Psychometric properties of Chinese Translated body compassion scale (BCS) among Hong Kong adolescents

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ABSTRACT

Background: Adolescence is at a transition stage of developmental psychology, and they must go through their psychosocial and identity crisis, which affect their self-concept. According to the structure of self-concept, *physical* is considered as one of the elements affecting a person's evolvement of self, which can be called as physical self-esteem. In regards to the equilibrium mental benefits of self-compassion, the concept of body compassion was focused. Together with the lack of body-part related research being further investigated among non-western countries, this research aimed at translating the Body Compassion Scale (BCS) to Chinese and examining the reliability and validity of the Chinese translated BCS among Hong Kong adolescents.
Methods: The reliability of the translated BCS was examined by the test-retest reliability test as well as the Cronbach's alpha value for the internal consistency. The confirmatory factor analysis (CFA) was adopted to investigate the construct validity, and Pearson's correlation was used to examine the convergent validity with other related scales.
Results: The Chinese translated BCS (Pilot Study: $n = 220$; Main Study: $n = 1047$) showed adequate psychometric properties results. It had a satisfying internal consistency and test-retest reliability. It showed an adequate goodness of fit results in CFA, with $X^2(465.64)/227 = 2.05, p < 0.001$, CFI $= 0.916$, TLI $= 0.906$, SRMR $= 0.071$, RMSEA $= 0.069$ [90% CI $= 0.06$ to 0.078]. Additionally, the measurement invariance model suggested that the factor loadings and mean differences of the translated BCS were invariant across early and older adolescents.
Conclusion: The Chinese translated BCS is considered as valid and reliable in examining Hong Kong adolescents' body compassion.

1. Introduction

Adolescence is at a transition stage of developmental psychology, and they must go through their psychosocial and identity crisis.[1–3] Their competencies are mainly gained from social value and accomplishment, in order to have a positive self-concept. Nonetheless, identity crisis to re-exploration of their personal identities also involves sexual and occupational identity, in which the re-examination of sexual identity comprises of individual's body image.[4] Therefore, adolescents' physical self, which is derived from perceived physical competence and attractiveness, was being seen as an important aspect towards overall self-concept.[5,6] The components of physical appearance and competence, such as body fat, weight, sports competence, strength and endurance, were able to predict and relate to self-concept.[7] Among the Chinese population, body satisfaction, body image disorders and negative physical self were being seen as gradually developing.[8–10] Research studies indicated that Chinese adolescents, both male and female, reported pressure relating to body dissatisfaction and engagement in body change behaviours due to peer and social media affections.[9] Individuals with negative physical self were also indicated as associated with negative coping ability and negative subjective well-being.[10] Furthermore, Hong Kong studies also demonstrated that Hong Kong secondary school students were highly concerned about their body-part satisfaction and eating behaviours.[11] While, body dissatisfaction was shown as associated with depressive

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symptoms, especially among adolescents.[12,13] Nevertheless, research studies that investigated the relationship between body-part issues and mental well-being in the non-western country were limited. Additionally, based on the concept of positive psychology,[14] mind and body connection focus should be shifted from manipulating the reduction of negative effects to cultivating positive effects through mindful awareness and acceptance.[15] Therefore, Chinese-focused body-part related research and the respective reliable assessment tools for bodily acceptance measurement should be expanded and further investigated.

Notwithstanding, the concepts related to body-part satisfaction and physical self were being seen as classical, hence, critiques are worth noting in order to reveal the value of embracing body compassion and the need to expand the tool for assessing body compassion.

The conceptual idea of physical self-concept is structured according to the Structure of self-concept[16] and is documented by the Exercise and Self-esteem model (EXSEM).[17] In the Exercise and Self-esteem model, self-competence and self-acceptance are agreed as the two major dimensions of global self-esteem. This is because self-perception of the body, which is influenced by subjective body image, body size acceptance, as well as the objective outcomes of the Body Mass Index, would determine self-esteem.[18] The physical competency gained from physical activity would also generate positive physical self-esteem, and lead to higher general self-esteem and global self-concept.[7] In the Exercise and Self-esteem model, the Physical Self-Perception Profile (PSPP) was specifically used to measure physical competence.[17] While, the Attractive Body subscale of the Physical Self-Perception Profile (PSPP) and the Rosenberg self-Esteem (1973) scale were being considered as better scales to indicate the components of self-acceptance.[17] Therefore, most of the recent research on examining exercise and self-related association or with the application of the Exercise and Self-esteem Model have treated the Physical Self-Perception Profile (PSPP) as the major tool to measure physical self. However, the negative effects, such as self-enhancement bias and narcissism,[19] brought by self-esteem were highly neglected.

Among various self-concepts, self-compassion was the only concept that responded to the negativity of self-esteem. Self-compassion is evoked to prevent high self-esteem, which also avoids leading to egoistic illusion and self-regulation failure.[20] Hence, self-compassion should be advocated, and at the same time, to reduce the risk of the negative effects brought by self-esteem. Yet, the relationship between self-compassion and physical self is questionable.

