greater than 5 days may adversely affect sperm counts, abstinence intervals as short as 2 days are associated with normal sperm densities (7). A widely held misperception is that frequent ejaculations decrease male fertility. A retrospective study that analyzed almost 10,000 semen specimens observed that, in men with normal semen quality, sperm concentrations and motility remain normal, even with daily ejaculation (8). Surprisingly, in men with oligozoospermia, sperm concentration and motility may be highest with daily ejaculation (8). Abstinence intervals generally also do not appear to affect sperm morphology, as judged by "strict" criteria (9). However, after longer abstinence intervals of 10 days or more, semen parameters begin to deteriorate. Although studies of semen parameters provide useful quantitative data, those data may not accurately predict the functional integrity or capacity of sperm.

Although evidence suggests that daily intercourse may confer a slight

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Reprint requests: Practice Committee, American Society for Reproductive Medicine, 1209 Montgomery Hwy, Birmingham, Alabama 35216 (E-mail: ASRM@asrm.org).

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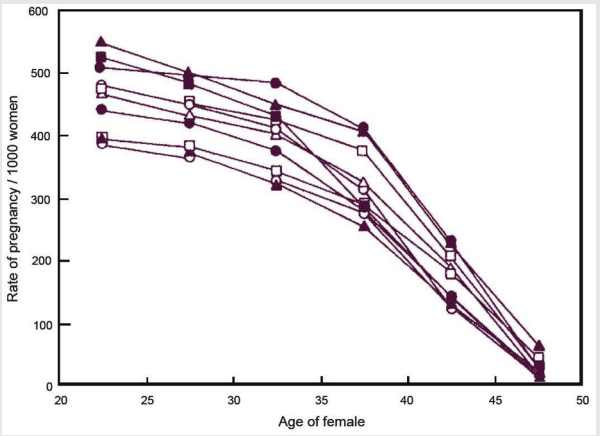
FIGURE 1



Pregnancy rate (per 1,000 women) in various populations at different times in history. Modified from Menken et al. (4). The 10 populations (in descending order at age 20 to 24) are Hutterites, marriages 1921–30 (*solid triangles*); Geneva bourgeoisie, husbands born 1600–49 (*solid squares*); Canada, marriages 1700–30 (*solid circles*); Normandy, marriages 1760–90 (*open circles*); Hutterites, marriages before 1921 (*open squares*); Tunis, marriages of Europeans 1840–59 (*open triangles*); Normandy, marriages 1674–1742 (*solid circles*); Norway, marriages 1874–76 (*open squares*); Iran, village marriages, 1940–50 (*solid triangles*); Geneva bourgeoisie, husbands born before 1600 (*open circles*).

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advantage, specific recommendations regarding the frequency of intercourse may unnecessarily induce stress. In one study involving 221 presumably fertile couples planning to conceive, the highest cycle fecundability (37% per cycle) was associated with daily intercourse (10). Intercourse on alternate days yielded a comparable pregnancy rate per cycle (33%), but the likelihood for success decreased to 15% per cycle when intercourse occurred only once weekly (10). The stress associated with trying to conceive can reduce sexual esteem, satisfaction, and the frequency of intercourse (11). These parameters are further aggravated when the timing of intercourse is linked to ovulation predictor methods or follows a strict schedule (12). Couples should be informed that reproductive efficiency increases with the frequency of intercourse and is highest when intercourse occurs every 1 to 2 days, but be advised that the optimal frequency of intercourse is best defined by their own preference within that context.

THE FERTILE WINDOW

For counseling purposes, the "fertile window" is best defined as the 6-day interval ending on the day of ovulation (10, 13). At least in theory, the viability of both oocytes and sperm should be maximal during that time. For clinical purposes, the interval of maximum fertility can be estimated by analysis of intermenstrual intervals, ovulation predictor kits, or cervical mucus scores.

