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Exploring the Associations of Being Exposed to Positive and Negative Body Talk with Self-Objectification, Appearance Comparison, Body Appreciation, Emotion Status, and Drive for Muscularity: Application of a Mixed-Effects Location Scale Model

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By

Yuhan Chen

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Faculty Advisor: Donald Hedeker

Preceptor: Marshall Ryan Jean

Abstract

Study Objectives:

The purpose of this study was to apply a Mixed-Effects Location Scale (MELS) Model, which allows for examining how covariates affect both the mean and variance structures, to analyze the impact of body talk on self-objectification, appearance comparison, body appreciation, emotional status, and drive for muscularity.

Methods:

Data were collected from 120 female undergraduate students over a 7-day Ecological Momentary Assessment (EMA) period. Exposure to positive and negative body talks was assessed through binary questions in the EMA questionnaire. Self-objectification, appearance comparison, body appreciation, emotional status, and drive for muscularity were measured by the Objectified Body Consciousness Scale (OBCS), the State Appearance Comparison Scale (SACS), the Body Appreciation Scale-2 (BAS-2), the International Positive and Negative Affect Schedule Short Form (I-PANAS-SF), and the Drive for Muscularity Scale (DMS), respectively. We employed the Mixed-Effects Location Scale (MELS) Model for our analysis.

Results:

Exposure to either positive or negative body talk increases the level of self-objectification ($b = .15$, $p = .004$; $b = .11$, $p = .037$), body comparison ($b = .29$, $p = .002$; $b = .25$, $p < .001$), and negative emotion ($b = .14$, $p < .001$; $b = .10$, $p < .001$) at the within-subject level. Exposure to negative body talk decreases the level of body appreciation ($b = -.05$, $p = .007$) and increases the level of drive for muscularity ($b = .07$, $p = .028$). The WS (within-subject) variance model

showed that exposure to positive body talk at the within-subject level is associated with greater WS self-objectification variance ($b = 0.84$, $p < .001$), greater WS body comparison variance ($b = 0.64$, $p < .001$), greater WS body appreciation variance ($b = .60$, $p = .002$), and greater WS drive for muscularity variance ($b = .37$, $p = .025$). Exposure to negative body talk at the within-subject level is associated with greater WS self-objectification variance ($b = 0.33$, $p = .048$), greater WS body appreciation variance ($b = 1.02$, $p < .001$), greater WS negative emotion variance ($b = 0.59$, $p < .001$), and greater WS drive for muscularity variance ($b = .36$, $p = .025$).

Conclusion:

Exposure to both positive and negative body talk predicts lower emotional status and negatively affects various aspects of body image, including decreased body appreciation and increased self-objectification, appearance comparison, and drive for muscularity. Additionally, exposure to both positive and negative body talk at the within-subject level predicts higher WS variance in emotional status, body appreciation, self-objectification, appearance comparison, and drive for muscularity over time.

1. Introduction

Fat talk refers to self-critical comments made to others regarding one's weight or body. For example, a person might say, "I feel so fat," or "I need to lose weight, or no one will find me attractive" (Nichter & Vuckovic, 1994). Over the past ten years, research on fat talk has expanded rapidly, uncovering various correlates and consequences of this behavior. For instance, research has found that fat talk is associated with eating disorders (Polivy & Herman, 2002), body dissatisfaction (Corning, Bucchianeri, & Pick, 2014), and negative body image (Shannon & Mills, 2015). While fat talk refers to negative evaluations of one's body, there is limited research on positive conversations about our bodies. Based on the attitudes toward one's body expressed in conversations, previous studies have categorized body talk into negative and positive categories (Lin, Flynn, & O'Dell, 2021). Negative body talk means fat talk, whereas positive body talk is defined as conversations that express appreciation and confidence regarding one's body, focusing on its strengths and positive attributes rather than criticizing or disparaging it (e.g., "I look so beautiful today" or "My skin feels so healthy and glowing"). Studies indicate that body talk is significantly more prevalent among women than men (Martz, Petroff, Curtin, & Bazzini, 2009), and it is widely recognized as a norm among adolescent and young adult females (Britton et al., 2006).

Body talk can also be divided into active participation in body talk and passive exposure to body talk. Active participation in body talk means initiating conversations about body shape and weight or engaging in discussions about body shape initiated by others. In contrast, passive exposure to body talk means hearing body talks in natural settings. According to Michelle, Janis, and Jeffrey (2014), the outcomes may differ between situations where

women actively participate in body talk and those where they merely hear it. Active participation involves making comments about one's own physical appearance, which can potentially trigger concerns and behaviors related to weight. Notably, in contemporary society, social media can significantly influence perceptions of body image and body image disturbance (Perloff, 2014). The phenomena of actively engaging in body talk online and passively encountering body talk on social media are increasingly prevalent (Fardouly & Vartanian, 2016). Therefore, engagement in body talk on the internet and social media will also be included in this study.

1.1. Body Talk with Dependent Variables

Objectification theory suggests that girls and women are often socialized to adopt an outsider's viewpoint as their main way of perceiving their own bodies (Fredrickson & Roberts, 1997). This perspective can result in habitual body monitoring, increasing women's chances of experiencing shame and anxiety, reducing opportunities for peak motivational states, and diminishing awareness of internal bodily states. Such experiences may contribute to mental health risks that disproportionately affect women, including depression, sexual dysfunction, and eating disorders (Fredrickson & Roberts, 1997). Empirical studies have long indicated that self-objectification is closely linked to body talk (Gapinski et al., 2003). The self-objectification theory highlights that women, when frequently exposed to idealized beauty standards on social media and receiving negative body comments from peers, begin the process of self-objectification (Ji et al., 2023). Jones et al. (2014) mentioned that engaging in negative body talk may lead to heightened levels of self-objectification. In Gapinski et al.'s study (2003), fat talk was linked to enhanced motivation and cognitive functioning in women

with low trait self-objectification, but it resulted in decreased motivation and performance in women with high trait self-objectification.

