The effect of oxytocin on donating money to charity: Moderation of the effect of oxytocin by experiences with parental use of love withdrawal, but not by experiences with harsh discipline in early childhood

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Leiden University
Faculty of Social and Behavioral Sciences
Supervisor: Dr. Huffmeijer
Second supervisor: Dr. Peltola

Brigitte E. van Vliet
0948306
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Abstract

Previous studies already showed that oxytocin promotes prosocial behavior. In addition, former research suggested that the effect of oxytocin depends on contextual and individual features. The current study examined the effect of intranasally administered oxytocin on donating money to charity and whether experiences of negative parenting (love withdrawal and harsh discipline) in the past moderated this relationship. It was hypothesized that participants who received oxytocin would donate more money than participants who received a placebo. In addition, it was hypothesized that participants without a history of negative parenting would donate more money than participants who did experience negative parenting in the past and that the effect of oxytocin on donating money was stronger for participants without a history of negative parenting, compared to participants who did experience negative parenting in the past. The sample consisted of 57 female undergraduate students. Participants randomly received either an oxytocin or a placebo nasal spray at the beginning of the session. To measure experiences with negative parenting, questionnaires were used to measure experiences with parental use of love withdrawal and harsh discipline in the past. Because the participants underwent a long experiment, they received 50 Euros afterwards to thank them for their participation. At the end, after they had received the money, participants were shown a video of UNICEF and were asked to donate some money to charity. No main effects of oxytocin, experiences of parental use of love withdrawal and harsh discipline in the past on the amount of money donated were found. Experiences with parental use of harsh discipline as a moderator also failed to reach significance. But experiences with parental use of love withdrawal moderated the relationship between administered oxytocin and donating money. The positive effect of oxytocin (donating more money after oxytocin administration than after placebo administration) was mainly found for participants who experienced less love withdrawal in the past.

Keywords*: oxytocin administration; love withdrawal; harsh discipline; donating money to charity*

1. Introduction

Oxytocin is a substance produced by the body, mainly in the hypothalamus (Carter, Pournajafi-Nazarloo, Kramer, Ziegler, White-Traut, Bello & Schwertz, 2007). It is a neuropeptide and has several functions for it is found in both the blood (as a hormone) and in the brain (as a neurotransmitter). Oxytocin is also known as the so-called 'love' hormone (Feldman, Weller, Zagoori-Sharon & Levine, 2007). This hormone plays an important role when a woman goes into labor, it supports the mother-child bonding right after birth and it stimulates lactation (Insel & Young, 2001). In addition, this 'love' hormone plays a substantial role in social behavior, including for the development of attachment and for showing affection to others (Zik & Roberts, 2015). During this process of behaving socially, oxytocin levels in blood increase. Oxytocin levels increase because of reactions of the heart. The heart will beat harder after being exposed to a social stimuli. These increased oxytocin levels elicit social reactions in humans (Yu, Ji, Gao, Fu, Guo, Song, Zhao, Burnstock, Shi, He & Xiang, 2011).

In addition, oxytocin as a neurotransmitter also plays an important role in social behavior. This neurotransmitter acts in the brain and functions within the central nervous system. Baumgartner, Heinrichs, Vonlanthen, Fischbacher and Fehr (2008) found that administered oxytocin was associated with a decrease in activation of the amygdala, which resulted in a decrease of fear of social betrayal. This social role of oxytocin was also found in the study done by Ditzen, Schaer, Bodenmann, Gabriel, Ehlert and Heinrichs (2009). They suggested that oxytocin was associated with a decrease in psychological stress and thereby a decrease in social-withdrawal-related behaviors. Besides a decrease in social-withdrawal-related behaviors, oxytocin seemed to increase generosity in humans (Zak, Stanton & Ahmadi, 2007), due to an increase in trust after oxytocin administration (Kosfeld, Heinrich, Zak, Fischbacher & Fehr, 2005).

1.1 Effect of oxytocin on prosocial behavior

Positive forms of social behavior are called prosocial behavior. Forms of prosocial behavior are altruism, charity and empathy (Wispé, 1972). Although numerous studies have been completed in order to explain what makes some people behave more prosocially towards other people, still a

lot is unknown and not clear about the precursors that contribute to showing more or less prosocial behavior (Staub, 1978). Previous research supported the idea that some people are biologically disposed to behave more prosocial than others (Campbell, 1965; Dawkins, 1976; Hoffman, 1981). This can be explained in the light of biological oxytocin levels. The oxytocin levels of some people are naturally lower compared to the oxytocin levels of other people. For example, Heim, Young, Newport, Mletzko, Miller and Nemeroff (2009) found in their study that women with a history of childhood abuse have naturally lower oxytocin levels, compared to women without a history of childhood abuse. This might indicate that people who have experienced childhood abuse will show less prosocial behavior, compared to people who were not abused in early childhood.

In the current study oxytocin levels were manipulated through the administration of a nasal spray. Kosfeld and colleagues (2005) were among the first who completed a study in human research about the effect of intranasally administered oxytocin. They suggested that administered oxytocin increases trust in other people. Participants in this experiment gave more money to other people in a trust game, compared to participants who received a placebo nasal spray. Hurlemann, Patin, Onur, Cohen, Baumgartner, Metzler, Dziobek, Gallinat, Wagner, Maier and Kendrick (2010) conducted a double-blind experiment to investigate whether intranasally administered oxytocin increases empathic behavior. Compared to men who received a placebo nasal spray, men who received oxytocin indeed showed more empathic behavior. This was also concluded in the meta-analysis conducted by Van IJzendoorn and Bakermans-Kranenburg (2012). In addition, Domes, Heinrichs, Michel, Berger and Herpertz (2007) demonstrated that after receiving oxytocin, participants were more able to 'read the mind' of other individuals, compared to participants who received a placebo nasal spray. To be able to assess and understand the emotions of another person is an important aspect of empathy. Zak and colleagues (2007) demonstrated that participants were more generous after receiving oxytocin and that this was associated with empathic and altruistic behavior.

