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ORIGINAL RESEARCH

Individualized Implementation of Youth Quality of Life Instrument-Research Version (YQOL-R) Among Chinese Adolescents with Different Weight Status

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Purpose: This study implemented the individualized Youth Quality of Life Instrument-Research Version (YQOL-R) to estimate the quality of life (QoL) among Chinese adolescents with three different Body Mass Index (BMI) levels. The study aims to explore and provide a reference for developing individualized QoL (IQoL) measurements in China.

Methods: The sample consisted of 822 aged 11–18 from nine schools. The data collection included all participants' primary characters (age, sex, annual household income, parental education, and recruitment community) and their self-report QoL. Precisely, based on the generic measurement of YQOL-R, we developed IQoL measurements by asking adolescents' perceived five most important things to them ($IQOL_{importance}$) and the aspects they most want to change ($IQOL_{change}$) from 19 facets, respectively. The one-way analysis of variance (ANOVA) was applied to compare total and subscale scores of $IQOL_{importance}$, $IQOL_{change}$, and YQOL-R among adolescents with three different weight status. Also, the data analysis used multivariable linear regression modeling to test the effects on scores of $IQOL_{importance}$ and $IQOL_{change}$.

Results: Overall, the obese adolescents identified "*Having good physical health*" as the most important (54.03%) and most like-to-change (42.65%); in contrast, the normal-weight group ranked "*Being myself*" as the top facet of $IQOL_{importance}$ (52.42%) and "*Having good friends*" as the top facet of $IQOL_{change}$ (43.12%). The obese adolescents' reported $IQOL_{importance}$ scores are significantly lower than those of the normal-weight group (P=0.039). However, there is no significant difference in $IQOL_{change}$ score among the three weight-status groups. The multivariable linear regression models indicated that adolescents who are girls (P=0.035), have higher educated fathers (P=0.049), and are overweight/obese (P=0.041) self-reported worse $IQOL_{importance}$ score; yet, the girls (P=0.023) and older adolescents (P=0.004) answered lower $IQOL_{change}$ scores. In addition, adolescents who had higher educated mothers (P=0.047; 0.023) and responded with higher total YQOL-R scores (P<0.001; <0.001) reported higher $IQOL_{importance}$ and $IQOL_{change}$ scores.

Conclusion: In the current study, although the self-reported YQOL-R scores from different weight status did not present a significant difference, the obese group reported a statistical trend towards lower $IQOL_{importance}$ scores than the normal-weight and overweight adolescents. These findings emphasize that $IQOL_{importance}$ and $IQOL_{change}$ could capture adolescents' perspectives with different weight statuses about their lives, which are unique as complementary health outcomes accompanying YQOL-R in health surveys and interventions among Chinese adolescents.

Keywords: individualized quality of life, IQoL, Chinese adolescents, youth quality of life instrument-research version, YQOL-R, different weight status, body mass index, BMI

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Introduction

Despite numerous appeals for action, addressing childhood obesity remains one of our time's most significant global public health challenges. Particularly in China's urban and rural areas, the prevalence of child overweight and obesity has experienced a rapid increase.[1,2] According to the latest Report on the Status of Nutrition and Chronic Diseases of Chinese Residents (2020),[2] the prevalence of overweight and obesity among children under the age of 6 is 11.4%, while for children aged 6–17, it is 19%. If no measures are taken, the Report on Childhood Obesity in China predicts that the rate of overweight and obesity among school-aged children (7–18 years old) will reach 28.0% by 2030, which equates to approximately 49.48 million Chinese children.[3] These data serve as an early warning of the looming threat of childhood obesity,[4] which has significant short-term and long-term repercussions on physical health,[5,6] including complications such as hypertension and metabolic disorders, as well as psychological consequences,[7,8] like low self-esteem and social exclusion. Ultimately, these consequences contribute to declining health-related quality of life (HRQoL).[9]

The HRQoL has been proposed as a comprehensive evaluation encompassing subjective perspectives on various aspects of health, including physical, psychological, functional, and social dimensions.[10,11] By utilizing HRQoL measures, both clinicians/general practitioners and researchers can derive valuable insights into the quality of life (QoL) experienced by individuals.[12] In essence, the assessment of HRQoL offers additional benefits in identifying factors that impede the adoption of a healthy lifestyle, thereby aiding in the design of tailored intervention strategies for public health policies and the evaluation of treatment effectiveness cost-effectively.[13,14] Two approaches are available for assessing HRQoL in overweight/obese children: generic and specific measures. To our knowledge, generic measures are frequently employed to facilitate comparisons with other cohorts. For instance, the Pediatric Quality of Life Inventory (PedsQL)[15] is a validated measure commonly used to compare children with overweight/obesity to those without excess weight or other chronic conditions.[9,16,17] In addition to generic HRQoL measures, weight-specific HRQoL measures can evaluate the success of patients in weight loss programs and exhibit responsiveness to minimal clinical changes. For example, the Weight-specific Youth Quality of Life Instrument (YQOL-W)[18] provides more detailed insights into weight-specific impairments and demonstrates greater sensitivity in detecting changes in HRQoL resulting from treatment effects in children with overweight or obesity compared to questionnaires solely assessing generic HRQoL.[18,19]

