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The Relationship Between Selective Serotonin Reuptake Inhibitors and Romantic Relationship Quality

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THE RELATIONSHIP BETWEEN SELECTIVE SEROTONIN REUPTAKE INHIBITORS AND ROMANTIC RELATIONSHIP QUALITY

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Abstract

This investigation examined the relationship between selective serotonin reuptake inhibitors (SSRIs) use and romantic relationship quality. The research sample consisted of participants in the attachment phase of their romantic relationship who had been in the same, current romantic relationship for a minimum of two years. Participants were recruited via professional listservs, electronic social networking, and prior relationships with the principal investigator. A total of 165 individuals participated in the main analysis. Results revealed no significant differences on romantic relationship quality scores by SSRI use after controlling for interest in sexual activity, sexual relationship satisfaction, depression, anxiety, paranoid, dependent, schizoid, sexual activity per month, time spent with one's partner, and dates per month. Correlational analysis revealed a significant positive relationship between SSRI use and interest in sexual activity, depressive symptoms, and dependent, paranoid, and passive-aggressive personality patterns. Results from independent T-tests found higher means on each of these variables with those using a SSRI. Higher scores on the scales that measured depressive symptoms and the personality patterns indicate the presence of more symptoms. However, higher scores on the interest in sexual activity variable indicate less interest in sexual activity. Correlational analysis revealed a significant negative relationship between partner's antidepressant status and the overall score on the Dyadic Adjustment Scale, dyadic satisfaction, dyadic cohesion, sexual activity per month, and sexual relationship satisfaction. Results from a MANOVA analysis revealed differences in mean scores on sexual relationship satisfaction by partner's antidepressant status. No

significant differences in mean scores were found between scores on the dyadic consensus, dyadic adjustment, and dyadic satisfaction by partner's antidepressant status.

DEDICATION

I dedicate this dissertation to my family:

To my siblings, Penny, Tim, Heather, Teri, and Myria. You are my best friends.

To my parents, Cloyce and Mary Etta Phillips. You have been an unfailing source of love and support.

To my husband, Samuel Meyer. You are the love of my life.

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Chapter One:

INTRODUCTION

According to the Centers for Disease Control (2006) in the National Vital Statistics Report, the current divorce rate is around 50%; thus, it could be extrapolated that half of all married individuals might divorce someday. While under certain circumstances divorce may produce a positive outcome, within the United States it is typically associated with negative outcomes for the individuals who are going through this process. Divorced individuals report higher psychological distress, physical ailments, decreased socioeconomic status, and reduced life span when compared to individuals who are married (Nock, 2005; Rogers, 1996; Thomas & Sawhill, 2005). The individuals who are divorcing are not the sole recipients of the adverse experiences, as often children are affected. Children with divorced parents have greater behavioral difficulties, have higher psychological distress, exhibit more difficulties in school, exhibit more violent behaviors, and have reduced academic achievement when compared to children with parents who are not divorced (Armato, 2005; Nock, 2005). Given the alarmingly high incidences of unfavorable outcomes associated with individuals involved in a divorce, the role of the couples counselor is to intervene during or before the relationship evolves to the point of divorce. While intervening, one role the couples counselor plays is being knowledgeable of factors that might influence romantic relationships.

To frame it in physiological terms, love may be a biological response to romantic interactions with another individual (Fisher, 1999; 2000; 2004; Liebowitz, 1983). Neurochemicals such as hormones and neurotransmitters play an important role within the biological response to a relationship. Neurotransmitters are chemical communicators

in the brain that carry messages across the synaptic cleft between neurons. Therefore, it is expected that medications influencing neurochemicals have the potential for affecting an individual's perception of the quality of his or her relationship (Fisher & Thomson, 2006). One class of medications that may play a role in altering the neurochemicals involved with love is Selective Serotonin Reuptake Inhibitors (SSRIs) (Fisher & Thomson, 2006). SSRIs are a drug classification given to medications that decrease the amount of the neurotransmitter serotonin drawn back into the presynaptic cleft, increasing the amount of serotonin left between neurons (nerve cells). Serotonin is one of the inhibitory neurotransmitters implicated in sleep, pain, and affective disorders (Reber & Reber, 2001). Common medications falling into this category include Celexa, Lexapro, Luvox, Paxil, Zoloft, and Prozac. SSRIs are classified as antidepressants; however, they are not solely prescribed for depression (Physician Desk Reference, 2005). In addition, they have been prescribed for conditions such as anxiety, bulimia nervosa, bipolar disorder, pain management, attention deficient disorder, substance abuse, and premenstrual syndrome (Masand & Gupta, 1999). Nonetheless, they are most commonly prescribed for depression and anxiety.

According to the Centers for Disease Control (2000), 23% of patients visiting their primary care physicians request a medication for depression. As previously noted, SSRIs are prescribed for a variety of disorders; consequently, the individuals requesting a prescription for depression are not the only individuals who are prescribed SSRIs. For example, when assessing the entire United States population, in 2004 the Department of Health and Services reported that 10% of women and 4% of men are currently on SSRIs.

Yet, lifetime prevalence rates of individuals with previous, current, or future histories of SSRI use are unknown.

With any medication, side effects can be expected. Known side effects of SSRIs include emotional blunting (Masand & Gupta, 1999; Opbroek et al., 2002), appetite suppression, sexual dysfunction, nervousness, headaches, and sleep disruption (Physician Desk Reference, 2005).

Theory on the Emotion Systems of Romantic Relationships

The influence SSRIs may have on individuals involved in romantic relationships cannot be understood without first understanding the stages of romantic relationships and the neurobiological responses to love. It is posited that through romantic coupling, three emotion systems have evolved with the primary goals of reproduction, mating, and, eventually, parenting (Fisher, 2000). The three emotion systems of romantic love include attraction, lust, and attachment. While much of this theory of love is based on an evolutionary perspective of romantic partnering, thus implicating the biological design of individuals from a primitive perspective of survival of the species, this perspective of love has evolved overtime as society's view of love has changed throughout history. For many couples mating, reproduction, parenting, and long term commitment are not consistent with their view of love. However, the biological responses in the brain seem to be consistent regardless of the purpose or type of romantic partnering (same sex or heterosexual). These emotion systems are associated with specific neurobiological responses and produce feelings specific to each system.

Attraction

The initial emotion system of a romantic relationship is attraction (Fisher, 2000). It is the "falling in love" or early attraction stage. It produces feelings of euphoria, obsessive thinking of the beloved, increased energy, and an emotional need for the beloved (Aron et al., 2005; Fisher, 1999; 2000; Fisher, Aron, Maskek, Li, & Brown, 2002; Fisher & Thomson, 2006). Tennov (1979) reported the falling in love stage lasted anywhere from 18-36 months. Consistent with this hypothesis, Marazziti, Akiskal, Rossi, and Cassano (1999) postulated that the early attraction period lasted around 12-18 months and with some individuals the stage lasted longer. Neurologically speaking, transition of this stage to the next stage (attachment) may commence earlier. For example, Aron et al. (2005) began to see differences in brain activity after about seven months of commitment to a romantic partner. This finding suggests that transitions between stages are a gradual process and perhaps biological responses to a romantic partner slowly evolve to the attachment stage.

The purpose of attraction is to initiate mate selection (Fisher, 2000). Neurochemically, this emotion system is associated with high levels of norepinephrine and dopamine and lower levels of serotonin (Fisher, 1999; 2000; Fisher et al., 2002; Marazziti, Akiskal, & Cassano, 1999). Dopamine is a neurotransmitter that has inhibitory and excitatory functions (Reber & Reber, 2001). It is implicated in such functions as attention, movement, learning, and reinforcing behaviors or other neurochemicals (Reber & Reber, 2001). It is also a precursor to norepinephrine (Reber & Reber, 2001). Norepinephrine is a neurotransmitter in the sympathetic nervous system, which is implicit in arousal in order to prepare the body for emergency or alarming responses such as increased energy and respiratory functioning (Reber & Reber, 2001).

Another chemical present during attraction is phenylethylamine (Crenshaw, 1996; Liebowitz,1983). Phenlethylamine (PEA) is known to produce feelings of euphoria and increased attention towards the beloved (Ratey, 2002). The rush of excitement associated with attraction is often thought to be the result of the increases of PEA levels (Ratey, 2002). Furthermore, once the individual continues to experience the increases of PEA when around the beloved, then he or she may become accustomed to this chemical and therefore the presence of the individual may no longer produce these same feelings with the same amount of intensity (Ratey, 2002).

Lust

Another emotion system involved in romantic relationships is lust (Fisher, 200). From an evolutionary perspective, the purpose of this system is reproduction. Lust is the sex drive, including sexual arousal and a desire for sexual gratification (Fisher, 2000). During the lust emotion system, individuals are motivated by a yearning for sexual union (Fisher, 2000). Here individuals express physical desire for the beloved.

When looking at the neurobiological component of lust, the hypothalamus is the center of the brain that is in charge of the sex drive and the hypothalmus-pituitary-adrenal (HPA) axis releases hormones (Fisher, 2004). The neurochemicals implicit in yearning for sexual activities include testosterone, which is released in both sexes, and progesterone and estradiol, which are released solely in females (De Vries & Simerly, 2002; Fisher, 2000; Fisher & Thomson, 2006; Rochira et al., 2003). Testosterone, progesterone, and estradiol are all hormones.

Attachment

The final emotion system of a romantic relationship is attachment (Fisher, 2000). Attachment has been associated with a motivation to sustain long term connections in order to rear children (Fisher, 2000), although this stage can occur without children. It is associated with feelings of calmness, security, connection, and comfort (Fisher, 2000; Fisher & Thomson, 2006). This stage has been distinguished from the attraction stage in terms of length of commitment as well as emotional and neurological differences. Attachment as previously reported commences anywhere from 7-36 months (Aron et al, 2005; Tennov, 1979). Emotionally, the intense obsessive feelings are replaced with tranquility.

Hormonally, this phase is associated with increases in oxytocin and vasopressin (Bartels & Zeki, 2004; Fisher, 2000). Oxytocin is involved with blood pressure, sexual intercourse, nursing, and uterine contractions (Reber & Reber, 2001). It is released during sexual arousal, sexual intercourse, and at orgasm (Gimpl & Fahrenholz, 2001). Vasopressin, also present during sexual intercourse, aids in memory formation and regulating water retention to maintain hydration (Reber & Reber, 2001). Similar to oxytocin, vasopressin is released during sexual intercourse and at orgasm (Ratey, 2001). Vasopressin is associated with a desire to be with the beloved and aggressive behaviors toward others interfering with the romantic relationship (Ratey, 2001).

While these three emotion systems of attraction, lust, and attachment are considered unique and one is able to differentiate among the systems, this does not mean there is no overlap between systems. The lust system is regularly a central part of the attraction and attachment emotion systems (Fisher, 2000). For example, during sexual encounters vasopressin and oxytocin, which are associated with the attachment emotion

system, are released. Furthermore, dopamine, associated with the attraction system, is also associated with attachment (Aron et al. 2005). During attachment, novel experiences (implicit with an increase of dopamine) help to maintain attachment to the beloved. It is possible for individuals to express attraction, lust, and attachment for different individuals, thus, indicating the independence among the emotion systems (Fisher, 2000).

Please see Figure 1 for a visual representation of the overlap among the three emotion systems of love. In this figure, attachment is centered due to the manner in which this study was designed to measure individuals in attachment love. It is important to note that this is not an indication that attachment should be the focus of romantic love, however, it is the focus in this study.

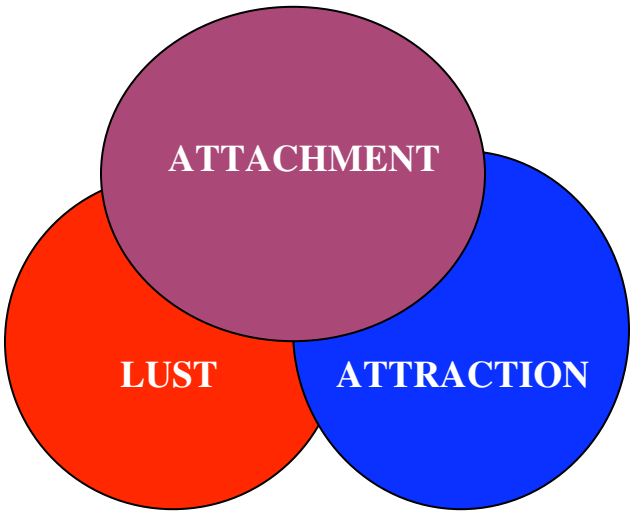

Figure 1: The overlap among the three emotion systems of love.

Background Information

Supportive Theories

According to much of Fisher's work (Fisher, 1999; 2000; 2004) and Liebowitz 's (1983) theory behind romantic relationships, love is largely associated with specific neurobiological responses. Therefore, it can be hypothesized that medications designed to affect neurochemicals may affect romantic relationships. While this hypothesis has never

been studied, there are three postulations (the sexual side effects related to SSRI use, the neurochemical changes related to SSRI use, and the apathy side effects related to SSRI use) that support the necessity for conducting this research (Fisher & Thompson, 2006). As previously noted, SSRIs influence serotonin levels. Thus, any neurochemicals affected by serotonin will also be affected by SSRI use. Specifically focused on the lust emotion system, SSRI use has been shown to produce adverse sexual side effects throughout the sexual cycle (Rosen, Lane, & Menza, 1999). While the portion of individuals experiencing sexual side effects varies among studies from 83% in a study conducted by Hu et al. (2004) to 73% in a study conducted by Montejo, Llorca, Izquierdo, and Rico-Vallademoros (2001), the excessively high occurrence cannot be ignored.

During the initial sexual stages, SSRI use has been associated with decreased sexual desire and decreased ability for arousal (Cantor, Binik, & Pfaus, 1999; Fisher, 2004; Rosen et al., 1999). Furthermore, there may be difficulty with sexual responsiveness, stimulation, and erectile function (Cantor et al., 1999; Fisher, 2004; Rosen et al., 1999). This difficulty may culminate with delayed or absent orgasm (Clayton, Kornstein, Prakash, Mallinckrodt, & Wohlreich, 2007; Rosen et al, 1999). According to Masand and Gupta (1999), unlike some side effects from SSRIs that may decrease over time, the sexual side effects may persist throughout treatment.

Sexual side effects may hinder the lust and attachment emotion systems of romantic relationships. The implications for the attachment emotion system may not be as obvious as the effects on the lust emotion system. After orgasm, oxytocin levels increase in females and vasopressin levels increase in males (Fisher, 1999). Similarly,

Ratey (2002) reported increases in oxytocin for both sexes after orgasm. SSRIs have been shown to interrupt oxytocin action (Cantor et al., 1999) and decrease oxytocin levels (Damjanoska et al., 2003). Oxytocin is one of the hormones affiliated with the attachment emotion system in romantic relationships. Therefore, if SSRI use is affecting oxytocin levels and if individuals on SSRIs have a diminished sex life, this reduces the opportunities for vasopressin and oxytocin releases. For that reason, it is theoretically possible that the use of SSRIs may affect the lust and attachment emotions systems of romantic relationships. Consequently, SSRI use may decrease relationship satisfaction in coupled individuals.

Not only might SSRI use affect the attachment emotion system due to the influence on oxytocin and vasopressin, but also it many further hinder the attachment emotion system because of the effect on dopamine. According to Aragona, Liu, Curtis, Stephan, and Wang (2003) dopamine is associated with establishing attachment in romantic relationships. Thus, dopamine is a central component of the attachment emotion system. It is important to note that dopamine also is reportedly increased during the attraction emotion system. As previously reported, couples may need to move through this stage in order to reach attachment. Serotonin is inversely related to dopamine (Esposito, 2006; Fisher, 2004; Lee & Keltner, 2005; Muira, Qiao, Kitagami, Ohta, & Ozaki, 2005b). Consequently, the increase of serotonin has been reported to decrease dopamine levels (Esposito, 2006; Muira et al., 2005b). Therefore, the impact of SSRI use on dopamine levels may decrease the quality of the romantic relationship.

Another side effect associated with SSRI use is emotional blunting (Barnhart, Makela, & Latocha, 2004; Fisher, 2004; Fisher & Thomson, 2006; Lee & Keltner, 2005;

Masand & Gupta, 1999; Opbrock et al., 2002). Emotional blunting is frequently experienced as a dulling of emotion, a lack of motivation, and an overall feeling of apathy (Barnhart et al., 2004; Fisher, 2004; Lee & Keltner, 2005; Opbrock et al., 2002). Opbrock et al. reported that 80% of their sample on SSRIs experienced the side effect of emotional blunting. Furthermore, Barnhart et al. reported that apathy is not a well known side effect of SSRI use and therefore SSRI users may not seek out help from their physicians in order to alleviate this side effect. Love is commonly thought of as an intense feeling (Fisher, 2004). Therefore, this blandness of emotions may be interpreted as a lack of love, consequently, reducing relational satisfaction.

Contrasting Theories

The research indicating that SSRI use inversely affects oxytocin (Jorgensen et al., 2003; Uvnas-Moberg et al., 1999) and vasopressin (Jorgensen et al., 2003) has not been consistently supported. For example, Uvnas-Moberg et al. reported an increase of oxytocin levels in plasma after an injection of a SSRI and Jorgensen et al. reported that SSRI use resulted in peripheral releases of vasopressin and oxytocin and central releases of vasopressin. Yet, Marar and Amico (1998) were not able to confirm or deny an inverse relationship with SSRI use and vasopressin or oxytocin levels. Hesketh, Jessop, Hogg, and Harbuz (2005) found an increase in vasopressin after SSRI use. Thus, based on this research, the impacts of SSRI use on vasopressin and oxytocin remains unclear. However, one plausible explanation for these differences might be due to the length of time of SSRI treatment. These increases in vasopressin and oxytocin may not be sustained with long-term use. Another possible explanation is that the initial increase in oxytocin or vasopressin as a result of the injection might actually deplete these hormonal

levels. If this were to happen, then there might not be as much of the hormone available for transmission during times when these hormones would naturally be released.

SSRIs are empirically supported to alleviate symptoms of depression and anxiety (Physician Desk Reference, 2005). Furthermore, depression and anxiety have been negatively associated with relationship satisfaction (Whisman, Uebelacker, & Weinstock, 2004; Whisman, Uebelacker, & Tolejko, 2006). It is plausible that the alleviation of symptoms due to SSRI treatment may improve the mood for the individual, thereby positively affecting the romantic relationship (Meyer, 2007). Therefore, the improved mood associated with SSRI use may actually increase the perceived quality of the romantic relationship. If this is true, then the hypotheses would not be supported and individuals on an SSRI may have higher averages means on the relationship quality scores when compared to those individuals not on an SSRI. Of course, another possibility is that there are no differences in relationship quality scores between those taking and not taking an SSRI.

Significance of the Study

The use of SSRIs is pervasive in our society (Department of Health, 2004). Falling and staying in love is a phenomenon not fully understood or explored, although biological responses to love are beginning to be researched. The empirical literature suggests that some of the neurochemicals associated with feelings of love (dopamine, oxytocin, and vasopressin) may be negatively influenced by the use of SSRIs (Cantor et al., 1999; Damjanoska et al., 2003; Muira et al., 2005b). Moreover, commonly reported side effects corresponding with SSRI use (emotional blunting and sexual dysfunction) may lead to difficulty with maintaining a romantic relationship. The high divorce rates in

our country make it imperative to investigate all of the factors that could impact the maintenance of romantic relationships. It is also important for consumers of SSRIs to be fully knowledgeable about the risks involved with the use of their medicine.

This study was designed to examine some of the gaps in the literature. There is no current research that examines the potential influence of side effects related to SSRI use on romantic relationships. This study did not use an experimental design where cause and effect can be determined; rather, a correlational design was used. Therefore, information learned from this investigation may lead to a greater understanding of associations found between the variables. This type of information is valuable in that it helps determine what the next steps should be in order to gain a greater understanding of potential associations between SSRI use and relationship quality.

As will be further explored in chapter two, empirical research suggests that anxiety, depression, and personality are all variables that may negatively impact relationship quality (Caughlin, Huston, Houts, 2000; Davila, Karney, Hall, & Bradbury, 2003; Kinnunen & Pulkkinen, 2003; Ruiz, Matthews, Scheier, & Schulz, 2006; Whisman, Uebelacker, Tolejko, Chatav, & McKelvie, 2006). In order to take into account potential confounding factors that may influence relationship quality and gather a more accurate representation of the relationship between SSRI use and relationship quality, scores from anxiety, depression, and personality disorders scales will be treated as covariates. Covariates were determined through empirical associations between the identified covariates and the other variables utilized in the study (Whisman et al., 2004; 2006). The variables anxiety, depression, and personality were chosen due to the high correlation between the presence of these disorders and SSRI treatment. Furthermore,

pervasive behavioral, thought, and personality patterns may lead to increased depression and anxiety levels and the consequent use of an SSRI. Thus, a personality disorders inventory was also utilized.

This information gained from a greater understanding of the relationship between romantic relationship quality and SSRI use will be valuable to counselors treating couples for problems in their relationship, physicians prescribing mediations to individuals, consumers of SSRIs, and loved ones of those taking SSRIs. Information gained from this study could help individuals make more knowledgeable decisions about the types of medications they are willing to take and the potential ramifications of these decisions on their relationships. It may further help all involved individuals to recognize that emotional blunting, sexual dysfunction, and reduced romantic relationship quality may actually be side effects from SSRI use. This information will be of particular importance for couples counselors in order to increase their knowledge of potential factors that may interfere in a romantic relationship. This information may help couples counselors with their goal of preserving the romantic relationship. As previously stated, this study was not designed to determine cause and effect. Nonetheless, this information could be valuable and help other researchers design their studies to further investigate this phenomenon.

