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La versione italiana dell' Alexithymia Questionnaire for Children (AQC): struttura fattoriale e attendibilità

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ABSTRACT

The aims of the study were to investigate factor structure and reliability of the Alexithymia Questionnaire for Children (AQC), originally validated by Rieffe et al. (2006), on an Italian population. A total sample of 1265 participants, ranging in age from 8 to 14 years, filled in the Italian version of the AQC and 160 children also completed the Youth Self Report (YSR), during school time. A sub-sample (N = 60) was retested after eight weeks for an assessment of the measure's stability. The three-factor model reported good fit indices on the total sample, even though not all items loading on the Externally Oriented Thinking (EOT) factor appeared statistically relevant. Moreover, the model was only partially invariant across gender and age groups: analysis indicated developmental gender-specific differences on Difficulty Identifying Feelings (DIF) and EOT factors. Significant correlations were found between AQC scores and the YSR internalizing and externalizing symptomatology scales. In conclusion, the three-factor model was confirmed and some evidence emerged concerning its generalization to gender and age-groups.
Keywords: alexithymia; children and pre-adolescent; invariance; Italian population.

RIASSUNTO

Gli obiettivi del presente lavoro sono valutare la struttura fattoriale e l'attendibilità dell'Alexithymia Questionnaire for Children (AQC), validato originalmente da Rieffe et al. (2006), su una popolazione italiana. Un campione di 1265 partecipanti, dagli 8 ai 14 anni, ha compilato la versione italiana dell'AQC e 160 bambini hanno anche completato lo Youth Self Report (YSR), durante l'orario scolastico. Un sottocampione (N=60) è stato anche ritestato dopo otto settimane per valutare l'attendibilità dello strumento. Il modello a tre fattori ha riportato buoni indici sul campione totale, anche se non tutti gli items che saturano sul fattore Pensiero Orientato all'Esterno (POE) si sono mostrati statisticamente rilevanti. Inoltre, il modello è apparso solo parzialmente invariante nei gruppi divisi per genere ed età: le analisi hanno indicato differenze di sviluppo specifiche per il genere sui fattori Difficoltà a Identificare i Sentimenti (DIS) e POE. Sono state riscontrate correlazioni significative tra i punteggi dell'AQC e le scale di sintomatologia internalizzante ed esternalizzante dello YSR. In conclusione, è stato confermato un modello fattoriale a tre fattori e sono emerse alcune evidenze sulla generalizzazione della struttura a gruppi distinti per genere ed età.
Parole chiave: alessitimia; bambini e preadolescenti; invarianza; popolazione italiana.

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RdP

Introduction

Alexithymia (in Greek: "lack of words to describe emotions") is defined as difficulty in identifying and communicating one's emotions, as well as an externally-oriented cognitive style and constricted imaginative processes. Alexithymia is currently considered a risk factor for any somatic and mental pathology, since difficulty in relating to oneself is thought to have different outcomes depending on interactions with other factors (Taylor, Bagby, Parker, 1997; Taylor and Bagby, 2013), Empirical research reports high alexithymia scores in adult subjects with different somatic pathologies (e.g., hypertension: Grabe et al., 2010; diabetes: Chatzi et al., 2009; asthma: Li, Sun, Zhuang, Yang, 2008; psoriasis: Korkoliakou et al., 2014; fibromyalgia: Martínez et al., 2015) and mental pathologies (e.g., post-traumatic stress disorder: Yehuda et al., 1997; borderline personality disorder: De Panfilis et al., 2015; depression: Li et al., 2015; panic disorder: Galderisi et al., 2008). High alexithymia scores are also found when a non-regulated emotion is expressed via acting out (e.g., substance abuse: Warner, 2007; eating disorders: Karukivi et al., 2010; sexual disorders: Madioni and Mammana, 2001; gambling disorders: Parker et al., 2005).

Despite the availability of numerous studies which stress the crucial role of emotional abilities in normal child development, relatively little interest has been shown in alexithymia by developmental psychopathology scholars. Although disturbed emotional development is thought to be the cause of almost the entire range of psychopathological conditions that can occur during childhood, emotional difficulty is coded in DSM-5 (APA, 2013) as merely a symptom or maladaptive behaviour that characterizes each clinical condition (Di Trani, 2013).