Body talk can lead to body comparison. According to objectification theory (Fredrickson & Roberts, 1997), negative body talk triggers self-objectification and appearance-related schemas, which in turn increase the likelihood of appearance comparisons. Negative body talk, which involves criticizing one's own body in conversations with others (Lin et al., 2021; Mills & Fuller-Tyszkiewicz, 2017), can indirectly link appearance comparisons to body shame. Additionally, research has shown that individuals who frequently engage in appearance comparisons are more prone to participating in fat talk (Mills & Fuller-Tyszkiewicz, 2018), suggesting a reciprocal relationship between negative body talk and appearance comparison.

Moreover, studies indicated that exposure to fat talk is associated with an increase in negative emotion (Arroyo & Harwood, 2012; Salk & Engeln-Maddox, 2012). Drawing on objectification theory (Fredrickson & Roberts, 1997), Gapinski et al. (2003) conducted an experiment suggesting that state self-objectification can lead to an increase in various negative emotions. Additionally, for women with high levels of self-objectification, exposure to fat talk appeared to trigger a reduction in negative emotions (Gapinski et al., 2003). Conversely, in an experiment where idealized media images were used as the trigger, increased self-objectification was associated with heightened anxiety, body dissatisfaction, and negative mood (Harper & Tiggemann, 2008).

Historically, research on body image has primarily concentrated on its negative dimensions, including body dissatisfaction and body shame (Avalos et al., 2005). However,

over the past decade, there has been a growing interest in exploring the positive aspects of body image. This emerging field has shifted focus towards concepts like body appreciation, which is defined as accepting, respecting, and having positive views about one's body (Avalos et al., 2005). Louise and Nicole (2014) found that discussions centered around exercise among women were predictive of increased body appreciation. They also discovered that the link between conversations about weight loss and body appreciation was mediated by negative attitudes. Additionally, body appreciation can play a protective role against body dissatisfaction when individuals are exposed to body talk and other external influences.

1.2. Ecological Momentary Assessment

Most of the previous studies are cross-sectional, offering limited evidence regarding the directionality of the relationships between body talk, body image, and emotional status (Mills & Fuller-Tyszkiewicz, 2018). Although there are a few longitudinal studies related to body talk (Arroyo & Harwood, 2012; Clark & Tiggemann, 2008; Dohnt & Tiggemann, 2006), they suffer from bias related to retrospective recall. This study employed ecological momentary assessment (EMA) to evaluate fat talk experiences. EMA involves repeated sampling of subjects' current behaviors and experiences in real time within their natural environments (Shiffman, Stone, & Hufford, 2008). This method is able to reduce recall bias, enhance ecological validity, and enable the study of microprocesses related to body talk in real-world settings (Shiffman, Stone, & Hufford, 2008).

1.3. Mixed-Effects Location Scale Model

Previous longitudinal studies on body talk have predominantly utilized Mixed Effects Models. In this experiment, however, we employ an advanced extension of the Mixed Effects

Model, the Mixed-Effects Location Scale (MELS) Model (Hedeker et al., 2008). This model extends the standard multilevel regression analysis by incorporating a log-linear submodel for error variance, which allows for examining how covariates affect both the mean and variance structures. The model is especially effective for jointly analyzing the mean and variability of subjects' responses over time (Leckie, 2014). This study represents the first reported application of a MELS regression to the impact of body talk. Through the analysis of EMA data using this model, we can not only understand the impact of body talk on body image and emotions at the mean level but also determine its effects on their variability over time.

1.4. Present Study

Despite numerous studies analyzing the negative impact of fat talk on body image and mood, there is very limited research on positive body talk (Shannon & Mills, 2015). Although previous studies have predominantly concentrated on experimental setups where women are involved in fat talk (Jones et al., 2014), few studies distinguish between actively participating in body talk and passively hearing body talk. Additionally, although many studies have explored the impact of body talk on self-objectification, body comparison, body appreciation, and emotional status, none have investigated how body talk affects the stability (variance) of these factors over time. Previous longitudinal studies on body talk have mostly utilized Mixed Effects Models, which can assess the impact of body talk on the mean level of the dependent variables but cannot examine the effect of body talk on the within-subject variance of the dependent variables.

This experiment employed the Mixed-Effects Location Scale (MELS) Model, which can measure the impact of body talk on the fluctuations (i.e., variance) of the dependent variables

across each instance of the experiment (Hedeker et al., 2008). In the current study, MELS was used to explore the associations between exposure to negative and positive body talk with self-objectification, appearance comparison, body appreciation, emotional status, and drive for muscularity in mainland China. We hypothesize that (1) exposure to or active engagement in negative body talk is associated with higher levels of self-objectification, appearance comparison, and drive for muscularity, and lower levels of body appreciation and emotional status; (2) exposure to or active engagement in positive body talk is associated with higher levels of self-objectification, appearance comparison, drive for muscularity, body appreciation, and emotional status; and (3) exposure to or active engagement in either negative or positive body talk is associated with greater within-subject variance in self-objectification, appearance comparison, drive for muscularity, body appreciation, and emotional status.

2. **Methods**

2.1. **Participants**

During the latter half of 2021, specifically from June to November, we recruited participants and gathered data in two separate batches. In total, the initial sample consisted of 223 undergraduate students at the Chinese University of Hong Kong, Shenzhen, who were recruited through a research participation program in which students were compensated with a small amount of course credit or a monetary reward. Ninety-three participants (41.7%) were excluded from further data analysis because they completed fewer than 50% of the 28 questionnaires distributed to them through WeChat groups.