Self-compassion was proved to be associated with physical-related self-esteem, like appearance self-worth and physical self-perception.[21–23] Research showed that self-compassion was significantly associated with Body Mass Index (BMI), body image, reduced body dissatisfaction and body appreciation; as well as the athletic abilities and physical appearance domain measured within the Self-perception profile.[24] Also, in regards to self-compassion as a coping strategy and an influential component of healthy behaviour engagement, the relationship between self-compassion and physical activity engagement as well as other proactive physical-related behaviour was mediated by body appreciation, relieving negative perception of poor body image, body surveillance and body shame.[23,25,26] Despite self-compassion has shown a significant relationship with various physical self-related factors, such as resilient body image, reductions in body dissatisfaction and self-objectification as well as higher physical-related self-worth,[27–30] self-compassion was considered as a broader scope that the Self-compassion Scale was not able to capture the specialized physical approach of individuals. This can be referred to the items of the Self-compassion Scale. For instance, the items stated "fail at

something important" or "judgmental about my own flaws and inadequacies", which are considered as too general and do not specifically direct to an element and issue, like social, emotional, moral or even physical. Therefore, Body compassion, which was developed by tying physical and the concept of self-compassion together, its scale was expected to be a more distinctive method to demonstrate the level of physical self towards self-compassion.

The Body Compassion Scale is developed by Altman et al. (2017)[15] and based on the construct of body image and self-compassion, aimed to evaluate and indicate individual relationships with their bodies with compassion.[31] However, the adequacy of Body compassion in demonstrating physical self, including the concept of physical competence and physical acceptance, is also a concern. The word "body" was widely used throughout the development of the concept of Body compassion, which may lead to a certain confusion that it only focused on body appearance. The term Body image is extensive that represents the multidimensional construct of one's physical self-perception and attitudes.[31] Body compassion thus has incorporated this concept of body image and included appearance, competence (fitness) and health (illness) as the physical self. The Body Compassion Scale has also involved the measure of acceptance, which represents the embracement towards one's appearance, the function of the body and the state of health of the current moment. It is noteworthy that the Body compassion construct has provided an effective conceptuality for acceptance-based approaches in dealing with physical well-being and other related disturbances. Additionally, it showed a strong correlation with the Body Image – Acceptance and Action Questionnaire.[25,32] As a result, body compassion can be expected to be in line with Sonstroem and Morgan's (1988) concept of physical self, which also included the measurement of self-acceptance with the body, its function, how it looks and the ability.

Self-compassion as a Buddhism-driven concept, which embraces showing kindness and mercy towards oneself, the Chinese population is expected to show more significant results compared to western countries. Noteworthy, studies regarding self-compassion among Chinese showed that despite Hong Kong secondary school students were having a comparatively lower self-compassion level, Chinese had a higher self-compassion level than that of Americans.[33,34] Therefore, body compassion in which is derived from the concept of self-compassion, is expected to be culturally relevant and should be investigated among the Hong Kong population. Additionally, different stages of puberty during adolescents was seen as one of the influencing factors in affecting adolescents' body image and satisfaction, self-esteem and other variables.[35,36] Therefore, researchers should not assume there were no differences between early and older adolescents in body compassion investigation.

To conclude, self-concept is derived from individuals' perception towards oneself and could lead to different judgments on self-worthiness and self-feelings in which related to one's self-esteem. Whereas, self-compassion tend to embrace equilibrium mental benefits and no judgmental thoughts, would have a higher power of protection against ego-defensive drawbacks, including the maintenance and pursuance of the physical aspects of self.[20,37] As a result, with adolescents being at an essential transition of identity formation and the lack of body-part related research being further investigate among non-western countries, this research would like to advocate body compassion as a new direction to explore and examine people's physical perception and acceptance. Moreover, considering that the Body Compassion Scale has been recently developed and has not yet been translated into Chinese, this research aimed at translating the Body Compassion Scale into a Chinese version, then examine and validate the psychometric properties of the translated scale among the Hong Kong

adolescents, as well as examining the measurement invariant (factor loadings and mean differences) across early and older adolescents.

2. Methods

2.1. Participants and sampling

This study is targeting secondary school students of Hong Kong. In both the pilot and the main study, the sampling has involved students in local mainstream schools, excluding the English Schools Foundation (ESF) and other international secondary day schools. According to the sample size rule of thumb of confirmatory factor analysis, the sample size is suggested to be 10 times of the variable indicators.[38] Therefore, the sample size for validating the translated 23-item Body Compassion Scale is expected to be more than 200. A convenience sampling method was used to recruit participants. The questionnaire was distributed and collected through personal visits to schools. Parents of students aged 18 or below were required to sign the informed consent at the beginning of the questionnaire.

2.2. Inclusion and exclusion criteria

The inclusion criteria of this study are (1) all participants are required to be a secondary school student, in which is in line with the adolescents' age range (approximately 12–18-year-old) categorized by Erik Erikson's theory of psychosocial development[1–3]; (2) Participants are required to be conversant and able to communicate and read in Chinese (3) Students without any kind of disabilities (i.e. motor, visual and hearing impairments, intellectual and social); and not diagnosed with any mental or cognitive illness; (4) Students without completed in surgery which prevent him from participating in physical activity in the past six months. Students who have been suffering or currently suffering from mental health issues, such as anxiety, stressfulness or non-diagnosed depression, would need to seek school teachers and parents for approval to participate in the survey, or else were classified as the exclusion criteria of the current study.

2.3. Measures

2.3.1. Self-compassion

The Self-compassion Scale – Chinese version[20,39] was used to measure the level of self-compassion. The Self-compassion Scale consists of 26 items of which the total score can determine the level of self-compassion of individuals. The 26 items were derived from the six self-compassion components: self-kindness, common humanity, mindfulness, self-judgement, isolation and over-identification. Sample items include: "When something upsets me I try to keep my emotions in balance." (reverse coding) And "I'm disapproving and judgmental about my own flaws and inadequacies." The items were rated with a 5 – point scale (1 = Almost Never, 5 = Almost Always). The 26 – item finalized study[20] has evidenced the high cross-validity of the Self-compassion scale's factor structure (NNFI = 0.92; CFI = 0.93) and test-retest reliability with all subscales and the total score relation over 0.80. Previous research has also indicated the high internal validity of self-compassion, with Cronbach's alpha >.90, which supported the significance of the scale as a measurement of the degree to which individuals are aware of their difficulties yet solve it in a gentle and lenient way.[40] Furthermore, the Chinese version of the Self-compassion Scale also showed a Cronbach's alpha of over 0.80 in the Chinese students' population and with the test-retest reliability at 0.89 [30,41], which verified the psychometric quality of the Chinese version of the Self-compassion Scale was adequate.

