Evaluating Brazilian Parenting: Evidence of Validity and Invariance for Fathers and Mothers

Avaliando a parentalidade brasileira: evidências de validade e invariância para pais e mães

Evaluación de la parentalidad brasileña: evidencias de validez e invariancia para padres y madres

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Data Availability: The dataset that supports the results of this study is not available on servers. However, it can be made available by emailing the authors.

Abstract: Historically, studies on parenting were mostly based on maternal reports, generating uncertainties about its conclusions. Inverting this logic, in Brazil, the Inventory of Father Involvement (originally developed in the USA to assess men) was improved and adapted for mothers, generating the Inventory of Father and Mother Involvement (IFMI). The IFMI's content validity was verified, but its internal structure was still unknown. This study aimed to verify evidence of validity based on its internal structure, reliability estimates and the invariance of this structure for fathers and mothers. For this purpose, 1244 fathers and mothers from 22 Brazilian states (with children aged 2 to 10) answered the Sociodemographic Questionnaire and the IFMI. Exploratory (EFA; $n = 621$), confirmatory (CFA; $n = 623$) and multigroup confirmatory factor analysis (MGCFA) were performed, and reliability estimates were verified. EFA and CFA results indicated the existence of seven factors in a second-order hierarchical structure. Reliability estimates ranged from $.635 \leq \omega \geq .875$. MGCFA results indicated the invariance of this structure for fathers and mothers. In addition to the evidence of validity, these results contribute to broadening theoretical understandings about Brazilian parenting, enabling future comparative studies. It is important to further verify additional validity evidence.
Keywords: fatherhood; motherhood; parenting; gender roles; psychological assessment; psychometric instruments

Resumo: Historicamente, os estudos sobre parentalidade baseavam-se, na maioria, em relatos maternos, gerando incertezas sobre suas conclusões. Invertendo essa lógica, no Brasil, o Inventário de Envolvimento Paterno (inicialmente desenvolvido nos EUA para homens) foi aprimorado e adaptado para mães, culminando no Inventário de Envolvimento Paterno e Materno (IEPM). A validade de conteúdo do IEPM foi verificada, mas sua estrutura interna era desconhecida. Este estudo teve como objetivo verificar evidências de validade com base na estrutura interna, estimativas de confiabilidade e invariância dessa estrutura para pais e mães. Para isso, 1244 pais e mães de 22 estados brasileiros (filhos de 2 a 10 anos) responderam ao Questionário Sociodemográfico e ao IEPM. Foram realizadas análises fatoriais exploratória (AFE; $n = 621$), confirmatória (AFC; $n = 623$) e confirmatória multigrupo (AFCMG) e verificadas estimativas de confiabilidade. Os resultados da AFE e AFC indicaram a existência de sete fatores, em uma estrutura hierárquica de segunda ordem. Estimativas de confiabilidade variaram de $0,635 \leq \omega \geq 0,875$. Os resultados do AFCMG indicaram a invariância desta estrutura para pais e mães. Além das evidências de validade, esses resultados contribuem para ampliar a compreensão teórica sobre a parentalidade brasileira, possibilitando futuros estudos comparativos. É importante verificar evidências adicionais de validade.
Palavras-chave: paternidade; maternidade; parentalidade; papéis de género; avaliação psicológica; medidas psicométricas

Resumen: Históricamente, los estudios sobre parentalidad se basaban mayoritariamente en informes maternos, lo que genera incertidumbre sobre sus conclusiones. Invirtiendo esta lógica, en Brasil, el Inventory of Father Involvement (creado inicialmente en los Estados Unidos para padres) fue mejorado y adaptado para madres, así se creó el Inventário de Envolvimento Paterno e Materno (IEPM). Se verificó la validez de contenido del IEPM, pero no su estructura interna. Este estudio tuvo como objetivo verificar evidencias de validez basada en su estructura interna, estimaciones de confiabilidad e invariancia de esta estructura para padres y madres. Para ello, 1244 padres y madres de 22 estados brasileños (con niños de 2 a 10 años) respondieron un cuestionario sociodemográfico y el IEPM. Se realizaron análisis factoriales exploratorios (AFE; $n = 621$), confirmatorios (AFC; $n = 623$) y confirmatorios multigrupo (AFCMG), y se verificaron estimaciones de confiabilidad. Los resultados de la EFA y AFC indicaron la existencia de siete factores en una estructura jerárquica de segundo orden. Las estimaciones de confiabilidad oscilaron entre $.635 \leq \omega \geq .875$. Los resultados de la AFCMG indicaron la invariancia da estructura para padres y madres. Además de evidencias de validez, estos resultados contribuyen a ampliar la comprensión teórica de la paternidad brasileña al permitir futuros estudios comparativos. Es importante realizar pruebas adicionales de validez.
Palabras clave: paternidad; maternidad; parentalidad; roles de género; evaluación psicológica; instrumentos psicométricos

For decades, important researchers have been theorizing about parenting (Belsky, 1984; Taraban & Shaw, 2018) and its relationships (Morris et al., 2021; Zimmer-Gembeck et al., 2022) – although partially related to maternal perceptions (Afrooz et al., 2022; Phares et al., 2005). Subsequently, the specific understanding of paternal involvement (Lamb, 1975, 2000) and its consequences was also verified. However, researchers have found divergent results when trying to understand the relationship between fatherhood and its impact on the well-being of fathers and mothers (Milovanska-Farrington & Farrington, 2021). Although benefits can be perceived (Pimpawatin & Witvorapong, 2022), fatherhood is also a complex function (Morse & Steger, 2019). Depending on the demands imposed by the fathering role and on parents' resources availability, the parental role could even lead to more serious clinical conditions, such as parental burnout (Mikolajczak et al., 2019). One of the ways to avoid these situations is to advance in the understanding of parenting, which can only be done with assessment tools that are appropriate to the cultural context, are comprehensive and cover different dimensions of parenting, and include maternal and paternal historical perspectives (Parent & Forehand, 2017). The new version of the Inventory of Father Involvement (IFI-BR-27) considers these characteristics (Santis & Noronha, in press), but additional evidence of its validity could provide important psychometric information about the measure. Thus, the objective of this work was to advance the psychometric studies of this new version, adapted for fathers and mothers with children in Kindergarten and Elementary 1.