Purpose of the Study

Empirical research supports the influence of SSRI use or increased serotonin levels on dopamine, oxytocin, and vasopressin (Cantor et al., 1999; Damjanoska et al., 2003; Muira et al., 2005b). Each of these neurochemicals are thought to be involved in the behaviors and emotions related to love in romantic relationships. For example, high levels of dopamine are thought to be involved in attraction and thought to reinforce the

reward system during attachment, as vasopressin and oxytocin are thought to be present during lust and attachment. Given this understanding of how neurochemicals may reinforce romantic relationships, it is important to investigate how SSRIs could potentially affect the perception of relationship quality between two individuals.

The purpose of this study was to examine the relationship between SSRI use and self-reported romantic dyadic adjustment, relationship satisfaction, dyadic consensus, dyadic cohesion, and affectional expression with dates per month, time spent together, sexual variables, depression, anxiety, and personality characteristics treated as covariates. The goal of this research study was to investigate the relationship between SSRI use and romantic relationship quality when the covariates were held constant.

Statement of the Hypothesis

Based on the preceding empirical support for the relationship between SSRI use and neurochemicals explicit during romantic relationships, the following hypothesis was derived. Holding sexual variables, time spent together, dates per month, depression, anxiety, and personality scores constant, it was hypothesized that individuals on SSRIs will have lower relationship quality scores than coupled individuals not on an SSRI medication.

Delimitations

In order to participate in this study, participants must:

Be 18 and older

In the same romantic relationship (either same sex or heterosexual) for a minimum of two years, thus, most likely in the attachment phase of the romantic relationship

Either are or are not taking an SSRI (if there is a history of SSRI use, but not current use, the individual must not have taken any SSRI medications in the past six months).

Chapter Two:

LITERATURE REVIEW

This literature review will include the empirical literature relevant to the neurochemistry of love, relationship satisfaction, and antidepressant medication. It is organized into the following three sections: 1) A review of the neurochemicals involved in the attachment stage of romantic love, 2) A summary of the relevant literature related to relationship satisfaction including the personality, anxiety, and depression literature, and 3) A review of the literature related to Selective Serotonin Reuptake Inhibitors and the relationships to dopamine, oxytocin, and vasopressin as well as a review of literature related to sexual side effects and apathy.

Due to the depth of information available in each of these three areas, only information directly relevant to the proposed research study will be explored. In addition, due to the continually changing nature of neuroscientific research, this review will also be limited to studies conducted in the previous 10 years.

Neurochemistry of Love

Liebowitz (1983) first proposed that love was a neurochemical response to another individual. The exhilaration reported during the early stages of love lead him to posit that in attraction, natural stimulants may be involved. In his hypothesis, norepinephrine, dopamine, and serotonin were postulated to be the neurotransmitters implicit in love. Around this time, from the biological and zoological fields, discoveries of monogamous behaviors from the prairie voles were also being explored (Carter, Witt, Thompson, & Carlstead, 1988; Fuentes, & Dewsbury, 1984; Pierce, Ferguson, & Dewbury, 1989; Shapiro, Austin, Ward, & Dewbury, 1986). The discovery of monogamy

in prairie voles was seminal in research on human attachment. This allowed researchers an animal model that could help explain monogamous behaviors in humans. In order to gain a greater understanding of the monogamous behaviors of prairie voles, the role of hormones were examined (Winslow, Hastings, Carter, Harbaugh, & Insel, 1993; Witt, Carter, & Insel, 1991; Witt, Carter, & Walton, 1990). From these early studies much of what is known about attachment in humans evolved. While the capabilities of exploration are not easily executed with human studies, the foundation has been laid and research on love in humans is beginning.

As previously discussed in chapter one, much of this research is based on Fisher's anthropological theory of love. Fisher's work is an amalgam of the human and animal research. She hypothesized neurochemical responses in humans during the attachment system of love (Fisher, 1999; 2000; 2004; Fisher & Thompson, 2006). Reportedly, long-term commitment is associated with oxytocin, dopamine, and vasopressin. The following review will explore the empirical literature related to these neurochemicals and serotonin.

Dopamine

Animals. Dopamine plays a critical role in enhancing bonding between romantic partners. Aragona, Liu, Curtis, Stephan, and Wang (2003) examined the influence of dopamine on partner-preference with male prairie voles. In the initial stage of the experiment, the researchers injected the prairie voles with haloperidol (DA (dopamine) antagonist) in order to block the dopamine receptors. While this did not impact mating, it was found to prevent the establishment of partner preferences. Partner preference was determined by placing the voles in a cage with three chambers: one for the familiar vole, one for the unfamiliar vole, and an empty chamber. Next the researchers injected the

prairie voles with apomorphine, a dopamine receptor agonist. Agonists bind to post synaptic receptors, thus mimicking the effect of the natural chemical. Therefore, apomorphine would mimic the dopamine. The voles that were given lower doses of apomorphine did form partner preferences; however, those voles given higher doses did not form partner preferences. Finally, the male voles were paired with either another male vole, a female vole where copulation did not occur, or with a female vole where copulations did occur. After the interaction, voles were sacrificed and examined for dopamine transmission in the nucleus accumbens. While it was not statistically significant ($p = .17$), the voles that mated with their partners had a mean dopamine turnover 33% higher than the other two groups in the nucleus accumbens. Based on the results from this stage of the experiment, the researchers wanted to investigate how injecting the voles with haloperidol and apomorphine directly into the nucleus accumbens would impact mating and partner preference. With the haloperiodol, mating-induced bonds were completely inhibited. In addition, low doses of apomorphine established partner preferences, but this was not repeated in higher dosages. This suggests the critical role that dopamine release in the nucleus accumbens plays in bond establishment.

In a comparable study with female prairie voles assessing pair bonding and dopamine, Wang et al., (1999) began their research by injecting the prairie voles with apomorphine and then placing them with male prairie voles. Following the apomorphine injection and cohabitation, the voles were injected with estradiol benzoate in order to induce estrous. Estrous is comparable to a menstrual cycle. The next step, similar to the study with the male voles, was an injection of haloperidol and again the females were paired with male voles. In a second experiment, female voles were first injected with

estradiol benzoate, again to induce estrous. The voles were then injected with either SCH23390 (a D_1 receptor antagonist) or eticlopride (a D_2 receptor antagonist). These antagonists prevent the dopamine action. Again, the females were paired with the male voles. Following this, the female voles were injected with either SKF38393 (the D_1 receptor agonist) or quinpirole (the D_2 receptor agonist). Agonist stimulates dopamine action. They were then paired with male voles.

From the first experiment, the female voles injected with apomorphine, when compared to those injected with saline, spent more time with their partner and in their partners' cages. The voles injected with high doses of haloperidol (in the first experiment) spent less time with their partners' and in their partners' cages than those injected with low doses of haloperidol and those injected with saline. From the second experiment, the D_1 receptor antagonist-injected voles spent more time with their partners than the unfamiliar voles when provided equal opportunities to be with both voles. This was also reported with the voles injected with saline. However, the D_2 receptor antagonist-injected voles (in the second experiment) spent the same amount of time with the stranger and the partner vole. The D_2 receptor agonist-injected voles were thought to establish partner preference; however, this was not observed with the D_1 receptor agonist-injected voles. These results suggest that injections of apomorphine (which mimics dopamine) in low doses initiates partner preferences. In addition, differences were observed with D_1 and D_2 receptors. This suggests the importance of the D_2 receptor in establishing partner preferences.

Gingrich, Liu, Cascio, Wang, and Insel (2000), in a similar methodologically designed study where the focus was solely on the D_2 receptors with injections delivered

to the nucleus accumbens also reported the importance of the D_2 receptor in establishing bonds in female prairie voles. Of those voles in estrous (those treated with estradiol benzoate to induce estrous), in the first 15 minutes once samples began being taken, extracellular levels of dopamine increased 51% over the baseline. This was prior to exposure to male voles. Once female voles were exposed to the males, the amount of mating did not significantly impact extracellular levels of dopamine. Of those voles injected with eticlopride (D_2 receptor antagonist), they displayed no difference in the amount of time they spent between their partner and a stranger. Antagonists inhibit the binding of the agonist. This was significantly different from the voles in the control group who spent more time with their partners than the strangers. For example, eight of the nine voles in the control group displayed a partner preference compared to only four of the ten voles that were injected with the D_2 receptor antagonist. Furthermore, voles that did not mate and were injected with quinpirole (D_2 receptor agonist) displayed partner preferences, whereas those voles in the control group that did not mate showed no differences in preferences. The empirical literature reported in this section suggests the importance of dopamine in mating and establishing bonds in attachment. In addition, significant differences have been found between the D_1 receptors and D_2 receptors. The D_2 receptors are considered to play a significant role in mate selection.

Humans. Much of the information on the emotion systems of love in humans has been discovered from the utilization of functional magnetic resonance imaging (fMRI). fMRI measures changes in oxygenated blood flow. Changes in oxygenated blood flow are associated with neural activity because as neurons are activated they consume the oxygen that is carried in the blood. Increases in blood flow are associated with activation.

Aron et al. (2005) imaged individuals who reported to be intensely in love and had been in their present relationship from 1-17 months with a mean of 7.4 months. In their analysis, the participants were shown pictures of their partner and another familiar individual with a distraction task of counting backwards between viewings of the different photographs. In order to assess for the feelings associated with love and to verify the emotion stage of love, the individuals were interviewed and given two self-report surveys. While viewing the pictures of the beloved, areas in the brain that were activated included those subcortical areas rich in dopamine. Activation areas included the ventral midbrain in the ventral tegmental area (VTA), the tail of the caudate, and the dorsal caudate body. These areas have been reported to be part of the brain's reward system.

Fisher, Aron, and Brown (2005) investigated individuals who reported to be in love, utilizing fMRI in order to assess neural correlates of love. In addition to the scans, the participants completed an instrument to measure romantic love. Duration, feelings, and intensity associated with the participants romantic partnering was also evaluated in a semi-structured interview. Prior to the scans, the participants were asked to think of a non-sexual experience with their beloved. During the scans the participants were either shown a picture of their beloved or asked to complete a distraction task. While shown the pictures of the beloved the right VTA was activated. As previously reported, this area is dopamine rich and associated with the reward systems in the brain.

Bartels and Zeki (2000) also utilized fMRI in a similarly designed study where individuals in love looked at pictures of their beloved and three other friends. These individuals had been in their relationship for longer than the two previous studies

described above. The average length of the romantic relationship in this study was 2.4 years. The individuals were asked to rate their feelings of sexual arousal and feelings of love on a scale of 1 to 9 when viewing all photographs. Areas of the brain that were activated while looking at pictures of their romantic partner included the anterior cingulate cortex (bilateral), posterior hippocampus (bilateral), middle insula (predominately with the left side), VTA, caudate nucleus (the head), and putamen. Once again, dopamine rich areas were activated while viewing pictures of the beloved. Findings suggest the importance that dopamine continues to play even in longer committed relationships, given that this research was conducted with individuals who have been with their partner for longer periods than other studies.

Results from the animal and human studies suggest the importance of dopamine in establishing partner preferences in animals and romantic love in humans. Dopamine levels and dopamine receptors were found to play an important role (Aragona et al., 2003; Aron et al., 2005; Bartels & Zeki, 2000; Fisher et al., 2005; Gingrich et al., 2000; Wang et al., 1999). Results from the studies with humans reported dopamine rich areas were activated in those who had been committed to their partner for less than one year and also with those who had been with their partner for greater than two years (Aron et al., 2005; Bartels & Zeki, 2000; Fisher et al., 2005). Activation in dopamine rich areas was also associated with sexual arousal (Bartels & Zeki, 2000). This suggests the importance of dopamine and increases in dopamine levels in attraction, lust, and attachment love. All studies examining each of these emotion systems of love, through fMRI, supported this same dopamine hypothesis. Levels of dopamine in dopamine rich areas and the impact on the different dopamine receptors cannot be known in humans due

to the invasive nature of measuring this type of research. However, examining activation in the brain as with the fMRI plays a critical part in understanding how love impacts the brain.

Oxytocin

Animals. Based on much of the known literature of the impact of oxytocin on pair bonding, Cushing and Cater (1999) hypothesized that oxytocin treatment in female prairie voles would decrease the amount of time between introduction to male voles and copulation. Oxytocin increase is posited to be the result of attachment to a partner. In voles, once attachment is established, sexual relations follow. Therefore, their idea behind the experiment was that oxytocin treatment would mimic social bonding and thus female voles would not need as much time to establish a bond with a mate before sexual interaction. Their hypothesis was confirmed. The females voles treated with oxytocin five days prior to cohabitation were more likely to mate within 48 hours with their partner than those not treated with oxytocin. If they did not mate during the initial two-day period, it was unlikely that they would later mate with their partner.

In another study supportive of the role of oxytocin in prairie voles, Bales and Carter (2003) neonatally injected male voles with oxytocin. At 20 days after birth, the voles were randomly placed with a female prairie for one hour. Following this, in order to determine partner preference, similar to the designs with the dopamine experiments, the male voles were placed in a cage with three chambers, one with the familiar vole, one with a stranger, and the other empty. There was not a significant difference between the oxytocin treated voles and the control group with time spent in side by side contact with a partner in unplanned exposure. However, a planned exposure of the voles to the familiar

and unfamiliar voles did reveal a significant difference with those treated with oxytocin displaying a partner preference. Therefore, those voles injected with oxytocin spent more time with the familiar vole than the unfamiliar vole.

There is not consistent support of the role of oxytocin with pair bonding in male voles. Cushing and Carter (2000) peripherally administered oxytocin with both female and male voles and reported contrasting results. Injections included saline utilized with a control group, a single injection of oxytocin, or three oxytocin injections into the subcutis. Subcutaneous injections would be similar to a human receiving a shot. Thus, oxytocin was not directly injected into the brain. After treatments, voles were placed with an opposite sex vole for one hour. Following this, they were tested for partner preferences. Female voles treated with the three peripheral injections of oxytocin displayed partner preferences; however, the control group and those injected with a single dose of oxytocin did not display partner preferences. These same results were not supported with the male voles. The male voles did not display partner preferences whether they were in the control group or had one or three shots of oxytocin. In addition, when female voles were concurrently treated with the three doses of oxytocin and an oxytocin antagonist, partner preferences were not displayed. The preceding research suggests the importance of oxytocin in establishing bonds with female prairie voles; however, the role of oxytocin in bond development with male voles is inconclusive.

Humans. Grewen, Girdler, Amico, and Light (2004) measured blood pressure and oxytocin in couples who engaged in partner contact (defined as together, sitting close on a love seat) and concluded their partner contact portion of the research study with a hug. Prior to and after partner contact blood was drawn to measure plasma oxytocin levels.

This measures a peripheral release of oxytocin. During the partner contact, the couples were instructed to discuss an experience that made them feel closer to one another for total of two minutes and then watch five minutes of a romantic video. Following this, the couple was then instructed to take two minutes to discuss a time when they both felt close to each other. In this study, having a more emotionally supportive partner was associated with higher plasma oxytocin levels in both genders before the partner contact. In addition, after the partner contact, for females an emotionally supportive partner was still positively associated with oxytocin levels. Furthermore, when partner support was divided into quartiles, oxytocin levels continued to increase as the levels of partner support increased. In those couples where both partners reported low levels of partner support, comparable oxytocin deficiencies were present in both partners. A correlation was found between the oxytocin levels of wives and their husbands' oxytocin levels prior to partner contact. Overall, females had higher oxytocin levels after the partner contact. In women, oxytocin mediated the relationship between reduced norepinephrine levels and emotional support by one's partner.

In a similarly designed methodological study, Light, Grewen, and Amico (2005) measured oxytocin levels, interpersonal connection, and blood pressure with women. At the beginning of the experiment, the women had baseline blood pressure and blood drawn; they additionally completed questionnaires assessing emotional support and physical affection. The women then engaged in physical contact with their partner discussing times when they felt close as a couple and watching a familiar romantic movie. In regards to physical contact, the couple sat close to each other and if they desired, they could hold one anothers' hands. Following this, the women were directed to

complete a task designed to elicit stress that included preparing and recording a speech that involved a time when the woman felt stressed or angry. Blood was taken during the speech preparation, while giving the speech, and after the speech was recorded.

The women were divided into groups by plasma oxytocin levels measured at baseline. Women with higher baseline oxytocin levels were more likely to report more frequent hugs between partners and more frequent massages. However, hand holding, lying or sitting closely, and kissing were not associated with higher oxytocin levels. This suggests that the quality and type of touch is what may impact oxytocin levels in women. Furthermore, those in the group with lower oxytocin levels were more likely to be married and not have children. In addition, oxytocin was found to partially mediate the relationship between blood pressure (lower systolic blood pressure and mean arterial pressure) and hug frequency. No differences were reported in responses based on the time in the menstrual cycle the women were.

Marazzitti et al. (2006) examined oxytocin levels and attachment in healthy individuals who either were or were not in a significant romantic relationship. Attachment was measured with a psychometric instrument. Blood was drawn three times in order to measure plasma oxytocin levels. The results indicated no differences in oxytocin levels between genders, whether individuals were or were not in a romantic relationship, the length of relationship, marital status, and age. There was, however, a positive correlation between oxytocin levels and scores on the anxiety scale. These findings suggest a relationship between plasma oxytocin and anxiety in attachment. Further research needs to investigate how this impacts individuals and their relationships.

Turner, Altemus, Enos, Cooper, and McGuinness (1999) examined changes in oxytocin levels in plasma among healthy women with normal menstrual cycles. After completion of questionnaires, blood was drawn from these women in order to establish a baseline and then blood was drawn before, during, and after three interventions. For the interventions, these women were asked to imagine a time when they felt a positive and a sad emotion and then receive a massage. Plasma oxytocin levels increased as a result of the massage and decreased as a result of the sad memory. Women in romantic relationships were found to have greater increased oxytocin levels as a result of the positive emotion memory. Furthermore, individuals who reported fewer intrusive problems in their romantic relationship and lower levels of anxiety in interpersonal relationships were more likely to maintain their oxytocin levels during the sad emotion. Interestingly, those individuals who were more likely to report greater interpersonal distress had higher oxytocin levels at baseline. This suggests a role with oxytocin responses to emotions and that oxytocin levels may be related to interpersonal characteristics.

Contrary to Turner et al. (1999), Turner et al. (2002) did not report increases in oxytocin in response to positive emotions. In their study of healthy women with regular menstrual cycles, blood was drawn every five minutes as they completed the tasks of recalling a memory where they experienced intense love and then watched a romantic comedy movie clip or recalled a memory of intense loss and then watched a movie clip of demonstrated grief. Findings included a slight decrease in plasma oxytocin levels as a result of the positive emotion and unchanged plasma oxytocin levels as a result of the negative emotion. In addition, relationship status was not associated with changes in

oxytocin levels during the tasks. These differences may reflect the methodology, characteristics of the sample, or another unknown factor. From these results one could infer that oxytocin may not play a central role in positive or negative emotions regardless of relationship status. It is important to remember that these experiences were either a recall of a previous event or a depersonalized film; therefore, one needs to question how oxytocin levels change as a result of the actual experience. In addition, the literature suggests (Challinor, Winters, & Amico, 1994) that plasma measures of oxytocin are an indication of peripheral, not central, release of the hormone. Central releases reflect secretion from the hypothalamus. How peripheral and central releases differ in terms of relationship status and experiences need to be further explored.

Gonzaga, Turner, Keltner, Campos, and Altemus (2006) wanted to investigate the relationship between oxytocin and emotions. They elicited emotional stories from women. The participants were asked to reveal an experience where they felt infatuation or love, a sad experience that involved abandonment, and they received a massage. Blood was drawn multiple times establishing baselines, during each intervention (when experiencing the designated emotion or receiving the massage), and five minutes after each intervention. As they were sharing the story about the designated feeling (love or sadness), when that feeling was evoked, the participants were asked to indicate that to the researchers. The recollections of these stories were videotaped and coded for sexual cues such as licking lips and affiliation cues such as sincere smiles or head nods. Oxytocin reactivity was positively associated with the affiliation cues and oxytocin was not associated with demonstrated sexual cues by the participants.

Taylor et al. (2006) in their efforts to measure relationship status and plasma oxytocin levels with older women (56 to 75 years of age) reported similar findings as Turner et al. (2002). Taylor and associates reported that higher oxytocin levels in plasma were associated with social, not psychological, distress. For example, higher oxytocin levels were correlated with lack of social contacts with mothers, best friends, pets, and social groups. Moreover, martial quality was negatively associated with oxytocin levels. Women with higher oxytocin levels were more likely to report that their spouses did not appreciate them, did not understand them, and that they could not go to their spouses with problems. The higher oxytocin levels perhaps leads one to seek out social contact. However, it cannot be ruled out that results from animal models may not be applicable to humans. The literature on oxytocin is inconclusive. More research needs to be conducted to examine the role oxytocin plays in romantic partnering.

Animal models investigating the role of oxytocin in partnering report more consistent findings then the role of oxytocin in humans. For example, in both female and male voles oxytocin treatments were associated with displays of partner preferences (Bales & Carter; Cushing & Cater 1999; 2000). With female prairie voles, the role of oxytocin and bonding remains consistent; however, this is not true for male prairie voles. In one study, males did not display partner preferences as a result of oxytocin injections Cushing and Cater (2000).

