

Psychometric Properties of the Self-Report Version of the Strengths and Difficulties Questionnaire in Iranian young Adolescents

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Abstract

Background: The Strengths and Difficulties Questionnaire (SDQ), is a brief behavioral screening tool, widely used for assessing mental health problems in adolescents. The present study evaluated the psychometric properties of the Persian version of the self-report SDQ (P-SDQ) in Iranian young adolescents.

Methods: In this cross-sectional study, 244 young adolescents participated from 4 different geographic regions of Tehran and completed the questionnaire. The reliability of P-SDQ scores was determined by Cronbach's alpha coefficient. The face validity was assessed qualitatively. The construct validity of the test scores was evaluated by Confirmatory Factor Analysis (CFA).

Results: The internal consistency of P-SDQ scores was confirmed for all subscales (alpha values ranged from 0.62 to 0.69) and the whole questionnaire (alpha=0.80), except for the peer relationship problems subscale scores (alpha=0.45). CFA supported a five-factor structure in the first order (relating the items to the subscales), except for the peer relationship problems subscale, and a one-factor structure in the second order (relating the subscales to the whole SDQ), except for the peer relationship problems subscale. In addition, the results of CFA revealed that the peer relationship problems subscale was showed; item-scale relations were significant in all subscales, except for the peer relationship problems subscale.

Conclusions: The obtained results supported t desirable reliability and validity for all P-SDQ subscale scores and the overall score, except for the peer relationship problems subscale. It seems that the peer relationship problems subscale of the P-SDQ requires further modifications prior to being considered as appropriate for assessing mental health in Iranian young adolescents.

Introduction

Psychosocial problems such as behavioral and emotional complications are highly prevalent in children and adolescents [1–3]. Studies have demonstrated that approximately 3%-18% of children and about 10–25% of adolescents suffer from psychopathological problems [1–5]. Although no comprehensive study has investigated the prevalence of psychosocial problems in Iran, its frequency has been reported to be 6.4–17.9% in adolescents [6–10]. Mohammadi et al. (2013) assessed the prevalence of psychological problems in adolescents (11- to 17-year-olds) in 5 provinces of Iran using the Strengths and Difficulties Questionnaire (SDQ), which was reported equal to 7.6–28.4% [11].

Despite relatively high prevalence rates of mental health problems, only a limited number of people suffering mental health problems seek mental health services at psychiatrist or psychologist offices and clinics. Furthermore, many mental health problems show subtle signs at earlier ages and may be missed or overseen without valid and reliable screening or diagnostic tools. Therefore, access to an instrument for detecting and measuring emotional and behavioral problems, especially in children and adolescents, is extremely important and necessary [12, 13] for early detection and early intervention purposes. It can also be helpful to clinicians in treatment planning [14, 15] and in estimating treatment outcomes.

SDQ is considered as an important screening instrument for child and adolescent psychiatric disorders in different countries [16–18]. SDQ scores have shown correlation with other measures of psychopathology in a significant way [19]. The early detection of the signs of psychosocial or socio-emotional developmental delays and disorders, followed by early intervention, along with paying attention to the early stages of development is important. Such actions can provide remarkable benefits with respect to mental health, overall wellbeing, and general child development. Valid and reliable screening instruments are necessary for the early detection of subtle developmental delays which are hardly recognizable otherwise.

The SDQ is a relatively short and user-friendly screening instrument. It is among the most widely applied tools for detecting the signs of emotional and behavioral disorders ("difficulties"), as well as assessing prosocial behaviors ("strengths") in children aged 3–16 years [12, 17, 20]. This instrument was originally developed based on Rutter's questionnaires and was later updated by Goodman, who added some items to the concentration, peer relationship problems, and prosocial behavior subscales of it. The improved questionnaire may be used on many children, particularly if focusing on children's strengths and weaknesses increases parental compliance [12, 21]. The "self-report", "teacher-report" and "parent-report" versions of the SDQ are available.