In the current study, prosocial behavior was measured as the amount of money participants donated to charity. When someone donates money to charity it benefits other people but not the person who donates the money, since the donating person ends up with less money in order to help others in need. Therefore, donating money to charity is altruistic behavior, which is a form of prosocial behavior (Huffmeijer, Alink, Tops, Bakermans-Kranenburg & Van

IJzendoorn, 2012). In the study of Barraza, McCullough, Ahmadi and Zak (2011) it was already demonstrated that administered oxytocin increased the amount of money participants donated to charity, compared to participants who received a placebo. But some people seemed to be more influenced by administered oxytocin than other people.

According to the interactionist approach, to investigate the effect of oxytocin on prosocial behavior, some contextual factors have to be taken into account. This approach will lead to a better understanding of the effect of oxytocin on prosocial behavior, because it will explain why some people are more influenced by the administration of oxytocin than other people (Bartz, Zaki, Bolger & Ochsner, 2011). The studies mentioned before described that oxytocin elicits prosocial behavior, but individual differences in early caregiving experiences may moderate the positive effect of oxytocin on prosocial behavior. A secure and healthy relationship between parents and their child is important for regulating children's social and emotional experiences throughout development. In this way, children learn to behave, adjust and respond appropriately to other people in their environment. A disturbed relationship between parents and their child or experiences of trauma in the early childhood years, such as maltreatment, can lead to an abnormal development whereby children can experience more difficulties to behave, adjust and respond appropriately and prosocially (Heim et al., 2009).

1.2 The effects of experiences with negative parenting in the past on the relationship between oxytocin and prosocial behavior

Negative parenting means the negative experiences people have experienced in early childhood in consequence of the way their parents have behaved and acted towards them. The current study focused on the influence of two forms of experiences with negative parenting. First, experiences with parental use of love withdrawal and second experiences with parental use of harsh discipline in the past. When parents use love withdrawal as a strategy, it means that parents show affection and love towards their child conditionally, for example only when the child is behaving properly or succeeded when performing a task (Huffmeijer et al., 2012). This method of disciplining children, gives children the feeling that being loved by their parents depends on how well they perform in their life. This dependency brings along emotional costs, for example feeling rejected or being afraid to fail (Elliot & Thrash, 2004). When parents use this strategy excessively, it is

seen as a form of psychological maltreatment (Euser, Van IJzendoorn, Prinzie & Bakermans-Kranenburg, 2010). Harsh discipline is a strategy whereby parents mainly physically discipline their child to let the child obey (e.g. spanking, hitting, kicking). When parents use this strategy excessively in order to let the child behave appropriately, it can be seen as a form of physical maltreatment (Straus & Hamby, 1997). The difference between these strategies can be seen in light of the consequences of experiencing these parenting forms. When children feel they are loved conditionally, they can feel rejected and neglected. They will think that this is a normal way of loving and interacting with each other and they might implement this behavior in daily situations later in life. Consequently, they might experience more internalizing problem behavior, for example anxiety and depression. When children have experienced harsh discipline early in life they might incorporate the thought that reacting physically in a situation is normal. These children will behave more aggressively towards others later in life and therefore experience more externalizing problem behavior. By including both forms of negative parenting in the current study, a more overall view of the effects of experiences with negative parenting on later prosocial behavior will be obtained.

Previous studies have already proven the disastrous effects of early negative caregiving experiences on functioning and adjustment later in life. Psychological maltreatment in the past predicted more aggressive behavior later in life (Crawford & Wright, 2008). In addition, individuals who were physically punished, e.g. spanked, by their parents as a child also behaved more aggressively when they were older (Lansford, Wager, Bates, Pettit & Dodge, 2012; Strassberg, Dodge, Pettit & Bates, 1994). Furthermore, Prino and Peyrot (1994) investigated the effects of physical abuse and neglect on aggressive, withdrawn and prosocial behavior of children. One of the most important results of their study was that non-abused children showed more prosocial behavior than abused children. In a study by Koenig, Cicchetti and Rogosh (2004) the moral development of children was investigated whereby the association between early maltreatment and later prosocial behavior of young children were tested. This study once more demonstrated that both physically abused and neglected children were less prosocial compared to the non-maltreated children.