The oxytocin literature with humans is unclear, however, it is important to note that all measures of oxytocin were with plasma levels. Thus these measures are peripheral, not central releases of oxytocin. The oxytocin literature is consistent with certain types of physical contact. Receiving massages was positively associated with

oxytocin levels (Gridler et al., 2004; Light et al., 2005; Turner et al., 1999). In addition, Light et al. further found that those individuals reporting more frequents hugs from their partner had higher oxytocin levels at baseline. Higher oxytocin levels were also associated with positive experiences. Women who reported having an emotionally supportive partner had higher oxytocin levels after physical contact with a partner (Gridler et al., 2004). Nonverbal cues demonstrating an affiliation to another individual such as smiles and head nods were also positively associated with oxytocin levels (Gonzaga et al., 2006). Turner et al. (1999) reported increases in oxytocin levels as a result of recalling a positive emotion. In addition, Turner and colleagues reported that when recalling a sad memory, oxytocin levels decreased. Moreover, individuals reporting fewer intrusive problems in the romantic relationship and lower levels of anxiety were more likely to maintain oxytocin levels (Turner et al., 1999). In contrast, Turner et al. (2002) reported a slight decrease in oxytocin levels after a positive emotion and no change on oxytocin levels after a negative emotion. It is important to note however, that these emotions were elicited from movie clips whereas the other emotions were personal memories. Turner and associates were not the only researchers reporting a correlation between anxiety and oxytocin. However, Marazzitti et al. (2006) reported that oxytocin was positively associated with anxiety.

Even though emotional support from a partner was positively associated with oxytocin levels (Gridler et al., 2004), Taylor et al. reported that the quality of the marital relationship was negatively associated with oxytocin levels. In addition, social or interpersonal distress was positively associated with oxytocin levels (Taylor et al., 2006; Turner et al., 1999). However, Marazzitti et al. found no differences in oxytocin levels

based on relationship status or the length of the relationship and Light et al. (2005) reported married women without children were more likely to have lower oxytocin levels. The literature in humans investigating oxytocin levels and romantic relationships remains cloudy and needs further investigations.

Vasopressin

Lim and Young (2004) investigated the role of vasopressin in pair bonding with male prairie voles. This was examined through fos expression. Fos expression measures synaptic activity between neurons. Injections of a vasopressin receptor (V1aR) antagonist were given in order to block the receptor activity, and an injection of adeno-associated viral (AAV) vector containing the V1aR (a vasopressin receptor) gene and a control virus carrying the lacZ gene were given to further examine the vasopressin neurotransmission. The latter two injections, AAV vector with V1aR and the control virus with the lacZ gene, were intended to examine alteration of the vasopressin gene and thus assess how increases in vasopressin receptors change pair bonding with the male voles. Following these injections, voles were paired with female voles in order to explore pair bonding and mating. Lim and Young found fos induction in the ventral pallidum, medial amygdala, nucleus accumbens, mediodorsal thalamus, medial preoptic area, and the bed nucleus of the stria terminals. Fos induction is a measure of neuronal activation. These areas of the brain are known for reward and sociosexual circuits. Furthermore, fos expression was higher in the ventral pallidum, medial amygdala, nucleus accumbens, and medial preoptic area for those voles that had mated when compared to the voles kept in isolation or paired with a sibling. Interestingly, there were no differences in fos expression in the laterodorsal thalamus. The laterodorsal thalamus is a known V1aR (type of vasopressin

receptor) dense area of the brain. In addition, fos expression in the mediodorsal thalamus was only different between the voles that mated and the voles in isolation. The voles that were paired with siblings had similar fos expression in the mediodorsal thalamus to the voles that mated.

This research implies that fos induction and expression could be involved with vasopressin induced bonding. In those voles injected with the (V1aR) antagonist into their mediodorsal thalamus and medial amygdala, partner preferences were still established. However, those voles injected with the antagonist into their ventral pallidum did not show partner preferences. This suggests that the V1a vasopressin receptors of the ventral pallidum might play a significant role in the establishment of bonds. The investigators were able to confirm the increased fos expression in the ventral pallidum with voles when they utilized the viral vectors. It appears vasopressin is of central importance for pair bonding with male voles.

Pitkow et al. (2001) executed a similar study with male prairie voles that altered the vasopressin gene (V1aR) with viral vector in order to increase vasopressin binding in the ventral pallial region. Those with the altered gene had almost a 100% increase in vasopressin receptor density. In addition to increasing receptors for binding, partner preference tests were conducted. When compared to the control groups, those with the altered gene that increased vasopressin binding were over twice as likely to display partner preferences without mating. Partner preference was established if the voles spent twice as much time with the familiar vole. In another study modifying the gene of the voles, Hammock and Young (2005) altered the vasopressin receptor gene (V1a) in vitro with male prairie voles. This resulted in either a shorter or longer average length of the

allele. Longer lengths are associated with increased receptor binding. Partner preference tests were executed with males with both allele lengths. Those voles with the longer allele were able to display partner preferences while those with the shorter allele length did not display preferences. Partner preference was determined when the voles spent twice as much time with a mate. These studies suggest the importance of vasopressin binding with male prairie voles in establishing bonds with female voles.

Liu, Curtis, and Wang (2001) also investigated the role of vasopressin in bonding with male prairie voles. The voles were either injected into the lateral septum area of the brain with cerebrospinal fluid (artificial), spinal fluid containing vasopressin, or receptor antagonists for vasopressin (V1a) or oxytocin. The voles were then allowed to cohabitate with a female prairie vole; some voles were allowed to mate and others were not. Following this, the male voles were caged with their cohabitated mate or a stranger vole to test for partner preferences. Those voles injected with cerebrospinal fluid and allowed to mate displayed partner preferences. In addition, those voles injected with low and high doses of the vasopressin antagonist also displayed partner preferences after mating; however those injected with the mid-range amount of vasopressin antagonist did not display mating-induced partner preferences. Even without mating, those voles injected into the lateral septum with high doses of vasopressin still displayed partner preferences. However, those injected with the spinal fluid or low doses of vasopressin did not display partner preferences without mating. In addition, those injected with the oxytocin antagonist did not display partner preferences. In a repeat experiment of voles injected with vasopressin, these voles also displayed partner preferences without mating. However, those voles injected with vasopressin and either a vasopressin or oxytocin

receptor antagonist did not display partner preferences. Again, these results confirm the previous research and the role vasopressin plays with male prairie voles in establishing bonds. For example even without mating, voles injected with spinal fluid containing vasopressin into the lateral septum displayed partner preferences. These findings suggest the importance of vasopressin in bonding as well as the possible role of the lateral septum in bond enhancement.

Vasopressin is believed to induce pair bonding (Hammock & Young, 2005; Lim & Young, 2004; Liu et al., 2001; Pitkow et al., 2001). When genes were altered in voles in order to increase vasopressin receptor density, those voles with the altered gene displayed partner preference even without mating (Hammock & Young, 2005; Pitkow et al., 2001). Certain vasopressin receptors are thought to enhance bonding. For example, Lim and Young found V1a vasopressin receptors in the ventral pallidum as particularly influential and changes in partner preference behaviors were observed when binding was inhibited with V1a receptors. Findings from all the preceding studies support the importance of vasopressin for establishing bonds and partner preferences in male prairie voles.

Combined Studies: Vasopressin, Dopamine, and Oxytocin

Neurologically, there are differences between monogamous and promiscuous voles. Smeltzer, Curtis, Aragona, and Wang (2006) assessed these differences in oxytocin, arginine vasopressin, and dopamine receptor binding with prairie and meadow (in the dopamine experiment) or montane (in the vasopressin and oxytocin experiment) voles. Prairie voles are known to be sexually monogamous while meadow and montane voles are known to be sexually promiscuous. In their study, all voles were sacrificed in

order to assess differences in the brains. Prairie voles had lower densities in the D_1 receptor sites and higher densities in the D_2 receptor sites in the medial prefrontal cortex when compared to the meadow voles. Male prairie voles were found to have the lowest densities of D_1 –like receptor binding. Prairie voles had higher densities of oxytocin receptor binding with female prairie voles having the highest densities in the medial prefrontal cortex. In regards to vasopressin, V_{1A} receptor binding, montane voles had the highest densities in the medial prefrontal cortex. Overall, male voles had higher densities of vasopressin than females.

Differences in how oxytocin, dopamine, and vasopressin receptor binding influence the development of long-term pair bonding are still being discovered; however, it could be extrapolated that these differences in available receptors for neurochemical binding influence the monogamous and promiscuous behaviors in voles. One could infer from these results that the higher densities of D_2 receptors in the medial prefrontal cortex and oxytocin receptors in the medial prefrontal cortex with the prairie voles are implicit in monogamous behaviors. In addition, sex differences with females having more oxytocin receptors and males having more vasopressin receptors indicates that mating and bonding in the brains of voles is processed differently across the sexes.

Cho, DeVries, Williams, and Carter (1999) also examined the impact of both vasopressin and oxytocin in bonding with prairie voles. Oxytocin, vasopressin, oxytocin or vasopressin receptor antagonists, or cerebrospinal fluid (artificial) were injected into the lateral ventricles of the voles. After injections, they were paired with a vole of the opposite sex. Of those given oxytocin and vasopressin injections, they were given one of three different doses (1 ng, 10 ng, and 100 ng). Partner preference tests followed. After

cohabitation, those male voles injected with any of the doses of vasopressin spent more time with their mates than the controls. In addition, those males injected with the two highest doses of oxytocin spent more time with their mates. In the male voles who were injected with vasopressin or oxytocin antagonists and then either oxytocin or vasopressin, those treated with the oxytocin and its antagonist spent the least amount of time with their mates when compared to the control group or those treated with the vasopressin antagonist and oxytocin combination. The male voles treated only with oxytocin or vasopressin displayed partner preferences and those male voles treated with either antagonist (vasopressin or oxytocin) and the appropriate corresponding hormone (oxytocin or vasopressin) did not display preferences.

The female voles injected with 100 ng of either vasopressin or oxytocin spent the most time with their mates and displayed partner preferences. The female voles treated with vasopressin and its antagonist spent less time with their mate than those treated with the oxytocin antagonist and vasopressin. In addition, those female voles treated with oxytocin and its antagonist spent less time with their mate than those females treated with oxytocin only and the vasopressin antagonist and oxytocin. The female voles treated with either oxytocin or vasopressin did exhibit partner preferences while those treated with either antagonist and either oxytocin or vasopressin did not.

As previously mentioned, in this study each treatment was administered directly into the lateral ventricles and the results suggest the importance of centrally administered treatments of these hormones when developing bonds. Contrary to some empirical evidence, injections of oxytocin and vasopressin in both males and females may enhance the development of partner preferences. Due to the inconclusive results, the impacts of

vasopressin and oxytocin on partner bonding in both male and female prairie voles needs to be further examined.

In order to understand monogamous behaviors in prairie voles, Smeltzer et al. (2006) compared differences in dopamine, oxytocin, and vasopressin receptors with promiscuous voles. When compared to the promiscuous voles, they reported higher densities in D_2 receptors (a type of dopamine receptor) and oxytocin receptors with the prairie voles. In addition, the promiscuous voles were found to have higher densities of vasopressin receptors than the prairie voles. Overall, female voles had higher densities of oxytocin receptors and males voles had higher densities of vasopressin receptors. In regards to mate selection and partner preferences, it is important to note that while there are differences in oxytocin and vasopressin across the sexes, this does not mean that oxytocin does not play a role for male voles and vasopressin is not important for female voles. Cho et al. (1999) found that in addition to injections of vasopressin increasing the amount of time male prairie voles spent their mates, oxytocin injections also increased the amount of time male prairie voles spent with their mates. Cho and colleagues also reported these findings to be supported with the females prairie voles, in that both oxytocin and vasopressin injections increased the amount of time spent with their mates.

Serotonin

There is a paucity of research in regards to the impact of serotonin on attachment. The negative association between serotonin and romantic relationships has been extrapolated from research suggesting an inverse relationship between serotonin and oxytocin, vasopressin, and dopamine. This area will be further explored under the SSRI

section where the empirical literature assessing the relationships between oxytocin, vasopressin, and dopamine with serotonin is found.

Only one study was found that assessed the serotonin system. Marazziti, Akiskal, Rossi, and Cassano (1999) compared individuals who had begun a romantic relationship in the past six months, individuals with obsessive-compulsive disorder, and a control group. After collecting blood samples, Marazziti and colleagues were able to determine that the density from the platelet serotonin transporter was significantly lower in the individuals who had recently fallen in love and in terms of duration were still in the early phase of romantic love. In addition, their scores were comparable to the group of individuals with obsessive-compulsive disorder. Obsessive-compulsive disorder has been associated with lower serotonin levels. In addition, the early stages of love have been compared to obsessive-compulsive disorder due to the overwhelming desire to be with the romantic partner and the intrusive thoughts about the romantic partner.

Relationship Satisfaction

When entering relationship satisfaction or marital satisfaction into any academic database, a plethora of results return. Research on relationship satisfaction has been conducted with numerous variables. For purposes of the scope of this study, only the relevant literature related to relationship satisfaction and personality, depression, and anxiety will be reviewed. There was overlap in much of the research relating relationship satisfaction to depression, anxiety, and personality. Therefore depression, anxiety, and personality will be reviewed singularly with relationship satisfaction and also concurrently with depression, anxiety, and or personality with relationship satisfaction. For example, some studies measured depression and personality with relationship

satisfaction. In these situations when more than one of the designated covariates in this proposed study were researched together, then there will be a section reviewing these variables together.

Psychological Distress

Depression. The research related to depression and relationship satisfaction consistently reports a negative association between relationship satisfaction and depression scores. Tower and Krasner (2006) reported a protective component of marital closeness in terms of depression scores. In their study, marital closeness was determined through a series of questions asking participants to report with whom they felt close, received emotional support, and shared confidences. Participants were also asked if someone else would report that they were an individual with whom he or she felt close, received emotional support, and shared confidences. They were additionally asked about their level of satisfaction with their sexual relationship. In the hierarchical regression model developed by Tower and Krasner, 52.8% of the variance in depression scores was explained by marital closeness, autonomy, and mastery over the environment. Furthermore, females with consistently low depression scores were more likely to identify their spouse in the marital closeness questions as well as predict that their spouses would identify them in the marital closeness questions. This pattern of results was not confirmed with the males in the study. One hypothesis explaining this pattern is that perhaps, for women, the quality of their interpersonal relationships contributes more to their psychological health than men. Men may not be as likely to seek out interpersonal relationships for psychological support.

Gender differences were also reported in Berge, Patterson, and Rueter (2006). They measured relationship satisfaction in couples with children who have chronic health problems. Berge et al. found an association between depression levels and relationship satisfaction. The women's perception of relationship satisfaction and levels of depression were dependent upon the health of their children. For example, as one's child had increasing health concerns, perceived relationship satisfaction decreased and depression levels increased. This was not the same for the husbands. For the husbands, the health of their children did not predict depression or relationship satisfaction scores. This gender difference may again be a reflection of women internalizing their interpersonal relationships. Other chronic variables may also contribute to depression levels in couples. Riso, Blandino, Hendricks, Grant, and Duin (2002) examined differences in marital satisfaction between chronically depressed (defined as depression exceeding two year) and non-chronically depressed individuals. They reported that those with chronic depression had lower scores on marital satisfaction when compared to the non-chronically depressed individuals.

Brennan, Hammen, Katz, and Le Brocque (2002) investigated the relationships between marital conflict, depression, substance abuse by the father, and diagnostic outcomes of children. They found no relationship between marital conflict and depression in both spouses, depression in the mother, substance abuse by the father, and children's externalized diagnoses (not including depression). Whisman and Bruce (1999) however, reported that those individuals in a dissatisfied marriage were more likely to experience a major depressive episode. Specifically, after controlling for demographic variables, the risk for a depressive episode was 2.71 times greater in those experiencing martial

distress. In this study, depression was diagnosed if participants met DSM criteria for depression. Martial satisfaction was determined by responses to one question that asked about the ability to get along with a spouse over the previous two weeks. Based on this study, it is difficult to determine how martial satisfaction would have changed as a result of a more comprehensive measure of marital satisfaction.

Anxiety. Similar to depression, anxiety has been consistently associated with decreased relationship satisfaction. Additionally, studies supporting this finding also will be reported in this literature review under the personality and psychological distress and depression and anxiety sections. Addis and Bernard (2002) examined the relationship between marital satisfaction and anxiety, anger, and curiosity in couples attending or not attending couples counseling. In their investigation, the couples who were currently participating in counseling had decreased marital satisfaction and increased rates of anxiety compared to those couples not in counseling. This suggests that for those couples seeking out help with their relationship, anxiety may play a negative role in their relationships and possibly lead to decreased relationship satisfaction.

Depression and Anxiety. Perren et al. (2003) explored the relationship between marital quality and presence of a psychiatric disorder, marital status, difficulties during pregnancy, and father's participation among soon to be parents during the second trimester of pregnancy. Perren and colleagues were able to diagnosis such disorders as substance abuse, depression, anxiety disorder, obsessive compulsive disorder, somatoform disorders, and dual diagnoses. They found that the severity of psychiatric symptoms was negatively associated with marital quality. In addition, a father's diagnosis of a psychiatric disorder was associated with lower marital quality scores, while mother's

diagnosis of a psychiatric disorder indicated no statistically significant differences in martial quality. Furthermore, lower scores on the marital quality questionnaire were associated with the father's unwillingness to participate in the research study. Marital status and difficulties during pregnancy were not associated with martial quality.

Whisman, Uebelacker, and Weinstock (2004) assessed the relationship between relationship satisfaction and anxiety and depression scores in couples. In this study, one's anxiety scores were negatively associated with relationship satisfaction scores. In addition, both one's own and one's partner's depression scores were negatively associated with relationship satisfaction scores. Whisman (2007) measured the relationship between marital distress and depression and anxiety disorders. Overall, martial distress was associated with an increased risk of a psychiatric disorder diagnosis. A positive association was reported between increased martial distress and increased risk for anxiety disorders. Furthermore, generalized anxiety disorder had the strongest association with martial distress when compared to any of the other anxiety disorders. In regards to depression, a positive relationship between mood disorders and martial distress was reported.

All the previously examined studies assessed relationship satisfaction with a nonclinical population; thus, it is important to assess what relationship satisfaction looks like in a clinically depressed population. Coyne, Thompson, and Palmer (2002) assessed differences in marital satisfaction, expressed affection, psychological distress, and conflict coping with women diagnosed with depression who were receiving treatment (either inpatient or outpatient) and a community sample. The husbands of these women also participated in the research. In lieu of focusing on marital satisfaction, marital

distress was emphasized. Depression and anxiety symptoms were defined as psychological distress. In this study, the women in the inpatient and outpatient groups reported more psychological distress than the women in the community sample. Interestingly, the husbands of these women also reported higher levels of psychological distress. In addition, 65.8% of outpatient women had scores that fell in the range of a distressed marriage. This was significantly higher than the number of distressed marriages in inpatient women (46.9%) and in the community sample (17.1%). The husbands with wives in either the inpatient or outpatient groups had statistically greater distress in their marriages when compared to the community group.

In summary, the majority of the studies assessing psychological distress and relationship satisfaction report a negative relationship between martial quality and depression and anxiety (Addis & Bernard, 2002; Coyne et al., 2002; Perren et al., 2003; Riso et al., 2002; Tower & Krasner, 2006; Whisman & Bruce, 1999; Whisman et al., 2004; Whisman, 2007). Only one study found no relationship between marital conflict and depression (Brennan et al., 2002). In contrast, Tower and Krasner reported marital closeness predicted depression scores and for females, low depression scores were associated with spousal emotional support and their corresponding spouse also indicating them as a source of emotional support. Riso et al. found that individuals reporting chronic depression had lower marital satisfaction scores. Similarly, Berge et al. found that the health of a child negatively predicted depression and relationship satisfaction scores. When assessing the relationship in terms of marital dissatisfaction, Whisman and Bruce reported marital dissatisfaction increased the risk for experiencing a depressive episode.

When including anxiety as an additional variable, Perren et al. (2003) and Whisman et al. (2004) reported marital quality was negatively associated with depression and anxiety. In addition, Whisman reported that marital distress was positively associated with increased risk for anxiety disorders and mood disorders with generalized anxiety disorder having the strongest positive relationship with marital distress. When assessing females receiving either inpatient or outpatient treatment of clinical depression, Coyne et al. reported that those females receiving treatment had higher levels of depression and anxiety when compared to a community sample. Furthermore, their corresponding husbands also reported higher levels of depression and anxiety when compared to the husbands of the women in the community sample. Interestingly, the couples with a female spouse receiving outpatient treatment had the highest rates of distressed marriages. When anxiety was assessed without depression, Addis and Bernard reported that couples receiving conjoint counseling were more likely to report decreased relationship satisfaction and increased levels of anxiety. Overall, the results indicate that depression and anxiety are associated with decreased martial quality.

Personality

Personality factors also influence relationship satisfaction. Lavee and Ben-Ari (2004) examined the impact of emotional expressiveness, gender, and neuroticism on martial quality in Middle Eastern couples. Results indicated that neuroticism predicted marital quality. For both genders, neuroticism was negatively associated with one's perceived martial quality. Furthermore, husbands' scores on the neuroticism scale negatively predicted their wives' perception of their marital quality. However, it is important to note that martial satisfaction was measured in a single, Likert scaled

question. The ability for one question to capture the comprehensive nature of marital satisfaction is dubious.