2.3.2. Body compassion

The Body Compassion Scale is a construct that represents a combination of physical-related attitude and well-being at a mindfulness and self-acceptance approach, in other words, enlightening both physical perception and self-compassion. The scale items were created according to the three subscales construct of the Self-compassion Scale, they are mindfulness versus over-identification, self-kindness versus self-judgment and common humanity versus isolation.[20] Each subscales item have also corresponded with the three major components of the physical self (appearance, competence, and health).[15,32] The Body Compassion Scale is a 23-item scale, with three subscales named as Defusion, Common Humanity and Acceptance. The items were rated with a 5 – point scale (1 = Almost Never, 5 = Almost Always).[15,20] The level of the body compassion is calculated by summing up the score of common human, acceptance and the reverse-scored defusion subscale, in result with scores ranging from 26 to 114. The reliability and validity check of the Body Compassion Scale has been assessed through CFA, Cronbach's alpha coefficient and the correlation co-efficient with other related scales. The Comparative Fit Index (CFI) of the three-factor model was shown as 0.924, which indicated as construct reliable and a good fit measurement model. The Cronbach's alpha values of the three separate subscales were at 0.85 or above that indicated an adequate internal consistency of the scale. And yet, the Cronbach's alpha value of all 23 items was at 0.92 thus the use of a total score was suggested. The concurrent validity of the Body Compassion Scale was shown as satisfied by having a relatively high correlation coefficient with the Self-compassion Scale (r = 0.747), body image flexibility scale (r = 0.669) and the negative effect scale (r = −0.436). However, the original scale has only been adapted to a few percentages of Asians of the research sample and it was in English. Therefore, in order to adopt the Body Compassion Scale in Hong Kong, translation and validation are needed for the current research.

2.3.3. Body Mass Index

The self-report Body Mass Index (BMI) was utilized to examine the ratio of weight (kg) and height(m) of the individuals. The Body Mass Index was calculated with the formula, $BMI = kg/m.^{2}$ Healthy individuals were indicated with BMI ranged at 18.5–24.9, while individuals with a BMI over 25.0 is considered as overweight.

2.3.4. Physical activity level

The Physical Activity Questionnaire – Adolescents (PAQ-A) Chinese Version was utilized to obtain self-report physical activity levels. The physical activity questionnaire for adolescents is a subjective measure of the adolescent' physical activity. It consisted of 9 questions, on a 5- point Likert scale and 8 of which are for calculating moderate to vigorous physical activity. The PAQ-A is self-administered and inquires respondents to recall their physical activity in the past week (7 days), in order to measure the average moderate to vigorous physical activity levels of the high school students. It has been told that the PAQ-A questionnaire has shown relatively moderate-to-strong correlations with other physical activity measurement scales, including IPAQ.[42] The PAQ-A has emphasized its appropriateness is focused on high school students of age 14–20 within the school system, documented with a Cronbach's alphas at around 0.80. The Physical Activity Questionnaire for Adolescents (PAQ-A) in Chinese Version was also being adopted and evaluated among the adolescents aged 13–14 and achieved a result of Cronbach's alpha ranged from 0.82 to 0.85, with a 0.81 test-retest reliability after omitting question number 3 (lunchtime activity). The satisfied internal consistency and adequate validity have evidenced the availability of utilizing PAQ-A in the Chinese version within the Chinese adolescents.

2.4. Procedure(s)

The Body Compassion Scale[15] is essential to be translated into Chinese and validated in order to be tested among Hong Kong secondary school students.

To translate the Body Compassion Scale, a forward and backward translation have been processed. The forward translation process was made by two independent translators, with one translator being unaware of the objective of the questionnaire so that possible differences within the translation may be detected. While the backward translation was also being back-translated independently by another two translators to ensure the accuracy of the translation.[43—45] Also, the translators are with the mother tongue in English, and not aware of the intended concepts of the measures to avoid bias. Any discrepancies between the translators have been discussed and resolved. Second, the initial version of the translation has been given to the expert panel for comments to produce the pre-final version. The expert panel was formed by the original translator and 2 experts, one who is familiar with the research field of physical body-related and has been teaching courses related to masculinity and body-image at the university for more than 6 years; and another one is a professional in language translation together with the mother tongue in the translated language, who had worked as a licensed court translator for over 20 years. The expert panel mainly provided comments on the use of words in the translated questionnaire, while discrepancy was discussed among the expert panel. Finally, the pre-final version of the translated questionnaire was put into a pilot test with five secondary school students. After completing the translated questionnaire, the students were asked about their interpretations of each questionnaire item and the meaning of the corresponding response. This process enabled the researcher to ensure the translation are kept in line with the meaning of the original scale. The final adjustment has been made on those with confusion. After finalized the translated scale, a validation survey has put into a pilot study, and after a 1-month interval, a retest has been done for test-retest reliability test. With the outcomes from the pilot study, the Chinese translated Body Compassion Scale was put into a larger sample size study for further affirmation.

