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Focus on feelings. Parental emotion socialization in early childhood

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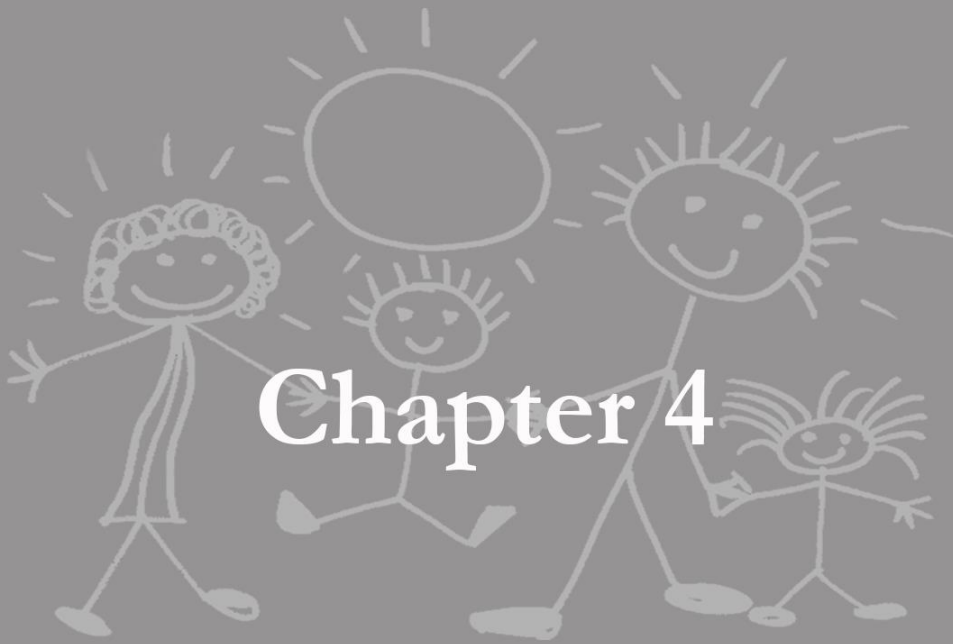


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Family of Origin Affects Mothers', but not Fathers', Gender-Typed Parenting Through Their Testosterone Levels

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An adapted version of this chapter is submitted for publication

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ABSTRACT

Gender-typed parenting has received ample research attention in the past decades. However, little is known about the factors that can explain individual differences in fathers' and mothers' gendered characteristics. In this study we examined the links between the sibling gender combination in fathers' and mothers' family of origin, their circulating testosterone levels, and their gender-typed parenting characteristics. Participants included 189 fathers and 104 mothers. Evening and morning salivary testosterone samples were analyzed with radio-immunoassays to determine circulating testosterone levels. We examined the following parenting dimensions: (1) fathers' and mothers' gendered cognitions measured with an Implicit Association Task, (2) parents' role division of caregiving and household tasks in the family, and (3) parents' observed gendered emotion socialization behavior while going through a picture book with their preschoolers. We found that the proportion of brothers in mother's family of origin was positively related to higher morning testosterone levels, which in turn were related to mothers' less gendered emotion socialization behavior toward their preschoolers. We also found that the proportion of brothers in mother's family was related to a more traditional role division between mothers and their partners. These findings suggest that growing up with more brothers than sisters affects specific aspects of mothers' gendered characteristics, and call for further research on the mechanisms underlying individual differences in fathers' and mothers' gender-typed parenting.

Keywords: sibling, gender, testosterone levels, fathers, mothers, gendered parenting, intergenerational

INTRODUCTION

Gender-typed parenting has interested researchers for decades. We know, however, relatively little about the factors that may explain individual differences in fathers' and mothers' gendered parenting characteristics. From the perspective of intergenerational transmission of behavior (e.g., Bretherton & Munholland, 2008; Champagne, 2008), parents' own family background is likely to play a role in their current gendered parenting, and specifically, the number of male and female siblings in their family of origin. Studies on gender development indicate that the sibling gender combination in a family affects the development of gender-typed ideas, characteristics, and behaviors in children (e.g., McHale, Crouter, & Whiteman, 2003). But not only are the socialization patterns related to the gender combination in the family of origin relevant, the gender of parents' siblings may also affect a parent's neurobiological functioning. Previous research indicates that a higher number of older or twin male siblings in a family is related to higher in utero testosterone levels for later offspring in both animals and humans (Williams et al., 2000; Tapp, Maybery, & Whitehouse, 2011). Furthermore, there is evidence that higher in utero testosterone exposure predicts higher testosterone levels in adulthood (e.g., Jamison, Meier, & Campbell, 1993; Manning, Scutt, Wilson, & Lewis-Jones, 1998), suggesting that the sibling gender combination in parents' family of origin may predict their current circulating testosterone levels as well. The steroid sex hormone testosterone is an important biomarker of gender-typed characteristics and behaviors in various species (McIntyre & Hooven, 2009), and parents' circulating levels of testosterone may also modulate their gendered parenting characteristics. This suggests that parental testosterone may act as a mediating factor in the relation between the sibling gender combination in their family of origin and their current gendered characteristics (see Figure 1). In this study we examined the links between the proportion of male siblings in fathers' and mothers' family of origin, their circulating testosterone levels, and parents' gendered parenting characteristics as reflected by their gendered cognitions, the gendered role division in the family, and parents' gendered emotion socialization.

