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Prospective relationships between skin color satisfaction, body satisfaction, and binge eating in Black girls

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Abstract

Adolescence Although it has been demonstrated that (a) body dissatisfaction and internalization of societal appearance standards contribute to disordered eating and (b) that internalization of societal appearance standards leads to decreased skin color satisfaction among Black women, it has not been established whether skin color dissatisfaction contributes to disordered eating among Black women or girls. The objective of the present study is to determine the influence of skin color satisfaction as a potential predictor for binge eating, and its effect through body image in Black girls during the vulnerable developmental period of adolescence. Using data from ten annual measurements in 1213 Black girls across ages 10–19, we sought to determine whether skin color satisfaction predicts Binge Eating Disorder (BED) risk and symptoms using pre-registered logistic and multilevel models. We found that lower skin color satisfaction at ages 13 and 14 significantly predicted greater odds of BED and lower skin color satisfaction at all ages predicted greater BED symptoms. Body satisfaction mediated the relationship between skin color satisfaction and BED

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Jordan E. Parker: Conceptualization, Methodology, Formal analysis, Funding acquisition, Writing – original draft, Writing – review & editing. **A. Janet Tomiyama:** Conceptualization, Methodology, Supervision. **Craig K. Enders:** Methodology, Software, Formal analysis, Supevision, Writing – review & editing. **Mahasin S. Mujahid:** Methodology, Supervision, Writing – review & editing. **Barbara A. Laraia:** Methodology, Funding acquisition, Supervision, Writing – review & editing. **Elissa S. Epel:** Methodology, Funding acquisition, Supervision, Writing – review & editing

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.bodyim.2022.04.004.

symptoms. Our results suggest that skin color dissatisfaction is a novel component of body image for Black girls that is also related to binge eating.

Keywords

Body dissatisfaction; Skin color satisfaction; Binge eating; Black women; Intersectionality; Adolescence

1. Introduction

The way that we think about, criticize, and disapprove of our bodies can lead to profound, long-term consequences. Women in particular live in, experience, and often negatively evaluate their bodies amidst changing sociocultural landscapes, with body satisfaction varying widely across racial groups (Awad et al., 2015). As such, body satisfaction should receive careful attention as a component of an individual's self-evaluation, yet it has not been extensively characterized through an intersectional lens. To date, many studies on body image have focused on analyses across or between racial groups, with far less literature seeking to characterize within-racial group differences. For example, one dominant viewpoint is that when compared with white women, Black women present with higher levels of body satisfaction (Gordon et al., 2010; Lokken et al., 2008) and perhaps due to cultural norms that favor fuller figured bodies, Black women also maintain a more favorable view of larger body sizes and worry less about dieting and weight fluctuations (Rucker & Cash, 1992). In large part, this research has framed body image for Black women through a white lens, measuring body satisfaction through superimposing a white standard to the Black experience (Watson et al., 2019).

The apparent trend of high levels of body satisfaction among Black women may have more to do with the use of methods that utilize white-centric beauty norms as the standard against which to measure the ideal body (Lowy et al., 2021; Watson et al., 2019). Current literature agrees that existing theoretical models and empirical measures were developed in and for primarily white populations (Kashubeck-West et al. 2013), thus relying heavily on a concept of beauty that is white-dominant and neglecting to examine racial and cultural factors that may be relevant (Cassidy et al., 2015). Recent work to validate traditional metrics in diverse populations suggests that body dissatisfaction for Black women may not be adequately captured by traditional measures (like the Multidimensional Body Self-Relations Questionnaire and Eating Disorders Inventory-3; Kashubeck-West et al., 2013) and affirms that beauty ideals do differ between Black and white women (Davis et al., 2010). Further, meta-analyses indicate that the lower levels of body dissatisfaction reported by Black women in previous studies were not only of small effect sizes, but even those small effects have diminished over time (Roberts, Cash, Feingold, & Johnson, 2006). Taken together, these findings suggest that a large portion of body image research to date would benefit from measuring and recognizing the culturally salient and gendered-racial components of body image construction in Black women. Here, we theorize that aspects of body image subjected to gendered and racialized beauty norms may contribute to body dissatisfaction, ultimately increasing risk for binge eating.

1.1. Positionality

We and others (e.g., Lowy et al., 2021; Watson et al., 2019) assert that the study of body image in Black women has been historically reported from the perspective of and has been measured through the lens of white academics. We also acknowledge the importance of critical reflexivity (Cole, 2020), or the importance of disclosing how an individual's identity and standpoint may influence the perspective through which a study is written, conducted, and reported. Thus, we recognize the importance of acknowledging our positionality in authoring this manuscript as it undoubtedly influences how we choose to write about, analyze, and report on data related to body image in Black women. The first author identifies as a millennial, upper middle-class, cisgender, Black woman and is a psychology doctoral student who studies body image, eating behaviors and health in Black women through the lenses of intersectionality and Black feminism. The second author identifies as a white male quantitative psychologist, whose research expertise centers on missing data methodologies. The third author is a social epidemiologist who identifies as a Black cisgender and heterosexual woman and mother from a multi-faith family. As a scientist, educator, and mentor, her lived experiences inform her interest in racial/ethnic and place-based health inequities. The fourth author is a senior researcher who is a cisgender, white, upper middle-class female with expertise in the measurement and analysis of dietary intake, food security, and eating behaviors. Her research focuses on identifying and addressing social determinants of diet-related health outcomes. The fifth author is a mid-life, upper middle-class, white woman with a background in health psychology and health disparities. The senior author identifies as an Asian American, upper middle-class, cisgender woman who is a social health psychologist with interests in weight stigma, body image, stress, and eating behavior.

In this vein, we would also like to define identity terminology used throughout this manuscript. First, we conceptualize race as a socially constructed category, rather than one that is biologically bound (Braun & Saunders, 2017; Roth, 2016). We refer to Black as a racial identity, encompassing all individuals of Black and African descent, whether foreign born or born in the United States, and including various ethnic identities. Whereas not all individuals who identify as Black identify as African American (e.g., Black people born outside of the U.S.), individuals who identify as African American typically also identify as Black, making Black a more inclusive term for individuals with a lived experience of Blackness. We use the term woman to refer to an individual's gender identity, however, to our knowledge, no studies included transgender women, and thus more accurately reflect cisgender women's experiences.

1.2. Theoretical foundations

As articulated by legal scholar Kimberlé Crenshaw in the late 1980's, intersectionality theory critiques the previous tendency of law and other structural entities to consider racial and gender discrimination separately, effectively excluding Black women at the center of both systems of oppression (Crenshaw, 1993)—per Crenshaw, race and gender cannot be considered mutually exclusive lived experiences. This idea is a central tenet of Black feminism, which critiques not only the patriarchal structure embedded in society, but also (white) feminism, which reduces the feminine experience through the erroneous

belief that to be a woman can be separated from being a Black woman (Combahee River Collective, 1995). Black women, that is, experience a distinct "material reality" and as such, their experiences should be articulated and conceptualized through their own lens (Collins, 1989). The origins of intersectionality did not begin with Crenshaw, as is widely held, but rather, her argument drew from and paid homage to a rich legacy of the work of Black women throughout history who sought to articulate how intersecting systemic oppressions shaped their lived experiences of social inequality (Cole, 2020; Collins, 2000). It is worth noting that the interpretations and use of intersectionality have varied significantly since its conception, from its application to other marginalized groups to its application as an identity-based framework (Cole, 2020). In line with other experts on intersectionality, Cole (2020) argues that its intent is not to center on the identities held by Black women but rather "the subject position and social location of Black women and the vulnerabilities they face at this intersection." In fact, both Black feminist thought and intersectionality represent an effort on behalf of Black women to articulate and validate their own experiences, as well as produce knowledge from a self-defined standpoint (Collins, 2000).