Watson and Humrichouse (2006) also measured relationship satisfaction with a single question. In this study, relationship satisfaction was examined with the Big 5 personality factors (openness, agreeableness, conscientiousness, extraversion, and neuroticism) (Thurstone, 1934). Over this two-year longitudinal study in newlyweds, relationship satisfaction decreased over the duration of the study. While one's personality ratings were not related to relationship satisfaction, spouses' scores were. For example, agreeableness was positively associated with relationship satisfaction while neuroticism was negatively associated. Furthermore, declines in neuroticism and increases in agreeableness and conscientiousness were reported at the end of the study; suggesting that personality may change over the duration of a marriage. If relationship satisfaction is associated with personality and personality changes are present in the duration of the relationship, then this leads one to question how changes in personality may impact one's perception of the quality of the relationship.

Gattis, Berns, Simpson, and Christensen (2004) looked at the Big 5 personality factors and relationship satisfaction as well. Scores on neuroticism were associated with marital distress and scores on agreeableness, positive expressiveness, and conscientiousness were positively associated with martial satisfaction. Similar scores between both partners on the personality variables were associated with distress or nondistress in the relationship. For example, there was a small association with similar scores on agreeableness in nondistressed couples. In addition, there was a small association with similar scores on openness to experiences and neuroticism in distressed

couples. A small association was also reported with dissimilar scores on the extraversion and conscientiousness scales in distressed couples.

Overall, associations have been reported with scores on personality inventories and relationship quality scores (Gattis et al., 2004; Lavee & Ben-Ari, 2004; Watson & Humrichouse, 2006). Neuroticism has been consistently negatively associated with relationship quality (Gattis et al., 2004; Lavee & Ben-Ari, 2004). This has also been reported with husbands' neuroticism scores negatively predicting their wives' marital quality scores (Lavee & Ben-Ari, 2004; Watson & Humrichouse, 2006). Watson and Humrichouse also confirmed this same trend with the wives; the wives' neuroticism scores negatively predicted their husbands' martial quality scores. They also found that spouses' scores on agreeableness were positively associated with marital satisfaction. Similarly, Gattis et al. reported that ones' agreeableness, conscientiousness, and positive expressiveness scores were positively associated with relationship satisfaction.

Personality and Psychological Distress

Personality and Anxiety. Caughlin et al., (2000) investigated the relationship between martial satisfaction and trait anxiety in couples participating in a longitudinal study from the beginning of their marriage to the 13th year of their marriage. In this study, trait anxiety was assessed; therefore, anxiety was considered to be a personality characteristic instead of only a psychological symptom. While marital satisfaction had a negative relationship with anxiety, one's level of anxiety was not correlated with his or her spouse's perceived marital satisfaction. Anxiety may be a pervasive characteristic that influences one's perception of marital satisfaction; however according to these results it may not impact the spouse's perception of the quality of the relationship.

In another longitudinal study (28 year duration) commencing when participants were eight years old, Kinnunen and Pulkkinen (2003) assessed personality characteristics, anxious behaviors through teacher ratings at age eight and then measured relationship satisfaction at age 36. Relationship satisfaction was determined by responses to three questions taken from a well known relationship satisfaction questionnaire. At age 36, those individuals who were in good quality relationships were reported to have demonstrated less anxious behaviors in childhood when compared to those individuals in poor quality relationships. This finding suggests that anxiety may persist throughout one's life and that it may negatively impact the quality of one's romantic relationship. Results from personality characteristics at an early age were then correlated with marital status and satisfaction. Males satisfied in their current relationship were reported to have lower neuroticism scores during their assessment at age 27. Females dissatisfied in their current relationship had higher hostility scores in their assessment at age 27. Similar to previous studies, personality is associated with relationship satisfaction.

Depression and Personality. Davila et al., (2003) wanted to assess how neuroticism and gender moderated the relationship between marital satisfaction and depression. This was a longitudinal assessment of newlywed couples without children during the first four years of their marriages. Consistent with other research, there was a negative relationship between depression and relationship satisfaction. Relationship satisfaction gradually declined over the four-year period and depression symptoms occurred in cycles. Neuroticism moderated the relationships between depression and marital satisfaction; higher neuroticism was associated with a stronger relationship between depression and marital satisfaction. While gender differences were not observed

in the relationship between depression and marital dissatisfaction; gender did moderate the relationship between these variables. In females, the relationship between levels of depression and martial dissatisfaction was stronger.

In another study assessing personality, depression, and marital satisfaction, Ruiz et al., (2006) measured these variables with spouses and patients who had undergone heart surgery. Inventories were given prior to surgery. A follow-up was conducted 18 months later. Prior to surgery, the patient's marital satisfaction moderated the relationship between the their spouse's neuroticism levels and the patient's depressive symptoms. At the follow up, the patient's depressive symptoms were negatively associated with his or her own marital satisfaction and the patient's marital satisfaction scores were negatively associated with his or her spouse's depressive symptoms. Overall, a negative association was found between one's level of neuroticism and his or her spouse's reported relationship satisfaction. Therefore, personal characteristics and one's psychological health may account for differences in relationship satisfaction and when measuring relationship satisfaction these may be important variables to investigate.

Depression, Anxiety, and Personality. Whisman et al., (2006) examined marital discord and the big five personality factors, depression, and anxiety in older adults. Martial discord was positively associated with neuroticism and negatively associated with agreeableness. In addition, in females marital discord was negatively associated with extraversion and conscientiousness. Depression scores were positively associated with marital discord. A positive relationship was reported between marital discord and anxiety; this relationship was not confirmed in their hierarchical analysis. This implies that the strength of the relationship between anxiety and relationship satisfaction was

significant with all included variables and was dependent upon how and when it was included in the statistical model. As was reported in previous studies, depression and personality are related to one's perception of the quality of the relationship. However, marital discord was measured through three questions asking how happy, upset, and satisfied the participants feel in their current romantic relationship. Due to the comprehensive nature of relationship satisfaction, one needs to question if the answers to these three questions can fully capture the relationship satisfaction construct.

Results from the empirical studies discussed in the preceding section were similar to the findings reported in the psychological distress and personality sections. For example, depression and anxiety were, again, negatively associated with marital quality (Caughlin et al., 2000; Davila et al., 2003; Kinnunen & Pulkkinen, 2003; Ruiz et al., 2006; Whisman et al., 2006). Neuroticism was once more negatively associated with marital quality (Kinnunen & Pulkkinen; 2003; Ruiz et al., 2006; Whisman et al., 2006). Davila et al. additionally reported that greater neuroticism scores predicted a stronger relationship between marital satisfaction and depression and Ruiz et al. reported that neuroticism was negatively associated with one's spouse's relationship satisfaction scores. Whisman et al. further found marital discord to be negatively associated with agreeableness and that for females only, extraversion and conscientiousness were negatively associated with marital discord.

Selective Serotonin Reuptake Inhibitors (SSRIs)

Much research has been conducted with SSRIs and other neurochemicals as well as SSRIs and their sexual side effects. Medications are chemically based and with any medication, side effects are ubiquitous. As previously discussed in chapter one, common

side effects from SSRIs include gastrointestinal discomfort, headaches, nervousness, apathy, sexual dysfunction, changes in appetite, and sleep distributions (Physician Desk Reference, 2005). In addition, in treatments with medications designed to alter neurochemicals, changes in other neurochemicals can be expected. This section will review the relevant literature related to SSRIs and the chemicals implicit in attachment love (dopamine, oxytocin, and vasopressin) as well as the potential side effects of SSRIs that may impact attachment love such as apathy and sexual dysfunction.

Dopamine

Esposito (2006) reviewed the literature on the relationship between serotonin and dopamine. In this analysis, serotonin was consistently reported to inhibit dopamine release. In the review, the correlation of reduced dopamine turnover was frequently reported in individuals with depression and reduced dopamine turnover was also associated with SSRI use. It was unclear, however, if the decreases in amount of dopamine available for transmission were sustained in long-term treatment.

Muira, Kitagami, and Ozaki (2007) examined the influence of paraxetine (an SSRI) on tetrahydrobiopterin, homovanilic acid, serotonin, 5-hydroxyindoleacetic acid, and dopamine levels in the midbrain and prefrontal cortex of mice. The mice on paraxetine were housed in groups or in social isolation and were further divided into groups that did or did not experience a stress test at the end of a 28 day trial. When compared to the control groups, the mice in the in-group housing had a significantly decreased amount of homovanilic acid dopamine ratio in their prefrontal cortex. This is a measure of dopamine levels. In addition, those who experienced the novelty of stress had reduced their dopamine turnover. In the midbrain, the paroxetine was again found to

decrease the homovanilic acid dopamine ratio. These findings in the prefrontal cortex and midbrain indicate a decrease in dopamine levels and imply that there is a decrease in available dopamine for transmission. Those in the isolation housing did not have the same suppression of dopamine turnover.

This study was a replication of two previous studies where Muira, Qiao, Kitagami, Ohta, and Ozaki (2005a, 2005b) utilized similar methodologies with fluvoxamine instead of paroxetine. Similar results were reported; fluvoxamine treatments decreased dopamine available for neurotransmission in the prefrontal cortex and midbrain. This decrease in available dopamine is a concern for individuals in romantic relationships if it is true that dopamine is associated with each of the emotion systems of love (attraction, lust, and attachment). If dopamine is not available when it typically increases during times associated with a romantic relationship, this leads one to question the impact on romantic relationship.

Nakayama (2002) examined the impact of an injection of paroxetine on extracellular levels of dopamine and serotonin in rats. Extracellular dopamine levels were increased in the prefrontal cortex and the increase in levels was sustained 180 minutes after the injection. This leads one to question how long extracellular dopamine levels sustain the increase. If dopamine levels are sustained and remain elevated for a significant length of time, then perhaps the concern of SSRI use decreasing dopamine levels is unfounded. Valentini, Cacciapaglia, Frau, and Di Chiara (2005) also reported increases in extracellular dopamine levels with citalopram and paroxetine. With citalopram at 10mg/kg, dialysate dopamine increases were reported in the occipital cortex and parietal cortex; however, dopamine increases were not observed in the prefrontal

cortex. Paroxetine at 10 mg/kg was found to increase the extracellular dopamine in the occipital and prefrontal cortex. Pozzi, Invernizzi, Garavaglia, and Samanin (1999) also reported changes in dopamine levels on the prefrontal cortex in mice. In their study, the increase of extracellular dopamine was significant with fluoxetine. Like Valentini et al., they utilized citalopram and found that the increase of concentrations of dopamine in the prefrontal cortex was not significant with a lower dosage (10 mg/kg) and only significant with a higher dosage (25 mg/kg).

This discrepancy among the impact of other SSRIs and their relationship to dopamine was also reported in Bymaster et al. (2002). Bymaster and associates compared the influence of fluoxetine, citalopram, sertaline, paroxetine, and fluvoxamine on dopamine, serotonin, and norepinephrine extracellular concentrations in the prefrontal cortex of rats. The rats were administered one of the five SSRIs and then levels of all of the neurochemicals over the next four hours were compared to the rats' mean baseline. This allowed the researchers to determine initial and sustained (four hour) increases in the neurochemical levels. Fluoxetine was the only SSRI to significantly produce sustained increased levels of dopamine. This suggests that perhaps the chemical structure of fluoxetine is different from the other SSRIs and this may lead to the changes in dopamine levels.

Smith, Kuczenski, George-Friedman, Malley, and Foote (2000) examined the relationship between extracellular dopamine and serotonin levels in monkeys given fluoxetine daily for 21 days. In the caudate, no significant changes in extracellular dopamine levels were reported. When assessing the results from these studies, the impact

of SSRI use on extracellular dopamine levels in the prefrontal cortex cannot be determined.

While Bymaster et al. reported increased concentrations of dopamine, Amargos-Bosch, Artigas, and Adell (2005) found no significant changes in dopamine levels in rats after their two-week administration of fluoxetine. This suggests that SSRIs may not have a long-term impact on dopamine. Chen and Lawrence (2003) also found no relationship between the SSRI sertaline and the dopamine system. In their study with rats, they assessed the differences between sertaline and desipramine (a tricyclic anti-depressant) on the serotonergic and dopaminergic systems. Six hours after their decapitation, the sertaline injected rats showed no significant differences in dopamine transporters. Dopamine transporters bind to dopamine and execute uptake from the synaptic cleft. This terminates the dopamine signal and removes the dopamine from the synaptic cleft. The findings reported in Chen and Lawrence suggests that sertaline may not have an impact on the dopamine system.

Ainsworth (1998) investigated the effect of fluoxetine and other antidepressant medications on dopamine in the nucleus accumbens in rats injected twice daily and reported increased binding at D_2 (one type of dopamine receptors) receptors in the shell and core of the nucleus accumbens, a reward center in the brain. However, extracellular dopamine levels were not changed in the nucleus accumbens as a result of the fluoxetine injections. This was also confirmed in Pozzi, Invernizzi, Garavaglia, and Samanin (1999) where neither fluoxetine nor citalopram significantly changed dopamine concentrations in the nucleus accumbens.

In summary, the results of SSRI use on dopamine in rats are inconclusive. Esposito (2006), Muria et al. (2007), and Muria et al. (2005a, 2005b) all reported decreases in available dopamine associated with fluvoxamine and paroxetine use. However, Nakayama (2002) and Valentini et al. (2005) found that paroxetine was associated with increased dopamine levels. Additionally, Valentini et al. reported citalopram produced similar results. Only one study reported increases in dopamine levels with fluoxetine injections (Bymaster et al., 2002) and with other SSRIs (citalopram, sertaline, paroxetine, and fluvoxamine) no significant changes were reported in dopamine (Ainsworth, 1998; Amargos-Bosch et al., 2005; Bymaster et al., 2002; Chen & Lawrence, 2003; Pozzi et al., 1999; Smith et al., 2000). These findings suggest that with rats, SSRIs use and the impact on the dopamine system needs further exploration.

SSRIs and Oxytocin and Vasopressin

Uvnas-Moberg, Bjorkstrand, Hillegaart, and Ahlenius (1999) assessed the relationship between two SSRIs, citalopram and zimeldine, oxytocin, and other related peptides (CCK, somatostatin, insulin, and gastrin) in rats. In this study, rats were given citalopram or saline everyday for 14 days and then one day after the final citalopram or saline injection was given, the rats were injected with zimeldine. The rats were then decapitated either 40 minutes or three hours after the final injection. In both SSRI treated groups, there was a significant increase in plasma oxytocin levels. After the two weeks of citalopram administration whether the rats were given saline or zimeldine, the results were similar. While this study is with rats and one cannot necessarily infer that results would be similar in humans, it still should be considered as a possible effect of

citalopram treatment with humans. How these increased plasma levels may impact a romantic relationship is unknown.

In another study utilizing citalopram, Hesketh, Jessop, Hogg, and Harbuz (2005) examined how this SSRI and restraint stress influenced vasopressin, corticosterone, adrenocorticotrophin, and oxytocin. In their study, rats were injected with citalopram for 14 days and also restrained in a plastic circular container to induce stress. Magnocellcular oxytocin mRNA was increased in the restraint only and citalopram and restraint groups; however, citalopram alone did not alter the oxytocin mRNA levels. In addition, results indicated that arginine vasopressin mRNA increased in the parvocellcular cells in the paraventricular nucleus after the 14 days of citalopram injections in the citalopram injection and restraint group. Furthermore, the restraint stress alone did not change the arginine vasopressin mRNA levels.

Jorgensen, Kjaer, Knigge, Moller, and Warberg (2003) investigated the relationship between serotonin and vasopressin and oxytocin by injecting rats with 5-hydroxy-d,l-tryptophan (a serotonin precursor) and fluoxetine (an SSRI). Those rats that were injected six hours prior to decapitation had a 15% increase in levels of oxytocin messenger ribonucleic acid (mRNA) in their paraventricular nucleus and no changes in levels of oxytocin in their hypothalamic supraoptic nucleus. This is contrary to the results reported in Hesketh et al. Furthermore, those rats that were injected with the 5-hydroxy-d,l-tryptophan and fluoxetine 40 minutes prior to decapitation had increased plasma concentration of oxytocin and vasopressin. However, those rats that were injected six hours prior to decapitation had no changes in levels of vasopressin messenger ribonucleic acid (mRNA) in their paraventricular nucleus or hypothalamic supraoptic nucleus. Again,

this may be in contrast to the results reported in Hesketh et al., although Hesketh and colleagues were only able to report results up to three hours after SSRI administration. This leads one to question the sustained effect of fluoxetine on vasopressin.

Differences in empirical research supporting the increase or decrease of oxytocin levels after administration of SSRIs might be explained by the duration of treatment. Cantor, Binik, and Pfaus (1999) found that the chronic use of an SSRI inhibited sexual behavior in rats; yet, this behavior was reversed when the rats were treated with oxytocin. This suggests that long term use of the SSRI (fluoxetine) depletes oxytocin levels. Cantor and colleagues injected rats with fluoxetine, oxytocin, or saline for a total of 11 trials with each trial lasting four days. During the fluoxetine treatments the rats demonstrated decreases in sexual behaviors and ejaculation when in the presence of a female rat. During the oxytocin treatments, while there was no change in sexual behaviors, there was an increase in the number of ejaculations.

The sexual side effects could also be a reflection of the ability to release oxytocin in natural situations. Similar to Cantor and associates (1999), Jong et al. (2005) examined the relationship of paroxetine on sexual behavior in rats. After daily injection of paroxetine for 21 days, male rats were provided a sexual opportunity with a female rat. Compared to the control group, the treated rats experienced increased ejaculation latency, increased mount frequency, and a reduction in ejaculation frequency. Furthermore, fos-immunoreactivity (marker of neural activation) in the oxytocinergic magnocellular was decreased. The results from this study suggest that prolonged treatment with paroxetine may prevent oxytocin release in serotonin receptor activation.

Raap et al. (1999) investigated the relationship of fluoxetine and a serotonin receptor agonist (8-OH-DPAT) on adrenocoticotropic hormone and oxytocin secretion in rats. The rats were administered fluoxetine for 14 days and then were injected with 8-OH-DPAT. They were then sacrificed in intervals between two and 60 days after the final fluoxetine injection. 8-OH-DPAT and other serotonin receptor agonists are associated with increasing oxytocin and other hormone levels. Compared to the controls, after two days following the final fluoxetine injection those rats had oxytocin levels that were inhibited by 74%. After 60 days, those rats injected with fluoxetine still had inhibited oxytocin levels of 26.1% compared to the control group. This implies that the effects of fluoxetine on oxytocin continue to impact this hormone long after the final treatment. Similar findings were reported in Damjanoska et al. (2003). They executed a comparable methodological study with rats that were given fluoxetine for 2, 3, 7, 21, or 42 days, followed by DOI (a serotonin receptor agonist fully known as (±) -1-(2,5-dimethoxy-4-iodophenyl)2-amino-propane HCI), and then decapitated 15, 30, or 60 minutes after the DOI injection. Oxytocin responses to the DOI were attenuated after 3, 7, 21, and 42 days of fluoxetine injections.

D'Souza, Zhang, Garcia, Battaglia, and van de Kar (2003) also reported an inhibited oxytocin response to 8-OH-DPAT in rats after they received 14 days of fluoxetine treatments. D'Souza and colleagues reported a dose dependent attenuated response of 76% for those given fluoxetine (5 mg/kg daily) for the 14 days and a 93% inhibited response when given fluoxetine (10mg/kg daily). This leads one to question the actual impact of SSRIs on oxytocin. The possibility that SSRIs actually have no effect on oxytocin levels should be considered. Landry et al. (2005) in their study treating

prepubescent rats with fluoxetine and/or a serotonin receptor agonist found no difference in oxytocin levels based on analysis from trunk blood between those treated with fluoxetine only and those in the control group. Therefore, these results from SSRI use and oxytocin literature are not as consistent as expected.

The empirical studies investigating the relationship between SSRI use and vasopressin in rats are conflicting. Hesketh et al. found increases in vasopressin mRNA levels after SSRI use, while Jorgensen et al. reported no differences in vasopressin plasma levels. There is also conflicting literature investigating the relationship between SSRI use and oxytocin. For example, while Uvnas-Moberg et al. (1999) and Jorgensen et al. (2003) reported increases in oxytocin plasma levels, Hesketh et al. (2005) and Landry et al. (2005) reported no difference in oxytocin level due to SSRI use. Differences in the oxytocin studies could perhaps reflect a difference in duration of treatment. It was suggested that prolonged SSRI use might decrease oxytocin levels (Cantor et al., 1999; Damjanoska et al., 2003; D'Souza et al., 2003; 1999; Jong et al., 2005) and that the depletion in oxytocin levels may also persist after SSRI treatment has ceased (Raap et al., 1999). The data from the studies on the relationship between SSRI use and oxytocin and vasopressin in rats appear to be inconclusive and further research is needed.

SSRIs and Sexual Dysfunction in Humans

Rosen et al., (1999) reviewed the literature related to the use of SSRIs and sexual dysfunction. In their meta-analysis of the relevant empirical studies, delayed and absent ejaculations and orgasms were consistently represented in the literature. The prevalence was across many SSRIs, including sertaline, fluoxetine, paroxetine, fluvoxamine, and citalopram. Delayed or absent orgasms or ejaculations were reported in as few as 0.64%

of the sample population to as high as 61% of the sample population. While some studies found a decrease in the frequency of delayed or absent orgasms and ejaculations after a prolonged duration of SSRI use, this finding was not consistent. Rosen et al. also examined the literature related to the hypothesis that sexual dysfunction side effects are the result of a decrease in dopamine. They reported that dopamine is consistently reported to enhance sexual arousal and that dopamine antagonists consistently inhibit sexual responses.

