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Psychometric Summary of the Technology-delivered Tension Scales for Weight Management

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Abstract

The purpose of this article is to summarize the psychometric results from studies of the last 25 years of the Overeating Tension Scale, Exercise Tension Scale, Feelings Tension Scale, and Feelings about Weight Tension Scale. These reliable and valid technology-delivered weight management scales can be used by clinicians independently or in combination to longitudinally identify specific triggers of overeating, skipping exercise, feeling low or down, and strong feelings about one's body weight; motivational states, and related tension levels. Through cognitive behavior therapy, individuals can learn to shift to another motivational state and employ healthy coping mechanisms to avoid related negative behaviors. Psychometric results from seven developmental studies are described, including technology-delivery adaptation results from the original paper and pencil versions. Future tension scale development priorities also are discussed.

Keywords

reproducibility of results; user-computer interface; obesity; stress; psychological; telemedicine/telehealth

The tension scales were developed to evaluate obese patients' progress while using holistic cognitive-behavioral therapy strategies (Kramer, 2007; Popkess-Vawter, 2013; Popkess-Vawter, Gerkovich, Wendel, 2000). The purpose of this article is to summarize the psychometric results from development studies of the last 25 years of the Overeating Tension Scale, Exercise Tension Scale, Feelings Tension Scale, and Feelings about Weight Tension Scale (Godwin, 2013, April; Hudson, Legrand, Kramer-Jackman, & Geisler, 2015, July; Kramer, 2007; Kramer-Jackman, & Popkess-Vawter, 2011; Popkess-Vawter, Gerkovich & Wendel, 2000). Psychometric results from seven developmental studies, including two previously unpublished studies are described. Future tension scale development priorities also are discussed.

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Weight management researchers have known for decades that stress and emotions frequently trigger overeating (Brownell & Rodin, 1994; Burch, 1973; O'Reilly, Cook, Spruijt-Metz, & Black, 2014; Polivy & Herman, 1985; Popkess-Vawter, 2005a; Popkess-Vawter, Gajewski, & Yoder, 2005). Studies have further confirmed that often unpleasant feelings trigger overeating in overweight and obese weight cyclers, yet have minimal impact on normal weight individuals' consumption (Popkess-Vawter, 1994; Popkess-Vawter, & Owens, 1999; Popkess-Vawter, & Turner, 2001; Popkess-Vawter, Wendel, Schmoll, & O'Connell, 1998). Weight cyclers are individuals with repeated weight loss greater than ten pounds followed by weight gain, reoccurring in a pattern of three or more times over the past two years (Montani, Vieceili, Prevot, & Dullo, 2006; Popkess-Vawter, 2013). It is also known that unidimensional, calorie focused, "quick fix" weight loss methods have limited long term effects on overweight or obese individuals, and often compound the weight cycling problem (National Heart, Lung, & Blood Institute [NHLBI], 2013; Popkess-Vawter, 2013). In addition, few weight management programs directly address how negative beliefs and self-statements about one's shortcomings and interactions with others can repeatedly increase tension and distort attitudes, and lead to negative behaviors, such as overeating, skipping exercise, and strong feelings about one's body weight (Hudson, Legrand, Kramer-Jackman, & Geisler, 2015, July; Popkess-Vawter, 2005b, 2013)

Multidimensional comprehensive weight management programs that comprise of multiple dietary, physical activity, and cognitive-behavioral strategies have been shown to be effective in treating overweight and obese individuals (American Dietetic Association, 2009; Anderson, Konz, Frederick & Wood, 2001; Corbalan, et al., 2009; Fabricatore, 2007; Fossati et al, 2004; Lin, O'Conner, Whitlock, & Beil, 2010; Munsch, Meyer, & Biedert, 2012; NHLBI, 2013; Spahn et al., 2010; Stahre & Hallstrom, 2005; Thompson, 2015; Tsiros, et.al, 2008). Cognitive-behavioral therapy focuses on both cognitive therapy and behavioral therapy. Cognitive strategies address modifying maladaptive thoughts, self-statements, or beliefs that can cause unpleasant feelings (Craske, 2010). Behavioral strategies focus on decreasing maladaptive behaviors and increasing adaptive ones (Craske, 2010). A multidimensional weight management program called the Holistic Self-Care Model (Popkess-Vawter, 2013) employs multiple cognitive-behavioral therapy strategies focused on teaching individuals to recognize and modify their negative thoughts that are cause unpleasant feelings and tension, and to shift to another motivational state, employing healthy coping mechanisms and avoiding related negative behaviors (Hudson, Legrand, Kramer-Jackman, & Geisler, 2015, July; Popkess-Vawter, Brandau, & Straub, 1998; Popkess-Vawter, 2000; Popkess-Vawter 2005b; Popkess-Vawter, 2013; Kramer, Luder, & Popkess-Vawter, 2004; Popkess-Vawter, & Owens, 1999; Popkess-Vawter, & Turner, 2001; Popkess-Vawter, Brandau, & Straub, 1998). Preliminary evidence found that patients completing a Holistic Self-Care Model based weight management program demonstrated that the holistic cognitive-behavioral therapy strategies were helpful in achieving a healthy weight (Kramer, Luder, & Popkess-Vawter, 2004). Greater detail of the application of the Holistic Self-Care Model is available in the *Holistic Nursing: A Handbook for Practice* (Popkess-Vawter, 2013).

