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ORIGINAL ARTICLE

Maternal Antenatal Attachment Scale (MAAS): adaptation to Spanish and proposal for a brief version of 12 items

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Abstract The psychometric properties of the adapted Spanish version of the Maternal Antenatal Attachment Scale were examined. The main goal was to investigate the reliability and construct validity of the conceptual structure of Condon's proposal. Five hundred twenty-five pregnant women, attending maternal education classes in Bizkaia (Spain), answered the translated and back-translated version of the Maternal Antenatal Attachment Scale. This scale comprises 19 items with five answer choices divided into two subscales: quality of attachment and intensity of attachment. Participants also answered a questionnaire about the reproductive history that was developed ad hoc for the present study. The Spanish adaptation of the Maternal Antenatal Attachment Scale final version comprises 12 items: seven items have been removed due to their inadequate psychometric properties. Internal consistency of the inventory is moderate-high (.73) and it ranges from .68 (intensity of attachment) to .75 (quality of attachment) for the dimensions. Three alternative structural models were proven using a confirmatory factor analysis. Lastly, the two-related-factor model was chosen, as it obtained suitable fit indexes (χ^2=102.28; p<.001; goodness-of-fit index (GFI)=.92; comparative fit index (CFI)=.95; root mean square error of approximation (RMSEA)=.042, 90 % CI [.030–.054]). Due to its adequate psychometric properties, the Spanish version of the Maternal Antenatal Attachment Scale can be proposed as a suitable instrument for the purpose of measuring antenatal attachment. The study of antenatal attachment helps to detect possible difficulties for the mother in establishing an affective relationship with the foetus. This may affect the foetus growth, delivery and the future mother-child relationship.

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Introduction

The mother-child bond, which is established following birth, starts via a profound, enigmatic relationship prior to this (DiPietro 2010). Technically, this is known as maternal-foetal attachment (Alhusen 2008; Pisoni et al. 2014; Yarcheski et al. 2009). Other terms used to name this construct are prenatal attachment (Armstrong 2002; Bouchard 2011; Pellerone and Micciché 2014), parental-foetal relationships (Condon 1985), antenatal emotional attachment (Condon 1993) and antenatal attachment (Condon and Corkindale 1997), among others.

Consensus regarding the definition of the construct of maternal-foetal attachment is moderate. For example, Condon (1993) described maternal-foetal attachment as the emotional bond that is developed between the pregnant woman and her unborn child. Cranley (1981) focused on the extent to which women develop and manifest behaviour that represents both union and interaction with their unborn child. Doan and Zimerman (2002) understand the antenatal bond as an abstract concept representing a relationship between mother and foetus, which is accompanied by cognitive and emotional skills that enable to conceptualize the existence and to foster the development of another human being. Despite the differences, all of them agree in considering that the antenatal bond should be understood via a multi-dimensional approach (Doan and Zimerman 2003; Siddiqui et al. 1999).

The prevailing theoretical model is currently the one proposed by Condon (Condon 1985, 1993; Condon and Corkindale 1997), who considers that the essential experience of maternal-foetal attachment is the love felt by the mother

towards the foetus, which is expressed via a hierarchical construct. From this love felt and expressed by the mother, five subjective experiences emerge. Those experiences mediate between the pregnant woman's love and conduct, namely the dispositions *to know*, *to be with*, *to avoid separation or loss*, *to protect* and *to identify and gratify the needs of the foetus* (Condon 1993). Despite the fact that Condon states that maternal-foetal attachment is defined on the basis of the five aforementioned dispositions, it is important to stress that he also highlights the fact that the essence of the construct is the interrelation among its components (Condon 1993; Condon and Corkindale 1997).

Growing interest in the maternal-foetal bond has led professionals to design assessment tools for this construct. The first scale used to evaluate it was designed by Cranley (1981) and was based on a multi-dimensional model put forward by the author herself. Subsequently, other authors became involved in the same proposal (Van den Bergh and Simons 2009), developing the most-used instruments nowadays: the Maternal-Fetal Attachment Scale (MFAS) by Cranley (1981), the Maternal Antenatal Attachment Scale (MAAS) by Condon (1993) and the Prenatal Attachment Inventory (PAI) by Müller (1993). None of these three instruments has been adapted to Spanish.