Consistent with this dopamine hypothesis, Tsai, Shui, Liu, Tai, and Tsai (2006) reported that the rats in their study that displayed no sexual behaviors had the lowest dopamine levels when compared to rats displaying sexual behaviors and the rats displaying some sexual behaviors, but not ejaculating. Thus, there appears to be support that a decrease in dopamine as a result of SSRI use may explain sexual side effects in humans. It is important to note that many physicians prescribe dopamine enhancers to alleviate sexual side effects.

It has been reported that depression is frequently known as negatively impacting sexual function. In order to test this hypothesis, Clayton, Kornstein, Prakash, Mallinckrodt, and Wohlreich (2007) examined sexual dysfunction in individuals diagnosed with depression who were taking duloxetine (a serotonin norepinephrine reuptake inhibitor), escitalopram (SSRI), or a placebo. Participants completed a sexual functioning questionnaire prior to beginning treatment and at 4, 8, 12, and 32 weeks after treatment began. At 4 and 8 weeks after treatment commenced, treatment-induced sexual dysfunction in the escitalopram group was significantly higher than in the placebo group and at four weeks the sexual dysfunction induced from escitalopram was significantly

higher than that from duloxetine. Incidences of sexual dysfunction in the group utilizing escitalopram were 48.7% at eight weeks and 43.6% at eight months.

In another study comparing anti-depressants, Philipp, Tiller, Baier, and Kohnen (2000) investigated the difference between a reversible monoamine oxidase A inhibitor (RIMA) and SSRIs (Fluvoxamine, sertaline, fluoxetine, and paroxetine) on sexual dysfunction with depressed adults. In this study, SSRI use resulted in 56.2% of the sample population experiencing orgasm difficulties and 32.8% of the sample experiencing difficulties with ejaculation. This was consistent with Clayton et al.'s (2002) findings reported above. Risk for sexual dysfunction with the non-SSRIs (bupropion IR, bupropion sustained release, and nefazodone) ranged from 22% to 28% compared to 36% to 43% for SSRIs, mirtazapine, and venlafaxine XR. Mirtazapine and venlafaxine XR are not SSRIs. Furthermore, when comparing non-SSRIs with SSRIs, those on SSRIs reported prevalence rates of sexual dysfunction ranging from 7% to 30%. In addition, those on SSRIs or venlafaxine XR were four to six times more likely to report sexual dysfunction than those on bupropion SR.

Montejo, Llorca, Izquierdo, and Rico-Villademoros (2002) also reported high rates of sexual dysfunction in those on antidepressants (SSRIs and non-SSRIs). Here sexual dysfunction was represented as changes in libido, erectile function, ejaculation, orgasm, and sexual satisfaction. Rates of sexual dysfunction were assessed among individuals with no previously reported incidences of sexual dysfunction. Sexual dysfunction was reported in 59.1% of the sample on antidepressants, including those on and not on SSRIs. Rates of sexual dysfunction among those on SSRIs included 72.7% for

citalopram, 70.7% for paroxetine, 62.9% for sertaline, 62.3% for fluvoxamine, and 57.1% for fluoxetine.

While there is consistent support for sexual dysfunction associated with SSRI use, differences in sexual behaviors were not altered in prairie voles (Villalba, Boyle, Caliguri, & DeVries, 1997). In this study, male and female voles were injected with fluoxetine. Of those on the SSRI, there were no differences reported in sexual behaviors compared to the control group. In addition, when compared to the control group, those treated with fluoxetine took longer to respond to parental roles. However, other parental behaviors and care for offspring did not differ.

Sexual side effects from SSRI use in humans have been consistently reported across numerous studies (Clayton et al., 2002; Montejo et al, 2002; Philipp et al., 2000; Rosen et al., 1999). One explanation for the sexual side effects is related to decreased levels of dopamine as a result of SSRI use (Rosen et al., 1999; Tsai et al, 2006). For example, Tsai et al. found in their study with rats that those rats not displaying sexual behaviors had the lowest dopamine levels. While this study utilizing an animal model found differences in sexual responses, Villalba et al. (1997) found no differences in sexual behaviors in prairie voles between those voles treated with fluoxetine and those voles receiving no SSRI treatment.

SSRIs and Apathy

The potential apathy side effect is also a concern for those in romantic relationships. Often individuals are unaware that apathy could be a side effect for SSRI use. Apathy could be associated with the quality of the romantic relationship instead of being associated with the medication. In turn, this may impact one's perception of his or

her romantic relationship. Barnhart, Makela, and Latoucha (2004) reviewed the relevant literature related to apathy, or what has been titled SSRI-induced Apathy Syndrome, and SSRI use. Apathy was defined as a lack of motivation that could not be explained by emotional, cognitive, or consciousness impairment. In their analysis, Barnhart et al. reported paucity in the documented reports. Reviewing back as far as 1970 only produced 12 results. This lack of research suggests the relevant newness and modest amount of knowledge about this growing area. In their assessment, apathy was differentiated from depression. Much of the literature was reported in case studies. Apathy is a syndrome known to impact children and adolescents as well as adults. It was suggested that the impact of SSRIs on dopamine might be increasing these apathy symptoms because ingestion of dopamine enhancing medications alleviated the symptoms. Barnhart and colleagues called for a need for physicians to be able to identify emotional blunting and for individuals on SSRIs to be able to recognize this as potential side effect.

The pervasiveness of this syndrome was elucidated in Opbroek et al. (2002). In this study, in order to participate, all members of the sample had to be experiencing sexual dysfunction as a result of SSRI use and also be in remission from depression. Participants reported being on paroxetine, fluoxetine, or sertaline. In order to measure apathy, the participants completed an emotional expression questionnaire. Identified symptoms such as decreased ability to cry and decreased pleasure were reported in 80% of the sample population. Depression scores were not associated with emotional expression. Furthermore, gender was not a significant predictor of emotional expressiveness.

Lee and Keltner (2005) assessed a series of case studies of individuals experiencing this emotional blunting side effect or what they called Antidepressant Apathy Syndrome. In this analysis, individuals reported such symptoms as indifference, no motivation, difficulty concentrating, disinhibition, feelings of sedation, and apathy. Many of the individuals with these symptoms were relieved of these symptoms upon a change in dosage or a switch to a medication other than an SSRI. However, if individuals are not cognizant that these types of side effects could be related to their medication, they may not seek out help from the individual who prescribed the medication.

Few studies have investigated SSRI-induced Apathy Syndrome or Antidepressant Apathy Syndrome. This syndrome has been described as a lack of motivation, indifference, and a decreased ability to express emotions such as pleasure and sadness (Barnhart et al., 2004; Lee & Keltner, 2005; Opbroek et al., 2002). This syndrome could be pervasive in individuals already experiencing other side effects from SSRI use. For example, Opbroek et al. reported in their sample of individuals with SSRI induced sexual side effects that 80% of the sample had difficulty expressing emotions. Possible explanations of this syndrome are decreased dopamine levels (Barnhart et al., 2004) and incorrect SSRI dosages (Lee & Keltner, 2005).

Conclusion

This literature review was designed to investigate current literature related to romantic relationship quality, the neurochemicals of love, and the use of SSRIs. This dissertation study was designed to investigate the relationship between romantic relationship quality and SSRI use with personality, depression, and anxiety scores treated as covariates. These variables were selected as covariates because the literature was

consistent with reporting that these variables may negatively impact relationship quality (Addis & Bernard, 2002; Caughlin et al., 2000; Coyne et al., 2002; Davila et al., 2003; Gattis et al., 2004; Kinnunen & Pulkkinen, 2003; Lavee & Ben-Ari, 2004; Perren et al., 2003; Riso et al., 2002; Ruiz et al., 2006; Tower & Krasner, 2006; Watson & Humrichouse, 2006; Whisman & Bruce, 1999; Whisman et al., 2004; Whisman et al., 2006; Whisman, 2007).

According to an anthropological theory of love proposed by Fisher, the neurochemicals dopamine, oxytocin, and vasopressin were suggested to be positively related to the attachment emotion system of love (Fisher & Thompson, 2006, Fisher, 2004, 2000, 1999). Upon review of the literature, evidence suggests empirical support of this hypothesis (Aragona et al., 2003; Aron et al., 2005; Bales & Carter, 2003; Bartels & Zeki, 2000; Cho et al., 1999; Cushing & Cater, 1999, 2000; Fisher et al., 2005; Gingrich et al., 2000; Gonzaga et al., 2006; Gridler et al., 2004; Hammock & Young, 2005; Light et al., 2005; Lim & Young, 2004; Liu et al., 2001; Pitkow et al., 2001; Smeltzer et al., 2006; Turner et al., 1999; Wang et al., 1999). However, it is important to note that results from human studies related to romantic relationships and oxytocin were inconsistent. For example, while Gridler et al. and Light et al. suggested that oxytocin was positively associated with emotional support from a romantic partner, Taylor et al. found a negative relationship between romantic relationship quality and oxytocin levels. Too further muddy the findings, Marazzitti et al. found no relationship between oxytocin levels and relationship status. This is perhaps because this study did not examine marital quality, only demographic variables.

When the use of SSRIs was examined with neurochemicals: dopamine, oxytocin, and vasopressin levels, the results were also inconclusive. However, there was enough empirical support to suggest that SSRI use reduces dopamine and oxytocin levels (Cantor et al., 1999; Damjanoska et al., 2003; D'Souza et al., 2003; Esposito, 2006; Jong et al., 2005; Muria et al., 2007; Muria et al. 2005a, 2005b; Raap et al., 1999; Rosen et al., 1999; Tsai et al, 2006). Contrary to this, SSRI use was also suggested to increase oxytocin, vasopressin, and dopamine levels (Bymaster et al., 2002; Hesketh et al., 2005; Jorgensen et al., 2003; Nakayama, 2002; Uvnas-Moberg et al., 1999; Valentini et al., 2005). Due to the inconsistent findings between SSRI use and dopamine, oxytocin, and vasopressin levels, more research needs to investigate these relationships.

One's perception of the quality of his or her romantic relationship may also be related to how one feels when in the presence of his or her partner and the sexual relationship (Donnelly, 1993, Fisher, 2004). The literature consistently reports sexual dysfunction as a potential side effect of SSRI use (Clayton et al., 2002; Montejo et al, 2002; Philipp et al., 2000; Rosen et al., 1999). Montejo et al. reported sexual dysfunction was experienced by over 70% of their sample on an SSRI. Many individuals perceive their sexual relationship with their partner to be an indicator of the quality of the relationship (Donnelly, 1993); therefore, it was important to investigate this side effect associated with SSRI use. Finally, there is empirical evidence to suggest that apathy may be a side effect of SSRI use (Barnhart et al., 2004; Lee & Keltner, 2005; Opbroek et al., 2002). Opbroek et al. reported 80% of their sample with SSRI induced sexual dysfunction were also experiencing SSRI-induced Apathy Syndrome or Antidepressant Apathy Syndrome. This is a concern with romantic relationships because many

individuals are not cognizant of this potential side effect and these lack of feelings may become associated with the quality of the romantic relationship.

Chapter Three:

RESEARCH METHOD

Participants/Recruitment

A non-random, availability sampling procedure was used to recruit potential participants for this study. Electronic means was the only method of recruitment employed. While this is a convenient method for collecting responses, Lefever, Dal, and Matthíasdóttir (2007) reported nonrandom sampling, variability of the technology, and fraudulent responses were concerns when conducting research online. Invitations to participate in this research study were electronically sent to the following professional listservs: Listserv Concerning Counselor Education & Supervision, Graduate Students in Counselor Education, American Psychological Association (APA) Division 43 Family Psychology Members, Family Psychology Researchers, Discussion for Students Interested in Family Psychology, APA Division 43 Members Interested in Relational Diagnosis, the Discussion for Education & Training in Family Psychology, International Association for Marriage and Family Counselors (IAMCF) Graduate Student and New Professionals Listserv, IAMFC Professional Members Listserv, and the National Association for Drama Therapists Listserv. In addition, an electronic invitation to participate was sent to the University of Missouri- Saint Louis' Division of Counseling and Family Therapy email list. Lastly, electronic invitations to participate were sent to the author's personal and professional acquaintances, friends, and family. Invitations were emailed every 3-4 days over a three-week period. Some participants informed the author that the invitation to participate was also forwarded on to individuals they knew met the qualifications of the study. From these avenues, individuals were informed they

could request hard copies of the survey to fill out and mail back to the researcher. Five individuals selected this method of participation. Please see the Appendix A for the invitation to participate emailed.

Instruments

Demographic Measure. This included such information as: gender, age, his or her occupation, partner's occupation, military status, geographic location, income, highest completed education, type of relationship (same sex or heterosexual), relationship status, length of relationship, children, ages of children (if applicable), how often participant attends religious services, race and ethnicity, how many days per week participant exercises for at least thirty minutes, average amount of time spent with romantic partner in minutes on a daily basis, and how often the individual goes out a date with his or her partner on a weekly and monthly basis. Please see Appendix B for demographic measure.

Medication Inquiry. This included a list of SSRIs such as Celexa, Lexapro, Escitalopram Oxalate, Fluvoxamine, Paroxetine, Sertraline, Luvox, Paxil, Zoloft, Citalopram, Fluoxetine, Zimeldine, and Prozac and a list of dopamine enhancers such as Permax, Olanzapine, Amantadine, D-amphetamin, Dostinex, Cabergoline, Bromocriptine, Pergolide, Pramipexole, Lisuride, Uprime, and Apomophine where the individual may place a check mark next to the medication(s) he or she (or his or her spouse) is currently taking. The use of dopamine enhancers (commonly prescribed with SSRIs) is negatively associated with sexual dysfunction and serotonin levels; therefore, individuals taking dopamine enhancers were excluded from the study. Next to the name of the medication, the individual could also indicate his or her dosage, if known. There

was fill in the blank section where the individual could list other medications he or she is taking and dosages if known. Please see the Appendix B for the medication inquiry.

Dyadic Adjustment Scale. The Dyadic Adjustment Scale (DAS; Spanier, 1976) assesses romantic dyadic adjustment. This scale has a total of 32 items that are divided into 4 subscales: dyadic satisfaction, dyadic cohesion, affectional expression, and dyadic consensus. The dyadic satisfaction subscale measures the amount of pleasure, contentment, and fulfillment one feels from the quality of his or her romantic relationship. The dyadic cohesion subscale measures the amount of closeness one experiences through a relationship with a romantic partner. The dyadic consensus subscale measures the amount of, and importance of, agreement one experiences with a romantic partner. The affectional expression subscale measures the amount of physical expression of love and affection for one's partner and what one experiences by his or her partner.

The questions are rated on a variety of Likert-type scales ranging from 0-5, 1-6, 0-4, and 1-5; these scales are ranked with *always disagree* to *always agree, never* to *all the time, extremely unhappy* to *perfect,* and *never* to *more often* (than once a day). In addition, there are two dichotomous questions that require a *yes* or *no* response. The Likert-type scales utilized are not consistent among the subscales; thus, some subscales utilize multiple Likert-type scales as answers to the questions. Higher scores on this inventory indicate higher levels of dyadic adjustment. An example question from the dyadic consensus subscale is, "How often do you or your mate leave the house after a fight?" An example question from the dyadic cohesion subscale is "Do you and your mate engage in outside interests together?" An example question from the dyadic

affectional expression subscale asks about level of agreement with, “Demonstrations of affection.” An example question from the dyadic satisfaction subscale asks about level of agreement with, “Leisure time interests and activities.” (Spanier, 1976).

This scale was normed on married and divorced individuals (Spanier, 1976). The mean for married individuals was 114.8 with a standard deviation of 17.8 and the mean for divorced individuals was 70.7 with a standard deviation of 23.8. In regard to reliability with the sample above, there was an overall internal consistency alpha of 0.96, with the subscales having alphas of .94 for dyadic satisfaction, .81 for dyadic cohesion, .90 for dyadic consensus, and .73 for affectional expression (Spanier, 1976). In regard to validity, evidence of concurrent validity with the Locke Wallace Marital Adjustment Scale was reported with the same sample; this instrument is also utilized to assess for romantic relationship satisfaction (Spanier, 1976).

State Trait Anxiety Inventory (STAI). The State Trait Anxiety Inventory (Spielberger, 1983) was utilized to assess state levels of anxiety. The full inventory includes two subscales: the state and the trait subscales. For purposes of this study, only the current anxiety levels were measured and therefore, only the State Anxiety Inventory (SAI) subscale was utilized. This subscale includes 20 items that asks test takers to indicate current intensity of anxiety from 1 (*not at all*) to 4 (*very much so*) (Barnes et al., 2002). An example question from the state subscale is, “I feel tense” (Spielberger, 1983). According to Spielberger (1983), the instruments were normed on high school juniors, college freshman, individuals enrolled in an introduction to psychology course, prisoners, neuropsychiatric patients, and general medical patients. Kuder Richardson 20 internal consistency for the anxiety-state scale ranged from .83 to .92 (Spielberger, 1983). In

regard to concurrent validity, the STAI was correlated with the Taylor Manifest Anxiety Scale (.80) and the IPAT Anxiety Scale (.75) (Spielberger, 1983).

Center for Epidemiologic Studies Depression Scale (CES-D). The CES-D (Radloff, 1977) will be utilized to assess levels of depression. This instrument contains 20 items that are answered with a Likert Scale ranging from 1 (*rarely)* to 4 (*most or all of the time).* All questions are answered based on experiences the participant has had over the past week. Example items include, "I was happy," "I felt sad," and "I felt I could not shake the blues even with help from my family or friends." (Radloff, 1977).

The CES-D was normed on a predominately Caucasian population of males and females. In addition, this scale was also normed on a psychiatric population. Reliability scores were higher for the psychiatric population than the general population. Internal consistency alphas ranged from .85 (general population) to .90 (psychiatric population) (Corocan & Fischer, 1987). In addition, the split half Spearman Brown ranged from .77 to .92 (Corocan & Fischer, 1987). Test- retest reliability was .51 to .67 for a 2-8 week period and .32 to .54 for a 3-12 month period (Corocan & Fischer, 1987). The CES-D is said to have concurrent validity with other depression inventories. There was a small statistical association with this scale and social desirability. Reliability and validity have been confirmed for samples of Caucasians and African Americans (Corocan & Fischer, 1987).

Personality Belief Questionnaire-Short Form (PBQ-SF). The PBQ-SF (Butler, Beck, & Cohen, 2007) will be utilized to assess pervasive personality patterns. This instrument was generated from the Personality Belief Questionnaire developed by Beck and Beck in 1995. It is an abridged version from the original 126 items; it now contains

65 items. The questionnaire is divided into 10 subscales: avoidant, dependent, obsessive-compulsive, anti-social, schizoid, paranoid, histrionic, narcissistic, passive-aggressive, and borderline subscales. The participants are asked how much they believe each statement on the inventory. The items will be scored on a five point Likert scale where 0 equals *not at all* and 4 equals *totally believe.* Example items include, "Being exposed as inferior or inadequate will be intolerable." and "Other people are often too demanding" (Butler et al., 2007).

The sample population on which the PBQ-SF was normed included individuals with either a DSM Axis I and/or Axis II disorder (Butler et al., 2007). They participated in one of two groups. In the first sample, 55% were female and in the second sample 58% were female (Butler et al., 2007). Information on ethnicity was not provided for the initial sample, but the second sample was predominately Caucasian (86%) with 5% African Americans, 3% Latinos, 3% Asian, and an additional 3% reporting other ethnicities (Butler et al., 2007). The internal consistency alpha for the entire scale was .97 with alphas on the subscales ranging from .81 to .92 (Butler et al., 2007. Test- retest reliability on the subscales after four weeks ranged from .57 for the anti-social subscale to .82 for the obsessive –compulsive subscale (Butler et al., 2007). The PBQ-SF has concurrent validity with the Personality Belief Questionnaire (Butler et al., 2007).

Procedures

Participants were invited to access the survey introductory web page at (www.surveymonkey.com) wherein the purposes of the survey, eligibility for participation, and informed consent were found. In the invitation to participate and in the informed consent, potential participants were informed that upon completion of the

survey they could volunteer to be entered into a drawing for one of three $50 Target gift cards. Please Appendix B for a copy of the informed consent. Upon agreement to participate, interested individuals were invited to continue to the survey containing the demographic information, a medications inquiry, and the four psychometric scales. In addition, from the introductory web page, participants were allowed to request hard copies of the survey to be distributed via parcel post if they had limited computer and online access. Once individuals were aware of the study, they could either utilize the link available in the "seeking participants" letter sent to the electronic sources or request hard copies by emailing the researcher.

After completion of the informed consent, including reading the risks, benefits, and agreement to participate statements, the individual was directed to the survey. The participants were to complete the demographic information first. Following the demographic information the participants were asked to complete four scales: the Dyadic Adjustment Scale to assess dyadic adjustment, relationship satisfaction, dyadic consensus, dyadic cohesion, and affectional expression; the State Anxiety Instrument designed to assess anxiety levels; the Center for Epidemiologic Studies Depression Scale to assess depression levels; and the Personality Belief Questionnaire-Short Form to assess pervasive personality patterns. Upon completion of the demographic information and the four instruments, the participants completed the medication inquiry. The total expected time to complete all of the scales and general demographic information was approximately 50-60 minutes. However, individuals reported to the researcher that the actual time needed to complete the survey was between 20-30 minutes.