The studies mentioned before described the effects of negative parenting early in life on later prosocial behavior, but experiences with negative parenting may also moderate the effect of oxytocin on prosocial behavior. Because of individual differences concerning this contextual

factor, some people are perhaps more influenced by the administration of oxytocin. Concerning the moderating effect of experiences with love withdrawal, Riem, Bakermans-Kranenburg, Huffmeijer and Van IJzendoorn (2013) investigated whether administered oxytocin elicited more prosocial behavior, compared to participants who received a placebo nasal spray. This study suggested that participants who received oxytocin showed more prosocial behavior than participants who received the placebo, but this effect only applied for participants who experienced less parental use of love withdrawal in the past. Hereby, oxytocin administration further increased the number of balls thrown toward the excluded person in individuals who experienced low levels of maternal love withdrawal. In addition, Van IJzendoorn, Huffmeijer, Alink, Bakermans-Kranenburg and Tops (2011) already studied whether experiences of parental use of love withdrawal in the past moderated the impact of oxytocin administration on donating money in an experiment. They also found a positive effect of oxytocin on donating money only for participants who experienced low levels of parental use of love withdrawal in the past and no effect of oxytocin on donating money for participants who experienced high levels of parental use of love withdrawal in the past. Assor, Roth and Deci (2004) found a possible explanation for this effect. When parents use love withdrawal as a strategy to control their child, a child unconsciously incorporate certain thoughts, which lead to certain scripted behavioral enactments, which resulted in showing desired behavior (e.g. donating money). Koenig and colleagues (2004) suggested the same underlying mechanism for individuals who have experienced parental use of love withdrawal in the past. People who have experienced love withdrawal in early childhood tend to make decisions based on what others expected the individual would do (showing desired behavior). Otherwise, the individual is afraid of being rejected or being criticized by others. Another study found a moderating effect of experiences of negative parenting on the whole, whereby participants without an abusive past were more affected by oxytocin administration in a positive way (showing more prosocial behavior) than participants with an abusive past (Meinlschmidt & Heim, 2007). Therefore, it is plausible that the same results will be found for the other domain of negative parenting in the current study, namely experiences with parental use of harsh discipline in the past. Bakermans-Kranenburg, Van IJzendoorn, Riem, Tops and Alink (2011) accomplished an experiment in which they investigated whether infant crying would elicit sensitive caregiving or hostility/ use of excessive force after administration of oxytocin and whether experiences of parental use of harsh discipline in the past would moderate the effect of

oxytocin. Results of this study demonstrated that participants with no experiences of parental use of harsh discipline during childhood used less excessive force in the oxytocin condition. For participants who had experienced harsh discipline in the past there was no difference between the oxytocin and placebo condition. They concluded that experiences of parental use of harsh discipline in the past appeared to be an important moderator in the relationship between oxytocin and prosocial behavior. They also concluded that oxytocin probably increases trust and cooperation in individuals with a favorable past, but that this positive effect cannot be generalized to individuals with an abusive past.

1.3 The current study

Therefore, the current study tested whether experiences of negative parenting in the past moderated the effect of oxytocin on donating money to charity. The aim of this study was to discover if and how experiences with parental use of love withdrawal and harsh discipline in early childhood made people more or less influenced by the administration of oxytocin in a positive way and its effect on prosocial behavior. In the current study the effect of oxytocin was measured through administering a nasal spray which consisted either oxytocin or a placebo. Oxytocin levels increase substantially after administration of oxytocin, compared to administration of a placebo (Huffmeijer, Alink, Tops, Grewen, Light, Bakermans-Kranenburg & Van IJzendoorn, 2012). MacDonald and MacDonald (2010) demonstrated that intranasally administered oxytocin found its direct way to the brain where it functions. This makes it possible to test the effect of oxytocin. When the role of experiences with negative parenting in the past is discovered, a more specific and detailed theory about the role of oxytocin on prosocial behavior can be developed (Bartz et al., 2011).

For this reason, the current study tested the effect of oxytocin on the amount of money participants donated to charity, the effects of both forms of negative parenting on the amount of money participants donated and whether the relation between administered oxytocin and donating money was moderated by the two forms of negative parenting (both experiences with love withdrawal and harsh discipline). It was hypothesized that participants who received the intranasal oxytocin would donate more money than participants who received a placebo. In addition, it was hypothesized that participants without a history of negative parenting donated

more money than individuals who did experience negative parenting in the past. Furthermore, it was expected that the positive effect of oxytocin on donating money was stronger for participants without a history of negative parenting than for participants who did experience negative parenting in the past.

Findings of this study will, once more, contribute to the knowledge whether participants who receive oxytocin show more prosocial behavior, compared to participants who receive a placebo. Besides, results of the current study might provide a more differentiated theory about the effect of oxytocin and if people without a history of negative parenting are more or less affected by administered oxytocin in a positive way than people with a history of negative parenting. By obtaining more empirical knowledge about the effect of oxytocin on prosocial behavior and if experiences with negative parenting in the past influences this relationship, interventions can be developed through which individuals who have experienced negative parenting can learn to improve their social functioning and adjustment.

2. Method

2.1 Participants

The participants in the current study are part of a study done by Huffmeijer and colleagues (2012). In their study, students were not allowed to participate when one or more of the following criteria applied to them: color blindness, smoking, alcohol and drug abuse, neurological and psychiatric disorders, pregnancy, breast-feeding and use of medication (except oral contraceptives). The current study used the data collected during the second sessions of the original study. A total of 57 female undergraduate students participated in the current study, with an age range from eighteen to 30 years (M = 20.51, SD = 2.9).

2.2 Procedure

In the original study, participants visited the laboratory twice. The sessions were four weeks apart from each other. It is known that oxytocin levels vary during the day. Therefore, it was decided that all sessions took place in the afternoon. This standardized way of collecting data ensures

more comparability of the results between the participants. Before each session, participants were instructed not to consume any alcohol and not to be intensely physically active throughout the 24 hours before the beginning of the session. In addition, they were asked not to drink any caffeine-holding drinks on the day of the session. The current study will only report on results of all second sessions, since completing the CTS questionnaire and the donating task took place at the second session. Concerning the administration of the nasal spray, both the participants and the experimenters did not know which nasal spray (oxytocin or placebo) the participants received at the beginning of the second session (this was counterbalanced). The nasal sprays were randomly assigned to the participants.

