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Original Article

Birth Weight Predicts Scores on the ADHD Self-Report Scale and Attitudes Towards Casual Sex in College Men: A Short-Term Life History Strategy?

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Abstract: Early development can have long-term effects on physiology and behavior. While severe disturbances predictably lead to dysfunction, recent work in humans and animals has led to a growing appreciation for the more subtle ways in which early conditions can modulate behavioral tendencies later in life. Life history theory predicts that early cues signaling a stressful or suboptimal environment might lead an organism to adopt a strategy favoring short-term gains and early reproduction. Fifty college men reported their birth weight, completed the Attention-Deficit/Hyperactivity Disorder (ADHD) Self-Report Scale, and answered a series of questions about their sexual history and attitudes towards short-term sexual encounters. Lower birth weights were associated with higher scores on the ADHD scale ($r = -.352$; $p \leq .05$) and more favorable attitudes towards casual sex ($r = -.456$; $p \leq 0.001$). There was a significant interaction between birth weight and casual sex favorability in predicting number of sexual partners ($F_{1,46} = 4.994$; $p \leq .05$). This suggests that, although men who are smaller at birth may otherwise be at a disadvantage in reproductive terms, they may offset their reduced fitness by being more willing to engage in casual sex.

Keywords: Life-history theory, development, ADHD, impulsivity, short-term strategy

Introduction

In recent years, many researchers studying human health have turned their attention towards investigating the developmental origins of health and disease (DOHaD). As evidence of the field's growing popularity, the Journal of Developmental Origins of Health and Disease was launched in 2010. The inspiration for this approach was the observation that infants born with lower birth weights are at greater risk of developing cardiovascular disease and insulin resistance during adulthood (Hales and Barker, 1992). This effect has been observed across the typical healthy range of birth weights, thus it cannot be attributed to a disruption of development caused by severe malnutrition (see Barker and Sultan, 1995). According to the 'thrifty phenotype' hypothesis (Hales and Barker, 1992), the effect

occurs because the developing fetus permanently adjusts its metabolism in response to prenatal under-nutrition, so as to be better prepared for a postnatal environment with scarce nutritional resources. If the postnatal environment turns out to be rich in nutritional resources, this can lead to health problems for these individuals. Gluckman, Hanson and Buklijas (2010) suggest that researchers are likely to find many such examples of developing organisms adjusting their physiology in anticipation of future environmental conditions. Thus, there may be long-term hormonal and behavioral, as well as metabolic, consequences resulting from early environmental conditions.

There are at least two ways in which these anticipatory responses can lead to dysfunction later in life. One is when the prediction turns out to be incorrect, as when lower birth weight individuals develop the 'thrifty phenotype', but later come to live in a nutritionally enriched environment that puts them at increased risk for disease (see [Gluckman and Hanson, 2006](#)). The second is when the response confers both an immediate advantage and a long-term disadvantage in terms of reproductive fitness (Gluckman, Low, Buklijas, Hanson and Beedle, 2011). In this case, the organism is said to have adopted a short-term life history strategy. Hormonal or nutritional cues during development that signal a stressful or unpredictable postnatal environment may lead to a short-term strategy that places greater emphasis on reproducing quickly and less emphasis on long-term health or offspring quality.

Recent work suggests that behavior is indeed modulated by the early environment in ways consistent with a short-term life history strategy. In rats, low levels of maternal licking and grooming (as would be expected in a high stress environment) lead female offspring to mature faster, become more sexually receptive, and reproduce more quickly than those who received high levels of licking and grooming (Cameron, Fish and Meaney, 2004). In humans, Nettle, Coall and Dickins (2010) reported that being born small for gestational age increased the likelihood of early reproduction among British women. Thus, sexual impulsivity appears to be elevated by cues during development that signal a high-stress environment.