As regards the MFAS, there have been several studies that point to its limitations. Some authors question the validity of the scale (Doan et al. 2003; Mercer et al. 1988), while others state that the use of subscales causes problems (Müller and Ferketich 1992, 1993; Sjögren et al. 2004). Another criticism made of the MFAS is that not all its items can be answered from the start of gestation (e.g. some of them refer to quickening) and there is a limited link of some items to the maternal-foetal attachment construct (Van den Bergh and Simons 2009).

Both Condon (1993) and Müller (1993) decided to construct new evaluation instruments for maternal-foetal attachment. Müller developed the PAI, which only provides an overall measurement of antenatal attachment and focuses more specifically than the MFAS on affective aspects of the mother-foetus bond (Brandon et al. 2009). However, the one-dimensional nature of the aforementioned instrument has also been questioned (Barone et al. 2014; Bielawska-Batorowicz and Siddiqui 2008; Pallant et al. 2014; Siddiqui and Hägglöf 2000) and there have been few studies that have examined its psychometric functioning (Van den Bergh and Simons 2009). Moreover, this instrument also contains items that cannot be answered from the start of gestation (Kleinveld et al. 2007).

Condon constructed the MAAS and stressed the need to differentiate between two aspects that the two previous instruments failed to distinguish: the attitude of the pregnant mother towards the pregnancy and maternity and the mother's attitude towards the foetus. The first version of the MAAS comprised 36 items listed as an inventory. Four factors were obtained in the pilot study for this instrument: current attachment to the foetus, current attitude regarding the pregnancy, attitude to future maternity-related events and interaction with the foetus (Condon 1985). Subsequently, Condon (1993) reviewed the scale and proposed a version comprising 19 items that focused specifically on the woman's attitude to the foetus and provided two subscales: *quality of attachment* and *intensity of attachment* or *time in* '*attachment mode*'. The first subscale includes experiences involving closeness, tenderness, pleasure deriving from interaction, anxiety in fantasizing about losing the foetus and the conceptualisation of the foetus as a small person. The intensity of attachment subscale refers to the extent to which the foetus takes up a key position in the emotional life of the pregnant woman, and covers the amount of time devoted to thinking, talking and dreaming about or feeling the foetus (Condon and Corkindale 1997).

A review of the literature on the MAAS has identified three works that involve adapting the scale to other languages: specifically, to Portuguese (Gomez and Leal 2007), Dutch (Van Bussel et al. 2010) and Hungarian (Mako and Deak 2014). However, there are not enough data to assess the functioning and psychometric goodness of the MAAS. Laxton-Kane and Slade (2002) reviewed 23 articles published since 1990 and came to the conclusion that measurements of the maternal-foetal bond needed to be more thoroughly studied. A more recent review (Van den Bergh and Simons 2009) pointed out that there are limited psychometric data available for assessing the MAAS.

Therefore, there are two objectives that have acted as guidelines for the present study: on the one hand, adapting the 19-item version of the MAAS to Spanish and, secondly, studying the psychometric properties of the instrument using suitable procedures for the purpose of analysing its component items and ascertaining its conceptual structure.

Materials and methods

Participants

Five hundred twenty-five pregnant women from the province of Bizkaia (Spain) took part, all of whom attended maternal education classes. Of these, 86.7 % (n=455) attended their classes in public health centres and 13.3 % (n=70) in private centres. The mean age of these women was 33.46 years (standard deviation [SD]=3.71; ranging from 18 to 43 years), having on average reached 31 weeks' gestation (SD=4.39; ranging from 20 to 39 weeks' gestation). Of these, 69.9 % (n=367) had no previous biological children and 77.7 % (n=408) had never experienced any perinatal loss. Of the cases, 7.8 % (n=41) had become pregnant as a result of assisted reproduction techniques.