Before the session took place, participants filled out a questionnaire measuring experiences with parental use of love withdrawal in the past. At the start of the session, participants were asked to sign informed consent, after which the first saliva sample was taken. After collecting the first saliva sample, the nasal spray was administered. About half of the participants received oxytocin (N = 27) and half of the participants received a placebo nasal spray (N = 30). Subsequently, an electrode net was placed on the head of the participant. First, the EEG of the participant was recorded during resting periods of two minutes (the first period with eyes opened, the second period with eyes closed). After that, the ERP experiment was accomplished during a 1-hour task. Within this task, a break was implemented in which the participants completed the CTS questionnaire and in which the second saliva sample was collected. Finally, the EEG of the participant was again recorded during resting periods of two minutes (the first period with eyes opened, the second period with eyes closed). After the EEG was recorded, the third and last saliva sample was collected. At the end of the second session, participants received 50 Euros to thank them for participating. Finally, they were shown a video of UNICEF and were asked if they wanted to donate some money.

2.3 Experiences with parental use of love withdrawal in the past

To measure experiences with parental use of love withdrawal during childhood, participants filled out a questionnaire which consisted of eleven items, as used in the study of Huffmeijer and colleagues (2012). This questionnaire was built up from items of the Children's Report of Parental Behavior Inventory and the Parental Discipline Questionnaire. Participants were asked

to rate how well every item described their mother and father separately. An example of an item was "My mother is a person who, when I disappoint her, tells me how sad I make her". Participants had to answer every item on a 5-point scale ranging from 1 (not at all) to 5 (very well).

The scores for experiences with maternal use of love withdrawal and paternal use of love withdrawal were summed, whereby an overall score of experiences with parental use of love withdrawal was computed. The internal consistency for this questionnaire was already computed by Huffmeijer and colleagues (2012). They found a Cronbach's alpha of .83 in their sample, which is adequate. The reliability and validity of the CRPBI was earlier positively determined (Locke & Prinz, 2002).

2.4 Experiences with parental use of harsh discipline in the past

To measure experiences with parental use of harsh discipline in the past, participants completed the Conflict Tactics Scales, the CTS (Straus & Hamby, 1997). This questionnaire consisted of eighteen items in which participants were asked to rate to what extent their parents used certain strategies to, mainly physically, discipline them. An example of an item was "They hit or kicked me very hard" and participants had to answer every item on a 5-point scale ranging from 1 (almost never) to 5 (almost always).

Internal consistency of this questionnaire was adequate, Cronbach's alpha was .74 for the current sample. The construct validity of the CTS was already described in the article of Straus and Hamby (1997). To assess the construct validity, it was established whether results of the CTS questionnaire were coherent with theoretical and empirical indications of physical abuse, what the CTS supposed to measure. The construct validity can be accepted, because findings suggested that the indications of the CTS were coherent with previous research findings and theories (Straus & Hamby, 1997).

2.5 Donating task

At the end of the second session in the study of Huffmeijer and colleagues (2012), participants received 50 Euros to thank them for participating in the study. Before going home, participants

were shown a video of UNICEF. In this video a child was introduced, who was obliged to work and not able to go to school, because of poverty. After watching this video, participants were asked to donate some money for charity. To make the donating task a realistic task, the money box was already filled with some coins. All the money collected via the donating task was sent to UNICEF after the study was completed.

2.6 Statistical analyses

2.6.1 Data-inspection

The data of this study were inspected on several aspects. First of all, I have checked if there were any missing values in this dataset. Concerning the univariate data-inspection, distributions of the variables were examined. To get an overview of the distribution of the nasal sprays (oxytocin or placebo) across participants, a pie chart was drawn (categorical variable). Of the variables 'experiences with parental use of love withdrawal', 'experiences with parental use of harsh discipline' and 'donating money', which are all continuous variables, *z*-scores were computed to identify outliers ($z > |3.29|$). To check for normality, the standardized skewness and standardized kurtosis were computed of all three variables ($< |3|$). In addition, I have checked the normality of all three continuous variables using histograms with normal curves.

Concerning the bivariate data-inspection, boxplots were drawn to examine outliers and homoscedasticity (relation between variables) of the relation between 'administration of oxytocin or placebo' and 'donating money'. With a matrix scatterplot it was first verified whether the relations of both 'experiences with parental use of love withdrawal' and 'experiences with parental use of harsh discipline' with 'donating money' were homoscedastic. Second I have checked whether the relations of both 'experiences with parental use of love withdrawal' and 'experiences with parental use of harsh discipline' with 'donating money' were not non-linear. Finally I have verified if there were any bivariate outliers.

