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Research Paper

Heart rate variability reactivity and new romance: Cause or consequence?☆,☆☆

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ABSTRACT

There are documented physiological differences between single and coupled individuals during the "honeymoon period" of nascent romantic relationships. One such difference is in autonomic reactivity, specifically heart rate variability (HRV) reactivity. This finding had previously been interpreted as evidence of a stress buffering effect of relationship formation. The present study explored among university women two competing longitudinal hypotheses conceptualizing differences in HRV reactivity as either a cause or a consequence of romantic relationship formation. Results did not support the hypothesis that HRV reactivity changes as a consequence of beginning a new romantic relationship. Instead, lower HRV reactivity predicted greater relationship formation amongst women with low BMI and higher resting HRV. The functioning of the heart therefore predicted the likelihood that an individual would find love. These interactions may be the result of differing success rates of various mating strategies for women with low and high BMI and HRV.

1. Introduction

Beginning a new romantic relationship is often accompanied by a barrage of emotional and physiological changes. Individuals report experiencing euphoria during the honeymoon period and exhibit differences in hormone and neurotransmitter levels (Marazziti, Akiskal, Rossi, & Cassano, 1999; Marazziti & Canale, 2004), and brain activation patterns (Aron et al., 2005). Recent evidence points toward a link between autonomic reactivity and relationship formation, with new romantic relationships potentially buffering physiological reactivity to negative emotions. Specifically, differences in heart rate variability (HRV) have been detected between single and newly-coupled individuals presented with emotional stimuli (Schneiderman, Zilberstein-Kra, Leckman, & Feldman, 2011).

HRV refers to the variation between successive heartbeat intervals and is extracted through electrocardiography (ECG). A variable heart responds more readily to environmental cues and returns to baseline more quickly. The high frequency (HF) component of HRV (.15–.40 Hz) primarily represents the influence of the parasympathetic nervous system (Thayer, Åhs, Fredrikson, Sollers, & Wager, 2012) which is associated with vegetative and restorative functions. Resting HRV refers to a single measurement taken while the individual is at rest, whereas HRV reactivity measures phasic changes in HRV in response to a stressor.

According to Porges' (1995; 1998) polyvagal theory, the myelinated branch of the vagus nerve exerts parasympathetic influence on the heart and controls the social engagement system. This social engagement system serves as the neurophysiological basis for courting behaviours associated with seduction and the control of facial expression, vocalization, and head tilt. This system communicates reproductive availability and fosters proximity with potential romantic partners (Porges, 1998). In times of stress this system is depressed to allow for the expression of the sympathetic nervous system's fight-or-flight response. HRV may therefore serve as an index of both the vagus nerve's parasympathetic influence on the heart and the activation of the social engagement system. Building on Porges' theory, Schneiderman et al. (2011) found that, in comparison to single participants, individuals who had recently begun new romantic relationships demonstrated lower HRV reactivity in response to negative emotion-inducing videos. They postulated that HRV reactivity decreases during the process of courting associated with new romantic relationships due to increased activation of the social engagement system.

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The first purpose of the present study is to replicate key findings reported by Schneiderman et al. (2011). A cohort of single women was studied over a 6-month period. The *replication* hypothesis asserts that compared to participants who remained single over the 6-month follow-up, their newly-coupled counterparts will evidence (a) higher HRV during an emotionally evocative negative film clip and (b) lower HRV reactivity, defined as milder change in HRV from positive to negative film clips. Schneiderman et al. interpreted both findings as evidence for love causing a "buffered stress response" to negative stimuli (p. 1318). However, given the cross-sectional nature of their methodology, assertions about cause cannot be claimed with certainty. Thus, two competing longitudinal hypotheses are posited to understand the relationship between HRV reactivity and relationship status:

1. The *consequence* hypothesis asserts that newly-coupled individuals will evidence a drop in HRV reactivity to emotion-evoking film clips as their relationship status changes from single to coupled, while HRV for singles will remain unchanged.
2. The *cause* hypothesis states that single individuals with lower HRV reactivity at baseline will be more likely to enter into a new romantic relationship over a 6-month follow-up interval. Other variables associated with HRV reactivity and relationship formation may serve as potential moderators including: resting HRV, attachment style, emotional distress, self-esteem, and body mass index (BMI).

2. Method

2.1. Participants

Ninety-one single, female postsecondary students who were interested in forming a monogamous heterosexual romantic relationship participated in the study. Eight participants were excluded for technical reasons, excessive ectopic heartbeats, or failure to follow instructions. Of the remaining 83 participants, 47 (57%) returned and completed the follow-up laboratory session and thus comprise the sample of interest. Mean age was 19.09 years (SD = 2.23). Mean BMI was 22.31, SD = 2.84, range = 17.47–31.01. Twenty-eight (60%) remained single while 19 (40%) became coupled over the 6-month follow-up, operationally defined as entering into a monogamous heterosexual romantic relationship lasting at least 10 days. The length of 10 days was chosen based on Schneiderman et al.'s (2011) 2-week minimum relationship duration. Shorter relationship duration was expected to yield greater differences in HRV in the event that HRV reactivity changed upon beginning a romantic relationship. Mean duration of the romantic relationships at follow-up was 37.2 days (SD = 18.23; range 10–66 days).

