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High Parental Investment in Childhood is Associated with Increased Mate Value in Adulthood

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Abstract

Stressors in the childhood environment, such as decreased parental investment (PI) regulates an individual's reproductive behaviors. The effect of these behaviors on fitness is partly determined by individual mate value (MV). We tested whether PI during childhood is associated to MV in adulthood. Adult men and women ($N = 1244$) reported received maternal and paternal investment, and also current MV. We found that high PI in childhood was associated with increased MV in adulthood. Additionally, there was a positive correlation between maternal and paternal investment and the association between paternal investment and MV was mediated through maternal investment. We conclude that PI, especially maternal investment, might influence MV in offspring.

Keywords: Parental Investment, Mate Value, Life-History Theory, Paternal Investment, Maternal Investment, Sexual Strategies

High Parental Investment in Childhood is Associated with Increased Mate Value in Adulthood

Humans are born relatively helpless and require large amounts of parental investment (PI) to develop, survive, and reproduce, and this dependency on PI continues throughout childhood and adolescence. Parents invest in offspring by providing the metabolic resources necessary for conception and gestation, but also feed, shelter, foster and care for their children. PI also include teaching children to navigate societal expectations that are likely to surround them in adulthood (e.g. Kramer, 2011). The initial physiological contribution by the mother outweighs that of the father (Trivers, 1972), and maternal investment continues to be larger than paternal investment also after birth. Paternal investment is relatively high among humans (Marlowe, 2000). Mothers and fathers report equal preparedness for altruistic investment in children (Antfolk, Karlsson, Söderlund, & Szala, 2017). Fathers are, however, often more involved in more distal forms of investment, such as the provision of resources, and mothers tend to be more involved when considering more proximate forms of investment, such as care taking and instructive interactivity with the child (Finley, Mira, & Schwartz, 2008). Apart from these general sex differences in PI, there are also individual differences in the quality and amount of PI that mothers and fathers provide.

Sexual Strategies and Mate Value

Sexual strategies (e.g., behaviors that affect mate choice and reproduction) are—at least partly—shaped by the environment. A short-term strategy is characterized by short, frequent relationships with a relatively high number of partners, and a long-term strategy is characterized by longer, less frequent relationships with a relatively low number of partners (Buss & Schmitt, 1993). Most women show a preference for long-term strategies. Men, on the other hand, show a preference for short-term strategies, but most men are

unable to attract a large number of female partners, and, therefore, also adopt long-term strategies. By mixing strategies, an individual can also reap the benefits of both types of strategies (Gangestad & Simpson, 2000). Although long-term strategies are more common among women, and short-term strategies more common among men, both types of strategies are seen in both sexes. Which strategy that will benefit the reproduction of a particular individual depends highly on situational factors and on individual factors, such as the own mate value (MV; Gangestad & Simpson, 2000).

MV can be broadly defined as the degree to which an individual attract mates of the opposite sex. An individual's MV is the result of several attributes, including age, fertility, intelligence, social status, access to resources, and willingness to provide PI (e.g., Buss, 1989). Again, there are some general sex differences in attributes that affect MV. Men put a relatively high value on youthfulness and fertility when choosing mates (e.g., Antfolk et al., 2015; Buss, 1989), whereas women put a relatively high value on social status, intelligence, access to resources, and willingness to provide PI (e.g., Buss, 1989).

Because there is variation in the traits that constitute MV, there are also individual differences in MV. Individuals with high MV are less restricted in applying and optimizing their own sexual strategy (e.g., Simpson & Gangestad, 1992). Indeed, there is a positive correlation between physical attractiveness and the number of sexual partners for both men and women (e.g., Thornhill & Gangestad, 1994). Facial symmetry is also related to extra-pair mating—a typical mixed strategy (Gangestad & Thornhill, 1997). Men with high social status also have more partners (Pérusse, 1993). Hence, MV affects the possibility to choose and optimize sexual strategies and to, in turn, increase reproductive fitness.

Childhood Environment and Reproductive Behavior in Adulthood

Life-history theory suggest organisms face trade-offs between investment in development and reproduction (e.g., Sterns, 1992). Whereas stable environments allow for

increased investment in development, which, in turn, can increase the quality of reproduction, a high number of offspring is more beneficial in stressful environments (Belsky, Steinberg, & Draper, 1991; Chisholm, 1993). Draper and Harpending (1982) proposed that the father's investment behavior during childhood shapes strategies used by their daughters later on in their life: If the father is not present or invests little, their daughters mature relatively early and show an interest in sex at a relatively young age, and are less choosy in their mate choices. This association has been demonstrated several times (see Webster, Graber, Gesselman, Croiser, & Schember, 2014 for a systematic review).