From a theoretical point of view, starting from the assumption that alexithymia is a dimensional characteristic, sensitive to changes on the basis of individual experiences, it is possible to assess in children conditions in which the emotional competence is placed below the average of the general population (Di Trani et al., 2016).

Nevertheless, there is a relatively small body of empirical research on alexithymia in developmental stages (Di Trani, 2013). Several studies have shown a relationship between alexithymia and somatic complaints in children and adolescents (Ebeling, Moilane, Linna, Räsänen, 2001; Rieffe, Meerum, Terwogt, Bosch, 2004; Rieffe, Oosterveld, Terwogt, 2006; Rieffe et al., 2010), and other studies have found high levels of alexithymia in children with specific somatic pathologies (e.g., hematic disorders: Fukunishi, Tsuruta, Hirabayashi, Asukai, 2001; headache: Natalucci et al., 2018; cancer: Mishra, Maudgal, Theunissen, Rieffe 2012).

In regard to the evaluation of alexithymia in clinical samples, higher levels of alexithymia have been found in samples of adolescents with eating disorders (Zonnevylle-Bender et al., 2004) and with chronic fatigue syndrome (van de Putte et al., 2007) attention deficit and hyperactivity disorder (Donfrancesco et al., 2013), autistic spectrum disorders (Griffin, Lombardo, Auyeung, 2016), as compared to normal samples. Moreover, Moriarty et al. (2001) have shown a lower attention to feelings in adolescent sex offenders, although the alexithymia scores were not significantly lower than those of a control group without sexually abusive behaviors. Furthermore, studies on normal samples have shown a relationship between alexithymia and dissociative symptoms in a sample of adolescents (Sayar, Kose, Grabe, 2005) and between lower emotional competence and less abilities to seek help in adolescents (Ciarrochi, Deane, Wilson, Rickwood, 2002). Furthermore, sporadic studies have analysed alexithymia and the presence of internalizing/externalizing symptoms in normal children and adolescents. Internalizing symptoms include over-controlling and inner-directed behaviours, somatic symptoms and negative feelings, while externalizing symptoms refer to aggressive, hyperactive behavior and oppositive attitudes. Rieffe et al. (2010) have found a relationship between alexithymia and internalizing symptoms in a sample of children and young adolescents, and Honkalampi et al. (2009) have shown correlations between alexithymia and depressive symptoms, internalizing/externalizing problems in a sample of 3936 adolescents. In Di Trani et al. (2013) an association between internalizing/externalizing symptoms and alexithymia in 160 pre-adolescents was found.

The international literature seems to support the association between alexithymia and both somatic and mental pathologies also in childhood and adolescence, but further studies are needed to confirm this relation (Di Trani et al., 2016). The lack of adequate psychometric instruments for the assessment of alexithymia in various developmental stages is a crucial limitation for exploration of the relationship between the ability to regulate emotions and health.

The ability to recognize and verbalize emotions in adolescence is usually explored by adapting questionnaires for the assessment of emotion regulation in adulthood. Several studies have evaluated the psychometric properties on adolescent populations of the most frequently used self-administered scale for the assessment of alexithymia in adults – the 20-Item Toronto Alexithymia Scale (TAS-20; Bagby, Parker, Taylor, 1994): this was implemented by means of a confirmatory factor analysis (Zimmermann et al., 2007; Sakkinen et al., 2007; Nishimura et al., 2009) or of an exploratory factor analysis (La Ferlita et al., 2007).

In children, Fukunishi, Yoshida, Wogan (1998) proposed an Alexithymia Scale for Children, which is administered to teachers and parents. The scale was validated on 286 children (mean age of 9 years) and the factor analysis revealed a two-factor structure (Difficulty Expressing Feelings and Difficulty Relating to Others).

