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Does Semen Have Antidepressant Properties?

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In a sample of sexually active college females, condom use, as an indirect measure of the presence of semen in the reproductive tract, was related to scores on the Beck Depression Inventory. Not only were females who were having sex without condoms less depressed, but depressive symptoms and suicide attempts among females who used condoms were proportional to the consistency of condom use. For females who did not use condoms, depression scores went up as the amount of time since their last sexual encounter increased. These data are consistent with the possibility that semen may antagonize depressive symptoms and evidence which shows that the vagina absorbs a number of components of semen that can be detected in the bloodstream within a few hours of administration.

KEY WORDS: semen; depressive symptoms; vaginal absorption; condom use; sexual activity.

INTRODUCTION

When it comes to mental and emotional problems, one of the most consistent sex differences involves the prevalence of depression. Females are more prone to develop depressive disorders than males (Shanfield & Swain, 1984; Thomas & Striegel, 1994; Vance, Boyle, Najman, & Thearle, 1995). The incidence of clinical depression in females exceeds that shown by males by a factor of three to five times (Culbertson, 1997). In females, depression is often associated with different reproductive outcomes such as death of a child, miscarriage, and menopause (Suarez & Gallup, 1985).

In reviewing the literature on vaginal absorption of seminal products, Ney (1986) hypothesized that semen may have an effect on mood in women. Hormones in seminal plasma include testosterone, estrogen, follicle stimulating hormone and luteinizing hormone, prolactin, and a number of different prostaglandins. Many of the compounds present in human semen can be absorbed through the vagina (Benziger & Edleson, 1983). Both testosterone and estrogen are absorbed through vaginal epithelium (Rigg, Milanes, Villanueva, & Yen, 1977; Schiff, Tulchinsky, & Ryan, 1977; Wester, Noonan, & Maibach, 1980). Although little research has been conducted on the vaginal absorption of prolactin, the absorption and subsequent rise in estrogen levels triggers an increase in prolactin as well (Keller, Riedmann, Fischer, & Gerber, 1981; Yamazaki, 1984). Some prostaglandins have been shown to be absorbed rapidly from the vagina, namely E1, E2, and F2 α (Eliasson & Posse, 1965; Sandberg, Ingelman-Sundbery, Ryden, & Joelsson, 1968) and testosterone is absorbed more quickly through the vagina than through the skin (Wester et al., 1980).

To test Ney's hypothesis, we measured depressive symptoms in college females as a function of sexual activity and condom use. Consistency of condom use was used to index the presence of semen in the female reproductive tract.

METHODS

Participants were recruited as volunteers from upper division undergraduate courses at the State University of New York at Albany. The study was approved by the local institutional review board and subject participation was strictly optional. A sample of 293 college females agreed to fill out an anonymous, written questionnaire designed to measure various aspects of their sexual behavior, including frequency of sexual intercourse, number of days since their last sexual encounter, and types of contraceptives

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used. Among the sexually active females in the sample, the use of condoms was taken as an indirect measure of the presence of semen in the reproductive tract. Frequency of sexual intercourse was transposed into number of coital acts per year. Each respondent was also asked to complete the Beck Depression Inventory, which is a widely used measure of individual differences in depressive symptoms (Beck, 1961; Winter, Steer, Jones-Hicks, & Beck, 1999).

RESULTS

Most of the respondents answered most of the questions, but in a few instances items were left blank. The majority of females in the sample were sexually active (87%, $N = 256$). As depicted in Table I, depression scores on the Beck Depression Inventory (BDI) among the sexually active respondents were found to vary as a function of condom use ($F[4, 292] = 5.72$, $p < .001$). Post hoc comparisons based on Fisher's LSD showed that females who engaged in sexual intercourse but never used condoms exhibited significantly lower scores on the BDI than those who usually ($p < .001$) or always ($p < .05$) used condoms. Females who engaged in sexual intercourse but did not use condoms also evidenced significantly lower levels of depressive symptoms than those who abstained from sexual intercourse ($p < .001$). However, depression scores between females who used condoms and those who did not engage in sexual intercourse were not significantly different.