Prior to the tension scales, there were no measures available to identify specific triggers of overeating, skipping exercise, feeling low or down, nor strong feelings about one's body

weight; and the related motivational states, and tension levels. Currently, reliable and valid questionnaires exist to measure obesity related concepts, such as bulimia (Thelen, McLaughlin-Mann Pruitt, & Smith, 1987), eating disorder-related social comparison (Fitzsimmons-Craft, & Bardone-Cone, 2013), physical activity (Flack, McDonald, Beets, Brazendale, & Lui-Ambrose, 2016), self-esteem (Rosenberg, 1965), weight-based self-esteem (Trottier, McFarland, Olmsted, & McCabe, 2013), and mindfulness eating (Framson et al., 2009). Yet, the tension scales are currently the only known questionnaires that identify specific triggering events, providing quantifiable metamotivational tension levels that can be tracked over time, and support the use of strategies to modify behavior.

Framework: Reversal Theory

Reversal theory is a phenomenological theory that provides a framework to locate tension stress in metamotivational states where negative self-statements originate and can be targeted for positive self-statement replacement to decrease tension stress (Apter, 1989, Popkess-Vawter, Wendel, Schmoll, & O'Connell, 1998; Popkess-Vawter, 2013). Reversal theory describes how personality is inherently inconsistent, and that people reverse between opposing states called metamotivational states. Individuals experience their motivations and actions in different ways, depending on which metamotivational state they are in at the time (Apter, 1989). Healthy individuals reverse between states easily and often throughout the day (Apter, 1989).

Individuals reverse between four pairs of opposing states: telic and paratelic, conformist and negativistic, mastery and sympathy, and alloic and autic (Apter, 1989). At a given point in time, individuals are in combinations of the different states, consisting of one state of each of the four pairs, but never in both states of a pair at the same time (Popkess-Vawter, Gerkovich, & Wendel, 2000).

When in the telic state, individuals are serious-minded and goal-oriented; when in the paratelic state, they are playful and spontaneous (Apter, 1989). When in the conformist state, people prefer to go along with rules and regulations; when in the negativistic state, they prefer to break rules and want to be rebellious or noncompliant. When in the mastery state, individuals feel that being tough and being in control are important; when in the sympathy state, they feel that being tender and noncompetitive are important. In the alloic state, people derive pleasure from thinking of others before themselves in an altruistic way; in the autic state, they derive pleasure from thinking of themselves before others (Apter, 1989).

Pleasant feelings are associated with no tension or the way individuals want to feel. Tension is defined as a feeling of discomfort—the difference between the way people feel and want to feel; the greater the difference, the greater the tension (Popkess-Vawter, Gerkovich, & Wendel, 2000). For example, often a woman begins a new diet feeling strongly motivated to reduce excess calories and fat (telic, compliant, mastery/alloic). Yet, within a short time, she may involuntarily reverse in the way she views her calorie and fat restrictions to feel punished or deprived, thus becoming more inclined to overeat (reversal to paratelic, defiant, sympathy/autic); (Popkess-Vawter, Brandau, & Straub, 1998).

Item Format, Administration, and Scoring

The Tension scales were developed to operationalize and apply reversal theory to an individual's weight related experiences (Popkess-Vawter, Gerkovich, & Wendel, 2000). The four independent self-report scales (The Overeating Tension Scale, Exercise Tension Scale, Feelings Tension Scale, Feelings about Weight Tension Scale), all consist of the same instrument structure: 32 items and total score tension range from 0 – 108. Only the directions and purposes of the tension scales vary (see Table 1). The scales are semantic differential scales that use bipolar terms for the pleasant and unpleasant feelings for each metamotivational state (Popkess-Vawter, Gerkovich, & Wendel, 2000). An example of how a respondent would complete the first subscale pair (telic/paratelic) of the technology-delivered tension scales is provided using a mock-up of the Feelings about Weight Tension Scale (See Figure 1).