The defining symptoms of attention-deficit/hyperactivity disorder (ADHD) include impulsivity (a preference for immediate gratification over distal rewards, also referred to as 'delay discounting' or 'future discounting'), and inattention/hyperactivity (difficulty maintaining focus on a single task). While some psychologists have argued that such symptoms could be adaptive in a more naturalistic environment (e.g., Hartmann, 1993; Shelley-Tremblay and Rosen, 1996), experimental evidence to support this claim has been lacking (see Goldstein and Barkley, 1998). More recently, Daly and Wilson (2005) have suggested that impulsivity can be adaptive, particularly when the environment is unpredictable and mortality rates are high. Thus, pursuing immediate gains in terms of both resources and reproduction would be consistent with a short-term life history strategy. This raises the prospect that impulsivity may be developmentally programmed. The etiology of ADHD is multifaceted and involves genetic and environmental factors (Tripp and Wickens, 2009), but evidence suggests that early development plays a role. Individuals who are underweight at birth (<2.5 kg) are more likely to exhibit symptoms of ADHD (Breslau, Chilcoat, Johnson, [Andreski and Lucia, 2000](#)). Among boys born in the healthy range of birth weights (2.5–5 kg), one study reported an inverse linear relationship between birth

weight and symptoms of ADHD (Kelly, Nazroo, McMunn, Boreham and Marmot, 2001). However, in other studies this effect was found to be non-significant (e.g., [Lahti et al., 2006](#)).

Since impulsive behaviors are consistent with a short-term life history strategy, there is reason to suspect that they may be modulated by the early environment. While several lines of evidence suggest this to be the case, there are a number of unresolved questions, including: Is there truly a relationship between size at birth and symptoms of ADHD within the healthy range of birth weights? Since low birth weight females reproduce sooner, do males who are small at birth show an increase in sexual impulsivity? What is the effect of this impulsive phenotype on reproductive fitness? The current study attempts to address these three questions in a male college-age sample.

Materials and Methods

52 males were recruited as participants from the research pool at the University at Albany. Participants were instructed to bring information about their birth weight and birth length to the experiment. Two individuals either failed to report birth weight and length or reported that they were only 'somewhat sure' or 'not sure at all' that these values were accurate, in which case these values were discarded. An additional survey was mailed to each participant's biological mother, provided the participant chose to participate in this part of the study. The survey asked questions about experiences during the pregnancy including maternal age, number of previous pregnancies/deliveries, and weight and length of the child at birth. Self-addressed stamped envelopes were included. Completed surveys were returned by 24 mothers, and there was a high degree of correspondence between the birth weight reported by the mother and that provided by the participant ($r = .950$, $p < .001$).

Behavioral measures were assessed using questionnaires. Inattention and impulsivity were assessed with the Adult ADHD Self-Report Scale (Adler, Kessler and Spencer, 2003). This rating scale, based on the DSM-IV criteria for ADHD, consists of eighteen items: 9 for impulsivity (e.g., "How often do you interrupt others when they are busy?") and 9 for inattention (e.g., "How often do you have trouble wrapping up the final details of a project, once the challenging parts have been done?"). Each question is answered on a Likert-type scale ranging from 0 (rarely/never) to 5 (very often). Answers are totaled to yield a measure of impulsiveness and a measure of inattention. There was high internal consistency among the 18 items on the scale (Cronbach's $\alpha = .864$).

A sexual behavior and opinion inventory asked a series of questions about the individual's attitudes towards short-term and long-term sexual relationships, as well as two sexual history items, which inquired about age at first sexual intercourse and number of opposite-sex partners. These sexual history questions provided an indirect measure of reproductive success in a college-age sample. Number of sexual partners has often been used in this way as a proxy measure of reproductive fitness, particularly in males (Faurie, Pontier and Raymond, 2004; [Pérusse, 1993](#)). Twenty-one opinion questions asked participants to rate their attitudes towards casual sexual encounters (sex without romantic involvement) on a seven-point Likert-type scale. Some examples include: 'I could easily