2.6.2 Preliminary analyses

After transforming scores on 'experiences with parental use of love withdrawal' and 'experiences with parental use of harsh discipline' into *z*-scores to check for possible outliers and providing an overview of the normality of both variables, a correlation was calculated in order to decide whether both variables could be combined into one variable ('negative parenting'). When 'experiences with parental use of love withdrawal' and 'experiences with parental use of harsh discipline' were combined into one variable 'negative parenting', two main effects ('administration of oxytocin or placebo' and 'negative parenting' on 'donating money') and one interaction effect (the interaction between 'administration of oxytocin or placebo' and 'negative parenting' on 'donating money') would be tested. The correlation should not be too low (<.50), because this implicates that 'experiences with parental use of love withdrawal' and 'experiences with parental use of harsh discipline' are two different constructs and should not be combined into one variable. But the correlation should also not be too high (near .100). Combining both variables would then be pointless and using one of the variables would be enough to represent 'negative parenting'. The correlation analysis revealed that the correlation was too low (r = .24) to combine the variables, thus three main effects ('administration of oxytocin or placebo', 'experiences with love withdrawal' and 'experiences with harsh discipline' on 'donating money') and two interaction effects (the interaction between 'administration of oxytocin or placebo' and 'experiences with love withdrawal' on 'donating money' and the interaction between 'administration of oxytocin or placebo' and 'experiences with harsh discipline' on 'donating money') were tested (see below).

Furthermore, I have checked whether the administration of oxytocin had an influence on filling out the CTS questionnaire, by using a *t*-test. Moreover, I have used a *t*-test to examine whether participants scoring higher and lower on love withdrawal were equally distributed across the placebo and oxytocin groups.

2.6.3 Main analyses

With the help of IBM SPSS Statistics 21 statistical analyses were conducted to test the effect of oxytocin on donating money and whether experiences with parental use of love withdrawal and

parental use of harsh discipline in the past moderated this relationship. A multiple regression analysis was performed with 'administration of oxytocin or placebo', 'experiences with parental use of love withdrawal' and 'experiences with parental use of harsh discipline' as the independent variables and 'donating money' as the dependent variable. Besides testing three main effects, two interaction effects were tested. To make it possible to test interaction effects, the variable 'administration of oxytocin or placebo' (dichotomous, contrast codes) was coded as 1 (oxytocin) and -1 (placebo). Both the interaction between 'administration of oxytocin or placebo' and 'experiences with harsh discipline' on 'donating money' and the interaction between 'administration of oxytocin or placebo' and 'experiences with love withdrawal' on 'donating money' were tested. When an interaction effect was significant, a verification of the direction of this effect had to be computed. The median split of the respective moderator was used to split up the participants in the sample into two groups with high and low scores on the variable. In this way, it was possible to test the direction of the interaction effect.

3. Results

3.1 Features of the continuous variables

The current sample consisted of 57 participants. Table 1 provides a summary of the three continuous variables. Scores on the questionnaire measuring experiences with parental use of love withdrawal ranged from 27 to 72 (M = 49.38, SD = 12.49). Scores on the questionnaire measuring experiences with parental use of harsh discipline ranged from eighteen to 51 (M = 33.25, SD = 6.44). Even though the questionnaire measuring harsh discipline consisted of more items, the mean score of this questionnaire was lower compared to the questionnaire measuring love withdrawal. Keeping in mind that both questionnaires had to be answered on a 5-point scale ranging from 1 (not at all/ almost never) to 5 (very well/ almost always), this seemed to indicate that experiencing love withdrawal is more common than experiencing harsh discipline. Furthermore, the amount of money donated to charity in this sample ranged from zero Euros to fifteen Euros (M = 2.87, SD = 2.86).

Table 1

Summary of the continuous variables.

	N	Min	Max	*M*	*SD*	Standardized skewness	Standardized kurtosis
Love withdrawal	57	27	72	49.38	12.49	.42	-1.70
Harsh discipline	57	18	51	33.25	6.44	2.01	1.13
Donating	57	0.00	15.00	2.87	2.86	.06	-.18

3.2 Data-inspection

First of all, there were no missing data detected in this data set. Concerning the distribution of 'administration of oxytocin or placebo', 27 participants (47.4%) received the oxytocin nasal spray and 30 participants (52.6%) received a placebo nasal spray. Furthermore, there were no outliers on 'experiences with parental use of love withdrawal' and 'experiences with parental use of harsh discipline', for all *z*-scores were smaller than 3.29. Besides, the standardized skewness and standardized kurtosis of both variables were within the acceptable range of -3 to 3. Concerning the variable 'donating money', the distribution was too skewed to the right (standardized skewness was 6). After squaring this variable, both the standardized skewness and standardized kurtosis fell within the acceptable range of -3 to 3. Also the *z*-scores of 'donating money' were all smaller than 3.29. Finally, the histograms with normal curves suggested normality of all three continuous variables, as illustrated in figure 1.

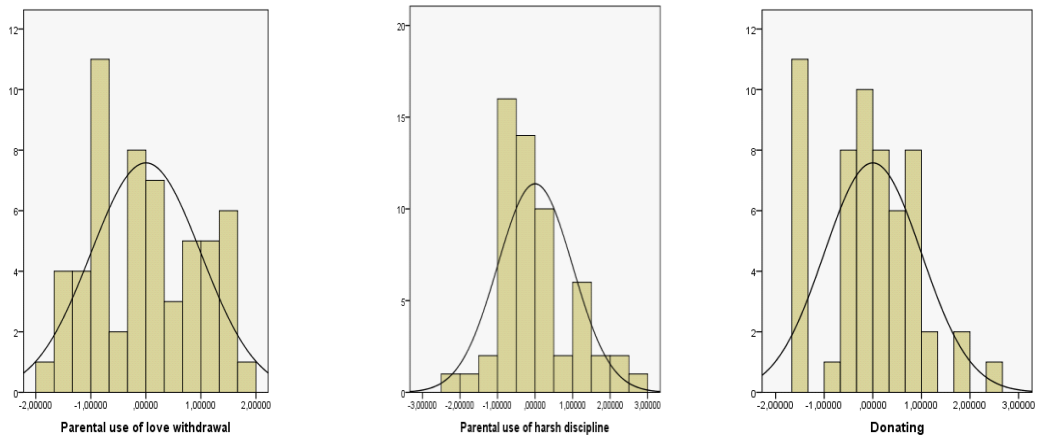

Fig. 1 Normal distributions of all three continuous variables ('experiences with parental use of harsh discipline', 'experiences with parental use of love withdrawal' and 'donating money'), illustrated by histograms with normal curves. The histogram of the variable 'donating money' was drawn after the distribution was squared.