When completing the Feelings about Weight Tension Scale, respondents first recall a time in the last month when they had strong feelings about their weight, and then describes the situation in a text box. The directions are different for each tension scale asking the respondent to recall a situation when they overate, skipped exercise, felt low or down, or had strong feelings about their weight. Once the respondent has described their situation, they are asked to select the option that best describes how they were feeling just before their self-described situation occurred either as serious (telic state) or as playful (paratelic state).

In Figure 1, the serious or telic state was selected, and the electronic system delivers the telic metamotivational state set of items. In this example, the unselected paratelic state items are not shown to the respondent. The visible semantic differential rankings for the telic state are then completed by marking a number on a one to ten scale, identifying the extent they experienced the feelings between the two opposite unpleasant/pleasant feeling (unsettled/settled) terms listed. The respondent completes this semantic differential rankings for items asking how they felt and then how they wanted to feel. The electronic system then subtracts the respondent's number answer for how they felt from how they wanted to feel for the eight items, resulting in four scores. These scores are electronically added to represent the telic metamotivational state subscale tension score. The respondent is not made aware of the self-selected metamotivational states or scores. Respondents continue to respond to items about the next paired metamotivational states (compliant or defiant), which are not shown on Figure 1 but are formatted using the same method.

Finally, respondents select among the last four metamotivational states (mastery/autic; mastery/alloic; sympathy/autic; or sympathy/alloic) and answer related items. The three subscale metamotivational state scores are then added to get tension scale total score. Paper and pencil administration is described in the Popkess-Vawter, Gerkovich, and Wendel (2000) publication. Online technology-delivery of the scales is discussed in the Kramer (2007), and Kramer-Jackman, & Popkess-Vawter (2011) study publications.

Overeating Tension Scale (Studies I – IV)

From 1994–1999, four instrument development studies were conducted to establish reliability and validity of the paper and pencil version of the Overeating Tension Scale (Popkess-Vawter, Gerkovich, & Wendel, 2000; see Table 2). Two instrument development studies ($N = 373$; $N = 208$), refined and reduced 48 items to 32 (four items for each metamotivational state); (Popkess-Vawter, Gerkovich, & Wendel, 2000). Two more studies ($N = 330$, $\alpha = .74 - .93$; $N = 130$, $\alpha = .70 - .92$) provided internal consistency reliabilities for the subscales using normal weight and overweight women participants (Popkess-Vawter, Gerkovich, & Wendel, 2000). Construct validity was supported using hypothesis testing that overweight participants reported higher overeating tension than normal weight participants [$F(1, 126) = 7.12$, $p < .009$]; (Popkess-Vawter, Gerkovich, & Wendel, 2000). The studies found that the Overeating Tension Scale had sufficient reliability and validity to measure tension before overeating.

Exercise Tension and Feelings Tension Scales (Study V)

In 2001, work began to develop the Exercise Tension Scale and Feelings Tension Scale using the same reversal theory-based scale modified to measure tension-related skipping planned exercise and feeling low or down, respectively (Kramer, 2007). The scales were also adapted and evaluated for technology-delivery so they could be utilized to evaluate weight management interventions in rural Kansas Telehealth programs (Kramer, 2007; Kramer-Jackman, & Popkess-Vawter, 2011). The study, Psychometric Analysis of Three Tension Scales in Rural Telehealth Setting for Weight Management Practice, was implemented in two phases (see Table 2). Phase 1 established technology-delivery and usability: a) readability at a fifth grade level by a literacy expert; b) acceptable content validity by four reversal theory experts; c) acceptable usability and technology-delivery (human computer-interaction) ratings by an expert reviewer; and e) acceptable participant usability and above-average performance evaluation scores from six participants.