Procedure

A cross-sectional design was used via a self-administered questionnaire to evaluate pregnant women attending maternal education classes (January 2012–July 2012). Midwives or persons in charge of maternal education classes were contacted at 36 public health centres and 9 private centres in the province of Bizkaia. Of these 45 centres, 29 finally took part.

The following were considered as inclusion criteria: (1) being pregnant, (2) attending maternal education classes and (3) having a heterosexual partner. Exclusion criteria were (1) non-Spanish nationality and (2) problems understanding the language (Spanish).

The questionnaire was completed during the final 15 min of class or once it had ended, depending on the preference of midwives. One member of the research team explained the nature of the study to the participants, requested their collaboration and pointed out the confidentiality criteria regarding the information, the voluntary nature of their participation and their freedom to stop completing the questionnaire once they had started. Except two cases, all women answered the questionnaires. Questionnaires completed by those women (n=25) who were accompanied by their partners were disregarded in order to prevent any possible bias.

Instruments

All the participants in this study responded to a questionnaire prepared specifically for this research that included a series of questions on their reproductive history (gestational age, previous miscarriage, parity and use of assisted reproduction) and the 19-item version of the Maternal Antenatal Attachment Scale (MAAS) by Condon (1993). The MAAS is constructed in the form of an inventory, e.g. for each entry the participant has to choose the response that best fits their experience over the past 2 weeks. Five possible response options are provided for each item, which express a scale from lesser to greater frequency, intensity or quality of conduct or feeling proposed in the wording. Condon (1993) proposed two summary indexes representing the two underlying constructs on the scale: quality of attachment and intensity of attachment or time in 'attachment mode'. To calculate these, the values of the inverse items firstly had to be re-codified so as to then proceed to the average sum of the scores that make up each subscale (Table 1), taking into account the fact that item number 7 does not form part of them as it did not reach enough load weight (≥.40) in either of the two factors in the exploratory analysis carried out in Condon's study (1993). The reliability attained by both scales in the original study was over .80 and ranged between .69 and .80 in the versions adapted to other languages (Gomez and Leal 2007; Mako and Deak 2014; Van Bussel et al. 2010).

The instrument underwent a translation/back-translation process prior to the psychometric assessment of the MAAS in order to adapt it to the Spanish language (Behling and McFillen 2000). In an initial phase, two bilingual people translated the MAAS items independently into Spanish. Both translations were simultaneously discussed by the translators until consensus was reached, with the conceptual equivalence and clarity of the wording of the items being also assessed until an adapted version was obtained. In a second phase, a further two bilingual people who were unaware of the original MAAS version translated the version in Spanish back into English, reaching consensus about a new version in English. Lastly, the back-translated version obtained was compared with the original version in order to contrast its conceptual content-based equivalence, in addition to its consonance in terms of syntax and technique. No differences were found between the two versions.

Data analysis

To describe the characteristics of the sample, frequencies (n), proportions, key tendencies (means—M) and deviations (standard deviation—SD) were measured. For the analysis of the items in the MAAS, the M, SD, asymmetry (S), kurtosis (K) and the correlation coefficient between the item and the rest of the global scale (r_g) or subscale (r_s) were measured, as well as the value of Cronbach's alpha coefficient if the item was removed from the global scale (α_g) or in the case of the subscale (α_s).

The suitability of the correlation matrix was verified to ensure it is factorable on the basis of the Kaiser-Meyer-Olkin test (KMO) and the Bartlett sphericity test. Parallel analysis (PA—Timmerman and Lorenzo-Seva 2011) and minimum average partial method (MAP—Velicer 1976) tests were carried out as extraction criteria for the number of factors deemed advisable according to the configuration of the correlation matrix. Multivariate normality was also analysed using the Mardia test (Mardia 1970).