During early childhood parents play a key role in children's gender socialization (Lindsey & Christy, 1997). Through gendered parenting

fathers and mothers convey to their children what it means to be a boy or a girl, and which emotions and behaviors are more accepted in boys and in girls. Apart from parents creating a gender-typical environment for their children by the choice of toys, clothes, activities, and chores (Pomerleau, Bolduc, Malcuit, & Cossette, 1990; Witt, 1997), three other dimensions of parenting that are key to children's gender role development can be distinguished. First, from the perspective of gender schema theory (Bem, 1981), parents' ideas about normative behaviors and characteristics in men and women are likely to shape the gender-typed messages they give either directly or indirectly to their children (for a meta-analysis on the relation between parents' and children's gender schemas see Tenenbaum & Leaper, 2002). Second, parents' own gender role behavior, for example the division of paid work and household chores between fathers and mothers, provides children with important information about the appropriateness of specific behaviors and activities for males and females (e.g., Cunningham, 2001; Fulcher, Sutfin, & Patterson, 2008). Third, parents stimulate different emotions and behaviors in boys and girls through gender differentiated parenting (e.g., Brody, 2000; Lytton & Romney, 1991). For example, parents have been found to tolerate the expression of anger more in boys than in girls (e.g., Chaplin, Casey, Sinha, & Mayes, 2010; Martin & Ross, 2005), while sadness is more strongly discouraged in boys than in girls (e.g., Fivush & Buckner, 2000).

The degree to which parents socialize gender stereotypical ideas and behaviors in their children varies among parents. Both theory and research on the intergenerational transmission of behavior suggest that parents' own family background plays a role in their current gendered parenting behavior. Specifically, there is ample evidence that early experiences within the family of origin shape current social-emotional characteristics through social learning (Bretherton & Munholland, 2008; Goodman & Godlib, 1999; Van der Voort et al., 2014) as well as neurobiological adaptations (Champagne, 2008; Polan & Hofer, 2008). One aspect of parents' family background that might influence their later gendered parenting characteristics is the gender combination of siblings in their family of origin. From studies on child gender development we know that children growing up with a brother are more masculine in their interests, characteristics, and play activities than children with sisters (for a review, see McHale et al., 2003). Most of these studies have

focused on children with one sibling, but it is feasible that the proportion of male siblings in a family also impacts gender role development as this may reflect the masculine (or feminine) climate in a family in terms of gender-typed ideas and interaction-patterns. In line with this idea, the normative climate hypothesis suggests that in families with relatively more boys than girls, family members' expectations are biased toward more masculine features and behaviors (e.g., dominance striving and achievement-orientation) in all children, regardless of the children's individual gender (Powell & Steelman, 1990). Indeed, there is some evidence that children growing up in all-boy families are more likely to experience parenting behaviors that stimulate masculine characteristics and behaviors (e.g., emphasizing appropriate male behaviors during parent-child discussion) than children in families with at least one girl (Endendijk et al., 2014; Van der Pol et al., 2015). Although to date no studies have examined the link between the proportion of male siblings in parents' family of origin and their current gender-typed parenting, both theory and research indicate that gendered ideas and behaviors in early and middle childhood are significant precursors of future gender role development (for a review, see Martin & Ruble, 2010). From that perspective one may expect that having grown up with predominantly brothers or sisters also affects fathers' and mothers' gendered parenting characteristics.

Another factor that may explain individual differences in gendered parenting is parents' circulating level of testosterone. This steroid sex hormone has been proposed as an important biomarker of gender-typed characteristics in various species (McIntyre & Hooven, 2009). Indeed, there is ample evidence that testosterone is related to gendered ideas and behaviors in children and adults, with higher levels of testosterone predicting more male-typed characteristics in both males and females (for a review, see Berenbaum & Beltz, 2011). Such findings suggests that higher circulating testosterone levels may predict more stereotypical gendered ideas and behaviors in fathers, whereas higher levels of testosterone in mothers may lead to more contra-stereotypical features. However, to our knowledge there are no studies that examined the link between testosterone and gendered *parenting* characteristics. Studies focusing on the association between steroid sex hormones and other childrearing aspects such as parenting quality suggest that circulating testosterone may have a different effect on fathers' and mothers' parenting

behavior. That is, there is some evidence that higher basal testosterone levels predict higher quality parenting in mothers (Endendijk et al., 2015), while for fathers lower levels of testosterone have been linked to more optimal parenting characteristics including higher paternal responsiveness to infant distress (Alvergne, Faurie, & Raymond, 2009; Fleming, Corter, Stallings, & Steiner, 2002; Mascaro, Hackett, & Rilling, 2013).