However, both generic and condition-specific instruments measure respondents' HRQoL by applying standardized questionnaires about components or determinants of life. The HRQoL is acknowledged as a multidimensional concept, and the evaluations from the current instruments assume the importance of different components is equal to all individuals and generalizing individuals' HRQoL with all of these preset contents, which varies due to how they perceive and judge life's different aspects.[20] In short, although the development of scale items is typically conducted by a panel consisting of medical experts, physicians, nurses, and patients, diversity assessed panel, their reliance on standardized questions and predefined domains restricts individuals from incorporating important factors or excluding irrelevant items.[21,22] To understand the specific challenges children face and develop tailored interventions to enhance their QoL, we believe it is essential to delve into insights at the item level.[13,23,24]

Furthermore, to our knowledge, no studies have developed a measurement tool for individualized quality of life (IQoL) designed explicitly for Chinese adolescents. To address this research gap, we used the individualized Youth Quality of Life Instrument-Research Version (YQOL-R) to assess the QoL among Chinese adolescents across three different Body Mass Index (BMI) levels. This study aims to fill the knowledge gap and provide a foundation for developing personalized QoL measures. Notably, the findings from this study will be utilized to construct an individualized and accurate measurement model for assessing QoL among Chinese adolescents with varying weight status, which will contribute valuable evidence to support the development of policies, programs, and services aimed at enhancing the QoL for this population.

Materials and Methods

Study Design and Participants

As part of the larger "Weight-specific Quality of Life in Adolescents" project,[25] a multi-center questionnaire study was conducted in Hangzhou City, Zhejiang Province. This project aimed to develop and evaluate the measuring properties of

the Chinese version of the weight-specific YQOL-W and generic YQOL-R. In this study, we only included self-administered data from adolescents who answered the generic QoL measurement YQOL-R.

We employed a multistage stratified sampling technique to select a diverse group of adolescents. First, we intentionally divided Hangzhou City into three areas - "main city", "sub-center district", and "suburb" - and selected one district from each area. From the three selected districts (Shangcheng, Jianggan, and Xiaoshan Districts), we selected a total of nine schools - three elementary schools (grade 6), three middle schools (grades 7–9), and three high schools (grades 10–12)– from three different community categories, namely "urban", "suburban", and "migrant", within each district. The research team pre-estimated the sample size in each unit and recruited a similar sample size under different groups based on specific characteristics like sex, age, weight categories, and socioeconomic status (SES).

The study included all school-aged adolescents (11–18 years) who could read at the 5th-grade level. After obtaining consent from nine schools as sampling units, the research team conducted an initial screening of all students' previous anthropometric examination results provided by the schools to exclude the ineligible adolescents if they met any of the following conditions: 1) were pregnant or breastfeeding; 2) currently taking psychotropic medication; 3) had a history of anorexia nervosa, bulimia, major depression, panic disorder, psychosis, or bipolar disorder; 4) had a life-threatening illness; or 5) had comorbid physical disabilities, long-term health problems, or mental health disorders that had a greater impact on QoL than weight. The recruitment process emphasized that participation was voluntary and would not affect school performance and provided attendance rewards to each adolescent with a $4 gift.

Data Collections

All participating students were instructed to complete the YQOL-R questionnaire and provide basic personal information. The questionnaire included requesting participants' sex (*boy* and *girl*), age (11–18 years), and SES. For SES evaluation, the questionnaire incorporated queries to the parents/guardians of adolescents to report essential family details, such as parental education, household income, and type of residence.

Participants' weight status was classified based on body mass index (BMI; kg/m^2) cut-off points for screening three weight groups (normal weight, overweight, and obesity) in Chinese adolescents, as established by the Group of China Obesity Task Force.[26] To calculate the BMI value, the height and weight of each adolescent were measured. In order to avoid inaccuracies resulting from self-reporting, both height and weight were measured in person using a digital height tool (JIANGSU SUHONG height measure; SH-8063) and weight measuring instrument (Tanita digital scale; HD-384). Participants were instructed to remove shoes, hats/hair ornaments, and heavy clothing to maintain measurement accuracy. Two independent research assistants performed each measurement twice. The third measurement would only be conducted if the difference between the first two measurements exceeded 1.0cm or 1.0kg. The final recorded measurement constituted the average of the two closest measurements.

Instruments

Youth Quality of Life Instrument-Research Version (YQOL-R)

The YQOL-R is a generic QoL measure designed for all youths aged 11–18. It comprises two types of items: contextual (i.e., can be reported by others) and perceptual (i.e., known only to the youths themselves).[27,28] As a self-administered instrument, the major component of the whole scale is the perceptual type with 41 items, which were identified from four domains: Sense of Self (14 items), Social Relationships (14 items), Culture and Community (10 items), and General Quality of Life (3 items).[28]

The response scale of YQOL-R is an 11-point scale with anchors at 0 (*Not at all*) and 10 (*A great deal or ultimately*).[27] Before computing the scores, negatively worded items were reverse-coded. The scores were then transformed linearly to a scale from 0 points (*the worst QoL*) to 100 points (*the best QoL*) for easy interpretability, where higher scores indicate a better QoL (shown in Supplementary Data 1).[27] The Chinese version of the YQOL-R was culturally adapted and validated by the Department of Social Medicine at Zhejiang University School of Public Health in collaboration with the Seattle Quality of Life Group (SeaQoL).[29]

Individualized QoL (IQoL) Measurements

At present, measurements can ask respondents to select the aspects that affect their QoL and provide self-assessments based on their feelings. Assessed scores are calculated by combining ratings and weights from the personality-assigned aspects.[30] In this study, we used 19 facets mapped from 38 items, without the General Quality of Life domain of 3 items, to propose two IQoL measurements: the participants were asked to select the "Five most important aspects of their life" ($IQOL_{importance}$) and "Five aspects they would most like to change" ($IQOL_{change}$) from a list of 19 facets, respectively (Table 1). Instead, the five responded facets were selected as each adolescent's personalized entries to score their IQoL.