Rieffe et al. (2006) designed a self-report simplified version of the TAS-20 for children. The version retained structure and concepts of the 20 items of the adult scale, while the language was adjusted so that items were more readily understandable by children, and a three-point Likert-scale scoring system instead of a five-point one was used. The scale was administered to two groups of male and female children: one comprising 400 children with a mean age of 11 years, 2 months; the other comprising 340 children with a mean age of 13 years, 7 months. A Confirmatory Factor Analysis confirmed the TAS-20 3-factor structure (Difficulty Identifying Feelings, Difficulty Describing Feelings, and Externally Oriented Thinking) in both age groups, although the third factor appeared less stable, since just 3 out of the original 8 items had saturations over 0.40. Similarly, measures of internal consistency seemed satisfactory for the first two of these factors, but insufficient for the third one. As for the predictive validity, the first two factors were significantly correlated with a somatic symptomatology scale (Somatic Complaint List; Rieffe et al., 2004) and with the subscales of Rage, Fear, and Sadness (a negative correlation with the Happiness subscale) deriving from a questionnaire on mood state (Mood List for Children; Rieffe et al., 2004). Only the third factor proved to be negatively correlated with the Happiness subscale. In Loas et al. (2017) the psychometric properties of the Alexithymia Questionnaire for Children have been investigated in different non-clinical and clinical samples of children and adolescents, proposing the superiority of a two-factor model over the classical three-factor model.

Di Trani et al. (2009) have already explored the factor structure of the Alexithymia Questionnaire for Children in an Italian sample, providing preliminary evidence of two possible factor structures: a 3-factor structure (Difficulty Identifying Feelings, Difficulty Describing Feelings, and Externally Oriented Thinking) and a 4-factor structure (Difficulty Identifying Feelings, Difficulty Describing Feelings, Confusion on Physical Sensations and Externally Oriented Thinking). Moreover, analyses showed higher alexithymia total scores in children (aged from 8 to 10) compared with pre-adolescents (aged from 11 to 14). No significant gender differences in mean total scores were found. The present study had four main objectives:

Since a direct comparison among the fits of competing models (three vs. four factors) of the Alexithymia Questionnaire for Children on the same sample is still lacking in the literature, our main objective was to provide such information by recruiting a larger and more representative sample of Italian children

Rieffe et al. (2006) generalized the same three-factor structure to two age-groups (11 years old vs 13 years old, approximately). We aimed to extend this result by testing whether the same factor structure is tenable on groups that differ not only in terms of age but also in terms of gender, because this factor has proved to be one of those for which significant differences are found on adult samples (Bagby et al., 1994). Hence, four groups, matched for both age and gender, were studied.

In order to evaluate the internal and temporal stability of the alexithymia factors, test-retest and internal reliability were considered.

In order to examine the convergent validity of the questionnaire, relationships between alexithymia levels and internalizing and externalizing symptomatology scales of the Youth Self Report were also evaluated.

Method

Subjects

The sample consisted of 1265 children, ranging in age from 8 to 14 years (mean age=10.80, s.d.=1.77), of both sexes (734 boys and 531 girls), attending primary schools (third, fourth and fifth grades) and secondary schools in Rome.

The sample was split into four groups: 360 males aged 8-10; 372 males aged 11-14; 174 females aged 8-10; 357 females aged 11-14. Two children did not state their age.

Measures
The Italian Version of the Alexithymia Questionnaire for Children.

The English version of the questionnaire (Rieffe et al., 2006) was independently translated into Italian by two clinicians skilled in the construct. The translations were then compared, and the resulting version was back-translated into English by a third person for a further check. The questionnaire, like the original scale, was composed of 20 items with three reply options (not true at all, quite true, or true). The English and Italian versions are reported in Appendix A.
The Youth Self Report (YSR 11/18; Achenbach, 1991).

The Youth Self Report (YSR) provides self-ratings for 112 problem items paralleling those of the Child Behavior Checklist CBCL/6-18. The YSR also includes open-ended responses to items covering physical problems, concerns, and strengths. Youths assess themselves on how true each item is now or was within the past six months, using the same three-point response scale as the CBCL/6-18 and Teacher Report Form (TRF). The YSR is recommended only with children 11 years and older and allows an investigation of the degree of self-awareness around the development of social abilities and the possible presence of psychological and behavioral problems. The YSR, like the CBCL and the TRF, yields scores on eight empirically derived syndrome scales: anxious/depressed; withdrawn/depressed; somatic complaints; social problems; thought problems; attention problems; rule-breaking behaviour; aggressive behaviour. These scales are grouped into two higher order factors: Internalizing Symptomatology Scale (the sum of the first three sub-scales) and the Externalizing Symptomatology Scale (the sum of the last two sub-scales). The instrument showed good psychometric characteristics (range of test-retest value, 0.47 to 0.79; range of internal consistency, 0.71 to 0.95), and it has been utilized in studies of very large populations both in U.S.A. (Achenbach, 1991; Ivanova and Achenbach, 2007; Rescorla, 2007) and in Italy (Frigerio et al., 2009).
Procedure

We contacted the headmasters of primary and secondary schools to obtain permission to ask parents for authorization to administer questionnaires to their children for research purposes (we received no rejections from either headmasters or parents).

