

Is Human Ovulation Concealed? Evidence From Conception Beliefs in a Hunter-Gatherer Society

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Received December 10, 2001; revision received October 26, 2003; accepted December 11, 2003

Several researchers have suggested that ovulation may not be concealed in humans living under natural conditions with minimal hygiene. Because measuring coital frequency in such a population is problematic, I tested this proposition indirectly by asking Hadza hunter-gatherers of Tanzania when a woman can get pregnant. If people (1) know that pregnancy is caused by sex, and people (2) say that women conceive in the middle of the menstrual cycle, we might infer that people think women conceive in the middle of the cycle because most copulations occur then. If copulation peaks strongly around ovulation, it is not concealed. The Hadza know that pregnancy is caused by sex but most say conception occurs right after menstruation ends. Hadza conception beliefs therefore do not suggest that ovulation is more detectable in humans under more natural conditions.

KEY WORDS: concealed ovulation; conception beliefs; Hadza; menstruation.

INTRODUCTION

In most species of mammals, it is not difficult to know when a female is most likely to conceive. Even when there is no loud advertisement of ovulation such as a sexual swelling, there is usually a periovulatory period during which females accept copulations (receptivity peaks) or actively solicit them (proceptivity peaks) and become highly attractive to males (attractivity peaks). In the vast majority of primate species copulations are concentrated around ovulation (Hrdy & Whitten, 1987). In contrast, there is no obvious cue to ovulation in women. Outside menses, attractivity remains fairly constant across the menstrual cycle, as reflected in an impressively flat coital frequency, at least in comparison to almost all other primate species in the wild. Some studies have found a slight peak around ovulation, some just before menses, but most have found the strongest peak right after menses, though nearly all are nonsignificant peaks, at least in complex societies (Bancroft, 1989; Gray & Wolfe, 1983; Hedricks, 1994; James, 1971; Manson, 1986; Morris & Udry, 1982). However, it has been suggested ovulation may not be so concealed among humans living under

more natural conditions where less emphasis on hygiene might mean olfactory cues are detectable (Manning, Scutt, Whitehouse, Leinster, & Walton, 1996; Pawlowski, 1999; Singh & Bronstad, 2001; Small, 1996; Steklis & Whiteman, 1988; Stern & McClintock, 1998). This would presumably result in a strong peak in copulations at midcycle.

Selection will always favor males who are better able to detect ovulation and find females more attractive when they are ovulating because this would cause such males to increase their mating effort when they have the best chance of siring offspring. Therefore, if ovulation is not concealed, there should be a rise in female attractivity and male-initiated copulation at midcycle. Ideally then, we would like to measure coital frequency across the cycle to test if ovulation is detected. Unfortunately, this would be near impossible in a nonliterate, small-scale society with little privacy. An alternative way to investigate this question indirectly is to inquire about conception beliefs.

Clearly, individual animals do not need to be conscious of conception or when conception occurs for ovulation to be detected. The best evidence that ovulation is detected, consciously or not, is simply a noticeable increase in copulation around ovulation; however, humans are conscious of many things that exhibit a temporal pattern. Therefore, if there is a noticeable midcycle

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rise in coital frequency, and if people know sex is the cause of pregnancy, they might say women conceive during midcycle, which might imply that ovulation is not so concealed. To see if people living under more natural conditions might detect ovulation, I asked men and women in a hunter-gatherer society, the Hadza of Tanzania, when a woman can get pregnant.

METHOD

Participants

The Hadza are mobile hunter-gatherers who live in a savanna-woodland habitat in northern Tanzania. They live in camps that average about 30 people and move about once every month or two. Altogether, there are about 1000 speakers of the Hadza language (Blurton Jones, O'Connell, Hawkes, Kamuzora, & Smith, 1992). Women dig wild tubers, pick berries, and gather baobab fruit while men collect wild honey and hunt mammals and birds with bow and arrow. There is a dry season from June through November, during which time camps grow larger because they must be near the few permanent waterholes. Drinking water is precious and there is too little to waste on thoroughly washing oneself, so people do not bathe for long periods. The whole year round, Hadza have a strong smell of smoke since they are so often near their hearths. They are also covered with dirt as they sit and lie on the ground. Because they live in a semiarid habitat and sweat little compared to Europeans, their smell seems less influenced by sweat. Most also have almost no body hair.