In calculating the scores for $IQOL_{importance}$ and $IQOL_{change}$, the conditions were required to meet two criteria: 1) a selection of at least four facets and 2) a completion of at least 80% of the items in each facet. The calculation rules are similar to those used in YQOL-R, where each entry is converted into a standard score ranging from 0 to 100.[27,28] The facet score is the arithmetic mean of the items within each facet, while the IQoL scoring calculates the arithmetic mean of the scores for each facet (shown in Supplementary Data 1). Higher scores indicate perceived better QoL.

Table 1 19 Facets of the YQOL-R

Facets	Number of Items	YQOL-R Items*
1.Getting support from adults in my life	1	REL13 - adults treat me fairly
2. Being myself	3	SELF4 - good about self
		SELF5 - important to others
		SELF6 - comfortable with sexual feelings
3. Believing in myself	4	SELF1 - keep trying;
		SELF2 - handle difficulties;
		SELF3 - able to do things well
		SELF10 - okay to make mistakes
4. Caring for others	1	REL22 - role model
5. Having a sense of belonging	1	SELF28 - left out
6. Engaging in activities I enjoy	2	ENV29 - life is interesting
		ENV30 - try new things
7. Getting along well with my family	6	REL14 - attention from family
		REL15 - understood by parents
		REL16 - useful to family
		REL17 - family cares;
		REL18 - family encourages
		REL19 - get along with parents
8. Having freedom	2	REL26 - take part in activities
		REL20 - participate in decisions
9. Having good friends	3	REL25 - satisfied with social life
		REL23 - tell friends feelings
		REL24 - happy with friends
10. Having a bright future	1	ENV32 - forward to future
11. Having a healthy body	1	SELF7 - enough energy
12. Being good-looking	1	SELF8 - pleased with looks
13. Feeling relaxed and at ease	2	SELF9 - comfortable with stress
		SELF21 - alone in life
14. Having enough money	1	ENV33 - enough money
15. Enjoying the community where I live	1	ENV31 - like neighborhood
16. Earning respect from my classmates	1	REL27 - respect from peers
17. Personal safety	2	ENV34 - safe at home
		ENV38 - safe at school

(*Continued*)

Table 1 (Continued).

Facets	Number of Items	YQOL-R Items*
18. Studying a good school	3	ENV35 - good education ENV36 - get information ENV37 - enjoy learning
19. Feeling that my life has meaning	2	SELF11 - life has meaning SELF12 - beliefs give strength

Notes: *Items in the table are named respecting their associated domains have been identified from the generic QoL measurement YQOL-R (SELF, question from the Sense of Self domain; ENV, question from the Culture and Community domain; REL, question from the Social Relationships domain).
Abbreviations: YQOL-R, Youth Quality of Life Instrument-Research Version; SELF, Sense of Self domain; ENV, Culture and Community domain; REL, Social Relationships domain.

Statistical Analysis

The categorical variables reported the demographic characteristics of the participants as frequencies and percentages. Continuous variables were presented as means and standard deviations (SD). The study used one-way analysis of variance (ANOVA) to compare the total and subscale scores of $IQOL_{importance}$, $IQOL_{change}$, and YQOL-R among participants with different weight statuses. Also, researchers explored the relationships between scores of $IQOL_{importance}$, $IQOL_{change}$, and YQOL-R by conducting Pearson's correlation test. Considering all potential and influential factors' characters, researchers adopted the multivariable linear regression modeling to test the effects on scores of $IQOL_{importance}$ and $IQOL_{change}$. The statistical analysis used SPSS 20.0 software and set the statistical significance at $P<0.05$.

Ethics Statement

This study was reviewed and approved by the Ethics Committee of the Zhejiang University School of Medicine and followed the declaration of Helsinki.[31] All procedures involved in this study were explained friendly and understandable to all potential participants. All respondents, including recruited adolescents and their parents/guardians, provided written informed consent before participation. All data were analyzed without personal identifiers.

Results

Participant Characteristics

Ten participants dropped out of the study as they responded to less than 80% of the items in any subscale of YQOL-R. At the same time, eight were invalid for choosing at least four facets of individualized items. The Pearson Chi-square test ($P>0.05$) showed no significant differences in demographic variables between participants with and without missing data in the YQOL-R. The present study involved valid data from 822 participants (97.8%).

The adolescents had a mean age of 14.25 years (SD=1.987). Approximately 49.4% of the participants were male, were male, and 51.1% were between 11 and 14. Approximately 58.5% of the participants had a yearly household income exceeding 60,000 Yuan. Most fathers had attained no more than a middle school education level (47.2%), as did most mothers (57.3%). The rate of overweight or obese participants was 67.2% (Table 2).