2.5. Statistical analysis

The statistical analysis was done using the IBM SPSS software Statistics for Windows, Version 25.0. The Explorative Factor Analysis (EFA) was done and factorial validity of the questionnaire was determined by the Kaiser—Mayer—Olkin (KMO) value and Bartlett's test. A KMO value of at least 0.07 is expected to indicate an adequate, factorial, and valid questionnaire. With the factorial validity and no items' factor loading below 0.4 and being deleted, the reliability of the questionnaire was evaluated through its internal consistency (composite reliability) by assessing the Cronbach's alpha, as well as test-retest reliability. Cronbach's alpha of at least 0.70 is expected to indicate the adequacy of the items' internal consistency. Test-retest reliability test is seen to be significant to validate the administrative process of responding to the questionnaire, especially with indicators as a form of attitudes, which may be considered as more stable across time. The Pearson correlation test was conducted to indicate the concurrent validity check, utilizing the Chinese Self-compassion Scale and the self-report Body Mass Index recorded in the demographic information, to prove the association of related variables.

The construct validity of the questionnaire was evaluated by using Confirmatory Factor Analysis (CFA) using the Rstudio.[46] Other than having the factor loadings of each item are expected to be 0.4 or above, the following fit indices for assessing the goodness of fit of models were used for determination. Firstly, the minimum fit function (X^2) was used, having chi-square to degree of freedom ratio value ranged 2 to 5 as a good fit.[47] However, the Chi-square value was seen to be sensitive to sample size and would reduce the power of indicating model fitness. Therefore, other than the minimum fit function, various additional goodness-of-fit indicators were suggested to be involved[48] and with the following level of index assumed to be good fit: Comparative Fit Index (CFI)[49] and Tucker—Lewis Index (TLI) rated as 0.90 or above as a model of good fit[49]; Standardized Root Mean Square Residual (SRMR) value of 0.08 or below as a model of good fit[49]; Root Mean Square Error of Approximation (RMSEA) value as 0.05 or below, with a 90% confidence interval that holds within this value was considered as a model of good fit.[50]

3. Results

3.1. Pilot study

236 students have access to the online survey webpage through the school online physical education class and direct social media message. A total of 220 students completed the whole questionnaire survey and being included in the data analysis, with 71.9% were male and 28.1% were female, and 61% of them aged 12—14, 26.3% aged 15—18. Within those 220 participants' data, no missing data were found. While, in the re-test, 193 participants were remained and have taken the test for the second time, which indicated a 13% attrition rate.

3.1.1. Internal consistency and test-retest reliability

The Cronbach's alpha value of the 23-item Body Compassion Scale - Chinese Version was 0.888, which was inlined with the original Body Compassion Scale. Moreover, the three subscales have demonstrated a satisfying internal consistency as well, with Defusion = 0.892, Common Humanity = 0.93, Acceptance = 0.836. It is worth noted that, the scale has shown adequate squared multiple correlations ranged from 0.316 to 0.713. The item with the lowest value is item 5 from the factor of "Defusion", and this result indicated the need for further tests for justification. However, referring to the Cronbach's Alpha if the item is deleted, the Cronbach's Alpha value after deleting item 5 will be decreased from 0.888 to 0.885. The Cronbach's Alpha value will be still being satisfactory, it indicated that item 5 was not necessarily to be deleted. Besides, all subscales showed a significant positive correlation with the total Body compassion score. Among the subscales, Defusion showed a negative correlation with Common humanity ($r = -0.42, -0.56, p < 0.01$) but no significant correlation with Acceptance in both pre-test and re-test (Table 1). While, the correlation between Common humanity and acceptance was inconsistent, it showed no correlation in the pre-test but showed a significant positive correlation in the re-test ($r = 0.21, p < 0.05$). Furthermore, the test-retest reliability results were shown as satisfying with Pearson's correlation coefficient at r = 0.83, p < 0.001.

3.1.2. Concurrent validity

In the original Body Compassion Scale validation study, the scale was reported to show a significant moderate to high positive correlation with the Self-compassion Scale; and a low but significant negative correlation with Body Mass Index (BMI).[31] In the current study, it also demonstrated a significant moderate positive correlation between the Chinese version of Body Compassion Scale and the Chinese version of the Self-compassion Scale, with r = 0.515, p < 0.0001. However, the results did not show a significant correlation between the scale and the self-reported BMI.

Table 1
Correlation Matrix between scales and subscales.

	DS	CH	AC	BMI	SC
DS	1				
CH	-.42**	1			
AC	.123	.119/.21*	1		
BMI	.052	-.024	-.026	1	
SC	.465**	.051	.370**	-.029	1
BC	.397**	.58**	.605**	.005	.515*

*$p < 0.05$,**$p < 0.001$.
Abbreviations: DS = Defution, CH = Common Humanity, AC = Acceptance, BMI= Body Mass Index, BC = Body Compassion, SC = Self-compassion.

3.1.3. Construct validity

Given the three-factor solution model has been indicated in the original body compassion scale validation, a Confirmatory Factor Analysis was conducted to examine the construct validity of the three-factor model of the Body Compassion Scale - Chinese Version. The result of the three-factor model with standardized path coefficient showed an adequate goodness-of-fit model, with $X^2(465.64)/227 = 2.05$,$p < 0.001$, CFI = 0.916, TLI = 0.906, SRMR = 0.071,RMSEA = 0.069. Although the RMSEA value was slightly higher than the expected goodness-of-fit value, it was as same as that of the original scale, thus it is considered as acceptable. On the other hand, a one-factor solution model was also examined, with $X^2(1583)/230 = 6.89$, CFI = 0.531, TLI = 0.484, SRMR = 0.171, RMSEA = 0.162, in which indicated a poor goodness-of-fit. This indicated that the three-factor solution model had a significantly better fit than that of the one-factor solution model. The final standardized model of the Body Compassion Scale - Chinese Version is shown in Fig. 1.