Ellis (2004) thoroughly evaluated competing explanations for the association between PI and sexual maturation in girls. Whereas some explanations (e.g., PI theory: Draper & Harpending, 1982) proposes that paternal investment plays a unique role, others (e.g, psychosocial stress theory; Belsky et al., 1991; Ellis, McFayden-Ketchum, Dodge, Pettit, & Bates, 1999) emphasizes also other stressor in the social environment. Whether or not maternal investment plays an equally important role as paternal investment has been discussed. In their paper, Draper and Harpending (1982) referenced Hetherington's (1972) study, which investigated differences in sexual attitudes between women growing up with and without their father being present. Interestingly, when the father had passed away, daughters displayed less attention-seeking behavior compared to when the father had separated from the family. In the former case, the mothers reported positive views on relationships, whereas in the latter case they reported negative views. This could suggest that variation in maternal investment potentially mediates the effects of paternal investment. In studies focusing on maternal investment, the quality (rather than the quantity) of investment has been shown to be related to sexual maturation in their girls. For example, daughters to more stern mothers have earlier menarche (Belsky, Steinberg, Houts, & Halpern-Felsher, 2010). Kim and Smith (1998) found an association between

mother-daughter conflict and timing of the daughters' first menstruation: The more conflict, the earlier the menstruation.

Fewer studies have investigated the association between PI and sexual maturation in boys. The outcome is mixed. For example, whereas a study by Sheppard and Sear (2011) showed that father absence also was associated with early reproduction in sons, a study by James and colleagues (2012) did not find that family relationships were associated with sex-related outcomes in boys.

Parental Investment and Mate Value

A question attracting less research interest is how childhood environment and PI affects MV in adulthood. Because the effect of sexual behaviors on actual fitness are tightly knit to MV (Buss & Schmitt, 1993; Gangestad & Simpson, 2000), an adaptive benefit of PI would be to also up-regulate the MV of offspring. A study by James and colleagues (2012) investigated the relationship between various factors in the childhood environment and sexual maturation and behavior in young adults. The main analyses did not include MV, but a weak, but statistically significant and positive zero-order correlation between the MV of the young adults and affective disorders in their mothers was reported in a correlation matrix. Some more distal findings include that mothers that are more depressed have children with lower MV (James et al., 2012), and that the more children a family contains, and the less PI that can be directed into each of these children individually, the lower MV these children have later on (Kaptijn, Thomese, van Tilburg, Liefbroer, & Deeg, 2010). Some studies have, however, investigated the association between PI and attributes that are facets of MV. For example, both paternal and maternal affection during childhood is associated with attractive personality traits (Dunkel, Nedelec, & van der Linden, 2018).

Although the research on PI and MV is somewhat lacking, it seems that parents actively try to influence the MV and reproductive behavior of their children. Parents affect their daughters MV by controlling their behavior to maintain their daughters' reputation (Kuhle et al., 2015). Parents also try to directly influence their children's physical appearance (e.g., instruct them to lose weight; Jackson, Wilkes, & McDonald, 2007). Parents can also influence other aspects of MV, by, for example, helping their children to achieve academic success (Hill & Tyson, 2009), which can increase social status. Hence, parents might try to influence the MV of their children. What is less clear is whether there is a link between PI in childhood and MV in adulthood.

The Current Study

The aim of the current study was to investigate whether there is an association between PI in childhood and MV in adulthood. We investigated the associations between maternal and paternal investment and MV in both men and women. Based on the aforementioned theory and findings, we expected a positive association between maternal investment and paternal investment and MV of adult men and women. These associations could be independent of each other, or, as speculated by Draper and Harpending (1982), the association between paternal investment and MV could be mediated by maternal investment.

Method

Participants

The current study included observations from 1244 respondents. Of these, 907 were women and 337 were men. The age range was 18-40 years and the mean age was 27.2 years (SD = 6.22). Observations were taken from the Finn-Kin data set (Albrecht et al., 2014), which is based on a randomized population-based sample of adults in Finland. The

data set includes responses to questions about sexual behavior, relationships, criminogenic traits, and family background. Due to differences in response rates, more women than men participated (For more details on this data collection, see Albrecht et al., 2014). In the current study, we only included respondents providing responses to all items used in the analyses.