Phase 2 involved 61 participants from two Kansas rural communities who pilot-tested 10 technology-delivered questionnaires that were revised based on Phase 1 results. Participants ranged from 21 to 77 years old, were predominantly female (80%), Caucasian (88%), and married (78%). The National Heart, Lung, and Blood Institute's body mass index (BMI) calculator was used to determine participants' body mass index (NHLBI, 2016). Participants consisted of 14 normal weight (BMIs = 18.5 – 24.9), 13 overweight (BMIs = 25 – 29.9), 25 obese (BMIs = 30 – 39.9), and 9 morbidly obese (BMIs = > 40) individuals. Power was estimated using 61 participants, a medium effect size (.30) for calculating correlations, and an alpha level of .05, which yielded a power estimated of 0.675 (Lenth, 2006), therefore, failing to meet an ideal power of greater than .90 (Waltz, Strickland, & Lenz, 2005).

Internal consistency reliability for all three tension scales was established at or >.70. Inter-item correlations calculated for all three tension scale items ranged from .424 – .972, therefore, were considered above the standard of .30 (Waltz, Strickland, & Lenz, 2005). Convergent validity was established using other questionnaires known to measure similar concepts of the three tension scales (see Table 3.). Validity was established for Overeating

Tension Scale and Bulimia Test (BULIT); (Thelen et al., 1996), and Exercise Tension Scale and Tension and Effort Stress Inventory (TESI); (Svebak, 1993), achieving positive moderate correlations .30-.60 (Waltz, Strickland, & Lenz, 2005). Correlations between other questionnaires were not significant (Kramer, 2007).

Hypothesis-testing established that all three tension scale scores were significantly correlated with BMI [OTS ($r = .451$, $p = .001$, $n = 53$); ETS ($r = .521$, $p = .0001$, $n = 51$); and FTS ($r = .373$, $p = .007$, $n = 51$); Kramer, 2007]. Although results were highly informative, the need for further testing with larger numbers of normal and overweight individuals was essential to establish reliability and validity of the three technology-delivered tension scales prior to official use with weight management patients.

To meet the purpose of this article, to summarize the tension scales' psychometric results, the final two unreported psychometric studies (Studies VI and VII) will be presented. The Online Tension and Weight Study (Study VI) evaluated the Overeating Tension Scale, the Exercise Tension Scale, and the Feelings Tension Scale with the following research questions:

- What are the internal consistency reliability results for the Overeating Tension Scale, the Exercise Tension Scale, and the Feelings Tension Scale?
- What are the construct validity results between: the Overeating Tension Scale and BULIT scale; the Exercise Tension Scale and International Physical Activity Questionnaire (IPAQ) scale; and the Feelings about Weight Tension Scale and Rosenberg Self-esteem scale?

The hypothesis for Study VI was subjects with higher body mass indices will have higher tension scores compared to participants with lower body mass indices on the Overeating Tension, Exercise Tension, and Esteem Tension Scales. The follow-up Feelings about Weight Tension Scale Pilot (Study VII) asked three research questions:

- What was the internal consistency reliability result for the Feelings about Weight Tension Scale?
- What was the convergent validity result between the Feelings about Weight Tension Scale and Overeating Tension Scale?
- What was the construct validity results between the Feelings about Weight Tension Scale and Rosenberg Self-Esteem Scale?

Methods

Sample and Participant Selection

Study VI Participants—In 2010, the Online Weight and Tension Study was conducted as a psychometric instrument evaluation delivered through the Internet. It was designed to reevaluate the internal consistency reliability, construct validity, and hypothesis testing with known groups for the three tension scales with a large online convenience sample.

Participants were recruited by internet from a University of Kansas Medical Center research study broadcast advertisement, a Kansas City lay person obesity support group, and word of mouth. Recruitment began in September 2010 and concluded in December 2010, using oversampling of 50 participants to account for missing data. The final 276 participants were divided equally into two NHLBI's (2016) BMI designated groups of normal weight, those with a body mass indices of 20 to 24.9 ($n=140$), and those categorized as overweight or obese with a body mass indices of 25 or greater ($n=136$; see Table 4). The post hoc power analysis revealed a power of .99, medium effect size (.30) at the .05 level (Faul, Erdfelder, Buchner, & Lang, 2009). The study participants ranged in age from 20 to 65 years, but were predominately 20 to 29 years old (51%), female (74%), and Caucasian (75%).

Study VII Participants—The follow-up pilot Study VII psychometrically evaluated internal consistency reliability, convergent, and construct validity of the Feelings about Weight Tension Scale. The newest tension scale posed “think of a time in the past month when you had strong feelings about your weight” and follows the same format as the other three tension scales.

Participants were recruited by Internet from the University of Kansas School of Nursing broadcast advertisement, and word of mouth over a two month period in 2012. The convenient sample of 53 participants was predominantly Caucasian female health profession students ranging in age from 21 – 65 years ($\mu = 30$). Thirty-eight participants had a normal BMI (> 19.9 and < 25), and fifteen participants met NHLBI (2016) criteria for being overweight or obese (BMI = > 24.9 ; see Table 4).