3.1.4. Factorial validity

Additionally, to ensure the factor distribution of the Chinese version of Body Compassion Scale were inlined with the original scale, factor analysis was done to indicate the factorial validity. The factor analysis results demonstrated a Kaiser-Mayer_Olkin (KMO) value of 0.901, which was similar to the original scale with 0.929. Hence, it warranted the common variability between items as well as the factorial validity of the Body Compassion Scale - Chinese version.

To conclude, the pilot study has provided preliminary evidence on the reliability and validity of the Chinese Translated BSC scale. However, the insignificant correlations between the subscales may require further investigation in the main study with a larger sample size and more appropriate gender distribution.

3.2. Main study

A total of 1097 students participated in the survey. Whereas 20 cases with more than 20% of missing data were deleted, also three univariate and multivariate outlier cases were identified and deleted. The rest of the missing data were replaced with the mean value of the item. The variables in the data set were shown as normally distributed with no items greater than 3.3 or less than −3.3. Finally, a total of 1074 cases were included in the data analysis, with 65% were male and 35% were female, and the mean age at 14.13 (sd = 1.44). Besides, the independent t-tests showed no significant differences between physical activity level and body compassion, whereas it showed significant differences between age group and body compassion t (1055) = 3.6, $p < 0.001$.

3.2.1. Internal consistency and test-retest reliability

The Cronbach's alpha value of the 23-item Body Compassion Scale - Chinese Version was 0.81. The three subscales have demonstrated a satisfying internal consistency as well, with Defusion = 0.92, Common Humanity = 0.91, Acceptance = 0.84. Table 2 shows all subscales were significantly correlated. Additionally, the subscale correlation in the current sample was shown as similar to the results indicated in the pilot study, in which having a negative correlation between the defusion and common humanity subscales, with r = −0.29,$p < 0.001$.

3.2.2. Factorial validity

The exploratory factor analysis showed a coexisting model of the original Body Compassion Scale, with three factors' eigenvalues greater than 2.0 and accounted for 30.6%, 50.48% and 61.19% of the variance respectively. The factor analysis results also demonstrated a Kaiser-Mayer_Olkin (KMO) value of 0.93, in which further indicated the appropriateness of the factor distribution.

3.2.3. Construct validity

The result of the Confirmatory Factor Analysis model showed a satisfying goodness-of-fit measurement model, with $X^2(995.19)/227 = 3.36$, CFI = 0.944, TLI = 0.938,SRMR = 0.042,RMSEA = 0.056 [90% CI = 0.053−0.06]. Additionally, a second-order Confirmatory Factor Analysis was also conducted in order to confirm the theoretical construct of body compassion with the three subscales. The second-order CFA showed adequate goodness of fit with $X^2(714.59)/204 = 3.5$, CFI = 0.962, TLI = 0.957,SRMR = 0.037, RMSEA = 0.048 [90% CI = 0.044 to 0.052]. Besides, it also

Table 2
Correlation Matrix between scales and subscales of the Main Study.

	DS	CH	AC	SC
DS	1			
CH	-.29**	1		
AC	.112**	.214*	1	
SC	.42**	.15**	.369**	1
BC	.577**	.523**	.618**	.546*

*$p < 0.05$,**$p < 0.001$.
Abbreviations: DS = Defusion, CH = Common Humanity, AC = Acceptance, BMI= Body Mass Index, BC = Body Compassion, SC = Self-compassion.
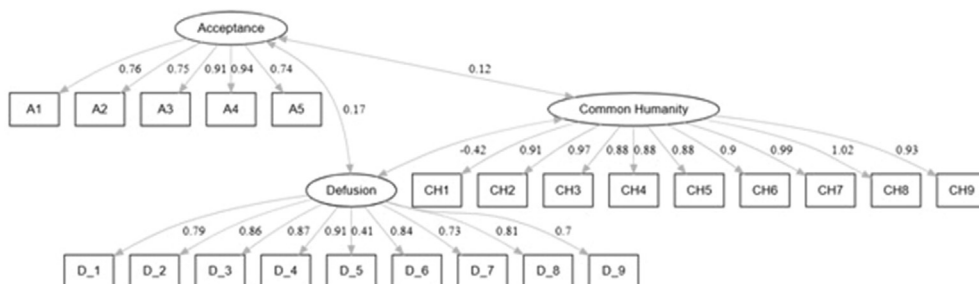

Fig. 1. The final standardized model of the Body Compassion Scale - Chinese Version.

demonstrated a significant moderate positive correlation between the Chinese version of Body Compassion Scale and the Chinese version of Self-compassion Scale, with r = 0.546, p < 0.0001.

3.2.4. Measurement invariant model

The Measurement Invariant Model testing was conducted using multiple-group CFA to examine whether the measurement model was invariant across early and older adolescents. A baseline model without any constrained parameters was first established, then two constrained models with constrained factor loadings (Metric Model) and constrained mean differences (Scalar Model) were established for equality across age groups. Table 3 demonstrates that the unconstrained model (Baseline Model) resulted in adequate goodness of fit index to the data. While, the Metric model and the Scalar Model with the factor loadings and mean differences being constrained to be equal across the two age groups, demonstrated adequate goodness of fit index to the data as well. Comparing the three models (Baseline, Metric and Scalar Model), they showed no changes in CFI, while only showed less than 0.002 in RMSEA, thus support the invariance across two age groups. In conclusion, the results revealed that the factor loadings and mean differences of the 23-item Chinese Translated Body Compassion Scale Measurement were invariant across early and older adolescents.