Chapter Four:

RESULTS

This chapter is organized into five sections. The first section includes an introduction into the statistical analysis. The second section provides the descriptive statistical analysis of population demographics including why certain individuals were eliminated from the study and a descriptive statistical analysis of the psychometric instruments. The third section includes the major MANCOVA analysis. The fourth section reviews supplemental analyses including a One-way Multivariate Analysis of Variance (MANOVA) and multiple T-tests. The final section summarizes the results.

Statistical Analysis

The Statistical Package for Social Sciences was used to analyze the data collected from the demographic questionnaire, the medication inquiry, and the four psychometric instruments (DAS, CES-D, SAI, and PBQ-SF). The purpose of this study was to examine the relationship between romantic relationship quality and the use or non-use of SSRIs with individuals who have been in the same, current romantic relationship for a minimum of two years. In order to measure this relationship, a One-way Multivariate Analysis of Covariance (MANCOVA) was utilized. The independent variable included use or non-use of a SSRI; the dependent variables included dyadic satisfaction, dyadic cohesion, dyadic consensus, and affectional expression. The variables treated as covariates included scores from the CESD, scores from the SAI, scores from the Paranoid, Dependent, and Schizoid subscales of the PBQ-SF, and the following demographic variables: hours spent together on a weekly basis, dates per month, sexual activity per month, sexual relationship satisfaction, and amount of sexual interest. MANCOVAs are conducted to

examine group mean differences. For the major analysis these group differences were computed between those on a SSRI and those not on a SSRI for the dependent variables after controlling for the covariates.

Incorporating covariates into a model increases the statistical power, reducing the chances of committing a Type II error due to the fact that the covariates account for a portion of the variance in the dependent variable. According to Huck and Cormier (1996), the group mean of the dependent variable is adjusted when controlling for the covariate. For example, if there is an above or below average mean on one of the covariate scales (depression, anxiety, or personality) in one of the groups (those on or not on an SSRI), then that group's scores will be adjusted on the dependent variables (dyadic adjustment, dyadic satisfaction, affectional expression, dyadic consensus, and dyadic cohesion). Thus, if the mean is above average on one of the covariates variables, then the mean scores of the dependent variables are decreased and if the mean on one of the covariates is below average, then the mean scores of the dependent variables are increased.

An alpha of 0.05 was utilized to reduce Type I or alpha errors, which are more commonly understood as false positives. Using an alpha of 0.05 allows for only five chances out of one hundred that the researcher will accept the alternate hypothesis when the null hypothesis is actually true. In addition, a one-tailed test was used because the hypothesized results are directional. Thus, the averaged means on the dependent variables for individuals on an SSRI were hypothesized to be lower than the averaged means on the dependent variables for individuals not on an SSRI.

Sample

The minimum sample size needed for this study was 152 (Kraemer & Thiemann, 1987). This sample size was computed from an anticipated small effect size of .20, thus anticipating that SSRI use would have a small association with romantic relationships. A power of 80% was the minimum accepted power for this study with an alpha of 0.05 to test for significance. The power estimate was generated in order to reduce Type II or beta errors commonly understood as false negatives.

A total of 230 individuals participated in this dissertation research. Of the 230 individuals, 65 individuals were eliminated from the study. Individuals were eliminated from the research if they did not meet participation requirements such as length of relationship (*n*=4), if they did not respond to all the questions related to the variables for the main analysis (*n*= 38), if they had taken a SSRI in the past six months but were no longer (*n*= 10), or if they were on medications that impacted serotonin such as other antidepressant medications and migraine medications (*n*=13). After this elimination process, the sample size for the major analysis was reduced to 165 individuals.

Descriptions of Participants and Psychometric Instruments

Demographic Information

It is important to note that missing data on the demographic variables was not included in the descriptive statistical analysis; therefore not all of the samples will be the same size and percentages will be used to help further understand composition. The majority of the sample were female (*n*= 136, 75%) with males representing only 25% (*n* = 45) of the sample. Ages ranged from 20-65 with a mean age of 35.52. (*SD* = 10.52). The majority of participants were Caucasians (*n*= 155, 85.6%); Latinos represented 6.6% of the sample (*n* = 12); African Americans/Blacks represented 3% of the sample (*n* = 6);

Asians represented 2% of the sample (*n* =4); Native American/Alaskan Natives represented 1.7% of the sample (*n* = 3); and only 0.1% of the sample identified themselves as Other (*n* = 1).

The length of relationship ranged from 24-624 months with a mean of 124.65 months (*SD* =114.64). The sample was predominately in an opposite sex relationship (92.23%, *n* = 167), with 6.6% in a same-sex relationship (*n* = 12), and 1% reporting multiple partners (*n* =2). The majority of the sample was married (69.06%, *n* = 125), with those in a committed relationship living together as the second most populous group (17.68%, *n* = 32), followed by those in a committed relationship not living together (11.05%, *n* = 20). The fourth largest group defined their relationship as other (1.7%, *n* = 3), and the least populous group was those in a civil union (0.1%, *n* = 1). The income ranged as follows: .5% (*n* = 8) earned under $25,000 per year, 8.5% (*n* = 15) earned $25,000-$39,999 per year, 21% (*n* = 37) earned $40,00-$59,999 per year, 20% (*n* =35) earned $60,00- $74,999 per year, 15 % (*n* = 26) earned $75,000- $89,999 per year, 14 % (*n* = 24) earned $90,000-$104,999 per year, .5% (*n* = 8) earned $105,000-$119,999 per year, and 12 % (*n*= 21) earned over $120,00 per year. Those having children represented 44.1% (*n* = 78) of the sample while 55.9% (*n* = 99) did not have children.

The participants mostly lived in suburban areas (55.3%, *n* = 99), with 31.3% (*n* = 56) living in urban areas, and 13.4% (*n* = 24) living in rural areas. The participants were predominately from the Midwest (55.37%, *n* = 98), followed by the East Coast (20.9%, *n* = 37), the South (11.86%, *n* = 21), the West Coast (6.78%, *n* =12), the Southwest (2.82%, *n* =5), and the West (2.26%, *n* = 4). The sample was well educated: 40.11% (*n* = 71) had a Master's degree, 30.73% (*n* = 55) had a Bachelor's degrees, 18.99% (*n* = 34) had a

Doctorate degree, 3.35% (*n* = 6) had some college, 3.35% (*n* = 6) % had a high school diploma, 2.79% (*n* = 5) went to a technical school, and 1.12% (*n* = 2) had an Associate's degree.

Data on relationship variables was also collected. The mean for minutes spent with one's partner per day was 271.1 (*SD* = 232.76) with a range of 0-1200 minutes. The mean for hours spent with one's partner per week was 42.05 (*SD* = 31.55) with a range from 1-168. The mean for hours spent with one's partner on a monthly basis was 175.92 (*SD* = 131.16) with a range from 5-672. Dates with one's partner per month ranged from 0-16 with a mean of 3.97 (*SD* = 3.24). Sexual activity per month ranged from 0-27 times per month with a mean of 7.07 (*SD* = 5.72). Almost one/fifth (18.97%, *n* = 33) of the sample reported they were very satisfied with their sexual relationship, 34.48% (*n* = 60) reported satisfaction with their sexual relationship, 20.11% (*n* = 35) were somewhat satisfied with their sexual relationship, 12.64% (*n* = 22) were somewhat dissatisfied with their sexual relationship, 7.47% (*n* =13) were dissatisfied with their sexual relationship, and 5.75% (*n* = 10) were very dissatisfied with their sexual relationship. The sample most commonly reported not experiencing any change in sexual interest (55.37%, *n* = 95), 34.83% (*n* = 62) reported less interest in sex than before, 8.99% (*n* =16) reported much less interest in sex than before, and 2.25% (*n* = 4) reported they had completely lost interest in sex. About 27% of the sample (*n* = 47) reported being on birth control medication while 42.13% of the sample (*n* = 75) reported being on some other type of prescription medication. Only 12 (6.8%) individuals reported their partner to be on an antidepressant, three individuals were unsure (1.7%) of their partner's antidepressant use, and the remaining 162 respondents (91.5%) reported that their partner was not on an

antidepressant. Only 23 (14.84%) individuals in the sample were on an SSRI, with the remaining 142 (86.06%) reporting that they are not currently taking a SSRI. For a review of the means and standard deviations on all the psychometric instruments by SSRI use, please see Table 1.

The mean for this sample (112.29, *SD* = 19.06) on the DAS was comparable to the normed mean for married individuals (*M*= 114.8, *SD* = 17.8) (Spanier, 1976). The mean for this sample (35.32, *SD*= 11.78) on the SAI was comparable to the normed mean for working adults (35.72, *SD* 10.40 for men and *M*=35.20, *SD*=10.61 for women) (Spielberger, 1983). The mean for the sample on the CES-D was 10.42 (*SD*= 8.61). Scores of 16 or higher would qualify an individual for clinical depression (Corocan & Fischer, 1987)

The PBQ-SF was normed on patients clinically diagnosed with DSM Axis I or Axis II disorders (Butler et al., 2007). On each of the subscales, this sample had lower means than the normed means for the clinically diagnosed sample. This sample had a mean of 2.81 (*SD*= 2.76) on the Borderline subscale while the normed mean was 9.81 (*SD*= 7.07). This sample had a mean of 4.16 (*SD*= 4.00) on the Paranoid subscale while the normed mean was 8.85 (*SD*= 6.07). This sample had a mean of 7.30 (*SD*= 4.90) on the Schizoid subscale while the normed mean was 9.90 (*SD*= 4.96). This sample had a mean of 4.92 (*SD*= 4.72) on the Histrionic subscale while the normed mean was 8.78 (*SD*= 6.43). This sample had a mean of 3.77 (*SD*= 3.76) on the Narcissistic subscale while the normed mean was 5.43 (*SD*= 4.19). This sample had a mean of 2.95 (*SD*= 3.34) on the Antisocial subscale while the normed mean was 4.80 (*SD*= 4.68). This sample had a mean of 8.18 (*SD*= 5.45) on the Obsessive-Compulsive subscale while the normed

mean was 11.93 (*SD*= 7.08). This sample had a mean of 5.09 (*SD*= 4.27) on the Passive-Aggressive subscale while the normed mean was 7.81 (*SD*= 5.64). This sample had a mean of 7.30 (*SD*= 4.90) on the schizoid subscale while the normed mean was 9.90 (*SD*= 4.96). This sample had a mean of 4.29 (*SD*= 3.35) on the Dependent subscale while the normed mean was 9.04 (*SD*= 7.21). This sample had a mean of 5.61 (*SD*= 3.06) on the Avoidant subscale while the normed mean was 11.52 (*SD*= 6.17).

MANCOVA

The primary purpose of a MANCOVA is to measure differences in the means between two or more groups on the predetermined dependent variables when controlling for variables that have been proven to significantly influence the dependent variables. This allows the researcher to determine main and interaction effects with the designated population(s).

Assumptions of MANCOVA

One concern when conducting a MANCOVA is unequal sample sizes. Pallant (2005) recommends that each group have more participants than number of dependent variables. For this particular analysis, there were four dependent variables and the smallest group (those on an SSRI) had 23 individuals, thus satisfying this criteria. In addition, Mardia (1971) contends that a sample size of at least 20 in the smallest group could ensure robustness. Tabachnick and Fidell (2001) recommend for survey designs a hierarchical analysis in which emphasis is placed on main effects in lieu of interactions. However in this analysis, one variable contained the grouping term, so interaction effects were not analyzed. Missing data is also a concern for MANCOVA analysis. For purposes of the inferential statistical analysis, missing data was not included in the analysis.

Another assumption of MANCOVA is that all variables are normally distributed. Each variable was checked for normality. All variables were normally distributed and no transformation of the data was necessary. Related to a normal distribution, the presence of outliers may influence the data and provide misleading results; therefore, it is necessary to remove outliers from the analysis. In order to assess for outliers, Mahalanobis distances were calculated. From this, one individual was identified as an outlier and that data was removed from further analysis.

It is necessary that dependent variables have a linear relationship. In order to test this assumption, all dependent variables were paired with one another and scatter plots were run with each group (those on and not on a SSRI). Analysis revealed all variables were linearly related. In order to check for multicollinearity or high correlations among the dependent variables, correlations were run among all dependent variables. Pallant (2005) suggests that correlations greater than .8 are cause for concern and recommends removal of one of the correlated dependent variables. Multicollinearity was not an issue for the dependent variables. Multicollinearity was, however, a concern among covariates. The variables minutes spent together per daily basis, hours spent together on a weekly basis, and hours spent together on a monthly basis were all significantly correlated (r-values ranged from .78 to .94). The variable, hours spent together on a weekly basis, was selected over the other two variables to represent the time spent together variable in the major analysis. It had a correlation over .20 with each of the dependent variables and it encompassed more time than the daily variable.

Homogeneity of variance-covariance matrices is also a concern. Here, it is important that the variability in each of the dependent variables is the same regardless of

the group the data is representing. Box's test of equality of covariance matrices was run and no significant results were reported indicating that the assumption of the homogeneity of variance was not violated. In order to select the covariates for the major analysis, correlations were run with the dependent variables and each of the demographic variables and scores on the four psychometric instruments. Pallant (2005) recommends three criteria when selecting covariates. Covariates should be continuous and reliable variables with a correlation of .2 or higher with the dependent variables. The psychometric instruments chosen for the major analysis were proven to be reliable and valid instruments (please see chapter three for more detailed information). Based on these three criteria, ten variables were selected as covariates for the MANCOVA: scores from the CES-D, scores on the SAI, scores on the Paranoid, Dependent, and Schizoid subscales of the PBQ-SF, the demographic variables hours spent together on a weekly basis, dates per month, sexual activity per month, sexual relationship satisfaction, and amount of sexual interest. Please see Table 2 for correlational results among the variables included in the major analysis.

Tests were run to assess the homogeneity of regression slopes assumption. This assumption is concerned with interaction between the independent or grouping variable and the covariates. A p-value of less than .05 would indicate a violation of this assumption. Results indicated this assumption was not violated for the dependent variables dyadic satisfaction (p = .19), dyadic cohesion (p = .33), and dyadic consensus (p = .59). However, this assumption was violated with the dependent variable affectional expression (p = .04). Tabachnick and Fidell (2001) recommend removal of the covariate that interacts with the independent variable for the major analysis. In order to assess

which covariate should be removed, each covariate was individually assessed for interaction with the independent variable. Results from this analysis indicated no significant results with the interaction terms. Therefore, all covariates were included in the major analysis.

Major Analysis

A one-way between-subjects multivariate analysis of covariance (MANCOVA) was performed on four dependent variables associated with romantic relationship quality of the respondents: dyadic satisfaction, affectional expression, dyadic consensus, and dyadic cohesion. These four dependent variables were measured from the Dyadic Adjustment Scale and represent the four subscales of this instrument. Adjustments to the dependent variables were made for 10 covariates: CES-D scores, SAI scores, dependent scores, paranoid scores, schizoid scores, sexual activity per month, hours spent together on a monthly basis, sexual satisfaction, dates per month, and sexual interest. See Table 1 for means (*SD*s) for each dependent variable by SSRI use.

Effects of the use or non-use of SSRIs on the dependent variables after adjusting for the covariates were investigated. Results did not reveal significant main effects for SSRI use or non-use (Hotelling's Trace = .01, F (2, 162) =. 39, p=. 81, partial eta squared (h_p^2) =. 01) on the dependent variables. Tests of between-subjects effects did not indicate significant differences in SSRI use on dyadic satisfaction (F (2, 162) =. 37, p = .543, h_p^2= .00), dyadic consensus (F (2, 162) =. 01, p = .76, h_p^2= .00), dyadic cohesion (F (2, 162) =.167 , p = .68, h_p^2= .00), or affectional expression (F (2, 162) =.00 , p = .98, h_p^2= .00). See Table 3 for multivariate tests and tests of between-subjects effects. The observed power for the corrected model for all four dependent variables was 1.00. The power of

the analysis is concerned with committing a Type II error or false negative. Pallant (2005) recommends a power over .80. Thus, after controlling for CES-D scores, SAI scores, dependent scores, paranoid scores, schizoid scores, sexual activity per month, hours spent together on weekly basis, sexual satisfaction, dates per month, and sexual interest, there were no significant differences in mean scores on the dependent variables (dyadic satisfaction, dyadic cohesion, dyadic consensus, and affectional expression) between those on a SSRI and those not on a SSRI.

Supplemental Analysis

Supplemental Analysis A

The first supplemental analysis was conducted to gain a greater understanding of how having a partner on an antidepressant is related to variables relevant to the romantic relationship. The relationships between individuals whose partners are on an antidepressant and overall score on the DAS, dyadic satisfaction, dyadic cohesion, sexual activity per month, and sexual relationship satisfaction were investigated using Pearson product-moment correlation coefficient. Preliminary analysis revealed no violations of linearity, normality, and homoscedasticity. Results revealed a significant negative relationship between having a partner on an antidepressant and sexual relationship satisfaction (r = - .24, n = 173, p =. 001); a significant negative relationship between having a partner on an antidepressant and sexual activity (r = - .20, n = 171, p =.011); a significant negative relationship between having a partner on an antidepressant and overall score on the DAS (r = -.18 n = 177, p =.017); a significant negative relationship between partners on an antidepressant and dyadic satisfaction (r = - .20, n = 177, p =.007); and a significant negative relationship between having a partner on an

antidepressant and dyadic cohesion (r = - .16, n = 171, p =.035). The amount of shared variance among partner antidepressant status ranged from 2.56%-5.76%. These are relatively small correlations. Thus, having a partner on an antidepressant was associated with less sexual relationship satisfaction, less sexual activity, a lower overall score on the DAS, less dyadic satisfaction, and less dyadic cohesion.

To enhance understanding of the correlations, a one-way multivariate analysis of variance (MANOVA) was conducted to measure differences in the means between the groups (those with a partner on an antidepressant, those who are unsure if their partner is taking an antidepressant, and those without a partner on antidepressant). The dependent variables included overall scores on the DAS, sexual relationship satisfaction, and sexual activity per month. Preliminary analysis was run to test assumptions: normality, linearity, outliers, homogeny of variance-covariance matrices, and multicollinearity. Prior to analysis, outliers were removed. In addition, to account for the violation of multicollinearity among variables, the variables dyadic consensus, dyadic cohesion, and dyadic satisfaction were not included in the MANOVA. Instead the overall score on the DAS was utilized. No other assumptions were violated.

Significant differences were found in the scores among the groups (Hotelling's Trace = .084, F (2, 169) =2.288, p=.035, h_p^2 =.04*)*. When results were considered separately, all three dependent variables remained significant (sexual activity per month *(*F (2, 169) = 3.678, p = .027, h_p^2= .042), sexual relationship satisfaction *(*F (2, 169) *=5.139*, p = .007, h_p^2= .058), DAS score *(*F (2, 169) = 3.46, p = .034, h_p^2= .040)). However, these differences in the means were only significant for sexual relationship

satisfaction after using a Bonferroni adjusted alpha of .017. For a review of the means (*SD*s) by partner on antidepressant status, please see Table 4.

To provide a more comprehensive understanding of the relationship between having a partner on an antidepressant and romantic relationship quality, an additional MANOVA was conducted. Three dependent variables were used: dyadic satisfaction, dyadic cohesion, and dyadic consensus. Affectional expression, the other subscale from the DAS, was not selected for this analysis because it was not associated with partner's antidepressant status. The independent variable was partner on an antidepressant status. Preliminary analysis revealed no violations of normality, linearity, homogeneity of variance-covariance matrices, and multicollinearity assumptions. Mahalanobis distances revealed one outlier and the data were removed prior to analysis. There was not a significant difference between antidepressant status and the dependent variables, F (2, 169) = 1.56, p = .16, Hotelling's Trace = .06, h_p^2 =.03. When results for the dependent variables were considered independently, none of the differences reached statistically significance using a Bonferroni adjusted alpha level of .017. It is important to note, however, that dyadic cohesion scores (p = .05) and dyadic satisfaction scores (p = .02) approached significance. No significant differences were found between mean scores on dyadic satisfaction, dyadic consensus, and dyadic cohesion by the category having a partner on an antidepressant.

Supplemental Analysis B

To further understand how SSRI use was related to the other variables from the data set, additional analysis was conducted. The relationships between individual SSRI use and CES-D scores, interest in sexual activity, dependent scores, paranoid scores, and

passive-aggressive scores were investigated using Pearson product-moment correlation coefficient. Preliminary analysis revealed no violations of linearity, normality, and homoscedasticity. Results revealed a significant positive relationship between SSRI use and interest in sexual activity (r = .21, n = 176, p =.006); a significant positive relationship between SSRI use and CES-D scores (r = .19, n = 177, p =.013); a significant positive relationship between SSRI use and passive-aggressive scores (r = .16 n = 178, p =.038); a significant positive relationship between SSRI use and paranoid scores (r = .20, n = 178, p =.008); and a significant positive relationship between SSRI use and dependent scores (r = .16, n = 178, p =.035). While these correlations are significant, the shared variance ranges from 2.56%- 4.41% among SSRI use and these variables. These are still relatively small correlations.

Higher scores on the continuous variables of CES-D, passive-aggressive, paranoid scores, and dependent scores indicate higher levels of the measured construct. Higher scores on the variable, interest in sexual activity, indicate less interest in sexual activity. Thus, SSRI use in a participant was positively associated with depression, less interest in sexual activity, and greater dependent scores, paranoid scores, and passive-aggressive scores.