Adolescents aged 11–16 years and the parents and teachers of children aged 3 to 16 years, can complete the above-mentioned questionnaires, respectively, and report the difficulties and strengths. Previous studies have suggested that all three versions of the questionnaire are acceptable, reliable and valid [15, 20, 22–24]. The SDQ has 5 subscales, including emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems, and prosocial behavior. Each of these subscales consists of 5 items. The first 4 subscales provide a “total difficulties” score, whereas the prosocial behavior scale independently reflects information on strengths. The SDQ has 5 subscales; 4 of which assess “difficulties”, as follows: emotional symptoms (e.g., fears), conduct problems (e.g., lies or cheats), hyperactivity/inattention (e.g., restlessness, hyperactivity), and peer relationship problems (e.g., picked on or bullied by other children). One subscale assesses prosocial behavior or “strengths” (e.g., being considerate of others’ feelings). Several studies have supported the 5-factor solution for the SDQ structure [25–30] and many others have not [27, 29, 31–33]. However, the tool is still being used in the 5-subscale form by many researchers and clinicians worldwide. Scoring is based on the guideline provided at the SDQ website [34]. The total “difficulties” score is determined by computing the sum of scores acquired in the 4 related subscales. The obtainable minimum and maximum total scores for the “difficulties” sections are 0 and 40, respectively. For each of the 5 scales, the score can range from 0 to 10 if all items are completed [34]. Higher achieved scores in the 4 subscales assessing “difficulties” indicate the higher levels of difficulties, and worse emotional symptoms and behavioral status, consequently. Moreover, in the prosocial behavior subscale, higher scores indicate the higher levels of strengths or better emotional and behavioral symptoms. The SDQ has been translated into more than 40 languages and applied to assess the behavioral disorders in children and adolescents in various countries around the world [17, 19, 20, 22, 24, 35–37].

Although there have been previous attempts to validate the Persian self-report version of the SDQ in the Iranian population in two different studies conducted by Alavi et al [38] and Ghanizadeh et al. [39], some short-comings or differences regarding the methodology and implementation strategies, as well as statistical methods, brought about the need to reassess the psychometric properties of this tool once again in a representative sample of healthy Iranian young adolescents using sound methodology and statistical analyses, in order to provide newer and trustworthy results. For example, although Alavi et al. conducted their study on a large population of adolescents in Tehran city, recruited from 22 clusters, there are ambiguities regarding the sampling method. We do not know whether adolescents were recruited from their homes or from other settings, and if the former is true, which is the most likely possibility, how was it possible to acquire the informed consent of parents and adolescents themselves and to complete the questionnaire, all in a one-and-first-time visit at the door? In addition, examiners were employed for completing a questionnaire which was supposed to be a self-report questionnaire. This may have caused under-reporting of “problems” as well as over-reporting of “pro-social behavior” by the adolescents at the presence of a stranger at the door, asking for prompt replies to sometimes-uneasy questions regarding their behaviors. Moreover, the psychometric evaluation of this tool by Alavi et al. has been limited to assessing the Cronbach’s alpha coefficient, Pearson’s coefficient for the correlation between each subscale score with the total score, as well as comparing the 90th percentile cut-off point with that of Goodman’s study. In addition, regardless of the possible methodological shortcomings and differences between Alavi’s study and the present study, Alavi’s study was conducted in the year 2007 (and reported in the year 2009), when Iran had a population of 70 million people, 20% of which were under 20 years old. It is noteworthy that the Iranian population in the year 2015 (the year the latest Census was carried out in Iran) has risen to 80 million, with 45% under 20, and as Alavi et al. have correctly stated themselves (29), the “rapid pace of cultural changes in Iran and the ongoing shifts in the socio-cultural behaviors” raise the need for re-evaluation of the validity and reliability of the scores of a tool such as the SDQ, which is supposed to assess such behaviors in the ever-changing young adolescent population in Iran.