4. Discussion

This study is aimed at translating and examine the psychometric properties of the Body Compassion Scale - Chinese version among a sample of Hong Kong secondary school students. The internal consistency of both 23-item and three subscales items, as well as the test-retest reliability outcomes, indicated that the scale generated strong robustness as the original Body Compassion Scale. Similarly, the goodness-of-fit index generated from the scale model supported the adequacy of the self-report measure Body Compassion Scale -Chinese Version. Despite the *t*-test showed significant differences between age groups in body compassion, the measurement invariance model demonstrated that the factor loadings and mean differences of the Chinese translated Body Compassion Scale measurement model were adaptive across age groups regardless of puberty. Hence, this study has supported the explicit goal of the formation of the Body compassion scale mentioned by Altman and her co-authors, which is to pull the elements of physical self and self-compassion together and to reframe it. Upon that, through translating the scale, it further evidenced that this reformation could be applied to the Hong Kong students, and the Chinese-translated version of the Body Compassion Scale is reliable and adaptive for examining the physical compassion level of the Hong Kong secondary school students.

One explicit result of the current research was shown to be different from the original scale, that was the association between subscales. In the original scale, the reverse-coded defusion subscales showed a positive correlation with all other subscales;

however, in the current research sample, the reverse-coded defusion subscales showed a moderate negative correlation with the Common humanity subscales, in both pilot and main study. As most of the self-compassion related research demonstrated that a high level of isolation tends to have a lower level of common humanity, thus the current research outcome can hardly be interpreted or supported by other literature. Yet, based on the traditional Buddhism philosophy penetrated in the social norms, people, especially Asians, tend to promote compassion to others and embrace the concept of 'Egolessness" (Anatman). Hence, from another perspective, it can be interpreted that people who have a lower level of defusion may seldom focus on their own feelings or inner self, and thus less related themselves to others, leading to a lower level of common humanity. Whereas, deeper investigation through a qualitative study is needed.

On the other hand, this study has indicated an insignificant correlation between BMI and Body Compassion Scale, which was the only difference compared to the result of the original scale. Altman et al. (2017)'s psychometric examination showed a significant negative correlation between BMI and Body Compassion Scale, with r = −0.174 and −0.201, p < 0.01. This can be explained by the gender distribution of the data. It is noted that over 70% of the participants in Altman's research were female, while there were also approximately 70% of the participants in the current research were male. According to the meta-analysis regarding body image and mental well being, gender was considered as a significant moderator within the relationship of these factors, in which women tend to be more sensitive and had a higher correlation among these factors than men.[51,52] Furthermore, the current research has shown a significant correlation between gender and body compassion, indicating that males tended to associate with a higher body compassion level, yet no significant association between gender and BMI. Therefore, Altman's data could only show relatively low significant correlation coefficients.[53] Additionally, in a meta-analysis on physical activity and body image,[54] it had only included three studies in the analysis, in which indicated that studies on body image related tended to be scarce. Therefore, having satisfactory psychometric property examination results with having over 70% were male in the current sample, it can further support the reliability of the Chinese-translated version of the Body Compassion Scale, in which body compassion does not only apply to female but also adaptive to male.

Still, a limitation is worth noting. There was an almost 13% attrition rate in the re-test of the pilot questionnaire distribution. This is due to the fact that some of the dropout participants were secondary three students, who were just ready to resume school from the affections of the COVID-19. At the time of re-test, their online classes have been cancelled and returned to face-to-face schooling, hence the online survey could not be reached again to one of the forms of students, leading to some loss of participants in the re-test. The research team has tried to discuss with the school teacher regarding re-distributing the questionnaire on-site, luckily, some re-test data were able to collect. However, re-distributing the

Table 3
Summary of goodness of fit of the measurement invariance analysis models.

23-item BCSC Model	Chi-squared test		Indices			
	X²/df	p	CFI	TLI	SRMR	RMSEA (90%CI)
Baseline Model	3.3	<0.001	0.923	0.915	0.117	0.066 (0.062–0.07)
Metric Model	3.2	<0.001	0.923	0.918	0.118	0.065 (0.061–0.068)
Scalar Model	3.16	<0.001	0.923	0.921	0.118	0.063 (0.06–0.07)

Note: N of Early Adolescents = 591, N of Older Adolescents = 483.
Abbreviations: CFI= Comparative Fit Index; TLI = Tucker−Lewis Index; SRMR= Standardized Root Mean Square Residual; RMSEA = Root Mean Square Error of Approximation, *p* = p-value; X² = Chi-square, df = Degree of freedom.

questionnaires in schools have caused the inconsistency of the test-retest interval between participants, leading to potential discrepancies within the data.

5. Conclusion

The Body Compassion Scale – Chinese version was considered as valid and reliable for utilization among Hong Kong secondary school students. With the outcomes from the current study, it can support the measurement of body identities with compassion interventions, as well as facilitate individuals' to pay more kind attention towards themselves in order to achieve a positive self-concept and reduce vulnerability caused by identity crisis during adolescent psychosocial development. Also, further validation can be done on different populations, such as the general Chinese population, Hong Kong elderly, younger children as well as athletes.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Compliance with ethical standards

The ethics application for this research has been approved by the Hong Kong Baptist University Research Ethics Committee (Ethics Code: REC/STUDENT/19–20/0560, date of approval: March 31, 2021).

Authors contribution

MYCW carried out the studies, participated in the statistical analysis and drafted the manuscript; PKC and KML participated in its design and coordination. All authors have read and approved the final version of the manuscript, and agree with the order of presentation of the authors.