Percentages of Personalized Aspects

Figure 1A shows the percentages and rankings of the top five essential aspects based on what was reported by all participants. These facets were identified as—"*Having a healthy body*" (51.34%), "*Being myself*" (51.22%), "*Getting along well with my family*" (47.57%), "*Having good friends*" (44.40%), and "*Believing in myself*" (41.48%). Conversely,

Table 2 Demographic Characteristics of the Sample (N = 822)

Characteristics (Valid Response, *n*)	Number	Prevalence (%)
Age (*n* = 820)		
11–14	419	51.1
15–18	401	48.9
Sex (*n* = 822)		
Boy	406	49.4
Girl	416	51.6
Annual household income[a] (*n* = 773)		
<60,000	321	41.5
≥60,000	452	58.5
Father's education (*n* = 806)		
Middle school or less	387	48.0
High school or vocational training	271	33.6
Some college or higher	148	18.4
Mother's education (*n* = 808)		
Middle school or less	469	57.3
High school or vocational training	229	28.0
Some college or higher	120	14.7
Recruitment community (*n* = 808)		
Urban	269	32.7
Rural	280	34.1
Migrant	273	33.2
Weight status (*n* = 822)		
Normal	269	32.8
Overweight	342	41.5
Obese	211	25.7

Notes: [a]The variable "Annual household income" was investigated as China's currency–Renminbi (RMB); its principal unit is called the Chinese Yuan (CNY).

Figure 1B demonstrated the percentages and rankings of the top five facets that participants wanted to change. The facets most frequently mentioned were "*Having good friends*" (44.89%), "*Having a healthy body*" (42.34%), "*Believing in myself*" (37.71%), "*Having a bright future*" (34.55%), and "*Feeling that my life has meaning*" (33.70%).

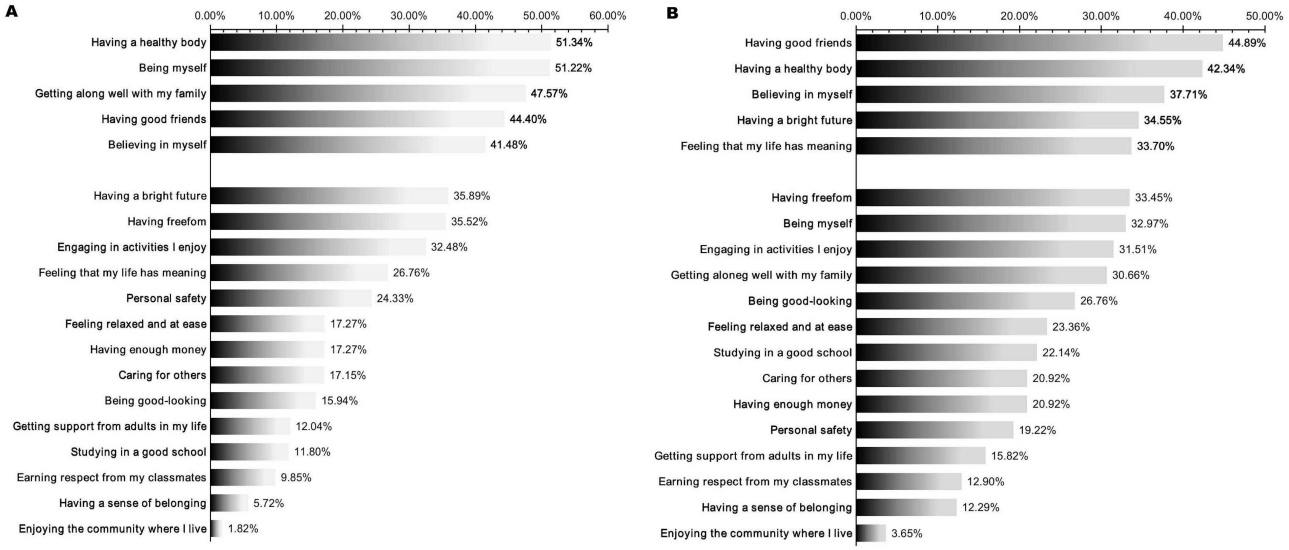

Figure 1 The description of IQoL by all valid participants (*N* = 822). (**A**) The five most important facets among all valid participants; (**B**) The five most like-to-change facets among all valid participants.

In Figure 2, the top five most important facets were the same as in Figure 1A, except that the order of obese participants' choices differed from that of normal-weight and overweight participants. Specifically, normal-weight and overweight participants ranked first on "*being myself*" (52.42% and 50.88%), while obese participants ranked first on "*Having a healthy body*" (54.03%). As shown in Figure 3, the top five most like-to-change facets were slightly diverse in different weight statuses. "*Having good friends*" was the top priority for both groups of normal-weight (43.12%) and overweight (47.95%), while "*Having a healthy body*" was still the top priority for obese participants (42.65%). Interestingly, obese participants reported "*having freedom*" (36.49%; ranked No. 3) and "*Being yourself*" (33.65%; ranked No. 4) as the most like-to-change things.