In the study conducted by Ghanizadeh et al., the target population was children and adolescents living in Shiraz city. Shiraz city is an important Iranian city in terms of historical as well as artistic roots. However, the population living in Shiraz is about 0.35 of that living in Tehran. Moreover, it is not comparable to Tehran city in terms of cultural diversity which is a dominant characteristic of Tehran due to the rather high rate of on-going migration to it from other cities and villages, which makes Tehran a miniature reflection of almost all the different socio-economic and cultural diversities present in the country. In addition, Ghanizadeh’s study was reported in 2007 and conducted earlier, which has not been mentioned in the article. So, just like Alavi’s study, the results are difficult to be trusted and relied on after more than 12 years.

In terms of methodology, there are also short-comings in Ghanizadeh's study. The population recruited from schools was only those in primary schools, that is, those under 11 years old. Among 330 adolescents aged 11 to 18 years who participated in the study, 155 (almost half) were recruited from only one psychiatric clinic, with no reported criteria excluding those with diagnosed psychopathologies. The authors have themselves acknowledged this limitation. It has not been clearly stated how and where the rest of this age group were recruited. Thus, this adolescent population is far from representative of normal Iranian adolescents.

Moreover, in statistical terms, the Cronbach's alpha coefficient and the correlation between items and subscale scores were the only psychometric analyses for which data was reported. The authors have claimed that EFA as well as CFA have been performed, resulting in a 3-factor solution for the tool, however data in terms of relevant tables, graphs or diagrams have not been provided.

So an urgent need for conducting another study aiming at determining the psychometric properties of the Persian self-report version of the SDQ was felt. In conducting the study, we aimed to answer three questions: (1) Are the scores of the Persian version of the SDQ (P-SDQ) reliable (in terms of internal consistency assessed by the Cronbach's alpha coefficient) in the present Iranian young adolescent population? (2) Are all sub-scale scores of the P-SDQ reliable and have the best fit? (3) Are P-SDQ scores valid according to Confirmatory Factor Analysis (CFA)?

Methods

Study design and setting

In the present cross-sectional study, young adolescents aged 11 to 14 years were selected by a multistage randomized cluster sampling method in Tehran City, Iran, from June to September 2018. Tehran is a multicultural megacity, with migrants from all over the country. To include various cultural and socio-economic classes, sampling was performed in 4 geographic regions (north, south, east and west) of Tehran, serving as different sampling strata. Sample size in each region was calculated proportional to its population size. In each region, schools, coffee shops, cinemas, sports clubs, parks, libraries, and internet cafes were randomly selected and samples included both genders.

Participants

We only included healthy young adolescents, and participants with gross or previously diagnosed mental disorders were excluded from the study. For this purpose, we asked the adolescent and his/her mother whether he/she had a history of psychiatric hospitalization, taking psychiatric medications or being under the supervision of a psychiatrist, and if so, he/she was excluded from the study.

Initially, 254 young adolescents aged 11–14 years who met the inclusion criteria were recruited, of which 244 (114 boys and 130 girls) participated in this study (response rate = 97.2%) and were accounted for in the final analysis. Almost all 10 adolescents who dropped out of the study were those who had not completed their questionnaire thoroughly and who were not accessible, thereafter. So, in case any missing data occurred which could not be compensated for by accessing the adolescent or his mother, the adolescent was excluded from the study.

Measurement

In this study, the scores of the Persian self-report version of the SDQ (P-SDQ) were meant to be validated in young Iranian adolescents.

Study size

We calculated the sample size considering 95% confidence (alpha = 0.05), a power of 0.8, an expected RMSEA = 0.08 utilizing STATISTICA 12 software in power analysis in SEM procedure, which resulted in 206 samples.

The aim of the study was explained and clarified for the parents and young adolescents, in person or by phone, prior to conducting the research. The consent form was obtained from the study participants at the first visit. The researcher tried to improve young adolescents' compliance by providing correct answers to the questions of the questionnaire, as well as establishing proper communication with them. Then, the self-report P-SDQ was delivered to the study participants' homes, where they were supposed to be completed by the young adolescents themselves. To ensure the correct completion of questionnaires, the researcher contacted the students. The researcher's contact number was also provided to the young adolescents in case of any questions or ambiguity in completing the questionnaire. The study participants who failed to complete the questionnaires or discontinued participating were excluded from the study.