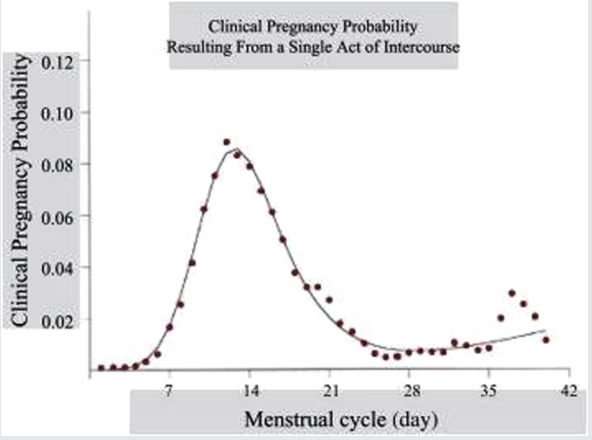
Intercourse is most likely to result in pregnancy when it occurs within the 3-day interval ending on the day of ovulation. In the study involving 221 presumed fertile women, peak fecundability was observed when intercourse occurred within 2 days prior to ovulation (10) (Fig. 2). In another family planning study, investigators combined data obtained from two cohorts, one using basal body temperature monitoring and the other using analysis of urinary estrogen/progesterone metabolites, to determine the likely time of ovulation; the likelihood of pregnancy was greatest when intercourse occurred the day prior to ovulation and started to decline on the day of presumed ovulation (14).

Among women who described their menstrual cycles as "generally regular," the likelihood of conception resulting from a single act of intercourse increases during the putative fertile window (15). The probability of clinical pregnancy increased from 3.2% on cycle day 8 to 9.4% by day 12 and decreased to less than 2% by cycle day 21. Whereas aging generally does not affect the size or nature of the fertile window, the likelihood of success decreases with increasing age (Fig. 3). In addition, cycle fecundability increases with the frequency of intercourse during the fertile window (16). Accurately predicting ovulation can be challenging with any available method. As a consequence, the likelihood of conception can be maximized by increasing the frequency of intercourse beginning soon after cessation of menses and continuing to ovulation in women having regular menstrual cycles. The length of the fertile window may vary among women, altering the likelihood of success (17). As a result, regular intercourse to optimize cycle fecundity should be recommended.

MONITORING OVULATION

The time of peak fertility can vary considerably, even among women who have regular cycles. Women who monitor their cycles and track changes in cervical mucus, libido, pain, or mood are able to predict ovulation accurately no more than 50% of the time (18). Although there is no substantial evidence that monitoring by this or other methods increases cycle fecundability, a common perception is that the timing of intercourse is crucial and therefore should be determined by

FIGURE 2



Probability of pregnancy with a single act of intercourse. Modified from Dunson et al. (14).

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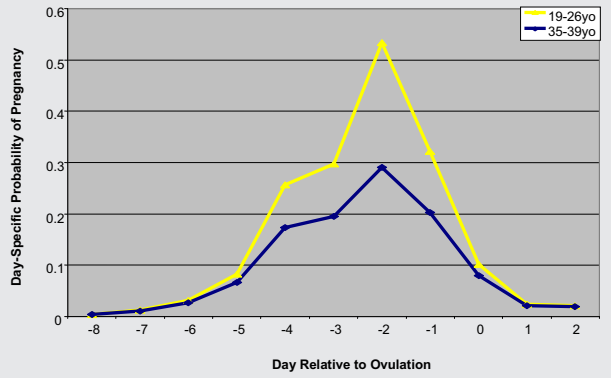
FIGURE 3



Probability of pregnancy by cycle day, involving recurrent intercourse, by age. Data from Stanford and Dunson (16).

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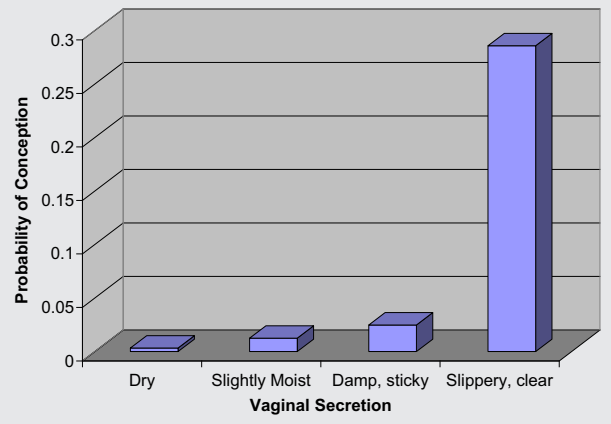
applying some form of technology. That perception has contributed much to the popularity of various methods to determine or predict the time of ovulation.