Out of the 3,640 assigned questionnaires, participants completed 3,033, resulting in an

overall response rate of 83.3%. The majority of participants (93%) were of Han ethnicity, the largest ethnic group in mainland China. The final sample comprised 130 female undergraduate students, aged between 19 and 24 years (M = 19.53, SD = 1.69), with a BMI ranging from 15.22 to 26.90 kg/m² (M = 20.40, SD = 2.40). For the excluded participants, 94% were of Han ethnicity, with an average age of 19.37 years (SD = 1.54) and an average BMI of 20.27 kg/m² (SD = 2.35). There were no significant differences between the included and excluded participants in terms of age ($p = 0.470$) and BMI ($p = 0.688$).

2.2. Procedure

Ethics approval was obtained from the Applied Psychology Institutional Review Board at the Chinese University of Hong Kong, Shenzhen. During the recruitment process, we invited all participants to join a chat group on WeChat. After securing participants' informed consent, an e-survey link was sent through the chat group using the Wenjuanxing platform, which functions similarly to Amazon Mechanical Turk. Participants were asked to fill out this electronic baseline questionnaire, allowing us to gather crucial demographic information.

Following this, an online training session was held to provide an overview of the study and acquaint participants with the ecological momentary assessment (EMA) data collection process. In this session, participants were trained to identify and report instances of positive and negative body talk in the upcoming EMA questionnaires. They were also instructed on how to receive timely notifications from the WeChat group and consistently complete the EMA questionnaires over a period of seven consecutive days. During the 7-day EMA data collection period, the research team sent out questionnaire notifications and links four times a day, specifically at 10:00, 14:00, 18:00, and 22:00.

2.3. Measures

2.3.1 Demographics and Trait Variables

In the baseline survey, participants were asked to provide their demographic details, including age, height, and weight. Based on the reported height and weight, each participant's BMI was calculated. Additionally, the survey included the Body Appreciation Scale-2 and the Body Dissatisfaction subscale from the Eating Disorder Inventory as trait variables.

Introduced in 1983, the Eating Disorder Inventory (EDI) has become one of the most commonly used self-report tools for evaluating eating disorders based on psychological symptoms (Garner, Olmstead, & Polivy, 1983). The EDI consists of 64 items rated on a 6-point Likert scale, ranging from 1 (never) to 6 (always), with higher scores indicating greater levels of eating disorder symptoms. For this study, the 9-item Body Dissatisfaction subscale from the Chinese version (Tseng et al., 2014) was used. This subscale has shown excellent internal consistency, with a Cronbach's alpha of .93. Additionally, in the current study, the baseline survey produced a Cronbach's alpha of .90, confirming its reliability in assessing body dissatisfaction among the participants.

The Body Appreciation Scale-2 (BAS-2), created by Tylka and Wood-Barcalow (2015), was utilized to measure baseline body acceptance and body appreciation. A detailed introduction will be provided in the section on dependent variables.

2.3.2. Body Talks Measurements

Before the experiment begins, participants will receive training to recognize body talk. In collecting EMA data, body talk questions were divided into two types: active participation in body talk and passive exposure to body talk. Participants were first asked, "Since last term,

have you engaged in or been exposed to body talk?" If they answered yes, they were then asked, "How many times have you heard or engaged in body talk since last term?" Following this, participants identified whether the body talk they encountered was negative (e.g., “I think my figure is not bad”) or positive (e.g., “I can't gain any more weight; I need to eat less.”). The results were recorded into four binary categories: "passive exposure to positive body talk," "passive exposure to negative body talk," "active engagement in positive body talk," and "active engagement in negative body talk." A value of "1" indicated that the participant was involved in that type of body talk. In this study, we only used the terms "passive exposure to positive body talk" and "passive exposure to negative body talk."

2.3.3. Self-objectification

The Objectified Body Consciousness Scale (OBCS) was employed to evaluate how individuals perceive and respond to their bodies as objects. This scale includes subscales for body surveillance, body shame, and control beliefs related to body appreciation. In a previous study involving Chinese undergraduate participants (Jackson & Chen, 2015), the Chinese version of the OBCS body surveillance subscale exhibited satisfactory psychometric properties, with a Cronbach’s alpha of .74 for men and .77 for women.

To assess participants' state-level self-objectification across the 28 time points of the EMA process, seven items were adapted from the 8-item body surveillance subscale developed by McKinley and Hyde (1996). These items were rated on a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree), with higher total scores indicating a greater degree of self-objectification.

2.3.4. Appearance Comparison

The State Appearance Comparison Scale (SACS) was utilized to evaluate participants' general tendency to compare their appearance with others at the state level. The SACS consists of three items, each asking participants to rate the extent of their appearance-related comparisons on a 7-point Likert scale, from 1 (No comparison) to 7 (A lot of comparison). Tiggemann and McGill (2004) demonstrated that the SACS has high internal consistency, with a Cronbach's alpha of 0.91.

2.3.5. Body Appreciation

The Body Appreciation Scale-2 (BAS-2) was used to assess state-level body appreciation measures. This scale comprises ten 5-point Likert-type items, with response options ranging from 1 (never) to 5 (always). Sample items include statements such as “I feel love for my body” and “I appreciate the different and unique characteristics of my body.” A higher total score on the BAS-2 denotes a higher level of body appreciation. In the Chinese context, Swami, Ng, and Barron (2016) successfully translated and validated the BAS-2 in Mandarin Chinese, demonstrating satisfactory internal consistency in women (Cronbach’s alpha = .89). In the present study, the baseline survey exhibited a high level of reliability, with a Cronbach’s alpha coefficient of .92.