Procedures

Study VI Procedures—Participants responded to an advertisement communicating to the study's email address. Researchers responded to participants' emails, verifying that respondents met entry criteria (between 21 and 65 years of age, not pregnant, no illness that affects weight loss or gain, and no medication that affects thinking or feelings about weight or impacts weight gain [i.e. steroids; anti-psychotic medications, antidepressant medications, insulin]). In addition, researchers calculated participants' BMI. Participants with a BMI greater than 19.9 and equal or less than 24.9 were placed into the normal weight group. Participants with a BMI equal to or greater than 25 were placed into the overweight and obese weight group.

Researchers tracked the number of participants in each weight group, stopping recruitment when each group reached over the sampling size numbers. Researchers then answered any participant's questions (including consent questions) and assured participants that the study website was protected by security measures to minimize any threat to identities and personal information. Qualified participants were emailed specific instructions about how to access the secure study website, a unique study identification number to use, and information on how to complete the randomized 10 study questionnaires (demographics, three tension scales, six comparison questionnaires including social desirability scale). Reliability and validity for comparison study questionnaires are listed on Table 3.

Completion of the study questionnaires took 20 to 30 minutes, and participants were automatically sent an email when they completed the study notifying them that their payment was being processed. Researchers verified that the participant completed all the questionnaires and then started the process to mail a \$15.00 dollar gift card to the specified address on the demographic form (Internal Revenue Service requires name, address, social security number for payment). Human Subjects approval was awarded prior to the start of the study.

Study VII Procedures—The follow up Study VII criteria to participate included; a) being between 21–65 years of age, b) not pregnant, c) no diagnosis of an illness that affect weight loss or gain, and d) not on any medications that affects thinking or feelings about weight or impacts weight gain. Once participants confirmed they met study criteria, they were emailed a secure web link and specific instructions about how to complete the questionnaires. Participants then provided confirmation of agreeing to participate and were automatically assigned a study identification number. They then completed the Feelings about Weight Tension Scale, a demographic form, and two comparison questionnaires (Overeating Tension Scale and Rosenberg Self-Esteem Scale), which were delivered utilizing Research Electronic Data Capture (REDCap) software package (Harris et al., 2009). Reliability and validity for the Rosenberg Self-Esteem scale is listed on Table 3. Completion of the questionnaires took participants 10 to 15 minutes. When completed, participants were provided with a number to provide to researchers in order to redeem a University logoed keychain worth \$3.50.

Analysis

Study VI Analysis—Participant data were associated with the participant's unique identification number, and automatically exported to an Access database every time the participant hit submit to go to the next webpage. Once data collection was closed, researchers downloaded and saved the data as Excel and Statistical Program for Social Sciences (SPSS) files. Data cleaning was minimal as participants' responses are routed electronically so that they may not advance to the next question until they respond to each question in order. Quantitative data quality assurance procedures were completed in conjunction with all analyses using SPSS software, including statistical assumption testing (scatterplot) and internal consistency reliability tests for the ten questionnaires. Data distributional properties were assessed and transformations made if necessary.

Construct validity was evaluated using Pearson correlations coefficients expecting to find moderate, positive correlations (.30 – .60; Waltz, Strickland & Lenz, 2005). For known-groups hypothesis testing, a *t* test for independent samples was used to test for significant differences ($p < .05$) between normal and overweight groups. In addition, exploratory distribution analysis of the metamotivational states experienced was completed by calculating the number of times obese or normal weight participants were in the eight metamotivational states. Finally, descriptive content analysis (Patton, 1990) was conducted for the open-ended participant-provided Feelings Tension Scale situations to identify common emergent situational themes. Two researchers independently coded each situation.

Raters then met to discuss each result with two reversal theory experts in order to reach consensus on all the situations (Patton, 1990).

Study VII Analysis—Follow up Study VII participant data were automatically assigned an identification number and downloaded into a REDCap database. Researchers then downloaded and saved data as Excel and Statistical Program for Social Sciences (SPSS) files. Data cleaning was minimal due to the technology-delivery features of forced item completion and the limited range of numerical values available for respondent selection. Internal consistency reliability results were evaluated for the Feelings about Weight Tension Scale, knowing that a Cronbach's alpha coefficient greater than .70 is desired. Convergent validity was evaluated using Pearson correlations coefficients between the Feelings about Weight Tension Scale and Overeating Tension Scale expecting moderate, positive correlations (.30-.60; Waltz, Strickland & Lenz, 2005). Construct validity was evaluated using Pearson correlations coefficients between the Feelings about Weight Tension Scale and Rosenberg Self-esteem scale expecting moderate, positive correlations (.30-.60; Waltz, Strickland & Lenz, 2005).