In addition to answers to the P-SDQ questions, some demographic data including gender, age, and the region of residence, parental education, and occupation were also obtained. Prior to beginning the fieldwork, the face validity of the Persian self-report version of the SDQ (P-SDQ) was evaluated qualitatively. In this qualitative evaluation, SDQ was completed by 20 young adolescents recruited by convenience sampling method from 4 different regions in Tehran. The same inclusion and exclusion criteria as the main study were employed for these samples. Each participant was asked to complete the questionnaire, with the researcher directly observing his reactions to each question. The young adolescents were informed that this was a face validation stage and that they were required to report any difficulties in understanding and replying to questions, as well as any ambiguities and non-relevancies, non-applications or cultural discrepancies

Statistical methods

The total "difficulties" score of the SDQ was computed by summing the scores acquired from the 4 "difficulties" subscales. (Emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems). The data were presented as mean \pm SD. For numeric and categorical variables, the data were summarized by mean \pm SD and frequency (percentage), respectively.

Cronbach's alpha coefficient and Intraclass Correlation Coefficient (ICC) were determined to assess the internal consistency and reliability of the scale scores, respectively. Cronbach's alpha coefficient of ≥ 0.70 was considered as acceptable, 0.60–0.70 as a medium, 0.50–0.60 as poor, and the values of < 0.50 were considered as unacceptable [40].

Construct validity was assessed using Confirmatory Factor Analysis (CFA) by the method of weighted least squares with a weighted asymptomatic covariance matrix. Fit indices and reasonable values of these indices for CFA were considered as $\chi^2/df < 5$, Root Mean Square Error of Approximation (RMSEA) as < 0.08 , and Comparative Fit Index (CFI), Goodness of Fit Index (GFI), and Adjusted Goodness of Fit Index (AGFI) as > 0.9 [41].

Data analysis was performed using SPSS and AMOS24 for CFA. $P < 0.05$ were considered as statistically significant.

Results

In conducting this research we had three questions in mind: (1) Are the P-SDQ scores reliable (in terms of internal consistency assessed by the Cronbach's alpha coefficient)? (2) Are all sub-scale scores of the P-SDQ reliable and have the best fit? (3) Are P-SDQ scores valid according to Confirmatory Factor Analysis (CFA)?

Participants' Demographic characteristics

A total of 254 11–14 year-old adolescents were recruited, of whom 244 (114 boys and 130 girls) completed the questionnaires (response rate=%97.2) As shown in Table 1, the sample included more girls (57.48%) than boys, and 13 year-olds constituted a larger portion of the sample (29.91%) than other age groups. Also, the highest percentages of mothers' and fathers' education belonged to the high school diploma level and the least percentage of mothers and fathers were illiterate.

Table 1
Demographic characteristics of adolescents participating in the study

Variable	Frequency (Percent)		
	Girls	Boys	Total
Sex	140 (57.37)	104 (42.62)	244 (100)
Age (Years)	11–12	32 (13.11)	26 (10.65)
	12–13	30 (12.29)	26 (10.65)
	13–14	40 (16.39)	33 (13.52)
	14–15	38 (15.57)	19 (7.78)
Mother's Education	Illiterate	7(2.75)	244(100)
	Elementary	58(22.83)	
	High School Diploma	120(47.24)	
	College	59(24.18)	
Father's Education	Illiterate	4(1.57)	244(100)
	Elementary	65(25.59)	
	High School Diploma	103(40.55)	
	College	13(5.32)	

Reliability

As per Table 2, the Cronbach's alpha coefficient for the total score of the 4 "difficulties" subscales of the SDQ was 0.79 which indicates its adequate internal consistency (≥ 0.7). For all 4 subscale scores, alpha coefficients ranged from a minimum of 0.45 (peer relationship problems) to a maximum of 0.69 (emotional symptoms). The Cronbach's alpha coefficient for the prosocial behavior subscale score was 0.69. Moreover, internal consistency reliability of the scores ranged from a minimum of 0.29 (peer relationship problems score) to a maximum of 0.42 (emotional symptoms score). In additionally we calculated the omega by JASP software (<https://jasp-stats.org/download/>) to get better consistency values.