2.3.6. Negative Emotion

The International Positive and Negative Affect Schedule Short Form (I-PANAS-SF) was used to measure participants' affect state. The I-PANAS-SF includes ten items, with five for positive affect and five for negative affect (Thompson, 2007). Participants answered on a 5-point Likert scale ranging from 1 (never) to 5 (always). In the current study, only the five negative affect items were used. The Chinese version of the I-PANAS-SF, translated by Liu,

You, Liu, and Chung (2020), demonstrates satisfactory nomological validity and acceptable internal consistency, with Cronbach's alpha exceeding 0.7.

2.3.7. Drive for Muscularity

The Drive for Muscularity Scale (DMS), developed by McCreary et al. (2004), is a 15-item self-report instrument designed to assess individuals' desire for muscularity. It comprises two subscales: the muscle-oriented body image subscale with 7 items and the muscle-oriented behavior subscale with 8 items. Participants rate their responses on a 6-point Likert scale, ranging from 1 (Never) to 6 (Always). Scores are calculated by summing or averaging the responses, with higher scores indicating a stronger drive for muscularity in terms of attitudes and behaviors. The DMS has been translated into various languages and has demonstrated good reliability and validity (e.g., the Spanish version by Sepulveda et al., 2016). In the current study, the Chinese version of the DMS (He et al., 2021) was used. The overall DMS exhibited a Cronbach's alpha of .85, with the Behavior subscale and Attitude subscale showing Cronbach's alphas of .85 and .81, respectively.

2.4. Model Specification

A mixed-effects location scale analysis was used to analyze the impact of body talk on self-objectification, body comparison, body appreciation, negative emotion, and drive for muscularity (Hedeker et al., 2008). This model extends the standard multilevel regression analysis by incorporating a log-linear submodel for error variance, which allows for examining how covariates affect both the mean and variance structures. The location scale mixed model enables the modeling of error variance with covariates through a log link function. The location-scale mixed model for the dependent variable y for subject i (where i =

1, 2, 3, ...N subjects) on times j (j = 1, 2, 3, ..., n_i, with n_i representing the number of times subject i completed the questionnaire) is given as:

$$Y_{ij} = x_{ij}\beta + \sigma_{v_{ij}}\theta_{1i} + \epsilon_{ij}$$

$$\sigma^2_{v_{ij}} = exp(u_{ij}\alpha)$$

$$\sigma^2_{\epsilon_{ij}} = exp(\omega_{ij}\tau + \tau_l\theta_{1i} + \sigma_\omega\theta_{2i})$$

$$\theta_{1i} \sim N(0,1)$$

$$\theta_{2i} \sim N(0,1)$$

$$\epsilon_{ij} \sim N(0, \sigma^2_{\epsilon_{ij}})$$

where x_{ij} is a vector of independent variables and covariates, and β is the corresponding vector of regression coefficients. The BS variance function represents the between-subjects variance, $\sigma^2_{v_{ij}}$, as a log-linear function involving a second set of covariates at the subject- or occasion-level, u_{ij}, with α representing the corresponding vector of coefficients. The WS variance function represents the within-subjects variance, as a log-linear function involving the same set of covariates at the subject- or occasion-level, ω_{ij}, with τ representing the corresponding vector of coefficients. The WS variance function incorporates θ_{1i} as a latent covariate, allowing for a subject-level connection between unexplained location and scale variability, with τ_l representing the regression coefficient. Furthermore, the specification of the within-subjects variance includes a random subject effect, allowing this variance to fluctuate at the individual subject level, independent of the effects of regressors (Hedeker, Mermelstein, & Demirtas, 2012). In this study, we primarily focus on the mean function and the within-subjects (WS) variance function; therefore, only an intercept is included in the between-subjects (BS) variance function.

2.5. Data Analysis

This study conducted a total of five analyses. The dependent variables for these five analyses were self-objectification, appearance comparison, body appreciation, negative emotion, and drive for muscularity. The independent variables for each analysis were exposure to negative or positive body talk. Given that we utilized EMA (Ecological Momentary Assessment) to collect data, each participant provided up to 28 sets of data. To measure the impact of body talk exposure at different times for the same individual and across different individuals, we categorized body talk exposure into within-subject and between-subject dimensions. The between-subject dimension is defined as the average body talk exposure for each participant. In contrast, the within-subject dimension represents the deviation of each participant's body talk exposure at each time point from their average exposure, effectively centering the values. In the final analysis, we identified four independent variables: within-subject (WS) exposure to positive body talk, WS exposure to negative body talk, between-subject (BS) exposure to positive body talk, and BS exposure to negative body talk.

Additionally, we considered demographic variables such as age and BMI. We also included trait body dissatisfaction and trait body appreciation, which were collected in the baseline survey. By introducing these covariates, we aimed to minimize the influence of age, body size, and attitudes towards body image on our results.

We employed the Mixed-Effects Location Scale (MELS) Model in our study. Specifically, we utilized the mean-level model and the WS-variance submodel. In both the mean-level model and the WS-variance submodel, we incorporated four independent

variables mentioned above, as well as four covariates: Age, BMI, Trait body dissatisfaction, and Trait body appreciation. This allows us to determine the impact of these variables on the values of the dependent variables, as well as on the within-subject variance. Given that the results from the BS-Variance submodel are not particularly relevant to our research, we did not include any covariates in the BS-Variance submodel.