Comparisons Among YQOL-R, $IQOL_{importance}$, and $IQOL_{change}$ Scores

Table 3 presented the $IQOL_{importance}$, $IQOL_{change}$, and YQOL-R scores of normal, overweight, and obese participants. One-Way ANOVA revealed significant differences in $IQOL_{importance}$ scores among weight-status groups ($P < 0.05$). Pairwise comparisons between weight categories showed that obese participants reported significantly lower $IQOL_{importance}$ scores than their normal-weight peers (Bonferroni corrected, $P < 0.05$). Differences among YQOL-R total and subscale scores, as well as $IQOL_{change}$ scores, were not significant. Total YQOL-R and all four domain scores were positively associated with $IQOL_{importance}$ and $IQOL_{change}$ scores (Table 4, $P < 0.01$).

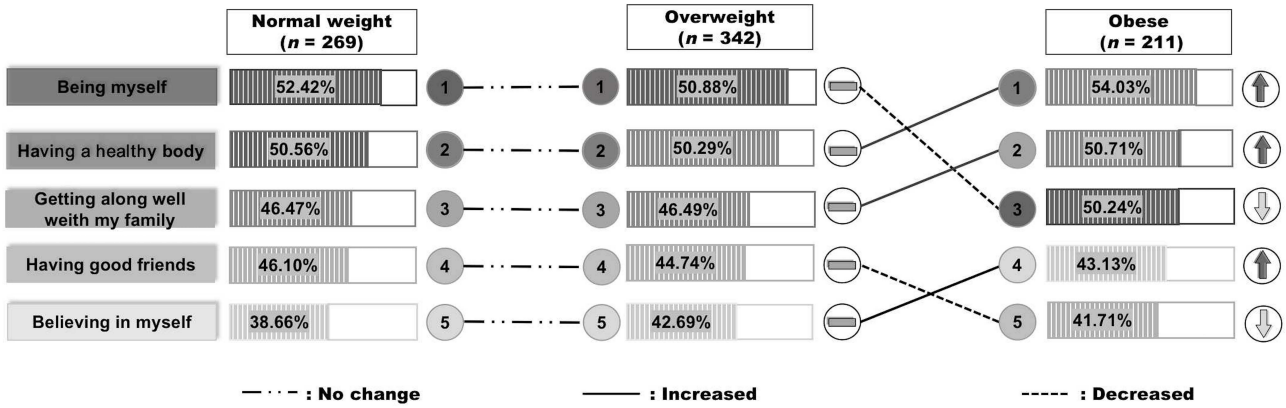

Figure 2 The five most important facets among participants with different weight status.

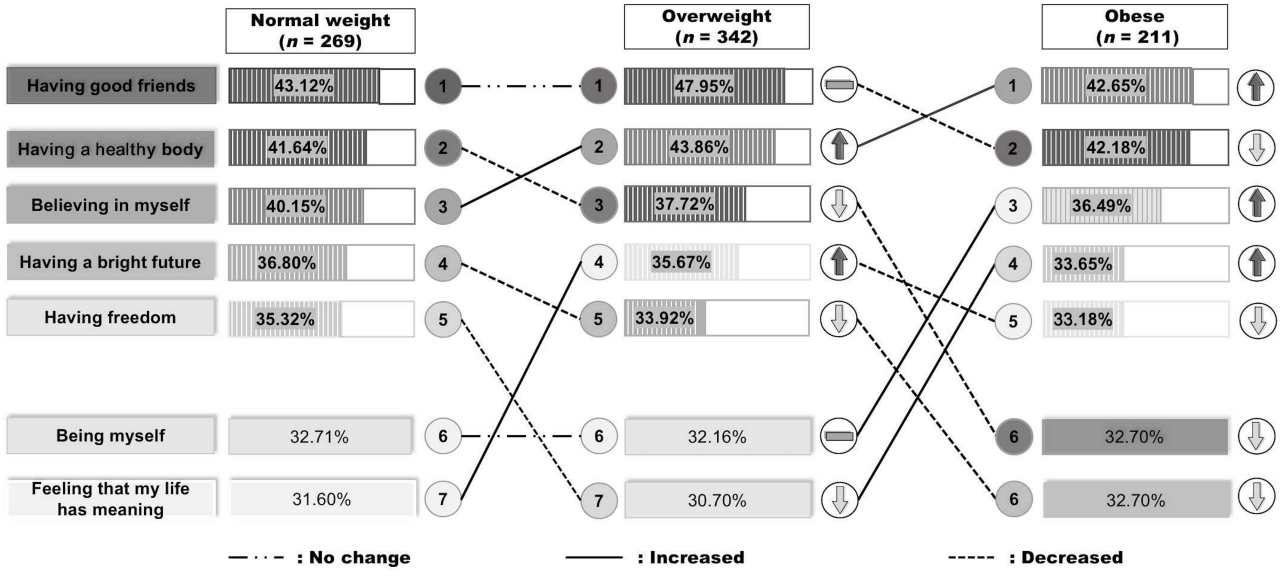

Figure 3 The five most like-to-change facets among participants with different weight status.