Administration of the questionnaire took place during school hours, under the supervision of a psychologist and a teacher. All the children received the Italian version of the AQC and 160 children (80 males and 80 females; age m = 12.50, sd = 1.12) also filled in the YSR 11/18. A randomly selected subsample of participants (N = 60) was selected prior to the initial administration for a reassessment after 8 weeks. Questionnaires compiled by foreign children were later discarded. No child refused to fill in the questionnaires.

Analysis Strategy

Since all items in the Alexithymia Questionnaire for Children have a three-point ordinal Likert-like scale and all the analyses were conducted with LISREL (Jöreskog and Sörbom, 1999), the Robust Maximum Likelihood estimation method was used, given that the asymptotic covariance matrix is implied in all the analyses, and sample size is relatively not too large (Jöreskog, 2002-2005; Flora and Curran, 2004). Confirmatory models were estimated assuming that latent variables are continuous while items are ordinal; hence, the fixed-item thresholds method was used (Jöreskog, 2002-2005). Assuming non-normality, the goodness of fit of the model was consequently evaluated by means of the Satorra-Bentler scaled chi-square statistic (Satorra and Bentler, 1988), as well as other well-known fit indices such as: the Root Mean Square of Approximation (RMSEA; Steiger, 1990), Comparative Fit Index (CFI; Bentler, 1990) and the Non-Normed Fit Index (NNFI; Bentler and Bonett, 1980). Following guidelines by Hu and Bentler (1990), the model is considered to hold approximately in the population if the RMSEA value is below 0.08 (the closer to 0.00 the better), and if both CFI and NNFI are above 0.95 are indicative of a reasonable goodness of fit.

Multi-sample CFA was performed in order to investigate how well the factor model emerging from the previous analysis could be generalized across four sub-populations, i.e., male children vs. pre-adolescent boys vs. female children vs. pre-adolescent girls, considering the first group as the reference sample. On adult samples, TAS-20 normative scores vary as function of gender, age and presence of clinical problems. It is consequently crucial to test whether the same factor structure (in terms of latent means and covariance structure) is invariant across at least gender and age groups.

A procedure for testing factorial invariance was followed (Vandenberg and Lance, 2000; Horn and Mc Ardle, 1992; Reise, Widaman, Pugh, 1993) and adapted to the case of ordered/categorical measures as indicated by Millsap and Yun-Tein (2004). The procedure consisted in a series of hierarchical statistical invariance tests were considered (configural, metric, scalar, unique variance, latent variance and latent means), starting with the omnibus test of the equality of covariance matrices across groups. The scaled difference chi-square statistics, $\Delta SB\chi^2$, was endorsed (Satorra and Bentler, 2001) for comparing two nested models, i.e. configural and metric invariant. The null hypothesis of the statistical test was accepted when the estimated probability of the test was greater than 0.01.

Finally, in order to evaluate internal consistency, Cronbach alphas and Spearman test retest reliability for the total alexithymia score and for factor indicators were performed and convergent validity was investigated using Pearson's correlation between the AQC (total and factor scores) and YSR Internalizing and Externalizing Scales.

Results

Confirmatory Factor Analysis

In order to confirm the factor structure of the Alexithymia Questionnaire for Children, we contrasted the goodness of fit of the two competing models: three-factor vs. four-factor model. The factor structure of the four-factor model was modeled according to the findings by Di Trani et al., 2009 (see Introduction). Table 1 presents the goodness of fit estimates, and the two models are contrasted with the independence model. Chi-square statistics are significant for all models because this statistical test is sensitive to the sample size and tends to become significant in large samples. Instead, on considering the other fit indices with respect to the guidelines accepted in literature, both models (three vs. four factor model) show good fit values. Even though all the fit indices of the four-factor structure are better than the three-factor structure, this last model shows a very good fit. Since the fourth factor does not seem to impact significantly on the overall fit statistics, it probably should have received more than one confirmation and - above all - it should have shown a striking improvement in model fit, and this was not the case. On the other hand, the three-factor model was more parsimonious and received several empirical confirmations. On this basis, the three factor model was retained.