Results

Study VI Results

Internal Consistency Reliability—Internal consistency reliability of the total scores on the three tension scales had alpha coefficients higher than the acceptable level of Cronbach's alpha coefficients (Overeating Tension Scale, $\alpha = .886$; Exercise Tension Scale, $\alpha = .846$; Feelings Tension Scale, $\alpha = .827$; see Table 2). All eight metamotivational states for all three tension scales were found to be internally consistent with $\alpha > .70$ (Waltz, Strickland, & Lenz, 2005). No item, when deleted, improved the total scale Chronbach's alpha, thus allowing all items to be retained for hypothesis testing. Significant inter-item correlations for the eight metamotivational states on all three tension scales were all correlated above the standard .30 ($r = .477$ to $.762$); thus, all subscales were considered sufficiently related (Waltz, Strickland, & Lenz, 2005). In summary, internal consistency reliability was established for the three tension scales, and they were significantly inter-correlated, showing consistent assessment of tension.

Known-groups Technique: Hypothesis Testing—The Overeating Tension Scale and Exercise Tension Scale total scores were significantly correlated with body mass indices [$r = .241$, $p = .01$, $n = 267$ and $r = .210$, $p = .01$, $n = 266$ respectively]. The Feelings Tension Scale was not significantly correlated with BMI. In summary, as hypothesized, Overeating Tension Scale and Exercise Tension Scale total scores were significantly correlated with the overweight and obese participants' body mass indices [Overeating Tension Scale, $r = .209$, $p = .016$, $n = 132$; Exercise Tension Scale, $r = .206$, $p = .018$, $n = 131$] but was not correlated with normal weight participants' body mass indices. The Feeling Tension Scale was not significantly correlated for either group.

Exploratory Metamotivational State Analysis—Assessment of the metamotivational states that respondents selected during their described tension scale situations was

completed. Results found that before overeating, overweight participants were in a playful (paratelic), conforming (compliant) self-focused, feeling tender (sympathy/autic) metamotivational states. Before skipping exercise, overweight participants reported being predominantly in serious-minded (telic), conforming (compliant), and other-centered, feeling tender (sympathy/alloic) metamotivational states. Overweight participants' tension scores (the difference between the way they wanted to feel and the way they felt) revealed significant differences from normal weight participants as well. The aim for using these scales is to support individuals' ability to recognize when they are in an unhealthy or stagnant pattern of metamotivational states with high tension levels, and to assist them to shift to a new pattern of states by selecting a healthy behavior such as exercising.

Content Analysis—Results indicated that further analysis and in-depth exploration were needed to reveal why there were no significant findings for the Feeling Tension Scale. Descriptive content analyses informed researchers that the Feelings Tension Scale yielded a more global assessment of many types of tension stress. The Feeling Tension Scale directions posed, “Think of a time in the last month when you felt low or down”. Participants reported negative feelings related to work stress; disagreements with family, friends, and colleagues; and studying/examination pressures. While having a reliable and valid global questionnaire of tension, stress can be beneficial for situations needing to measure situations of feeling low or down due to negative events. Researchers were striving for a scale that measured an individual's positive or negative feelings about his or her body weight. The individual's feelings needed to be directly related to events specific to the individual's weight (i.e., trying on jeans that are too tight), which in turn can precipitate strong feelings (tension stress). These results established the need to develop the Feelings about Weight Tension Scale.

Study VII Results

Face validity was achieved with ten participants, two theory experts, and two obesity clinicians prior to piloting the Feelings about Weight Tension Scale. The Feelings about Weight Tension Scale yielded adequate internal consistency reliability $> .70$ ($\alpha = .829$, $n = 53$); convergent validity with the Overeating Tension Scale ($r = .705$, sig. $p = 0.01$, $n = 53$); and construct validity with the Rosenberg Self-esteem scale ($r = -.589$, sig. $p = 0.00$, $n = 53$; see Table 2). Hypothesis testing for a significant correlation between BMI and Feelings about Weight Tension Scale was not attempted due to the participants being predominantly (72%) of a normal weight. To summarize, researchers found significant internal consistency reliability and moderate construct validity for the Feelings about Weight Tension Scale.

