



# Mindful Mating: Testing Measurement Invariance and Associations Between Relationship Mindfulness and Relationship Quality Among White and Black Women

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Accepted: 20 July 2024 / Published online: 5 August 2024  
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## Abstract

**Objectives** Mindfulness research has flourished over the past several decades with prominent effects on health and wellbeing. More recently, mindfulness has been expanded to interpersonal contexts, notably within couples. Relationship mindfulness, or mindfulness within the context of romantic relationships, has also demonstrated significant effects on relationship quality beyond individuals' dispositional mindfulness. Given the novelty of relationship mindfulness, there has been little psychometric evaluation of couple-oriented mindfulness scales. The goal of the current study was to test measurement invariance of the Relationship Mindfulness Measure (RMM) as well as the Positive–Negative Relationship Quality (PNRQ) across White and Black women. The associations between relationship mindfulness and positive and negative relationship quality were subsequently examined using latent variable modeling.

**Method** A sample of 393 women was recruited from two universities (Mean age White = 27.54, Mean age Black = 30.99). A multiple group confirmatory factor analysis was utilized to test measurement invariance, and latent variable structural equation modeling was used to test associations between relationship mindfulness and positive and negative relationship quality.

**Results** Confirmatory factor analysis demonstrated configural, metric, and scalar invariance across race for both the RMM and PNRQ. Race did not affect the significant associations found between mindfulness and relationship quality.

**Conclusions** The results indicate two key findings: (1) Relationship mindfulness was consistent across White and Black women, and (2) the effects of relationship mindfulness on relationship quality did not differ between Black and White women.

**Preregistration** This study is not preregistered.

**Keywords** Relationship mindfulness · Relationship quality · Measurement invariance · Race

Decades of research support the notion that mindfulness is critical to mental and physical health (Tomlinson et al., 2018) and has been recently extended to include mindfulness at the dyadic level (Kimmes et al., 2018; Pratscher et al., 2019). Trait mindfulness is defined as an individual's general tendency to be fully present and aware of one's internal and external experiences (Brown & Ryan, 2003). Although research has examined the contributions of trait mindfulness on dyadic processes such as relationship quality for two decades (e.g., Barnes et al., 2007;

Carson et al., 2004), the conceptualization and measurement of mindfulness as a relational process is more recent. Attention has expanded to include mindfulness within the context of romantic relationships, which has been termed relationship mindfulness (Kimmes et al., 2018). Relationship mindfulness has been identified as a distinct concept from dispositional mindfulness, uniquely influencing adult romantic relationships beyond what is accounted for by dispositional mindfulness (Kimmes et al., 2018) and those higher in relationship mindfulness have higher quality relationships (Fitzgerald, 2022; Kimmes et al., 2020; Stanton et al., 2021).

Increasing focus on relationship mindfulness is of critical importance as adult romantic relationships have consistently been demonstrated to play a crucial role in both mental and physical health outcomes (see Robles et al., 2014; Whisman & Baucom, 2012 for reviews). Relationship

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mindfulness may therefore be a critical component of long-term health and wellbeing, but may vary across race. More generally, mindfulness has origins in Buddhist traditions and has been adopted by Western culture (Bodhi, 2011), and the concept has undergone a metamorphosis from its original conceptualization (Ardelt & Grunwald, 2018). While a full discussion is beyond the scope of the current study, the adaptation of mindfulness in different cultures will result in specific racial and cultural groups creating their own specific meanings, interpretations, and behaviors that may be consistent across groups but may also differ (Greeson et al., 2022; Watson et al., 2016). Moreover, it is not uncommon for people of different racial groups and cultures to have different determinants of relationship quality (Cruz et al., 2014; Kline et al., 2012; Tadinac et al., 2012). We cannot presume that relationship mindfulness is a similar process across different racial groups and that the associations with relationship quality are similar across racial and cultural groups, and instead it must be explicitly tested.

Due to potential racial and cultural differences between White and Black adults within the context of their romantic relationships, the current study examined measurement invariance across White and Black women. Measurement invariance is a critical dimension of culturally sensitive research (Okafor et al., 2023). Without it, conclusions drawn from statistical analysis (e.g., statistical conclusion validity) are incorrect because of imprecise measurement resulting in biased parameter estimates and standard errors (Cole & Preacher, 2014). The current study focused on examining measurement invariance of the Relationship Mindfulness Measure and the Positive–Negative Relationship Quality measure across White and Black adults. Following measurement invariance, the study examined associations between relationship mindfulness and positive and negative relationship quality across race.

In line with the conceptualization of mindfulness espoused by Brown and Ryan (2003), mindfulness can refer to a discipline or technique that is intentionally practiced, or it can describe a dispositional trait that varies across individuals (Jones et al., 2011) and can be cultivated by the practice of mindfulness (Quaglia et al., 2016) and other practices such as yoga (e.g., Solarikova et al., 2021). Both types of mindfulness, often referred to as state and trait mindfulness respectively, have been examined in individuals as they relate to various health outcomes and are generally considered to produce positive outcomes (Fitzgerald, 2022; Murphy et al., 2012; Tomlinson et al., 2018). In the current study, we examined trait (dispositional) mindfulness because all individuals have a dispositional tendency to be mindful whereas only 10% of women and 5% of men engage in meditation (Upchurch & Johnson, 2019). Dispositional mindfulness has been an established correlate of mental

health (Brown & Ryan, 2003; Tomlinson et al., 2018) as well as relational outcomes (Barnes et al., 2007; Jones et al., 2011; Ryan et al., 2007).