Parents' circulating levels of testosterone may also act as a mediator in the relation between the sibling gender combination in their family of origin and their current gendered parenting characteristics (see Figure 1). As previously noted, one of the mechanisms through which early childhood experiences are likely to affect social-emotional functioning in adulthood is neurobiological adaptation (Champagne, 2008; Polan & Hofer, 2008). Specifically, there is ample evidence that early experiences (including in-utero experiences) modulate neuroendocrine system functioning (Champagne, 2008). With respect to parents' testosterone level, both human and animal twin studies indicate a positive link between the number of male twin siblings and prenatal levels of testosterone (for a review, see Tapp et al., 2011). There is also some evidence that adult men with (non-twin) older brothers have been exposed to higher prenatal testosterone levels than men without older brothers (Williams et al., 2000). Because prenatal androgen exposure is thought to have important organizational effects on the neuroendocrine system functioning throughout life (Berenbaum & Beltz, 2011), the proportion of male siblings may also modulate circulating testosterone levels in adulthood. Indeed, there is evidence that prenatal exposure to testosterone positively predicts basal testosterone levels in adulthood (Jamison et al., 1993; Manning et al., 1998). In addition, animal studies suggest that early social experiences can have long-term effects on basal testosterone levels in adulthood (e.g., Avital, Dolev, Aga-Mizrachi, Zubedat, 2011; Maslova, Bulygina, & Amstislavskaya, 2010), suggesting that different family interaction patterns as a function of the sibling gender combination may be related to individual differences in parents' current circulating testosterone levels.

The aim of the current study is to examine the links between the proportion of male siblings in fathers' and mothers' family of origin, parents' circulating testosterone levels, and their current gendered parenting characteristics. As operationalizations of fathers' and mothers' gendered parenting characteristics we examined their gendered cognitions, their gender

role behavior as reflected by the task division between fathers and mothers within each couple (i.e., gendered family management), and parents' gendered emotion socialization behavior. Based on the literature, we tested three hypotheses. First, we expected that the proportion of male siblings in parents' family of origin would be positively related to parents' circulating testosterone levels. Second, we expected that higher levels of circulating testosterone would be related to more gender *stereotypical* parenting characteristics in fathers and to more *contra-stereotypical* parenting characteristics in mothers. Third, we expected that parents' testosterone levels would partially mediate the relation between the proportion of male siblings in their family of origin and their current gendered parenting characteristics.

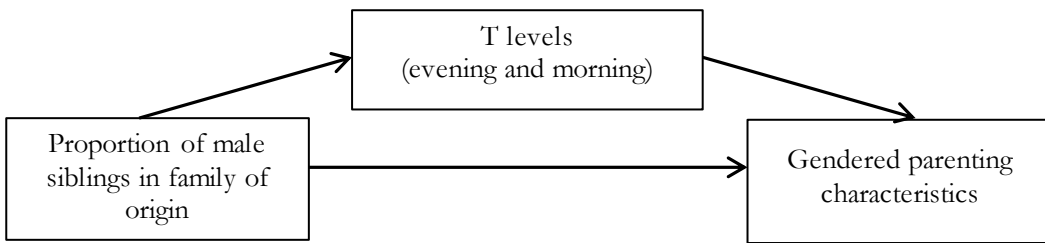


Figure 1. Theoretical Framework of Associations Between Parents' Family Background (Proportion of Male Siblings in Family of Origin), T Levels, and Gendered Parenting Characteristics.

METHOD

Sample

This study is part of the longitudinal research project *Boys will be boys?*, which examines the influence of gender-differentiated socialization on the social-emotional development of girls and boys in the first 4 years of life. The current paper focuses on the associations between fathers' and mothers' family background, their testosterone levels, and their gendered parenting characteristics. During the third wave of the study, parental salivary testosterone samples were collected.

Families with two children in the Western region of the Netherlands were selected from municipality records. Families were eligible for participation if the second-born child was around 12 months of age at the time of recruitment and the oldest child was around 2 years older. Exclusion

criteria were single parenthood, severe physical or intellectual impairments of parent or child, and having been born outside the Netherlands and/or not speaking the Dutch language. Between April 2010 and May 2011 eligible families were invited by mail to participate in the study. Both parents were asked to participate in one home visit each per year for a period of 4 years. In addition to the home observations, participation in the study included computer testing and filling in questionnaires. Of the 1,249 eligible families 31% ($n = 390$) agreed to participate. The participating families did not differ from the non-participating families on age of fathers ($p = .13$) or mothers ($p = .83$), the educational level of fathers ($p = .10$) or mothers ($p = .17$), and the degree of urbanization of the place of residence ($p = .77$). At the time of Wave 3, 18 families had dropped out due to emigration ($n = 5$), family issues ($n = 3$), considering participation as too demanding ($n = 7$), or because they could not be reached by phone or mail ($n = 3$). This resulted in a total of 372 participating families (95% of the original sample).