To validate the instrument based on the theoretical model, a confirmatory factor analysis (CFA) with covariance structural techniques using EQS (Bentler 1995; Bentler and Wu 1995) was conducted. Non-weighted least-square estimation was used to estimate the parameters. The chi-squared test (χ^2) was used to evaluate the goodness of fit of the corresponding model, and this indicated the probability that the variation between sampling variance and covariance matrix and the matrix resulting from the hypothesized model was random. In the event of non-compliance with the multivariate normality, estimations would have been carried out by applying robust methods (Satorra 2003; Satorra and Bentler 2001). Because χ^2 is sensitive to variations in sample size (Schermelleh-Engel et al. 2003), additional measurements of the goodness of fit of the model were used (Hu and Bentler

1999), such as the root mean square error of approximation (RMSEA) and 90 % confidence interval of RMSEA, which considers values <.05 to be adequate and those <.08 to be acceptable; the goodness-of-fit (GFI) and comparative fit (CFI) indexes, with values >.90; and the Akaike information criterion (AIC) to compare the models with different estimated parameters for which lower values would indicate higher parsimony and would be eligible. This last-mentioned model will be graphically presented and indicate the structural relationship parameters using standardized factor coefficients and estimation errors. A significance level of $p<.05$ was chosen for a 95 % reliability interval in order to interpret the results.

Results

Table 1 shows the descriptive statistics for the 19 items comprising the original version of the MAAS. The items have been arranged into subscales based on Condon's results (1993), so that item 7 appears at the end of the table. Generally speaking, except for items 8 and 17, all of them showed a mean score above 3 for a possible range between 1 and 5, which would indicate perceiving an intense, quality attachment. The mean score for the global scale was 4.21 (SD=0.31), with the mean score for the subscale quality of attachment (M=4.68, SD=0.26) being significantly higher (t=53.05; df=524; $p<.001$) than the mean score for intensity of attachment (M=3.57, SD=0.52). Cronbach's alpha for the total MAAS was .74, being .67 and .63 for the subscales intensity of attachment and quality of attachment, respectively.

Five items, one corresponding to the intensity dimension (item 18) and four to the quality dimension (items 12, 15, 16 and 19), evidenced very high asymmetry and kurtosis values (>3) showing a ceiling effect close to or above 90 % in the response to these items. This implies limited response discrimination. Likewise, two items on the intensity scale (items 14 and 18) and three on the quality scale (items 6, 12 and 16) evidenced correlation below .30 with the corresponding subscale total. Disregarding these items would help to improve the internal consistency of the instrument.

Initially, verification of the factor structure for Condon's model was sought through the original scale comprising 18 items (excluding item 7), using CFA techniques from the

Table 1 Descriptive statistics and internal consistency analysis of 19 original items of the MAAS (n=525)