Dispositional mindfulness refers to an individual's tendency to be mindful, but one can also be mindful within their relationship (Kimmes et al., 2018; Pratscher et al., 2019). Relationship mindfulness is characterized by behaviors and attitudes of being non-judgmental, compassionate, accepting, and present in one's romantic relationship (Kimmes et al., 2018), which can enhance the quality of such relationships (Fitzgerald, 2022; Kimmes et al., 2020). The Relationship Mindfulness Measure (RMM; Kimmes et al., 2018) was developed to specifically assess components of mindfulness that also occur relationally (e.g. focusing internally and focusing on a romantic partner). Adapted from the 5-item version of the Mindfulness Attention and Awareness Scale (MAAS; Van Dam et al., 2010), the 5 items of the MAAS were reworded to reflect mindfulness within one's relationship. Using a sample of undergraduate students, Kimmes et al., (2018) used confirmatory factor analysis to establish the factor structure and a unidimensional structure fit the data well. The RMM demonstrated test–retest reliability, and concurrent and predictive validity (12 weeks later) with relationship quality and attachment. More specifically, (1) relationship mindfulness was positively associated with trait mindfulness, and (2) dispositional mindfulness was not associated with relationship quality when accounting for the effects of relationship mindfulness. These findings indicate that relationship mindfulness is a distinct concept from dispositional mindfulness and has important implications for adult relationship health beyond individual dispositional mindfulness. Measurement invariance over a 12-week period was partially supported with a significant chi-square difference test, but changes in fit statistics were within acceptance ranges (Little, 2013). To our knowledge, this is the only existing measure evaluated using psychometric properties.

Following the initial development, numerous empirical studies have likewise supported relationship mindfulness as an important factor in determining the quality of adult romantic relationships. Using dyadic data of couples in a committed relationship, Kimmes et al., (2020) found that relationship mindfulness was associated with less negative and more positive relationships and fewer mental health problems. Likewise, studies using smaller sample sizes have found that greater relationship mindfulness is associated with more positive and less negative relationship quality in both individual (Fincham, 2022; Fitzgerald, 2022) and dyadic studies (Morris et al., 2023; Stanton et al., 2021). Despite these promising findings, existing studies have presumed that there is measurement equivalence across groups, notably gender and race; however, these assumptions have yet to be formally tested. Without examination,

conclusions of studies may become biased as the construct of relationship mindfulness may operate differently, influencing both parameter estimates and standard errors. The next critical step is to determine whether the associations between relationship mindfulness and relationship quality are similar across groups (e.g., race). Without such examination, researchers are forced to presume that the constructs are conceptually and statistically equivalent, which is often an untenable assumption.

Relationship quality has been the subject of conceptual differences ranging from a multidimensional scale consisting of specific domains, subjective ratings of overall relationship quality (e.g., global evaluations), and a bi-dimensional conceptualization (e.g., positive and negative relationship quality). The Positive–Negative Relationship Quality measure (Rogge et al., 2017) was measured using multiple samples including undergrads, an online sample, and those enrolled in an intervention (e.g., single group, pre-post design). Confirmatory factor analysis revealed that the positive and negative dimensions are separate dimensions that are moderately negatively correlated, and item response theory (IRT) analysis indicated that the positive and negative qualities shared only 42% and 27% of their variance with a global measure of relationship quality (Funk & Rogge, 2007), indicating distinctiveness. Further, IRT analyses demonstrated that the PNRQ was optimized (1) to detect changes over time and (2) for categorization of people into groups (e.g., high positive – low negative). Further, the PNRQ demonstrated predictive validity. Both the PNRQ and RMM demonstrated adequate psychometrics; however, their samples were quite homogenous across race and no invariance testing across racial groups occurred.

Currently, most of the mindfulness literature is based on research with primarily White samples (Eichel et al., 2021; Waldron et al., 2018), and mindfulness research among racial minorities is vastly understudied, which severely limits the ability to apply the potential psychological, physical, and social benefits of mindfulness in non-White populations (Keng et al., 2011; Okafor et al., 2023). Researchers have advocated for the cultural adaptation of mindfulness because (1) mindfulness was originally an Eastern practice and tradition, which has been adopted by Western psychology, and such adaptations are unlikely to happen in a universal manner, (2) items on mindfulness assessments may or may not be invariant across racial groups and some items may apply to a greater extent to White or Blacks adults, (3) items may be interpreted differently due to cultural attitudes, beliefs, behaviors, traditions, and meanings applied to items, and (4) mindfulness can be more closely related to spiritual and religious practices and beliefs which will vary across different racial and cultural groups (Biggers et al., 2020; Bodhi, 2011; Castellanos et al., 2020; Kirmayer, 2015; Okafor et al., 2023). On the other hand, relationship mindfulness may manifest through the same processes among Blacks

and Whites, particularly if individuals were raised in the same geographical areas. Mindfulness within the context of relationships may be more readily applicable to the processes that are a common part of romantic relationships regardless of cultural background (e.g., attentiveness, communication, mutual problem solving). Further, Blacks often adopt a “double consciousness” which is a blending of African and U.S. cultural values in which U.S. norms may dictate interactions and behaviors even within relationships built on African foundational values (Dixon, 2014). There is growing recognition of the problems with assuming equivalence without testing it. These advancements have yet to be examined in relationship mindfulness.

Relationship mindfulness might be especially significant and impactful in Black individuals' relationships. Black individuals tend to be more collectivistic prioritizing community engagement, interdependence, solidarity, and shared experiences (Biggers et al., 2020; Brewer & Chen, 2007; Dixon, 2014; Ellison et al., 2010; Kuo, 2013) and being fully present and engaged in one's romantic relationship may be of more central focus in high-quality relationships (Brewer & Chen, 2007). For example, Dixon (2014) discusses that communication is a critical part of strengthening Black intimate relationships and is underscored by the following (1) power of words, (2) effective speaking and listening skills, (3) gender differences in communication, and (4) Black communication styles. These foci emphasize the need for intentionality in communicating and may manifest as more mindful communication having a stronger positive effect on relationships.

