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Perceived stress, Self-esteem and Perceived Life Expectancy among Tai Chi Practitioners and Sedentary Persons

Estrés Percibido, Autoestima y Esperanza de Vida Percibida entre Practicantes de Tai Chi y Personas Sedentarias

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Abstract. The aims of this article were: 1) determinate internal consistency and factor structure of the two scales created to assess perceived stress and perceived life expectancy, 2) validate the Rosenberg's Self-Esteem Scale (RSE-10), 3) to study whether practicing Tai Chi has an effect on perceived stress, perceived life expectancy, and self-esteem, and 4) contrast a structural model of relation among these three variables. A scale to assess perceived stress, a scale to assess perceived life expectancy and the RSE-10 were administrated to a non-probability sample of 86 Tai Chi practitioners and 91 sedentary persons. The scales of perceived stress and life expectancy had one-factor structure and high internal consistency. One negatively keyed item of the RSE-10 had problems of internal consistency and did not load significantly on the expected factor. The model two correlated factors for the RSE-10 had a close fit to the data. Tai Chi practitioners had a significantly lower level of stress, higher level of self-esteem, and greater perceived life expectancy. A structural model was specified. In this model, the self-esteem (assessed by the 5 positively keyed items of the RSE-10) had a direct effect on stress and perceived life expectancy (total scores), and the stress had a direct effect on perceived life expectancy. This model showed a close fit. The properties of invariance of this model between Tai Chi practitioners and sedentary persons were acceptable. It is concluded that Tai Chi practice has a beneficial effect on perceived stress, perceived life expectancy and self-esteem.
Key words: Tai Chi, stress, self-esteem, perceived life expectancy, Mexico.

Resumen. Los objetivos de este artículo fueron: 1) determinar la consistencia interna y estructura factorial de las escalas creadas para evaluar estrés y esperanza de vida percibida, 2) validar la Escala de Autoestima de Rosenberg (RSE-10), 3) estudiar si la práctica de Tai Chi tiene un efecto sobre el estrés, esperanza de vida percibida y autoestima, y 4) contrastar un modelo estructural de relación entre estas tres variables. Una escala para medir estrés percibido, otra para medir esperanza de vida percibida y la RSE-10 fueron administradas a una muestra no probabilística de 86 practicantes de Tai Chi y 91 personas sedentarias. Las escalas de estrés y expectativa de vida percibida tuvieron una estructura unidimensional y consistencia interna alta. Un ítem inverso de RSE-10 tuvo problemas de consistencia interna y no tuvo una carga significativa en el factor esperado. El modelo de dos factores correlacionados para la RSE-10 tuvo buen ajuste. Los practicantes de Tai Chi tuvieron significativamente menor estrés, mayor autoestima y mayor esperanza de vida percibida. Se especificó un modelo estructural. En este modelo, la autoestima (medida por los 5 ítems directos de RSE-10) tuvo un efecto directo sobre estrés y esperanza de vida percibida (puntuaciones totales), y el estrés tuvo un efecto directo sobre esperanza de vida percibida. El modelo mostró buen ajuste. Las propiedades de invariancia del modelo entre practicantes de Tai Chi y personas sedentarias fueron aceptables. Se concluye que la práctica de Tai Chi tiene un efecto beneficioso sobre estrés, esperanza de vida percibida y autoestima.
Palabras clave: Tai Chi, estrés, autoestima, esperanza de vida percibida, México.

Introduction

When persons systematically practice physical exercise they begin to experience positive effects, both physical and psychological, such as improved glycemic control, improved weight control, increased bone density, improved muscular elasticity and strength, lower levels of stress, tendency to bring blood pressure into a healthy range, and better quality of sleep (Subirats, Subirats, & Soteras, 2012; Thornton, Sykes, & Tang, 2004). Constant

physical activity also increases self-confidence and the sensation of well-being (Payette, Gueye, Gaudreau, Morais, Shatenstein, & Gray-Donald, 2011), and it is also beneficial for the treatment of psychological disorders such as anxiety or depression (Lubans, Plotnikoff, & Lubans, 2012). Thus, physical activity turns out to be a therapeutic tool (Tarakci, Yeldan, Mutlu, Baydogan, & Kasapcopur, 2011).

Tai Chi is an exercise consisting of soft, low-impact movements, involving a high level of coordination between the movements of the body and the breathing process. Its exercises are designed to connect bodily awareness with movement, movement with breathing, and breathing with perception of vitality. Tai Chi stimulates the production of endogenous chemical compounds, such as β-endorphins (Zhang, Layne, Lowder, & Liu, 2012), which promote body relaxation and internal balance (Lan, Wolf, & Tsang, 2013). Nowadays, Tai Chi has become a popular means to improve health and obtain a longer life expectancy; owing to this reason, it has been included in the treatment of several physiological and psychological problems in some medical centers (Nomura, Nagano, Takato, Shouzoh, Yumi, & Seiji, 2011). In a review study, Hong (2008) found that a minimum practice of 3 hours a week during 3 months is required for that Tai Chi practitioners can perceive the beneficial effects of Tai Chi on their health.

There are many studies which have suggested that Tai Chi might be of benefit for patients living with chronic diseases, such as osteoarthritis (Fransen, Nairn, Winstanley, Lam, & Edmonds, 2007), cardiopathies (Taylor, Haskell, Stotts, & Froelicher, 2006), hypertension (Yeh, Wang, Wayne, & Phillips, 2008), rheumatoid arthritis (Wang, 2008), fibromyalgia (Wang, Schmid et al., 2010), and sleep disorders (Irwin, Olmstead, & Motivala, 2008).

In addition to the physical benefits, Tai Chi, like other modalities of physical exercise, has positive psychological effects, such as an increase of self-esteem (Adler & Roberts, 2006; Greenspan, Wolf, Kelley, & O'Grady, 2007). It should be mentioned that self-esteem is a very important achievement in the development of every human being, because it involves harboring a positive assessment and acceptance of self, and becomes a protector factor for mental health (Melendez & Rojas, 2006).

As previously mentioned, one of the psychological benefits of exercise might be the reduction of stress. Stress is a phenomenon emerging from the difficulty to satisfy the requirements or demands of the environment (Folkman, 2011). Chronic exposure to stress during extended periods produces harmful biological effects for the individual, as a consequence of high levels of cortisol (McEven, 2004).

The research on the effect of Tai Chi on reduction of the levels of stress has been carried out in clinical samples, and there seems not to be studies carried out in samples from the general population. As a hypothesis, it could be anticipated that Tai Chi will reduce and prevent the effects of stress, because this modality of physical activity seems to be a protective factor against diseases associated to the physiological deregulator effects of stress (Lee, Lee, & Woo, 2009).

Research has shown that Tai Chi practice extends life expectancy and is associated with greater self-esteem. Nevertheless, it has not been studied the perceived life expectancy, that is, if the persons feel that they will enjoy for a longer period of life. Perceived life expectancy is probably influenced by stress and self-esteem. It could be asked which ones are the effects of stress and self-esteem on perceived life expectancy among persons who practice or not Tai Chi.

Regarding perceived life expectancy, there seems not to be scales for its assessment; therefore, if one wants to assess this concept, it would be necessary to develop an instrument. Although there are several scales to assess perceived stress, there seems not to be any scale developed in Mexico; therefore, it would be possible to develop a scale in order to achieve greater cultural validity.

Regarding the assessment of self-esteem, the 10-item Rosenberg Self-Esteem (RSE-10) scale is one of the instruments more used (Lindwall et al., 2012). The RSE-10 was designed as a unidimensional measure of self-esteem (Rosenberg, 1965). Nevertheless, the model of one factor for the 10 items of the RSE-10 has consistently shown worse fit to the data than the model of two correlated factors: 5 positively worded items and 5 negatively worded items (Schmitt & Allik, 2005). A number of studies have found support for the notion that the use of both positively and negatively worded items may lead to errors of method related to different wording of the items (DiStefano & Motl, 2006; Tomas & Oliver, 1999). Research has shown that the method effects are primarily associated with negatively worded items (DiStefano & Motl, 2006; Lindwall et al., 2012; Marsh, Scalas, & Nagengast, 2010). Consequently, in order to reduce errors of method, it is advisable to simplify the RSE-10 to its 5 positively worded items when assessing self-esteem (Lindwall et al., 2012; Marsh et al., 2010).