Significant correlations were found between BDI scores and the length of time (in days) since engaging in sexual intercourse. For females who did not use condoms, length of time since their last sexual encounter was correlated with depressive symptoms ($r = .229$, $p < .05$). The same was true for females who reported using condoms some of the time ($r = .318$, $p < .05$). However, for those who used condoms most or all of the time these correlations were near zero and not significant. Thus, for sexually active females who did not typically use condoms, depressive symptoms increased as the amount of time since their last sexual encounter increased.

Table I. Female Condom Use and Scores on the Beck Depression Inventory

		BDI scores	
Condom use	*N*	*M*	*SD*
Never	88	8.00	6.58
Sometimes	54	10.54	7.60
Usually	38	15.13	11.22
Always	76	11.33	8.45
No intercourse	37	13.59	11.42

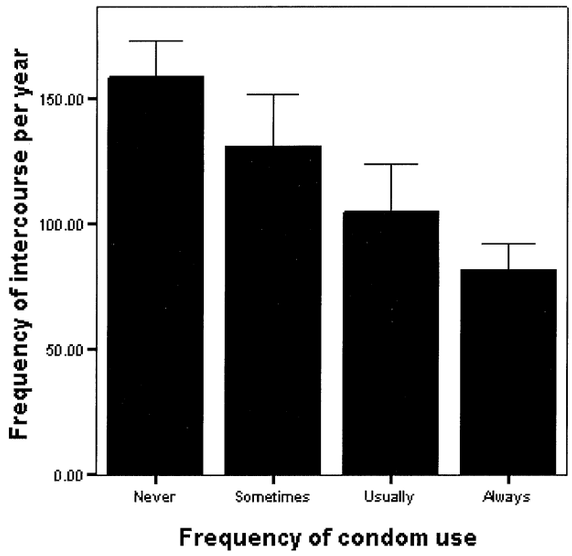

Fig. 1. Frequency of sexual intercourse as a function of the consistency of condom use.

Participants were also asked to respond to questions about how often they engaged in sexual intercourse. As shown in Fig. 1, there were differences in the incidence of intercourse among the different condom groups ($F[3, 252] = 5.47$, $p < .001$), with the frequency of sexual intercourse being inversely proportional to the consistency of condom use ($r = -.248$, $p < .001$). Fisher's LSD showed that females who did not use condoms had sex more often than those who used condoms most of the time ($p < .05$) and those who used condoms all of the time ($p < .001$).

To determine whether being in a relationship might affect depression scores, respondents were subdivided into two groups: those who were currently in a relationship with a member of the opposite sex ($N = 185$) and those who were not ($N = 98$). The BDI scores between females who were in a relationship ($M = 10.17$, $SD = 8.46$) and those that were not ($M = 12.11$, $SD = 9.55$) were not significantly different. Likewise, length of the relationship did not correlate with depressive symptoms. The only correlate of the relationship that approached significance was the frequency of sexual intercourse, which was inversely proportional to the length of the relationship ($r = -.134$, $p = .07$).

A multiple regression analysis of BDI scores, with condom use, days since intercourse, frequency of

Table II. Multiple Regression Analysis of BDI Scores

Predictor	*t*-statistic	Beta
Condom use	3.39*	.25
Days since sex	0.79	.061
Frequency of sex	1.54	.118
Duration of relationship	60	.045

*$p < .05$.

Au: Kindly check whether the *t*-statistic value for duration of relationship is 60 or 0.60.

intercourse, and duration of the relationship as predictors was computed and the results are depicted in Table II. Although the overall effect was modest ($R^2 = .076$), condom use accounted for more variance in depression than any of the other predictors, and the proportion of variance (.25) due to condom use was greater than that of all of the other predictor variables combined.