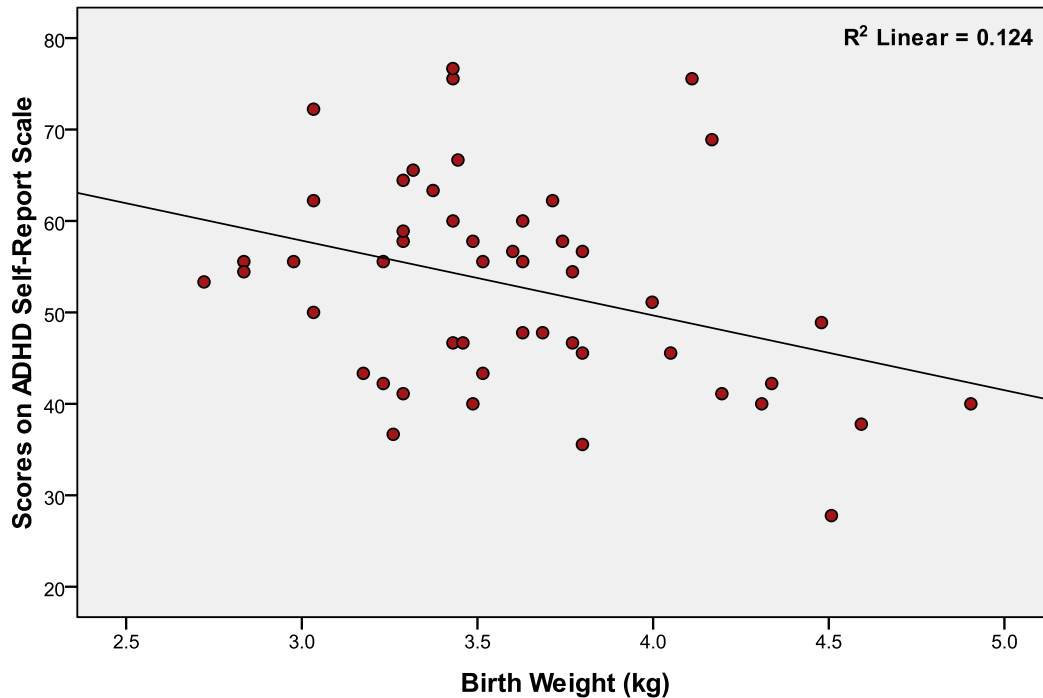
imagine myself enjoying one night of sex with someone I would never see again', 'I could enjoy sex with someone I find highly desirable even if that person does not have long-term potential', and reverse-weighted items such as 'I would have to be closely attached to someone (both emotionally and psychologically) before I could feel comfortable and fully enjoy having sex with him or her'. These responses were averaged to generate casual sex favorability ratings for each participant. All surveys were coded by subject numbers and deposited in a locked drop-box, so as to preserve anonymity. Two participants chose not to complete this portion of the survey. For the 50 completed inventories, there was high internal consistency among the 21 items (Cronbach's $\alpha = .914$).

All data were entered into a computer spreadsheet and analyzed with SPSS statistical software. The distribution for reported number of sexual partners displayed positive skewness causing it to differ significantly from a normal distribution (Kolmogorov-Smirnov $Z = 3.93$, $p \leq .01$). This was adjusted for by performing a natural logarithmic transformation on this variable [\ln ('number of sex partners' + 1)]. The resulting distribution did not differ significantly from normality (Kolmogorov-Smirnov $Z = 0.94$, $p = .337$). Significant Pearson correlations were explored using linear regression models and scatter-plots.

Results

Reported birth weights ranged from 2.7 to 4.9 kg and were normally distributed within a mean of 3.5 kg. Thus, all birth weights fell above the low birth weight (< 2.5kg) range (Breslau et al., 2000). Birth length was not significantly related to any behavioral variables. As depicted in Figure 1, weight at birth was negatively associated with total scores on the ADHD self-report scale ($r = -.352$; $p \leq .05$). When the ADHD subscales were examined, birth weight was negatively correlated with inattention ($r = -.380$; $p < .01$), but the correlation between birth weight and impulsivity fell short of significance ($r = -.235$; $p = .10$).

Figure 1: ADHD scores as a function of birth weight



Ratings of favorability towards casual sex tended to be higher in men who scored higher on the ADHD scale ($r = .330$; $p < 0.05$). This correlation remained significant when ADHD score was restricted to the inattention subscale ($r = .310$, $p < .05$), or to the impulsivity subscale ($r = .281$, $p < .05$). As shown in Figure 2, men who were smaller at birth had more favorable views towards casual sex as indicated on the sexual opinion inventory ($r = -.456$; $p \leq 0.001$).