Discussion

The Overeating Tension Scale, Exercise Tension Scale, and Feelings Tension Scale have been shown to be internally consistent, and the Overeating Tension Scale and Exercise Tension Scale were significantly correlated with BMI. These significant correlations and significant differences between tension scores and overweight participants' body mass indices (weight groups) provided evidence that relationships exist between overweight individuals' body mass indices and their tension levels before overeating and skipping

exercise. The Feelings Tension Scale results showed that it is an internally consistent and acceptable measure of global low esteem tension (feeling low or down), but is not specifically related to the context of weight-related feelings and tensions. Finally, the Feelings about Weight Tension Scale has internal reliability, as well as convergent and construct validity results that are promising; however, a larger psychometric study is needed to test further with obese and normal weight groups.

Limitations of both studies were that participants' weights were self-reported. Research showed that if participants provided an inaccurate weight, it was usually less than their true weight (Stommel & Schoenborn, 2009). Authors were aware that self-reporting of lighter weights could have caused participants to be placed in the normal weight group instead of the obese group in the case of the online weight and tension study. Miscategorized obese participants in the normal weight group could have increased the tension level variability and statistically decreased significant correlations between weight groups. However, the significant positive correlation results would have been affected, which was not the case.

In addition, participants for both studies were predominantly young, Caucasian, and females. Future tension scale development priorities include: a) conducting the Feelings about Weight Tension Scale online psychometric study with weight groups; b) exploring use of the Overeating Tension Scale, Exercise Tension Scale, and Feelings about Weight Tension Scale with telehealth and in-person weight management individuals in order to establish tension score ranges; and c) exploring the use of Overeating Tension Scale, Exercise Tension Scale, and Feelings about Weight Tension Scale with participants who are male, middle aged, and have greater ethnic diversity.

With the addition of the Feelings about Weight Tension Scale, the authors believe that a full range of possible triggers are covered for purposes of tailoring weight management interventions—precipitating events related to strong feelings about one's weight (FWTS) that may cause tension stress. Negative tension stress about weight then is added to other possible triggers (high tension stress events), which in turn can trigger overeating (OTS) and skipping exercise (ETS).

Care providers can use tension scales, independently or together, longitudinally over time to identify and track individuals' specific triggers or events of overeating, skipping exercise, and having strong feelings about one's weight, and then counsel them about modifying behavior through healthy coping mechanisms. Dissemination of the tension scale findings for the last 25 years provides evidence for their continued use and support of future research examining the tension scales' impact on evidence-based weight management counseling practice changes.

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Feelings about Weight Tension Scale	
Think of a time in the past month when you had strong feelings about your weight. In the space provided briefly describe the situation. Please tell about who was involved, where, when, and details about what happened.	(space)
Choose the option that best describes how you felt in the situation last month when you had strong feelings about your weight.	☐ Serious, having an important goal, planning ahead, trying to accomplish something important, caring about future outcomes. ☐ Playful, spontaneous, looking to have a good time, looking to have fun, focusing on the here and now.
The next questions show a range of feelings. Select the circle nearest the word that applies to how you felt during the situation related to your weight.	
1. I was feeling	
☐ 1 Unsettled ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 Settled	
2. I wanted to feel	
☐ 1 Unsettled ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 Settled	
3. I was feeling	
☐ 1 Anxious ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 Relaxed	
4. I wanted to feel	
☐ 1 Anxious ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 Relaxed	
5. I was feeling	
☐ 1 Worried ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 Not worried	
6. I wanted to feel	
☐ 1 Worried ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 Not worried	
7. I was feeling	
☐ 1 Nervous ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 Calm	
8. I wanted to feel	
☐ 1 Nervous ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 Calm	

Figure 1.
Technology-delivery of the Telic/Paratelic Subscales

Table 1

Tension Scales

Scale	Purpose of Scale	Number of Items	Total Score Range
Overeating Tension Scale (OTS)	Determines the reversal theory metamotivational states and related tension levels the respondent was experiencing during a self-determined situation of overeating.	32	0–108
Exercise Tension Scale (ETS)	Determines the reversal theory metamotivational states and related tension levels the respondent was experiencing during a self-determined situation of skipping planned exercise.	32	0–108
Feeling Tension Scale (FTS)	Determines the reversal theory metamotivational states and related tension levels the respondent was experiencing during a self-determined situation of feeling low or down.	32	0–108
Feelings about Weight Tension Scale (FWTS)	Determines the reversal theory metamotivational states and related tension levels the respondent was experiencing during a self-determined situation of strong feelings about their weight.	32	0–108