Applying the concept of intersectionality to body image, objectification theory offers a theoretical framework through which research can contextualize lived experience for Black women. Although objectification theory, itself, does not integrate the influence of race, its focus on sexism may allow for an extrapolation of how sexism *and* other forms of oppression influence body image. This framework, proposed by (Fredrickson & Roberts (1997), posits that the primary view through which women conceptualize themselves in a sexist society is from the standpoint of the observer, wherein recurrent objectification by others leads to self-objectification (Schaefer et al., 2018). These interpersonal and individual level processes can then lead women to excessive surveillance of their own bodies, through the lens of how they are perceived by others, and result in decreased body satisfaction and increased body shame when women perceive that their bodies are discrepant from those that society idealizes. Although all women are subjected to objectification by society, race undoubtedly plays a role in one's interpretation and experience of said objectification. Through integrating Black feminist theory with objectification theory, Watson et al. (2012) posit that the modern objectification of Black women stems from historical abuse by slave owners and dehumanization through social Darwinist ideology, which operated to recognize Black women for only the physical ability of their bodies (i.e. reproduction for slave labor, sexual temptation) while negating their personhood. These sources of institutionalized degradation served as the script through which Black women were acculturated to view their position in society and further support the notion that body image in Black women should be conceptualized distinctly from other racial groups.

1.3. Considering unique contributions to body image in Black women

Using an intersectionality framework, several studies have identified attributes like skin tone and hair as body image concerns specific to Black women, whose ideals are a result of dueling definitions of beauty between Black and white-centric norms (Awad et al., 2015; Capodilupo & Kim, 2014). Previous literature also suggests that Black women idealize larger body shapes and sizes, rating thinness as less desirable (Fujioka, Ryan, Agle, Legaspi, & Toohey, 2009) often in favor of a more curvy ideal (Hernández et al., 2021; Hunter,

Kluck, Ramon, Ruff, & Dario, 2021; Kelch-Oliver & Ancis, 2011). While recent studies argue that popular culture is moving toward acceptance and idealization of curvier figures (Hunter et al., 2021), this trend is not new among Black women, for whom idealization of curvier shapes ties more closely to cultural context (Kelch-Oliver & Ancis, 2011) rather than contemporary, mainstream norms (Chin Evans & McConnell, 2003). Although a body of research suggests that Black women are protected from pervasive body image concerns due to retention of said cultural beauty norms (i.e., fuller figures, lips and hair), other evidence demonstrates that Black women are not immune to white-centric beauty standards (Capodilupo & Kim, 2014). Moreover, research shows that the protective nature of Black-centric beauty norms has been so deeply co-opted by white women that traditionally Black features, such as full lips and curves, are no longer seen as beautiful on Black women (Awad et al., 2015; Kelch-Oliver & Ancis, 2011).

Several studies also use an intersectional lens to examine how gendered racism, or the interconnection between racism and sexism (Lewis & Neville, 2015), is experienced by Black women and may affect body image. One study found that for Black women, gendered racial microaggressions, defined as subtle verbal and behavioral expressions of oppression based on one's race and gender, can specifically convey expectations and standards for Black women's physical appearances. Messaging that conveys assumptions about Black women's bodies—such as their body shape, size, skin color, and hair—was identified as a core feature of gendered racial microaggressions (Lewis & Neville, 2015). Using the same scale, Dunn and colleagues (2019) found that these gendered racial microaggressions restrict body appreciation for Black women, influencing self-worth and evaluation of their own bodies (Dunn, Hood, & Owens, 2019).

Among Black women, both racism and sexism impact body image in that these forms of oppression are pathways through which the superiority of white-centric beauty messaging is delivered (Kempa & Thomas, 2000); however, in addition to the forms of oppression perpetuated against Black women by racism and sexism, they also contend with discrimination in the form of colorism. Whereas we understand racism and discrimination as having an impact on the Black community in relation to other racial groups, colorism, or the preferential treatment of same-race people based solely on their skin color (Walker, 1983), has a profound impact *within* the Black community wherein Black people with lighter skin receive preferential treatment or opportunities over Black people with darker skin. This racial stratification system represents another unerasable legacy of the institution of slavery, which not only privileged whiteness over blackness but also lighter Black skin over darker Black skin. Existing research on colorism asserts that lighter skin is associated with more years of education, better jobs, higher rates of employment, and higher salaries (Goldsmith, Hamilton, & Darity, 2007; Keith & Herring, 1991; Monk, 2014, 2021). Perceived skin tone is also a key source leading to differential exposure to discrimination (Adams, Kurtz-Costes, & Hoffman, 2016; Klonoff & Landrine, 2000), and further, there is a significant relationship between skin tone and allostatic load in which darkest skinned Black individuals have the highest and lighter skinned Black individuals have the lowest allostatic load (Cobb et al., 2016).

1.4. The role of skin color in body image construction

Several studies assert that skin color plays a central role in body image construction for Black women. Bond and Cash (1992) were among the first to examine the role of skin color in body image construction, finding that skin color dissatisfaction is associated with negative evaluation of appearance. Other studies support this notion, concluding that skin color satisfaction accounts for a significant amount of variance in appearance evaluation (Falconer & Neville, 2016). An individual's skin color is also one of the primary features of body image subjected to racial phenotypicality bias, wherein features seen as representative of a minoritized racial group are particularly scrutinized and consequently play a central role in one's self view (Maddox, 2004). When examined through an intersectional lens, colorism has a disproportionate impact—skin tone bias is more readily applied to Black women and girls than it is to Black men and boys (Abrams, Belgrave, Williams, & Maxwell, 2020; Hill, 2002; Hunter, 2002; Thompson & Keith, 2001). For example, while skin tone has little to no effect on ratings of attractiveness for Black men, among Black women, the effect of skin tone on rated attractiveness is "dose-dependent," such that as skin color deepens, ratings of attractiveness decrease monotonically (Hill, 2002). Skin color affects not only how Black women are seen by others, but also how they see and evaluate themselves (Falconer & Neville, 2016; Mucherah & Frazier, 2013). In fact, Black women anticipate being evaluated not only by their body shape and size, but also their skin tone, resulting in excessive surveillance of this aspect of their body image (Awad et al., 2015; Buchanan, Fischer, Tokar, & Yoder, 2008; Schaefer et al., 2018).

A theoretical perspective that accommodates the literature on body image and intersectionality is the Tripartite Influence Model, a model of body satisfaction that has been validated across racial groups (Burke et al., 2021). This model theorizes that one pathway through which body satisfaction is influenced is through promotion of societal beauty standards by parents, peers, and representations in the media (Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999)—internalization of those standards drives body dissatisfaction (Dakanalis et al., 2015). Among Black women, the degree of internalization of white beauty standards has a significant influence on skin color satisfaction, wherein the more strongly one internalizes white-centric beauty norms, the lower one's skin color satisfaction (Falconer & Neville, 2016; Harper & Choma, 2019; Maxwell, Brevard, Abrams, & Belgrave, 2015). Thus for Black women, internalization of societal beauty standards leads not only to body dissatisfaction, but also to skin color dissatisfaction, suggesting that white-centric beauty norms affect specific, racially-salient components of body satisfaction in addition to global body image.