For the analyses, we used the MIXREGLS program (Hedeker & Nordgren, 2013), driven by Stata (Leckie, 2014). Since MELS is highly sensitive to the variance of the dependent variable, if a participant had the same value for a dependent variable across all 28 measurements, the program would encounter issues, since such subjects provide no within-subject variability. Out of 130 participants, we ultimately selected 120 participants who exhibited at least some variation in each dependent variable during the 28 measurements.

3. Results

3.1. Descriptive Statistics

The descriptive statistics for the dependent variables are presented in Table 1. We observe that for self-objectification, body comparison, negative emotion, and drive for muscularity, both the mean and mode are below the midpoint. This indicates that participants generally exhibited low levels of self-objectification, body comparison, negative emotion, and drive for muscularity. Conversely, body appreciation scores were above the midpoint, reflecting a higher level of body appreciation among participants. It is important to note that each item of the I-PANAS-SF and Body Appreciation was rated on a 7-point Likert scale, as opposed to the original 5-point scale. Despite this difference, the subsequent analysis results

were not affected.

Table 2 presents the descriptive statistics for the independent variables. As shown, participants' mean scores for body talk were relatively low (M_positive = 0.040; M_negative = 0.042), suggesting that body talk was not very common during the measurement phase. Among the two types of body talk, negative body talk had a higher mean score, indicating that participants were more likely to be exposed to negative aspects of their bodies.

Table 1

Descriptive statistics for five dependent variables: self-objectification, body comparison, body appreciation, negative emotion and muscle dissatisfaction.

Dependent variable	Range	M_BS	Mdn_BS	SD_WS	SD_BS	Var_WS	Var_BS	ICC
Self−objectification	1−7	3.350	3.290	0.873	1.021	0.762	1.043	0.578
Body comparison	1−7	3.520	3.670	1.013	1.160	1.026	1.346	0.567
Body appreciation	1−5	3.740	3.640	0.335	0.704	0.113	0.496	0.815
Negative emotion	1−5	1.730	1.430	0.560	0.780	0.313	0.609	0.660
Drive for Muscularity	1−5	3.270	3.200	0.635	1.142	0.403	1.304	0.764

Note. M_BS = the mean score between subjects (BS), Mdn_BS = the median score between subjects (BS), SD_WS = the standard deviation within subjects, SD_BS = standard deviation between subjects, Var_WS = the variance within subjects, Var_BS = the variance between subjects (BS), ICC = The Intraclass Correlation Coefficient (ICC).

Table 2

Descriptive statistics for the frequencies of exposure to three types of body talk.

Exposure Type	Number of Exposures	Percentage of total responses	Range	Mean	SD
Exposure to positive body talk	111	3.980	0−1	0.040	0.2
Exposure to negative body talk	116	4.160	0−1	0.042	0.2

Note. Range = within-participant range, Mean = within-participant mean, SD = within-participant standard deviation.

3.2. Self-objectification

Table 3 presents the outcomes from two-level mixed location scale models that predict individuals' perceptions and reactions to their bodies as objects, based on measurements of body talk and various covariates. The results of the mean-level model indicated that both positive and negative body talk at the within-subject level were related to self-objectification levels. For each participant, exposure to either positive or negative body talk increased the level of self-objectification ($b = .15$, $p = .004$; $b = .11$, $p = .037$). Moreover, mean levels of self-objectification were higher in participants with lower BMI ($b = -.13$, $p = .007$) and higher trait body dissatisfaction scores ($b = .04$, $p = .011$). The corresponding within-subject (WS) variance model showed that exposure to both positive ($b = 0.84$, $p < .001$) and negative body talk ($b = 0.33$, $p = .048$) at the within-subject level was associated with greater WS self-objectification variance. It is noted that in both the mean-level model and the WS variance model, positive and negative body talk at the between-subject level did not have a significant effect on the level of self-objectification.

Table 3

Results from Mixed-Effects Location Scale Analysis Predicting Self-objectification Level from Exposure To Body Talks and Covariates.

Level	Self−objectification	Location−Scale Mixed Model							
		Mean Level				WS Variance			
		b	*SE*	*z*	*p*	*b*	*SE*	*z*	*p*
Within−subjects	Exposure to positive body talk	0.148	0.052	2.860	0.004	0.835	0.178	4.710	0.000
	Exposure to negative body talk	0.105	0.050	2.090	0.037	0.332	0.168	1.980	0.048
Between−subjects	Mean exposure to positive body talk	−0.283	1.216	−0.230	0.816	−2.258	1.524	−1.480	0.138
	Mean exposure to negative body talk	1.951	1.590	1.230	0.220	−0.353	1.977	−0.180	0.858
	Age	0.038	0.054	0.710	0.478	0.021	0.067	0.320	0.750
	BMI	−0.128	0.048	−2.680	0.007	0.065	0.059	1.090	0.276
	Trait body dissatisfaction	0.038	0.015	2.530	0.011	0.008	0.019	0.420	0.673
	Trait body appreciation	−0.135	0.170	−0.790	0.427	0.359	0.210	1.700	0.088

Note. WS = within-subjects; WS variance parameters were estimated using a log-linear model.

3.3. Body Comparison

Table 4 summarizes the findings from models predicting body comparison levels based on measurements of body talk and covariates. The outcomes from the mean-level model showed that, at the within-subject level, both positive and negative body talk were associated with body comparison levels. For each participant, passively hearing either positive or negative body talk led to a higher level of body comparison, with a coefficient of .29 ($p = .002$) for positive talk and .25 ($p < .001$) for negative talk. At the between-subject level, negative body talk was positively associated with body comparison levels ($b = 4.32$, $p = .016$). Additionally, participants with lower Body Mass Index (BMI) showed higher average levels of body comparison ($b = -.14$, $p = .007$), and those with higher scores for trait body dissatisfaction also exhibited increased body comparison ($b = .04$, $p = .010$). The WS (within-subject) variance model revealed that exposure to positive body talk at the within-subject level was linked to an increase in WS body comparison variance ($b = 0.64$, $p < .001$). Participants with higher levels of trait body appreciation were associated with increased body comparison variability.