Regarding the bivariate data-inspection, the boxplots of figure 2, illustrating the relation between ‘administration of oxytocin or placebo’ and ‘donating money’, demonstrated a homoscedastic relation and no outliers (for all scores fell within 1.5 times the interquartile range above the upper quartile and below the lower quartile). Furthermore, the relations of both ‘experiences with parental use of love withdrawal’ and ‘experiences with parental use of harsh discipline’ with ‘donating money’ were not non-linear (for both figures demonstrated straight rising lines), as illustrated in figure 3. Besides, figure 3 demonstrated that the relations of both ‘experiences with parental use of love withdrawal’ and ‘experiences with parental use of harsh discipline’ with ‘donating money’ were homoscedastic and there were also no outliers (for all scores were equally distributed around and nearby both lines).

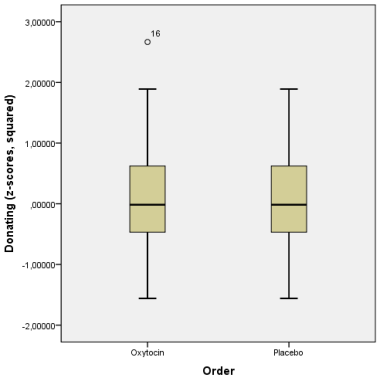

Fig. 2 Boxplots illustrating the relation between oxytocin or placebo administration on donating.

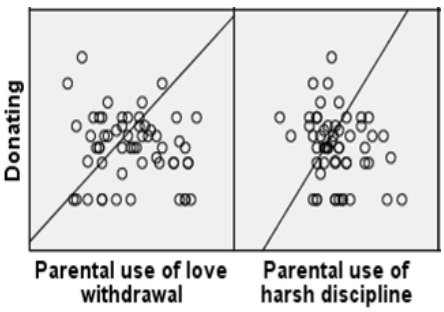

Fig. 3 Matrix scatterplot illustrating the relation between love withdrawal and harsh discipline on donating.

3.3 Preliminary analyses

The correlation between ‘experiences with parental use of love withdrawal’ and ‘experiences with parental use of harsh discipline’ appeared to be too low to combine them into one variable ‘negative parenting’ ($r(55) = .24$, $p = .08$), thus they were tested as two separate variables. This meant that three main effects and two interaction effects were tested in the current study. First the main effects of the independent variables ‘administration of oxytocin or placebo’, ‘experiences with love withdrawal’ and ‘experiences with harsh discipline’ on ‘donating money’. Second the interaction between ‘administration of oxytocin or placebo’ and ‘experiences with love

withdrawal' on 'donating money' and the interaction between 'administration of oxytocin or placebo' and 'experiences with harsh discipline' on 'donating money'.

Furthermore, a *t*-test showed that the administration of oxytocin did not have an influence on filling out the CTS questionnaire ($t(55) = 1.13$, $p = .26$). Moreover, a *t*-test demonstrated that the participants with a high and low score on the questionnaire measuring experiences with parental use of love withdrawal were equally divided in the oxytocin and placebo conditions ($t(55) = .60$, $p = .55$). Thus, random assignment to the different conditions of 'administration of oxytocin or placebo' can be assumed.

3.4 Multiple regression analyses

To test the effect of administered oxytocin on the amount of money participants donated to charity and the moderating effects of experiences with parental use of love withdrawal and parental use of harsh discipline in the past, a multiple regression analysis was conducted. The final model was significant, $F(5,51) = 2.57$, $p = 0.04$, $R^2 = 0.20$. All predictors together explained 20% of variation in donations. The main effect of 'administration of oxytocin or placebo' on 'donating money' was not significant ($\beta = .11$, $p = .40$). Main effects of both moderators 'experiences with parental use of love withdrawal' and 'experiences with parental use of harsh discipline' on 'donating money' were also not significant (respectively: $\beta = -.03$, $p = .81$; $\beta = -.19$, $p = .18$). Furthermore, the interaction between 'administration of oxytocin or placebo' and 'experiences with parental use of harsh discipline' on 'donating money' failed to reach significance as well ($\beta = -.01$, $p = .96$). Only the interaction between 'administration of oxytocin or placebo' and 'experiences with parental use of love withdrawal' significantly predicted donations ($\beta = -.36$, $p = .01$).