Articles on parental involvement and related issues are published almost daily in the press (Holden, 2020), and are also a common focus of scientific studies (Parent & Forehand, 2017). For many years, however, research on the subject was based on maternal reports and experiences (Phares et al., 2005). Phares et al. (2005) reviewed 514 studies that investigated issues related to parenting. The authors found that out of such studies, 45 % had only mothers as participants, 24.7 % involved mothers and fathers and reviewed maternal and paternal effects separately, 28.2 % reported both fathers and mothers, but did not review them separately or more often did not specify the respondent's gender; and 2.1 % involved only the fathers.

Although this trend continued until recent years (Afrooz et al., 2022), the need for men to be explicitly considered by the scientific community had already been signaled decades before (Lamb, 1975). Thus, despite its specific challenges (Schoppe-Sullivan & Fagan, 2020), the literature on fatherhood has advanced a lot in recent decades, contributing to the understanding of fathers' relevance in the development of children (Afrooz et al., 2022; Santis & Barham, 2017). Currently, there is consensus in the scientific literature on the importance of both fathers and mothers for child development (Sanders & Morawska, 2018) and family well-being (Dunst et al., 2021).

Given this recognized relevance, the proper assessment of parental involvement becomes essential, since the interpretations derived from studies on the subject depend on the methods and quality of the assessment made (Parent & Forehand, 2017). As in the historical development of studies on parenting, their evaluation also shows a tendency to adopt the maternal perspective (Adamsons & Buehler, 2007). This limitation may bias the conclusions made, causing uncertainties in relation to the specific results of men (Adamsons & Buehler, 2007). That said, for the proper assessment of parental

involvement in Brazil, in addition to a culturally adapted instrument (International Test Commission [ITC], 2017), it is also essential that the measurement be done through a multidimensional measure (focusing on different aspects of parenting), with consistent evidence of validity in relation to the context and population that will be assessed (including, therefore, data on men) and that includes the maternal and paternal historical perspective (Parent & Forehand, 2017).

In view of this need, Bossardi et al. (2018) observed a recent trend in adapting measures of assessment of father involvement for use with mothers as well. In Brazil, this process was implemented using the Paternal Engagement Questionnaire (Bossardi et al., 2018). However, the validity evidence assessed for the instrument is restricted, with participants originating only from the southern region of the country and with children in a narrow age range – from 4 to 6 years of age. The Inventory of Father Involvement (IFI; Hawkins et al., 2002) is also an instrument initially developed to assess the quality of paternal involvement, which has already been adapted for use with mothers in different cultural frameworks (such as proposed by Chui et al., 2016; Santis & Noronha, in press; Trahan & Cheung, 2016).

The IFI was originally developed in the USA, presenting adequate evidence of validity based on its internal structure. It is a multidimensional measure that contemplates spheres of involvement traditionally attributed to men (such as family financial support or psychological support to the mother) and contemporary dimensions, previously attributed to mothers (such as reading together and helping with daily activities). The dimensions assessed by the instrument are: (a) discipline and teaching responsibility; (b) school encouragement; (c) mother support; (d) providing; (e) time and talking together; (f) praise and affection; (g) development talents of future concerns; (h) reading and homework support and (i) attentiveness (Hawkins et al., 2002). The IFI has already been adapted for use in Brazil, where it is called Inventário de Envolvimento Paterno (IFI-BR). Different evidence of validity for the Brazilian version of the instrument were verified. Studies investigating the psychometric properties of the measure began with fathers of children aged from 5 to 10 (IFI-BR; Santis et al., 2017; Santis et al., 2022), considering the age range assessed by the IFI (Hawkins et al., 2002). However, considering the importance of early child development (McCormick et al., 2020), the measure was adapted for fathers with children from 2 to 10 (enrolled in Kindergarten to the first years of Elementary School), and additional evidence were verified (IFI-BR-27; Santis et al., 2023, Santis et al., 2024a; Santis et al., 2024b).

Given its characteristics and the need for a better assessment of parenting in Brazil (including, but not limited to, the father's perspective), the IFI-BR-27 was adapted for use with Brazilian mothers (Santis & Noronha, in press). Necessary improvements were proposed to the Providing factor (indicated by Santis et al., 2023) and the inclusion of a new factor, to assess the function of Openness to the world (Paquette, 2004) – which refers to the affective bond developed from parental stimulation and protection, achieved through discipline (Paquette et al., 2020). The inclusion of this new dimension aimed to update the instrument, including an important sphere of involvement for child development (Feldman & Shaw, 2021), historically attributed to men (Paquette, 2004), which can also be performed by mothers (Bueno et al., 2022).

Following international guidelines (American Educational Research Association [AERA] et al., 2014; ITC, 2017), the authors proceeded with the creation and adaptation of items, evaluation by expert judges and pilot study (Santis & Noronha, in press). Given the objectives and scope of the changes made and the positive results obtained, it is suggested that this new version of the measure be called the Inventory of Father and Mother Involvement (IFMI).