CRediT authorship contribution statement

Ming Yu Claudia Wong: Conceptualization, Methodology, Software, Validation, Formal analysis, Data curation, Writing – original draft, preparation. **Pak Kwong Chung:** Writing – review & editing, Supervision. **Ka Man Leung:** Writing – review & editing, Supervision, All authors have read and agreed to the published version of the manuscript.

References

1. Erickson E. *Young Man Luther: A Study in Psychoanalysis and History*. New York: Norton; 1958.
2. Erikson EH. *Youth: Change and Challenge*. New York: Basic Books; 1963.
3. Erikson EH. *Identity: Youth and Crisis*. London: Faber; 1968.
4. Bee HL. *The Developing Child*. London: Harper Collins; 1992.
5. Fox KR. *The Physical Self: From Motivation to Well-Being*. Windsor: Human Kinetics; 1997.
6. Harter S. The development of self-representation. In: Eisenberg WD, ed. *Handbook of Child Psychology:*. New York: Wiley; 1997:553–618. Social, Emotional, and Personality Development; vol. 3.
7. Bowker A. The relationship between sports participation and self-esteem during early adolescence. *Can J Behav Sci*. 2006;38:214–229. https://doi.org/10.1037/cjbs2006009.
8. Chen H, Jackson T. Stability of body image concerns among Chinese adolescents: nine-month test-retest reliabilities of the negative physical self scale. *Percept Mot Skills*. 2007;105:677–680. https://doi.org/10.2466/pms.105.2.677-680.
9. Xu X, Mellor D, Kiehne M, et al. Body dissatisfaction, engagement in body change behaviors and sociocultural influences on body image among Chinese adolescents. *Body Image*. 2010;7:156–164. https://doi.org/10.1016/j.bodyim.2009.11.003.
10. Zhou TM. On the relationship between negative physical self, coping strategies and subjective well-being among middle school students of the han, qiang and yi nationalities. *J Nanjing Norm Univ*. 2010;6.
11. Fung MSC, Yuen M. Body image and eating attitudes among adolescent Chinese girls in Hong Kong. *Percept Mot Skills*. 2003;96:57–66. https://doi.org/10.2466/pms.2003.96.1.57.
12. Fung SSW, Stewart SM, Ho SY, et al. Body dissatisfaction, maternal appraisal, and depressive symptoms in Hong Kong adolescents. *Int J Psychol*. 2010;45:453–460. https://doi.org/10.1080/00207594.2010.481719.
13. Knowles G, Ling FCM, Thomas GN, et al. Body size dissatisfaction among young Chinese children in Hong Kong: a cross-sectional study. *Publ Health Nutr*. 2015;18:1067–1074. https://doi.org/10.1017/S1368980014000810.
14. Seligman ME, Csikszentmihalyi M. Positive psychology: an introduction. In: *Flow and the Foundations of Positive Psychology*. Dordrecht: Springer; 2014: 279–298.
15. Altman JK, Linfield K, Salmon PG, et al. The body compassion scale: development and initial validation. *J Health Psychol*. 2020;25:439–449. https://doi.org/10.1177/1359105317718924.
16. Shavelson RJ, Hubner JJ, Stanton GC. Self-concept: validation of construct interpretations. *Rev Educ Res*. 1976;46:407–441.
17. Sonstroem RJ, Morgan WP. Exercise and self-esteem: rationale and model. *Med Sci Sports Exerc*. 1989;21:329–337. https://doi.org/10.1249/00005768-198906000-00018.
18. Pop C. Self-Esteem and body image perception in a sample of university students. *Eurasian J. Educ. Res*. 2016;64:31–44.
19. Fox KR, Corbin CB. The physical self-perception profile: devlopment and preliminary validation. *J Sport Exerc Psychol*. 1989;11:408–430. https://doi.org/10.1123/jsep.11.4.408.
20. Neff KD. Self-Compassion: an alternative conceptualization of a healthy attitude toward Oneself. *Self Ident*. 2003;2:85–101. https://doi.org/10.1080/15298860309032.
21. Baumeister RF, Heatherton TF, Tice DM. When ego threats lead to self-regulation failure: negative consequences of high self-esteem. *J Pers Soc Psychol*. 1993;64:141–156. https://doi.org/10.1037/0022-3514.64.1.141.
22. Breines J, Toole A, Tu C, et al. Self-compassion, body image, and self-reported disordered eating. *Self Ident*. 2014;13:432–448. https://doi.org/10.1080/15298868.2013.838992.
23. Albertson ER, Albertson ER, Neff KD, et al. Self-compassion and body dissatisfaction in women: a randomized controlled trial of a brief meditation intervention. *Mindfulness*. 2015;6:444–454. https://doi.org/10.1007/s12671-014-0277-3.
24. Hogan C. *Relationship between Self-Compassion, Self-Perception, and Stuttering Severity*. Graduate Independent Studies - Communication Sciences and Disorders; 2017. Available from: https://ir.library.illinoisstate.edu/giscsd/5.
25. Messer B, Harter S. *The Self-Perception Profile for Adults: Manual and Questionnaires*. Devenr, CO: The University of Denver, Department of Psychology; 2012.
26. Barnett MD, Sharp KJ. Maladaptive perfectionism, body image satisfaction, and disordered eating behaviors among U.S. college women: the mediating role of self-compassion. *Pers Indiv Differ*. 2016;99:225–234. https://doi.org/10.1016/j.paid.2016.05.004.
27. Cox AE, Ullrich-French S, Tylka TL, et al. The roles of self-compassion, body surveillance, and body appreciation in predicting intrinsic motivation for physical activity: cross-sectional associations, and prospective changes within a yoga context. *Body Image*. 2019;29:110–117. https://doi.org/10.1016/j.bodyim.2019.03.002.
28. Thall MS. *Exercise and Physical Activity in Middle-Aged Women: The Role of Self-Compassion [PhD Thesis]*. United States: The Ohio State University; 2014.
29. Tylka TL, Homan KJ. Exercise motives and positive body image in physically active college women and men: exploring an expanded acceptance model of intuitive eating. *Body Image*. 2015;15:90–97.
30. Liss M, Erchull MJ. Not hating what you see: self-compassion may protect against negative mental health variables connected to self-objectification in college women. *Body Image*. 2015;14:5–12. https://doi.org/10.1016/j.bodyim.2015.02.006.
31. Cash TF, Pruzinsky T. *Body Image: A Handbook of Theory, Research, and Clinical Practice*. New York: Guilford Press; 2004.
32. Altman JK, Zimmaro LA, Woodruff-Borden J. Targeting body compassion in the treatment of body dissatisfaction: a case study. *Clin Case Stud*. 2017;16:431–445. https://doi.org/10.1177/1534650117731155.
33. Kwan VSY, Kuang LL, Hui NH. Identifying the sources of self-esteem: the mixed medley of benevolence, merit, and bias. *Self Ident*. 2009;8:176–195.
34. Sun X, Chan DW, Chan L. Self-compassion and psychological well-being among adolescents in Hong Kong: exploring gender differences. *Pers Indiv Differ*. 2016;101:288–292.
35. Ackard DM, Peterson CB. Association between puberty and disordered eating, body image, and other psychological variables. *Int J Eat Disord*. 2001;29:187–194.
36. Williams JM, Currie C. Self-esteem and physical development in early adolescence: pubertal timing and body image. *J Early Adolesc*. 2000;20:129–149.
37. Neff KD. The role of self-compassion in development: a healthier way to relate to oneself. *Hum Dev*. 2009;52:211–214. https://doi.org/10.1159/000215071.
38. Wolf EJ, Harrington KM, Clark SL, et al. Sample size requirements for structural equation models: an evaluation of power, bias, and solution propriety. *Educ Psychol Meas*. 2013;73:913–934. https://doi.org/10.1177/0013164413495237.
39. Chen J, Yan LS, Zhou LH. Reliability and validity of Chinese version of self-