To explore the direction of the significant interaction between 'administration of oxytocin or placebo' and 'experiences with parental use of love withdrawal' on 'donating money', the participants were divided in two groups by making a median split. One group included participants with high scores on the questionnaire measuring experiences with parental use of love withdrawal and one group included participants with low scores on the questionnaire measuring experiences with parental use of love withdrawal. Separate multiple regression analyses were conducted with both groups. For both groups showing more experiences with love

withdrawal and less experiences with love withdrawal in the past, 'administration of oxytocin or placebo' did not become significant (respectively: β = -.18, p = .35; β = .37, p = .07). Even though 'administration of oxytocin or placebo' did not become significant when participants were divided into high scores and low scores on the questionnaire measuring experiences with parental use of love withdrawal, the interaction effect between 'administration of oxytocin or placebo' and 'experiences with parental use of love withdrawal' on 'donating money' was significant. The effect in the low love withdrawal group bordered on significance and can be considered as a trend. Although 'administration of oxytocin or placebo' failed to reach significance in this group, this result suggested that the positive effect of oxytocin (donating more money after oxytocin administration than after placebo administration) was mainly found for participants with low love withdrawal scores (see figure 4).

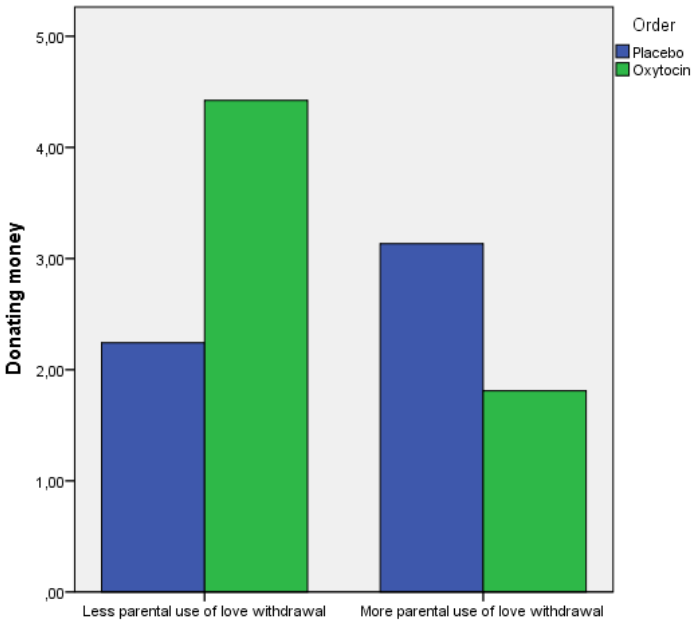

Fig. 4 Mean donations after administering oxytocin and placebo for participants reporting less experiences with parental use of love withdrawal (N = 28) and for participants reporting more experiences with parental use of love withdrawal in the past (N = 29). Only for illustrating this interaction effect, participants were divided in two groups on the basis of their scores on the questionnaire measuring 'experiences with parental use of love withdrawal'. This illustration demonstrates that the positive effect of oxytocin (donating more money after oxytocin administration) was mainly found for participants with low scores on the questionnaire measuring experiences with love withdrawal.

4. Discussion

4.1 Main results

In the current study, the effect of oxytocin on donating money was moderated by experiences with parental use of love withdrawal in the past. The positive effect of oxytocin (donating more money after oxytocin administration than after placebo administration) was mainly found for participants who have experienced less love withdrawal in early childhood. The strong effect for this form of negative parenting suggests that this form might be more disruptive on the long run than experiences with parental use of harsh discipline, because analyses revealed that experiences with harsh discipline in early childhood did not moderate the relationship between oxytocin and donating money. The result that an moderating effect for experiences with harsh discipline failed to occur can be found in the different adjustment problems as a consequence of experiencing both forms of negative parenting. People who have experienced love withdrawal show more internalizing problem behavior and people who have experienced harsh discipline show more externalizing problem behavior. The impact of experiencing internalizing problems is probably larger than the impact of experiencing externalizing problems. Therefore the difference between individuals who did and who did not experience internalizing problems is substantially larger, whereby participants who have experienced love withdrawal are a lot less influenced by administration of oxytocin, compared to participants who did not experience love withdrawal. The difference between individuals who did and who did not experience harsh discipline might be smaller, therefore a moderation effect for harsh discipline stayed out.

Besides the moderating effects of both love withdrawal and harsh discipline, this study also tested the direct effects of both forms of negative parenting on the amount of money the participants donated to UNICEF. Both love withdrawal and harsh discipline did not directly predicted donations. Love withdrawal and harsh discipline are both forms of negative parenting, but this cannot be seen as maltreatment. When these participants would have been maltreated, direct effects on donating money could have been larger, because experiences with maltreatment are more intense and have probably more impact on later prosocial behavior.

Although experiences with parental use of love withdrawal in the past moderated the relationship between administered oxytocin and the amount of money participants donated to

charity, administered oxytocin did not directly predicted donations in this study. A possible explanation for this finding was already mentioned in the review of Bartz and colleagues (2011). They described that a lot of studies about the social effects of oxytocin administration showed that there was no significant main effect of oxytocin on prosocial behavior. This is in line with findings of the current study. The review demonstrated that the effect of oxytocin is often moderated by stable characteristics and contextual factors of the participants who received the oxytocin nasal spray. In this study by the experiences with parental use of love withdrawal in the past.

4.2 Limitations and implications

The results of this study are meaningful, but limitations of the study must be taken into account, because of the limited generalizability of the results and the reliability of the methodology. First, to fill out the questionnaires measuring experiences with parental use of love withdrawal and harsh discipline in the past, participants had to think over their childhood. To be able to complete a questionnaire, participants have to rely on their memories about their past. Hardt and Rutter (2004) wrote an article in which the reliability of these retrospective reports was described. Several studies detected some bias in retrospective reports. They found a substantial rate of false negatives. This suggests that scores on both questionnaires were now perhaps lower than the actual rate. Therefore there is a higher chance that cases of experiences with negative parenting are missed in this study. Consequences of underreporting cases of love withdrawal and harsh discipline probably biased the results of this study in a way that significant results stayed out. Besides, although this is harder to quantify, false positive reports are probably rare in retrospective reports. Future research could include observations to test for experiences with negative parenting, this would be a good addition next to self-report.