For the current study, analyses were done for fathers and mothers separately. Fathers were excluded when they had missing data on any of the pertinent variables ($n = 164$) or when they were an only child ($n = 19$). This resulted in a total of 189 fathers. Their second-born children were 3.1 years old ($SD = 0.1$) (54% boys). The fathers were between 28.0 and 55.3 years of age ($M = 38.5$, $SD = 5.16$), and most of them had finished academic or higher vocational schooling (75%). At the time of the third wave, 2 fathers (1%) were divorced. The included fathers did not differ from the excluded fathers on any of the background variables (all $ps > .20$).

In a similar way, we excluded mothers with missing data on any of the variables under investigation ($n = 157$) or when they were an only child ($n = 17$). In addition, mothers who were pregnant ($n = 15$) or used contraceptives ($n = 79$) during saliva collection were excluded, resulting in a final set of 104 mothers. Their second-born children were 3.1 years old ($SD = 0.04$) (56% boys). The mothers were between 27.7 and 47.7 years old ($M = 36.1$, $SD = 4.1$) and most of them had finished academic or higher vocational schooling (73%). The included mothers did not differ from the excluded mothers on any of the background variables (all $ps > .32$). Linking the included fathers in the study to the included mothers revealed that 83 parents were from the same families.

Procedure

Each family was visited twice within about 2 weeks; once with the mother and the children and once with the father and the children. The order in which fathers and mothers were visited and interacted with their two children was counterbalanced between families. The participating families received a gift of 30 Euros and small presents for the children. During the home visit, parent-child interactions and sibling interactions were filmed. All visits were conducted by pairs of trained students. Before each home visit, both parents were asked to individually complete a set of questionnaires. At Wave 3, parents were asked to collect saliva samples before bed (PM) and at waking (AM) for the measurement of parental testosterone levels. Parents were also asked to fill in a questionnaire to establish basic background information associated with hormone levels (e.g., weight, pregnancy, and physical activity). Saliva samples were stored at -80°C until analysis. Informed consent was obtained from all families. Ethical approval for this research was provided by the Research Ethics Committee of the Institute of Education and Child Studies of Leiden University.

Measures

Proportion of male siblings. Prior to the home-visits, we asked fathers and mothers to fill in a questionnaire on family background characteristics, including parents' number of brothers and sisters. From the total number of children in the parent's family of origin, we calculated the proportion of male siblings in the family while taking the parent's own gender into account.

Parental testosterone levels. Salivary testosterone samples were analyzed at the endocrinology laboratory at Utrecht Medisch Centrum (Utrecht, the Netherlands). Testosterone levels in saliva were measured in duplicate using an in-house competitive radio-immunoassay employing a polyclonal anti-testosteron-antibody (Dr. Pratt, AZG 3290). $[1,2,6,7\text{-}^3\text{H}]$ -Testosteron (NET370250UC, PerkinElmer) was used as a traces following chromatographic verification of its purity. The lower limit of detection was 20 pmol/L. Inter-assay variation was 10.5-8.3% at 70-480 pmol/L respectively ($n = 33$).

Gendered cognitions. Fathers' and mothers' implicit gendered cognitions were assessed by a computerized version of the Implicit Association Task (IAT); the family-career IAT (Nosek, Benaji, & Greenwald,

2002). This version measures the association of female and male attributes with the concepts of career and family. The computer task was built with E-prime 2.0 (Schneider, Eschman, & Zuccolotto, 2002) based on the task on the Harvard Project Implicit demonstration website (implicit.harvard.edu) and the paper of Nosek and colleagues (2002). The task consists of congruent blocks in which participants are requested to sort career attributes (e.g., the word “salary”) to the male category and family attributes (e.g., the word “children”) to the female category, and incongruent blocks in which participants are asked to sort career attributes to the female category and family attributes to the male category. Participants sort the stimuli (i.e., words) by pressing a blue button that corresponds to the male category or a red button for the female category. To reduce possible order effects of the presentation of congruent and incongruent blocks, two precautionary measures were taken (Nosek, Greenwald, & Benaji, 2005): (1) the number of practice trials on the fifth of the seven blocks of the standard IAT procedure was increased, and (2) two versions of the IAT were constructed, one in which the congruent block was first administered and one in which the incongruent block was first administered. As expected, difference scores between the congruent and incongruent blocks were significantly higher on the version that started with the congruent block for both fathers and mothers ($ps < .05$). The participating families were randomly assigned to one of the two versions so that the mother and father within one family always completed the same version of the IAT. Version of the test was controlled for in the analyses. Participants conducted the IAT on a laptop computer. Reaction time and accuracy were automatically recorded for every trial.

The improved scoring algorithm by Greenwald, Nosek, and Benaji (2003) was used to determine each participant’s level of implicit gender-typed cognitions. A high positive score represents more difficulties to pair male attributes to the family concept and female attributes to the career concept than to pair female attributes to the family concept and male attributes to the career concept. In other words, higher positive scores represent stronger stereotypical ideas about the roles of men and women. Negative scores represent contra-stereotypical ideas about gender roles.