Cervical mucus (as detected by vaginal secretions at the introitus) provides an inexpensive and private index of when ovulation may be expected. The estimated probability of conception, in relation to the characteristics of cervical/vaginal secretions, is shown in Figure 4. The probability is highest when mucus is slippery and clear (19), but such mucus is by no means a prerequisite for pregnancy to occur. The volume of cervical mucus increases with plasma estrogen concentrations over the 5 to 6 days preceding ovulation and reaches its peak within 2 to 3 days of ovulation (20). A retrospective cohort study involving 1,681 cycles observed that pregnancy rates were highest (approximately 38%) when intercourse occurred on the day of peak mucus (day "0") and appreciably lower (approximately 15% to 20%) on the day

FIGURE 4



Estimates of the probability of conception according to vaginal secretion observations on the day of intercourse. Data from Scarpa et al. (19).

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before or after the peak (21). A prospective study including 2,832 cycles observed that changes in cervical mucus characteristics correlate closely with basal body temperature and predict the time of peak fertility more accurately than a menstrual calendar (22).

Ovulation detection devices, including kits for monitoring urinary luteinizing hormone (LH) excretion and electronic monitors, are promoted widely as tools that can help couples to determine their "fertile time" (23). There is some evidence to suggest that LH detection kits may underestimate the fertile window (24). Although numerous studies have validated the accuracy of methods for detecting the midcycle urinary LH surge (25–27), ovulation may occur anytime within the 2 days thereafter (27, 28), and false-positive test results occur in approximately 7% of cycles (29). Although urinary LH monitoring may help to reduce the time to conception in couples having infrequent intercourse by choice or circumstance, one large study found that changes in cervical mucus across the fertile interval predict the day-specific probabilities of conception as well as or better than basal body temperature or urinary LH monitoring (30).

COITAL PRACTICES

Postcoital routines may become ritualized for couples trying to conceive. Although many women think that remaining supine for an interval after intercourse facilitates sperm transport and prevents leakage of semen from the vagina, the belief has no scientific foundation.

Sperm deposited at the cervix at midcycle are found in the fallopian tubes within 15 minutes (31). Furthermore, sperm traverse the fallopian tube and are expelled into the peritoneal cavity rather than collecting in the ampullary portion of the fallopian tube (31). Studies in which labeled particles were placed in the posterior vaginal fornix at varying times of the cycle observed their transport into the fallopian tubes within as little as 2 minutes during the follicular phase (32). It is interesting that the particles were observed only in the tube adjacent to the ovary containing the dominant follicle and not in the contralateral tube. The number of transported particles increased with the size of the dominant follicle and after administration of oxytocin, given to simulate the increase in oxytocin observed in women during intercourse and orgasm.

There is no evidence that coital position affects fecundability. Sperm can be found in the cervical canal seconds after ejaculation, regardless of coital position. Although female orgasm may promote sperm transport, there is no known relationship between orgasm and fertility. There also is no convincing evidence to indicate any relationship between specific coital practices and infant gender.

Some vaginal lubricants may decrease fertility based on their observed effects on sperm survival in vitro. Whereas commercially available water-based lubricants (e.g., Astroglide [Biofilm, Inc.], K-Y Jelly [Johnson & Johnson], and K-Y Touch [Johnson and Johnson]) inhibit sperm motility in vitro by 60% to 100% within 60 minutes of incubation, canola oil has no similar detrimental effect (33). K-Y Jelly, olive oil, and saliva diluted to concentrations even as low as

6.25% adversely affect sperm motility and velocity, but mineral oil has no such effect (33–35).

Hydroxyethylcellulose-based lubricants such as Pre-Seed (INGfertility) and ConceivEase (Reproductive Laboratory) also have no demonstrable adverse impact on semen parameters (36). Although some lubricants adversely affect sperm parameters in vitro, the use of lubricants in couples attempting conception was shown not to affect the cycle fecundability (37). Given the differing effects of lubricants in vitro compared to practice, it seems prudent to recommend mineral oil, canola oil, or hydroxyethylcellulose-based lubricants when they are needed.