Table 2

Summary of Tension Scale Psychometrics by Scale

Reliability			Validity		Technology delivery					Performance evaluation (%)	
Study ^a	N	Internal consistency (α)	Inter-item (r)	Content validity (CVI)	Convergence construct validity (r)	Hypothesis testing construct validity (r)	e-health literacy (grade)	Human computer interaction (%)	Expert usability (%)	Participant usability	
Overeating Tension Scale											
I	373	.74 – .86		.75, .100							
II	208	.77–.87									
III	330	.74–.93									
IV	130	.70–.92			* $r = .327$.						
V	61	.898	.498–.994	.96	* $r = .318$.	*** $r = .451$.	3.8	>80	>80	3–4/4	>70
VI	267	.886	.559–.762			** $r = .241$.	< 5				
VII	53				** $r = .705$.		< 5				
Exercise Tension Scale											
V	61	.801	.532–.921	.96	$r = -.095$.	*** $r = .521$.	4.4	>80	>80	3–4/4	>70
VI	267	.846	.575–.722			** $r = .210$.					
Feelings Tension Scale											
V	61	.879	.483–.933	.96	$r = -.129$.	** $r = .373$.	3.9	>80	>80	3–4/4	>70
VI	267	.827	.477–.694			$r = .082$.	< 5				
Feelings About Weight Tension Scale											
VII	53	.829	.636–.958		** $r = -.589$		< 5				

Note: Abbreviations:

- * $p < .05$, two tailed.
- ** $p < .01$, two tailed.
- *** $p < .001$, two tailed.

^aStudies have been listed by a roman numeral to conserve space. Study I: 1994–1999 Studies (Popkess-Vawter, Gerkovich, & Wendel, 2000); Study II: 1994–1999 Studies (Popkess-Vawter, Gerkovich, & Wendel, 2000); Study III: 1994–1999 Studies (Popkess-Vawter, Gerkovich, & Wendel, 2000); Study IV: 1994–1999 Studies (Popkess-Vawter, Gerkovich, & Wendel, 2000); Study V: 2006–07 Psychometric analysis of three tension scales in rural telehealth setting for weight management practice (Kramer, 2007; Kramer-Jackman & Popkess-Vawter, 2011); Study VI: 2010–11 Online Weight and Tension Study (unpublished); Study VII: 2012 Online Weight and Tension Study: FWTS Pilot (unpublished).

Table 3

Comparison Measures Reliability and Validity

Comparison Measure	Author ^a	Concept measures	Number of items	Cited reliability coefficients (α)	Cited validity coefficients (r)
Bulimia Test – revised (BULIT-R)	Thelen, 1996	bulimia diagnosis	28	.85 – .98	.73 – .90
International Physical Activity Questionnaire (IPAQ)	Craig, 2003	physical activity	7	.45 – .90	.57 – .90
Marlowe-Crowne 2(10) Social Desirability Scale	Reynolds, 1982	social desirability	10	.73 – .87	.80 – .90
Rosenberg Self-Esteem Scale (RSES)	Rosenberg, 1965	general measure of self-esteem	10	.85	.77 – .88
Tension and Effort Stress Inventory (TESI)	Svebak, 1993	individuals' experiences of stressors, moods, and efforts to cope	24	.88, .75	NA

Note:

^a Citations have been listed by the first author's last name to conserve space.

Table 4

Descriptive Statistics for Tension Scale Studies

Variable	Online Weight and Tension Study (2010–2011). (N = 276)		Feelings about Weight Tension Scale Pilot Study (2012). (N = 53)	
	Frequency	%	Frequency	%
Gender				
Males	72	26	2	4
Female	204	74	51	96
Marital Status				
Single	120	44	32	60
Married/Partnered	130	47	19	36
Divorced/Widowed	26	9	2	4
Ethnicity				
African American	21	8	–	–
Caucasian	209	75	52	98
Hispanic	10	4	–	–
Native American	1	1	1	2
Other	35	12	–	–
Weight				
Normal (BMI 20–24.9)	140	51	38	72
Obese (BMI 25 and >)	136	49	15	28
Age				
20–29 years	141	51	36	68
30–39 years	66	24	8	15
40–49 years	36	13	1	1
50–59 years	27	10	4	8
60–65 years	6	2	4	8

Note. BMI = Body Mass Index.