In contrast to condoms, the use of oral contraceptives appeared to have no effect on depressive symptoms. Females who were using condoms and oral contraceptives ($N = 70$) showed BDI scores ($M = 12.24$) that did not differ from those ($N = 93$) who were using condoms alone ($M = 11.38$). Collapsing across condom use categories there were no significant differences in depressive symptoms for those who used oral contraceptives and those who did not.

Finally, females were asked if they had ever attempted suicide. Only 4.5% of the "never" use condom group had attempted suicide, in comparison to 7.4% for the "sometimes" use group, 28.9% in the "usually" use group, and 13.2% in the "always" use condom group. Those that usually and always used condoms were significantly more likely to have attempted suicide than those that never and sometimes used condoms ($\chi^2[1, N = 256] = 8.00$, $p < .005$). As was true for depressive symptoms, females who abstained from sexual intercourse showed an incidence of suicide attempts (13.5%) comparable to those that had sex but always used a condom.

DISCUSSION

It is important to acknowledge that these data are preliminary and correlational in nature, and as such are only suggestive. More definitive evidence for antidepressant effects of semen would require more direct manipulation of the presence of semen in the reproductive tract and, ideally, the measurement of seminal components in the recipient's blood.

Although our findings raise more questions than they answer, they do show that the level of depressive symptoms among sexually active female college students is related to the consistency of condom use. Females who had sex without condoms, and therefore would be more likely to have semen in their reproductive tract, evidenced significantly fewer depressive symptoms than those who used condoms (see Table I). Consistent with the hypothesis that there may be something about semen that antagonizes depression, females who were having sex without condoms also showed lower depression scores than those who were abstaining from sex altogether. The fact that depression scores among females who were not having sex did not differ from those who were using condoms demonstrates that it is not sexual activity per se that antagonizes depression.

Among sexually active females who never used condoms or only used condoms some of the time, there was a significant correlation between depression scores and how long it had been since they had sexual intercourse. In other words, depressive symptoms among females who did not typically use condoms increased as a function of the elapsed time since their last sexual encounter. One account of this relationship might be that females who do not use condoms are having sex partly to alleviate depressive symptoms. In support of this hypothesis, we found that the frequency of sexual intercourse was inversely proportional to the consistency of condom use (see Fig. 1). Indeed, females who did not use condoms were having sex almost twice as often as those who always used condoms.

In terms of the relationship between condom use and depressive symptoms, it is also important to comment on the differences in suicide attempts. Sexually active females who usually or always used condoms were more likely to report having attempted suicide than those who never or only sometimes used condoms. Likewise, in much the same way that was true of depression scores, those who abstained from having sex were equivalent to those that typically used condoms in terms of the proportion of respondents who admitted a prior suicide attempt.

It is important to acknowledge and comment on several possible alternative accounts of our findings. Because over 7 out of 10 of the sexually active females in this sample who never used condoms were using oral contraceptives, it is possible that there might be something about oral contraceptives that offsets or antagonizes depressive symptoms. However, both within and between condom use categories there were no significant differences in depression scores as a function of the use of oral contraceptives. Indeed, among the females who were using condoms, there were a substantial number that were also taking oral contraceptives. But, those who were using both oral contraceptives and condoms showed slightly (but not significantly) more depressive symptoms than those who were using condoms alone.

Another competing account of the proposition that semen functions as an antidepressant might be that sexually active females who never use condoms were less depressed simply because they were having sex more often (see Fig. 1). However, when collapsed across condom use categories the frequency of sexual intercourse did not correlate with scores on the Beck Depression Inventory. As further evidence that sexual intercourse per se has no effect on depressive symptoms, it is important to note that depression scores for females who abstained from sex did not differ from those who were sexually active and using condoms.