DIET AND LIFESTYLE

Fertility rates are decreased in women who are either very thin or obese, but data regarding the effects of normal variations in diet on fertility in ovulatory women are few (Table 1) (44). Whereas a healthy lifestyle may help to improve fertility for women with ovulatory dysfunction (38), there is little evidence that dietary variations such as vegetarian diets, low-fat diets, vitamin-enriched diets, antioxidants, or herbal remedies improve fertility or affect infant gender. Elevated blood mercury levels from heavy seafood consumption have been associated with infertility (45). Women attempting to conceive should be advised to take a folic acid supplement (at least 400 mcg daily) to reduce the risk for neural tube defects (46).

Smoking

Smoking has substantial adverse effects on fertility. A large meta-analysis comparing 10,928 smoking women with 19,128 nonsmoking women found that smoking women were significantly more likely to be infertile (odds ratio [OR] 1.60; 95% confidence interval [CI], 1.34–1.91) (39). The observation that menopause occurs, on average, 1 to 4 years earlier in smoking women than in nonsmoking women suggests that smoking accelerates the rate of follicular depletion (47, 48). Smoking also is associated with an increased risk of miscarriage, in both naturally conceived pregnancies and those resulting from assisted reproductive technologies (49, 50). Although decreases in sperm density and motility and abnormalities in sperm morphology have been observed in men who smoke, available data do not demonstrate conclusively that smoking decreases male fertility (51–53). The effects of smoking on fertility in men and women and the mechanisms that may explain its adverse impact are discussed at length in a separate Practice Committee report (54).

TABLE 1

Lifestyle factors that affect infertility.

Factor	Impact on fertility	Study
Obesity (BMI >35)	Time to conception increased 2-fold	Clark (38)
Underweight (BMI <19)	Time to conception increased 4-fold	Clark (38)
Smoking	RR of infertility increased 60%	Augood (39)
Alcohol (>2 drinks/d)	RR of infertility increased 60%	Eggert (40)
Caffeine (>250 mg/d)	Fecundability decreased 45%	Wilcox (41)
Illicit drugs	RR of infertility increased 70%	Mueller (42)
Toxins, solvents	RR of infertility increased 40%	Hruska (43)

Note: BMI = body mass index; RR = relative risk.
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Alcohol

The effect of alcohol on female fertility has not been clearly established. Whereas some studies have concluded that alcohol has a detrimental effect, others have suggested that alcohol may enhance fertility. A prospective survey of 7,393 women in Stockholm observed that the risk of infertility was significantly increased (relative risk [RR] 1.59; 95% CI, 1.09–2.31) among women who consumed 2 alcoholic drinks/day and decreased (RR 0.64; 95% CI, 0.46–0.90) for those who consumed less than 1 drink/day (40). Other studies have shown a trend toward higher alcohol consumption and decreased conception (55–57).

In contrast, data obtained by self-report from 29,844 pregnant Danish women have suggested that time to conception was shorter for women who drink wine than for women who consume no alcohol (58). However, a study involving 1,769 postpartum Italian women found no relationship between alcohol consumption and difficulty conceiving (59).

Higher levels of alcohol consumption (>2 drinks/day, with 1 drink >10 g of ethanol) probably are best avoided when attempting pregnancy, but there is limited evidence to indicate that more moderate alcohol consumption adversely affects fertility. Of course, alcohol consumption should cease altogether during pregnancy because alcohol has well-documented detrimental effects on fetal development, and no "safe" level of alcohol consumption has been established (60). In men, alcohol consumption has no adverse effect on semen parameters (53).