1.5. Body image during adolescence

Black women's body image is particularly important to study during adolescence (we use the term "girls" to describe the period of adolescence, and define adolescence according to the definition from the World Health Organization, as reflecting the phase of life between childhood and adulthood, from approximately ages 10–20; WHO Expert Committee on Health Needs of Adolescents, & World Health Organization, 1977). Dissatisfaction with one's body and initial issues with body image often first present during the early teens, when there is increased attention placed on body shape and size (Voelker, Reel, & Greenleaf,

2015). Adolescents may also be particularly vigilant of their bodies as they reach puberty, when their bodies are constantly changing and they begin the processes of self-comparison when it comes to establishing relationships with others (Kelch-Oliver & Ancis, 2011).

The attitudes that perpetuate colorism also often originate and are socioculturally reinforced during this developmental period. One study among Black girls ages 12–16 confirmed that not only do they equate light skin with beauty and dark skin with unattractiveness, but they also understand broader societal implications of skin tone including skin color as an index of social status, socioeconomic mobility, education, achievement potential, and desirability of personality traits (Abrams et al., 2020). Although these findings demonstrate that Black girls exhibit preferences for skin color that are associated with colorist attitudes, it has not been established how these attitudes affect their skin color satisfaction, or how ensuing (dis)satisfaction with one's skin color may be related to body image disturbances in adolescence, specifically.

1.6. Body dissatisfaction and disordered eating

In women across all ages and racial groups, one well-established downstream consequence of body dissatisfaction is disordered eating (Bucchianeri & Neumark-Sztainer, 2014). While many studies support the notion that body dissatisfaction leads to restrictive eating behaviors such as dieting and purging (Stice & Shaw, 2002), more recent work has demonstrated that body dissatisfaction more generally leads to maladaptive weight control behaviors, which includes binge eating (Andrés & Saldaña, 2014; Lewer, Bauer, Hartmann, & Vocks, 2017). Although it has been widely held that Black women do not suffer from eating disorders, lifetime rates of Binge Eating Disorder (BED) are disturbingly high among Black women, who report being more functionally impaired, have more severe associated mental health consequences, and demonstrate lower levels of help-seeking behavior than white women (Coffino et al., 2019; Sonneville & Lipson, 2018; Taylor et al., 2013). BED—characterized as the severe recurrence of eating large amounts of food without compensatory weight loss behaviors, accompanied by distress and a sense of loss of control over eating (American Psychiatric Association, 2013)—appears to have a distinct pathology in Black women, with specific risk factors that contribute to onset and prognosis (Pike, Dohm, Striegel-Moore, Wilfley, & Fairburn, 2001). While retention of Black cultural beauty norms that favor fuller-figured bodies may be protective against development of body dissatisfaction, subscription to white appearance standards, or idealizing whiteness, might result in greater body dissatisfaction and thus be a potential risk factor for disordered eating. For example, Black college women who feel less of a sense of belongingness in their ethnic group are more likely to present with BED pathology than those who report high levels of belongingness (Shuttlesworth & Zotter, 2011). Further, acculturative stress and internalization of white beauty standards correlate with "unhealthy" eating behaviors in Black women (Abrams, Allen, & Gray, 1993; Kempa & Thomas, 2000). Among other women of color, discrimination attributed to weight and skin color were the most strongly associated with binge eating (Beccia, Jesdale, & Lapane, 2020).

Black girls, specifically, report high levels of loss of control over eating and disinhibited eating, established predecessors of BED (Cassidy et al., 2018). They also report high levels

of body surveillance, a finding that is associated with depression, anxiety, lower self-esteem, and greater body shame—factors that have all been independently linked with disordered eating (Dakanalis et al., 2015; Grabe & Hyde, 2009; Grower, Ward, & Rowley, 2021; Tiggemann & Slater, 2015). Increased body surveillance itself has also been linked to disordered eating among adolescent girls (Jongenelis & Pettigrew, 2020; Schaefer et al., 2018; Slater & Tiggemann, 2010).

1.7. Current study

Although it has been demonstrated that (a) body dissatisfaction and internalization of societal appearance standards contribute to disordered eating and (b) that internalization of societal appearance standards leads to decreased skin color satisfaction among Black women, it has not been established whether skin color satisfaction contributes to binge eating among Black girls. We theorized that aspects of body image for Black women subject to gendered-racism, such as skin color, may lead to and increase risk for disordered eating during the vulnerable developmental period of adolescence. The objective of the present study was to determine the predictive ability of skin color satisfaction in Black girls and establish its potential as a predictor for binge eating. We hypothesized that (1) decreases in skin color satisfaction will predict increases in binge eating across ages 10–19 and (2) that body satisfaction will mediate the relationship between skin color satisfaction and binge eating.

2. Methods

2.1. Study design

Data for the present study were collected as part of the National Heart Lung and Blood Institute's Growth and Health Study (NGHS), a longitudinal cohort study aimed at determining the psychosocial factors associated with the development of obesity in a diverse sample. The study began enrollment in 1987 across three primary recruitment sites in Richmond, California, Washington, D.C., and Cincinnati, Ohio. Participants were recruited from school-based populations in Richmond and Cincinnati, and from families enrolled in a health-maintenance program in Washington, D.C. The study and participant cohort has been extensively described elsewhere (The National Heart, Lung, and Blood Institute Growth and Health Study & Research Group, 1992).

2.2. Participants

From 1987–1989, investigators enrolled 2379 girls (1213 Black and 1166 white) across the three study sites, who were no more than 2 weeks younger or older than 9 or 10 years old, respectively, at the time of enrollment. Inclusion criteria for the original study were: self-reported race of Black or white and living with parent/guardian(s) that were racially concordant with the enrollee, willing to consent on behalf of the minor, and willing to provide household demographic information about the child and their family. Further descriptive information on this sample has been previously published elsewhere (The National Heart, Lung, and Blood Institute Growth and Health Study & Research Group, 1992). The present analyses focus on the sample of 1213 Black girls who met the initial study's enrollment criteria. Data were collected via home visit at ten annual timepoints,

wherein a trained study staff member administered questionnaires, collected anthropometric measurements, and obtained biospecimens. Demographic data on each participant was collected from both the primary participant (child) and their parent/guardian.

2.3. Measures

The NGHS study was designed to examine trends relating to eating behaviors in Black and white girls, such that the investigators had a specific intent to ensure that study measures were both age- and race-appropriate. Both the dietary/nutrition data collected and the psychosocial measures collected were overseen by respective groups of experts outside of the study itself. Investigators noted that: (1) psychosocial instrument selection was based on appropriateness in terms of age, (2) attention was given to the length of forms, (3) and additional measures were developed by NGHS investigators only to "cover areas for which no pre-existing instruments could be identified." Studies published early in the longitudinal NGHS data support age and race validity (Brown et al., 1995; Kimm et al., 2006; Mcnutt et al., 1997).