The Hadza do not use any form of contraception or practice infanticide. Some Hadza say there is a postpartum taboo on sex but it does not appear to be very strictly observed given the occasionally short birth interval. The total fertility rate or number of births to women who have reached menopause is 6.2 (Blurton Jones et al., 1992). Hadza women usually marry around age 17 or 18 and have their first child at age 19. Men usually marry around age 20 or 21. Marriage is recognized when a couple begins living together, which usually follows a brief secret courtship and premarital sex. There is usually no ceremony. Polygyny is rare but divorce is common so serial monogamy is the best way to characterize the mating system. More detail on the mating system, which my research focuses on, can be found elsewhere (Marlowe, 1999a, 1999b, 2003, in press).

I interviewed 84 adults, 46 men and 38 women. Men's ages ranged from 18 to 70 years (M , 37), women's ages ranged from 13 to 54 years (M , 29). Although men were significantly older, there were no age trends

in answers, so age is ignored below. Of those interviewed, 75% were married (85% of males and 63% of females). Only one person did not know sex causes pregnancy. Most Hadza not only know pregnancy is caused by sex but also know, judging from conversations I have had, that semen is involved.

Measures and Procedure

I interviewed individually and in private most Hadza adults in six camps. The people in these camps ($n = 218$) comprised the majority of the 300 or so Hadza who are still living as full-time foragers. All interviews were conducted in Swahili, which all Hadza (except those under 4 years old and a few very old women) are fluent in as a second language. All adults consented to interviews but I did not interview a few of the oldest women because of their limited Swahili. I asked, "How does a woman get pregnant?" After establishing whether or not participants knew that pregnancy results from sex, I asked, "When can a woman get pregnant?" I could not ask, "When does ovulation occur?" since the Hadza have never heard of ovulation. Based on what they said, I classified their answers into four phases of the menstrual cycle: (1) "during menses" (day 1–5), (2) "right after menses" (day 6–8), (3) "during midcycle" (day 9–25), (4) "right before menses" (day 26–28), plus two other categories, (5) "other answers," which included answers like, "any day but her period," or "any day of the month," and (6) those who said they "did not know."

I used day 9–25 as midcycle or periovulatory period, which is much wider than the actual conception window of about 3–6 days around ovulation at day 14 (or more precisely, 14 days before the following menstruation). I did this in order to count as "during midcycle" as many of their answers as possible and therefore make it difficult to reject the hypothesis that ovulation is detected. I also did this because the Hadza language (Hadzane) only has numbers up to four and beyond that borrows from Swahili, which means they are not good at counting and were unlikely to say something like, "9 days after menses." If they said several days or a week after menses, I counted this as "during midcycle." Only answers that were explicit about the number of days being 3 or less before or after menses were coded as such. This means that all answers classified as "during midcycle" definitely include all people who might even be close to knowing when a woman can conceive.

Binominal tests were used to compare the frequencies of answers given to the expected values within each phase of the menstrual cycle under a null hypothesis that,

by chance, each day of a 28-day cycle is an equally likely answer. Answers were also tested against a null hypothesis that only the 23 days outside menses should count.

RESULTS

The largest percentage of men and women, 46.4%, said that a woman conceives “right after menses.” This usually meant the very day she washes as soon as her period stops. The second most common answer was “right before menses” at 15.5%. There was a tie between “during midcycle” and “during menses,” each with 9.5% (Table I). The 8.3% who said they did not know when a women can get pregnant (which included the one person who did not know sex causes pregnancy) were all women, which may be related to the greater sexual modesty of women.

For all further analyses, I excluded both those who said “do not know” and those who fell into the “other answers” category. This left 68 people (38 men and 30 women). Among women, 20% said conception occurs “during menses,” compared to only 5.3% of men. Among men, 65.8% said conception occurs “right after menses” compared to 46.7% of women (Table I). There were only 13.2% of men and 10% of women who said conception occurs “during midcycle.”

The null or expected likelihood of saying “during midcycle,” treating each day like the next, is that percentage of a 28-day cycle that falls between days 9–25, which is 60.7% (Fig. 1). The percentage should, of course, be even higher than chance if ovulation is actually detected. The number of Hadza saying “during menses” was not significantly different from chance. However, the number of people saying “during midcycle,” 11.8%, was significantly less than the expected 60.7%, while

the number saying “right after menses,” 57.4%, was significantly greater than the expected 10.7%. There were also significantly more people who said conception occurs “right before menses,” 19.1%, than the expected 10.7% (see Table I and compare Fig. 1 to Fig. 2). In an even more onerous test counting as “during midcycle” all those answers between days 9–25, but counting only the 3 days around ovulation as the expected frequency, there were still no more people saying “during midcycle,” 11.8%, than expected, 10.7%.

One might argue that a null hypothesis should consider only those days outside menses. Therefore, I also compared Hadza answers to a null hypothesis of equal likelihood for each of the 23 days outside menses and a 0% chance of saying “during menses.” Still, fewer than expected said “during midcycle” and more than expected said “right after menses.”