Table 2
Reliability (Cronbach's alpha and inter-item correlations) Coefficients for SDQ Scores in a Community Sample of Iranian Adolescents

SDQ scales	N of items	Cronbach's alpha (n = 251)	Inter-item correlations
Emotional symptoms	5	0.696	415
conduct problems	5	0.656	373
Hyperactivity-inattention	5	0.621	384
Peer relationship problems	5	0.449	290
Total difficulties	20	0.799	148
Prosocial behavior	5	0.687	393

Similar to Cronbach's alpha coefficient the McDonald's omega coefficient for the total score of the 4 "difficulties" subscales of the SDQ was 0.798 which indicates its adequate internal consistency (≥ 0.7) (Table 3)

Table 3
Scale Reliability Statistics by McDonald's

	McDonald's ω
Conduct problems Scale	0.533
Emotional symptoms Scale	0.625
Hyperactivity Scale	0.527
Peer relationship problems scale	0.366
Prosocial behavior Scale	0.658
Total 0.798	

Note. Of the observations, 244 were used, 0 were excluded listwise, and 244 were provided.

Validity

The validity of SDQ scores was determined via face validity and content validity.

Face validity

Since no problems were encountered in completing the questionnaire by the 20 young adolescents who participated in this part of the study, in terms of understanding the meaning of the questions, as well as the relevancy and cultural application and appropriateness of the proposed issues, no changes were required and applied to the wordings and content of the questionnaire, and so the face validity of the tool was verified.

Construct validity

Confirmatory Factor Analysis (CFA)

To verify that the categories defined in the questionnaire have sufficient adequacy, CFA was performed.

The goodness of fit of the model

Confirmatory factor analyses for the factor structure of P-SDQ

Fitting indexes

Second order CFA supported a five-factor structure in the first order (relating the items to the sub-scales except for the peer relationship problems subscale) and one-factor structure in the second order (relating the subscales to the whole SDQ, except for the peer relationship problems subscale) (Chi-squared/df = 2.43 < 5; SRMR = 0.042 < 0.08, GFI = 0.945 > 0.90, AGFI = 0.912 > 0.90, NFI = 0.0903 > 0.90, NNFI = 0.907 > 0.90, RFI = 0.944 > 0.90, IFI = 0.955 > 0.90, CFI = 0.949 > 0.90) (Table 4).

Table 4
Fitting Indexes

Model	χ^2	df	P	χ^2/df	RMR	GFI	AGFI	NFI	RFI	IFI	NNFI	CFI	RMSEA (95% CI)
Measurement	634.66	271	< 0.001	2.34	.042	.949	.912	.903	.944	.955	.907	.945	0.062 (0.054 ; 0.070)

χ^2 , chi-square; df, degrees of freedom; χ^2/df , normed chi-square; RMR: Root Mean R; GFI: Goodness of Fit Index; AGFI: Adjusted Goodness of Fit Index; RMSEA, root mean square error of approximation; NFI: Normed Fit Index; RFI: Relative Fit Index; IFI: Incremental Fit Index; NNFI: Non-Normed Fit Index; CFI, comparative

Conceptual measurement model

The conceptual model of the relationship between items and subscales of the SDQ is shown in Fig. 1.

Path diagram with standard coefficients for the SDQ

The standard coefficients of CFA for this questionnaire are demonstrated in Fig. 1.

Assessing the significance of coefficients of CFA

Based on Table 5, the CFA coefficients were significant for the 4 subscales including conduct problems, emotional problems, hyperactivity, and prosocial behavior subscales ($P < 0.05$), and insignificant for the peer relationship problems subscale ($P > 0.05$).