2.3.1. Body mass index (BMI)—At in-home visits, certified study staff measured weight and height using an electric scale and stadiometer, respectively. Each measurement was done at least twice and an additional third time if the second measurement differed from the first measurement by 0.5 cm or 0.3 kg. BMI was defined as weight in kilograms divided by squared height in meters and was collected annually across ages 10–19.

2.3.2. Socioeconomic status—Parental income was measured on a four-point categorical scale defined as: (1) less than $5000, (2) $5000–$20,000, (3) $20,000–$40,000, and (4) $40,000 or more. Parental education was defined as the highest level of education obtained by the participant's primary caregiver on a three-point categorical scale: (1) high school or less, (2) 1–3 years post-high school, and (3) 4–year college degree or more. These measures were collected at baseline when the participants were first enrolled in the study.

2.3.3. Skin color satisfaction—The primary predictor variable for this study was skin color satisfaction, which was measured using a 4-point Likert scale question collected at ages 10, 11, 12, 13, 14, and 15. The skin color satisfaction score was reverse-coded in accordance with the body satisfaction score (see below) such that a higher score indicates higher satisfaction. The question read: "How happy or unhappy are you with your skin color?" with the scale: 1 = Very happy, 2 = Happy, 3 = Unhappy, 4 = Very unhappy.

2.3.4. Body satisfaction—Body satisfaction was measured using a 9-item questionnaire developed by the original NGHS investigators (Brown et al., 1995), collected annually from ages 10–19. Items were answered on the same 4-point Likert scale as skin color satisfaction. The score was obtained by summing reverse-coded responses for the 9 items (total score range: 9–36, higher score = higher satisfaction). Seven out of the 9 items on the scale were derived from the Body Esteem Scale (Franzoi & Herzog, 1986); however, wording of the questions and rating scale were adapted by the original NGHS investigators to be more age accessible. Since the Body Esteem scale only includes questions about the lower body, they also added two additional questions (5 and 6) to make the scale inclusive

to whole body image. Questions included: “(1) How happy or unhappy are you with your present weight?” “(2) How happy or unhappy are you with the way your body looks?” “How happy or unhappy are you with these parts of your body? How happy are you with: (3) Your waist; (4) Your stomach; (5) Your arms; (6) Your breasts; (7) Your legs; (8) Your hips; (9) Your behind?”

Because this measure has not been widely used in other studies outside of NGHS analyses (Brown et al., 1995), we examined its correlation with the more widely used Eating Disorder Inventory – Body Dissatisfaction Subscale (EDI-BD; Garner, Olmstead, & Polivy, 1983) in the years in which both measures were collected in this study. We found a very strong inverse correlation between −0.71 and −0.80 (high body satisfaction score = low EDI-body dissatisfaction; $R^2 = 0.50 – 0.63$), supporting the use of this measure.

2.3.5. Binge Eating Disorder risk and symptoms—Binge Eating Disorder (BED) risk/symptoms were assessed using a custom questionnaire that closely follows the 7-item recommendations by Marcus and Kalarchian (2003) and the Children’s Binge Eating Disorder Scale (C-BEDS; Shapiro et al., 2007) for evaluating behaviors associated with binge eating in children. The questions are presented in Table 1 along with the possible response choices and the timepoints at which each question was collected.

In Year 9 (age 18) only, we were able to ascertain whether participants met criteria for BED (hereafter called “BED risk” vs. the symptom count referred to as “BED symptoms”). This is because in Year 9, there was sufficient information to classify participants using the criteria put forth by Shapiro (2007): answering affirmatively to questions 1 and 2A; answering affirmatively to at least one of questions 3, 4, and 5; and answering negatively to question 6B-I *or* answering affirmatively to question 6A. The BED risk score was coded 0/1 such that 1 indicated that the participant met probable BED criteria.

The continuous BED symptom count variable was calculated for all years. This symptom score was initially derived from questions 1–5 only, given that Q6 reports on *lack* of symptoms. Each of the 5 questions were scored on a 0–2 Likert scale (Never, Sometimes, and Always) and summed. After pre-registration but prior to running analyses, question 2B was excluded from the sum score due to irreconcilable discrepancies between the codebook and the data: it was discovered that the raw data was not coded in accordance with the corresponding codebook and we were unable to find study documentation to reconcile these inconsistencies. Thus, the final BED symptom score used in the present analyses represents the sum of questions 1, 3, 4 and 5 (Cronbach’s alpha = 0.6) with a score range from 0 (no symptoms) to 8 (maximum symptom presentation).

2.4. Analytic plan

2.4.1. Bayesian estimation and missing data handling—Given the longitudinal nature of the data, missingness occurred among all variables. Rates of missing data ranged from 0.08% to 29.5% and are further detailed in Supplemental Materials, Table S1. In our pre-registration, we initially specified the use of Multiple Imputation by Chained Equations (MICE; van Buuren and Groothuis-Oudshoorn, 2011) to address the problem of missing data; however, this imputation method is not well suited for multilevel data and

is particularly problematic in the case of estimating interactions and multilevel mediation, two of the proposed analyses of interest for these data. We determined the appropriate alternative to be Bayesian estimation (Enders, Du, & Keller, 2020), as this framework offers greater flexibility and a more nuanced missing data treatment for our specific analyses. Bayesian estimation uses an iterative Markov chain Monte Carlo (MCMC) algorithm that repeatedly performs two major steps: estimate the model parameters, conditional on the filled-in data set; then use the resulting parameter estimates to estimate (impute) the missing values. Repeating these steps for many iterations (e.g., we used 10,000 for all analyses) yields a distribution of estimates for each model parameter (i.e., a posterior distribution), the center and spread of which (i.e., the posterior median and standard deviation, respectively) function as point estimates and measures of uncertainty (analogous to frequentist point estimates and standard errors). The Bayesian analyses (like the MICE routine from the original preregistration) assume a so-called conditionally missing at random process whereby a person's unseen scores carry no information about missingness above and beyond that contained in their observed data values. This is a typical assumption for contemporary missing data handling procedures. All analyses were performed using the Blimp 3 application (Keller & Enders, 2021), and the specific details for each analysis are given below.

2.4.2. Hypothesis 1a—To test the hypothesis that skin color satisfaction predicted BED risk, we fit logistic regression models at each time point (for ages 10, 11, 12, 13, 14, and 15; Models 1–6) with skin color satisfaction as the focal predictor and BED risk at age 18 as the outcome variable; BMI, parental income (four categories represented as three dummy codes), and parental education (three categories represented as two dummy codes) were covariates in each model. The missing data literature recommends a so-called inclusive approach that includes auxiliary variables that are correlates of the analysis variables or their missingness (Collins et al., 2001). To this end, the logistic model for a given year also included BMI and skin color satisfaction scores from all other waves as auxiliary variables. In Blimp, these auxiliary variables enter as extra dependent variables that are predicted by the analysis variables, so their inclusion does not alter the meaning of the logistic model slopes. The key test of the hypothesis was whether skin color satisfaction at each age predicted BED risk, controlling for parental income/education and BMI. The hypothesis was supported if a null value of 0 fell outside the 95% credible interval.