The first and primary objective of the study is to examine measurement invariance of the RMM and the PNRQ measure across race. Following invariance testing, the second aim will be to examine the associations between relationship mindfulness and positive and negative relationship quality across race. We hypothesize that the constructs of relationship mindfulness and positive–negative relationship quality will be invariant (configural, metric, scalar) across race. Second, it is expected that relationship mindfulness will predict both positive and negative relationship quality in both Blacks and White, and we expect that the associations will be moderated by race whereby relationship mindfulness will have a stronger impact (moderate) on Blacks' reports of positive and negative relationship quality than Whites'. In the second objective, we will control for several covariates including age, relationship length, spirituality, and gender.

## Method

### Participants

Participants were recruited from undergraduate and graduate social sciences courses at two universities, one in the southern and one in the southwestern United States.

The study was conducted from the fall of 2022 to the fall of 2023. Many of the participants were “non-traditional” college students, who are quite different from the typical pool of college students seen in research (e.g., 18–22-year-olds). Instead, participants were older, varied in relation to their commitment level, and commonly had children. Participants were included in the current study if they were in a romantic relationship, defined by a committed relationship, cohabitating, engaged, or were married and had been in that relationship for at least 1 month. Those who were single or were in a non-committed relationship (e.g., “friends with benefits”) were excluded. We also excluded any participants who failed two or more of the six manipulation checks (e.g., Mark 3 for this question) to increase the validity of the data and avoid “clicking through.” We excluded male participants ( $n = 12$ ) due to insufficient numbers for gender comparisons, resulting in a more homogeneous sample. The first author’s institutional review board approved the current study’s procedures.

In total, the study included 393 adults including 246 White women (62.60%) and 147 Black women (37.40%). Regarding characteristics of White women, the average relationship length was 6.64 ( $SD = 7.29$ ) years, their average age was 27.54 ( $SD = 8.82$ ), 216 reported being heterosexual (87.80%), 157 reported not having children (63.82%), and 107 adults reported being in committed relationships (42.50%), 15 (6.10%) reported cohabitating, 22 (8.94%) were engaged, and 109 (44.31%) were married. Regarding Black women, they had an average age of 30.99 ( $SD = 11.05$ ), and the average length of their romantic relationship was 7.87 ( $SD = 8.15$ ) years. A majority of Black women reported having children (57.86%,  $n = 88$ ). Regarding relationship status, 67 women reported being in committed relationships (45.58%), 17 (11.56%) reported cohabitating, 10 (6.80%) were engaged, and 58 (39.46%) were married. Most Black participants reported being heterosexual (93.88%,  $n = 138$ ).

## Procedure

The data used in this study were part of an ongoing, multi-site, multi-wave student data collection. At the beginning of the semester, students were invited to participate in a longitudinal study spanning the entire semester. During the 3rd, 9th, and 15th week of the semester students completed an online survey. Students who participated and completed 80% of the questions at each of the three waves were compensated with extra credit. An alternative assignment was offered for those who were not 18, refused to participate, or missed one of the subsequent (2nd or 3rd) waves of data collection.

The measures in this study were collected at a single time point, precluding longitudinal analysis. Moreover, the constructs of interest are unlikely to change in such a short time period.

## Measures

Relationship mindfulness was measured with the Relationship Mindfulness Measure (RMM; Kimmes et al., 2018). The RMM demonstrates good test–retest reliability, concurrent validity, and predictive validity (Kimmes et al., 2018). The RMM consists of 5 items rated on a 6-point Likert-type scale with scores ranging from 1 (*Almost always*) to 6 (*Almost never*). The items include: “When my partner and I are together, it seems I am ‘running on automatic,’ without much awareness of what I’m doing,” “I have conversations with my partner without being really attentive,” “I get so focused on what I want my relationship with my partner to be like that I lose touch with what I’m doing right now to get there,” “When my partner and I discuss an issue or work on a problem together, I behave automatically, without being aware of what I’m saying or doing,” and “When I’m with my partner, I find myself saying or doing things without paying attention.” Items served as indicators of a latent variable. Omega = 0.86 (95% CI [0.82, 0.88]).

Positive and negative relationship quality was assessed with the Positive–Negative Relationship Quality scale (PNRQ; Rogge et al., 2017). The PNRQ is an implicit measure of positive and negative relationship quality, which has been demonstrated to be a superior measure of relationship quality compared to well-validated unidimensional measures (e.g., Couple Satisfaction Index) of relationship quality (Rogge et al., 2017). The PNRQ assesses relationship quality using four adjectives for both the positive and negative relationship quality. The positive relationship quality (PRQ) adjectives included “enjoyable,” “pleasant,” “strong,” and “alive” and the negative adjectives (NRQ) included “bad,” “empty,” “miserable,” and “lifeless.” The items were rated on a 7-point Likert scale with a response range from 1 (*Not at All*) to 7 (*Extremely*). PRQ items served as indicators on one latent variable and NRQ items served as indicators on a second latent variable. PRQ Omega = 0.96 (95% CI [0.95, 0.98]), NRQ Omega = 0.92 (95% CI [0.87, 0.95]).

One question created for the study assessed participants’ level of spirituality, which was “How spiritual are you?” and respondents rated their level of spirituality on a 1 (*not spiritual*) to 5 (*very spiritual*).

Participants were asked how many years and how many months they have been with their partner to assess relationship length. The number of years and months was converted into years (e.g., 1 year, 6 months = 1.50 years) and measured continuously. The smallest unit of measurement was 1 month (0.08 years).