Table 3 Comparisons of $IQOL_{importance}$, $IQOL_{change}$ and YQOL-R Scores for Different Weight Status (*N* =822)

	Normal (n = 269)[a]	Overweight (n = 342)[a]	Obese (n = 211)[a]	ANOVA	
				F	*P*-value
IQoL measurements					
$IQOL_{importance}$	73.90 ± 18.47	72.61 ± 18.75	69.50 ± 20.19	3.262	0.039*
$IQOL_{change}$	72.63 ± 18.49	72.92 ± 19.17	69.57 ± 19.49	2.258	0.105
Generic measurement (YQOL-R)					
Sense of Self domain	66.27 ± 18.59	65.49 ± 18.53	62.47 ± 18.14	2.738	0.065
Social Relationships domain	77.47 ± 19.25	76.88 ± 18.97	73.78 ± 20.44	2.403	0.091
Culture and Community domain	78.26 ± 19.28	78.07 ± 19.15	75.25 ± 21.17	1.699	0.184
General Quality of Life domain	80.52 ± 21.34	81.44 ± 20.91	77.08 ± 23.36	2.746	0.065
Total QoL	75.63 ± 17.77	75.47 ± 16.90	72.15 ± 19.04	2.872	0.057

Notes: [a]The results of each weight status group were presented as mean±SD. *$P<0.05$.
Abbreviation: IQoL, Individualized quality of life.

Table 4 Correlation Between YQOL-R (Total Score and Subscales Scores) and IQoL Scores[a]

YQOL-R	Total Score	Sense of Self Domain	Social Relationships Domain	Culture and Community Domain	General Quality of Life Domain
$IQOL_{importance}$	0.879**	0.845**	0.840**	0.796**	0.683**
$IQOL_{change}$	0.897**	0.846**	0.849**	0.815**	0.716**

Note: [a]Pearson's correlation. **$P < 0.01$.
Abbreviation: YQOL-R, Youth Quality of Life Instrument-Research Version.

Correlations Between $IQOL_{importance}$ and $IQOL_{change}$

As shown in Table 5, adolescents who are girls, have higher educated fathers, and are overweight/obese reported worse $IQOL_{importance}$ scores. In comparison, higher-educated mothers and higher YQOL-R scores were associated with a higher $IQOL_{importance}$ score. Girls and elderly adolescents reported lower $IQOL_{change}$ scores while having higher educated mothers, and the total YQOL-R score was associated with a higher $IQOL_{change}$ score. The recruitment community and annual household income were not associated with the IQOL scores (Table 6).

Discussion

The physical and mental health problems caused by overweight and obesity among children and adolescents have produced significant public health concerns.[32] HRQoL is a crucial outcome to reflect the influence of obesity on adolescents' daily life.[33] However, standard HRQoL instruments with fixed domains and items ignored the difference in individual perception of what matters most to them. Therefore, we constructed two feasible individualized measurements of $IQOL_{importance}$ and $IQOL_{change}$ to assess personalized QoL among adolescents with different weight status. Also, the development of IQOL instruments bridges an essential gap between the widely used generic scales and the assessment needs of the personalized sensitive characters.

Theoretical Implications

To date, research on personalized QoL measurement is developing steadily to expand the scope of application gradually. For instance, the SEIQOL developed by Irish scholars in 1991 was a validated IQoL instrument;[34] yet, its measurement of individualized preference is time-confusing from semi-structured interviews. Thus, in 1997, Browne et al developed the Evaluation of Individual Quality of Life- Direct Weighting (SEIQOL-DW)[30] based on SEIQOL to reduce the measurement burden. Specifically, the SEIQOL-DW administration manual[35] guides interviewers to read and choose from the domains (cues) participants most commonly elicited,[36] including *family, relationship, health, finances, living conditions, work, social life, leisure activities*, and *religion/spiritual life*. Because of the clinical values and the user-

Table 5 Multivariable Analysis of the $IQOL_{importance}$ Score[a]

Variables	Standardized Coefficients	t	95% CI		*P*-value
			Lower	Higher	
(Constant)		1.787	−0.565	12.018	0.074
Recruitment community					
Migration	Reference				
Urban	<0.001	−0.006	−1.616	1.606	0.995
Rural	<0.001	−0.023	−1.753	1.712	0.982
Sex					
Boy	Reference				
Girl	−0.037	−2.118	−2.692	−0.102	0.035*
Age[b]	−0.010	−0.567	−0.420	0.231	0.571
Annual household income[c]					
<60,000	Reference				
≥60,000	0.023	1.214	−0.541	2.295	0.225
Father's education[d]	−0.047	−1.975	−2.342	−0.007	0.049*
Mother's education[d]	0.048	1.991	0.017	2.464	0.047*
Weight Status					
Normal	Reference				
Overweight or obese	−0.035	−2.046	−2.817	−0.058	0.041*
YQOL-R total score[b]	0.019	49.918	0.913	0.988	<0.001**

Notes: [a]F=292.020, R^2=0.775. [b]Variables of "Age" and "YQOL-R total score" were identified as the continuous variable during the statistical analysis. [c]The variable "Annual household income" was investigated as China's currency–Renminbi (RMB); its principal unit is called the Chinese Yuan (CNY). [d]Variables of "Father's education" and "Mother's education" were identified as the ordinal variable (categorical) during the statistical analysis. *P<0.05. **P<0.01.
Abbreviation: YQOL-R, Youth Quality of Life Instrument-Research Version.