Inspection of the estimated parameters of this model shows that three factor loadings were non-significant (respectively: item 4, item 8 and item 15). On considering latent correlations among the three factors, all were found to be significant (between DIS and DDS, r=0.86; between DIS and POE, r=-0.20; p<0.01) with the exception of the correlations between DDF and EOT.

Table 1. Confirmatory Factor models: comparison between fit indices estimates of the three TAS-20 factor model and the four-factor model

	df	χ^2	SBχ^2	RMSEA	NNFI	CFI
Independence model	190	8453.18**	--	--	--	
Three-factor model	167	1304.24**	673.24**	.049	0.93	0.94
Four-factor model	164	978.23**	469.65**	.040	0.95	0.96

** p <.01

Note: χ^2 = Normal Theory Weighted Least Squares Chi-Square; df = degree of freedom SBχ^2 = Satorra-Bentler Scaled Chi-Square; RMSEA = Root Mean Square Error of Approximation; NNFI = Non-Normed Fit Index; CFI = Comparative Fit Index.

Multi-group analysis

A multi-group analysis was carried out in order to assess whether the three-factor structure model could be generalized across the four sub-populations. The male children group was used as the reference group (N = 360). Table 2 summarizes the results of the multi-group confirmatory factor analysis. The omnibus test of invariant covariance matrices failed to report a non-significant SB-χ^2, even though the other fit indices were satisfactory. Because this omnibus test is uninformative with respect to the specific source, which makes the measurement model non-equivalent, the proposed set of progressively restrictive tests were endorsed.

Table 2. Results of the multigroup confirmatory factor analysis

Model	SBχ^2	df	RMSEA	NNFI	CFI	Δdf	ΔSBχ^2
Test of Invariance of Covariance matrices	1260.20	690	0.05	0.93	0.94	--	--
M0: Configural Invariance [a]	1204.07**	668	0.05	0.93	0.94	--	--
M1: Strict Metric Invariance [a]	1336.27**	719	0.05	0.93	0.93	51	132.2**
M1a: Partial Metric Invariance [a]	1265.86**	707	0.05	0.94	0.94	39	61.79 [b]
M2a: Strict Scalar Invariance	1550.79**	758	0.06	0.91	0.91	51	284.93**
M2b: Partial Scalar Invariance	1308.33**	731	0.05	0.93	0.94	24	42.47 [c]
M3: Strict Invariance of Unique Variances	1550.23**	791	0.05	0.92	0.91	60	241.9**
M3a: Partial Invariance of Unique Variances	1367.91**	774	0.05	0.93	0.93	43	59.58*
M4: Strict Invariance of Factor Variances	1392.21**	783	0.05	0.93	0.93	9	24.3
M4a: Invariance of Factor Covariances	1408.77**	792	0.05	0.93	0.93	9	21.67
M5: Invariance of Latent Means	1451.801	801	0.05	0.93	0.93	9	43.08

[a] No intercept included; [b] p = .015; [c] p = .011; * p<.05; ** p<.01

Note: SBχ^2 = Satorra-Bentler Scaled Chi-Square; df = degree of freedom RMSEA = Root Mean Square Error of Approximation; NNFI = Non-Normed Fit Index; CFI = Comparative Fit Index; Δdf = differential degree of freedom; ΔSBχ^2 = differential Satorra-Bentler Scaled Chi-Square