## Data Analyses

The first step in the analytic plan was to run descriptive statistics including correlations, means, and standard deviations stratified across race. Following the generation of descriptive statistics, the primary analysis examined measurement invariance using confirmatory factor analysis in a structural equation modeling (SEM) framework. Measurement invariance is assessed using three hierarchical and increasingly restrictive steps (Little, 2013; Putnick & Bornstein, 2016). First, we examined configural invariance (e.g., equivalent factor structure), second, we tested metric invariance (or weak factorial invariance; factor loadings are constrained to be equal across groups), and third we examined scalar invariance (strong factorial invariance; intercepts are constrained to be equal across groups) (Van de Schoot et al., 2012). Further, when testing metric invariance, the factor variances were allowed to be free in one group, and in the scalar model the factor mean was allowed to be free. Some have argued (e.g., Little, 2013) that constraining the residual variances is too restrictive and factorial invariance is more than sufficient to proceed to estimating parameters without biased estimates and standard errors attributable to measurement non-invariance. To evaluate model-data fit in the confirmatory factor analyses, several commonly used fit statistics are used including the comparative fit index (CFI), Tucker-Lewis fit index (TLI), root mean square error of approximation (RMSEA), and the chi-square test (Putnick & Bornstein, 2016). The CFI and TLI statistics are generally acceptable at 0.90 and above, and at 0.95 demonstrate a good fit. RMSEA values below 0.08 demonstrate acceptable fit, and below 0.05 demonstrates good fit. The chi-square statistic that is non-significant demonstrates strong model-data fit (Hu & Bentler, 1999). Using guidelines in the evaluation of model-data fit needs to be done with general guidelines rather than specific rules because fit statistics can vary in accordance with model characteristics (Cheung & Rensvold, 2002). For example, less weight is placed on RMSEA because it tends to be inflated in small samples and simple models such as those with few degrees of freedom (e.g., confirmatory factor analysis) (Kenny et al., 2015). The RMSEA statistic, however, will be reported for transparency. Likewise, the omnibus chi-square test is an overpowered test, and there is a risk of rejecting adequately fitting models (Little, 2013). To assess whether invariance holds under increasingly stringent circumstances, the chi-square difference test and change in CFI ( $\Delta\text{CFI} < 0.01$ .) will be used to evaluate change (Cheung & Rensvold, 2002; Little, 2013). In all analyses, due to the distributions of the data, we used MLR (Yuan & Bentler, 2000), which implements a scaling correction factor for the chi-square, meaning the normal chi-square difference

test cannot be used. Instead, when conducting the chi-square test, the scaling correction factor will be considered (Satorra & Bentler, 2010).

In the third step of our analytic procedure, we used latent variable structural equation modeling to examine the associations between relationship mindfulness and positive and negative relationship quality controlling for sociodemographic factors. Latent variable models, unlike observed variable models (e.g., path analysis), account for measurement error leading to unbiased parameter estimates (Little, 2013).

Missing data in the current study was low and no variable has more than 2 (0.80%) missing data points. This likely reflects the requirement that students had to complete at least 80% of the study to obtain credit. Data were assumed to be missing at random and Full Information Maximum Likelihood, a default in Mplus, was used (Muthén & Muthén, 2017). Logistic regression used to identify predictors of missingness (0 = non missing, 1 = missing) did not identify any variables that predicted missingness (not reported in the document).

## Results

### Bivariate Correlations

Bivariate correlations, means, and standard deviations stratified across race are presented in Table 1.

### Relationship Mindfulness: Measurement Invariance

Following examination of bivariate correlations, we tested measurement invariance in the RMM (Table 2). The configural invariance model fit the data well  $\chi^2(10) = 14.50, p = 0.15, \text{RMSEA} = 0.07, \text{CFI} = 0.99, \text{TLI} = 0.98$ , which provides evidence that relationship mindfulness demonstrates the same factor structure (e.g., unidimensional construct) in White and Black women. Next, we tested metric invariance, which examines whether the loadings from the latent construct to each of the indicators are the same across groups. Constraining the factor loadings to be equal demonstrated good model-data fit:  $\chi^2(14) = 19.05, p = 0.16, \text{RMSEA} = 0.04, \text{CFI} = 0.99, \text{TLI} = 0.99$ . Change in the chi-square difference test and CFI was below the thresholds, indicating that there was not a significant loss of model-data fit in the more restrictive model and metric invariance was achieved ( $\Delta\chi^2(4) = 4.55, p = 0.33, \Delta\text{CFI} = 0.00$ ). Next, we tested scalar invariance, which keeps the factor loading constraints in the model and imposes additional constraints where the intercepts of the indicators are constrained to be equal across groups. The scalar model also demonstrated adequate model-data fit ( $\chi^2(18) = 30.23, p = 0.03, \text{RMSEA} = 0.06, \text{CFI} = 0.98, \text{TLI} = 0.98$ ) and the