Table 4

Results from Mixed-Effects Location Scale Analysis Predicting Body Comparison Level from Exposure To Body Talks and Covariates.

		Location–Scale Mixed Model							
Level	Body Comparison	Mean Level				WS Variance			
		b	*SE*	*z*	*p*	*b*	*SE*	*z*	*p*
Within–subjects	Exposure to positive body talk	0.289	0.092	3.130	0.002	0.636	0.165	3.850	0.000
	Exposure to negative body talk	0.253	0.062	4.090	0.000	−0.080	0.159	−0.500	0.617
Between–subjects	Mean exposure to positive body talk	−0.501	1.377	−0.360	0.716	0.549	1.236	0.440	0.657
	Mean exposure to negative body talk	4.321	1.793	2.410	0.016	−1.539	1.606	−0.960	0.338
	Age	0.014	0.060	0.230	0.819	−0.044	0.054	−0.820	0.411
	BMI	−0.141	0.052	−2.710	0.007	−0.022	0.048	−0.460	0.645
	Trait body dissatisfaction	0.043	0.017	2.590	0.010	0.015	0.015	1.920	0.055
	Trait body appreciation	−0.152	0.187	−0.810	0.415	0.171	0.171	2.210	0.027

Note. WS = within-subjects; WS variance parameters were estimated using a log-linear model.

3.4. Body Appreciation

Table 5 presents the results from models that predict levels of body appreciation using measurements of body talk and other covariates. The results of the mean-level model indicated that negative body talk at the within-subject level was negatively associated with body appreciation levels ($b = -.05$, $p = .007$). Additionally, mean levels of body appreciation decreased with age ($b = -.07$, $p = .019$). The corresponding WS (within-subject) variance submodel indicated that exposure to both positive and negative body talk at the within-subject level was associated with greater WS body appreciation variance ($b = .60$, $p = .002$; $b = 1.02$, $p < .001$).

Table 5

Results from Mixed-Effects Location Scale Analysis Predicting Body Appreciation Level from Exposure To Body Talks and Covariates.

		Location–Scale Mixed Model							
Level	Body Appreciation	Mean Level				WS Variance			
		b	*SE*	*z*	*p*	*b*	*SE*	*z*	*p*
Within–subjects	Exposure to positive body talk	−0.026	0.016	−1.570	0.116	0.602	0.196	3.060	0.002
	Exposure to negative body talk	−0.052	0.019	−2.720	0.007	1.017	0.188	3.060	0.000
Between–subjects	Mean exposure to positive body talk	−0.076	0.647	−0.120	0.906	−2.788	1.467	−1.900	0.057
	Mean exposure to negative body talk	0.010	0.842	0.010	0.991	−1.634	1.901	−0.860	0.390
	Age	−0.067	0.028	−2.360	0.019	0.103	0.064	1.610	0.107
	BMI	0.016	0.025	0.640	0.525	−0.018	0.057	−0.320	0.749
	Trait body dissatisfaction	−0.004	0.008	−0.470	0.638	0.031	0.018	1.720	0.086
	Trait body appreciation	0.607	0.090	6.750	0.000	−0.041	0.203	−0.200	0.841

Note. WS = within-subjects; WS variance parameters were estimated using a log-linear model.

3.5. Negative Emotion

Results from the two-level mixed location scale models predicting negative emotion states from measurements of body talk and covariates are given in Table 6. The results of the mean-level model indicated that, within individuals, both positive and negative body talk were associated with states of negative emotion. For every participant, passively listening to either positive or negative body talk resulted in increased states of negative emotion. The data showed a coefficient of .14 ($p < .001$) for positive talk and .10 ($p < .001$) for negative talk. The WS (within-subject) variance model indicated that, at the within-subject level, exposure to negative body talk was associated with increased variance in negative emotion states ($b = 0.59$, $p < .001$). It is observed that in both the mean-level model and the WS variance model, positive and negative body talk at the between-subject level have no significant impact on the state of negative emotions.

Table 6

Results from Mixed-Effects Location Scale Analysis Predicting Negative Emotion from Exposure To Body Talks and Covariates.

		Location–Scale Mixed Model							
Level	Negative Emotion	Mean Level				WS Variance			
		b	*SE*	*z*	*p*	*b*	*SE*	*z*	*p*
Within–subjects	Exposure to positive body talk	0.148	0.029	5.110	0.000	−0.118	0.170	−0.690	0.488
	Exposure to negative body talk	0.101	0.029	3.430	0.001	0.595	0.170	3.500	0.000
Between–subjects	Mean exposure to positive body talk	−0.286	0.964	−0.300	0.767	−1.048	1.788	−0.590	0.558
	Mean exposure to negative body talk	0.458	1.260	0.360	0.716	−2.623	2.318	−1.130	0.258
	Age	−0.010	0.042	−0.230	0.819	0.021	0.078	0.270	0.789
	Body Mass Index	−0.051	0.038	−1.340	0.181	0.005	0.070	0.080	0.938
	Trait body dissatisfaction	0.003	0.012	0.210	0.830	−0.011	0.022	−0.490	0.621
	Trait body appreciation	−0.168	0.134	−1.260	0.209	−0.123	0.247	−0.500	0.617

Note. WS = within-subjects; WS variance parameters were estimated using a log-linear model.