The aims of this article were: 1) determinate internal consistency and factor structure of the scales created to assess perceived stress and perceived life expectancy, 2) validate the scale RSE-10 in a Mexican sample, 3) to investigate whether practicing Tai Chi has an effect on perceived stress, self-esteem, and perceived life expectancy, and 4) to study the influence of self-esteem on stress and perceived life expectancy, and the effect that perceived stress has on this expectancy, specifying and contrasting a structural model.

Regarding the first aim, it is expected a structure of one factor for the scales assessing perceived stress and perceived life expectancy, because these two scales are composed of a small number of positively keyed items, which facilitates unidimensionality (Miller, 1995) and, consequently, a high internal consistency is expected. Besides, perceived stress can be conceived as a unitary concept (Cohen & Janicki-Deverts, 2012).

Regarding the second aim, a model of two correlated factors is hypothesized for the RSE-10: one factor defined by the 5 positively worded items, and another factor defined by 5 negatively worded items (Lindwall et al., 2012). The scale will show high internal consistency; nevertheless, problems of internal consistency are likely to appear among 5 negatively worded items (DiStefano & Motl, 2006).

Regarding the third aim, it is expected a lower level of perceived stress, a higher level of self-esteem and a greater perceived life expectancy among Tai Chi practitioners than among sedentary persons, having physical activity (Tai Chi practice versus sedentarism) a medium or large effect size on perceived stress, self-esteem, and perceived life expectancy. Practicing exercise like Tai Chi has a modulating effect on autonomic nervous system, and therefore the level of perceived stress is expected to be lower among Tai Chi practitioners than among sedentary persons (Motivala, Sollers, Thayer, & Irwin, 2006). Development of motor abilities and positive effects of exercise on mood seem to impact on self-esteem, being expected a higher level of self-esteem among Tai Chi practitioners than among sedentary persons (Mustian, Katula, Gill, Roscoe, Lang, & Murphy, 2004). Nevertheless, the effect size of practicing Tai Chi on self-esteem could be lower than the effect on perceived stress owing to the more complex and stable nature of self-esteem, and the physiological changes of autonomic nervous system directly related to stress (McEwen, 2004). The positive effect of this activity on practitioners' health could reinforce the belief of having a longer life expectancy; therefore, it is expected that Tai Chi practitioners experience a greater perceived life expectancy than the sedentary persons (Lee et al., 2009).

Regarding the fourth aim, it has been proved that self-esteem is a protective factor against stress (Motivala et al., 2006); therefore, it is expected that it will have a significant effect that will be associated to a lower level of perceived stress both among Tai Chi practitioners and sedentary persons. Persons with greater self-esteem will have probably a deeper belief of living more years owing to the self-confidence in their abilities to have success in life and coping difficulties. Being stress a state of emotional discomfort, it was considered that it would lead to a negative, pessimistic, and defeatist perception that would have a negative effect on perceived life expectancy. From these expectancies, a predictive model is proposed. In the model, self-esteem would have a direct effect on perceived stress and perceived life expectancy, and perceived stress would have a direct effect on perceived life expectancy.

Method

Participants

The inclusion criteria for the participants of this study were: age $\geq$ 18 years old, to know how to read and write Spanish language, and to provide an explicit consent to participate. The additional inclusion criteria for the Tai Chi group participants were to be ascribed to a Tai Chi academy, and to have regularly attended to classes for more than 3 months and at least 3 hours a week. An additional criterion for the sedentary group participants was to not have practiced any sport activity in the last five years. The exclusion criterion was: to leave four or more questions without an answer (this exclusion criterion did not apply to monthly income because many persons did not report it owing to security reasons).

The non-probability sample of Tai Chi practitioners was composed of 86 participants. All of them had been practicing Tai Chi for more than 3 months, three times a week, an hour per class, with a structure composed by warm-up exercises, basic techniques, and forms. To recruit the group of Tai Chi practitioners, the survey takers visited 14 Tai Chi academies. These ones were randomly chosen from a list provided by the Association of Wu Shu of the

State of Nuevo Leon, Mexico. The possible participants were asked whether they had been practicing Tai Chi regularly for more than three months and at least three hours a week. In the cases of affirmative answers, the survey takers explained the aims and identified the responsible researchers of this investigation. Then the participants were requested to provide an explicit consent. In the first page of the questionnaire, the aims of study, content of scales, names and institutional adscriptions of researches were provided. In this first page the informed consent was made explicit by participants (marking the appropriate box [yes/no], without signature). After the participants had finished responding the questionnaire, they deposited it in a closed box similar to the urns used in the elections of political candidates.

The non-probability sample of sedentary persons was composed of 91 participants. To obtain this group, the survey takers approached adults who were at the city's Macroplaza Park and asked them whether they practiced any type of sport activity. In the cases of negative answers, they were asked for to give their explicit consent and the questionnaire was applied only if this consent was granted. Once they had finished responding the questionnaire, they deposited it in a closed box.

The groups of Tai Chi practitioners and sedentary persons had a number of participants statistically equivalent (binomial test: $p = .76$). Likewise, both groups were statically equivalent in frequencies of sex ($\chi 2[1, 177] = 0.65$, $p = .42$). The total sample included 131 (74%) women and 46 (26%) men. The Tai Chi practitioners were 66 (77%) women and 20 (23%) men. The sedentary persons were 65 (71%) women and 26 (29%) men. The average age among Tai Chi practitioners was 60.12 years old ($SD = 10.74$), and the one among sedentary persons was 60.52 years old ($SD = 10.70$). The average ages of both groups were statistically equivalent ($t[175] = 0.25$, $p = .80$). The average level of schooling among Tai Chi practitioners was 9.45 years ($SD = 4.32$), while the one among sedentary persons was 7.55 years ($SD = 4.39$). The average level of schooling was significantly higher among Tai Chi practitioners than among sedentary persons ($t[175] = -2.91$, $p < .01$). The average monthly income among Tai Chi practitioners (M = 13,800 Mexican pesos [around 1,000 US dollars], SD = 18,136) was significantly higher than ($t[57.45] = 2.48$, $p = .02$) the one among sedentary persons (M = 6,565 Mexican pesos [around 500 US dollars], SD = 6,588).

Instruments

The questionnaire was composed of four questions about socio-demographic information (sex, age, level of schooling, and monthly income), and 25 items to assess the three constructs of the study: 9 items for assessing perceived stress, 6 items for assessing perceived life expectancy, and the 10 items from the Rosenberg's Self-Esteem (RSE-10) scale, in its Spanish version obtained through back-translation. The 25 items were randomly distributed and were printed in that order to avoid or reduce response biases.

The scales for assessing perceived stress and perceived life expectancy were elaborated for this study and their psychometric properties are shown in the section of results. The items composing these two scales proceed from the worries, fears, beliefs and opinions more frequently expressed by participants in workshops on stress management and perceived life expectancy carried out by the authors of this paper (data unpublished).

The nine items for assessing perceived stress were: 1. “I feel uncomfortable because other people are more competent than I am”, 2. “I think that I have the sufficient abilities to face the challenges of my life”, 3. “It worries me that people think that I'm a bad person”, 4. “I feel that life demands of me more than I can comply with”, 5. “I'm afraid of not being accepted by the others”, 6. “I am worried about the diseases I have”, 7. “I am worried about not having enough money for my own life”, 8. “thinking of coping new challenges in my life worries me a lot”, and 9. “I have control over diseases that I suffer”.

The answers to the positively keyed items were scored with the value 4 for the option “definitively agree”, 3 for “agree”, 2 for “disagree”, and 1 for “definitively disagree”, whereas the negatively keyed items were scored: 1 for “definitively agree”, 2 for “agree”, 3 for “disagree”, and 4 for “definitively disagree”.