Although the configural model had a significant SB-χ^2, the values of RMSEA, NNFI and CFI were acceptable. Under the assumption of strict metric invariance, the fit (SBχ^2) did not worsen excessively, and relaxing equality constraints on twelve factor loadings for eight items made it possible to reach the condition of partial metric invariance (ΔSBχ^2 (51)= 61.79, p $\approx$ .01). The strict scalar invariance condition was successively imposed on this model, resulting in a significant test (ΔSBχ^2 (51)= 284.93; p <0.01), and 27 parameters needed to be unconstrained (ΔSBχ^2 (24)= 42.47; p $\approx$ .01) before reaching the indifference between the two models. The test for strict Invariance of Unique variances confirmed non-invariance, and 17 parameters had to be relaxed to reach indifference with respect to the partial scalar invariant model fit (ΔSBχ^2 (43)= 59.58, p =0 .05). Finally, the test of equivalence of factor variances across the four groups showed that the factor variances were significantly different (ΔSBχ^2 (9)= 24.3, p = 0.003), while the test for the equivalence

of factor covariances did not show significant differences ($\Delta SB\chi^2$ (9)= 21.67, p > 0.01). Although limited to the partial scalar invariance, the test of invariance of Latent Means (Table 2) nevertheless did not show a strict invariance. The invariance was found when two latent means (DIF and EOT factors in the Adolescent Girls group) were unconstrained ($\Delta SB\chi^2$ (7)= 19.7, p ≈ .01).

The completely common metric standardized solution of factor loading, shown in Table 3, highlights that EOT is the only factor that is invariant across all four groups, even though three out of eight items (5, 18 and 19) do not significantly load on this factor. By contrast, items loading on DIF and DDF factors are all significant, but not all of them are invariant across the four groups.

Table 3. Common Metric Completely Standardized Solution: factor loadings

	DIF	DDF	EOT
DIF1	0.61**	--	--
DDF2	--	0.68** (0.65**)[a]	--
DIF3	0.46**	--	--
DDF4	--	0.41** (-0.21**) [a] (-0.51**)[b] (0.00)[c]	--
EOT5	--	--	-0.04
DIF6	0.57**	--	--
DIF7	0.50** (0.60**)[b]	--	--
EOT8	--	--	0.29**
DIF9	0.52** (0.74**) [a, c]	--	--
EOT10	--	--	-0.21**
DDF11	--	0.48**	--
DDF12	--	0.33** (0.53**)[c]	--
DIF13	0.67** (0.81**)[b]	--	--
DIF14	0.50**	--	--
EOT15	--	--	0.43**
EOT16	--	--	0.46**
DDF17	--	0.76** (0.64**)[c]	--
EOT18	--	--	0.00 (0.15)[b] (-0.16*)[c]
EOT19	--	--	0.00
EOT20	--	--	0.51**

p<.05; ** p<.01; [a] Pre-adolescent Males; [b] Female children; [c] Pre-adolescent females
DIF = Difficulty Identifying Feelings; DDF = Difficulty Describing Feelings; EOT = Externally Oriented Thinking

All the three factors showed positive and significant correlations (DIF and DDF: r=0.82; DIF and EOT: r=0.33; DDF and EOT: r=0.35; p<.01). Finally, Table 4 shows means and SD as a function of gender and age.

Table 4. Observed means (M) and SD for the total and the sub-samples

		Total Score		DIF		DDF		EOT	
	N	M	SD	M	SD	M	SD	M	SD
Boys:									
Age 8-10	360	38.74	5.52	13.14	3.03	9.71	2.16	15.89	2.61
Age 11-14	372	36.60	5.75	11.76	3.15	9.07	2.10	15.77	2.63
Girls:									
Age 8-10	174	38.40	5.72	12.46	3.04	9.48	2.01	16.45	2.77
Age 11-14	357	37.27	5.60	12.58	3.20	9.26	2.24	15.43	2.59
Total sample	1263	37.65	5.70	12.48	3.16	9.36	2.16	15.80	2.65

Note: Total Score = sum of the Alexithymia Questionnaire for Children items; DIF = sum of the seven items loading on the DIF factor; DDF = sum of the five items loading on the DDF factor; EOT = sum of the eight items loading on the EOT factor.

Reliability

The internal consistency for Total Score and DIF was good: Cronbach's Alpha 0.66 and 0.70, respectively. DDF and EOT did not meet the criteria for internal consistency (DDF Cronbach's Alpha=0.49; EOT Cronbach's Alpha=0.35).