Favorable attitudes towards casual sex predicted number of sexual partners ($r = .331$; $p \leq 0.05$), but scores on the ADHD scale did not ($r = -.030$; $p = 0.835$). Age at first sex was not found to be significantly related to size at birth ($r = -.073$; $p = .627$) or to other behavioral measures. Birth weight did not predict number of sexual partners ($r = .132$; $p = 0.359$), but controlling for casual sex favorability resulted in a positive partial correlation between birth weight and number of partners that was close to significance ($r = .253$; $p = .094$). The general linear model (GLM) revealed a significant interaction between birth weight and casual sex favorability in predicting number of sexual partners ($F_{1,46} = 4.994$; $p \leq .05$). The relevant Pearson correlations are reported in Table 1.

Figure 2: Attitudes towards casual sex as a function of birth weight

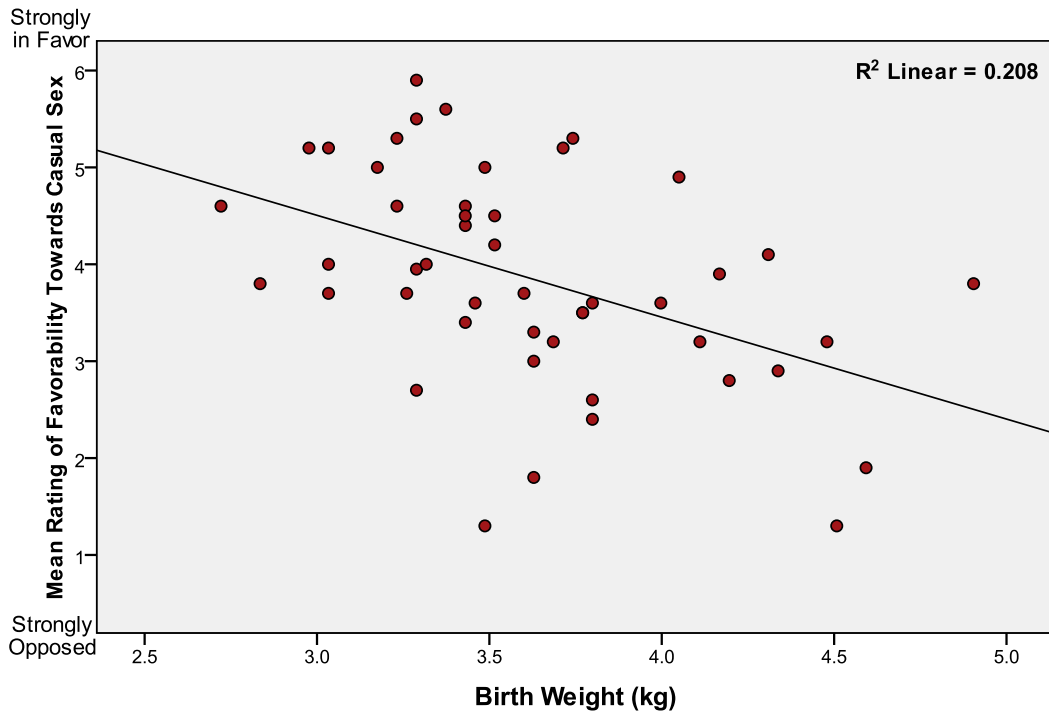


Table 1. Correlations between measures.