Table 5
The Significance of the Model's Coefficients

			Estimate	S.E.	C.R.	Standardized Estimate	P
Conduct problems	<- -	SDQ	1.000			1.000	
Prosocial behavior	<- -	SDQ	.663	.149	4.449	1.000	< 0.001
Emotional symptoms	<- -	SDQ	.831	.185	4.484	1.000	< 0.001
Hyperactivity	<- -	SDQ	.748	.180	4.151	1.000	< 0.001
Peer relationship problems	<- -	SDQ	.282	.175	1.614	1.000	.107
Conduct problems 1	<- -	Conduct problems	1.000			.428	
Conduct problems 2	<- -	Conduct problems	.686	.181	3.780	.307	< 0.001
Conduct problems 3	<- -	Conduct problems	.950	.183	5.206	.509	< 0.001
Conduct problems 4	<- -	Conduct problems	1.255	.223	5.626	.602	< 0.001
Conduct problems 5	<- -	Conduct problems	.447	.175	2.554	.191	.011
Emotional symptoms 1	<- -	Emotional symptoms	1.000			.393	
Emotional symptoms 2	<- -	Emotional symptoms	1.053	.269	3.913	.341	< 0.001
Emotional symptoms 3	<- -	Emotional symptoms	1.221	.263	4.633	.456	< 0.001
Emotional symptoms 4	<- -	Emotional symptoms	.937	.240	3.908	.340	< 0.001
Emotional symptoms 5	<- -	Emotional symptoms	.836	.232	3.597	.301	< 0.001
Hyperactivity5	<- -	Hyperactivity	1.000			.352	
Hyperactivity4	<- -	Hyperactivity	1.326	.268	4.946	.452	< 0.001
Hyperactivity3	<- -	Hyperactivity	1.204	.308	3.906	.379	< 0.001
Hyperactivity2	<- -	Hyperactivity	.908	.311	2.925	.268	.003
Hyperactivity1	<- -	Hyperactivity	1.568	.358	4.378	.485	< 0.001
Prosocial behavior 1	<- -	Prosocial behavior	1.000			.388	

			Estimate	S.E.	C.R.	Standardized Estimate	P
Prosocial behavior 2	<- -	Prosocial behavior	1.039	.276	3.765	.324	< 0.001
Prosocial behavior 3	<- -	Prosocial behavior	1.379	.305	4.518	.441	< 0.001
Prosocial behavior 4	<- -	Prosocial behavior	1.358	.301	4.510	.440	< 0.001
Prosocial behavior 5	<- -	Prosocial behavior	.753	.255	2.956	.233	.003
Peer relationship problems 5	<- -	Peer relationship problems	1.000			.116	
Peer relationship problems 4	<- -	Peer relationship problems	2.680	1.685	1.591	.360	.112
Peer relationship problems 3	<- -	Peer relationship problems	3.275	2.030	1.613	.426	.107
Peer relationship problems 2	<- -	Peer relationship problems	1.592	1.118	1.424	.191	.154
Peer relationship problems 1	<- -	Peer relationship problems	3.616	2.250	1.607	.405	.108

Assessing the significance of correlation between the factors

Based on Table 6, all relations between the subscales were significant ($P < 0.05$), except for the relations between the peer relationship problems subscale and all other 4 subscales, which were insignificant ($P > 0.05$).

Table 6
Significance of the Correlation between the Questionnaire's Subscales

correlation			P-value	Test index	S.E.	Standard coefficient	coefficient
Emotional symptoms	<->	Conduct problems	.001	3.961	.017	.690	.067
Hyperactivity	<->	Conduct problems	.001	3.649	.019	.929	.068
Prosocial behavior I	<->	Conduct problems	.001	-3.870	.013	-.550	-.050
Hyperactivity	<->	Emotional symptoms	.001	3.332	.013	.713	.045
Prosocial behavior	<->	Emotional symptoms	.018	-2.362	.009	-.265	-.021
Prosocial behavior	<->	Hyperactivity	.002	-3.033	.009	-.472	-.028
Peer relationship problems	<->	conduct problems	.131 ^a	1.512 ^a	.016 ^a	1.048	.024 ^a
Peer relationship problems	<->	Emotional symptoms	.131 ^a	1.509 ^a	.014 ^a	.999	.022 ^a
Peer relationship problems	<->	Hyperactivity	.147 ^a	1.451 ^a	.009 ^a	.867	.013 ^a
Peer relationship problems	<->	Social	.133 ^a	-1.504 ^a	.010 ^a	-.864	-.016 ^a

^a: There is no significance

Discussion

The present study investigated the psychometric properties of SDQ in a population-based sample of Iranian young adolescents living in Tehran. The obtained results demonstrated desirable reliability and validity for the scores of the Persian version of the self-report SDQ, except for the peer relationship problems subscale, which was somehow problematic. The Cronbach's alpha coefficient for the peer relationship problems subscale score was also identified to be below the satisfactory level in the present study.