The RSE-10 was created by Rosenberg (1965) in order to assess self-esteem. It is a 10-item, Likert-type scale with items that are answered on a 4-point range (from “strongly agree” to “strongly disagree”). Five of the ten items are positively worded and the remaining five items are negatively worded. The internal consistency of its 10 items ranges from .45 to .90 with an average of .81, and it has a factor structure of two correlated factors composed of five items each one (5 positively worded statements, and 5 negatively worded statements). The total variance explained by the two factors extracted through principal component analysis ranges from 25 to 54%, with an average of 41% (Schmitt & Allik, 2005). The 10 items were arranged in the following order: 1. “I feel that I have a number of good qualities”, 2. “I wish I could have more respect for myself”, 3. “I feel that I am a person of worth, at least on an equal plane with others”, 4. “I take a positive attitude toward myself”, 5. “I certainly feel useless at times”, 6. “All in all, I am inclined to feel that I am a failure”, 7. “I am able to do things as well as most other people”, 8. “At times I think I am no good at all”, 9. “On the whole, I am satisfied with myself”, and 10. “I feel I do not have much to be proud of”.

The six items for assessing perceived life expectancy were: 1. “I have a very good health”, 2. “I have a very bad health”, 3. “I have a lot to live ahead”, 4. “I have few years to live”, 5. “I feel that I'm going to live many years”, and 6. “I feel that my life is over”.

Procedure

The eight voluntary survey takers received special training before applying the questionnaire. This study complied with the ethical norms of investigation of the American Psychological Association (2002). Each one of the persons who participated in the survey was informed about the aims of the investigation project and the content of the scales that composed the questionnaire. They were asked for to give their explicit consent to participate after having received a brief description of the investigation project. Anonymity and confidentiality for the information supplied were guaranteed. For this reason any personal identification data were not requested. Each participant was instructed to leave in blank those questions that they did not want to answer; however they were encouraged to answer all the questions and check that they had not skipped any of them. The anonymity of the answers was guaranteed by not asking for personal identification data and by depositing the answered questionnaire inside a closed urn.

Analysis of data

The internal consistency of the scales was calculated by Cronbach's alpha coefficient. Internal consistency values equal to or greater than .70 were considered high; equal to or greater than .60 were considered acceptable, and lesser than .60 were considered low.

Principal component analysis and confirmatory factor analyses were employed to determine the factor structure of scales of perceived stress and perceived life expectancy. Confirmatory factor analysis was used to validate the expected model of two correlated factors for the RSE-10. The number of components to retain was determined through Horn parallel analysis (model = principal component analysis, number of created samples = 1,000, method to create data = permutations, cut-off percentile = 95). The structural equation modeling was employed to contrast a model of predictive relations among the variables of perceived stress, perceived life expectancy, and self-esteem.

The discrepancy function in confirmatory factor analysis and structural equation modeling was estimated by maximum likelihood. Eight fit indexes were considered: Pearson's Chi-Square test ($\chi 2$), quotient between Chi-Square statistic and its degrees of freedom ($\chi 2/df$), Joreskög-Sorböm Goodness of Fit Index (GFI), Joreskög-Sorböm Adjusted Goodness of Fit Index (AGFI), Bentler-Bonett Normed Fit Index (NFI), Bentler's Comparative Fit Index (CFI), and Steiger-Lind Root Mean Square Error of Approximation (RMSEA), and Joreskög-Sorböm Standarized Root Mean Square Residual (SRMS). The following criteria were stipulated for defining close fit to the data: $p > .05$ for Chi-Square test, $\chi 2/df \leq 2$, GFI $\geq .95$, AGFI, NFI and CFI $\geq .90$ and RMSEA and SRMS $\leq .05$. The criteria for defining acceptable fit to the data were: $p > .01$ for Chi-Square test, $\chi 2/df \leq 3$, CFI $\geq .85$, AGFI, NFI and CFI $\geq .80$, and RMSEA and SRMS $\leq .08$. The fulfillment of assumption of multivariate normality was assessed through the standardized value of Mardia's multivariate kurtosis; a value higher than 10 was considered as indicator of deviation from multivariate normality. In case of unfulfillment of the assumption of multivariate normality, bootstrap procedures were used (bias-corrected percentile method for contrasting the statistical significance of estimated parameters and Bollen-Stine bootstrap probability for contrasting the goodness of fit of the model), extracting 2,000 bootstrap samples. Standardized effect sizes of structural weights were calculated; values lower than .10 reflected a trivial effect, between .10 and .29 a small effect, between .30 and .49 medium effect and equal or higher than .50 a large effect (Kline, 2010).

The Student's t-test for two independent samples was used to compare means of perceived stress, self-esteem and perceived life expectancy between Tai Chi practitioners and sedentary persons. The Levene's test was used to contrast the equality of variances. The pooled standard error was used to calculate the statistic of mean comparison (t-test) in case of sustaining the null hypothesis of equality of variances, and the Satterthwaite's approximation was used in case of rejection of this null hypothesis. The effect size of the physical activity (Tai Chi versus sedentarism) on perceived stress, perceived life expectancy, and self-esteem was calculated by Cohen's *d* statistic. Values of Cohen's *d* statistic lower than .20 were interpreted as a trivial effect size, between .20 and .49 as a small effect size, between .50 and .80 as a medium effect size and higher than .80 as a large effect size (Ellis, 2010). Since schooling was a differential variable between the two

compared groups, analysis of covariance (ANCOVA) was performed for statistically controlling for the effect of schooling in these mean comparisons. The effect size was calculated by partial eta squared (partial η2). Values of partial η2 between .02 and .14 were interpreted as a small effect size, between .15 and .34 as a medium effect size, and .35 or higher as a large effect size (Ellis, 2010).

The missing values of each variable were substituted by the mean of the corresponding variable. Regarding the variable related to monthly income, this substitution was not considered adequate because approximately 50% of the participants did not report this information. The statistical analysis was performed with SPSS16 and AMOS16.

Results

Internal consistency and factor structure of scales for the assessment of perceived stress and perceived life expectancy

The internal consistency of the 9 items assessing perceived stress was high in the 3 samples (α = .81 in the total sample, .83 among sedentary persons, and .71 among Tai Chi practitioners), and the internal consistency of the 6 items assessing perceived life expectancy was also high in the 3 samples (α = .82 in the total sample, .82 among sedentary persons, and .71 among Tai Chi practitioners).

The determination of factor structure was done in the total sample of 177 participants. Only one-component was defined for each one of the scales by Horn parallel analysis. The percentage of explained variance by the single component was 41.4% for the 9 items assessing perceived stress, and 51.5% for the 6 items assessing perceived life expectancy. All loads were higher than .40. One-factor models were specified and contrasted for the scales assessing perceived stress and perceived life expectancy through confirmatory factor analysis using ML method.

The one-factor model for the 9-item perceived stress scale had a close fit to the data: $\chi 2(27, N = 177) = 24.57$, $p = .60$, $\chi 2/df = 0.91$, GFI = .97, AGFI = .95, NFI = .94, CFI = 1, RMSEA < .01, and SRMR = .04. The standardized value of Mardia´s multivariate kurtosis was 10.44, so that the assumption of multivariate normality was unfulfilled, and thus it was necessary to apply bootstrap procedures. Bollen-Stine bootstrap probability showed also a close fit to the data. The model fit better in 433 bootstrap samples and fit worse in 1,567 bootstrap samples than in the observed sample (Bollen-Stine bootstrap $p = .78$). The 18 estimated parameters were statistically significant by both ML and bias-corrected percentile methods. The measurement weights for the 9 items ranged from .34 to .75 with a mean of .57, estimated by ML method (Figure 1).