Hence, it should be noted that evidence of validity based on the content of the IFMI has already been verified by Santis and Noronha (in press). However, additional evaluations are necessary to correspond to the cumulative and continuous process that is the search for psychometric evidence for measures (AERA et al., 2014). This new evidence will indicate, for example, the latent structure underlying the responses of Brazilian fathers and mothers to the instrument (Damásio, 2012), allowing the evaluation of the invariance of this structure between both parents (Damásio, 2013). In addition to providing evidence of validity for the measure, analyses such as these would also contribute to a better theoretical understanding of parenting, how it is constituted and potential differences between fathers and mothers in Brazil.

Thus, the objective of this work was to advance the psychometric studies of the IFMI, a new version of the IFI-BR-27 able to assess the parental involvement of Brazilian fathers and mothers with children enrolled in Kindergarten to the first years of Elementary School (approximately 2 to 10 years

of age). Specifically, based on a cross-sectional design, evidence of validity based on the internal structure of the instrument was investigated, including factor analysis, precision estimates, and comparison of this internal structure between fathers and mothers.

Method

Participants

A total of 516 fathers and 728 mothers (1244 subjects) participated in this study. To be included in the sample, participants should be parents, have at least one child registered in Kindergarten or in the first years of Elementary School (approximately, from 2 to 10 years of age) and have contact with the child at least once a week. No other restrictions were placed – for example, on the degree of parenthood (e.g., biological or adoptive parent), family configuration or child characteristics. Most participants received an invitation to participate in the study through their child's school (58.4 %), followed by those who received an indication from a friend (15.4 %), who saw the call on a social network (12.1 %) and those who received the indication from a stranger (in a WhatsApp group, for example) (4.3 %) – 9.6 % said they had found out about the survey in another way and 0.2 % did not respond. Participants lived in 22 Brazilian states; most of them in the states of São Paulo (65.7 %), Mato Grosso do Sul (10 %) and Paraná (6.2 %). Regarding age, participants were between 16 and 61 years (M = 36.23; SD = 7.10), 81.7 % were married or in common law marriage – 9.3 % were single, 8.4 % were separated or divorced and 0.4 widowed (0.2 % did not answer this question).

Most participants had completed higher education (50.4 %), followed by those who had completed High School or who had incomplete higher education (32.6 %), completed Elementary School or incomplete High School (7.2 %), incomplete the first years of Elementary School (5.7 %) and completed only the first years of Elementary School (3.9 %); 0.4 % did not respond. Regarding monthly family income, 35.9 % of parents reported income between R$1,000 and R$ 3,000 Brazilian reais (R$); 20.2 % between R$3,000 and R$6,000; 13.2% between R$ 10,000 and R$ 20,000; 11.9 % reported income up to R$ 1,000; 11.3 % between R$ 6,000.00 and R$ 10,000; and 6.5 % reported income greater than R$ 20,000 (1.1 % did not inform) – the minimum wage in Brazil at the time of data collection was R$ 1,212.00. Regarding children, most participants had one (43.4 %) or two (39.9 %) children, but there were also those with three (12.1 %), four (3.2 %) or five or more children (1.4 %). Regarding the target child1 of the study, 51.8% were boys and 47.9 % girls (0.2 % did not inform), and their age ranged from 2 to 11 years (M = 6.10; SD = 2.445).

Instruments

Sociodemographic Questionnaire. Instrument with questions to characterize the sample; for example: how you found out about this survey, where do you live, age, marital status, education, average family income, number of children and gender, age and school cycle of the target child.

Inventory of Father and Mother Involvement (IFMI). The IFMI derives from an instrument originally developed to assess the quality of paternal involvement of US fathers with children aged approximately 5 to 10 years (IFI; Hawkins et al., 2002). The 26 items in this version assess nine dimensions of involvement, using a scoring scale ranging from 0 (*very poor)* to 6 (*excellent)*, or *not applicable*. Its Brazilian version (IFI-BR; Santis et al., 2017; Santis et al., 2022) was adapted for use with fathers of children registered in Kindergarten and in the first years of Elementary School (approximately 2 to 10 years of age). This version has 27 items (IFI-BR-27) that assess the same nine dimensions, and evidence of convergent validity (r = .67 and r = .58) and validity based on the internal structure (χ^2/df = 3, 52; CFI = .937; TLI = .929; and RMSEA = .066) have already been verified (Santis et al., 2024b). Additional evidence also indicates that the instrument is little influenced by social desirability (Santis et al., 2024a). The IFI-BR-27 was later adapted for use with mothers as well, and changes were made to its items, originating the IFMI. Validity evidence based on the content of the IFMI has already been verified (Santis & Noronha, in press).

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[1] When parents had more than one child in Kindergarten or the first years of Elementary School, participants were instructed to focus their responses on one of them. In the first half part of data collection, this should be the oldest and in the second half, the youngest (always considering only those students registered in these two school cycles).

Procedure

The project was approved by the Research Ethics Committee of the Universidade São Francisco, Brazil (protocol number: 4.654.515). Data collection took place online (via Google Forms) from July to December 2021 and was disseminated in different ways: using the investigators' contact networks, social networks and through the newsletter of a Brazilian funding agency. In addition, the data collection was also publicized by schools. To that effect, 13 private schools and 33 Municipal Departments of Education from different Brazilian states were asked to disseminate the study to parents. Four private schools and the Education Departments of 12 municipalities agreed to participate in promoting the project. In all cases, parents received the study invitation as an opportunity to reflect on their parental role. By clicking on the link to access the instruments, they could only start answering them after reading and accepting the Free and Informed Consent Form (FICF). Participants were asked if they would be keen to share their email address to receive a copy of the FICF and general feedback about the study after its completion.