Gendered family management. To measure gendered family management, three aspects of parents’ role division were taken into account. First, to obtain a measure of families’ paid work-division, mothers’ weekly

working hours were subtracted from fathers' working hours. Second, we asked parents to indicate how much time they spent with their children during a normal week on a 5-point scale (0 = 0 to 15 hours, 4 = more than 60 hours). Missing scores were predicted from other waves using linear regression. To obtain a measure of gender-typed child-care division, fathers' time spent with the children was subtracted from mothers' time spent with the children. Third, we asked parents to fill in a 23-item questionnaire on the division of household tasks between the two parents during the past week (e.g., doing groceries, cooking dinner, cleaning) on a 5-point scale (1 = I exclusively performed this task, 5 = my partner exclusively performed this task). The internal consistencies on this scale were .78 (Cronbach's alpha) for fathers and .72 (Cronbach's alpha) for mothers. Mother scores were reversed so that a higher score indicated that the mother had performed the task more often than the father. When parents had not filled in the questionnaire, their missing scores were predicted from other waves with linear regression analyses. Because father and mother scores were significantly related, $r = 0.74$ (181), $p < .01$, but mothers' mean scores were significantly higher than fathers' mean scores, $t(182) = 13.30$, $p < .01$ (analyses based on fathers for whom valid information was available from both parents), combined standardized mean scores were computed to create a measure for gender-typed household task division. A higher score on each of the three aspects of parents' role division indicated a more traditional role division between fathers and mothers, i.e., father as economic provider of the family and mother as primary caregiver.

A principal component analysis was conducted on the three aspects of parents' role division (i.e., parents' gendered division of work outside the home, gendered child-care division, and gendered household task division). Based on the Scree test a one-factor solution that explained 62% of the variance was chosen. Factor loadings were high (gendered work division outside the home: 0.83, gendered child-care division: 0.74, gendered task division: 0.80). Based on the factor loadings, the three aspects of parents' role division were combined into a standardized score. The internal consistency for the composite of parents' gendered family management was 0.69 (Cronbach's alpha).

Gendered emotion socialization. To measure fathers' and mothers' gendered emotion socialization we observed their use of gender labels while discussing an emotion picture book with their children. This book consists of

eight pictures without text or storyline, with drawings of children showing the following emotions: anger, fear, sadness, and happiness. For the current study we focus on the emotions anger and sadness because these emotions are strongly tied to prevailing gender-typed ideas in Western societies about accepted emotional expressions in males and females (Brody, 2000). Each emotion was shown twice in the picture book; once within a context indicating the cause of the emotion (e.g., not being allowed to touch attractive toys causing anger and a broken toy causing sadness) and once displaying only the face of the child. The children on the pictures without context were drawn in such a way that they were gender neutral (i.e., ambiguous gender, half-long hair). Because the children read the Emotion Picture Book twice (once with each parent), two versions of the book were developed that included drawings of the same children but with different hair colors and clothes in each version.

To check whether parents' use of gender labels for the children on the pictures without context could not be influenced by other facial characteristics than the emotion being expressed, we conducted a second small-scale study with a group of 71 respondents (34% male) between 20 and 61 years of age ($M = 34.9$, $SD = 12.6$). Each child from the Emotion Picture Book was shown four times displaying the four emotions in randomized order. The findings showed that, regardless of hair color and color of clothes, respondents were more likely to use the label boy for angry children compared to children displaying other emotions, whereas they were more likely to use the label girl for children displaying sadness.

During the home-visits, fathers and mothers were asked to discuss the pictures in the Emotion Picture Book with their child without further directives. Five minutes were allotted for this discussion, but the task could be ended earlier if the parent had finished the book. Fathers' mean duration of book reading was 3 minutes and 12 seconds ($SD = 66$ seconds), and mothers' mean duration of reading the book was 3 minutes and 20 seconds ($SD = 74$ seconds). Parents' use of gender labels (e.g., 'boy', 'girl', 'he', 'her', 'Bob') was coded per picture without context. Intercoder reliability was established on 30 observations. Cohen's Kappas for all pairs of the 16 coders were higher than .60 for gender labeling. Fathers and mothers within the same family were coded by different coders to guarantee independency among ratings.

To obtain a measure of parents' stereotypical use of gender labels, parents who used the label boy for the emotion anger and the label girl for the emotion sadness (i.e., stereotypical labels) were given a score of 1 for each emotion, respectively, while parents who used the label girl for anger and the label boy for sadness (i.e., contra-stereotypical labels) were given a score of -1. Parents who used gender neutral labels (e.g., "child") or both the labels girl and boy for either emotion were given a score of 0.

Data-analysis

All measures were inspected for possible outliers that were defined as values more than 3.29 *SD* above or below the mean (Tabachnick & Fidell, 2012). Outlying values were winsorized, meaning that they were given a score that was no more extreme than the most extreme value that fell within the accepted range of a normal distribution. All variables were normally distributed.

To control for the effect of age and weight on parental testosterone (abbreviated as T) levels, residualized scores were computed. Pearson correlation coefficients were computed to examine the associations between the variables. To examine whether fathers' and mothers' family background as reflected by the proportion of male siblings in family of origin had an indirect effect on their gendered parenting characteristics through parents' evening and morning T levels, a set of mediation analyses were performed. The Preacher and Hayes approach to test mediation was applied using the macro package for SPSS available online which allows for multiple predictors and mediators (Hayes, 2013). This method adopts the bootstrapping approach that does not assume that the sampling distributions of the indirect effect are normal, unlike the Sobel test (Preacher & Hayes, 2004). Sampling distributions are estimated from random samples based on the original data. Five thousand bootstrap resamples were taken and 95% BC confidence intervals were computed (Preacher & Hayes, 2008).