3.6. Drive for Muscularity

Table 7 provides the results from two-level mixed location scale models that predict drive for muscularity levels based on measurements of body talk and other covariates. The results from the mean-level model indicated that at the individual subject level, experiencing negative body talk led to an increase in drive for muscularity levels ($b = .15$, $p < .001$; $b = .10$, $p < .001$), while the effect of positive body talk was not significant. The within-subject variance model showed that exposure to both positive and negative body talk was associated with an increase in the variance of within-subject drive for muscularity ($b = 0.37$, $p = .025$; $b = 0.36$, $p = .025$).

Table 7

Results from Mixed-Effects Location Scale Analysis Predicting Drive for Muscularity from Exposure To Body Talks and Covariates.

		Location–Scale Mixed Model							
Level	Negative Emotion	Mean Level				WS Variance			
		b	*SE*	*z*	*p*	*b*	*SE*	*z*	*p*
Within–subjects	Exposure to positive body talk	0.014	0.034	0.400	0.687	0.373	0.167	2.240	0.025
	Exposure to negative body talk	0.069	0.032	2.200	0.028	0.360	0.161	2.240	0.025
Between–subjects	Mean exposure to positive body talk	−0.733	1.374	−0.530	0.594	0.548	1.565	0.350	0.726
	Mean exposure to negative body talk	1.761	1.775	0.990	0.321	−2.297	2.032	−1.130	0.258
	Age	−0.007	0.060	−0.110	0.909	0.058	0.068	0.840	0.400
	Body Mass Index	−0.003	0.054	−0.050	0.960	0.021	0.061	0.340	0.731
	Trait body dissatisfaction	0.020	0.017	1.160	0.244	0.023	0.019	1.200	0.231
	Trait body appreciation	−0.284	0.190	−1.500	0.135	0.212	0.216	0.980	0.328

Note. WS = within-subjects; WS variance parameters were estimated using a log-linear model.

4. Discussion

The purpose of this paper is to illustrate the use of the location-scale mixed model for performing two-dimensional analyses on both mean levels and within-subject variance. This is achieved by utilizing body talk data and five dependent variables related to body image and emotions. We utilized the Ecological Momentary Assessment (EMA) to collect longitudinal data on exposure to negative and positive body talk. We categorized body talk into within-subject level and between-subject level for analysis. Unlike conventional mixed effects models, the Mixed-Effects Location Scale (MELS) model not only assesses the impact of body talk at both chronic and subject levels on the mean levels of dependent variables but also examines its effect on within-subject variance. Specifically, using MELS, we analyzed how body talk and other covariates influence Self-Objectification, Appearance Comparison, Body Appreciation, negative emotion, and Drive for Muscularity in terms of both mean levels (mean-level model) and temporal stability (within-subject variance model).

This study is the first to apply MELS to body talk data. After controlling for the impact of covariates on variance, we found that most results in the mean-level model were consistent with those obtained using conventional mixed-effects models in previous literature. Interestingly, the within-subject variance model revealed that for each dependent variable, at least one form of body talk (negative or positive) increased the variance of the dependent variable. Detailed interpretations are provided below.

4.1. Self-objectification

In the mean-level model presented in Table 3, we found a positive correlation between negative body talk and the degree of self-objectification. This finding is consistent with

previous research (Ji et al., 2023; Gapinski et al., 2003). Additionally, we observed that positive body talk is also positively correlated with the degree of self-objectification. This result suggests that regardless of whether the body talk we receive is positive or negative, it leads to an increase in self-objectification. However, it is important to note that the body talk we receive includes comments made by others about others as well as comments made by others about ourselves. The impact of these two types of body talk may differ. Future research should further distinguish between these two types of body talk. Overall, we can conclude that even positive comments about our bodies can lead us to focus excessively on our physical appearance and neglect our awareness of internal bodily states. We also found that individuals with a higher BMI tend to have a lower degree of self-objectification, indicating that those considered to have better shape are more prone to self-objectification. Conversely, individuals who are less satisfied with their bodies tend to have higher levels of self-objectification, which aligns with previous findings (Fredrickson & Roberts, 1997).

In the within-subject variance model, both positive and negative body talk at the within-subject level are significantly positively correlated with the variance in self-objectification. This indicates that in our daily lives, exposure to body talk makes our levels of self-objectification more unstable. This instability shows that our focus on external appearance is not fixed but fluctuates more when we are exposed to body talk. Based on the conclusions of both models, it is crucial to note that exposure to positive body talk does not reduce self-objectification; instead, it might have a counterproductive effect. To reduce self-objectification levels, it is necessary to decrease exposure to any form of body talk.

4.2. Body Comparison

In the mean-level model presented in Table 4, we found that negative body talk is positively correlated with the degree of body comparison. This is consistent with previous research (Fredrickson & Roberts, 1997). Additionally, we observed a significant positive correlation between positive body talk and body comparison. This finding parallels the results for self-objectification, indicating that regardless of whether the body talk we hear is positive or negative, it increases the extent of our body comparisons. According to Objectification Theory (Fredrickson & Roberts, 1997), this outcome may be related to self-objectification serving as a mediating role between body talk and body comparison, suggesting that further investigation into the causal relationship is needed. Similar to the results for self-objectification, body comparison is significantly negatively correlated with BMI and significantly positively correlated with trait body dissatisfaction. This indicates that individuals who have a more desirable body shape and those who are more dissatisfied with their own bodies are more likely to engage in body comparison. Additionally, at the between-subject level, individuals with a higher average exposure to negative body talk are more likely to engage in body comparison. One explanation for this is that negative body talk may intensify participants' dissatisfaction with their bodies.