Data analysis

Before conducting the main analyses of this study, a preliminary descriptive evaluation of each item was conducted (mean, standard deviation, asymmetry, kurtosis and corrected homogeneity index). To carry out the main analyses, the total sample of the present study (N = 1244) was randomly divided into two different samples (n = 621 and n = 623). To ensure that both samples were equivalent, t-tests and chi-square tests of independence were performed, comparing the samples in relation to their sociodemographic characteristics. The results indicated that there were no statistically significant sociodemographic differences between the samples.

Exploratory Factor Analysis (EFA)

The EFA was carried out in the Factor program (10.10.02), with a sample composed of 621 parents. The factorability of the data matrix was verified using the Kaiser-Meyer-Olkin criterion (KMO > 0.7) and the Bartlett Test of Sphericity (p < .05) (Tabachnick & Fidell, 2019). EFA was performed using the polychoric matrix and Robust Diagonally Weighted Least Squares (RDWLS) extraction method (Asparouhov & Muthén, 2010). The Parallel Analysis technique with random permutation of the data observed was one of the techniques used to guide the decision on the number of factors to be retained (Timmerman & Lorenzo-Seva, 2011) and the rotation used was Oblimin. Literature information on the concept assessed (quality of parental involvement), and the theoretical framework adopted in the construction of the original instrument, were also used in deciding the factorial structure. Faced with the initial solution of nine factors of the IFI-BR-27 (Santis et al., 2024b), the authors decided to start the analysis by distributing the items into 10 factors – adding to this structure the factor developed in the previous study (Openness to the world). In the following analyses, models with different numbers of factors were tested, including the number of factors suggested by the result of the Parallel Analysis.

The adequacy of the models was evaluated using different fit indexes. Since the intention is to advance the understanding of the psychometric properties of an instrument (IFMI) whose previous version (IFI-BR-27) already presents evidence of validity, the most restrictive criteria for evaluating these indexes were considered, thus ensuring the best internal structure for the IFMI. These indexes and their evaluation criteria were: Root Mean Square Error of Approximation (RMSEA < .06), Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) – CFI and TLI > .95 (Brown, 2006) and the χ^2/df ratio (χ^2/df < 2) (Schweizer, 2010; Tabachnick & Fidell, 2019). Items with a factorial load greater than .30 were classified as adequate (Damásio, 2012). When the results of the fit indexes and factorial loads were adequate, theoretical information about the construct was also used to define the most plausible model for the IFMI. Furthermore, in the interpretation of the factors, those with less than three items were considered unfeasible, as they were more likely to present problems (Kline, 2011), in addition to broadly representing the facet of the construct to which they refer.

Confirmatory Factor Analysis (CFA) and Multigroup CFA

Initially, the internal structure derived from the EFA was evaluated through a CFA, performed using the JASP software (version 0.14.1) and with a sample composed of 623 parents. The analysis was performed using the Robust Diagonally Weighted Least Squares (RDWLS) estimation method, based on

the polychoric correlation matrices (Asparouhov & Muthén, 2010). Three different models of internal structure were evaluated: (a) first order model (correlated factors), (b) second order model (hierarchical) and (c) bifactor model.

Then, the invariance of the factorial structure, for fathers and for mothers, was evaluated by means of a multigroup confirmatory factor analysis (MGCFA), also performed in the JASP software (version 0.14.1), and with the RDWLS estimation method. For each group (fathers and mothers), the invariance was evaluated considering three models, which vary according to the level of the parameters constraints: (a) configural (less restricted), examining the number of factors in the model and the items that are related to each factor, (b) metric, based on the magnitude of the factor loading of the items, and (c) scalar (more restricted), evaluating the invariance at the levels of the intercepts of the items (Damásio, 2013).

The same fit indices (χ^2/df, CFI, TLI and RMSEA) and assessment criteria previously used were also used in the assessment of the CFA. Additionally, the Standardized Root Mean Square Residual (SRMR) was also evaluated, for which the evaluation criterion was to be values lower than .08 (Kline, 2011). To assess the invariance between the groups (fathers and mothers), the differences in the CFI values between the three evaluated models (configural, metric and scalar) were evaluated. Differences of up to 0.01 indicate the invariance of the model with the greatest parameter restriction, between the two models compared (Milfont & Fischer, 2010).

Reliability

The reliability of the factors was verified using Cronbach's alpha and the composite reliability (CR) (calculated using the online calculator from the State University of Montes Claros; Vecon, n.d.). In both cases, values equal to or greater than 0.7 are considered good precision indicators (Tabachnick & Fidell, 2019). The Average Variance Extracted (AVE) was also calculated, indicating the proportion of total variance of the items that is explained by the latent factor – thus reflecting consistency. Although fixed cutoff points are discouraged for its interpretation, values from 0.5 are considered adequate (Hair et al., 2009).

Results

Initial descriptive evaluation of items

Table 1 presents the preliminary descriptive results on the items, considering the total study sample. As can be seen, the average values ranged from 3.98 to 5.54. Additionally, the lowest value of the corrected homogeneity index that was verified was 0.48.