Subscale	Item	1	2	3	4	5	M	SD	S	K	r_g	α_g	r_s	α_s
Intensity	1[a]	6.3	31.4	25.7	20.6	16.0	3.08	1.18	0.18	−1.01	.29	.74	.32	.65
	2	–	0.2	13.9	50.1	35.8	4.21	0.67	−0.33	−0.68	.53	.71	.48	.62
	4	1.3	2.3	26.9	44.2	25.3	3.90	0.85	−0.55	0.43	.37	.72	.38	.63
	5[a]	1.7	25.5	27.4	27.6	17.7	3.34	1.09	0.03	−1.07	.51	.71	.48	.60
	8	11.2	33.0	29.1	21.9	4.6	2.75	1.06	0.16	0.72	.39	.72	.42	.62
	14	1.9	2.7	20.0	46.3	29.1	3.98	0.87	−0.88	1.10	.27	.73	.24	.66
	17	18.3	43.2	17.5	13.1	7.8	2.48	1.16	0.68	−0.39	.38	.72	.39	.63
	18[a]	0.4	–	3.8	5.5	90.3	4.85	0.50	−4.02	18.80	.26	.73	.24	.66
Total subscale							3.57	0.52	0.81	0.85				.67
Quality	3[a]	–	0.2	6.1	28.8	65.0	4.58	0.61	−1.24	0.71	.41	.72	.45	.56
	6[a]	–	4.4	15.8	3.6	76.2	4.51	0.91	−1.55	0.86	.17	.74	.14	.68
	9[a]	–	–	0.6	22.3	77.1	4.76	0.43	−1.46	0.71	.32	.73	.40	.58
	10[a]	1.5	2.7	15.6	67.2	13.0	3.87	0.71	−1.24	3.36	.34	.73	.31	.60
	11	–	0.2	5.3	16.0	78.5	4.72	0.56	−2.03	3.34	.37	.73	.51	.55
	12[a]	–	0.4	1.0	12.0	86.7	4.84	0.41	−3.14	11.90	.23	.74	.28	.61
	13	0.4	0.8	1.5	27.6	69.7	4.65	0.59	−2.18	7.28	.44	.72	.44	.57
	15[a]	–	–	–	5.9	94.1	4.94	0.23	−3.75	12.12	.27	.74	.34	.61
	16[a]	–	0.4	1.3	1.3	97.0	4.94	0.31	−6.75	48.27	.16	.74	.16	.63
	19	–	0.2	0.2	0.6	99.0	4.98	0.17	−13.53	202.39	.19	.74	.27	.62
Total subscale							4.68	0.26	−1.43	2.95				.63
	7[a]	–	1.0	3.2	35.2	60.6	4.55	0.60	−1.28	1.81	.26	.73		
Total scale							4.21	0.31	−0.30	0.48		.74		

M mean, SD standard deviation, S asymmetry, K kurtosis, r_g, correlation coefficient of item with the rest of the scale, α_g coefficient of reliability of the total scale if the item is removed, r_s correlation coefficient of item to the subscale to which it belongs, α_s coefficient of reliability of the subscale if the item is removed

[a] Reverse-coded items

polychoric correlation matrix and the non-weighted least-square method. The correlation matrix was not defined as being positive, and there was no convergence. The data did not show multivariate normality (Mardia standardized estimator=371.69>1.96); it was therefore advisable to disregard those items with aberrant values. A decision was made to disregard items 6, 12, 14, 15, 16, 18 and 19 via the initial descriptive analyses.

KMO (.89) and Bartlett's sphericity (χ^2=1286; p<.001) tests were applied to the polychoric correlation matrix, showing that it was factorizable. Parallel and MAP tests recommended retaining two factors, in which item 7 (initially excluded by Condon) mainly saturated the quality of attachment subscale. From these results, three MAAS structural tests were once again tried out. The first (M1) considers the single-factor solution, the second (M2) the existence of two correlated factors, and the third (M3) a model comprising two factors subsumed in a second-order factor. Neither was multivariate normality obtained, although the Mardia index was significantly lower than that obtained for the total 18 items (23.58< 371.69). For this reason, robust estimation methods were used to assess whether the data fitted the models proposed. The results and fits are shown in Table 2. The single-factor model (M1) was disregarded because it failed to achieve fit criteria in any of the indexes taken into consideration. For their part, models M2 and M3 did evidence suitable fits—slightly better in the case of the two-factor model subsumed in a second-order factor, with significant statistical differences being detected between both (χ^2=4.84; df=1; p=.027). Nonetheless, a decision was made to accept the two-correlated-factor model as it proved to be parsimonious. Figure 1 shows the graph and saturated weights of the items comprising each subscale and the correlation between both.

The internal consistency for the total scale (α=.73) was calculated from the 12 items that had been finally retained, and for the dimensions intensity of attachment (α=.66) and quality of attachment (α=.65). Likewise, composite reliability coefficients were calculated from the factor coefficient and measurement errors provided by the CFA, these being .68 and .75, respectively.

The scores for the summarized indexes of both subscales, which were constructed from the six items retained in each of them, tended to be significantly lower than the indexes constructed from items on the original scale (Table 3). The scores obtained in the quality of attachment dimension were significantly higher than those noted in the intensity of antenatal attachment dimension.