DISCUSSION

More than 50% of all Hadza interviewed (57.4% of those assigned to the four phases) believed women conceive right after menstruation. People in many other preindustrial societies have the same belief (Paige & Paige, 1981; Strassman, 1996, 1999). In the case of the Dogon of Mali, Strassman (1999) attributed this to the knowledge that domestic animals, like dogs and cows, are most fertile right after pre-estrus bleeding. In the case of the Hadza, this is less likely, since they have no domestic animals (though occasionally some camp will have one dog). They would either infer this from wild animals or from their own pattern of sexual activity. Since the Hadza, unlike Americans (Small, 1996), have no knowledge of ovulation, it is possible they are influenced by a

Table I. Hadza Answers to the Question, “When Can a Woman Get Pregnant?”

Sample	Menstrual Cycle Phase					
	During menses % (n)	Right after menses % (n)	During midcycle % (n)	Right before menses % (n)	Other answers % (n)	Do not know % (n)
Males						
All answers	4.3 (2)	54.3 (25)	10.9 (5)	13.0 (6)	17.4 (8)	0.0 (0)
In 4 phases	5.3 (2)	65.8 (25)	13.2 (5)	15.8 (6)	NA	NA
Females						
All answers	15.8 (6)	36.8 (14)	7.9 (3)	18.4 (7)	2.6 (1)	18.4 (7)
In 4 phases	20 (6)	46.7 (14)	10 (3)	23.3 (7)	NA	NA
Combined						
All answers	9.5 (8)	46.4 (39)	9.5 (8)	15.5 (13)	10.7 (9)	8.3 (7)
In 4 phases	11.8 (8)	57.4 (39)	11.8 (8)	19.1 (13)	NA	NA
Expected	17.9	10.7	60.7	10.7		
Observed	11.8	57.4	11.8	19.1		
Probability	<i>p</i> = .123	<i>p</i> < .0005	<i>p</i> < .0005	<i>p</i> = .020		

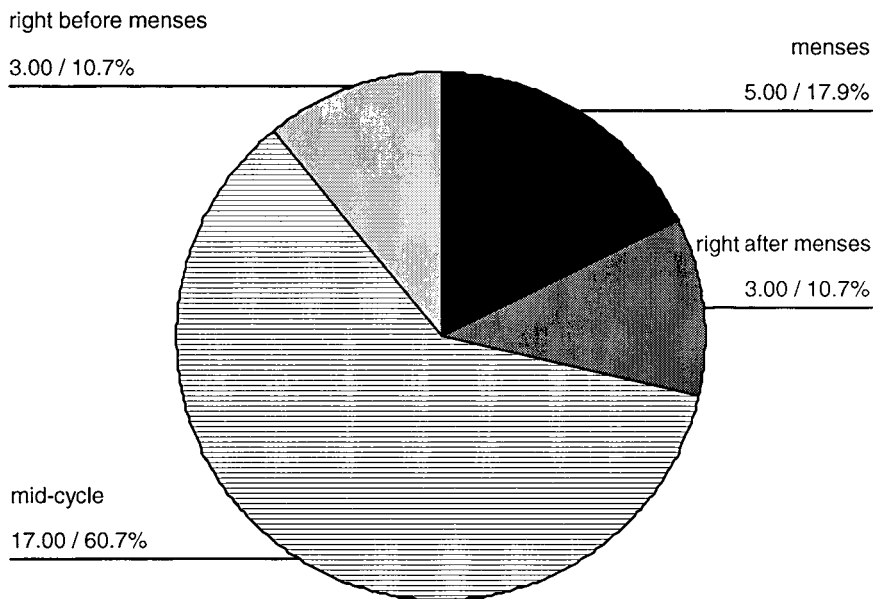


Fig. 1. Menstrual cycle phases Hadza answers could fall within, showing number of days and percent of the 28-day cycle each phase represents in the null hypothesis.

postmenstrual peak in copulation or at least male desire following 5 days of abstinence during menses, something that has been found in other populations (Dixson, 1998; Manson, 1986; Morris & Udry, 1982; Wood, 1994).