Another limitation of the current study is that the results are limited generalizable, because of the sample of this study. The current sample consisted of 57 female undergraduate students. Although the size of this sample is favorable, in light of the power of the results, it is questionable if the results can be generalized to males as well. Previous research has shown that oxytocin has an influence on prosocial behavior in both women and men (Donaldson & Young, 2008) and that gender can moderate the effect of oxytocin (Zik & Roberts, 2015). Kubzansky,

Mendes, Appleton, Block and Adler (2012) found that administering oxytocin by men resulted in less distress when exposed to social stress, whereby women reported more distress and anger in the same situation. The last interesting study worth to mention about gender-specific associations is done by Koenig and colleagues (2004). They found that the development of females' prosocial behavior may be more affected by a history of child abuse than the development of males. Although future research need to further test the different results between men and women, there seems to exist a pattern of gender moderating effects after administration of oxytocin. Future research could include both males and females in a sample, a mixed sample, to test for gender-specific associations.

A third limitation of the current study is that only participants who studied at the university were included. It can be presumed that all students were of a relatively high social economic class, since they were all able to study at the university, but it is questionable if the results can be generalized to people with a lower SES as well. Research has shown that people with a lower SES often grow up in a poorer social environment and because of this experience more negative emotions such as depression and anxiety (Gallo & Matthews, 2003). These people could behave less prosocially or get less influenced by the administration of oxytocin. Therefore future research also need to focus on people with a lower SES.

Furthermore, to recruit participants for the current study the nonprobability sampling technique was used. This way of sampling, also called convenience sampling, jeopardize the generalizability of the results of the current study as well. It is important that future research recruits participants in a way in which every unit in the population has a chance (greater than zero) of being selected in the sample, also called probability sampling.

Future research can also test an extension of the model tested in the current study. In the current study, it is investigated whether experiences of negative parenting in the past moderated the relationship between the administration of oxytocin and donating money to charity. Future research can focus on an extension of this moderation model, namely a mediated moderation model, illustrated in figure 5. Previous studies have shown that experiences of negative parenting in early childhood can lead to naturally lower concentrations of oxytocin in women (Heim et al., 2009). This is a mediation effect. Benarroch (2013) also found that experiences of trauma and neglect in childhood permanently change the biological regulation system of oxytocin. People who have experienced trauma and neglect had naturally lower oxytocin levels. This permanently

altered, biological oxytocin system can probably moderate the relationship between the administration of oxytocin and (prosocial) behavior as well, besides the moderation of experiences with negative parenting. This can provide a more complete understanding of the effect of oxytocin on behavior.

In addition, the current study measured prosocial behavior of participants who have experienced love withdrawal and harsh discipline. This study suggested a moderating effect for participants who have experienced love withdrawal, but not for individuals who have experienced harsh discipline, on the relationship between administered oxytocin and donating money. This indicates a specific maladjustment pattern rather than a general maladjustment pattern of negative experiences in early childhood (Prino & Peyrot, 1994). Future research should focus more on specific maladjustment patterns of these individuals rather than a general maladjustment pattern, in order to be able to develop more refined theories about the different effects of different types of negative parenting on the development and adjustment of children.

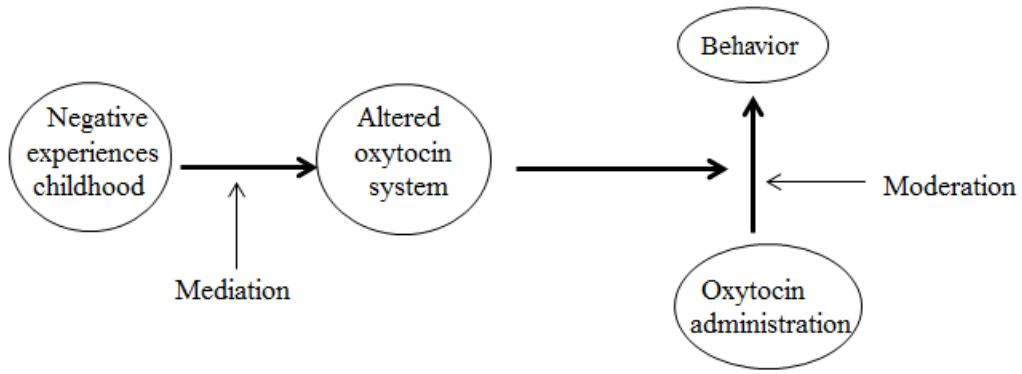

Fig. 5 Mediated moderation model.

4.3 Conclusion

Bartz and colleagues (2011) pointed out that inconsistencies across studies about the effect of oxytocin on prosocial behavior should not be perceived as 'noise', but as an indication to interpret these findings as dependent on the situation and individual characteristics. The effect of oxytocin on donating money was dependent on the indication whether participants experienced parental use of love withdrawal in their childhood. Future research needs to focus on further investigating important and influential moderators. Replication and future research is essential,

with the limitations and implications taken into account, to come to a more robust and refined theory about the effect of oxytocin on prosocial behavior.

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