Discussion

The purpose of this study was to adapt the MAAS to Spanish and obtain a version of the instrument with suitable psychometric properties and a factor structure similar to that of the original instrument. The result of this study was a brief version of 12 items that evidenced good fit in the two-factor structure proposed by Condon: six items belonged to the intensity of attachment dimension and six to the quality of attachment dimension.

The results obtained from the sample used in this study showed that some of the items comprising Condon's original scale evidenced little capacity to discriminate participant responses, as they occupied an excessively marked positioning towards the external score: in five MAAS items, over 85 % of participants expressed the maximum score for the wording of the item. This lack of variability made the item a constant value, whereby its contribution to the summary index of the scale tended to overestimate it. In this respect, the scores obtained in both scales with the brief version of the MAAS tended to focus more within the range of possible scores (1 to 5), although they remained above the mean value of this range, thus indicating both high intensity and, above all, quality of the antenatal attachment perceived by pregnant women. Indeed, the mean score obtained in the quality of attachment subscale exceeded by more than one point that observed for intensity of attachment. Similar results were found in the study carried out by Van Bussel et al. (2010), who also found a slight negative asymmetry with significantly higher scores. These results could be due to the features of the sample, i.e. that they were at a very advanced stage of gestation and attended maternal education classes, which implies greater commitment to the gestation period. This effect could be attributed to a reflection of the desirability and involvement of women during gestation: as gestation time increases, the presence of the foetus becomes more noticeable, thus increasing interaction with

Table 2 Structural model of the MAAS on the basis of a confirmatory factor analysis (n=525)

Model	χ^2_{SB}	χ^2_{SB}/df	p	AIC	GFI	AGFI	CFI	RMSEA (90 CI)
M1—single factor	182.10	3.37	0.001	70.10	.85	.78	.87	.067 (.057 to .078)
M2—two correlated factors	102.28	1.93	0.001	−3.72	.92	.89	.95	.042 (.030 to .054)
M3—two factors subsumed by a second-order factor	97.44	1.87	0.001	−6.55	.92	.89	.95	.041 (.028 to .053)

χ^2_{SB} Satorra-Bentler chi-square test, p probability value, *AIC* Akaike information criterion, *GFI* goodness-of-fit index, *AGFI* adjusted goodness-of-fit index, *CFI* comparative fit index, *RMSEA (90 CI)* root mean squared error of approximation (90 % confidence interval)