In the within-subject variance model, we found that exposure to positive body talk increases the within-subject variance of body comparison. This means that engaging in positive body talk results in more fluctuation in how we compare our bodies to others. Conversely, negative body talk does not have this effect. One possible explanation is that positive body talk may promote self-affirmation, but it can also raise expectations and standards, leading to more fluctuation in comparisons. Additionally, trait body appreciation

was found to be positively correlated with the within-subject variance of body comparison. This indicates that individuals with higher average levels of body appreciation exhibit more unstable body comparison behaviors.

4.3. Body Appreciation

In Table 5, we found a significant negative correlation between negative body talk and body appreciation. However, positive body talk did not have a significant relationship with body appreciation, which contrasts with the findings of Louise and Nicole (2014) that discussion about pursuing a good body shape through exercise among women predicted increased body appreciation. This result suggests that while negative body talk reduces body appreciation, positive body talk does not have a positive impact on body appreciation. It is important to note that the positive body talk received by participants may have largely consisted of praise directed at others rather than themselves, potentially influencing the results. Further research is required to distinguish between different types of body talk to understand their specific effects. Additionally, we found a significant negative correlation between age and body appreciation, indicating that during college years, females' levels of body appreciation decrease with age. One possible explanation is that older college students are likely to encounter more media-promoted ideal body images. These images often significantly differ from their own body types, which can result in decreased body appreciation (Carpenter, 2023).

In the within-subject variance model, both positive and negative body talk significantly increased the within-subject variance of body appreciation. Similar to previous findings, this suggests that exposure to body talk causes our body appreciation to fluctuate more, resulting

in greater instability and variability. According to research (Scully et al., 2023), engaging in body talk, especially on social media, can intensify social comparisons. This heightened comparison can lead to increased body dissatisfaction and greater variability in body appreciation.

4.4. Negative Emotion

In Table 6, we found a significant positive correlation between negative body talk and negative emotions at the within-subject level, consistent with previous studies (Arroyo and Harwood, 2012; Salk and Engeln-Maddox, 2012). Interestingly, we also observed a significant positive correlation between positive body talk and negative emotions, suggesting that even positive body talk can increase negative emotions, which is counterintuitive. One possible explanation is that body talk participants are exposed to comments directed at others as well as themselves. Comments about others can also evoke negative emotions in participants, as they might lead to dissatisfaction with their own bodies. Additionally, body talk comes from both real-life interactions and online sources. On the internet, we often come across encouragements and praises for good body shapes that are not directed at us. These comments can negatively affect our mood.

In the within-subject variance model, negative body talk is significantly positively correlated with the variance of negative emotions, while positive body talk does not significantly affect this variance, which suggests that exposure to negative body talk leads to greater emotional fluctuations. These findings align with studies that found frequent engagement in negative body talk is associated with increased body dissatisfaction and a cycle of negative emotions, including anxiety, depression, and lower self-esteem, which

contribute to significant mood swings (Gapinski et al., 2003). We can conclude that reducing exposure to negative body talk can help maintain emotional stability. Compared to the conventional mixed-effects model, the Mixed-Effects Location Scale (MELS) model offers a superior measurement of emotions, as it assesses both the intensity and the stability of emotions over time.

4.5. Drive for Muscularity

In Table 7, we found a significant positive correlation between negative body talk and drive for muscularity, while positive body talk did not have a significant impact. Previous research on body talk has not explored its effects on the drive for muscularity. One possible explanation is that negative body talk may lead to greater dissatisfaction with body shape, thereby increasing the drive for muscularity as individuals attempt to improve their self-image and gain social acceptance. In contrast, positive body talk, while boosting self-esteem, might not trigger the same drive for muscularity because individuals feel more satisfied with their body image.

In the within-subject variance model, both negative and positive body talk are significantly positively correlated with the variance in drive for muscularity. This indicates that when people are exposed to either positive or negative body talk, their desire to increase muscle mass and their satisfaction with their muscular physique become more variable. One possible reason is that both positive and negative body talk heighten individuals' focus on their body image. Positive body talk may boost self-esteem and motivate muscle enhancement, while negative body talk may cause dissatisfaction and a desire to improve self-image through muscle gain. This increased focus results in more fluctuation in their

muscularity drive and satisfaction.

4.6. General Conclusion

In these five studies, negative body talk significantly impacted all dependent variables in the mean-level model. Positive body talk significantly influenced self-objectification, body comparison, and negative emotion. This demonstrates the pervasive impact of body talk on various aspects of body image as well as emotions. It is important to note that, regardless of whether body talk is negative or positive, its effects are almost uniformly detrimental, highlighting the necessity of reducing body talk in our daily life. In the within-subject variance model, body talk universally affects the stability of all dependent variables: exposure to body talk increases the variance of variables related to body image and emotions. This indicates that body talk not only affects these variables at the mean level but also reduces their stability, making individuals' states and emotions more volatile.

4.7. Limitations

(1) Due to the complexity of the EMA collection process, our participants were all students from the same university, limiting the generalizability and external validity of our conclusions. (2) Although we initially had 223 participants, due to low completion rates and model constraints, we ultimately analyzed the results of only 120 participants, resulting in a smaller sample size. (3) This study used the MELS model, but the model did not account for the interaction effects between body talk and other covariates, nor did it include mediation analysis. The effects and causal relationships of body talk on dependent variables may be more complex and require further exploration in future research. (4) The study only used data on exposure to body talk, without considering data on actively engaging in body talk. Future

research should measure both types of body talk and compare the differences in outcomes. (5) This study categorized exposure to body talk simply as positive or negative, without distinguishing between comments directed at others and comments directed at oneself. These different types of body talk may have distinct impacts, and future research should more precisely classify types of body talk. Additionally, the study did not consider the frequency of exposure to body talk over time, relying solely on binary results. Including frequency data could make the research findings more comprehensive and accurate.

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