Spearman test-rest reliability correlations over an 8-week period ranged from a minimum of 0.65 (p <0.01; DDS) to a maximum of 0.76 (DIS), with an average test-retest of 0.69. The Total Score showed the highest test-retest coefficient (r=0.91).

Convergent validity

Significant correlations were found between the total AQC score and the scores of internalizing (r=.55; p<.01) and externalizing symptomatology (r=.33; p<.01) of the YSR 11/18. With reference to AQC Factors, significant correlations emerged between: DIF and internalizing (r=.57; p<.01) and externalizing symptomatology (r=.39; p<.01); DDF and internalizing symptomatology (r=.42; p<.01); EOT and internalizing (r=.17; p<.05) and externalizing symptomatology (r=.16; p<.05).

Discussion

The study, using the Robust Maximum Likelihood estimation method, which is more suitable for three-point scale items, has shown the satisfactory applicability of the Alexithymia Questionnaire for Children to the Italian population. In particular, it demonstrates that it can be applied to children as young as 8 years old, while the English version had not been applied to children aged under 9.

The results of the Confirmatory Factor Analysis on the whole sample of 1265 children are coherent with both the traditional three-factor structure and a four-factor structure. We decided to maintain the three-factor structure because it is supported by Rieffe's (2006) original work and by a large quantity of studies on adults, in different languages and cultures (Parker, Taylor, Bagby, 2003; Taylor, Bagby, Parker, 2003).

In regard to the multigroup results, three items, #5, #18 and #19, do not show significant loadings on the EOT factor, confirming the result reported by Rieffe et al. (2006). The remaining five items, however, show fully satisfactory loadings even in multi-group analysis (while other factors show different loadings in different age/gender groups). We consequently believe that, rather then questioning the presence of an EOT dimension in children, this result simply shows that these items propose concepts that are too abstract to be fully understood by children. This may explain why Item 4 shows loadings on the DDF factor which are different in sign and/or dimension in different age/gender groups. For this reason, we suggest that items 4, 5, 18 and 19 should be omitted from scoring.

Regarding the other two factors, DIF and DDF, it should be stressed that items loading on these factors behave differentially as a function of gender and age group. Consequently, these two factors emerged as highly gender- and age-specific, and this should be considered a crucial aspect when assessing alexithymia in children. On the other hand, gender differences have already been reported in adults by some authors (see for example: 49, 51). Therefore, our study not only confirms these results but suggests that these differences are also associated with age differences.

Multi-group analysis showed that only the factor structure (i.e., the configural model) could be stable in the four subgroups examined (males aged 8-10, males 11-14, females 8-10, females 11-14). On the other hand, the mean scores appeared to be higher in the male 8-10 group in comparison with all other groups, which did not differ significantly from each other. These results cannot be considered conclusive, however, because the three-factor model was only partially scalar invariant. Hence further evidence is required before concluding that there is a significant delay in emotional development in male children compared to females, a gap which is bridged in subsequent development.

As to correlations among factors, the correlation between DIF and DDF was very strong, while those involving EOT were much weaker, though significant. This result is in line both with patterns obtained by Rieffe et al. (2006) in children, and with the entire body of assessment in adults (Parker et al., 2003; Taylor et al., 2003). The EOT factor, in children as in adults, may therefore continue to be considered part of the alexithymia construct, but possibly in a different position with respect to the first two factors: one possibility, for instance, is that EOT may have a compensatory function with respect to a primary deficit, as measured by DIF and DDF.

The internal consistency of the Questionnaire was satisfactory for the Total Score and for the DIF factor, which is the basic dimension of the alexithymia construct. On the other hand, it was not satisfactory for both the DDF and EOT factors. Once again, these results confirm those by Rieffe et al. (2006). Test-retest reliability was satisfactory for all dimensions, in particular for the Total Score.