**Table 1** Correlations, means, and standard deviations among study variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	M (SD) White	M (SD) Black
1. RMM1	-	0.47**	0.67**	0.55**	0.55**	0.13*	0.15*	0.17**	0.14*	-0.19**								3.84 (1.59)	3.98 (1.60)
2. RMM2	0.59**	-	0.55**	0.53**	0.57**	0.19**	0.20**	0.18**	0.17**	-0.24**								4.43 (1.56)	4.32 (1.60)
3. RMM3	0.55**	0.61**	-	0.68**	0.69**	0.19**	0.22**	0.23**	0.23**	-0.23**								4.04 (1.66)	4.31 (1.55)
4. RMM4	0.40**	0.51**	0.59**	-	0.68**	0.19**	0.23**	0.23**	0.27**	-0.24**								4.15 (1.52)	4.07 (1.63)
5. RMM5	0.53**	0.51**	0.64**	0.58**	-	0.18**	0.21**	0.21**	0.20**	-0.15*								4.35 (1.67)	4.25 (1.58)
6. PNRQ1	0.22**	0.33**	0.26**	0.21**	0.15	-	0.94**	0.83**	0.83**	-0.46**								6.23 (1.15)	5.60 (1.55)
7. PNRQ2	0.21*	0.32**	0.20*	0.17*	0.07	0.91**	-	0.85**	0.87**	-0.48**								6.18 (1.17)	5.49 (1.61)
8. PNRQ3	0.23*	0.26**	0.22**	0.23**	0.11	0.89**	0.90**	-	0.84**	-0.49**								6.22 (1.25)	5.46 (1.64)
9. PNRQ4	0.21*	0.23*	0.21*	0.20*	0.05	0.82**	0.84**	0.89**	-	-0.45**								6.01 (1.36)	5.47 (1.63)
10. PNRQ5	-0.19*	-0.15	-0.09	-0.17*	-0.08	-0.42**	-0.45**	-0.46**	-0.38**	-								1.89 (1.37)	2.07 (1.36)
11. PNRQ6	-0.24*	-0.19*	-0.16	-0.16	-0.10	-0.51**	-0.52**	-0.57**	-0.49**	0.80**								1.53 (1.24)	1.82 (1.36)
12. PNRQ7	-0.21*	-0.17*	-0.11	-0.11	0.00	-0.52**	-0.52**	-0.60**	-0.53**	0.72**								1.75 (1.42)	1.95 (1.52)
13. PNRQ8	-0.22**	-0.18*	-0.08	-0.08	-0.02	-0.50**	-0.51**	-0.60**	-0.55**	0.65**								1.65 (1.31)	1.83 (1.50)
14. Age	0.12	-0.02	0.03	0.03	0.12	-0.13	-0.18*	-0.11	-0.10	-0.06								6.23 (1.15)	5.60 (1.55)
15. Spiritual	-0.02	0.11	0.05	0.06	0.05	0.08	0.06	0.08	0.06	0.00								6.18 (1.17)	5.49 (1.61)
16. Gender	0.00	0.11	-0.03	0.03	-0.04	-0.05	0.03	0.01	0.01	-0.02								6.22 (1.25)	5.46 (1.64)
17. Length	0.05	-0.03	-0.02	0.02	0.03	-0.06	-0.11	-0.05	-0.03	-0.08								6.01 (1.36)	5.47 (1.63)
1. RMM1	-0.15*	-0.19**	-0.19**	-0.15*	-0.15*	-0.07	-0.07	0.03	0.03	-0.01								1.89 (1.37)	2.07 (1.36)
2. RMM2	-0.17**	-0.20**	-0.20**	-0.15*	-0.15*	0.00	0.00	0.07	0.07	-0.10								1.53 (1.24)	1.82 (1.36)
3. RMM3	-0.20**	-0.24**	-0.24**	-0.21**	-0.21**	-0.09	-0.09	-0.03	-0.03	0.02								1.75 (1.42)	1.95 (1.52)
4. RMM4	-0.17**	-0.16*	-0.16*	-0.18**	-0.18**	-0.15*	-0.15*	0.05	0.05	0.08								1.65 (1.31)	1.83 (1.50)
5. RMM5	-0.08	-0.08	-0.08	-0.09	-0.09	-0.13*	-0.13*	0.03	0.03	0.02								6.23 (1.15)	5.60 (1.55)
6. PNRQ1	-0.57**	-0.47**	-0.47**	-0.53**	-0.53**	-0.31**	-0.31**	0.16*	0.16*	-0.01								6.18 (1.17)	5.49 (1.61)
7. PNRQ2	-0.57**	-0.50**	-0.50**	-0.57**	-0.57**	-0.30**	-0.30**	0.14*	0.14*	-0.02								6.22 (1.25)	5.46 (1.64)
8. PNRQ3	-0.59**	-0.46**	-0.46**	-0.55**	-0.55**	-0.24**	-0.24**	0.15*	0.15*	0.03								6.01 (1.36)	5.47 (1.63)
9. PNRQ4	-0.53**	-0.48**	-0.48**	-0.60**	-0.60**	-0.31**	-0.31**	0.15*	0.15*	0.03								1.89 (1.37)	2.07 (1.36)
10. PNRQ5	0.76**	0.69**	0.69**	0.66**	0.66**	0.11	0.11	-0.11	-0.11	-0.05								1.53 (1.24)	1.82 (1.36)
11. PNRQ6	-	0.77**	0.77**	0.78**	0.78**	0.18**	0.18**	-0.05	-0.05	-0.08								1.75 (1.42)	1.95 (1.52)
12. PNRQ7	0.86**	-	-	0.84**	0.84**	0.22**	0.22**	-0.06	-0.06	-0.04								1.65 (1.31)	1.83 (1.50)
13. PNRQ8	0.83**	0.91**	0.91**	-	-	0.19**	0.19**	-0.14*	-0.14*	-0.05								27.63 (8.90)	31.36 (11.32)
14. Age	0.01	0.04	0.04	0.12	0.12	-	-	0.07	0.07	-0.11								3.56 (1.13)	3.76 (1.07)
15. Spiritual	0.02	0.02	0.02	-0.04	-0.04	0.07	0.07	-	-	-0.05								2.00 (0.32)	1.97 (0.18)
16. Gender	0.00	-0.08	-0.08	-0.07	-0.07	-0.17*	-0.17*	-0.04	-0.04	-								2.00 (0.32)	1.97 (0.18)
17. Length	-0.04	-0.02	-0.02	0.08	0.08	0.78**	0.78**	0.06	0.06	-0.16								6.64 (7.29)	7.87 (8.15)