To enhance understanding of the differences between the groups of SSRI use, individual T-tests were run. A one-way multivariate analysis of variance (MANOVA) was not chosen for the analysis because Tabachnick and Fidell (2001) do not recommend MANOVA for unrelated dependent variables. In addition to the prior preliminary analysis, tests for homogeneity of variance were conducted and this assumption was not violated on the analyses with the dependent variables interest in sexual activity, paranoid

scores, dependent scores, or passive-aggressive scores. It was however, violated on the independent T-test with CES-D scores as the dependent variable. Pallant (2005) recommends reducing the alpha in order to ensure a more stringent level of significance. For that particular T-test, the alpha was adjusted to .025 before considering the analysis significant.

An independent T-test was conducted to compare paranoid scores, passive aggressive scores, dependent scores, CES-D scores, and interest in sexual activity between those participants on a SSRI and those not on a SSRI. There was a significant difference in paranoid scores for those on a SSRI (M = 6.04, SD = 4.45) and those not on a SSRI (M = 3.76, SD = 3.73, p = .008). There was a significant difference in passive-aggressive scores for those on a SSRI (M = 6.70, SD = 5.15) and those not on a SSRI (M = 4.75, SD = 3.99, p = .038). There was a significant difference in dependent scores for those on a SSRI (M = 5.61, SD = 3.76) and those not on a SSRI (M = 4.05, SD = 3.23, p = .035). There was a significant difference in interest in sexual activity for those on a SSRI (M = 2.00, SD = .85) and those not on a SSRI (M = 1.54, SD = .72, p = .006). There was a significant difference in CES-D scores for those on a SSRI (M = 14.61, SD = 11.27) and those not on a SSRI (M = 9.83, SD = 8.06, p = .013). Thus, upon further analysis, individuals on SSRIs had higher mean scores on the dependent, passive-aggressive, paranoid, and CES-D scales and interest in sexual activity. As previously mentioned, higher mean scores on interest in sexual activity indicate less interest in sexual activity.

Summary of Results

Correlational analysis revealed that the amount of dates per month with one's partner, the amount of time spent with one's partner, the amount of sexual activity per

month, the amount of interest in sexual activity, and the amount of satisfaction in the sexual relationship were positively associated with the dependent variables measuring romantic relationship quality: affectional expression, dyadic satisfaction, dyadic consensus, and dyadic cohesion. In addition, scores on the CES-D, SAI, paranoid, dependent, and schizoid scales were negatively associated with affectional expression, dyadic satisfaction, dyadic consensus, and dyadic cohesion. The main analysis revealed that SSRI use was not significantly related to dyadic satisfaction, affectional expression, dyadic consensus, or dyadic cohesion when controlling for dates per month with partner, amount of time spent with one's partner, sexual activity, interest in sexual activity, sexual relationship satisfaction, CES-D scores, SAI scores, dependent scores, paranoid scores, and schizoid scores.

A partner's antidepressant status was significantly negatively correlated with sexual relationship satisfaction, sexual activity per month, dyadic satisfaction, dyadic cohesion, and overall score on the DAS. In addition, there were significant differences in the mean scores on sexual relationship satisfaction dependent upon partner's antidepressant usage. No differences in mean scores were found on dyadic satisfaction, dyadic consensus, and dyadic cohesion by partner on partner's antidepressant status when using Bonferroni's adjusted alpha. However, differences in mean scores on dyadic satisfaction and dyadic cohesion approached significance. SSRI use was significantly positively correlated with paranoid scores, CES-D scores, dependent scores, passive-aggressive scores, and interest in sexual activity. There were significant differences in the mean scores on the dependent subscale, paranoid subscale, passive-aggressive subscale, CES-D, and in interest in sexual activity dependent upon SSRI use. Individuals on SSRIs

had higher mean scores on each of the psychological distress scales and were less interested in sexual activity.

Table 1: Psychometric Instruments

	SSRI non-use		SSRI use		Range
Scale	*M*	*SD*	*M*	*SD*	
CESD	9.83	8.06	14.61	11.27	0-41
SAI	34.81	11.75	39.04	12.06	20-74
DAS	112.70	19.35	109.48	17.80	39-142
CN	48.90	8.73	46.74	8.42	15-63
AE	8.37	2.32	8.04	2.10	2-12
DS	38.67	7.27	38.91	5.28	13-48
CH	16.75	3.60	15.78	3.97	4-24
BOR	2.72	2.76	3.43	2.87	0-22
PAR	3.76	3.73	6.04	4.45	0-22
SCH	7.05	4.84	8.83	5.31	0-21
HIS	4.68	4.56	6.26	5.68	0-19
NAR	3.66	3.62	4.17	4.56	0-18
AS	2.82	3.26	3.43	3.53	0-16
OC	8.05	5.36	9.04	6.29	0-24
PA	4.75	3.99	6.70	5.15	0-17
DEP	4.05	3.23	5.61	3.76	0-17
AV	5.52	2.99	6.09	3.54	0-15

M= mean, *SD*= standard deviation, CN= Dyadic Consensus Subscale, AE= Affectional Expression Subscale, DS= Dyadic Satisfaction Subscale, CH= Dyadic Cohesion Subscale, BOR= Borderline Subscale, PAR= Paranoid Subscale, SCH= Schizoid Subscale, HIS= Histrionic Subscale, NAR= Narcissistic Subscale, AS= Anti-Social Subscale, OC= Obsessive- Compulsive Subscale, PA= Passive Aggressive Subscale, DEP= Dependent Subscale, and AV= Avoidant Subscale.

Table 2: Correlational Analysis

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. SSRI	-													
2. DS	.01	-												
3. CN	-.08	.75+	-											
4. AE	-.05	.62+	.61+	-										
5. CH	-.09	.68+	.65+	.57+	-									
6. CES-D	.19+	-.30+	-.34+	-.26+	-.31+	-								
7. SAI	.12	-.32+	-.30+	-.27+	-.37+	.78+	-							
8. PAR	.20+	-.05	-.21+	-.10	-.17*	.43+	.41+	-						
9. DEP	.16*	.08	-.24+	-.16+	-.21+	.40+	.43+	.80+	-					
10. SCH	.12	-.16*	-.21+	-.12	-.23+	.29+	.28+	.62+	.70+	-				
11. HW	-.03	.25+	.27+	.14	.33+	-.09	-.18*	-.08	.47	.02	-			
12. IS	.21+	-.28+	-.27+	-.30+	-.34+	.28+	.21+	.09	.09	.23+	- .01	-		
13. SRS	.01	.54+	.45+	.57+	.42+	-.26+	-.26+	.00	.36	-.10	.14	-.38+	-	
14. SA	-.04	.32+	.29+	.36+	.30+	-.17*	-.14	-.06	.08	-.12	.12	-.36+	.57+	-
15. DM	-.01	.29+	.22+	.30+	.35+	-.13	-.18*	-.16	.25	-.05	.12	-.03	.21+	.34+

CN= Dyadic Consensus Subscale, AE= Affectional Expression Subscale, DS= Dyadic Satisfaction Subscale, CH= Dyadic Cohesion Subscale, PAR= Paranoid Subscale, SCH= Schizoid Subscale, HW= hours spent with partner per week, IS=Interest in Sexual Activity, SA= Sexual Activity, SRS= Sexual Relationship Satisfaction, DM= Dates per month. * $p < .01$, + $p < .05$

Table 3: Multivariate Tests

Effect		Value	F	DF	Sig.	Partial Eta Squared
Intercept:	Hotelling's Trace	1.09	40.88	2, 162	.00	.52
SSRI Score:	Hotelling's Trace	.01	.39	2, 162	.81	.01

Tests of Between Subjects

Source	DV	Sum of Squares (Type III)	F	DF	Sig.	Partial Eta Squared
Corrected	CN score	4602.07	8.34	2, 162	.00	.38
Model	AE score	357.72	9.55	2, 162	.00	.41
	CH score	967.57	10.20	2, 162	.00	.42
	DS score	3519.87	10.86	2, 162	.00	.44
SSRI	CN score	4.73	.09	2, 162	.76	.00
Score	AE score	.00	.00	2, 162	.98	.00
	CH score	1.44	.17	2, 162	.68	.00
	DS score	10.97	.37	2, 162	.54	.00

CN= Dyadic Consensus Subscale, AE= Affectional Expression Subscale, DS= Dyadic Satisfaction Subscale, CH= Dyadic Cohesion Subscale

Table 4: Means and Standard Deviation by Partner on Antidepressant Status

	PA		NPA		US	
Scale	*M*	*SD*	*M*	*SD*	*M*	*SD*
DAS	106.83	22.11	113.32	18.18	88	30.35
SA	3.42	2.24	7.51	5.77	3.33	5.77
SRS	3.46	1.34	4.42	1.33	2.67	2.08

PA= Partner on an Antidepressant, NPA= Partner not on an Antidepressant, US= Unsure if Partner is on an Antidepressant, DAS= Overall Score on the DAS, SA= Sexual Activity, SRS= Sexual Relationship Satisfaction

CHAPTER FIVE:

Discussion

The use of antidepressant medications is pervasive in the United States. Antidepressants are the most commonly prescribed medication in the United States (CDC, 2006). The Department of Health (2004) estimated 10% of females and 4% of males are on SSRI medications. The prevalence of use necessitates conducting research on this medication. With many medications, not all side effects are revealed and/or understood during clinical trials. Side effects may not be recognized as so until the medication is in general use. For example, Ferguson et al. (2005) in their meta-analysis of SSRI use and suicide reported increased risk of suicide attempts with SSRI use. This risk was not identified during the clinical trials of the medication and it was not until the medication became more commonly used that this factor became a concern. Given the lack of comprehensive understanding of the effect of medications, any research that can further enhance the understanding of the implications of medication is imperative.

This study was designed to enhance understanding about the use of SSRIs. Upon a review of the literature, a theory behind the neurochemistry of love in the attachment emotion system hypothesized that SSRI use could impact the neurochemistry considered to be involved in romantic love (Fisher & Thompson, 2006). Research was found to provide theoretical support of this hypothesis (Cantor et al., 1999; Clayton et al., 2002; Damjanoska et al., 2003; D'Souza et al., 2003; 1999; Esposito, 2006; Jong et al., 2005; Montejo et al, 2002; Muria et al., 2007; Muria et al., 2005a; 2005b; Philipp et al., 2000; Raap et al., 1999; Rosen et al., 1999; Tsai et al, 2006), yet no known previous studies had examined the relationship between SSRI use and romantic relationship quality.

Therefore, this research was designed to fill that gap in the literature and examine this relationship between SSRI use and romantic relationship quality with individuals who have been in the same, current romantic relationship with at least two years. The length of the relationship was determined in order to most likely assess attachment love.

Discussion of the Findings

In this study, it was hypothesized that holding time spent together, sexual variables, dates per month, depression, anxiety, and personality scores constant, coupled individuals on SSRIs would have lower relationship quality scores than coupled individuals not on an SSRI medication. Upon further analysis, more variables were found to correlate with romantic relationship quality, including hours spent with partner per week, dates with partner per month, having a partner on an antidepressant, sexual relationship satisfaction, interest in sexual activity, and sexual activity per month. Furthermore, not all of the scores from the subscales on the psychometric instrument that measured personality were found to be associated with romantic relationship quality; therefore, the subscales included as covariates in the major analysis examined dependent, schizoid, and paranoid personality patterns. The results from this research did not support the hypothesis. SSRI use was not significantly related to romantic relationship quality when holding the covariates constant; thus, there were no statistically significant differences in the mean scores on romantic relationship quality between those on or not on a SSRI.

Fisher and Thompson (2006) hypothesized that SSRI use could impact attachment in romantic relationships if the individuals on SSRIs were experiencing sexual side effects, and subsequently not participating in sexual activity with their partner and/or

achieving orgasm. Results from the correlational analysis revealed no significant associations between sexual activity or sexual relationship satisfaction and SSRI use. This suggests that individuals are still participating in sexual activity and are still satisfied in that relationship. Therefore, this activity that enhances bonding did not appear to be disrupted with this sample.

The lack of disruption in the sexual relationship may not be the only reason why the hypothesis was not supported. Fisher (personal communication, October 12, 2008) posited that there were individuals who are on a SSRI because they need the boost in serotonin due to pervasive depression and there are those individuals who continue to take the SSRI after they no longer need the medication. She hypothesized it is those individuals who continue to use the SSRI after the need has subsided who could potentially be jeopardizing their romantic relationships. For these individuals, nonselectively increasing their serotonin levels could influence the quality of the relationship. In this study, CES-D scores were correlated with SSRI use. Thus, SSRI use was associated with more depressive symptoms. Therefore in this study, the presence of depressive symptoms is more prevalent with those on a SSRI. This is perhaps suggesting a need for the SSRI, not a continuation of the medication after the symptoms are assuaged. This could explain the lack of support for the research hypothesis. The individuals have a need for the SSRI and are therefore not bringing their serotonin to unhealthy levels.

The sample size of those on a SSRI was small (n=23). This limited number of individuals on a SSRI could have affected the variability of the scores on the dependent variables. This leads one to question, if 23 individuals could be representative of all of

those on a SSRI or if further exploration of this relationship needs to be conducted. It should not be ruled out, however, that the hypothesis could be at fault. Meyer (2007) suggested that those on a SSRI may be experiencing an alleviation of psychological distressing symptoms and therefore the quality of the romantic relationship may not be negatively impacted by the use of this medication.

The correlational analysis demonstrated that depression was negatively associated with romantic relationship quality. This finding is not surprising given the copious amount of research purporting this same relationship (Berge et al., 2006; Coyne et al., 2002; Davila et al., 2003; Perren et al., 2003; Riso et al., 2002; Ruiz et al., 2006; Tower & Krasner, 2006; Whisman & Bruce, 1999; Whisman et al., 2004; Whisman et al., 2006; Whisman, 2007). Similarly in the present study, anxiety was also found to be negatively associated with romantic relationship quality. Again, this result was expected given the abundance of literature supporting this relationship (Addis & Bernard, 2002; Caughlin et al., 2000; Coyne et al., 2002; Kinnunen & Pulkkinen, 2003; Perren et al., 2003; Whisman et al., 2004; Whisman et al., 2006; Whisman, 2007). Spending time together, including dates with one's partner, was positively associated with romantic relationship quality. This finding is consistent with the literature that suggests the importance of spending time engaged in novel activities with one's partner in order to maintain the relationship (Fisher, 2004; Meyer, 2007). Finally, sexual variables (sexual activity and satisfaction) were positively associated with romantic relationship quality and decreased interest in sexual activity was negatively associated with romantic relationship quality. Tower and Krasner (2006) also substantiated this relationship when they utilized sexual satisfaction as a measurement of marital closeness.

Personality dimensions (dependent, schizoid, and paranoid) were the other covariates negatively correlated with romantic relationship quality. According to the American Psychiatric Association (2000), individuals with a dependent personality disorder are excessively psychologically dependent on others; individuals with a schizoid personality disorder are detached in social relationships; and individuals with a paranoid personality disorder are mistrusting of others. These characteristics conceptually seem to be inversely associated with romantic relationships. Perhaps an excessive need for a partner, which may be found with individuals with higher scores on the dependent personality subscale, leaves one feeling unfulfilled in the relationship and perhaps the need for one's partner is at a standard that one's partner cannot met. For those individuals scoring higher on the schizoid personality subscale, perhaps they do not need as much of a connection in a romantic relationship and therefore, the quality of the romantic relationship is not as important for these individuals. Finally, for those individuals with higher scores on the paranoid personality subscale, this could indicate a mistrust of others. These individuals may not perceive there is a foundation of trust in the relationship, which may lead to less satisfaction in the romantic relationship.

The negative association between paranoid and schizoid personality patterns and romantic relationship quality are supported in the literature. Tower and Krasner (2006) reported emotional support and connection as well as trusting one's spouse as a confidant were predictors of marital closeness. Furthermore, Lavee and Ben-Ari (2004) reported a positive association between the wives' relationship satisfaction and the husbands' ability to express emotions. However, it is likely that emotional closeness could have a curvilinear relationship with romantic relationship quality if pervasive psychological

dependence is a negative correlate. This curvilinear relationship may suggest that there is a positive relationship between emotional closeness and relationship quality to a certain point and then that relationship changes to an inverse relationship when too much emotional closeness is needed in the romantic relationship. Perhaps the emotional closeness one desires is a healthy part of a romantic relationship, but in excess, it can reach a point where it begins to negatively impact the romantic relationship.

Supplemental analysis revealed that the overall score on the DAS, dyadic satisfaction, dyadic cohesion, sexual activity per month, and sexual relationships satisfaction were negatively correlated with partner antidepressant use. In addition, SSRI use was positively correlated with decreased sexual interest. This is consistent with past studies that overwhelmingly report adverse sexual responses to SSRI use (Clayton et al., 2002; Montejo et al., 2002; Philipp et al., 2000; Rosen et al., 1999). As previously indicated, the sexual relationship is associated with marital satisfaction (Tower & Krasner, 2006). It seems plausible then that having a partner on an antidepressant and experiencing sexual side effects could negatively influence the romantic relationship if sexual activity and sexual satisfaction are decreased. It is important to note however, that MANOVA results (with a Bonferroni- adjusted alpha of .017) only found sexual relationship satisfaction scores to be significantly different between those with a partner on an antidepressant, those who did not have a partner on an antidepressant, and those who were not sure if their partner was on an antidepressant. Furthermore, when examining differences in mean scores on dyadic satisfaction, dyadic consensus, and dyadic cohesion by the partner on antidepressant category, no significant differences were found. This supports the previous analysis that the quality of the sexual relationship

is what may be impacting the romantic relationship, not the presence of one partner on an antidepressant.

Results from the supplemental analyses also suggest that SSRI use is positively correlated with depression scores, paranoid, dependent and passive aggressive scores. Individual T-tests also supported these relationships with depression, dependent, paranoid, and passive-aggressive scores.

The positive association between SSRI use and CES-D scores is expected due to the fact that individuals are prescribed SSRIs for depression (Physician Desk Reference, 2005). SSRI use was also positively correlated with scores on schizoid, passive-aggressive, and dependent personality dimensions. This research was not intended to diagnose individuals with personality disorders; it was only intended to measure patterns related to personality disorders. From this perspective, this research, nonetheless, has assessed for pervasive personality patterns. Any persistent pattern could be expected to influence relationship quality and intrapersonal perspectives. Aversive, persistent patterns often lead individuals to seek treatment. Therefore, the increase in association between SSRI use and these personality patterns could be a reflection of what led the individual to begin taking a SSRI. This suggests that these personality patterns could have been the impetus for the depression or anxiety that then in turn led the individual to utilize a medication for symptom alleviation. This does not, however, explain that not all personality subscales were associated with SSRI use.

It is related then that one reason for these differences in SSRI use among passive-aggressive, dependent, and paranoid scores could be that these patterns are more pervasive or reflective of depression or anxiety. Thus, the depression or anxiety explains

the SSRI use. The American Psychiatric Association (2000) reports that individuals with dependent personality disorders may be more likely to experience mood and anxiety disorders. They additionally found that as children, individuals with paranoid personality disorder often exhibited social anxiety. Furthermore, the American Psychiatric Association (2000) reports that individuals with passive-aggressive personality disorder have a defeatist perspective and similarly, individuals with depression often feel worthless. While no known research has examined medication prescriptions by personality disorders, depression and anxiety are often comorbid with personality disorders. Consequently, what may account for the correlations is that individuals who happen to have a personality disorder are seeking a medication for their mood or anxiety disorder and therefore they are more likely to be prescribed an antidepressant.

Validity of Results

With all research studies, the validity of the findings is threatened in several ways. Design flaws and generalizibility to other populations are a concern for all research. What is important is to recognize where the validity of the study is in question and how these factors impact the results.

Threats to Internal Validity

Descriptive field statistics are, by design, low in internal validity. Therefore, by the nature of the research design, internal validity is in question. Several limitations may engender threats to this type of validity. First, mono-method bias is a threat. The only manner in which the data was collected was through self-report. Self-report analysis is a threat to internal validity due to the fact that the only way the constructs are measured is through an individual's perception and desired responses.

A second threat to internal validity includes hypothesis guessing. While this study was designed to assess group differences on romantic relationship quality, an individual may be able to guess this hypothesis and therefore report information in a certain way to affect the results. In addition, a person may incorrectly guess what the hypothesis was and adapt his or her results either to fit or hurt the assumed hypothesis. For example, the participants were informed that this study was designed to assess romantic relationships and medications. It could have been assumed that the medication would positively influence the relationship and therefore individuals responded to the questions from that perspective.

Third, evaluation apprehension may affect results. The participant may feel trepidation about being evaluated and therefore he or she may inaccurately report his or her responses. For example, the STAI is reportedly high in individuals with malingering. Therefore, an individual may report higher levels of anxiety than the true levels to somehow benefit the participant. Related to this, a large number of participants knew the author; therefore, it is necessary to question if these participants answered questions in a socially desirable manner. This was a cause for concern in the responses to the Dyadic Adjustment Scale. The DAS was the only source of data for the dependent variables of the major analysis. This leads one to question: could inaccuracy of responses have contributed to the results? Furthermore, questions asked in the survey were personal. Not all individuals may feel comfortable answering questions about their romantic relationship, including their sexual relationship.

Mono-operation bias may also affect the results. Only one scale each was utilized to capture the constructs of romantic relationship quality, personality, depression, and

anxiety. All four concepts are comprehensive constructs that cannot be fully explained through one scale. When assessing a construct in only one way, the ability to accurately capture that construct is in question.