Table 6 Multivariable Analysis of the $IQoL_{change}$ Score[a]

Variables	Standardized Coefficients	t	95% CI		*P*- value
			Lower	Higher	
(Constant)		2.506	1.577	12.981	0.012*
Recruitment community					
Migration	Reference				
Urban	<0.001	0.015	−1.449	1.471	0.988
Rural	−0.010	−0.522	−1.988	1.152	0.602
Sex					
Boy	Reference				
Girl	−0.036	−2.272	−2.532	−0.185	0.023*
Age[b]	−0.046	−2.891	−0.729	−0.139	0.004*
Annual household income[c]					
<60,000	Reference				
≥60,000	−0.006	−0.347	−1.513	1.058	0.728
Father's education[d]	−0.039	−1.803	−2.031	0.086	0.072
Mother's education[d]	0.050	2.272	0.174	2.392	0.023*
Weight Status					
Normal	Reference				
Overweight or obese	0.002	0.136	−1.163	1.337	0.892
YQoL-R total score[b]	0.902	56.551	0.942	1.010	<0.001**

Notes: [a]F=369.880, R^2=0.814. [b]Variables of "Age" and "YQOL-R total score" were identified as the continuous variable during the statistical analysis. [c]The variable "Annual household income" was investigated as China's currency–Renminbi (RMB); its principal unit is called the Chinese Yuan (CNY). [d]Variables of "Father's education" and "Mother's education" were identified as the ordinal variable (categorical) during the statistical analysis. *P<0.05. **P<0.01.
Abbreviation: YQOL-R, Youth Quality of Life Instrument-Research Version.

friendly character, SEIQOL-DW was promoted as a valid instrument to assess the determinants of QoL,[35,37,38] and has been applied among various patient groups widely, such as patients with chronic kidney disease,[39] incurable cancers,[40] and neurodegenerative disorders.[41]

To promote a simplified IQoL measurement in children and adolescents, we elicited two IQoL measures ($IQOL_{importance}$ and $IQOL_{change}$) based on the generic instrument YQOL-R. This research aimed to identify the domains of QoL that are important and like-to-change to adolescents with different weight status. In the current study, although the self-reported YQOL-R score from different weight status did not present a significant difference, the obese group reported a statistical trend towards lower $IQOL_{importance}$ scores than the normal-weight and overweight adolescents. In short, compared with the generic YQOL-R, $IQOL_{importance}$ could distinguish individualized demands from different weight statuses. Although, to our knowledge, no previous studies have examined the difference between the individualized and the generic QoL instruments among the youth, our findings consisted of other IQoL studies. For example, a study among adults with muscle diseases documented that Individualized neuromuscular quality of life (INQoL) was more sensitive than the generic scale of the SF-36 Health Survey in their capturing physical limitations.[42] An analysis of patients with liver transplantation patients recommended administering the individualized and standard measurements of HRQoL.[43] Therefore, the instrument of $IQOL_{importance}$ can be used as a supplement to YQOL-R to explore a specific emphasis on QoL measurement. $IQOL_{importance}$ and $IQOL_{change}$ scores reported moderate to strong correlation with the total YQOL-R and all four domain scores, implying good criterion validity.

Practical Implications

The main findings have practical implications worth considering. First, consistent with previous findings, the results showed that girls reported worse QoL than boys,[44,45] and older adolescents had lower $IQOL_{change}$ scores than their younger counterparts.[8,46,47] The current study was consistent with previous findings showing a positive association between higher maternal education and better adolescent QoL;[48,49] however, fathers with higher education significantly affected their children's lower importance score for individual QoL. Related studies have shown that in Chinese culture, fathers have a greater influence on their children's self-esteem, self-awareness, and social development than mothers;[50,51] additionally, higher-educated fathers may exert more pressure and make decisions on their children, negatively affecting children's well-being and happiness.[49]

The above results differ somewhat from those reported in our previous study in which YQOL-W was administered to a similar population.[25] Because of the difference between the predetermined items in YQOL-W and the individually assigned preferences in $IQOL_{importance}$, the opposite results may illustrate the importance of the measurement properties concerning different types of adolescents' perceptions and conceptions.

Moreover, the current study indicates that being obese/overweight has no significant association with the $IQOL_{change}$, which is consistent with a prior nationwide study in China that utilized both the Child Health Utility-9D (CHU-9D-CHN) and the Pediatric Quality of Life Inventory™ (PedsQL™) scale to measure the HRQoL of children, which without significant disparities in HRQoL scores among varying weight status.[52] Nevertheless, using $IQOL_{importance}$ instrument, our findings were consistent with other international studies[17,53–55] and indicated that obesity/overweight individuals were associated with worse QoL. Due to the measuring facets as individualized preferences, the interpretations of results by analyzing how the person values these facets are noteworthy.

Previous findings support the claim that "*Having a healthy body*" is the most crucial facet among obese adolescents with a low $IQOL_{importance}$ score.[14] Excess weight has been shown to worsen the QoL in overweight/obese children compared to those with diabetes, gastrointestinal disorders, and cancer.[56] Specifically, obesity negatively impacts physical functioning by interfering with the body's vital systems, significantly burdening obesity-related illnesses.[14,54,57] In addition, the self-perceived threat of severe obesity can negatively impact the QoL of individuals with obesity/overweight.[8,47] According to a qualitative study, obese participants commonly believed that obesity could lead to health conditions such as heart attack, stroke, diabetes, and hypertension.[58]