White/European American are presented above the diagonal and Black/African American are presented below the diagonal \*  $p < 0.05$ , \*\*  $p < 0.01$

**Table 2** Measurement invariance model statistics of the study’s constructs

Relationship	CFI	TLI	RMSEA	Model $\chi^2$	$\chi^2$ sig	$\Delta$ CFI	$\Delta\chi^2$	$\Delta\chi^2$ sig
Configural Invariance	0.99	0.98	0.07	$\chi^2(10)=14.50$	0.15	-	-	-
Metric Invariance	0.99	0.99	0.04	$\chi^2(14)=19.05$	0.16	-0.00	$\chi^2(4)=4.55$	0.33
Scalar Invariance	0.98	0.98	0.06	$\chi^2(18)=30.23$	0.03	-0.01	$\chi^2(4)=10.25$	0.04
Positive–Negative Relationship Quality								
Configural Invariance	0.99	0.98	0.06	$\chi^2(34)=54.30$	<0.001	-	-	-
Metric Invariance	0.98	0.98	0.06	$\chi^2(40)=69.53$	<0.001	0.00	$\chi^2(6)=12.86$	0.05
Scalar Invariance	0.98	0.97	0.06	$\chi^2(46)=76.76$	<0.001	0.00	$\chi^2(6)=9.97$	0.12

Both  $\Delta\chi^2$  and  $\Delta$ CFI were used to evaluate model-data fit. CFI Comparative fit index, TLI Tucker-Lewis index, RMSEA Root mean squared error of approximation, and  $\Delta$  represents change between the nested model. Changes greater than 0.01 for CFI or a significant chi-square test indicate significantly worse model fit

differences in fit ( $\Delta\chi^2(4)=10.25, p=0.04, \Delta$  CFI=-0.01), providing some evidence of scalar invariance, indicating no worse fit than the metric model. Due to mixed evidence, we subsequently tested partial scalar invariance. We tested each of the five intercepts and found the intercept for Item 3 (“I get so focused on what I want my relationship with my partner to be like that I lose touch with what I’m doing right now to get there.”), demonstrated a significant decrease in model-data fit:  $\Delta\chi^2(1)=5.20, p=0.02$ , resulting in partial scalar invariance. There were no residual covariances estimated between the items at any of the stages of invariance testing.

**Positive Negative Relationship Quality: Measurement Invariance**

Next, we examined invariance in the PNRQ (Table 2). During estimation of the configural model ( $\chi^2(38)=103.37, p<0.001, RMSEA=0.09, CFI=0.96, TLI=0.94$ ), we added two non-hypothesized residual covariances between Item 3 (alive) and Item 4 (strong), which were on the positive relationship quality subscale and Item 7 (empty) and 8 (lifeless), which were on the negative relationship quality subscale. The covariance between the positive items may be related to the nature of the items where the alive and strong adjectives are more strongly worded than the pleasant and enjoyable adjectives. Likewise, the correlated residuals of the negative indicators may reflect a more specific dimension of the relationship, such as a lack of vitality and lack of passion, whereas the other indicators (bad and miserable) are more general evaluations of the relationship. Thus, we believe that there are grounds to keep the covariances of the residuals. These covariances were estimated in the configural, metric, and scalar models. The configural model demonstrated adequate model-data fit  $\chi^2(34)=54.30, p<0.001, RMSEA=0.06, CFI=0.99, TLI=0.98$ . The metric model was examined next and demonstrated adequate model-data fit ( $\chi^2(40)=69.53, p<0.001, RMSEA=0.06, CFI=0.98, TLI=0.98$ ) and the chi-square difference test and change in CFI indicate no significant worse fit:  $\Delta\chi^2(6)=12.86, p=0.05, \Delta$  CFI=0. Thus, constraining the loadings to be

equal did not significantly decrease the fit supporting metric invariance. Finally, scalar invariance was examined by constraining the intercepts to be equal, and the model fit the data well:  $\chi^2(46)=76.76, p<0.001, RMSEA=0.06, CFI=0.98, TLI=0.97$ . The change in fit statistics indicate that the model did not demonstrate any worse fit ( $\Delta\chi^2(6)=9.97, p=0.12, \Delta$  CFI=0), indicating scalar invariance (Table 3).

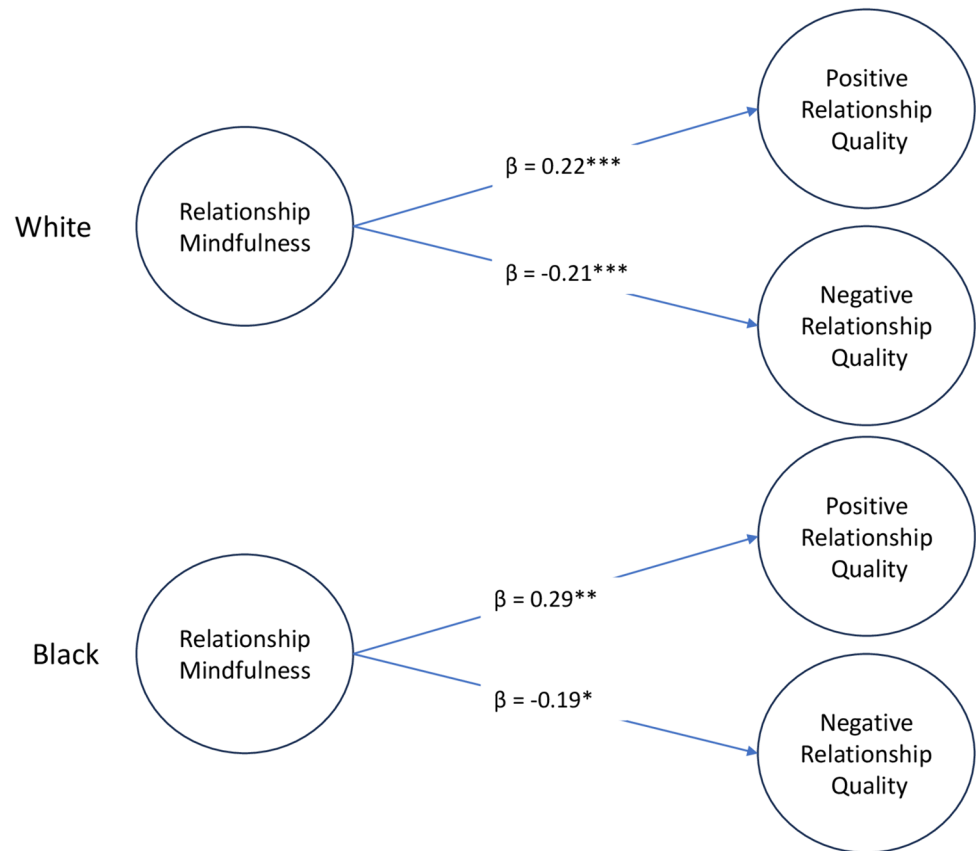
**Latent Variable Structural Equation Modeling**