Table 1
Descriptive results of items (N = 1244)

Item	Mean[1]	SD	Skewness	Kurtosis	Corrected homogeneity index
1	4.19	1.59	-0.62	-0.43	0.48
2	4.27	1.57	-0.64	-0.43	0.52
3	5.16	1.17	-1.52	2.10	0.55
4	5.18	1.11	-1.52	2.42	0.64
5	5.18	1.13	-1.64	2.96	0.63
6	4.12	1.56	-0.74	-0.01	0.57
7	4.94	1.28	-1.31	1.42	0.62
8	4.81	1.38	-1.28	1.22	0.57
9	4.75	1.45	-1.25	1.07	0.59
10	5.31	1.04	-1.89	4.13	0.66
11	5.09	1.10	-1.41	2.14	0.73
12	4.52	1.40	-1.02	0.78	0.52
13	4.83	1.24	-1.10	1.01	0.66
14	5.26	1.05	-1.82	3.86	0.66
15	5.07	1.18	-1.56	2.63	0.70
16	4.37	1.53	-0.93	0.34	0.50
17	5.54	0.94	-2.54	7.18	0.60
18	5.06	1.19	-1.51	2.36	0.69
19	5.00	1.16	-1.33	1.82	0.68
20	5.14	1.27	-1.80	3.19	0.56
21	4.54	1.48	-1.05	0.53	0.60
22	4.32	1.51	-0.71	-0.20	0.59
23	4.92	1.24	-1.36	1.90	0.72
24	4.92	1.17	-1.21	1.51	0.72
25	5.13	1.08	-1.50	2.51	0.71
26	4.56	1.41	-0.91	0.37	0.66
27	3.98	1.73	-0.63	-0.47	0.53
28	4.78	1.29	-1.17	1.35	0.62
29	4.90	1.25	-1.30	1.73	0.70
30	4.69	1.32	-1.08	0.95	0.68
31	4.37	1.43	-0.74	0.00	0.61
32	4.90	1.16	-1.19	1.67	0.72
33	4.80	1.27	-1.13	1.05	0.70
34	4.73	1.37	-1.20	1.29	0.61
35	5.05	1.17	-1.53	2.66	0.70

Note. SD: standard deviation.
[1] Possible score ranged from 0 to 6.

Exploratory Factor Analysis

Bartlett's sphericity tests (6994.1, df = 595; $p < .001$) and KMO (0.93) suggested interpretability of the item correlation matrix. In the different exploratory factor analysis carried out, the results of the Parallel Analysis indicated the unifactorial structure as being the most representative of the data. Thus, models indicating from 10 to one factor were tested. Table 2 presents the adjustment indicators verified in each model.

Table 2
Fit indexes of the different tested models (n = 621)

	Indexes			
	χ^2/df	CFI	TLI	RMSEA
Reference value	< 2	> .95	> .95	< .06
Models evaluated				
1 factor	**4.00**	.986	.985	**.069**
2 factors	**3.40**	.990	.988	**.062**
3 factors	**2.72**	.993	.992	.053
4 factors	**2.59**	.994	.992	.051
5 factors	**2.27**	.995	.994	.045
6 factors	**2.06**	.996	.995	.041
7 factors	1.75	.998	.996	.035
8 factors	1.43	.999	.998	.026
9 factors	1.03	1.000	1.000	.007
10 factors	0.65	1.000	1.000	.000

It should be observed that the models assessed presented suitable results for most fit indexes. However, a high value for the χ^2/df ratio was found for models with one to six factors and high RMSEA was found for models with one and two factors – information highlighted in bold in Table 2. Thus, for the models that presented all appropriate results (from seven to 10 factors), theoretical assumptions were used for the qualitative analysis of the models – considering the items that would compose each factor and identifying those with more suitable content. This was also done with the unifactorial model, as it was the model indicated by the Parallel Analysis. In Table 3, there is a summary of the factors that were verified in each of these models.

Table 3
Summary of the theoretical interpretation of factors in models with appropriate results (n = 621)

Models	Identified factors							Number of items excluded
	Providing	Support (+ i7)	Discipline (+32)	School	Time + affection	Stimulation	Reading	
10	X	X (without i7)	X	X	X (few items included[1])	X	No	10
9	X	X (+noise)	X	X	X	No	No	10
8	**X (+ i27)**	**X (+noise)**	**X**	**X**	**X**	**X**	**X (+noise)**	**6**
7	X (+ i27)	X (+noise)	X	No	X (+noise)	X (+noise)	No	10

Note. Support: Mother/Father support; Discipline: Discipline and teaching responsibility; School: factor that reflects the school context; Time + affection: combination of items that reflect the content of the factors Time and Talking Together and Praise and Affection; Stimulation: Stimulus to take risks and to persevere; Reading: Reading and Homework Support; Number of items excluded: number of items that would be excluded in each model.
[1]For this model, few items representing the two dimensions that made up the factor were included.

The analysis of the factor loadings of the models showed that, despite the specific differences of each model, seven dimensions of the quality of parental involvement (indicated in Table 3) were consistently found. Among them, some represent factors present in the IFI-BR-27: (a) Providing, (b) Mother/father support, with the addition of an item with theoretical relevance (7: Being involved in the daily or regular routine of taking care of your children's basic needs or activities), (c) Discipline and teaching responsibility, with the addition of a theoretically appropriate item (32: Explain to your child why you consider some behaviors as being wrong), (d) Reading and homework support, (e) School encouragement and (f) a factor that would be the combination of items that reflect the content of the factors Time and talking together and Praise and affection.

The persistent combination of other items also formed some new factors: (g) one that reflects activities that involve the school context and (h) another that grouped two of the three facets of the Openness to the world dimension, both associated with stimulation (to risk-taking and to perseverance). However, in the different models presented in Table 3, some factors were identified with noise, which are additional items that distort the predominant theoretical meaning of the factor. These items, as well as those that made up factors with less than three items or factors without theoretical meaning, should be excluded from the instrument's final structure.