RESULTS

Table 1 and Table 2 display the means, standard deviations, and bivariate correlations for, respectively, fathers' and mothers' family background (proportion of male siblings in family of origin), their T levels, gendered cognitions (implicit gender stereotypes), gendered family management

(parents' gender-typed role division), and gendered emotion socialization (use of stereotypical gender labels). Consistent with previous studies we found that fathers' T levels were significantly higher than mothers' T levels in the evening, $t(82) = 16.09, p < .01, d = 2.35$, and in the morning, $t(82) = 18.04, p < .01, d = 2.76$. Further, mothers scored higher on the IAT than fathers, $t(82) = -2.53, p < .05, d = -0.38$, indicating stronger implicit gendered cognitions in mothers than in fathers. No differences were found between fathers' and mothers' gendered emotion socialization.

Table 2 shows that proportion of male siblings in mothers' family of origin was positively related to their evening T levels and to gendered family management. Further, as expected, morning and evening T levels were significantly correlated for fathers (Table 1) and mothers (Table 2). In addition, mothers' morning T levels were negatively related to their gendered emotion socialization behavior (Table 2). That is, mothers with high T levels in the morning were less likely to use stereotypical gender labels when discussing emotions with their children than mothers with low T levels.

Table 1. *Fathers: Summary of Means, Standard Deviations, and Correlations for Main Variables (n = 189).*

	1	2	3	4	5	M	SD
1. Proportion male siblings						0.72	0.24
2. Evening T	-.11					168.91	44.18
3. Morning T	-.11	.38**				341.68	76.70
4. Gendered cognitions	.11	.07	-.02			0.35	0.29
5. Gendered family management	-.13	.08	.00	.05		0.07	2.10
6. Gendered emotion socialization	.01	.04	-.02	.05	.04	0.18	0.42

Note. Correlations with T levels are based on residualized scores for T. Means and standard deviations for T represent raw data.

* $p < .05$. ** $p < .01$.

Table 2. *Mothers: Summary of Means, Standard Deviations, and Correlations for Main Variables (n = 104).*

	1	2	3	4	5	<i>M</i>	<i>SD</i>
1. Proportion male siblings						0.29	0.23
2. Evening T	.25*					73.52	26.98
3. Morning T	.16	.68**				153.27	46.43
4. Gendered cognitions	.01	.01	-.09			0.47	0.31
5. Gendered family management	.23*	.00	-.01	-.05		0.07	2.38
6. Gendered emotion socialization	.10	-.04	-.23*	.08	.01	0.12	0.40

Note. Correlations with T levels are based on residualized scores for T. Means and standard deviations for T represent raw data.

* $p < .05$, ** $p < .01$

To examine whether the proportion of male siblings in parents' family of origin was indirectly related to parents' gendered parenting characteristics via their T levels (see Figure 1), the Preacher and Hayes approach to test mediation was applied. A total of three regression analyses were performed for each parent predicting the gendered characteristics (i.e., gendered cognitions, gendered family management, and gendered emotion socialization) with parents' T levels in the evening and morning as mediators. In the mediator variable model, which was the same for all three analyses for each parent (predicting parents' evening and morning T levels from proportion of male siblings), the proportion of male siblings in mothers' family of origin predicted higher maternal T levels in the evening ($B = 26.77-27.21$, $SE = 10.44-10.52$, $ps < .05$). Further, we found that the proportion of male siblings in mothers' family positively predicted gendered family management both with ($B = 2.53$, $SE = 1.03$, $p < .05$) and without ($B = 2.37$, $SE = 0.99$, $p < .05$) controlling for their T levels. In addition, mothers' morning T levels were a negative predictor of their gendered emotion socialization behavior ($B = -0.003$, $SE = 0.001$, $p < .01$). We also found evidence for an indirect negative effect of the proportion of male siblings in mothers' family of origin on mothers' gendered emotion socialization through their morning T levels ($B = -0.10$, $SE = 0.07$, $BC\ CI = -0.30, -0.004$). Figure 2 shows the complete mediation model. Note that the direct effect of the proportion of male siblings in mothers' family on their gendered emotion socialization behavior is positive but non-significant, whereas the indirect

effect through mothers' morning T levels is significantly negative. A mediation analysis with mothers' morning T levels as outcome variable and gendered parenting characteristics as mediators revealed no significant indirect effects, offering support for the idea that mothers' family background influence their circulating T levels in the morning, which *in turn* affect their gendered emotion socialization behavior.

The indirect paths from the proportion of male siblings in mothers' family of origin to mothers' gendered cognitions and gendered family management through their T levels were not significant. For fathers, we found no significant relations between the proportion of male siblings in their family of origin, T levels in the evening and morning, and gendered parenting characteristics, and the indirect paths from fathers' family background via their T levels were not significant either. Analyses with the non-imputed data on parents' gendered family management showed similar results.