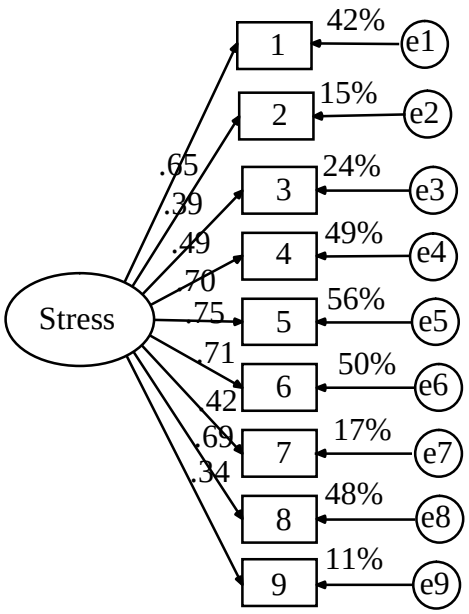

Figure 1. Model of one factor for the 9 items composing the scale of perceived stress.

A one-factor model was specified for the 6 items assessing perceived life expectancy. The standardized value of Mardia´s multivariate kurtosis was 19.93, so that the assumption of multivariate normality was unfulfilled, and thus it was necessary to apply bootstrap procedures. The model showed a close fit through 2 indexes (SRMR = .04 and CFI = .92) and acceptable fit through 4 indexes (Bollen-Stine bootstrap p = 42/2000 = .02, GFI = .94, AGFI = .86, and NFI = .89), but its fit was poor through 3 indexes ($\chi 2[9, N = 177] = 35.33$, $p < .01$, $\chi 2/df = 3.93$, and RMSEA = .13 [90% CI: .09, .183, $p < .01$ for H0: RMSEA ≤ .05]). Its 12 parameters were significant by ML estimation and bias-corrected percentile method. The fit improved significantly when a correlation between residuals (corresponding to items 2 and 5) was specified ($\Delta\chi 2[1, N = 177] = 18.39$, $p < .01$). The modified model had a data fit from acceptable ($\chi 2[8, N = 177] = 16.94$, $p = .03$, $\chi 2/df = 2.12$, and RMSEA = .08 [90% CI: .02, .13, $p = .16$ for H0: RMSEA ≤ .05]) to close (Bollen-Stine bootstrap p = 545/2000 = .27, GFI = .97, AGFI = .93, NFI = .95, CFI = .97, and SRMR = .04). All its parameters continued to be statistically significant by both ML and bias-corrected percentile methods. The measurement weights for the 6 items ranged from .58 to .77 with a mean of .66, estimated by ML method (Figure 2).

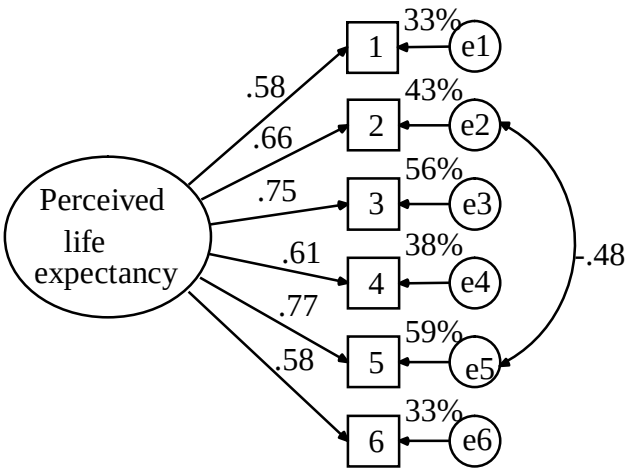

Figure 2. Model of one factor with a correlation between measurement residuals for the 6 items composing the scale of perceived life expectancy.

Internal consistency and factor structure of the RSE-10

The internal consistency of the 10 items of the RSE-10 was high in total sample (α = .72) and among sedentary persons (α = .71), and was acceptable among Tai Chi practitioners (α = .64). The internal consistency was increased with the deletion of the item 10 "I feel I do not have much to be proud of" (.76 in total sample, .78 among sedentary persons, and .65 among Tai Chi practitioners).

The 5 positively keyed items of the RSE-10 had also a high internal consistency in the total sample (α = .76), and among sedentary persons (α = .79). The internal consistency was acceptable among Tai Chi practitioners (α = .66). The negatively keyed 5 items had a low internal consistency in the total sample (α = .56), among sedentary persons (α = .55), and among Tai Chi practitioners (α = .42); their internal consistency was increased with the deletion of the item 10 in the total sample (α = .63), among sedentary persons (α = .70), and among Tai Chi practitioners (α = .44).

The model of 2 correlated factors (5 positively worded items and 5 negatively worded items) had an acceptable fit to the data. The standardized value of Mardia´s multivariate kurtosis was 34.15, so that the assumption of multivariate normality was unfulfilled, and thus it was necessary to apply bootstrap procedures. Five indexes showed a close fit to the data (Bollen-Stine bootstrap probability = 537/2,000 = .27, $\chi 2/df = 1.70$, AGFI = .91, CFI = .94, and RMSEA = .06 [90% CI: .03, .09, $p = .21$ for H0: RMSEA ≤ .05]), 2 indexes exhibited an acceptable fit (GFI = .94, and SRMR = .06) and 2 indexes had a poor fit ($\chi 2[34, N = 177] = 57.72$, $p < .01$, and NFI = .87). The 21 estimated parameters of the model were statistically significant by both ML and bias-corrected percentile methods, except for the coefficient of the determination of factor defined by negatively keyed items on item 10. The measurement weights for the 10 items ranged from .14 to .79 with a mean of .57, estimated by ML method.

With the specification of one modification (one correlation between measurement residuals), the fit to the data was close for the 9 calculated indexes: Bollen-Stine bootstrap probability = 946/2,000 = .47, $\chi 2(33, N = 177) = 46.55$, $p = .06$, $\chi 2/df = 1.41$, GFI = .95, AGFI = .92, NFI = .90, CFI = .97, RMSEA = .05 (90% CI: 0, .08, $p = .51$ for H0: RMSEA ≤ .05), and SRMR = .05. The fit of the modified model was significantly better than the fit of the model without the correlation between structural residuals ($\Delta\chi 2[1, N = 177] = 11.17$, $p < .01$). The 22 estimated parameters of the modified model remained statistically significant by both ML and bias-corrected percentile methods, except for the coefficient of determination of the factor defined by negatively keyed items on item 10. The measurement weights for the 10 items ranged from .13 to .81 with a mean of .57, estimated by ML method (Figure 3).

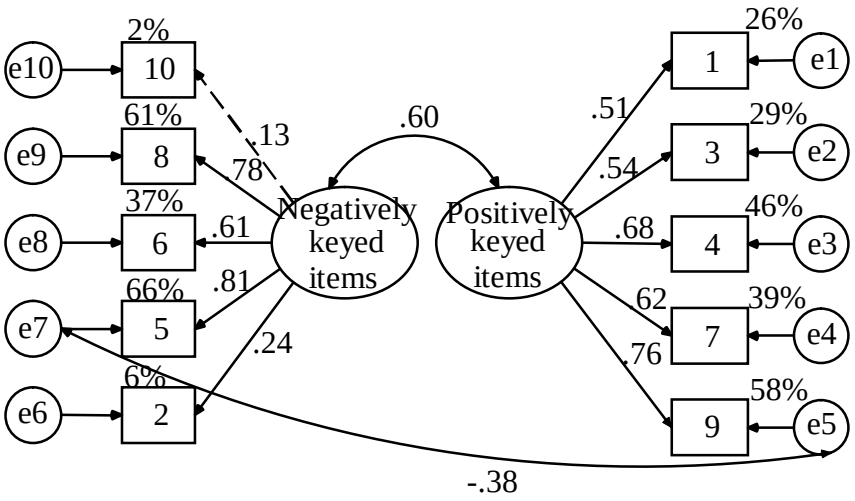

Figure 3. Model of two correlated factors for the RSE-10.