Regarding convergent validity, Total AQC score significantly correlate with both internalizing type (withdrawal, anxiety states, and depression) and externalizing type (aggressive and delinquent behavior) symptomatology, although correlation with internalizing symptoms appears stronger ($r=.55$) than correlations with externalizing symptoms ($r=.33$). As described in the Introduction, with reference to adulthood, many studies indicate that alexithymia may have a relationship with the manifestation of various forms of distress, both physical and mental, to the extent that alexithymic characteristics can be considered a general risk factor for the development of pathology. Such a relationship was not yet confirmed for childhood, due to the paucity of existing research studies and the difficulty in creating self-report measuring instruments for children. At any rate, we can assume that, in childhood as in adulthood, alexithymia can represent a vulnerability factor that, in interaction with other variables (individual, relational, and environmental), can contribute to the development of various forms of problems. In fact, the presence of a disturbance in affect regulation does not necessarily imply an observation of low levels of manifest emotion, but high alexithymia scores may be seen in subjects characterized by excessive levels of expressed emotion and by modalities of chaotic expression (Solano, 2013). In other words, emotions that are not elaborated and regulated can find expression through acting out (externalizing symptoms) or, alternatively (in our sample, somewhat more often), through the creation of worries, somatic symptoms, ill-defined emotional states, and tendencies toward melancholy (internalizing symptoms).

Summarizing, the current results suggest that caution is required when evaluating results obtained with DDF and EOT factors taken in isolation, while the Total Score appears most reliable as a measure of contact with, and the identification and regulation of, emotions in this developmental stage.

The limitations of this study are essentially its lack of predictive validity indicators and the small number of participants subject to the rest-retest reliability measures. Determining the measure's relationships with different health indicators could be the objective of further investigations.

Author Contributions
M.D.T. designed the study, recruited the participants, analyzed the data and wrote part of the article. F.P. contributed to analyze the data and to write the article. A.R. coded the data. P.S.G. contributed to write the article. L.S. supervised all phases.

Compliance with Ethical Standards

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The authors declare that they have no competing interests.

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All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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Informed consent was obtained from all individual participants included in the study.

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Appendix 1

Alexithymia Questionnaire for Children (English and Italian versions)

1. I am often confused about the way I am feeling inside
   Sono spesso confuso/a su come mi sento dentro
2. I find it difficult to say how I feel inside
   Mi è difficile dire come mi sento dentro
3. I feel things in my body that even doctors don't understand
   Sento cose nel mio corpo che neanche i medici capiscono
4. I can easily say how I feel inside
   Riesco facilmente a dire come mi sento dentro
5. When I have a problem, I want to know where it comes from and not just talk about it
   Quando ho un problema, voglio sapere da dove viene e non semplicemente parlarne
6. When I am upset, I don't know if I am sad, scared or angry
   Quando mi agito, non so se sono triste, spaventato/a o arrabbiato/a
7. I am often puzzled by things that I feel in my body
   Spesso sento nel corpo cose strane
8. I'd rather wait and see what happens, instead of thinking about why things happen
   Preferisco aspettare e vedere che succede, piuttosto che pensare a perché succedono le
   cose
9. Sometimes I can't find the words to say how I feel inside
   A volte non riesco a trovare le parole giuste per dire come mi sento dentro
10. It is important to understand how you feel inside
    E' importante capire come ti senti dentro
11. I find it hard to say how I feel about other people
    Trovo difficile dire quello che provo per gli altri
12. Other people tell me that I should talk more about how I feel inside
    Gli altri mi dicono che dovrei parlare di più di come mi sento dentro
13. I don't know what's going on inside me
    Non so che mi succede dentro
14. I often don't know why I am angry
    Spesso non so perché sono arrabbiato/a
15. I prefer talking to people about everyday things, rather than about how they feel
    Preferisco parlare con gli altri di cose di tutti i giorni, piuttosto che di come si sentono
16. I prefer watching funny television programmes, rather than films that tell a story about
    other people's problems
    Preferisco guardare programmi televisivi divertenti piuttosto che film che raccontano una
    storia sui problemi di qualcuno
17. It is difficult for me to say how I really feel inside, even to my best friend
    Mi è difficile dire come mi sento veramente dentro, anche alla persona più amica
18. I can feel close to someone, even when we are sitting still and not saying anything
    Riesco a sentirmi vicino a qualcuno anche se stiamo seduti e non diciamo niente
19. Thinking about how I feel, helps me when I want to do something about my problems
    Se penso a come mi sento, questo mi aiuta a fare qualcosa per i problemi che incontro
20 When I have to concentrate on a film to understand the story, I enjoy the film much less
    Quando mi devo sforzare per capire la storia di un film, il film mi piace molto di meno