Our finding is in line with previous studies [39, 42]. Ghanizadeh et al. (2007) assessed the psychometric properties of the parent's, teacher's and adolescent's versions of the SDQ in an Iranian 3-18-year-old population. Desirable internal consistencies were found for the scores of the self-report version of SDQ ($\alpha = 0.628$ except for the prosocial behavior and peer relationship problems subscales. Koskelainen et al. (2001) studied psychometric properties of the self-report version of the SDQ) among Finnish 13- to 17-year-old adolescents. Internal consistency alpha of the peer problems scale score was low ($\alpha = 0.53$).

So, it seems likely that there are some intrinsic and inherent issues regarding the "peer relationship problems" subscale of the SDQ, or maybe at least regarding the Persian version of the subscale, which the original authors have provided as the approved translated version on their website and which was used in the present study. Anyway, this seems to be an issue that the original authors need to be concerned with and try to overcome. Also, it is always possible that cultural and language differences between different communities bring out some misunderstandings, as well as some limitations in responding to some questions and in expressing feelings.

Our findings (except for peer relationship problems subscale) were consistent with those of previous studies assessing the reliability and validity of SDQ scores [17, 19, 20, 22, 35–37]. In Netherlands, Theunissen et al. (2019) assessed the psychometric properties of the self-report version of SDQ in 13- to 14-year-old Dutch adolescents. It was recognized as a valid and reliable tool with Cronbach's alpha coefficient of 0.75 for the detection of emotional and behavioral problems in adolescents [37].

The factor analyses do not quite support all of the suggested original factor structures. The present study revealed that factor analyses support a four-factor model consisting of emotional problems, conduct problems, hyperactivity/inattention, and prosocial behavior, with the exception of peer relationship problems. These cultural and situational differences may have affected the evaluation of the psychometric properties of P-SDQ.

Vugteveen et al. (2018) assessed the factor structures of the adolescent and parent versions of SDQ. They reported measurement invariance in the clinical ($n = 4.053$) and community ($n = 962$) samples of Dutch adolescents aged 12 to 17 years. CFA was performed, as well. Their obtained results suggested the measurement invariance of the presumed five-factor structure for the parent version of SDQ and a six-factor structure for the adolescent version of it. These detections suggest that the adolescent- and parent-report SDQ scores can be interpreted using community-based standard scores, irrespective of whether the adolescent has been referred due to mental health problems or not [43].

Dickey and Blumberg reported no prophecy of a five-component structure for the parent-reported SDQ in the household population of the United States. Some items designed to assess conduct problems were more closely related to hyperactivity, and some items designed to assess peer relationship problems were more strongly correlated with emotional or prosocial problems. Factor analyses identified a stable three-factor model consisting of externalizing problems, internalizing problems, and a positive construal factor [44].

Akpa et al.'s estimates of the fit indices confirmed the structure identified by the second EFA (3-factor oblique model) as the best model for the sample of adolescents studied[45]. Javier Ortuño-Sierra et al. showed the five-factor model as the most suitable[46]. Andrew Percy performed a confirmatory factor analysis (CFA) of the SDQ and reported that the five-factor solution was a better fit for the data than a three-factor solution [30, 47]

Janssens et al. (2009) conducted a study in Antwerp, Belgium. They reported that the model with 5 latent variables outlined by Goodman only fitted moderately well on their studied samples. Moreover, the model with 3 latent variables failed to offer a better fit, either. The internal consistency of the self-report scale scores was measured equal to 0.62. They achieved the Cronbach's alpha coefficients of 0.72 and 0.75 for the scores of the parent- and teacher-report versions of SDQ, respectively. This finding is concordant with our results regarding the self-report version of SDQ. Their study demonstrated a rather lower internal consistency for the peer relationship problems subscale score (0.39), which is consistent with the findings of the present study (0.44).