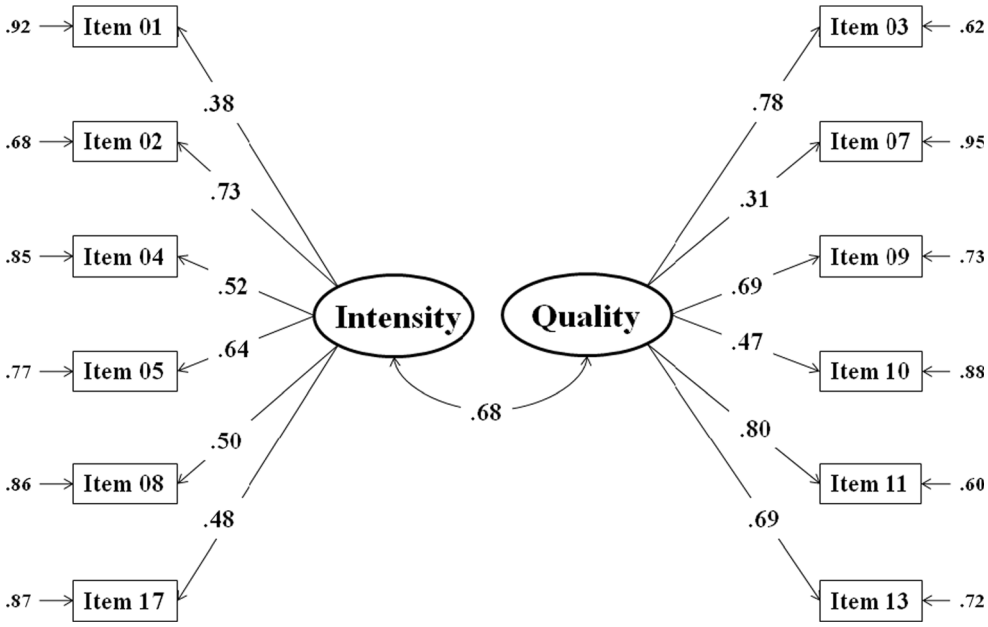

Fig. 1 Confirmatory factor analysis of the MAAS (two-correlated-factor model)

the pregnant mother and resulting in greater physical and psychological involvement with the foetus.

The brief version of the MAAS offered a factor solution in accordance with that proposed by the author of the scale (Condon 1993), maintaining a two-dimensional structure that referred to the intensity and quality with which pregnant mothers perceived the bond they had with the foetus. Three possible conceptual models were tried out in our study. The single-factor model found no empirical support, i.e. the shaping of the items expresses the existence of two differing latent components, albeit ones which are related to each other. Proof of this lies in the fact that the correlated factor model evidenced an association of .68 between both factors, and the two-factor model subsumed in a general, second-order factor also evidenced a good fit, with the quality dimension carrying greater weight than the intensity dimension. This implies that, when assessing the mother-foetus bond, it is important to take both dimensions into consideration independently, although it would also be reasonable to obtain a global score for the construct.

Conceptually, Condon (1993) proposed a hierarchical maternal-foetal attachment model made up of five dimensions. However, when he developed his antenatal attachment assessment instrument (the MAAS), he only focused on quality of attachment and intensity of attachment; he did not take into consideration dispositions which, based on his theoretical model, are indicators showing that the pregnant woman has established an affective bond with the foetus. Although it is true to say that some of the items would seem to deal with the content of the five dimensions that the author theorized, others are difficult to classify in some of them. For instance, the final item of the MAAS refers very clearly to the *avoid separation or loss* disposition, but there is only one item that could be categorized within this dimension. Other items, such as numbers 8 and 18, might be classified in the disposition *to be with*. Yet this task cannot be performed with all of them: each item does not refer to one of the five dimensions. Some of them, such as numbers 2, 3, 11 and 13, refer to the tone and emotional intensity of the pregnant mother regarding the foetus. It is also difficult to draw a distinction between those items referring to the disposition *to protect* and disposition to *identify and gratify the needs of the foetus*. Moreover, items such as number 9 may simultaneously be related to two dimensions: disposition *to know* and disposition *to be with*. To

Table 3 Contrast of differences between MAAS dimensions in its original and brief versions

Model		Mean	SD	Contrast	dif.	*t*	*p*
Original MAAS	Intensity	3.57	0.52	Brief vs. original intensity dimension	−0.28	37.77	.001
	Quality	4.68	0.26	Brief vs. original quality dimension	−0.16	19.67	.001
Brief version[a]	Intensity	3.29	0.62	Quality vs. intensity dimensions in brief version	1.23	48.43	.001
	Quality	4.52	0.35				

dif. mean differences, *t t* test pairs, *p* probability value

[a] In the brief version, both scales are composed of six items

sum up, the items contained in the MAAS do not reflect the theoretical dimensions postulated by its author in terms of content, and the items that might be classified within some of the dimensions referred are few and differing in number within the instrument.

As Van den Bergh and Simons (2009) pointed out, existing psychometric data that can be used to assess the MAAS are few and far between. In his original study of the scale, Condon (1993) carried out an empirical study in which only 112 pregnant women took part. When conducting the exploratory factor analysis using varimax rotation, a factor solution was obtained that reflected the two factors proposed by the author. The reliability coefficients obtained in this study were above .80. However, the author failed to specify the specific values obtained.