Owing to problems of internal consistency among the 5 negatively worded items and the advice on simplifying the scale to its 5 positively worded items, a unidimensional model was contrasted for the 5 positively worded items. The model had a fit to the data from acceptable ($\chi 2[5, N = 177] = 12.10$, $p = .03$, $\chi 2/df = 2.42$, and RMSEA = .09 [90% CI: .02, .16, $p = .13$ for H0: RMSEA ≤ .05]) to close (GFI = .97, AGFI = .92, NFI = .94, CFI = .96, and SRMR = .04). The standardized value of Mardia´s multivariate kurtosis was 46.44, so that the assumption of multivariate normality was unfulfilled, and thus it was necessary to apply bootstrap procedures. Bollen-Stine bootstrap probability showed a close fit to the data. The model fit better in 1,041 bootstrap samples and fit worse in 959 bootstrap samples than in the observed sample (Bollen-Stine bootstrap $p = .48$). The 10 estimated parameters were statistically significant by both ML and bias-corrected percentile methods. The measurement weights for the 5 items ranged from .50 to .77 with a mean of .62, estimated by ML method.

When a correlation between measurement residuals was specified in the model, the goodness of fit was sustained by the Chi-square test ($\chi 2[4, N = 177] = 5.68$, $p = .22$), the fit

was better than the fit of the previous model ($\Delta\chi 2[1, N = 177] = 6.42$, $p = .01$), and the 10 estimated parameters remained statistically significant by both ML and bias-corrected percentile methods. The parameters ranged from .54 to .69 with a mean of .61, estimated by ML method (Figure 4).

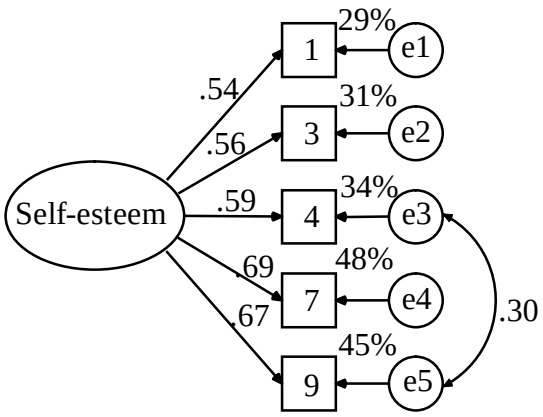

Figure 4. Model of one factor for the 5 positively keyed items of RSE-10.

Mean difference between Tai Chi practitioners and sedentary persons

The scores of the three scales were obtained by means of the sum of their items (nine items for perceived stress, five items for self-esteem, and six items for perceived life expectancy). After dividing the sum-score of each scale by its number of items, the ranges of the three scales were reduced to a continuum from 1 to 4. In order to interpret this continuum of values, the scores were grouped in 4 intervals of constant amplitude ([maximum score on an item - minimum score on an item]/number of intervals = [4 -1]/4 = 0.75) to make them correspond to the four discrete values of answers of the items. In this way it was possible to interpret these intervals from the item answer labels: from 1 to 1.74 (discrete value 1= "definitively disagree"), from 1.75 to 2.49 (discrete value 2 = "disagree"), from 2.50 to 3.24 (discrete value 3 = "agree"), and from 3.25 to 4 (discrete value 4 = "definitively agree") (Figure 5).

The mean of perceived stress scale among the sedentary persons was 2.06 (*SD* = 0.68), and among the Tai Chi practitioners was 1.67 (*SD* = 0.49). When comparing both means, the difference was statistically significant ($t[163.79] = 4.33$, $p < .01$). The effect size of the physical activity (Tai Chi versus sedentarism) on perceived stress was medium (-0.66, 95% CI: -0.95, -0.35) by Cohen's *d* statistic. The participants who practice Tai Chi presented lower level of perceived stress than the sedentary participants. The mean of Tai Chi practitioners was within the interval "definitively disagree" (absence of perceived stress), and the mean of sedentary persons was within the interval "disagree". Both values can be interpreted as a low level of perceived stress, probably with no clinical relevance (Figure 5).

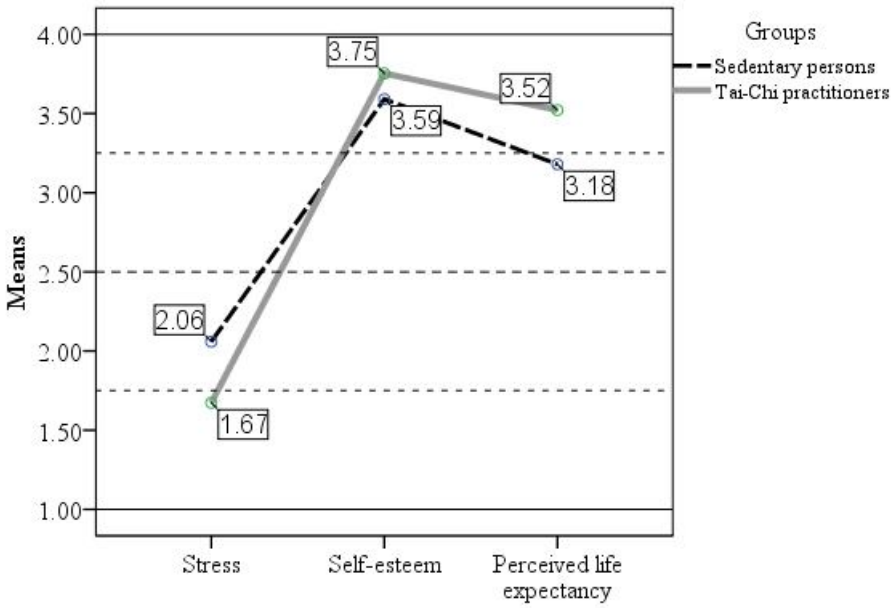

Figure 5. Graph of means of perceived stress, self-esteem and perceived life expectancy for the two compared groups.

The mean of self-esteem scale among the sedentary persons was 3.59 (*SD* = 0.50), and among the Tai Chi practitioners was 3.75 (*SD* = 0.33). When comparing both means, the difference was statistically significant (*t*[155.54] = -2.56, *p* = .01). The effect size of the physical activity (Tai Chi versus sedentarism) on self-esteem was small (0.38, 95% CI: 0.08, 0.67) by Cohen's *d* statistic. The participants who practice Tai Chi presented higher self-esteem than the sedentary participants. The means of both groups were within interval "definitively agree". Both values can be interpreted as a high level of self-esteem (Figure 5).

The mean of the perceived life expectancy scale among the sedentary persons was 3.18 (*SD* = 0.63), and among the Tai Chi practitioners was 3.52 (*SD* = 0.41). When comparing both means, the difference was statistically significant (*t*[157.01] = -4.30, *p* < .01). The effect size of the physical activity (Tai Chi versus sedentarism) on perceived life expectancy was medium (0.63, 95% CI: 0.33, 0.94) by Cohen's *d* statistic. The participants who practice Tai Chi expressed higher perceived life expectancy than the sedentary participants. The mean of Tai Chi practitioners showed a definitive agreement with the concept that exercising is a means to prolong own life and the mean of sedentary persons showed an agreement that was not definitive with this concept (Figure 5).

The mean differences of schooling and monthly income between the two groups were statistically significant. This way it was necessary to statistically control these two variables to verify whether the mean differences remained significant. The income was not taken into account owing to the high number of missing values and suspicion of little reliability. After controlling statistically the level of schooling, the three differences remained significant: perceived stress (*F*[1, 174] = 12.12, *p* < .01) with a small effect size (partial eta squared =

.07), self-esteem (F[1, 174] = 4.89, p = .03) with a small effect size (partial eta squared = .03), and perceived life expectancy (F[1, 174] = 11.53, p < .01) with a small effect size (partial eta squared = .06). The level of schooling had significant effect, as a covariate in the general lineal model, on perceived stress (F[1, 174] = 17.88, p < .01) and perceived life expectancy (F[1, 174] = 20.99, p < .01) with small effect sizes (partial eta squared =.09 and .11, respectively), but not on self-esteem (F[1, 174] = 1.48, p = .23; partial eta squared = .01).

Predictive model from a one-group analysis (total sample)

In both groups, the same model was contrasted. The variable self-esteem was exogenous and predicted perceived stress and perceived life expectancy, and the endogenous variable perceived stress predicted perceived life expectancy. Perceived stress and perceived life expectancy were specified as manifest variables (sum-score) and self-esteem was specified as an unobserved variable with five indicators (five positively keyed items).