2.4.3. Hypothesis 1b—To test the hypothesis that skin color satisfaction predicted BED symptoms, we used a multilevel model (Model 7) with repeated measurements (level-1) nested within persons (level-2). The analysis was a two-level random intercept model with skin color satisfaction, measurement occasion (coded 0 through 9), and their interaction as within-person predictors; within-person BMI, parental income (four categories represented as three between-person dummy codes), and parental education (three categories represented as two between-person dummy codes) were covariates in the model. The focal predictor—skin color satisfaction—was centered at each person's own mean (i.e., centering within cluster, or group mean centering) to define this variable's slope as a pure within-person effect (Enders & Tofighi, 2007). Measurement occasion did not require centering because it has a meaningful zero and contains only within-person variation (all participants share

the same scores, so between-person variation is 0 by definition). This model was also fit using Bayesian estimation in Blimp 3. We again adopted an inclusive missing data handling strategy by including body satisfaction as a level-1 auxiliary variable. The key test of the hypothesis was whether there was a significant interaction effect between skin color satisfaction and time, controlling for the covariates. The hypothesis was supported if a null value of 0 fell outside the interaction coefficient's 95% credible interval.

2.4.4. Hypothesis 2—To test the hypothesis that body satisfaction mediates the relationship between skin color satisfaction and binge eating symptoms, we fit a multilevel mediation model (Model 8). Fig. 1 shows a path diagram of the analysis model, which also included within-person BMI, parental income (four categories represented as three between-person dummy codes), and parental education (three categories represented as two between-person dummy codes) as covariates (the figure omits these variables for clarity, but both downstream variables would have incoming arrows from these covariates). The focal predictor and the mediator—skin color satisfaction and body satisfaction—were centered at each person's own mean (i.e., centering within cluster, or group mean centering; Enders & Tofighi, 2007), such that the α and β paths are pure within-person slopes, and the indirect effect is also a within-person process (i.e., a 1–1–1 mediation model; Preacher, Zyphur, & Zhang, 2010).

Multiplying the α and β slopes (i.e., the indirect pathways) defines the product of coefficients estimator of the mediated effect, $\alpha\beta = \alpha \times \beta$. It is widely known that the sampling distribution of the indirect effect can be markedly asymmetric and kurtotic, even when the component pathways follow a normal distribution (MacKinnon, 2008). The Bayesian analysis naturally accommodates this important feature: the MCMC algorithm iteratively estimates α and β, and multiplying each pair of estimates creates a distribution, the shape of which naturally varies according to the component pathways. As noted previously, the upper and lower limits of the 95% credible (confidence) intervals are asymmetric, as recommended in the methodology literature (see Yuan & MacKinnon, 2009 for a more detailed description of the Bayesian mediation procedure). The key test of the hypothesis was whether there was a significant indirect effect, controlling for the covariates. The hypothesis was supported if a null value of 0 fell outside the 95% credible interval of the mediated effect.

2.4.5. Estimation details—When implementing Bayesian estimation for complex models with missing data, it is important to verify that the MCMC algorithm has converged before interpreting the results. Following recommendations from the literature, we used the potential scale reduction factor diagnostics (Gelman & Rubin, 1992) for this purpose. Practically speaking, these diagnostics define the length of the initial burn-in or trial period during which MCMC achieves equilibrium with the data. Based on this information, we specified two MCMC chains with random starting values, each with 20,000 burn-in cycles and 5000 iterations following the burn-in period. The aforementioned distributions thus consist of 10,000 estimates of each parameter. We verified that 10,000 estimates were sufficient by examining the effective number of independent MCMC samples for each parameter, all of which were greater than the recommended value of 100 (Gelman et al.,

2014, p.287). Note that Bayesian estimation does not involve saving and reanalyzing the imputations; rather, the filled-in values are just a temporary means to an end, which is to estimate the parameters at each MCMC cycle. Bayesian estimation is conceptually similar to full information maximum likelihood estimation in this regard.

2.5. Preregistration, data sharing and availability

All analyses were preregistered at https://osf.io/mzp28/. General study data are available per NIH guidelines at https://biolincc.nhlbi.nih.gov/static/studies/nghs/, including the full study protocol, summary of all data collected, additional details on collection procedures, and details on quality assurance. De-identified data and analysis scripts specific to this proposed study are available on the OSF page.

3. Results

Table 2 displays the descriptive statistics for the cohort, stratified by year.

3.1. Logistic regression

We first sought to determine whether skin color satisfaction across ages 10–15 predicted BED risk, controlling for BMI and parental income/education. The results of the logistic regression analyses for Models 1–6 are presented in Tables 3–8 and indicate partial support for Hypothesis 1a. At ages 13 and 14, skin color satisfaction was a significant predictor of BED risk (i.e., the 95% intervals did not include 0; median estimate [95% credible interval] = −0.41 [−0.74, −0.07] and −0.47 [−0.81, −0.13], Tables 6 and 7, respectively) controlling for all other predictors in the model. Among 13-year-old Black girls, the odds of BED were 0.67 lower ($e^b = e^{-0.41} = 0.67$) for each one unit increase in skin color satisfaction, meaning that greater skin color satisfaction was associated with a lower probability of BED diagnosis. The same trend was also true at age 14: for each one unit increase in skin color satisfaction, the odds of BED were 0.62 lower ($e^b = e^{-0.47} = 0.62$). At ages 10, 11, 12, and 15, skin color satisfaction was not a significant predictor of BED risk. These results were not contingent on the inclusion of covariates, such that the uncontrolled models at each time point remained nonsignificant for ages 10, 11, 12, and 15 and significant at ages 13 and 14 (Table S2).

3.2. Multilevel model

We found support for Hypothesis 1b with a multilevel model predicting BED symptoms from skin color satisfaction, time (i.e., age), and the interaction term between skin color satisfaction and time, controlling for BMI and parental income/education. In a moderated regression model, lower-order terms for variables involved in the interaction are conditional effects; the skin color satisfaction regression coefficient represents the influence of that variable when time = 0 (i.e., age = 10), and the time slope gives the influence of age at a person's own mean value (i.e., group mean centering defines 0 as a person's own mean). Thus, the β_1 coefficient, which is effectively 0, indicates a lack of association at age 10. Our results indicate a significant interaction term between skin color satisfaction and time (median estimate = −0.03, 95% CI = [−0.06, −0.002], Table 9). The negative slope suggests that, for every additional year in age, the within-person regression of BED symptoms on skin color satisfaction becomes more negative (i.e., the slope decreases by .03). The bottom

four rows of the table show the simple slopes of skin color satisfaction at different ages; by age 13, increases in satisfaction are significantly associated with a reduction in binge eating symptoms, and the strength of this negative association increases over time. Finally, on an effect size metric, the magnitude of the interaction was subtle; the model with the interaction term explained slightly more variance in BED symptoms when compared to the model without, improving the R^2 effect size from 0.056 (standard deviation = 0.006) to 0.058 (standard deviation = 0.007). The 0.002 R^2-change effect size ($f^2 = 0.002$) represents a small effect—meta-analyses report average effect sizes for interaction terms to be 0.009 (Aguinis, Beaty, Boik, & Pierce, 2005), and suggest benchmarks of 0.005, 0.01, and 0.025 for small, medium, and large effects, respectively (Kenny, 2018). In the uncontrolled model that did not include covariates, this result was no longer significant (Table S3); however, the estimates and inference for the age-specific effects were robust to exclusion of covariates from the model.