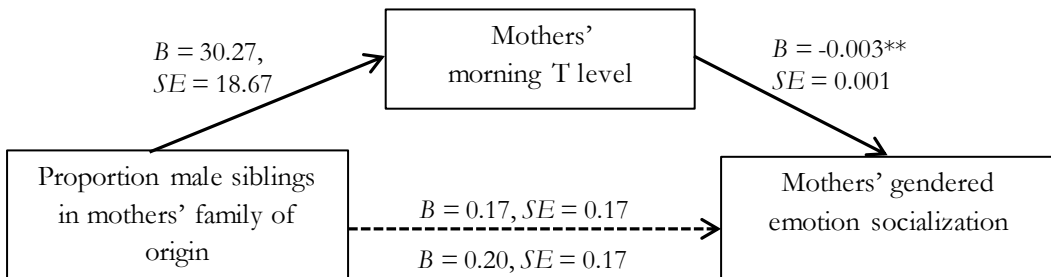


Figure 2. Mediation Model Predicting Mothers' Gendered Emotion Socialization from the Proportion of Male Siblings in Mothers' Family of Origin Through Morning T Levels ($n = 104$).

Note. Proportion of male siblings in relation to gendered emotion socialization. The results below the dotted arrow refer to the relation after controlling for mothers' T levels.

DISCUSSION

This study is the first to examine individual differences in fathers' and mothers' gendered parenting characteristics in relation to their family background and their circulating T levels. The findings indicate that both the sibling gender combination in mothers' family of origin and mothers' basal T levels are associated with their gendered parenting characteristics. The proportion of brothers in mothers' family of origin was related to mothers' elevated morning T levels, which in turn predicted less gendered emotion

socialization of their preschoolers. Further, we found that the proportion of brothers in mothers' family was related to a more traditional role division between mothers and their partners. For fathers no associations were found between the proportion of male siblings in their family of origin, their circulating T levels, and their gendered parenting characteristics.

We found support for the hypothesis that mothers' circulating T levels mediate the relation between their family background and their gendered parenting characteristics. The positive link between the proportion of brothers in mothers' family and mothers' circulating T levels is in line with previous (twin) studies among animals and humans that have repeatedly found evidence for the idea that the proportion of male siblings is related to higher in-utero exposure to T (for a review, see Tapp et al., 2011). This phenomenon has been suggested to be due to maternal circulation, i.e., women who give birth to more boys than girls have higher circulating T levels themselves (Grant, 2007), which they pass on to all of their children via umbilical cord blood (Miller, 1994). Other researchers propose that the gestation of a son alters mothers' physiology, resulting in higher in utero T exposure in subsequent offspring, a process referred to as maternal memory for previous sons (Saino, Leoni, & Romano, 2006; Williams et al., 2000). Higher prenatal T exposure in children with (twin or) older male siblings may, in turn, stimulate circulating T levels after birth (Jamison et al., 1993; Manning et al., 1998).

Alternatively, it could be that the positive association between the proportion of male siblings in mothers' family of origin and their circulating T levels results from their being exposed to their older and/or younger siblings' masculine behaviors and interaction patterns, characterized by interpersonal dominance striving and achievement orientation (McIntyre & Edwards, 2009). In line with this idea, a large body of research has shown that both physical and non-physical social competitive situations trigger T release in males and females (for reviews, see Archer, 2006; Salvador & Costa, 2009). Although most of these studies focused on immediate T responses following competition, animal studies suggest that early social experiences can have long-term effects on endocrine system functioning (e.g., Avital et al., 2011; Maslova et al., 2010). From that perspective it is possible that the masculine climate in mothers' family of origin as a function of the number of brothers in the family increases their current circulating T levels irrespective of birth

order. The finding that mothers with higher T levels in the morning in turn were less likely to use stereotypical gender labels when discussing emotions with their preschoolers corresponds with both theory and research indicating that higher T levels predict more male-typed characteristics in men and women (Berenbaum & Beltz, 2011). Mothers with relatively high circulating T levels may socialize their children in a way that contradicts prevailing gender stereotypes about emotion expression because they themselves are more masculine in their behaviors and characteristics (Cohen-Bendahan, Van de Beek, & Berenbaum, 2005).

Contrary to our expectations, we found that the proportion of male siblings in mothers' family of origin was positively related to their stereotypical gender role behavior in their current family as reflected by a more traditional task division between mothers and their partners (i.e., mother as caretaker, father as economic provider of the family). This finding does not correspond with previous research on child gender development in which both girls and boys with an older brother were found to be more masculine in their interests and behaviors than children with sisters (e.g., Rust, Golombok, Hines, Johnston, & Golding, 2000). Although growing up with a brother may prompt girls' masculine interests and play activities, being one of the few females in the family can also stimulate girls' stereotypical gender role behavior as both parents and siblings may expect them to take on the role of caregiver. Consistent with this idea, McHale and Crouter (2003) found that girls with an older or younger brother performed more household chores than girls with a sister. Women who took on the caregiver role in their family of origin may also do this in their current family. This is consistent with evidence that women who grew up in a family with traditional gender roles are less likely to participate in the labor market (Farré & Vella, 2013).