A third possibility might be that having sex without condoms could be an indicator of high-risk behavior, because the prospect of contracting a sexually transmitted disease is greater among those who do not use condoms. Thus, one could argue that individual differences in risk taking behavior may be confounded with condom use. However, several studies have shown that various instances of sexual risk taking behavior do not correlate with scores on the Beck Depression Inventory (Dilley, McFarland, Sullivan, & Discepola, 1998; McCusker, Goldstein, Bigelow, & Zorn, 1995).

Still another account of these data might be that females who were not using condoms were less depressed because they were more likely to be in a committed, long-term sexual relationship. To take into account the effect that being in a relationship might have on depressive symptoms, females were asked if they were currently involved in a sexual relationship, and if so, how long it had lasted. There were no significant differences in depression scores between those who were in relationships and those who were not. Likewise there was no correlation between the amount of time since their last sexual encounter and depressive symptoms among females who were in relationships. Moreover, the length of the relationship was not correlated with individual differences in depressive symptoms.

Research has shown that the vagina absorbs several biological products contained in seminal fluid (e.g., estrogen, testosterone, prostaglandins) that can be measured in the female's bloodstream within several hours after administration (Benziger & Edleson, 1983; Sandberg et al., 1968). Our data are consistent with Ney's suggestion that semen in the female reproductive tract may play a role in modulating depressive symptoms (Ney, 1986). Indeed, our results suggest that semen may act to promote further sexual activity. Of the various components found in semen, the presence of estrogen and estrogen metabolites are obvious candidates for what might be mediating these effects. Both estrogen and prostaglandins have been shown to alleviate depressive symptoms, or at least exist in lower levels in those who are depressed (Abdullah & Hamadah, 1975; Zweifel & O'Brien, 1997). Estrogen has been shown to have mood elevating effects in postmenopausal females (Coope, 1996) and estrogen-based contraceptives have also been reported to elevate mood in younger females (Roy-Byrne, Rubinow, Gold, & Post, 1984).

If semen does antagonize depressive symptoms in females, it is interesting to speculate about where this effect may originate; that is, are the effects mediated by the transport of semen components through vaginal tissue or through the uterus? One obvious way to make a preliminary determination about the site of action would be to compare females who are using diaphragms as a means of contraception with those who are neither using diaphragms or condoms. Among those using diaphragms, the effect of semen would be restricted to the vaginal tract. It is also possible that there may be other nonreproductive sites of entry. For example, it would be interesting to investigate the possible antidepressant effects of oral ingestion of semen, or semen applied through anal intercourse (or both) among both heterosexual couples as well as homosexual males.

There are any number of other ways to test the possibility that semen has antidepressant properties. In addition to determining whether sexually active females are in a relationship, it would be helpful to know whether their commitment to and satisfaction with that relationship varies as a function of condom use. It would also be interesting to examine depression among postpartum, menopausal, and premenstrual (luteal phase) females as a function of their prior history of condom use. Each of these conditions carry an increased risk of developing depressive symptoms (e.g., Suarez & Gallup, 1985) and these conditions are all uniquely associated with varying degrees of semen withdrawal. Thus, we would predict that among females who are having sex without condoms the severity of depressive symptoms should rise during the postpartum and postmenopausal period. In contrast, among women who use condoms we would expect less of a change in depressive symptoms during these times.

REFERENCES

Abdullah, Y. H., & Hamadah, K. (1975). Effect of ADP on PGE1 formation in the blood platelets from patients with depression, mania and schizophrenia. *British Journal of Psychiatry, 127,* 591–595.

Beck, A. (1961). A systematic investigation of depression. *Comprehensive Psychiatry, 2,* 163–170.

Benziger, D. P., & Edelson, J. (1983). Absorption from the vagina. *Drug Metabolism Reviews, 14,* 137–168.

Coope, J. (1996). Hormonal and non-hormonal interventions for menopausal symptoms. *Maturitas, 23,* 159–168.

Culbertson, F. (1997). Depression and gender: An international review. *American Psychologist*, *52*, 25–31.