Caffeine

High levels of caffeine consumption (500 mg; >5 cups of coffee/day or its equivalent) have been associated with decreased fertility (OR 1.45; 95% CI, 1.03–2.04) (61). During pregnancy, caffeine consumption over 200 to 300 mg/day (2–3 cups/day) may increase risk for miscarriage (41, 62, 63) but does not affect risk for congenital anomalies (64). In one trial involving 1,207 women who were randomly assigned to drink decaffeinated versus caffeinated coffee (at least 3 cups/day) during pregnancy, there were no observed differences between the two groups in gestational age at delivery or in infant weight, length, head circumference, or abdominal circumference (65). Overall, moderate caffeine consumption (1 to 2 cups of coffee per day or its equivalent) before or during pregnancy has no apparent adverse effects on fertility or pregnancy outcomes. In men caffeine consumption has no effect on semen parameters (55).

OTHER CONSIDERATIONS

The effects of marijuana and other recreational drugs are difficult to determine because their use is illegal. Nevertheless,

such drug use generally should be discouraged for both men and women, particularly because they have well-documented harmful effects on the developing fetus (66). One study found that the prevalence of infertility was increased in ovulatory women who reported using marijuana (RR 1.7; CI 95%, 1.0–3.0) (42). Marijuana use has no significant effect on semen parameters (53).

A literature review concluded that sauna bathing does not decrease female fertility and is safe during uncomplicated pregnancy (67). In normal men, recommendations for behavioral modifications aimed at controlling or decreasing exposure of the testicles to sources of heat are unsupported (53, 68).

Exposure to environmental pollutants and toxicants is being recognized as a potential cause of reduced fertility. Although information is now limited, it is increasing rapidly. Fecundability may be decreased in women exposed to certain toxins and solvents such as those used in the dry cleaning and printing industries, and men exposed to heavy metals may be more likely to have abnormal semen parameters (43). Pesticide exposure may be a concern for agricultural workers. A recent review and meta-analysis found that when job title was used as proxy for exposure, fecundability ratios (FR) were decreased for both men (FR 0.95; 95% CI, 0.84–1.08) and women (FR 0.89; 95% CI, 0.82–0.97) (69). A growing body of studies are evaluating the effect of pesticide exposure on sperm parameters (70). In addition, animal studies have demonstrated clearly that environmental exposures can have important reproductive consequences (71–75). For example, exposure to lead and industrial microwaves is probably best avoided or minimized (76). Prescription and over-the-counter drug use must be carefully controlled and must be managed on an individual basis.

SUMMARY

- The ''fertile window'' spans the 6-day interval ending on the day of ovulation and correlates with the volume and character of cervical mucus.
- Frequent intercourse (every 1 to 2 days) during the fertile window yields the highest pregnancy rates, but results achieved with less frequent intercourse (2 to 3 times per week) are nearly equivalent.
- Specific coital timing or position and resting supine after intercourse have no significant impact on fertility.
- Devices designed to determine or predict the time of ovulation may be useful for couples who have infrequent intercourse.
- Moderate alcohol (1 to 2 drinks per day) or moderate caffeine consumption may have an adverse effect on fertility.

RECOMMENDATIONS

- Time to conception increases with age. For women over age 35 years, consultation with a reproductive specialist should be considered after 6 months of unsuccessful efforts to conceive.
- For women having regular menstrual cycles, intercourse every 1–2 days starting prior to the fertile window can help to maximize fecundability.
- Smoking, higher levels of alcohol consumption (>2 drinks per day), recreational drugs, and use of most commercially available vaginal lubricants should be discouraged for couples trying to conceive.

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This document was reviewed by ASRM members and their input was considered in the preparation of the final document. The following members of the ASRM Practice Committee participated in the development of this document. All Committee members disclosed commercial and financial relationships with manufacturers or distributors of goods or services used to treat patients. Members of the Committee who were found to have conflicts of interest based on the relationships disclosed did not participate in the discussion or development of this document.

Samantha Pfeifer, M.D.; Samantha Butts, M.D., M.S.C.E.; Gregory Fossum, M.D.; Clarisa Gracia, M.D., M.S.C.E.; Andrew La Barbera, Ph.D.; Jennifer Mersereau, M.D.; Randall Odem, M.D.; Richard Paulson, M.D.; Alan Penzias, M.D.; Margareta Pisarska, M.D.; Robert Rebar, M.D.; Richard Reindollar, M.D.; Mitchell Rosen, M.D.; Jay Sandlow, M.D.; Michael Vernon, Ph.D.

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