	ADHD Scale	Number of sex partners	Age at first sex	Favorability towards casual sex
Birth weight	-.352*	.132	.073	.456***
ADHD scale		-.030	.147	.331*
Number of sex partners			-.400**	.310*
Age at first sex				-.152

* $p < .05$, ** $p < .01$, *** $p < .001$

Discussion

An inverse linear relationship was found between birth weight and behaviors associated with ADHD in a college-age male sample. This is consistent with the findings of [Kelly et al. \(2001\)](#) who reported a similar finding in boys between the ages of 4 and 15. Although poor prenatal nutrition is associated with an increased risk of developing many kinds of dysfunction later in life, the observation of this effect within the normal range of

healthy birth weights is consistent with the possibility that ADHD-type behaviors may be developmentally programmed in response to early cues signaling stressful environmental conditions. Although severe ADHD is likely to be maladaptive in any environment (Gudjonsson, Sigurdsson, Gudmundsdottir, Sigurjonsdottir and Smari, 2010), subclinical levels may confer some advantages in an evolutionary context. Being easily distracted from the task at hand in order to attend to other environmental stimuli might be beneficial when detecting threats or predators (see Boonstra, Hik, Singleton and Tinnikov, 1998), while impulsivity could be useful in high-stress environments (Daly and Wilson, 2005). It is worth noting that only one participant in this study reported having been clinically diagnosed with ADHD.

The strong negative correlation observed between birth weight and favorability towards casual sex is of particular interest from a life history perspective. Men who were smaller at birth had much more favorable views towards casual sex, in addition to scoring higher on the ADHD scale. Furthermore, increased favorability towards casual sex was associated with an increased number of sexual partners. Birth weight was not significantly correlated with number of sexual partners, but a partial correlation between birth weight and number of sex partners when controlling for casual sex favorability was positive and close to significant. In addition, there was a significant interaction between birth weight and casual sex favorability in predicting number of sexual partners. Perhaps men who are small at birth are able to offset the negative impact this would otherwise have on their reproductive fitness by being more impulsive and more willing to engage in casual sexual encounters. When fetal conditions are less than ideal, these males may respond by developing in a way that makes them more likely to utilize short-term mating strategies. Thus, although lower birth weights may leave males at a phenotypic disadvantage that would otherwise reduce their ability to attract mates (see Phillips et al., 2001), their increased willingness to engage in casual sex may offset this trend, leading them to have about the same number of sexual partners as higher birth weight males, beginning at roughly the same age. This may explain the lack of a correlation between age at first sex and birth weight in males despite the significant negative correlation in females reported by Nettle et al. (2010). Sexually eager young men with reduced fitness may have a more difficult time finding willing mates than sexually eager young women with reduced fitness because females tend to be choosier when selecting mates (Johnstone, Reynolds and Deutsch, 1996).

Some degree of impulsivity in pursuing goals is likely to be adaptive under certain conditions, particularly in high stress environments (Daly and Wilson, 2005). This is true with regards to both economic and reproductive resources. Research on ADHD has primarily focused on impulsivity in an economic context by utilizing measures such as delay discounting tasks (e.g., Scheres, Lee and Sumiya, 2008). However, sexual impulsivity and a tendency towards early reproduction may be more relevant from an evolutionary perspective. This research suggests that ADHD scores are linked to favorability towards casual sex, and that both tend to be higher in men who were smaller at birth. Determining the precise nature of the relationship between sexual impulsivity and economic impulsivity, and how they are each impacted by the early environment, will be a promising area for future research.

A few limitations of this research project should be noted. The sample of 50 males in the final analysis was relatively small. It would be useful to attempt to replicate this study, perhaps while adding other established measures of ADHD, such as the future discounting task employed by Daly and Wilson (2005). Since the research was correlational, no variables were experimentally manipulated. An implicit assumption was that developmental factors influence adult behavior, not vice versa. However, because developmental influences were inferred using retrospective surveys, the causal nature of these relationships cannot be directly determined. Extraneous variables such as socio-economic status, which may exert an influence on both developmental factors and subsequent physiology and behavior, cannot be ruled out. Additionally, this research used reported number of sexual partners as an indirect measure of reproductive fitness. While this measure is commonly used for this purpose in studies of human evolutionary fitness in college-age samples, it is an imperfect reflection of one's reproductive potential, as it does not take mate quality into account. Finally, although the findings are roughly in line with life history theory and a possible adaptive role for ADHD-type behavioral tendencies, it was somewhat surprising to find that birth weight was significantly related to the inattention subscale, but not to the impulsivity subscale (although there was a trend in the predicted direction). Future studies using alternative measures of inattention and impulsivity are needed to clarify the relationship between these traits and birth weight.

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