Lastly, the small size of those on a SSRI could have influenced the results. This was previously mentioned as a potential explanation for lack of support of the hypothesis. However, even if the hypothesis had been supported, it cannot be ignored that those on a SSRI represented only 14.84% of the total sample. Obviously, this is an unequal distribution. In addition, in the major analysis, the total number of individuals on a SSRI was only 23. This limited number of individuals may not be able to successfully represent the total number of individuals who are currently taking a SSRI.

Threats to External Validity

With all studies there are limitations that thwart the ability to generalize results beyond the population that was analyzed. There are four main concerns in regard to generalizibility. This population was not representative of the United States in four manners. First, the majority of the participants were Caucasian (85.6%). The second largest population represented was Latino, but they totaled only 6.6%. The remaining culture and ethnic backgrounds were only 3% or less. Second, this population was more educated than the average sample from the United States. Almost 90% of the sample had at least a Bachelor's degree and the largest educational degree represented was those with a Master's degree (40.11%). Third, over 92% were in an opposite sex relationship with same-sex relationships representing only 6.6% of the sample, and the remainder reporting multiple-partnered relationships. Finally, income was not representative of the average sample from the United States. Over 40% of the sample earned between $40,000-$75,000

per year. Therefore, these results should only be considered generalizable to well-educated, Caucasian, upper middle class individuals in an opposite sex relationship.

The study measured group differences between those on an SSRI and those who are not, and additionally in the supplemental analysis, those with a partner on an antidepressant, not on an antidepressant, or those unsure about the antidepressant status of their partner. Another threat to external validity is whether or not the individual correctly identified him or herself. Individuals not answering this question were excluded from the analysis, but making sure each individual was assigned to the correct group is still a concern. This study assessed group differences, and if an individual was not placed correctly in the appropriate group the results may be impacted. Moreover, individuals may want to keep their and their partner's medication history private, and therefore incorrectly answered those questions.

Third, the participants were found through online measures. This limits the amount of individuals with access to participate in the study. Even though hard copies of the survey were available if requested, the individuals still needed to learn about the study through online means to request the hard copy. In addition, the majority of the sample was collected through counseling related listservs, which will again limit the types of individuals who hear about the surveys. Possible threats to generalizibility include the possibility that individuals with access to this type of technology may represent a higher social class than individuals without the means to have access to the technology. In addition, these individuals may be more technologically savvy than the general public. This leads one to question if relationship satisfaction is different among those more familiar with technology compared to those who are less technologically

savvy. Furthermore, the majority of individuals were somehow related to the field of counseling. This type of occupation is not representative of all the possible occupations in the United States. The other individuals who did not hear about the research study through listservs had some affiliation with the author.

Finally, this research is an ex post facto design. Causal inferences cannot be made with this type of research. Participants were not randomly assigned to groups. The groups to which they naturally belonged were utilized. Since the groups cannot be randomly assigned, confounding factors that are characteristic of the groups may impact the results.

Limitations

Findings from the study should be interpreted with caution. There are not only design and sampling flaws present in this study, but the novelty of the topic and capricious nature of medications are also cause for concern. First, this research grouped all SSRIs into the same category. There are a multitude of SSRIs and each type of SSRI is molecularly different. While the intent of all of these medications is to impact serotonin, the question remains; do these medications impact serotonin in the same manner? For example, there is variability in the serotonin receptors affected by different SSRIs. Do the different receptors make that much of a difference? These questions should be considered in the evaluation of this study.

Second, medications classified as SSRIs have been known to change drug classification once the medicine is further studied. For example, Effexor, which was once thought of as an SSRI, is now classified as a Serotonin Norepinephrine Reuptake Inhibitor (SNRI). Therefore, this medication that was thought to only impact serotonin actually also affects norepinephrine. The possibility that any of the SSRI medications

utilized in this study could change classification upon further research creates more apprehension in the interpretation of the results.

Third, individuals may be taking medications that are affecting the processing and effects of the SSRI. For example, individuals may be on dopamine enhancing medication such as permax, olanzapine, amantadine, and d-amphetamin. Typically dopamine enhancers help to alleviate the sexual side effects from the SSRIs. Individuals on all types of dopamine enhancers were eliminated from the study besides those on bupropion, which is classified as an antidepressant. Individuals on buproprion and a SSRI remained in the study. How this affected the results is unknown. All reported medications taken by the participants were examined by the author. Individuals on medications that influenced the serotonin system were eliminated from the study. However, there are probably other types of medications that are unknowingly impacting serotonin. This could have confounded the results of the study.

Future Studies

This is the only known study to have examined the relationship between SSRI use and partner antidepressant use with romantic relationship quality. In this study, few questions were answered and many more need to be asked. Consequently, more research is needed to gain a greater understanding of these relationships. As previously noted, many of the participants were known by the author; therefore, it is necessary to see if these same results would be repeated with a population not familiar with the author. This could eliminate the concern that individuals provided socially desirable responses. Another avenue to explore with this same design is differences in more groups utilizing these same variables. Other categories that could be included with the independent

variables include relationship type (same sex, opposite sex, and multiple partnered couples), emotion system of the relationship (attraction, lust, or attachment), gender, whether or not the participants have children, those on bupropion in addition to a SSRI, type of SSRI, SSRI dosage, length of time on the SSRI, and other medications that impact the serotonin system.

When reviewing the neurochemical research, many of the precursor studies involved animal models. Prairie voles have often been the animal of choice for attachment studies (Winslow et al., 1993; Witt, et al., 1991; Witt et al., 1990). With this in mind, researchers could inject prairie voles with a variety of SSRIs and then measure partner preferences after the injections. In addition, animal models could be used to investigate sexual side effects and time spent with one's partner after an SSRI injection. Even though it is unclear if animal models accurately predict human behaviors, it should still be examined.

Apathy, as a side effect of SSRI use, had a scarcity of research. In general, this topic needs to be further investigated. Additionally, how apathy impacts romantic relationships is still in question. Examining emotional expressiveness and how one experiences his or her feelings could be measured along with romantic relationship quality. This proposed study then could evaluate the hypothesis that emotional blunting may negatively impact romantic relationships.

Implications for Counselors

The results for the major analysis were not significant; however, these results and the results from the supplemental analyses have implications for counselors. First and foremost, counselors can be reassured that SSRI use may not negatively affect romantic

relationship quality after controlling for sexual, time, and psychological variables. Even though results from this investigation did not suggest a negative association between SSRI use and romantic relationship quality, it is still important for counselors to be familiar with side effects of medications. In this study, almost half of the participants reported being on some medication. While not all of these were psychotropic medications, there were many seemingly benign medications that influenced neurochemistry. For example, many individuals were eliminated from this study due to intake of migraine medications. As a counselor, one may hear that an individual is on a medication for migraines and not consider the implications this may or may not have on the mental health of the client. While it would be difficult for counselors to become experts on all medications, to increase the understanding of the client the counselor may want to further examine any medication that a client reports taking and become familiar with potential side effects.

Counselors will see many clients on psychological medications. In this study, in addition to antidepressant medications, individuals were on anti-anxiety medications, anti-convulsive medications commonly prescribed for bipolar disorder, and anti-psychotic medications. It is imperative that counselors familiarize themselves with commonly prescribed medications for mental disorders and frequently reported side effects associated with these medications. Many individuals are receiving psychotropic medications prescribed by a general practitioner and not a psychiatrist. The physician, then, may not be as familiar with side effects as the psychiatrist. Therefore, as counselors we need to be advocates for our clients and encourage them to be cognizant of medications and their side effects and how these may affect their mental health.

As demonstrated in the analysis, many variables were associated with romantic relationship quality such as time spent together, amount of dates with one's partner per month, sexual activity, sexual interest, and sexual satisfaction. Keeping this in mind, counselors need to be comprehensive with the amount of information they are gathering from couples at intake and specifically should inquire about these variables when conducting couples counseling. In addition, when conducting correlations, SSRI use was associated with sexual interest, and a partner using an antidepressant was associated with less sexual activity and less sexual relationship satisfaction. Due to the fact that these sexual variables are associated with romantic relationship quality, counselors should also inquire about antidepressant usage by each partner.

Sexual side effects are prevalent with SSRI use (Clayton et al., 2002; Montejo et al, 2002; Philipp et al., 2000; Rosen et al., 1999). Apathy has also been shown to be an adverse effect of SSRI use (Barnhart et al., 2004; Lee & Keltner, 2005; Opbroek et al., 2002). Whereas many individuals are aware of the sexual side effects, very few individuals are aware of the emotional side effects. Counselors need to be able to discuss these side effects with their clients on SSRIs and encourage them to speak with their physician if they are experiencing adverse reactions to their medications.

Conclusion

This is thought to be the first known study to examine the relationship between SSRI use and romantic relationship quality with those individuals considered to be in the attachment phase of their romantic relationship. These individuals reported to have been in the same, current romantic relationship for at least two years. There were no differences in means found between those who used an SSRI and those who did not in

terms of romantic relationship quality after controlling for interest in sexual activity, sexual relationship satisfaction, depression, anxiety, paranoid, dependent, schizoid, sexual activity per month, time spent with one's partner, and dates per month. This could perhaps be explained by the small sample size of those on a SSRI, the lack of disruption in the sexual relationship between partners, the individuals from the sample who are on SSRIs could have a genuine need for the medication and therefore are not increasing their serotonin to unhealthy levels, and the quality of hypothesis. Variables found to be associated with romantic relationship quality included time spent with one's partner, amount of dates with one's partner per month, depression scores, anxiety scores, dependent personality patterns, paranoid personality patterns, schizoid personality patterns, sexual interest, sexual activity per month, and sexual relationship satisfaction. Variables found to be correlated with a partner's antidepressant status included overall score on the DAS, dyadic satisfaction, dyadic cohesion, sexual activity per month, and sexual satisfaction. In the MANOVA run with partner antidepressant status and DAS score, sexual activity per month, and sexual relationship satisfaction, only sexual relationship satisfaction scores had lower means for having a partner on an antidepressant and being unsure if a partner were on an antidepressant when compared to scores for a partner not on an antidepressant. Additional analysis revealed no differences in mean scores with romantic relationship quality by partner on an antidepressant status. Other variables associated with SSRI use included sexual interest, depression scores, dependent personality patterns, passive-aggressive personality patterns, and paranoid personality patterns. Those on a SSRI had higher mean scores on each of these variables when compared to those not on a SSRI.

Results from this study should be considered with caution. Limitations to this study include a lack of diversity in the sample population, very small numbers of individuals on SSRIs, mono-operation bias, non-randomized groups, mono-method bias, and selection bias. Future studies are recommended to repeat the current study and additionally examine more types of groups on relationship quality scores. Potential groups could be categorized by type of relationship, gender, phase of romantic relationship, type and dosage of SSRI, and other medications used. Furthermore, utilizing animal models to examine differences in partner preferences, time spent with partner, and sexual side effects by SSRI type could be valuable in understanding the relationship between SSRI use and romantic relationships. More research should also be conducted to gain a greater understanding of the potential side effect of apathy due to SSRI use and how this could potentially impact romantic relationships.

The results from this study have implications for counselors. Counselors can feel rest assured that SSRI use might not negatively affect the quality one's romantic relationship. Counselors need to be knowledgeable about side effects of medications and understand how the medications their clients are taken could be impacting their mental health. Counselors need to be familiar with commonly prescribed medications for psychological disorders and their potential side effects. Finally, the many variables found to be associated with romantic relationship quality should encourage couples counselors to do a comprehensive intake with their couples and share with the couples what variables could possibly positively impact romantic relationships.

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Appendix A: Invitation to Participate

You are invited to participate in a dissertation research study approved by the University of Missouri- Saint Louis Institutional Review Board. The aim of the study is to examine the relationship between the use or non-use of prescription medications and romantic relationship quality. This study is conducted by Dixie Meyer, doctoral candidate at the University of Missouri-St. Louis. Your participation will involve: a) completing an online survey about your medication use, romantic relationship, and psychological well-being that will take approximately 20-45 minutes to complete or b) completing a paper/pencil version of this same survey. In order to request a hard copy of this survey, please email ddm6v8@umsl.edu. Of those completing the survey, three individuals will be randomly selected to receive a $50 Target gift card.

To qualify to take part in this research, you must meet the following criteria:

* You are 18 years of age or older

* You have been in the same, current romantic relationship for at least two years.

Please cut and paste the following link into your address bar to be directed to the survey.

https://www.surveymonkey.com/
s.aspx?sm=j_2byIX8yXicPKQ6A4bH9X2A_3d_3d

All responses will remain confidential.

Thank you for your willingness to participate in this research.

Dixie Meyer

Appendix B: Informed Consent

Informed Consent

Dear Research Participant,

You are invited to participate in a dissertation research study. The aim of the study is to examine the relationship between the use or non-use of prescription medications and romantic relationship quality. This study is conducted by Dixie Meyer, who is a doctoral candidate at the University of Missouri-St. Louis. You have been asked to participate in the research because you are currently in a romantic relationship for a minimum of two years. All individuals eighteen and older are eligible to participate. Please read this form and ask any questions you may have before agreeing to be in the research. Your participation in this research is voluntary. Your decision to participate will not affect your current or future relations with the university. If you decide to participate, you are free to withdraw at any time.

Your participation will involve: a) completing an online survey about your medication use, romantic relationship, and psychological well-being that will take approximately 45 minutes to complete or b) completing a paper/pencil version of this same survey. In order to request a hard copy of this survey, please email ddm6v8@umsl.edu. You may choose not to answer any questions you do not want to answer. You will NOT be penalized in any way should you choose not to participate or to withdraw. All responses to this survey will be kept confidential.

The risks associated with participation in this study are minimal, but may include some minor discomfort when answering questions about your personal experiences, your romantic relationship, and your use or nonuse of prescription medications. If based on your participation in this study, you would like to speak with an individual about a personal issue that has come to mind please call 1-800-422-4453. The name of this service is CHILDHELP, but it is available for both adults and children. The individuals answering the phones are trained professionals who can provide you with resources available in your area. This service is available 24 hours a day.

About 150-200 individuals will be involved in this research. Those completing this survey will be eligible for a random drawing for one of three $50 Target gift cards. You will need to provide your name and email address. Your name and email address will not be connected with your responses; therefore, your responses will not be identifiable.

If you chose, you may personally print a copy of this disclosure form or if you are filling this survey out with a paper/pencil version, you may keep this copy. If you have any

questions or concerns regarding this study, or if any problem(s) arise, you may email the Investigator, Dixie Meyer at ddm6v8@umsl.edu. You may also ask questions or state concerns regarding your rights as a research participant to the Office of Research, at (314) 516-6759.

By continuing with this survey, you are indicating that you have read the above statement and have been given the opportunity to express concerns by contacting the investigator. Furthermore, you are indicating that you believe you understand the purpose of the study, as well as the potential benefits and risks that are involved. You are, additionally, giving your permission to participate in the research described above.

Appendix C: Survey

Romantic Relationships and Medications Survey:
Demographic Information and Medication Inquiry

1. Survey: Demographic Information

This survey will consist of a total of seven pages of questions.

Once you have completed all of the questions, on the final page, page 9, you may enter into a drawing for one of three $50 Target gift cards.

1. Gender
    - Male
    - Female
2. Age
3. Race/Ethnicity
    - Caucasian
    - African/American Black
    - Asian
    - Latino
    - Native American/Alaskan Native
    - Pacific Islander
    - Middle Eastern
    - Other
4. Type of Romantic Relationship
    - Opposite-Sex
    - Same-Sex
    - Multiple Partners
5. Relationship Status
    - Committed not living together
    - Committed living together
    - Civil union
    - Married
    - Other
6. Length of Relationship in Months
7. Household Income
    - Under $52,000
    - $25,000-39,999
    - $40,000-59,999
    - $60,000-74,999

- $75,000-89,999
- $90,000-104,999
- $105,000-119,999
- Over $120,000

8. Do you have any children
   - Yes
   - No
9. Number of children
10. Ages of children
11. Occupation
12. Partner's Occupation
13. Military Status (check as many as apply)
    - Currently in the military
    - Partner is in the military
    - Retired from the military in the past year
    - Retired from the military more than one year ago
14. Geographic setting
    - Urban
    - Suburban
    - Rural
15. Geographic location
    - Midwest
    - South
    - East coast
    - West coast
    - West
    - Southwest
16. Highest Education degree obtained
    - Less than high school
    - High school
    - Some college
    - Technical college
    - Associates
    - Bachelors
    - Masters
    - Doctorate
17. How often do you attend religious services?
    - More than once per week
    - Once per week
    - Every other week

- Once a month
- Six times per year
- Four time per year
- Twice per year
- Once her year
- Less often than once per year

18. How many days per week do you exercise at least 30 minutes a day?
19. How many minutes do you spend with your partner on a daily basis?
20. How many hours do you spend with your partner on a weekly basis?
21. How many hours do you spend with your partner on a monthly basis?
22. How many days per month do you go on a date with your partner?
23. How many days per month do you engage in sexual activity with your partner?
24. How satisfied are you with your sexual relationship?
    - Very satisfied
    - Satisfied
    - Somewhat satisfied
    - Somewhat dissatisfied
    - Dissatisfied
    - Very dissatisfied

Survey Continued: Medication Inquiry

1. Are you currently taking Paxil?
   - Yes
   - No
2. If yes, dosage (if known)

3. Are you currently taking Fluoxetine?
   - Yes
   - No
4. If yes, dosage (if known)

5. Are you currently taking Celexa?
   - Yes
   - No
6. If yes, dosage (if known)

7. Are you currently taking Lexapro?
   - Yes
   - No
8. If yes, dosage (if known)

9. Are you currently taking Prozac?
   - Yes
   - No
10. If yes, dosage (if known)

11. Are you currently taking Escitalopram Oxalate
    - Yes
    - No
12. If yes, dosage (if known)

13. Are you currently taking Fluvoxamine?
    - Yes
    - No
14. If yes, dosage (if known)

15. Are you currently taking Zimeldine?
    - Yes
    - No

16. If yes, dosage (if known)

17. Are you currently taking Paroxetine?
    - Yes
    - No
18. If yes, dosage (if known)

19. Are you currently taking Seromex?
    - Yes
    - No
20. If yes, dosage (if known)

21. Are you currently taking Sarafem?
    - Yes
    - No
22. If yes, dosage (if known)

23. Are you currently taking Dapoxetine?
    - Yes
    - No
24. If yes, dosage (if known)

25. Are you currently taking Deroxat?
    - Yes
    - No
26. If yes, dosage (if known)

27. Are you currently taking Zoloft?
    - Yes
    - No
28. If yes, dosage (if known)

29. Are you currently taking Luvox?
    - Yes
    - No
30. If yes, dosage (if known)

31. Are you currently taking Sertraline?
    - Yes
    - No

32. If yes, dosage (if known)

33. Are you currently taking Citalopram?
    - Yes
    - No
34. If yes, dosage (if known)

35. Are you currently taking Permax?
    - Yes
    - No
36. If yes, dosage (if known)

37. Are you currently taking Olanzapine?
    - Yes
    - No
38. If yes, dosage (if known)

2. **Survey Continued**. You are almost finished!

This is the final page of questions.

1. Are you currently taking Amantadine (Symmetrel)?
    - Yes
    - No
2. If yes, dosage (if known)

3. Are you currently taking D-amphetamin (Dextroamphetamine or Dexedrine)?
    - Yes
    - No
4. If yes, dosage (if known)

5. Are you currently taking Dostinex?
    - Yes
    - No
6. If yes, dosage (if known)

7. Are you currently taking Cabergoline?
    - Yes
    - No
8. If yes, dosage (if known)

9. Are you currently on Bromocriptine?
    - Yes
    - No
10. If yes, dosage (if known)

11. Are you currently on Pergolide?
    - Yes
    - No
12. If yes, dosage (if known)

13. Are you currently on Pramipexole?
    - Yes
    - No
14. If yes, dosage (if known)

15. Are you currently on Lisuride?
    - Yes
    - No
16. If yes, dosage (if known)

17. Are you currently on Uprime?
    - Yes
    - No
18. If yes, dosage (if known)

19. Are you currently on Apomophine?
    - Yes
    - No
20. If yes, dosage (if known)

21. Are you currently taking a birth control medication?
    - Yes
    - No

22. Are you currently taking any other prescription medications not previously listed?
    - Yes
    - No

23. Please list any other medications you are currently taking.

24. If you are not currently taking Celexa, Lexapro, Escitalopram Oxalate, Fluvoxamine, Paroxetine, Sertraline, Luvox, Paxil, Zoloft, Citalopram, Fluoxetine, Zimeldine, Seromax, Sarafem, Deroxat, Dapoxetine, or Prozac, have you taken any of the these medications in the past six months?
    - Yes
    - No

25. Is your partner currently on an antidepressant?
    - Yes
    - No
    - Unsure

3. Survey: Gift Card Option

You are finished!

Thank you for participating in this research study. In order to show my appreciation, you may enter into a drawing for one of three $50 Target gift cards.

Please provide your name and an email address or phone number, in order to be entered into the drawing. Your information will only be used to contact you, if you are selected as one of the three winners of the gift cards.

Appendix D: Permission to Use Instrument

Permission to Use Instrument:
RE: Personality Belief Questionnaire-Short Form

From: **Andrew Butler**
Sent: Tue 2/19/08 9:18 PM
To: 'Dixie and Sam Meyer'
1 attachment(s)
PBQ Short...zip (150.8 KB)

Dear Dixie,

I am attaching a folder which includes the PBQ-SF and related materials. You are authorized to use the instrument for your study. I ask only that you provide a summary of your findings once your study is complete.

Best wishes,

Andrew C. Butler, Ph.D.

2100 Garden Rd., Ste A-102

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