2.2. Materials

2.2.1. Demographics questionnaire assessing BMI

Demographics Questionnaire Assessing BMI: calculated as BMI = weight (lb.)/(height [in.] x height [in.]) x 703 from self-reported height and weight. Motivation to begin a romantic relationship was assessed using the item "Please rate your motivation to begin a monogamous heterosexual romantic relationship on the following scale" rated on two separate scales. For the first scale, responses ranged from 0 (*I do not want to begin a monogamous romantic relationship)*, to 4 (*I am currently taking action to begin a relationship)*. On the second scale, responses ranged from 0 (*Not at all motivated*) to 7 (*Extremely motivated*). Participants also rated their expectancy to begin a romantic relationship over the follow-up period. Possible responses for the expectancy item ranged from 0 (*Not at all likely*) to 7 (*Extremely likely*).

2.2.2. Rosenberg self-esteem scale (RSES)

Rosenberg Self-Esteem Scale (RSES): a 10-item self-report measure of global self-esteem (Rosenberg, 1965). Responses were given on a 4-point Likert-type scale, ranging from 1 (*strongly disagree*) to 4 (*strongly agree*).

2.2.3. Attachment style questionnaire (ASQ)

Attachment Style Questionnaire (ASQ): a 40-item self-report measure of how individuals currently view their attachment security with other adults (Feeney, Noller, & Hanrahan, 1994). Respondents rated how much they agree with each item on a 6-point scale ranging from 1 (*totally disagree*) to 6 (*totally agree*). The two-dimensional scoring method described by Alexander, Feeney, Hohaus, and Noller (2001) yields two insecure subscales. Individuals who scored high on the Avoidant Attachment subscale were expected to not meet the inclusion criteria of being motivated to form a monogamous romantic relationship. Thus, the Anxious Attachment (ASQ: AN) subscale was chosen as the measure of attachment security.

2.2.4. Kessler psychological distress scale (K6)

Kessler Psychological Distress Scale (K6): a 6-item scale measuring general emotional distress during the past 30 days (Kessler et al., 2002). Respondents rated items on a 5-point scale ranging from 0 (*None of the time*) to 4 (*All of the time*).

2.2.5. Pleasantness questionnaire

Pleasantness Questionnaire: a manipulation check to ensure the film clips produced emotions of the intended affective valence (Rottenberg, Ray, & Gross, 2007). Emotions experienced while viewing the film clips were rated on a 9-point Likert-type scale ranging from 0 (*unpleasant*) to 8 (*pleasant*).

2.3. Apparatus

2.3.1. Electrocardiogram

ECG was recorded using a 72-channel amplifier, sampled at 1024 Hz. Participants were fitted with three electrodes with snap-on Ag-AgCl on cleaned skin located below the right clavicle and below the left rib in a lead-II configuration and a ground electrode below the left clavicle. Raw ECG data was extracted and inspected using ASA-Lab software (Version 16; Advanced Neuro Technology, Enschede, Netherlands) and then imported into Kubios 2.1 HRV specialized analysis software (Biosignal Analysis and Medical Imaging Group; http://kubios.uef.fi/). Using a fast Fourier transformation method, a distinct peak known as an R-spike was identified and interval series between R-spikes were calculated by power spectrum density to derive $HFms^2$ as the metric of HF HRV (bandwidth = .15–.40 Hz).

2.4. Procedure

The protocol was approved by the Lakehead University Research Ethics Board and was carried out in accordance with the provisions of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans. Participants completed an online battery of psychometric questionnaires including the RSES, ASQ, and K6. They then attended a laboratory session before which they refrained from drinking alcohol for 24 h, and eating, drinking caffeinated beverages, or exercising for 2 h as these variables have been shown to affect HRV (Buchheit et al., 2004; Nederkoorn et al., 2000; Sondermeijer, van Marle, Karmen, & Krum, 2002; Weise, Krell, & Brinkhoff, 1986). During the baseline laboratory session, researchers attached ECG electrodes to participants who then viewed four 4:45-min film clips which depicted couples engaging in various tasks. Pilot participant ratings were used to amalgamate shorter clips into three pairs of 4:45-min film clips designed to evoke different emotions (positive, neutral, and negative emotions). Each pair of clips was rated as being equivalent in both affective valence and arousal.

Participants watched film clips in the following order: neutral, positive or negative, neutral, positive or negative. Positive and negative