In the total sample of 177 participants, the standardized value of Mardia´s multivariate kurtosis was higher than 10 (37.96), and therefore it was necessary to use bootstrap procedures for complementing the estimations of parameters and fit indexes calculated by ML.

All the parameters were significant both by ML estimation and by bias-corrected percentile method. It was explained 54% of variance of perceived life expectancy and 40% of variance of perceived stress. Explained variance of the 5 self-esteem indicators ranged from 33 to 47% with a mean of 40%. The standardized direct effect of self-esteem on perceived stress was large (β = -.63) and medium on perceived life expectancy (β = .48). The standardized indirect effect of self-esteem on perceived life expectancy (mediated by perceived stress) was small (β = .21), giving a large total effect size of self-esteem on perceived life expectancy (β = .69). The standardized direct effect of perceived stress on perceived life expectancy was medium (β = -.34). The indirect effect was statistically significant by bias-corrected percentile method (95% CI: .10, .32; p < .01).

The goodness of fit was supported by the Bollen-Stine bootstrap probability (p = 399/2000 = .20). The null hypothesis of goodness of fit was rejected by Chi-square test (χ2[13, N = 177] = 34.70, p < .01). Four indexes showed a close fit to the data (GFI = .95, NFI = .92, CFI = .94 and SRMS = .05), two exhibited an acceptable fit (χ2/df = 2.67, AGFI = .89), and one revealed a poor fit (RMSEA = .10) (Table 1).

Table 1
Fit indexes to contrast the invariance of the modified predicted model between sedentary persons and Tai Chi practitioners

Fit Indexes	One-group		Multi-group					
	Orig.	Mod.	U	MW	SW	SC	RC	MR
χ2	34.70	18.60	39.76	46.01	50.98	63.13	63.78	143.92
Df	13	12	24	30	31	32	33	40
P	< .01	.10	.02	.03	.01	< .01	< .01	< .01
χ2/df	2.67	1.55	1.66	1.53	1.64	1.97	1.93	3.60
BS W	399	1,010	804	1,044	848	454	550	20
BS *P*	.20	.51	.40	.52	.42	.23	.28	.01
GFI	.95	.97	.94	.93	.92	.91	.91	.83
AGFI	.89	.93	.86	.87	.86	.84	.84	.76
NFI	.92	.96	.90	.89	.88	.84	.84	.65
CFI	.94	.98	.96	.96	.95	.92	.92	.72
RMSEA	.10*	.06ns	.06ns	.06ns	.06ns	.08ns	.07ns	.12**
SRMS	.05	.04	.05	.07	.07	.13	.13	.09

Modification: correlation between the residuals of items 3 and 5 of the RSE-10.
Models nested in constrains: U = Unconstrained, MW = Measurement weights, SW = Structural weights, SC = Structural covariances, RC = Residual covariances, MR = Measurement residuals.
RMSEA: with the probability of H0: RMSEA ≤ .05: ns $p \geq .05$* $p < .05$, ** $p < .01$.

After revising the modification indices, a correlation between two measurement residuals had a value higher than 10. Once specified this correlation, all indexes showed a close fit (Table 1), being its goodness of fit significantly higher than the one of previous model ($\Delta\chi2[1] = 16.10$; $p < .01$). All the parameters, including the correlation between the two measurement residuals, were significant both by ML estimation and by bias-corrected percentile method. It was explained 58% of variance of perceived life expectancy and 44% of variance of perceived stress. Explained variance of the 5 self-esteem indicators ranged from 33 to 43% with a mean of 37%. The standardized direct effect of self-esteem on perceived stress and perceived life expectancy were large (β = -.66 and .56, respectively). The standardized indirect effect of self-esteem on perceived life expectancy (mediated by perceived stress) was small (β = .18), giving a large total effect size of self-esteem on perceived life expectancy (β = .74). The standardized direct effect of perceived stress on perceived life expectancy was medium (β = -.27). The indirect effect was not statistically significant by bias-corrected percentile method (95% CI: -.004, .290; $p = .053$) (Figure 6).

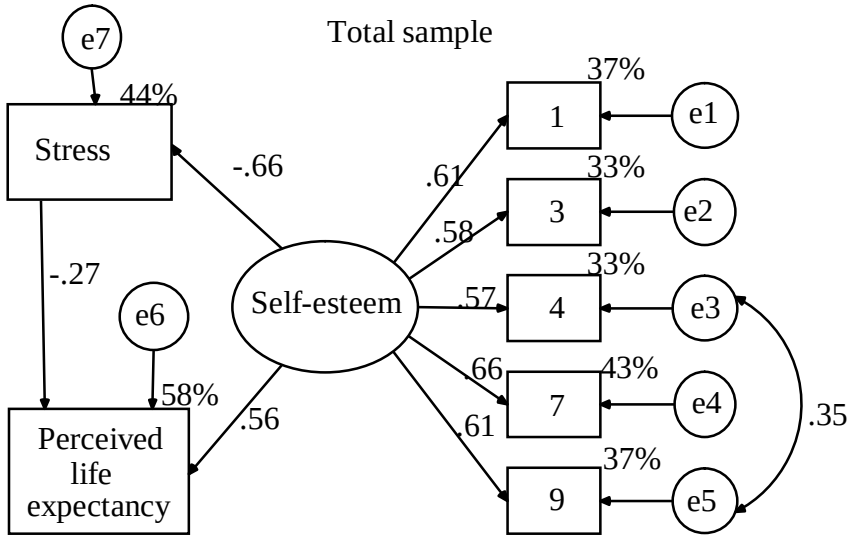

Figure 6. Modified model with standardized coefficients calculated by Maximum Likelihood in the total sample.

Invariance of model between sedentary persons and Tai Chi practitioners

Six models nested in constrictions of parameter equality (between both groups) were specified: one unconstrained model and five models with cumulated constrains (in measurement weights, structural weights, structural covariances, residual covariances, and measurement residuals), following Byrne's (2008) recommendations.

The standardized values of Mardia´s multivariate kurtosis were higher than 10 in the group of sedentary persons (19.57) and in the group of Tai Chi practitioners (15.34). For this reason, bootstrap procedures were used for complementing the estimations of parameters and fit indexes calculated by ML, extracting 2,000 bootstrap samples.

The parameters were significant in the unconstrained model in both groups, except two of them, one in the group of Tai Chi practitioners and another in the group of sedentary personas. Among Tai Chi practitioners, the structural weight of perceived stress on the perceived life expectancy was non-significant (β = .08, B = 0.07, SE = 0.16, *Z* = 0.44, *p* = .66) in the unconstrained model, and this parameter continued being non-significant in the constrained model in measurement weights (β = -.12, B = -0.10, SE = 0.09, *Z* = -1.09, *p* = .28), and became significant in the constrained model in structural weights (β = -.23, B = -0.23, SE = 0.07, *Z* = -3.26, *p* < .01), as well as in the other three nested models (Figure 7). Among sedentary persons, the covariance between the two measurement residuals was non-significant in the unconstrained model: cov = .05, *EE* = .04, Z = 1.36, *p* = .18. This parameter only became significant in the constrained models in residual covariances: Z = 3.83, *p* < .01, and measurement residuals: Z = 3.62, *p* < .01 (Figure 8).

From ML estimation, in the unconstrained model of the group of Tai Chi practitioners, the standardized direct effects of self-esteem on perceived stress and perceived life expectancy

were large (β = -.71 and .76, respectively). The standardized indirect effect of self-esteem on perceived life expectancy (mediated by perceived stress) was non-significant (β = -.06, p = .46), giving a large total effect size of self-esteem on perceived life expectancy (β = .70). The standardized direct effect of perceived stress on perceived life expectancy was non-significant (β = .08, *p* = .46) (Figure 7). The results of significance were the same by bias-corrected percentile method.