Indicators

To measure PI, five items were included for maternal investment and five items were included for paternal investment. These items measured how much the respective parent had talked with the respondent, praised the respondent, been aware of what the respondent was doing, displayed physical affection to the respondent, and how emotionally close the respondent and the parent is (See Table 1 for exact formulations). For all items, responses were given on a continuous scale ranging from 0 (“Very seldom”/”Not at all”) to 100 (“Very often”/”Very aware”/”Very much”) using a visual slider.

To measure MV, we included four items. The items were formulated to limit sex related variation in MV. Two items measured how the participants viewed themselves. The other two items were similar, but formulated to measure how other individuals view the respondents MV (See Table 1 for exact formulations). For all items, responses were given on a continuous scale ranging from 0 (“Not at all”) to 100 (“Very”) using a visual slider.

In both cases, numeric anchor points (i.e., 0 and 100) were chosen to maintain coherence between various measures in the data collection (Albrecht et al., 2014).

Statistical Analyses

For statistical analyses, we used the *R* platform (R Core Team, 2008). Prior to analyses, incomplete cases were removed. We used the lavaan-package (Rosseel, 2012) to fit three path-analyses: *i*) a latent variable for MV was regressed on a latent variable for

paternal investment; *ii*) a latent variable for MV was regressed on a latent variable for *maternal* investment; and *iii*) a latent variable for MV was regressed on both paternal and maternal investment. For all path-analyses, model fit indices were evaluated, and, when necessary, model modifications were done to account for residual correlations between indicators within latent constructs. Using the semTools-package (SemTools Contributors, 2016), we also tested measurement invariance between female and male respondents for the two first models. For configural invariance, the same path analysis was imposed on both groups. For weak invariance, loadings were constrained across both groups. For strong invarance, loadings and intercepts were contrstrained across both groups. The final model constrains loadings, intercepts, and means.

The Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA) were used as model fit indices. CFI is a value between 0 and 1 for the discrepancy function while adjusting for the sample size, and 0.90 or higher indicates acceptable fit (Hu & Bentler, 1999). RMSEA is an index of the residuals of the model and the value ranges from 0 to 1, with smaller values indicating less residuals and therefore a better model fit. A value below 0.06 is considered acceptable. For RMSEA, confidence intervals and p-values can be computed (Hu & Bentler, 1999).

Open Data

Data and scripts for analyses are available at the first author's Open Science Framework site (site omitted during blind review).

Results

Descriptive Results

We first calculated means and standard deviations, as well as the range for all indicators (See Table 1).

[INSERT TABLE 1 ABOUT HERE]

After this, we calculated the correlation matrix for the indicators. Correlation coefficients are reported in Table A in the appendix. A visual correlation plot is shown in Figure 1.

[INSERT FIGURE 1 ABOUT HERE]

Three clusters of strong, positive correlations could be seen from the correlation plot. The indicators of maternal investment were strongly correlated with each other, and the indicators of paternal investment were also strongly correlated with each other. Also, the indicators of MV were strongly correlated with each other. There were also moderate to strong positive correlations between indicators for maternal and paternal investment. For example, the extent to which the mother has been talking to the participant was correlated with the extent to which the father has been talking to the participant.

Path Analyses for Paternal Investment and Mate Value

Our first model disregarded the indicators for maternal investment, and included two latent variables. These two latent variables were paternal investment (determined by the indicators for paternal investment) and MV (determined by the indicators for MV). As expected, we found a statistically significant positive association between paternal investment and MV. The standardized coefficient was .13, $p < .001$. The model fit was poor, CFI = .939 and RSMEA = .112 [.103, .122], $p < .001$. To improve the model fit, we allowed residuals of the MV indicators to correlate. The modification indices suggested that the residuals between “attact1” and “appeal2” and between “attract2” and “appeal1” were dependent. These correlations were included in the follow-up model. After this, the

significant positive association between paternal investment and MV remained, .12, $p <$ .001, and model fit indices were acceptable, CFI = .998 and RSMEA = .023 [.009, .035], p = 1.00. See Figure 2 for a path diagram.

[INSERT FIGURE 2 ABOUT HERE]

Path Analyses for Maternal Investment and Mate Value

Our second model was similar to the first, but instead of the indicators for paternal investment, it included the indicators for maternal investment and MV. As expected, we found a significant positive association also between maternal investment and MV. The standardized regression coefficient was .18, $p < .001$. The model fit was poor, CFI = .928 and RSMEA = .115 [.106, .125], $p < .001$. Again, modification indices suggested that the same residuals ("attact1" and "appeal2", and "attract2" and "appeal1") were dependent and these correlations were included in the follow-up model. The positive association between maternal investment and MV remained statistically significant, .18, $p < .001$. Model fit indices were acceptable, CFI = .994 and RSMEA = .035 [.024, .046], p = .989. See Figure 3 for a path diagram.