compassion scale. *Chin J Clin Psychol.* 2011;19:734−736.
40. Terry ML, Leary MR, Mehta S. Self-compassion as a buffer against homesickness, depression, and dissatisfaction in the transition to college. *Self Ident.* 2013;12:278−290. https://doi.org/10.1080/15298868.2012.667913.
41. 賴志超 蘇倫慧 正念. 自我療癒力與心理適應: 自我悲愍與自我貶抑的中介效果. [Mindfulness, self-healing power and psychological adaptation: the mediating effect of self-grief and self-deprecation]. 中華輔導與諮商學報. 2015;42:93−124 ([in Chinese]).
42. Kowalski KC, Crocker PR, Donen RM. *The Physical Activity Questionnaire for Older Children (PAQ-C) and Adolescents (PAQ-A) Manual.* vol. 87. College of Kinesiology, University of Saskatchewan; 2004:1−38.
43. Guillemin F, Bombardier C, Beaton D. Cross-cultural adaptation of health-related quality of life measures: literature review and proposed guidelines. *J Clin Epidemiol.* 1993;46:1417−1432.
44. Beaton D, Bombardier C, Guillemin F, et al. *Recommendations for the Cross-Cultural Adaptation of the DASH & QuickDASH Outcome Measures.* vol. 1. Institute for Work & Health; 2007:1−45.
45. Tsang S, Royse CF, Terkawi AS. Guidelines for developing, translating, and validating a questionnaire in perioperative and pain medicine. *Saudi J Anaesth.* 2017;11:S80−S89. https://doi.org/10.4103/sja.SJA_203_17.
46. RStudio Team. *RStudio.* Boston, MA: Integrated Development for R. RStudio, Inc.; 2015. Available from http://www.rstudio.com/.

47. Kline RB. *Principles and Practice of Structural Equation Modeling.* second ed. New York: Guilford; 2005.
48. Hair JF, Black WC, Babin BJ, et al. *Multivariate Data Analysis.* vol. 6. Upper Saddle River: Pearson Prentice Hall; 2006.
49. Hu LT, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct Equ Model.* 1999;6: 1−55.
50. Jaccard J, Wan CK. *LISREL Approaches to Interaction Effects in Multiple Regression.* London: Sage; 1996. https://doi.org/10.4135/9781412984782.
51. Walker DC, White EK, Srinivasan VJ. A meta-analysis of the relationships between body checking, body image avoidance, body image dissatisfaction, mood, and disordered eating. *Int J Eat Disord.* 2018;51:745−770. https://doi.org/10.1002/eat.22867.
52. Mills J, Fuller-Tyszkiewicz M. Fat talk and body image disturbance: a Systematic Review and Meta-Analysis. *Psychol Women Q.* 2017;41:114−129. https://doi.org/10.1177/0361684316675317.
53. Cohen J. A power primer. *Psychol Bull.* 1992;112:155−159. https://doi.org/10.1037/0033-2909.112.1.155.
54. Bassett-Gunter R, McEwan D, Kamarhie A. Physical activity and body image among men and boys: a meta-analysis. *Body Image.* 2017;22:114−128. https://doi.org/10.1016/j.bodyim.2017.06.007.