From ML estimation, in the unconstrained model of the group of sedentary persons, the standardized direct effect of self-esteem on perceived stress was large (β = -.54) and on perceived life expectancy was medium (β = .46). The standardized indirect effect of self-esteem on perceived life expectancy (mediated by perceived stress) was small and significant (β = .23), giving a large total effect size of self-esteem on perceived life expectancy (β = .69). The standardized direct effect of perceived stress on perceived life expectancy was medium (β = -.42) (Figure 8). The results of significance were the same by bias-corrected percentile method.

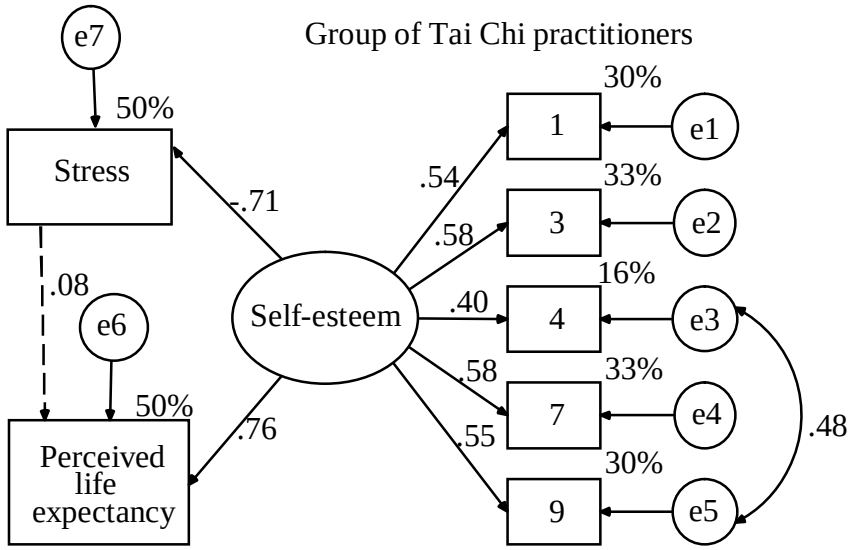

Figure 7. Modified unconstrained model with standardized coefficients calculated by Maximum Likelihood among Tai Chi practitioners.

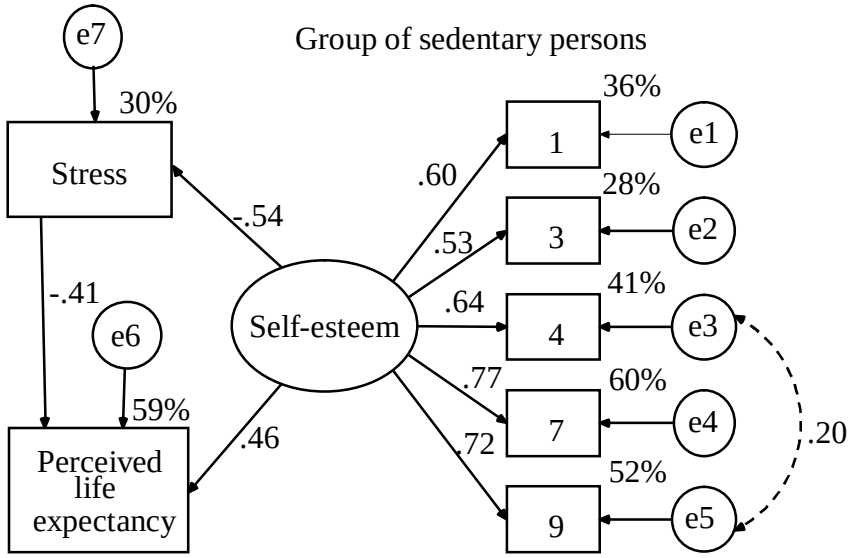

Figure 8. Modified unconstrained model with standardized coefficients calculated by Maximum Likelihood among sedentary persons.

The goodness of fit was supported by the Bollen-Stine bootstrap probability in all models, except in the constrained model in measurement residuals. In the unconstrained model, the null hypothesis of goodness of fit could be maintained with a significance level of .01 by Chi-Square test ($\chi 2[24, N = 177] = 39.76$, $p = .02$). Five indexes showed a close fit to the data ($\chi 2/df = 1.66$, NFI = .90, CFI = .96, SRMS = .05, and RMSEA = .06, $p = .27$ for H0 = RMSEA $\leq .05$), and two indexes exhibited an acceptable fit (GFI = .94 and AGFI = .86), and none of them revealed a poor fit. The goodness of fit of the unconstrained model was statistically equivalent to the goodness of fit of constrained models in measurement weights ($\Delta\chi 2[6, N = 177] = 6.24$, $p = .40$) and structural weights ($\Delta\chi 2[7, N = 177] = 11.21$, $p = .13$), but was better than in the 3 remaining nested models (Table 1).

Discussion

On the two created scales of assessment

The hypotheses of one-factor structure and high internal consistency for the scales assessing perceived stress and perceived life expectancy were supported by the present data. This unidimensionality was favored by the fact that the number of items composing each of them was small and these items had high loads on their corresponding factors, that is, they were good indicators. Concordant with the unidimensionality, the internal consistency was high. This unidimensionality was sought to facilitate the specification and interpretation of the model of relationships among self-esteem, perceived stress and perceived life expectancy. The unidimensionality of perceived stress was founded in the previous conceptual research (Cohen & Janicki-Deverts, 2012), and the unidimensionality of perceived life expectancy was expected because the concept was defined as unitary and

makes reference to healthy years left to live. The fact that both scales assess subjective aspects of self-perception justifies the use of the adjective “perceived”.

On the validation of the 2-factor model for the RSE-10

The model of two correlated factors for the RSE-10 was supported by the present data, using confimatory factor analysis. Nevertheless, the negatively worded items showed problem of internal consistency, and the negatively keyed item 10 did not load significantly on its factor. This problem is concordant with method effects associated with these items found in previous research (DiStefano & Motl, 2006; Lindwall et al., 2012; Marsh et al., 2010). In order to use the concept of self-esteem as unitary, the RSE-10 could be reduced to its five positively worded items, which did not show problem of internal consistency. Indeed, the concept of unidimensionality was already present in the definition and original design of the RSE-10 scale (Rosenberg, 1965).

Effect of Tai Chi on perceived stress, self-esteem, and perceived life expectancy

As it was expected, a significant effect of Tai Chi on perceived stress, perceived life expectancy and self-esteem was found (Dechamps, Lafont, & Bourdel, 2007; Wang, Bannuru, Ramel, Kupelnick, Scott, & Schmid, 2010). The effect size of this physical activity was medium on perceived stress and perceived life expectancy. It is known that stress is directly influenced by physical activity, which modulates the sympathetic and parasympathetic activities, and this way physical activity allows a greater balance between these two functional branches of autonomic nervous system and improves the general parameters of health in several medical conditions (Motivala et al., 2006). Physical activity has a modulating effect on mood (Peluso & Guerra-de-Andrade, 2005). This latter effect, in conjunction with the enhancement of the general parameters of health, could lead to a greater perceived life expectancy.

The effect size of practicing Tai Chi was small on self-esteem. This might be explained by the more complex structure of this variable, since self-esteem is derived from an integration of the life experiences of the individual in a coherent, significant and positive image (Hill & Buss, 2006). This small effect size of Tai Chi practice on self-esteem has been found in some clinical studies with an experimental design, which have shown that the Tai Chi practice increases the self-esteem in the participants of those studies (Mustian et al., 2004; Wang, Bannuru et al., 2010). Nevertheless, the greater level of self-esteem could be more a cause rather than an effect of Tai Chi practice in older adults from the general population, and this possibility needs further research. This latter interpretation is more concordant with the specified model in this study.