[INSERT FIGURE 3 ABOUT HERE]

Path Analysis for both Maternal and Paternal Investment and Mate Value

After the two initial models, we fitted a model with MV regressed on both maternal and paternal investment. In this model, the previously significant association between paternal investment and MV was not statistically significant, .04, p = .238. The association between maternal investment and MV remained, .16, $p < .001$. The association between

maternal and paternal investment was .55, $p < .001$. The model fit was poor, CFI = .892 and RSMEA = .111 [.105, .116], $p < .001$. Also in this model, the residuals correlation between "attact1" and "appeal2" and between "attract2" and "appeal1" needed to be accounted for. In the follow up model, the association between paternal investment and MV remained as before, .05, $p = .198$. The association between maternal investment and MV remained, .15, $p < .001$. The association between maternal and paternal investment was .52, $p < .001$. The model fit indices were acceptable, CFI = .997 and RSMEA = .040 [.033, .046], $p = 1.00$. See Figure 4 for a path diagram with standardized coefficients.

[INSERT FIGURE 4 ABOUT HERE]

To explore whether any particular facet of PI was more (or less) strongly associated with a particular facet of MV, we scrutinized residual correlations of the three tested models. The values for standardized estimated parameter change for direct associations between indicators for PI and MV revealed only small estimates, ranging from -.04 to + .02. (see table X in the Appendix). This suggests that the modeled association between the latent variables for PI and MV explained most of the associations between particular pairs of PI and MV indicators.

Indirect Associations

Following this, we estimated the indirect association of paternal investment on MV formally. The indirect association between paternal investment (mediated by maternal investment) was .07, $p < .001$. The indirect association between maternal investment (mediated by paternal investment) and MV was, on the other hand, not significant, .02, $p = .199$.

Measurement Invariance

We then tested whether the loadings, intercepts, and means were invariant across female and male participants in the two first models. The analysis suggested that criteria for only configural invariance were met. For maternal investment, also criteria for weak invariance were met. This suggests that intercepts and means differed between female and male participants (Table 2).

[INSERT TABLE 2 ABOUT HERE]

We, therefore, tested the final model also separately for male and female participants. For females, the association between maternal investment and MV was .15, p = < .001. The association between paternal investment and MV was .05, p = .261. The model fit was good, CFI = .985 and RSMEA = .044 [.037, .052], p = .889. For males, the association between maternal investment and MV was .13, p = .110. The association between paternal investment and MV was .06, p = .465. The model fit was good, CFI = .989 and RSMEA = .035 [.016, .050], p = .947.

Discussion

We investigated the hypothesis that PI increases the MV of the offspring. Previous research has mainly been focused on PI and the sexual strategies that their children develop (e.g., Belsky et al., 1991). Fewer studies have addressed the question of how PI relates to MV.

Parental Investment and Mate Value

The results of the current study indicate that PI is associated with how their adult children perceive their MV. In accordance with our expectation, increased PI is associated with increased MV. We also found a difference between how maternal and paternal

investment is associated with MV. In the current study, only maternal investment was directly associated with MV. Paternal investment was only indirectly associated with MV, and the association was mediated by maternal investment. Interestingly, there was a strong association between maternal and paternal investment. Concerning measurement invariance tests, we found support for similar patterns among men and women, but mean levels differed between the two sexes.

Because mothers generally invest more than fathers (e.g., Finley et al., 2008), it is not very surprising that maternal investment (vs. paternal investment) is more strongly related to MV. This is in line with previous research on PI and MV showing that decreased PI is associated with decreased MV (Kaptijn et al., 2010) and that decreased maternal investment (but not decreased paternal investment) is associated with decreased MV (James et al., 2012).