Following invariance testing, the interrelationships between relationship mindfulness and relationship quality were examined accounting for the covariates (Fig. 1) in a multiple group model across race. Although we found only partial scalar invariance, scalar invariance is not required for estimating structure

**Table 3** Standardized factor loadings for relationship mindfulness measure and positive–negative relationship quality in the confirmatory factor analysis

	Factor Loading	
	White	Black
Relationship Mindfulness		
RMM 1	0.72	0.70
RMM 2	0.68	0.70
RMM 3	0.85	0.84
RMM 4	0.79	0.72
RMM 5	0.80	0.79
Positive Negative Relationship Quality		
Positive Relationship Quality		
PNRQ 1	0.97	0.94
PNRQ 2	0.99	0.94
PNRQ 3	0.90	0.92
PNRQ 4	0.89	0.85
Negative Relationship Quality		
PNRQ 5	0.81	0.82
PNRQ 6	0.94	0.97
PNRQ 7	0.84	0.87
PNRQ 8	0.85	0.82

**Fig. 1** Structural model depicting the correlations between the latent constructs. Note. \* $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\* $p < 0.001$



parameters. The latent variable model demonstrated adequate model-data fit: ( $\chi^2(224) = 380.75, p < 0.001, RMSEA = 0.07, CFI = 0.95, TLI = 0.94$ ). Among White women, relationship mindfulness was associated with higher levels of positive relationship quality ( $\beta = 0.22, p < 0.001$ ) and lower levels of negative relationship quality ( $\beta = -0.21, p < 0.001$ ), controlling for the influence of age, relationship length, gender, and spirituality.

Within the Black model, relationship mindfulness was similarly significant in predicting both positive and negative relationship quality. Black women who had higher levels of relationship mindfulness reported greater levels of positive relationship quality ( $\beta = 0.29, p = 0.005$ ) and lower levels of positive relationship quality ( $\beta = -0.19, p = 0.04$ ). We constrained the path from relationship mindfulness to positive and negative relationship quality across race and both difference tests, accounting for the scaling correction factor, were non-significant ( $p > 0.05$ ), indicating that race did not moderate the association.

## Discussion

The primary purpose of the study was to examine measurement invariance of the RMM and PNRQ across race. A secondary aim was to examine the preliminary associations between relationship mindfulness and positive and negative

relationship quality in White and Black women using a multiple group structural equation model. The study contributes to the literature by the establishment of partial scalar invariance of relationship mindfulness and scalar invariance of positive and negative relationship quality across race; the specific associations between relationship mindfulness and relationship quality across race; and the associations between relationship mindfulness and relationship quality did not differ in strength between Whites and Blacks.

The study demonstrated partial scalar measurement invariance across relationship mindfulness and scalar invariance in positive–negative relationship quality among White and Black women. These findings expand on the initial psychometric evaluation of the relationship mindfulness measure (Kimmes et al., 2018), which examined relationship mindfulness among “traditional” undergraduate students (e.g., 18–22 year old White females). Our findings replicated these findings among similarly degree seeking individuals, but our sample had more diversity related to age, race, relationship length, parental status, and marital status, which provides greater generalizability for the use of the RMM. However, the psychometrics remain focused on degree-seeking students. To our knowledge, this is the only other psychometric study apart from the initial validation by Kimmes et al. (2018) investigating the relationship mindfulness measure.



Continued psychometric evaluation is needed for the RMM across other racial and ethnic groups, between men and women, and in non-degree-seeking populations to determine whether the measure can be appropriately used in such populations. In general, the invariant factor structure of the RMM indicates that there are commonalities in the conceptualization and operationalization of relationship mindfulness in White and Black adults. Unlike measures of dispositional mindfulness, where issues of item wording and content have been identified as problematic (e.g., Okafor et al., 2023), the RMM performed quite well across race, which is consistent with other studies on communication finding that there are few communication differences among White and Black couples (e.g., Helgeson et al., 2021). The exception was that the RMM did not demonstrate scalar invariance. Recall that the item, “I get so focused on what I want my relationship with my partner to be like that I lose touch with what I’m doing right now to get there” demonstrated similar factor loadings across race, but the intercepts were significantly different with the intercept being higher for African Americans compared to Whites. The first possibility is that the highly powered chi-square test is highly sensitive and detected a relatively small difference in the item intercepts. While we had nearly 150 African American women in our sample, the sample size may be not large enough and the chi-square test is picking up trivial differences. Alternatively, it is possible that true racial differences were detected in the item intercepts. Blacks reported a higher item intercept than Whites indicating that Black women, on average, were more present in their relationship with their partners, which may be a reflection of cultural norms and expectations of romantic relationships, particularly shared experiences, being more present, and focusing on the “here and now” (Brewer & Chen, 2007).