Regarding the unifactorial model, it was suggested by Parallel Analysis. However, unlike most of the other models, it did not present satisfactory adjustment indices, as shown in Table 2. Furthermore, the theoretical analysis showed that it would include items that bring different understandings (albeit complementary) on different factors of parental involvement. For example, this single factor would include items describing a direct parental involvement with the child (such as "Helping your child with homework") and an indirect involvement related to financial support (such as "Managing money to be able to afford child's expenses") or to supporting the other parent (such as "Giving your child's mother/father encouragement and emotional support"). Another example could be the indistinction between behaviors that aim to discipline the child (such as "Setting rules and limits for your child's behavior"), from those behaviors that portray affection between parents and children (such as "Telling your children that you love them"). Although all these dimensions represent, in general, the quality of parental involvement, it is understood that the single factor would imply a significant loss in understanding about the specificities of the construct.

Bearing this in mind and considering the results presented in Tables 2 and 3, it is understood that the model derived from the indication of eight factors (highlighted in bold in Table 3) would be the most suitable for the IFMI. Regarding the percentage of variance explained for this model, this varied from 52.79 % to 2.34 % per factor, being 76.88 % considering all factors. Additionally, this model is able to adequately represent the seven dimensions consistently identified in the other models assessed, thus implying the exclusion of only six items (the lowest value compared to other models). The items excluded and the reasons for exclusion were: (a) three items that made up a factor that was not theoretically interpretable (3: "Providing your children's basic needs", 4: "Talk to your child about the risks of each situation" and 5: "Praising your children for being good or doing the right thing"), (b) two items that were making noise in the "Reading and homework support" factor (1: "Attending, even if online, events your child participates in") and in the "Support" factor (10: "Praising your child for something he/she has done well"), and (c) one item that did not load on any factor (7: "Being involved in the daily or regular routine of taking care of your children's basic needs or activities"). In addition, the model showed adequate factor weights (> 0.30) and fit indices (χ^2/df = 1.43; CFI = .999; TLI = .998; RMSEA = .026) in the EFA.

Confirmatory factor analysis (CFA), reliability and multigroup CFA

The CFAs were performed considering the final model of the EFA, previously reported. In this model, 29 items are included (thus excluding items 1, 3, 4, 5, 7 and 10). Considering the above, the presence of seven factors was indicated for this analysis (since, in the eight-factor model considered the most adequate, one factor was not theoretically interpretable). In Table 4, we present the results of the three models evaluated in the CFA. It is observed that all models presented fit indices within the established parameters. Although the bifactor model presented the most adequate indices, it was the only one with factorial weights below the criterion. The other two models, in addition to the fit indices, also presented factorial weights within the expected range.

Table 4
Results of CFA based on the final structure for the IFMI (n = 623)

|	Factorial weights	χ^2/df	RMSEA	TLI	CFI	SRMR
Reference value	> 0.30	< 2	< .06	> .95	> .95	< .08
Model						
1st order	≥ 0.337	1.10	.013	.998	.998	.051
2nd order	≥ 0.336	1.17	.017	.997	.997	.052
Bifactor	≥ 0.040	1.05	.009	.999	.999	.049

As in previous studies with the instrument, when answered only by fathers (Santis et al., 2024b), the results of the first and second order models are close, with slightly better rates for those of the first order. As Santis et al. (2024b) did, in order to contribute to the decision of which model would best represent the present study's data and the construct assessed, we observed some results that could indicate the plausibility of a second-order hierarchical variable. One of these indicators is the magnitude of the correlation between the factors in the first-order model, which, in this study, ranged from .597 to .868 – indicating the possibility that there is a latent structure influencing the instrument's specific factors. Furthermore, in the bifactor model, the factor loadings were significantly higher in the general factor (ranging from .274 to .721) than in the specific factors (ranging from .096 to .680), which also strengthens the plausibility of the second-order factor. As pointed out by Santis et al. (2024b), theoretical characteristics also support this idea, indicating the possibility that a more generic variable influences or enables variations in the quality of parental involvement. Hence, we considered the second-order model to be the most suitable for the IFMI. Complete results of this model are shown in Figure 1.

The reliability of all factors was adequate for both evaluated indicators, as can be seen in Table 5. Results were also adequate for the EVA, although some values were lower than the criterion.

Table 5
Reliability results (Cronbach's Alpha, Composite Reliability, and Average Variance Extracted)

	Cronbach's Alpha	CR	AVE
Reading and homework support	.74	.74	.49
Mother/Father Support	.69	.71	.45
Providing	.62	.74	.38
School Encouragement	.87	.87	.58
Stimulus to take risks and to persevere	.77	.77	.46
combination of Time and talking together and Praise and affection	.85	.85	.54
Discipline and teaching responsibility	.85	.86	.60

Note. CR: composite reliability; AVE: Average Variance Extracted.