3.3. Multilevel mediation

Lastly, we found support for Hypothesis 2, as the 95% credible interval revealed a significant indirect effect of skin color satisfaction on binge eating symptoms, controlling for BMI and parental income/education (Fig. 2; median estimate and CI of $\alpha\beta = -0.05$, [−0.07, −0.03]). The negative indirect effect indicates that a one unit increase in skin color satisfaction decreases binge eating by .05 units indirectly via body satisfaction. This result suggests that body dissatisfaction is indeed a possible mechanism through which skin color satisfaction influences binge eating behaviors, and the α path additionally provides support for the notion that skin color satisfaction is a significant contributor to body satisfaction in Black girls ($\alpha = 2.33$, [2.17, 2.50]). These results are sensitive to inclusion of covariates such that the uncontrolled model is no longer significant (Fig. S1).

4. Discussion

Informed by the theoretical frameworks of intersectionality, Black feminist theory, and objectification theory, we hypothesized that skin color satisfaction represented an influential yet understudied driver of body satisfaction for Black girls. We theorized that dissatisfaction with one's skin color is associated with body dissatisfaction and associated downstream health consequences such as binge eating. Our results were consistent with this: Black girls who were more dissatisfied with their skin color later displayed higher risk of BED and more BED symptoms—a relationship mediated by body dissatisfaction. These findings support the notion that construction of body image is intersectional, and for Black girls, specific body image concerns arise when accounting for influence of both race and gender. We assert that body image among Black women should be measured through a lens that acknowledges the historical and sociocultural contexts in which Black women and girls conceptualize and evaluate their bodies (Mucherah & Frazier, 2013; Rucker & Cash, 1992) to comprehensively evaluate its relationship to disordered eating in this demographic group. Studies reporting lower prevalence of disordered eating and body image disturbances among Black women, perhaps, fail to measure racially-salient components of body image and thus erroneously conclude that Black women generally maintain a more positive body image. An effort to expand the constructs of body image, that is, to include measures with

specific salience for a given racial group, may not only better conceptualize the idealized body, but also contribute to greater inclusivity in eating disorder research. Quantifying the effects of skin color and skin color satisfaction offer one such way that race can be operationalized beyond binary categories and the varying effects of multiple forms of historical and contemporary oppression can be recognized.

The implications of these findings are not only applicable in the study of body image, but also across primary care, clinical psychology, and public health. BED has significant downstream health consequences such as cardiovascular disease, diabetes, cancer, stroke, and all-cause mortality (Agyemang & Powell-Wiley, 2013; de Zwaan, 2001; Centers for Disease Control and Prevention, 2020). Particularly with the significant attention being placed on racial health disparities (U.S. Department of Health and Human Services, n.d.), it becomes critical to elucidate factors contributing to the development of BED as they relate to the intersectional identities of Black women. These results suggest that binge eating, driven not just by body dissatisfaction but also by skin color (dis)satisfaction, could be driving disparities in poor health outcomes in Black women.

4.1. Limitations

The primary predictors and outcome variables for this study are novel. To our knowledge, they are not widely established in the literature in their current form, partially due to this area of research being particularly unique and also due to adaptations done to study measures to promote age appropriateness. The skin color satisfaction scale used in this study mirrors the Skin Color Satisfaction Scale (Falconer & Neville, 2016), which was initially validated in Black college women. The scale as designed by Falconer and Neville (2016) originally contained nine questions, but found that a condensed 4-item, 9-point Likert scale had the highest Cronbach's alpha, 0.71. The items used by Falconer & Neville (2016) reflect a slightly different desired outcome, indexing satisfaction with one's skin color (Item 1) alongside comparing one's skin tone in relation to one's family (Item 2), to other African Americans at large (Item 3), and also reflecting the degree to which an individual desired their skin to be lighter (Item 4). The skin color satisfaction scale used in this study reflects Item 1 only, on a 4-point Likert scale better suited for use in children, and solely measuring one's independent valuation of their skin color. While this operationalization of skin color reflects the desired construct for this study, there are drawbacks to a single item scale. For example, this measure does not ascertain actual, or perceived skin tone and thus, we were not able to determine whether participants were dissatisfied with their skin due to it being too dark or too light. Previous literature, however, does indicate that actual skin tone is not significantly related to body image measures, but skin color satisfaction is (Bond & Cash, 1992).

Moreover, Binge Eating Disorder only recently received DSM-diagnostic criteria (DSM-5, released May 2013), meaning that during this study's data collection, BED was not an officially recognized clinical diagnosis and thus there was no BED-specific scale included in the study measures. However, given the primary interest of the study in examining eating behaviors and obesity risk, there was ample information collected through custom questionnaires that provided diagnostic insight. The BED symptom score and dichotomous

risk were based on current, well-established guidelines derived from meta-analyses and SCID-IV diagnostic criteria for detecting and diagnosing BED in adolescent populations (Marcus & Kalarchian, 2003; Shapiro et al., 2007). While the BED risk assessment more closely followed DSM-V criteria, with the necessary exclusion of Question 2B (capturing severity/frequency of loss of control over eating), the BED symptom score was unable to ascertain loss of control over eating, a core feature of the DSM-V criteria for BED. What the measure does index is: eating in secret, eating as a reward, emotional eating, and eating in the absence of hunger (Table 1). Of note, our models predicting BED risk were robust to inclusion/exclusion of BMI and parental income/education; however, our models predicting BED symptoms were not. This pattern further suggests that the BED risk and symptom variables perhaps capture different aspects of Binge Eating Disorder. Given the stability of the results associated with our BED risk variable, we suggest that greater confidence should be put in the results associated with this outcome.

With respect to future research in this area, it is also of paramount importance to recognize the relative risks and rewards in studying these constructs in developing children. While some studies demonstrate no adverse effects to discussing weight beliefs in young children (Harriger & Trammell, 2021), others suggest that leading questions about one's body may sow seeds of insecurity and negativity that were not previously present (Damiano et al., 2020). Since BED did not receive diagnostic criteria until 2013, prevalence when this study was conducted in the 1980's is not readily available. Modern estimated BED rates range by gender, race, and age, with lifetime prevalence estimated at 2.6% among all U.S. adults (Kessler et al., 2013), 3.5% among women (Hudson, Hiripi, Pope, & Kessler, 2007), and 2.2% among Black women (Goode et al., 2020; Marques et al., 2011). Lifetime prevalence by age 20 is estimated at 5% (Stice, Marti, Shaw, & Jaconis, 2009). Indeed, the percentage of children who met criteria for binge eating in this sample was approximately 7%, higher than modern estimates, perhaps supporting the argument by Damiano and colleagues (2020) that targeted and repeated inquiry with respect to body image and eating behaviors may be counterproductive to healthy development. Though it is critical to understand how young people conceptualize, criticize, and view their bodies and their perception of their eating behaviors, it is arguably far more important to protect participants and take extreme caution with the framing, intensity of involvement, and responsiveness to such questions.

Lastly, we acknowledge potential concerns related to the use of BMI as a control variable. We note that inclusion of BMI as a covariate is not because it is a legitimate marker of adiposity or health (Flegal, Graubard, Williamson, & Gail, 2005; Katzmarzyk et al., 2011; Rothman, 2008; Tomiyama, Hunger, Nguyen-Cuu, & Wells, 2016), rather, it allows us to say that the relationship between skin color (dis)satisfaction and binge eating appears independent of the influence of BMI and it not just an issue prevalent in people with larger bodies. Future studies would be strengthened by instead, controlling for perceived or subjective body size, which may more accurately capture an individual's embodied experience.