For fathers, we found no associations between the proportion of male siblings in their family of origin, their circulating T levels, and their gendered parenting characteristics. Perhaps the rise of T levels during puberty, which is substantially higher for boys than for girls (Blakemore, Berenbaum, & Liben, 2009), dampens the effect of the sibling gender combination in fathers' family of origin on their endocrine system functioning in adulthood. Instead, more recent social experiences and neuro-biological processes might affect fathers' current T levels. Regarding fathers' gendered parenting characteristics, the effects of growing up with either brothers or sisters may be negligible because

for males prevailing ideas about gender-appropriate behaviors and characteristics are generally less flexible than for females (Maccoby, 1998). Specifically, it is more accepted for girls and women to show male-typed behavior than it is for boys and men to show female-typed behavior (e.g., Kane, 2006). In addition, there is evidence that girls are more likely to imitate a male role model than boys to imitate a female role model (Bussey & Bandura, 1984). Stricter behavioral display rules for males than for females may lead boys to be less susceptible to the gender of their siblings than girls in the development of gender-typed ideas, characteristics, and behaviors. Similarly, prevailing gender stereotypes in a society may outweigh the effects of individual variations in basal T on fathers' gendered parenting characteristics. Alternatively, it could be that fathers' parenting characteristics are more affected by the *flexibility* in circulating T as reflected by fathers' T responses to external factors instead of basal T level. Indeed, animal studies indicate that T-responsivity is a better predictor of parenting in males than basal T (Gleason & Marler, 2010; McGlothlin, Jawor, & Ketterson, 2007).

The current study has some limitations. First, examining saliva T as a proxy for serum T may substantially underestimate the relations between T and behavior, especially in women (Granger, Shirtcliff, Booth, Kivlighan, & Schwartz, 2004; Shirtcliff, Granger, & Likos, 2002). Women have higher levels of sex hormone-binding globulin (SHBG) in their blood than men (Cunningham & McKenna, 1988). Because SHBG-bound testosterone is not transported into saliva (Pardridge, 1986), this might affect the validity of salivary testosterone measures in women. Indeed, several studies found only modest correlations between salivary T levels and serum T levels in females (Granger et al., 2004; Shirtcliff et al., 2002). However, other studies have shown that T can be successfully measured in saliva of both males and females (e.g., Dabbs, 1990; Vittek, Hommedieu, Gordon, Rappaport, & Southren, 1985), and documented meaningful associations between salivary T and social-emotional characteristics in men and women (e.g., Smeets-Janssen et al., 2015; Van Honk et al., 1999). Second, although we found a negative association between mothers' morning T levels and their gendered emotion socialization behaviors, no relations were found between mothers' T levels and their gendered cognitions or their gender role behavior in the family. This may be due to the way these gendered parental characteristics were measured. The instruments we used to study parents' gendered cognitions and their

gender role behavior focused on the division of paid work and household and caregiving tasks between men and women. It may be that (implicit ideas about) the task division between men and women is affected more by the gender role attitudes and role division they encountered in their family of origin (Farré & Vella, 2013) and by parents' education level (Antill & Cotton, 1988; Boehnke, 2011) than their endocrine system functioning. Third, the direction of the negative association between mothers' T levels in the morning and their gendered emotion socialization behavior is not unequivocal because both characteristics were measured at the same time. Although statistically we found more support for the notion that mothers' morning T levels predict their gendered emotion socialization than vice versa, this does not rule out the possibility that gendered parenting affects parents' endocrine system functioning over time. According to the challenge hypothesis the association between T and parenting is reciprocal, with high T levels inhibiting parenting, and cues associated with children, child care, or parenting relating to decreased T levels in both mothers and fathers (Archer, 2006). A number of studies have found support for this hypothesis (Gettler, McDade, Feranil, & Kuzawa, 2011; Kuzawa, Gettler, Huang, & McDade, 2010; Wingfield, Hegner, Dufty Jr., & Ball, 1990). Cross-lagged longitudinal designs (i.e., both T levels and parenting measured at all time points) and experiments are needed to provide more insight in the possible bidirectionality of the relation between parents' endocrine system functioning and their gendered parenting characteristics.

To conclude, this study shows that the gender combination of siblings in mothers' family of origin predicts mothers' current gendered parenting characteristics both directly and indirectly through their circulating T levels. Interestingly, growing up with more brothers than sisters was differentially associated with specific aspects of mothers' gendered parenting. A higher proportion of male siblings in mothers' family of origin was indirectly linked to mothers' less gendered emotion socialization behavior toward preschoolers via their elevated morning T levels and, at the same time, directly predicted a more traditional role division in mothers' current family. This study indicates that the impact of parents' family background on social learning and neurobiological functioning deserves careful research attention to obtain insight in processes underlying individual differences in fathers' and mothers' gendered parenting characteristics.