Figure 1
Representation of the final factorial structure and results of the CFA (n = 623)
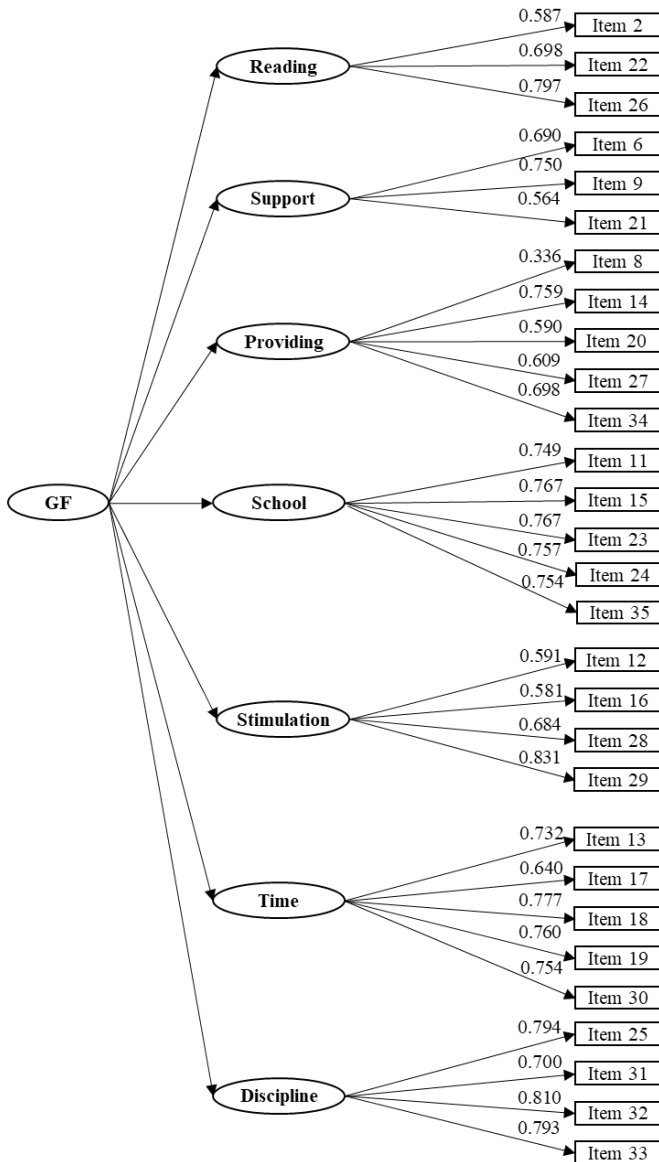
Note. GF: General factor; Reading; Reading and homework support; Support: Mother/Father Support; School: School Encouragement; Stimulation: Stimulus to take risks and to persevere; Time: combination of items that reflect the content of the factors Time and talking together and Praise and affection; Discipline: Discipline and teaching responsibility.

The invariance of this model was evaluated for fathers and mothers. In Table 6, we present the fit indices for the three models assessed, with different restriction levels (configural, metric and scalar). As can be seen, the fit indices were adequate for all models, and the variations in CFI values were .005 between the configural and metric models and .001 between the metric and scalar models. Thus, we verified the invariance of the proposed internal structure for the IFMI, for fathers and mothers, for all levels of assessed restriction.

Table 6

Invariance analysis, for fathers and mothers, of the IFMI structure – without items 1, 3, 4, 5, 7 and 10 (n = 623)

	χ^2/df	RMSEA	SRMR	IFI	GFI	TLI	CFI	ΔCFI
Reference value	< 2	< .06	< .08	> .95	> .95	> .95	> .95	≤ 0.01
Model								
Configural	0.74	0.000	0.060	1.009	0.980	1.009	1.000	
Metric	1.01	0.005	0.070	1.000	0.972	1.000	1.000	0
Scalar	1.01	0.005	0.069	1.000	0.997	1.000	1.000	0

Note. IFI: Bollen's Incremental Fit Index; GFI: Goodness of Fit Index.

Discussion

The objective of the present study was to continue the cumulative process of searching for evidence of validity for the expanded and adapted version of the IFI-BR-27 for fathers and mothers (called Inventory of Father and Mother Involvement – IFMI). This process was initiated by Santis and Noronha (in press), who verified adequate evidence of content validity. In the present study, additional validity evidence based on the IFMI internal structure was identified, in addition to adequate estimates of reliability and invariance for both parents. Besides being an additional proof of quality of the instrument, these results also contribute to the understanding of the parental involvement in contemporary Brazil.

In view of the procedures performed by Santis and Noronha (in press) (mainly, the creation of new items and application in a different sample – which included mothers), it was necessary to reassess the way fathers and mothers understood the phenomenon underlying the items that make up the instrument. Techniques such as the EFA, used in the present study, are essential to achieve this objective (Damásio et al., 2021). Then, based on the understanding derived from the results of the EFA, the CFA was performed. Since the CFA is a restrictive and theory-oriented analysis (Peixoto & Martins, 2021), its use in this study was necessary to test the plausibility of the structure suggested in the EFA.

Although the results of AFE and AFC are adequate in their broad majority, that was not the case with reliability results. For two of the seven factors of the IFMI, reliability estimates were below the criteria (Mother/Father support, α = .69 and CR = .71; and Providing – α = .62 and CR = .74), but only when considering the Cronbach's alpha. These factors also presented the lowest AVE values. For the Mother/Father support factor, the value found is close to the criterion, and the factor is composed of only three items. It is known that reliability values tend to be penalized in factors with fewer items (Graham, 2006). The same consideration can be made regarding the Providing factor, which is composed of five items. However, it is known that this is a dimension of parenting that has not yet been well elaborated in the scientific literature (Doucet, 2020), even though its recognition as part of parenting is old (Lamb, 2000; Olmstead et al., 2009). This difficulty contributes to the inconsistency of its definitions and operationalizations (Schmidt, 2018). This reliability result of the present study may be a consequence of this characteristic. Thus, it is understood that the present study brings a practical and conceptual advance, as it considers and operationalizes this important parenting dimension. However, future studies may evaluate the items here included. It could also be interesting for future studies to test additional items to compose these factors.

In addition to evidence of validity based on internal structure, the EFA and CFA results provide important theoretical information on parenting. As proposed in the IFI, for father involvement (Hawkins et al., 2002), the results of the present study also indicated parental involvement as a multidimensional construct, corroborating what has been verified in other studies on parenting (Reid et al., 2015; Smetana, 2017). Since parental involvement can be influenced by the cultural context in which it takes place (Chen et al., 2019), the structure derived from the factor analyses of this study provides empirical indications of how fathers and mothers understand the composition of the dimensions of parental involvement in Brazil – a context in which parenting is still less studied, as demonstrated in the review made by Li and Meier (2017). Thus, as well as in the IFI (Hawkins et al., 2002), in the IFI-BR (Santis et al., 2017) and in the IFI-BR-27 (Santis et al., 2024b), we observe in the IFMI factors that represent an involvement traditionally attributed to men (such as financial support of the family; Olmstead et al., 2009), but also those which portray a direct and daily involvement with the child (such as helping with

homework), a characteristics incorporated into expectations for fatherhood only in recent decades (Cabrera et al., 2000).