4.2. Conclusions

The results of this study suggest that the societal value placed on lightness of skin color has measurable impacts on Black girls. Skin color dissatisfaction predicted longitudinal risk for meeting BED criteria as well as BED symptoms. The relationship between skin color dissatisfaction and BED was mediated by body dissatisfaction, suggesting that skin color dissatisfaction is an influential component of body image for Black girls that may independently promote the negative downstream health consequences of body dissatisfaction, such as binge eating.

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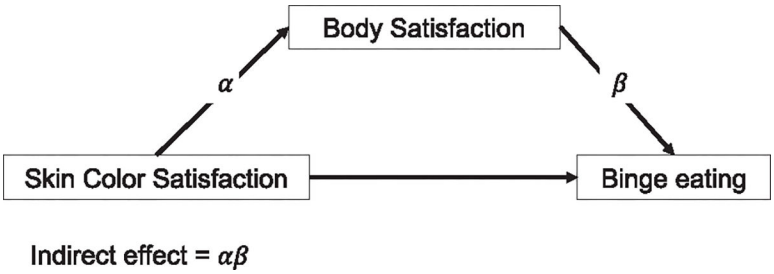

Fig. 1.
Proposed mediation model.

Fig. 2.

Results of mediation analyses with Bayesian inference estimates (median [95% credible interval]) (Model 8).

Table 1

Binge Eating Disorder questionnaire and response choices with measurement tmepoints.

Question	Response choices	Age (s) collected
(1) I eat between meals even when I am not hungry.	Never, Sometimes, Always	10, 11, 12, 13, 14, 15, 16, 18
(2) During the past twelve months, have you eaten unusually large amounts of food at one time and felt that you were unable to stop eating once you started?	A. Yes, No B. If Yes: Never, Sometimes, Always	17, 18, 19
(3) When I am [worried, sad, bored] I eat more.	Never, Sometimes, Always	10, 11, 12, 13, 14, 15, 16, 18
(4) When I do something well, I give myself a food treat	Never, Sometimes, Always	10, 11, 12, 13, 14, 15, 16, 18
(5) I sneak food when no one is looking.	Never, Sometimes, Always	10, 11, 12, 13, 14, 15, 16, 18
(6) During the last 30 days, which of the following did you do to lose weight or keep from gaining weight?	A. I did not try to lose weight or keep from gaining weight. B. I dieted. C. I did not eat at all for one or more days. D. I exercised to lose weight or keep from gaining weight. E. I made myself throw up. F. I took diet pills. G. I used laxatives, ipecac, or diuretics. H. I used diet drinks such as Slim Fast I. I used some other method (specify)	15, 16, 17, 18, 19

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Table 2

Descriptive statistics for demographic, predictor, mediator, and outcome variables for the NGHS cohort stratified by year.

	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	Age 16	Age 17	Age 18	Age 19
Parental education (%)										
≤ High school	31.5%									
1–3 years post-high school	47.4%									
≥ 4-year college degree	21.1%									
Parental income (%)										
< $5000	27.9%									
$5000 – $20,000	19.2%									
$20,000 – $40,000	29.5%									
≥ $40,000	23.3%									
BMI										
Mean (standard deviation)	19.2 (4.2)	20.4 (4.7)	21.5 (5.1)	22.7 (5.4)	23.7 (5.8)	24.4 (6.0)		25.9 (6.9)	26.4 (7.3)	27.0 (7.5)
Skin color satisfaction										
Mean (standard deviation)	3.6 (0.7)	3.6 (0.6)	3.6 (0.6)	3.5 (0.6)	3.5 (0.6)	3.6 (0.6)				
Body satisfaction										
Mean (standard deviation)	28.8 (5.2)	28.2 (5.4)	27.9 (5.7)	27.1 (5.3)	26.7 (5.7)	26.5 (5.5)	26.2 (5.9)	25.6 (5.9)	25.4 (6.0)	25.2 (5.9)
BED symptoms										
Mean (standard deviation)	2.7 (1.9)	2.4 (1.8)	2.0 (1.7)	1.9 (1.6)	1.9 (1.6)	1.8 (1.5)	1.8 (1.5)	1.6 (1.4)		1.8 (1.5)
BED risk (%)									6.7%	

Note. Values presented in table for parental income, parental education, and BED risk are the percentage of the total sample represented in each category. Values presented for BMI, skin color satisfaction, body satisfaction and BED symptoms are means and (standard deviations).

Table 3

Logistic regression results at age 10 (Model 1)

Parameter	*Mdn*	*SD*	LCL	UCL	OR
β_0	−1.62	0.90	−3.43	0.07	0.20
β_1 (*SKIN COLOR SATIS.*)	−0.06	0.18	−0.39	0.44	0.95
β_2 (*BMI*)	−0.05	0.03	−0.11	0.01	0.96
Parental Education					
(≤ *HIGH SCHOOL*)	Reference Group				
β_3 (*1–3 YRS POST-HIGH SCHOOL*)	−0.09	0.29	−0.65	0.49	0.92
β_4 (≥ *4-YR COLLEGE DEGREE*)	−0.66	0.43	−1.53	0.15	0.52
Parental Income					
< ($5000)	Reference Group				
β_5 ($5000 – $20,000)	0.16	0.39	−0.61	0.93	1.17
β_6 ($20,000 – $40,000)	0.34	0.36	−0.33	1.05	1.40
β_7 (≥ $40,000)	0.19	0.42	−0.62	1.00	1.21
R^2	.06	.03	.02	.13	–

Note. Values presented in the table are median point estimates (in log odds units) for the logistic regression coefficients and their standard deviations. LCL, UCL, and OR correspond to the lower credible limit, upper credible limit and odds ratios.

* denotes a significant 95% credible interval.

Table 4

Logistic regression results at age 11 (Model 2)

Parameter	*Mdn*	*SD*	LCL	UCL	OR
β_0	−1.84*	0.90	−3.61	−0.10	0.16
β_1 (*SKIN COLOR SATIS.*)	−0.02	0.19	−0.37	0.38	0.98
β_2 (*BMI*)	−0.04	0.03	−0.10	0.02	0.96
Parental Education					
(≤ *HIGH SCHOOL*)	Reference Group				
β_3 (*1–3 YRS POST-HIGH SCHOOL*)	−0.10	0.30	−0.67	0.49	0.91
β_4 (≥ *4-YR COLLEGE DEGREE*)	−0.66	0.42	−1.50	0.14	0.52
Parental Income					
< ($5000)	Reference Group				
β_5 ($5000 – $20,000)	0.14	0.40	−0.64	0.93	1.15
β_6 ($20,000 – $40,000)	0.33	0.37	−0.37	1.07	1.39
β_7 (≥ $40,000)	0.16	0.41	−0.63	0.99	1.17
R^2	.06	.03	.02	.13	–

Note. Values presented in the table are median point estimates (in log odds units) for the logistic regression coefficients and their standard deviations. LCL, UCL, and OR correspond to the lower credible limit, upper credible limit and odds ratios.