What should we make of the 9.5% who thought women conceive during menses? Since it was mostly women who said “during menses,” this could reflect a greater willingness on the part of women than men to engage in sex during menstruation. Menstruation

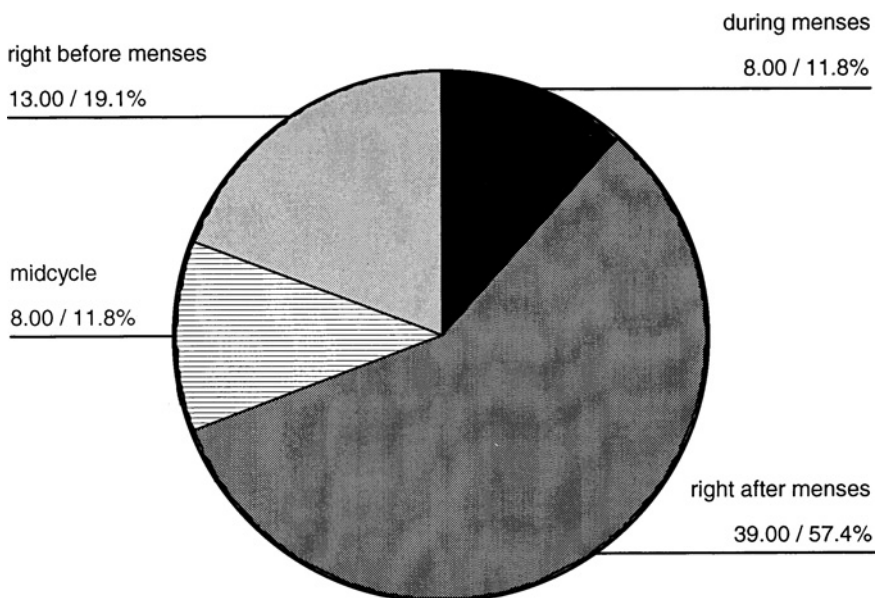


Fig. 2. Number and percent of Hadza whose answers to the question, “When can a woman get pregnant,” fell in the 4 menstrual cycle phases, used to compare to the null hypotheses shown in Fig. 1(a) [*n* = 68; 38 males, 30 females].

constitutes a clear sign of temporary nonfertility in humans, given that it is so copious. We should, therefore, expect female attractiveness to drop at menses, as apparently it does, given the commonly reported menstrual hiatus in copulation cross-culturally (Ford & Beach, 1951). The largely flat frequency of sex through the rest of the cycle then suggests that men may attempt to detect ovulation but that the best they can achieve is a decreased interest in copulation during menses and an increased interest at all other times, waiting until menstruation ends and then having sex regularly starting the day after. So long as desire increases with each day of abstinence, this alone would produce a peak in coital frequency following the five days of menstrual sexual abstinence (Manson, 1986).

Assuming people's beliefs about time of conception are influenced by cyclical changes in desire or other feelings, there is no evidence that Hadza women experience a marked increase in midcycle proceptivity since women were no more likely than men to say women conceive "during midcycle." Women's answers overall were, in fact, further from the reality of conception than men's answers. One of several hypotheses for concealed ovulation proposes it evolved to keep a woman herself from knowing when she could opt out of getting pregnant (Burley, 1979). But those who argue that ovulation might not be so concealed usually point to evidence of subtle changes in women's desire or behavior across the cycle (Pawlowski, 1999; Small, 1996). Although it is important if women can subconsciously keep track of their own ovulation, since this would give them greater ability to choose the sires of their offspring, it is concealment from others that is presumably the goal of concealed ovulation. The only reason ovulation would be difficult to detect at all is that an arms race between detection and concealment has been won by women. If it were in the interest of women for men to detect ovulation, then it would be easy to detect, since selection will favor males who can detect it.

Men may be capable of detecting a smell they find attractive at ovulation when their noses are close to a vagina or, as in the case of one experiment, t-shirts worn by women (Singh & Bronstad, 2001). However, if it requires being that close, it would usually be the case that the men were already engaged in precopulatory foreplay with the woman and may therefore have little consequence. This ability then would be little more than evidence that males have been selected to try to detect ovulation but have largely failed to overcome the selection on females to conceal it.

In most species of mammals, not only is the timing of ovulation obvious to the males of the species in question, it is obvious even to the human observer. In cross-species perspective, the most remarkable thing about humans

using daily diaries to record coital frequency is not the slight peak found in different phases of the cycle but the lack of a really strong peak at ovulation. Some have suggested that hunter-gatherers might have a better chance of detecting ovulation than we in industrialized societies do. However, because the Hadza smell so strongly of smoke (something that must have been true of all our fire-using ancestors presumably for the last few hundred thousand years), it is possible that it is even more difficult for them to detect ovulation. Given that the Hadza know that pregnancy is caused by sex, if a large percentage had said women conceive "during midcycle," we might surmise that they thought so because of a marked peak in copulation frequency at midcycle, and that ovulation is not concealed. Since the Hadza did not know when a woman can conceive, their conception beliefs provide no hint of a periovulatory peak in female attractiveness or coital frequency, and thus no evidence that ovulation is any less concealed among people living under natural conditions than it is in our hygiene-conscious culture.

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