Future research should replicate these results to discern whether our finding is due to an underpowered sample size to detect a small difference in the item’s intercept (2.43 for White and 2.72 for Blacks) or if the RMM is largely culturally sensitive, but the item may need refinement. This is critical because without effective measurement that assesses the same construct across multiple populations and over time, parameter estimates and standard errors can become biased leading to type I and type II errors due to measurement error being modeled rather than true associations (Cole & Preacher, 2014). More specifically, these findings indicate that structural equation modeling, especially with latent variables, is a more than sufficient method to test relationship mindfulness among White and Black women; however, when latent means become more critical parameters (e.g., growth curve analysis), the lack of scalar invariance becomes more problematic.

We also found that the PNRQ is a culturally sensitive measure of relationship quality in our sample. The PNRQ

has been validated using advanced psychometric techniques (e.g., IRT; Rogge et al., 2017), but to our knowledge, had yet to be tested across race. We found support for invariance across race for the PNRQ indicating that the scale assesses the relationship quality in the same manner for Blacks and Whites. Given that the nature of the scale is an implicit assessment of relationship quality, it is unsurprising that adults who live in the same country, and even same geographic region, ascribe similar meaning to the adjectives. Invariance may not hold for those from different cultural backgrounds outside the United States. The invariance of the measures is particularly fruitful, both for the PNRQ and the RMM, as they are both brief measures (8 items and 5 items, respectively) and are well suited for both longer surveys and could be slightly modified for use in short-term longitudinal data collection (e.g., daily diary) where the number of items that can be given to respondents is limited.

Following the establishment of scalar measurement invariance, we conducted a multiple group structural equation model to estimate the associations between relationship mindfulness and positive and negative relationship quality in White and Black women. Consistent with previous research, we found that relationship mindfulness was positively linked to positive relationship quality and inversely linked with negative relationship quality (Fitzgerald, 2022; Morris et al., 2023; Stanton et al., 2021). We extend research, to our knowledge, by considering the associations between relationship mindfulness and positive and negative relationship quality across race. We found that the associations between relationship mindfulness and positive and negative relationship quality were not significantly different between White and Black women. This finding is in contrast with our hypothesis that relationship mindfulness would have a stronger influence on Blacks’ relationship quality due to their more collectivistic values regarding relationships. Blacks’ may tend to be more mindful in their romantic relationships as a result of their cultural background (Brewer & Chen, 2007), however, with the adoption of Western norms and behaviors within relationships (Dixon, 2014), the meaningfulness of mindfulness in their relationships may have diminished. Thus, the “westernization” of mindfulness, including mindfulness in one’s relationship, is a similar process for White and Black women. Additionally, we measured relationship quality as our dependent variable and the effects of relationship mindfulness may have a similar impact on how individuals rate their relationship, but racial differences may emerge if the outcome variable was a more specific domain such as dyadic coping or conflict. Although the PNRQ is a concise and efficient measure, it does not identify specific areas of adult relationships where relationship mindfulness may be more or less salient across race (DiLillo et al., 2009; Fitzgerald, 2022). Stated another way, implicit measures cannot provide information on what is bad

or enjoyable about the relationship. Future research would do well to test racial differences in relationship mindfulness in a more nuanced way.

### Limitations and Future Directions

Despite several strengths of the study, the findings should be interpreted in light of its limitations. First, the current study was cross-sectional, thus temporal ordering of the constructs cannot be established, and longitudinal data are necessary to establish directionality between relationship mindfulness and relationship quality. Despite the use of a convenience sample of college and graduate students, which embodied diversity related to marital status, age, parental status, and employment, the sample was limited to education-seeking women, which limits generalization of the findings to other racial groups and men. The use of alternate and more robust sampling strategies would strengthen conclusions drawn. A third limitation is that we only used one partner, so we are missing valuable information regarding (1) invariance across gender (and other cultural groups) and (2) relationship mindfulness is inherently a dyadic construct so the inclusion of the partner in understanding the associations between relationship mindfulness and positive and negative relationship quality is needed. We specifically want to point readers to the fact that we examined race as a moderating variable in both the factor structure and structural parameters, but did not account for cultural differences. There may be cultural differences (e.g., Irish vs German heritage) within a single race (e.g., White). Another limitation is that we were unable to examine longitudinal invariance due to the measures only being assessed at Time 1; the RMM in particular has demonstrated only partial metric invariance over time (Kimmes et al., 2018).

Findings from the current study highlight several important contributions including (1) the RMM and the PNRQ perform well among White and Black education seeking women, and (2) provide initial correlations between the invariant constructs across race with notable differences. These findings will hopefully spur future research into the interrelationships between these constructs in diverse populations and over time.

**Author Contributions** Michael Fitzgerald: conceptualization, methodology, data analysis, writing – original draft preparation, reviewing and editing. Viktoria Papp: writing – original draft preparation, reviewing and editing. Jana Payne: writing – original draft preparation, reviewing and editing.

**Data Availability** The data are not available because participants were not informed that their data would be publicly available in a de-identified manner; therefore, participants did not provide informed consent for their data to be shared.

### Declarations

**Ethics Approval** All procedures performed involving human participants were in accordance with the ethical standards of the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The study was approved by the internal review board at the University of Southern Mississippi.

**Informed Consent** Informed consent was obtained electronically from all individual participants included in the study. Data are not available as participants didn't provide consent to have data publicly shared.

**Conflict of Interest** The authors have no relevant financial or non-financial interests to disclose.

**Use of Artificial Intelligence** AI was not used.

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