Given the existing studies, we identified another important facet- "*Believing in myself*" and "*Being myself*"- that has explained lower $IQOL_{importance}$ scores regarding emotional and psychological difficulties experienced by overweight/obese individuals.[59–61] Consistent with previous research, bullying experiences may have a more significant impact on

the body image of adolescents with obesity than those without;[62–64] from this, the increased effects related to weight-based stigma among the younger population is noteworthy to interpret the youth with overweight or obesity are vulnerable to poor QoL.[59,65–67] Numerous studies grounded in social psychology and weight stigma have proposed an explanatory framework for the health consequences of perceiving oneself as overweight.[33,66,68,69] According to this model, self-perception of being overweight triggers concerns of social rejection and the internalization of weight stigma, resulting in psychological distress, which negatively affects health-promoting lifestyle behaviors.[7,68]

In addition, weight-related stigma may cause children to feel socially isolated from their peers and family,[70–72] which affects how obese participants respond to items related to "*Getting along well with my family*" and "*Having good friends*". Another possible reason is the negative impact on children's family environment. Past studies have summarized that parents can play a critical role in reducing childhood obesity through daily lifestyle changes.[49,73] Minors often depend on their parents' healthy or unhealthy food choices, leading parents to consume energy-dense foods, which may indicate a similar trend in their children.[73,74]

In contrast to $IQOL_{importance}$, which refers to the essential things perceived by the participants, $IQOL_{change}$ assesses the QoL of adolescents in terms of facets that tend to change. In our analysis, it was only the obese participants who showed an interest in the changes in "*Having freedom*." Based on the discussions above about the obese group, the results suggest that individuals have the autonomy to make their own lifestyle choices.[75] Obesity-related complications can have psychosocial effects such as low self-esteem and social stigma, which restrict an individual's autonomy to act and negatively impact their QoL.[6,76,77]

Among all participants, adolescents with a normal weight had the highest prevalence of specifically selecting three facets: "*Believing in myself*", "*Being myself*", "*Having a bright future*", and "*Being myself*", indicating their strong willingness to change. This study highlights the importance of weight status perception. Instead of the physical weight status, the adolescents' weight status perceptions have more significant impacts on their self-reported QoL.[44,47] Influenced by the belief that "leanness and muscle: the thinner, the better",[8] adolescents are often dissatisfied with their weight or body shape, leading to pressure and concern about weight-related issues.[8] This includes pursuing a thinner and more muscular appearance to meet society's expectations of body shape.[78] This phenomenon is more prevalent among individuals with lower body weight. For instance, a study indicated that approximately one-third of students in the underweight and normal weight categories reported feeling overweight.[47]

Existing evidence has proven that increased abnormal weight perceptions bring adverse mental effects, such as stress, low self-esteem, depression, and body dissatisfaction,[79,80] which are correlated with poor QoL among adolescents.[44,81] Further, a growing literature summarized that misperceptions of being too fat were associated with worse physical, emotional, school, and social functioning, leading to poor HRQoL.[44,47,82] In short, the similar negative assessments on QoL from both normal and obesity/overweight groups because of their weight status perceptions might explain the non-significant difference from various weight status groups on $IQOL_{change}$ score.

Given the above analysis, the present study showed that weight self-perception plays a more decisive role than actual body weight while adolescents self-report their QoL. This finding calls for a joint effort from multiple areas of knowledge must be provided to improve adolescents' accurate perception of their weight status. Further, our findings raise the issue of whether there is a need to prioritize intervention efforts to promote better QoL by re-defining the population of adolescents most at risk. Instead of overweight status, multiple roles around children, including parents, teachers, and clinicians, should be aware of the associations between the normal-weight group and poor QoL. Providing attention and support to this population is also essential.

Strengths and Limitations

The study is the first analysis to measure adolescents' individualized QoL and aims to implement the main findings on preventing and controlling adolescents' obesity in China. Although the association of QoL with obesity and overweight was documented in previous studies, most results were developed among clinical samples of obese youth, leading to less conclusive evidence of an association in population-based samples. Instead of the single group, our findings among a diverse, representative sample of Chinese adolescents with various weight statuses presented comparisons of differential associations between BMI and QoL. However, some limitations of the study need to be addressed. First,

$IQOL_{importance}$ and $IQOL_{change}$ were administered in combination with YQOL-R. Participants were not asked to weigh their chosen five facets, losing individual preference information like other IQOL measures. Second, the data were cross-sectional and cannot be used to infer the causation of the observed associations.

Conclusion

Measuring quality-adjusted-life years using generic preference-based QoL measures is common when evaluating health interventions. However, there are concerns that measures in common use, such as the YQOL-W, focus signally on overweight or obese adolescents and may not be appropriate for measuring QoL for people with different weight status. As part of a wider study, we explored the appropriateness of generic preference-based measures for people with different weight status. In this study, the obese group reported a statistical trend towards lower $IQOL_{importance}$ scores than the normal-weight and overweight adolescents. Also, our further analysis indicated that adolescents who are girls, have higher educated fathers, and are overweight/obese self-reported worse $IQOL_{importance}$ scores; yet, the female and older adolescents answered lower $IQOL_{change}$ scores. In addition, adolescents who had higher educated mothers and responded with higher total YQOL-R scores reported higher $IQOL_{importance}$ and $IQOL_{change}$ scores.

Data Sharing Statement

The data used and analyzed during the current study are available from the senior corresponding author (Hongmei Wang: rosa@zju.edu.cn) on reasonable request.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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