The two groups of participants in this non experimental study were paired in the socio-demographic variables of sex and age; they differed in level of schooling and monthly income, which are two variables related to stress (Cohen, Doyle, & Baum, 2006; Folkman, 2011), self-esteem (McMullin & Cairney, 2004; Mruk, 2006) and life expectancy (Alves & Rodrigues, 2005; Hancock, 2010). Sedentary persons had lower level of schooling and lower monthly income than Tai Chi practitioners. Thus, the higher level of perceived stress and the lower levels of self-esteem and perceived life expectancy among the sedentary

persons might be attributed to these two socio-demographic variables. The variable monthly income was disregarded because of questionable reliability and high number of missing values. Nonetheless, the variable level of schooling, closely related to monthly income (U.S. Department of Commerce, Bureau of the Census, 2013), was taken into account. After statistically controlling for level of schooling, the differences remained significant. Therefore, despite the limitations of the study regarding the lack of pairing between sedentary persons and Tai Chi practitioners in levels of schooling and income, the effect of the Tai Chi practice on the three variables remained significant. In other words, statistical analysis allowed overcoming the limitation introduced by the lack of pairing of the two groups in level of schooling and income.

On the contrast of the specified structural model

The specified model proposes that self-esteem, which is a relatively stable and persistent variable, has a direct effect on perceived stress (protector effect) and perceived life expectancy (enhancer effect); besides, the model proposes that perceived stress has a direct effect on perceived life expectancy (decreasing effect). Consequently, since self-esteem is a determinant variable of perceived stress, then self-esteem might also have an indirect effect on perceived life expectancy, being the expected effect an enhancer one. This model was valid (a close fit to the data) for the total sample, pooling sedentary persons and Tai Chi practitioners. The three direct paths were significant, but the possible indirect path proposed by the model (the effect of self-esteem on perceived life expectancy mediated by perceived stress) did not have any effect.

After studying the invariance of this structural model between Tai Chi practitioners and sedentary persons, using models nested in constraints of equality of parameters, the fit indices were adequate. In the model with stricter constraints, all the parameters were significant, but the fit indices were poor and statistically worse than the fit indices of the four models without constrains in residuals. In the unconstrained model, the indices showed a close fit to the data, but two parameters were not significant (the total effect of perceived stress on perceived life expectancy in the group of Tai Chi practitioners and the correlation between two measurement residuals in the group of sedentary persons). These two parameters are significant only after applying the corresponding constraints (the former after constraining the structural weights, and the latter after constraining the residuals). Therefore, the model is adequate in persons with physical activity (Tai Chi practice) and also in sedentary persons, that is, in the total sample. It should be pointed out that there are two little differential aspects between sedentary persons and Tai Chi practitioners. What are these little differences?

First, in the group of Tai Chi practitioners, self-esteem increases the perceived life expectancy and decreasing perceived stress with large effect sizes, leaving perceived stress without a direct effect on perceived life expectancy. In the group of sedentary persons, the effect of self-esteem has the same direction on perceived stress (decreasing) and perceived life expectancy (increasing) as in the other group and the effect sizes were also large, but it does not remove the direct effect of perceived stress on the decrease of perceived life expectancy.

Second, the modification that was made to the model introducing a correlation between measurement residuals is attributable to the group of Tai Chi practitioners. In these participants, the contents of the item 3 ("I take a positive attitude toward myself"), and item 5 ("On the whole, I am satisfied with myself") are positively related independently of the effect that the latent variable self-esteem has on them. This correlation shows that adopting a positive attitude toward oneself improves personal satisfaction, probably fomented by the ideology and meditation exercises that Tai Chi practitioners learned through Tai Chi. This interpretation supports the propositions proceeding from other studies that the Tai Chi practice improves the self-esteem.

Even though this study is not an experiment, with measurements taken before and after the treatment and random assignment of participants to the experimental group and control group, the fact that both groups were paired in the socio-demographic variables of sex and age, and that level of schooling was statistically controlled gives validity to the significant effects of Tai Chi on perceived stress, self-esteem and perceived life expectancy. These significant effects are in agreement with previous experimental studies (Dechamps et al., 2007; Mustian et al., 2004; Wang, Bannuru et al., 2010).

This study selected sedentary persons as the comparison group in order to have a case that was opposite to the situation of exercise practice, thus being more probable to attribute the differences to such activity, since both groups were paired in the socio-demographic variables relevant to perceived stress (Cohen et al., 2006; Folkman, 2011), self-esteem (McMullin & Cairney, 2004; Mruk, 2006), and perceived life expectancy (Alves & Rodrigues, 2005; Hancock, 2010). The sample cannot be considered small. The proportion of number of participants and parameters to be estimated (N:q) was 14:1, what represents an acceptable proportion with a significant effect on statistical power (Jackson, 2003).

The findings of this study are important with respect to other studies made in this area. Most of them have been made with experimental designs in clinic-based settings, using a small sample size, and though they possess the strength of internal validity, in the sense of a greater certainty in the causal link between the independent and dependent variables, they lack the necessary external validity to generalize the findings towards the population from which their samples were extracted. Even though the study was carried out with a non-probability sampling, it can be said that it has enough ecologic validity, since the Tai Chi group belongs to the non-clinical, "natural" population of regular practitioners, mainly older women.

Conclusion

The scales assessing stress and life expectancy were unidimensional and consistent. The content of both scales refers to aspects of subjective evaluation; hence, the terms of perceived stress and perceived life expectancy were used.

The model of two correlated factors for the RSE-10 was supported by data. Problems of internal consistency appear among negatively worded items. These problems are concordant with method effects founded by other studies. The five positively worded items showed high internal consistency and unidimensionality with close fit to the data (after

specifying a correlation between residuals); hence, the scale was reduced to these items, and this way was possible to define a unidimensional concept of self-esteem.

Tai Chi practitioners (mainly older women) had a lower level of perceived stress, higher level of self-esteem, and greater perceived life expectancy. The effect sizes of practicing Tai Chi on perceived stress and perceived life expectancy were medium without statistically controlling schooling, but were small when schooling was statistically controlled (covariable differential between two groups). The effect size of practicing Tai Chi on self-esteem was small. Being self-esteem a more stable variable, higher self-esteem could be an antecedent (motivation) rather than a consequence of the Tai Chi practice. From the hypotheses of the beneficial effects of Tai Chi practice, a model was specified in which the self-esteem had a direct effect on perceived stress and perceived life expectancy and the perceived stress had a direct effect on perceived life expectancy. This model showed a close fit to the data in the total sample (without considering the variable practicing or not practicing Tai Chi). The properties of invariance of this model between Tai Chi practitioners and sedentary persons (considering the variable practicing or not practicing Tai Chi) were acceptable. It should be pointed out that, in the unconstrained models, the direct effect of perceived stress on perceived life expectancy was not significant among Tai Chi practitioners, but it was significant among sedentary persons; this path became significant in both groups once being constrained the structural weights. In Tai Chi practitioners, the effect of self-esteem on perceived stress and perceived life expectancy was so large that leaves perceived stress without any effect on perceived life expectancy in the unconstrained model.

Recommendations

It is suggested using the new scales of perceived stress and perceived life expectancy in future research, and studying its psychometric properties in other samples. It is advisable to reduce the Rosenberg Self-Esteem scale to its 5 positively worded items to evaluate the concept of self-esteem as a unidimensional concept.

It is recommended the Tai Chi practice among older adults as an effective means to reduce perceived stress and create a greater perception of life expectancy, considering that those persons with greater self-esteem are more willing to practice it. The role of the self-esteem as an antecedent or consequence of the Tai Chi practice requires further studies in older adults from the general population. The present data do not allow clarifying this issue. The mean comparison shows that practicing Tai Chi has a significant effect on self-esteem (higher self-esteem as a consequence of practicing Tai Chi) and the residual correlation between 2 indicators of self-esteem (positive attitude toward oneself and the satisfaction with oneself) among Tai Chi practitioners, but not among sedentary persons, might be a pre-existent relation (higher self-esteem as a precondition for practicing Tai Chi).

Finally, it is recommended to include the Tai Chi practice in public health programs to widen its scope to whole population of older persons. Probably, the free access to the groups of Tai Chi practice could make the mean differences in schooling and monthly incomes disappear when the comparisons between Tai Chi practitioners and sedentary persons were done in future research.

The importance of increasing perceived life expectancy resides in its decreasing effect on the anxiety related to death and aging. These latter variables might be included in future research.

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