Dilley, J. W., McFarland, W., Sullivan, P., & Discepola, M. (1998). Psychosocial correlates of unprotected anal sex in a cohort of gay men attending an HIV-negative support group. *AIDS Education and Prevention*, *10*, 317–326.

Eliasson, R., & Posse, N. (1965). Rubin's test before and after intravaginal application of prostaglandin. *International Journal of Fertility*, *10*, 373.

Keller, P. J., Riedmann, R., Fischer, M., & Gerber, C. (1981). Oestrogens, gonadotropins and prolactin after intra-vaginal administration of oestriol in post-menopausal women. *Maturitas*, *3*, 47–53.

McCusker, J., Goldstein, R., Bigelow, C., & Zorn, M. (1995). Psychiatric status and HIV risk reduction among residential drug abuse treatment clients. *Addiction*, *90*, 1377–1387.

Ney, P. G. (1986). The intravaginal absorption of male generated hormones and their possible effect on female behavior. *Medical Hypotheses*, *20*, 221–231.

Rigg, L. A., Milanes, B., Villanueva, B., & Yen, S. C. C. (1977). Efficacy of intravaginal and intranasal administration of micronized estradiol 17-beta. *Journal of Clinical Endocrinology and Metabolism*, *45*, 1261–1264.

Roy-Byrne, P., Rubinow, D., Gold, P., & Post, R. (1984). Possible antidepressant effects of oral contraceptives: Case report. *Journal of Clinical Psychiatry*, *45*, 350–352.

Sandberg, F., Ingelman-Sundberg, A., Ryden, G., & Joelsson, I. (1968). The absorption of tritium labeled prostaglandin E1 from the vagina of non-pregnant women. *Acta Obstetricia et Gynecologica Scandinavica*, *47*, 22–26.

Schiff, I., Tulchinsky, D., & Ryan, K. J. (1977). Vaginal absorption of estrone and 17-beta estradiol. *Fertility and Sterility*, *28*, 1063–1066.

Shanfield, S., & Swain, B. (1984). Death of adult children in traffic accidents. *Journal of Nervous and Mental Disease*, *172*, 533–538.

Suarez, S., & Gallup, G. G., Jr. (1985). Depression as a response to reproductive failure. *Journal of Social and Biological Structures*, *8*, 279–287.

Thomas, V., & Striegel, P. (1994). Stress and grief of a perinatal loss: Integrating qualitative and quantitative methods. *Omega: Journal of Death and Dying*, *30*, 299–311.

Vance, J., Boyle, F., Najman, J., & Thearle, M. (1995). Gender differences in parental psychological distress following perinatal death or sudden infant death syndrome. *British Journal of Psychiatry*, *167*, 806–811.

Villanueva, B., Casper, R., & Yen, S. S. C. (1981). Intravaginal administration of progesterone: Enhanced absorption after estrogen treatment. *Fertility and Sterility*, *35*, 433–437.

Wester, R. C., Noonan, P. K., & Maibach, H. I. (1980). Variations in percutaneous absorption of testosterone in the rhesus monkey due to anatomic site of application and frequency of application. *Research*, *267*, 229–235.

Winter, L., Steer, R., Jones-Hicks, L., & Beck, A. (1999). Screening for depressive disorders in adolescent medical outpatients with the Beck depression inventory for primary care. *Journal of Adolescent Health*, *24*, 389–394.

Yamazaki, I. (1984). Serum concentration patterns of an LHRH agonist, gonadotrophins and sex steroids after subcutaneous, vaginal, rectal and nasal administration of the agonist to pregnant rats. *Journal of Reproduction and Fertility*, *72*, 129–136.

Zweifel, J. E., & O'Brien, W. H. (1997). A meta-analysis of the effect of hormone replacement therapy upon depressed mood. *Psychoneuroendocrinology*, *22*, 189–212.

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