The observed association between PI and MV can be explained in several ways. Firstly, physiological factors, such as health, are central to some facets of MV, such as attractiveness (e.g., Buss, 1989). Secondly, the observed association could be mediated by related psychological factors, such as increased self-esteem. Studies have shown that self-esteem is increased by secure attachment and parental empathy (e.g., Laible, Carlo, & Roesch, 2004). High self-esteem is also related to high self-estimated MV (Brase & Guy, 2004). This could also explain why only small unique associations were found between particular facets of PI and facets of MV. Thirdly, highly investing parents might also be more likely to communicate certain values and expectations, that, in turn, affect behavior and thereby increase MV. One example of this could be parents who communicate expectations regarding chastity for women (Kuhle et al., 2015). Fourthly, the association could be explained by other family-related variables, such as the number of biological

siblings, which naturally affects the amount of investment that can be directed to each child (Smith, 2017).

Limitations and Future Research

Due to the correlational nature of the design, it is impossible to confirm the assumed casual direction (PI affects MV) and we cannot rule out reversed causality or a spurious association. Any observed association between parental behavior and child outcomes are open for genetic confounds (Pinker, 2002). In fact, a recent paper by Barbaro and colleagues suggests that the observed association between parental investment and sexual behavior in daughters might be entirely due to not controlling for genetic influence (Barbaro, Boutwell, Barnes, & Shackelford, 2017). To rule out that our observations are spurious, longitudinal, genetically informed studies are necessary. This would also alleviate the problems with retrospective assessment of PI.

The current study is that it does not distinguish between different forms of PI and their unique associations with MV. We did not find that of the measured forms of PI was more or less related to any of the measured facets of MV. It must, however, be noted that by including also other forms of PI and MV, more specific conclusions could be drawn. For example, instructive investment (e.g., talking) is more likely to be associated with behavioral aspects of mate value, whereas basic provision of food and shelter is likely to directly affect health and attractiveness (Kyweluk, Georgiev, Borja, Gettler, & Kuzawa, 2018; Magnus et al., 2017). We hope that future studies are designed to better elucidate these matters in the context of MV.

A final limitation concerns generalizability. The current study is based on Finnish individuals with what seems to be heterosexual parents. Caution is necessary when generalizing the results beyond this population.

Conclusions

Taken together, the results of the current study show an association between PI and MV. The more parents invest in their children, the more attractive their children are as mates in adulthood. One of many reasons for high PI can, therefore, be to increase parental inclusive-fitness by increasing the children's MV. The current study also shows that maternal investment is more strongly associated with children's MV. To our best knowledge, few studies have previously investigated the association between PI and MV.

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Table 1

Means, Standard Deviation, and Range for Indicators

Indicator	Formulation	*M*	*SD*	Range
Mtalk	How often did your mother talk with you when you were a child?	82.18	20,68	0-100
Mpraise	How often did your mother praise you when you did something good as a child?	70.42	24,85	0-100
Maware	How aware was your mother of where you spent your time and what you did with your friends when you were a child?	74.75	23,63	0-100
Maffect	How much physical affection [i.e., hugs, kisses, caressing] did your mother show you as a child?	74.75	23,63	0-100
Mclose	How emotionally close are you and your mother?	67.24	25,20	0-100
Ftalk	How often did your father talk with you when you were a child?	63.74	27,16	0-100
Fpraise	How often did your father praise you when you did something good as a child?	59.26	27,74	0-100
Faware	How aware was your father of where you spent your time and what you did with your friends when you were a child?	56.35	30.25	0-100
Faffect	How much physical affection [i.e., hugs, kisses, caressing] did your father show you as a child?	47.96	27.65	0-100
Fclose	How emotionally close are you and your father?	54.75	28.02	0-100
attract1	Compared to other individuals of the same gender as you, how attractive are you as a partner?	53.68	20.03	0-100
attract2	Compared to other individuals of the same gender as you, how attractive do others think you are as a partner?	58.66	17.06	0-100
appeal1	Compared to other individuals of the same gender as you, how appealing are you as a partner with respect to traits that make an individual appealing [i.e., personality, status, intelligence)?	57.47	18.22	0-100
appeal2	Compared to other individuals of the same gender as you, how appealing do others think are you as a partner with respect to traits that make an individual appealing [i.e., personality, status, intelligence)?	59.36	17.30	0-100
Age	Respondent age	27.20	6.22	18-40

Table 2

Measurement Invariance for Female and Male Participants

Model	Maternal Investment					Paternal Investment				
	CFI	AIC	LRT	*df*	*p*	CFI	AIC	LRT	*df*	*p*
Configural	.924	94644		52		.939	95757		52	
Weak	.924	94638	8.08	59	.326	.936	95773	30.13	59	< .001
Strong	.912	94705	81.28	66	< .001	.929	95811	51.55	66	< .001
Means	.912	94704	2.14	68	.343	.929	95809	1.66	68	.434