Another study that was reviewed in which the scale was analysed was that carried out by Gomez and Leal (2007). These authors prepared a Portuguese version of the MAAS with suitable internal consistency and test-retest stability. One hundred seven pregnant women took part in their study and the authors pointed out that the antenatal attachment assessed via the MAAS was one dimensional. They did not support the idea that quality of attachment and intensity of attachment were distinct components of antenatal attachment. Furthermore, they disregarded two items from the instrument (number 10 and number 12), instead creating a version with 17 items. The reliability coefficient obtained for this version of the instrument was .78.

The third study of the MAAS that was reviewed was carried out by Van Bussel et al. (2010), who developed the Dutch version of the scale. Four hundred three pregnant women took part in this study over three gestational trimesters. However, these authors did not study the factor structure of the MAAS, although they did study its reliability and pointed out that it was lower than that obtained in the original study by Condon (1993): .79 in the first trimester of gestation, .80 in the second and .78 in the third. Reliability coefficients for the quality of attachment subscale ranged from .69 to .73 over the three trimesters, and between .73 and .77 in the case of the intensity of attachment subscale. Significant and moderate correlations were found between both subscales over the three trimesters.

Mako and Deak (2014) developed the Hungarian version of the MAAS. This study involved 237 women within different stages of pregnancy, and the authors concluded that the instrument was a reliable and valid measure of maternal prenatal attachment from an early stage of pregnancy. The reliability coefficient obtained for this version of the instrument was .87. Reliability coefficient for the quality of attachment subscale was .80 and .77 for the intensity of attachment subscale. Moderately strong correlation was found between these two subscales. These authors did not analyse the factor structure of the MAAS.

As can be concluded from the results of the four studies found in the literature on the scale, data with which to compare the brief version adapted to Spanish of the MAAS are limited. The first two studies analysed the instrument with a very small number of participants, while the other two studies, which assessed a large number of individuals, did not examine the factor structure of the instrument. Thus, more studies are needed to get evidence regarding the dimensional structure of the MAAS and its psychometric goodness needs to consolidate.

Some limitations are worthy of note in our study. The first to be mentioned refers to the features of the participants in the study. All the pregnant women were from the same province (Bizkaia), were at the later stages of pregnancy and attended maternal education classes. The women who attended these sessions were possibly those who felt most attachment to the foetus and were most involved in the pregnancy and maternity. Moreover, they were at a very advanced stage of gestation in which attachment to the foetus tends to be great. Social desirability, which has not been assessed in this study, is another variable that may have influenced the high scores obtained. This desirability was increasingly noted by those administering the test as a group and in the presence of the chief midwife in each of the maternal education groups, and to this should be added the limitations of the self-report measures themselves: responding without clearly understanding the item content, responding quickly and imprecisely owing to a lack of motivation, etc.

Therefore and in order to overcome the limitations referred to above, it would be interesting to refine the MAAS in future studies. It is suggested to carry out the empirical study with women from different locations and the three gestational trimesters. It would also be interesting to assess those who reject maternal education sessions and control social desirability using some additional measure. Lastly, complementing the information provided by the MAAS by in-depth interviews about the relationship with the foetus might provide additional interesting data with which to continue adapting the instrument.

The brief Spanish version of the MAAS makes it possible to successfully assess quality and intensity features of maternal-foetal attachment at the later stages of pregnancy, as construct validity and reliability show. The study of this construct is of both theoretical and clinical relevance, and the brief MAAS is the first instrument that has been adapted to Spanish in order to assess it. A brief instrument such as the MAAS can help to detect possible problems in establishing a bond with the foetus with negative consequences both on the antenatal and postnatal levels, in order to plan early intervention aimed at encouraging quality antenatal affective relationship.

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Ethical standards The Research Ethics Committee at the University of Deusto (Bizkaia, Spain) reviewed and provided ethical approval for this research project to proceed. The information obtained was only used for research purposes. Participation in the study was voluntary, and the information obtained was confidential and used solely for research purposes.

Conflict of interest The authors declare that they have no conflict of interest.

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