*denotes a significant 95% credible interval.

Table 5

Logistic regression results at age 12 (Model 3)

Parameter	*Mdn*	*SD*	LCL	UCL	OR
β_0	−0.86	0.87	−2.60	0.86	0.42
β_1 (*SKIN COLOR SATIS.*)	−0.23	0.19	−0.59	0.15	0.80
β_2 (*BMI*)	−0.05	0.03	−0.11	0.002	0.96
Parental Education					
(≤ *HIGH SCHOOL*)	Reference Group				
β_3 (*1–3 YRS POST-HIGH SCHOOL*)	−0.08	0.30	−0.65	0.51	0.92
β_4 (≥ *4-YR COLLEGE DEGREE*)	−0.63	0.43	−1.51	0.19	0.53
Parental Income					
< ($5000)	Reference Group				
β_5 ($5000 – $20,000)	0.17	0.40	−0.61	0.93	1.18
β_6 ($20,000 – $40,000)	0.39	0.36	−0.36	1.06	1.40
β_7 (≥ $40,000)	0.15	0.42	−0.69	0.94	1.16
R^2	.07	.03	.02	.15	–

Note. Values presented in the table are median point estimates (in log odds units) for the logistic regression coefficients and their standard deviations. LCL, UCL, and OR correspond to the lower credible limit, upper credible limit and odds ratios.

* denotes a significant 95% credible interval.

Table 6

Logistic regression results at age 13 (Model 4)

Parameter	*Mdn*	*SD*	LCL	UCL	OR
β_0	−0.61	0.79	−2.20	0.92	0.54
β_1 (*SKIN COLOR SATIS.*)	−0.41*	0.17	−0.74	−0.07	0.67
β_2 (*BMI*)	−0.03	0.03	−0.08	0.02	0.97
Parental Education					
(≤ *HIGH SCHOOL*)	Reference Group				
β_3 (*1–3 YRS POST-HIGH SCHOOL*)	−0.05	0.30	−0.62	0.54	0.96
β_4 (≥ *4-YR COLLEGE DEGREE*)	−0.58	0.43	−1.46	0.23	0.56
Parental Income					
< ($5000)	Reference Group				
β_5 ($5000 – $20,000)	0.17	0.40	−0.62	0.95	1.18
β_6 ($20,000 – $40,000)	0.31	0.36	−0.39	1.05	1.36
β_7 (≥ $40,000)	0.13	0.41	−0.66	0.95	1.14
R^2	.08	.03	.03	.15	–

Note. Values presented in the table are median point estimates (in log odds units) for the logistic regression coefficients and their standard deviations. LCL, UCL, and OR correspond to the lower credible limit, upper credible limit and odds ratios.

*denotes a significant 95% credible interval.

Table 7

Logistic regression results at age 14 (Model 5)

Parameter	*Mdn*	*SD*	LCL	UCL	OR
β_0	−0.59	0.81	−2.18	0.98	0.55
β_1 (*SKIN COLOR SATIS.*)	−0.47*	0.17	−0.81	−0.13	0.62
β_2 (*BMI*)	−0.02	0.02	−0.07	0.02	0.98
Parental Education					
(≤ *HIGH SCHOOL*)	Reference Group				
β_3 (*1–3 YRS POST-HIGH SCHOOL*)	−0.04	0.30	−0.61	0.54	0.97
β_4 (≥ *4-YR COLLEGE DEGREE*)	−0.63	0.43	−1.48	0.17	0.53
Parental Income					
< ($5000)	Reference Group				
β_5 ($5000 – $20,000)	0.16	0.40	−0.62	0.91	1.17
β_6 ($20,000 – $40,000)	0.34	0.36	−0.35	1.06	1.41
β_7 (≥ $40,000)	0.23	0.41	−0.58	1.03	1.25
R^2	.08	.03	.03	.15	–

Note. Values presented in the table are median point estimates (in log odds units) for the logistic regression coefficients and their standard deviations. LCL, UCL, and OR correspond to the lower credible limit, upper credible limit and odds ratios.

* denotes a significant 95% credible interval.

Table 8

Logistic regression results at age 15 (Model 6)

Parameter	*Mdn*	*SD*	LCL	UCL	OR
β_0	−2.15*	0.95	−4.05	−0.36	0.12
β_1 (*SKIN COLOR SATIS.*)	0.05	0.22	−0.36	0.50	1.06
β_2 (*BMI*)	−0.03	0.02	−0.07	0.01	0.97
Parental Education					
(≤ *HIGH SCHOOL*)	Reference Group				
β_3 (*1–3 YRS POST-HIGH SCHOOL*)	−0.11	0.29	−0.68	0.47	0.89
β_4 (≥ *4-YR COLLEGE DEGREE*)	−0.65	0.42	−1.50	0.15	0.52
Parental Income					
< ($5000)	Reference Group				
β_5 ($5000 – $20,000)	0.15	0.39	−0.64	0.92	1.16
β_6 ($20,000 – $40,000)	0.31	0.35	−0.38	1.00	1.36
β_7 (≥ $40,000)	0.13	0.41	−0.66	0.93	1.14
R^2	.06	.03	.02	.13	–

Note. Values presented in the table are median point estimates (in log odds units) for the logistic regression coefficients and their standard deviations. LCL, UCL, and OR correspond to the lower credible limit, upper credible limit and odds ratios.

*denotes a significant 95% credible interval.

Table 9

Multilevel model results for hypothesis 1b (Model 7)

Parameter	*Mdn*	*SD*	LCL	UCL
β_0	3.05*	0.13	2.78	3.31
β_1 (*SKIN COLOR SATIS.*)	−0.003	0.05	−0.11	0.10
β_2 (*TIME)*	−0.10*	0.01	−0.11	−0.09
β_3 (*BMI*)	−0.02*	0.01	−0.03	−0.01
Parental Education				
(≤ *HIGH SCHOOL*)	Reference Group			
β_4 (*1–3 YRS POST-HIGH SCHOOL*)	0.06	0.10	−0.15	0.25
β_5 (≥ *4-YEAR COLLEGE DEGREE*)	−0.06	0.13	−0.32	0.18
Parental Income				
(< $5000)	Reference Group			
β_6 ($5000 – $20,000)	−0.16	0.13	−0.41	0.11
β_7 ($20,000 – $40,000)	−0.28*	0.12	−0.51	−0.05
β_8 (≥ $40,000)	−0.33*	0.13	−0.60	−0.09
β_9 (*SKIN COLOR SATIS.* × *TIME*)	−0.03*	0.02	−0.06	−0.002
Intercept var.	0.92	0.05	0.83	1.02
Residual var.	1.70	0.03	1.64	1.75
R^2	0.06*	0.01	0.05	0.07
Conditional Effects by Age				
SKIN COLOR SATIS. at				
AGE = 10	−0.003	0.05	−0.11	0.10
AGE = 13	−0.10*	0.03	−0.16	−0.04
AGE = 16	−0.20*	0.06	−0.31	−0.09
AGE = 19	−0.29*	0.10	−0.48	−0.10

Note.

* indicates significant 95% credible interval. Point estimates presented in the table represent the median of the Bayesian posterior distribution, its standard deviation, and the 95% credible interval around the point estimate. LCL and UCL correspond to the lower and upper credible limits, respectively.