Furthermore, a community-based study in Ireland reported many deflections on the detailed structure of the self-report SDQ both individually and in connection with the reverse-coded items. CFA suggested that a five-factor solution was a better fit for the data, compared to a three-factor solution. Andrew Percy et al. conducted a study in September 2000 in Northern Ireland. They concluded that Cronbach's alpha for the total difficulties subscales scores was reported to be 0.779 (we also obtained Cronbach's alpha coefficient of 0.799 for the total difficulties subscales); thus, it has an acceptable internal consistency. However, the internal consistency of the hyperactivity subscale score was mild. The internal consistency of the 3 subscales scores was acceptable; it was less desirable for the two of five subscales scores. The total difficulties scores of self-report SDQ were very similar to those of a previous study in Britain [42, 48–51]. The difficulty with the inverse coded questions in the EFA is in-line with those reported by other research studies worldwide [49].

The following limitations can be considered for the study: first, the study sample consisted of young adolescents with an age range of 11–14 years, which evidently cannot represent all childhood age ranges. Second, young adolescents in this study were recruited from a population-based sample of young adolescents living in Tehran. Although Tehran is a megacity comprising of very diverse socio-cultural, economic and ethnic groups of people who somehow represent the entire country, nonetheless a nation-wide sample would be preferable. Third, only the self-report version of SDQ was validated in the current study, so the

other versions of SDQ still need to be validated in future research. Also, other psychometric properties of the Persian self-report version, such as test-retest reliability and concurrent validity were not addressed in the current study and can be the focus of future research.

Conclusions:

The Persian version of SDQ has acceptable psychometric properties. The internal consistency of the scores of the self-report version of SDQ is desirable. Therefore, it is a valid instrument for the detection of emotional and behavioral problems in Iranian young adolescents ages 11 and 14 years.

However, it seems that the peer relationship problems subscale of the P-SDQ requires further modifications prior to being considered as appropriate for assessing mental health in Iranian young adolescents. Translation revision of the present Persian version of the tool and its cultural adaptation, especially the “peer relationship problems” subscale, is recommended for future studies.

List Of Abbreviations

SDQ, Strengths and Difficulties Questionnaire; P-SDQ; Persian version of the self-report SDQ, EFA; Exploratory Factor Analysis, CFA; Confirmatory Factor Analysis, ICC; Intraclass Correlation Coefficient, PAF; Principal Axis Factoring, KMO; Kaiser-Meyer-Olkin, RMSEA; Root Mean Square Error of Approximation, CFI; Comparative Fit Index, GFI; Goodness of Fit Index, AGFI; Adjusted Goodness of Fit Index,

Declarations

Ethics approval and consent to participate: All procedures performed in this study were in accordance with the ethical criteria of the Ethical Committee of the University of Social Welfare and Rehabilitation Sciences and received its approval (Approval ID: IR.USWR.REC.1398.008). Written informed consent for participation in the study (participation of adolescents and their parents) was obtained from mothers. They signified their consent before completion of the questionnaires. In addition, any of the young adolescents who were reluctant to participate themselves, were not included, but written consent was not required from the adolescents themselves.

Availability of data and material: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Consent for publication

Informed consent was obtained from participants for the publication in this manuscript.

Competing interests: The authors declare that they have no conflict of interest.

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Authors' contributions: PS: Conception and design; the collection and interpretation of data, drafting the article; MS, FS, SH, and RV: conception and design, and critically revising the article for important intellectual content; AS: data analysis; MAJ: data analysis, critically drafting and revising the article for important intellectual content. RV was also responsible for overall supervision. All Authors read and approved the manuscript.

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Figures



Figure 1

Conceptual model of the relationship between items and subscales of the SDQ



Figure 2

Path diagram of the SDQ revealing the standardized parameters relating items to SDQ. Footnote: All parameters were statistically significant ($P<0.05$).

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