Still on the factors identified, we observe that the proposal by Santis and Noronha (in press), to include the assessment of the function of openness to the world in the new version of the IFI-BR-27 (the IFMI), was successful – since one of the factors identified was the Stimulation. This factor reflects two of the three spheres proposed for evaluating this function of the Activation Theory (Paquette et al., 2020): (a) the stimulus to take risk and (b) perseverance, not being contemplated only (c) positive control. However, this last sphere is theoretically associated with the Discipline and teaching responsibility factor, present in the IFMI. In fact, one of the items created by Santis and Noronha (in press) to contemplate the sphere of positive control (item 32) was included into the Discipline and teaching responsibility factor – evidencing the similarity. This range of dimensions is very important to compose a parenting assessment measure. Unlike unifactorial structures, multidimensionality enables a greater understanding of the dimensions in which there is a higher quality of involvement, as well as comparisons of this involvement between parents with different characteristics.

Although there is a trend towards greater equity between men and women in the division of tasks associated with household and children's chores, mothers still concentrate most of these functions (Schoppe-Sullivan & Fagan, 2020). Thus, the IFMI could bring an important contribution to the assessment of how these different factors have been performed by Brazilian fathers and mothers. However, for this comparative assessment to be reliable, the internal structure identified for the instrument needs to be representative of the parental involvement of both fathers and mothers. In the present study, the results of the multigroup CFA were used for this understanding, assessing whether the configuration and measurement parameters were equivalent between the two groups (Damásio, 2013). For some time, studies that investigated the invariance for fathers and mothers on parenting instruments were scarce (Adamsons & Buehler, 2007; Fagan et al., 2014). However, conflicting evidence on the equivalence of parental role of men and women (Cabrera et al., 2014) may be driving this type of investigation.

Thus, studies that compare the structural equivalence between fathers and mothers have been carried out, investigating different aspects related to parenting, such as: feeding practices employed by fathers and mothers (Jansen et al., 2017), the attachment (Nunes et al., 2020) and the bond between father/mother and child (Kullberg et al., 2020). However, a minority of these invariance studies aim to evaluate instruments that measure parenting in a comprehensive way (not focusing on its specific components). Among these studies, most do so for instruments that assess parental involvement with adolescent children (such as Finley et al., 2008; van Heel et al., 2019). In addition to the IFMI, the invariance of the internal structure of the Alabama Parenting Questionnaire, assessed in the United States by Shaffer et al. (2022), also made this assessment (focusing on parental involvement more broadly and with children). However, the present study was the only one identified by the authors so far to make this assessment with Latino or Brazilian populations.

Thus, it is concluded that the IFMI accumulates important evidence of validity for its use in Brazil, and the results of the present study indicate that the measure can be used to compare parental behaviors of men and women. Even so, some limitations must be set in relation to the instrument and these results (mainly considering the composition of the sample that derived them), indicating restrictions of the present study. Initially, as for the results of the present study, even though the parents participating in this survey came from 22 Brazilian states, some states remained unrepresented – Brazil is composed of 26 states plus the federal district. On the other hand, there was an over-representation of the southeastern region of Brazil (mainly due to participants from the state of São Paulo) – although the second and third states with the highest representation were from the central-west and southern regions of Brazil, respectively. Furthermore, half of the participants in this study completed higher education. Even though a greater diversity was verified in relation to family income, more expressive variations in levels of education and income would better represent the reality of the Brazilian population.

Thus, future studies with this instrument should contemplate more diverse samples of Brazilian fathers and mothers. Furthermore, it would be important that additional validity evidence for the IFMI be verified. Validity evidence based on the relationship with external variables, for example, may add to the evidence already verified, indicating whether the use of the new version of the instrument captures

relationships as they are foreseen in theory. For example, one can test whether moderate correlations are verified with correlated constructs (Peixoto & Ferreira-Rodrigues, 2019) to parental involvement, such as coparenting (Schoppe-Sullivan & Fagan, 2020). Finally, studies on the psychometric characteristics of the items are also essential for a better understanding of the IFMI quality – for example, to understand whether there are differences between fathers and mothers at the level of the items. Techniques derived from the Item Response Theory (IRT) may be useful in this test (Peres et al., 2019).

Conclusions

The present study contributed to demonstrate the suitability of using the IFMI with Brazilian fathers and mothers with children registered from Kindergarten to the first years of Elementary School (approximately 2 to 10 years of age), bringing an important contribution to the assessment of parenting in Brazil. To this end, the IFMI would rely on 29 items answered on a scale ranging from 0 (*very poor)* to 6 (*excellent)*, distributed across seven parenting dimensions. In addition to enabling this assessment to be given more reliably, these results also demonstrated the possibility that the IFMI could be used to compare the parental involvement of Brazilian fathers and mothers. This possibility will help to fill gaps in the understanding of current parenting configuration in less studied frameworks, like the Brazilian. Future studies that seek additional validity evidence for the instrument, based on diverse and representative samples of the Brazilian population, are encouraged. The importance of childhood experiences (such as parental ones) for human development is known (Daines et al., 2021). Thus, in practical terms, the existence of a measure such as the IFMI could support the assessment of parental involvement in different Brazilian contexts, investigating the need for and the effectiveness of intervention programs that aim to improve the quality of parental involvement.

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