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Sensibilidad y especificidad del "Cuestionario de Edades y Etapas: Socioemocional" (ASQ: SE-2) en una población colombiana

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Sensitivity and specificity of "Ages and Stages Questionnaires: Social-emotional" (ASQ: SE-2) in a Colombian population

Recibido: Febrero 07 de 2021 | Revisado: Marzo 03 de 2021 | Aprobado: Septiembre 02 de 2022

Cómo citar este artículo: Castellanos-Páez, V., González, D. & Montañez-Reyes, L. (2022). Sensitivity and specificity of "Ages and Stages Questionnaires: Social-emotional" (ASQ: SE-2) in a Colombian population. *Tesis Psicológica, 17*(2), 132-145. https://doi.org/10.37511/tesis.v17n2a7

ABSTRACT

The timely detection of risks in emotional development requires valid and reliable instruments that sufficiently evaluate the construct. In Colombia, the Personal-social Subscale of the Abbreviated Development Scale (EAD-3 by its acronym in Spanish) is used; however, there are instruments that more fully evaluate the dimensions of social-emotional development for which there is no conclusive evidence on their sensitivity and specificity in the Colombian population. This instrumental study had the objective of identifying the sensitivity and specificity of the questionnaires for 6, 12, 18, 24, 30, and 36 months of the ASQ: SE-2. The sample comprised 512 boys and girls between 3 and 36 months of age from one Colombian city and are part of the Colombian Institute of Family Welfare and the Secretariat for Women, Gender Equality, and Social Development. A comparative analysis between the ASQ:SE-2 and the personal-social subscale of the EAD-3 showed a relationship between the two instruments to identify risk in social-emotional development in the 6 (X2(1, 85) = 7.869, p=.005), 18 (X2(1, 97) = 15.966, p=.000), and 36 months (X2(1, 50) =11.387, p=.001) questionnaires. The ASQ:SE-2 reports optimal levels of specificity and adequate sensitivity in the 12 and 18-month questionnaires. The results provide positive evidence for the use of the ASQ:SE-2 as a recommended instrument for screening social-emotional development in the Colombian population.

Keywords: social-emotional development, psychometrics, ASQ: SE-2, EAD-3.

RESUMEN

La detección oportuna de riesgos en el desarrollo emocional requiere instrumentos válidos y confiables que evalúen suficientemente el constructo. En Colombia, se utiliza la Subescala Personal-Social de la Escala de Desarrollo Abreviada (EAD-3 por sus siglas en español); sin embargo, existen instrumentos que evalúan de manera más completa las dimensiones del desarrollo socioemocional, para las cuales no hay evidencia concluyente sobre su sensibilidad y especificidad en la población colombiana. Este estudio instrumental tuvo como objetivo identificar la sensibilidad y especificidad de los cuestionarios para 6, 12, 18, 24, 30 y 36 meses del ASQ: SE-2. La muestra estuvo compuesta por 512 niños y niñas entre 3 y 36 meses de edad de una ciudad colombiana, y son parte del Instituto Colombiano de Bienestar Familiar y la Secretaría de la Mujer, Igualdad de Género y Desarrollo Social. Un análisis comparativo entre el ASQ: SE-2 y la subescala personal-social del EAD-3 mostró una relación entre los dos instrumentos para identificar riesgo en el desarrollo socioemocional en los cuestionarios de 6 (X2(1, 85) = 7,869, p = 0,005), 18 (X2(1, 97) = 15,966, p = 0,000) y 36 meses (X2(1, 50) = 11,387, p = 0,001). El ASQ: SE-2 reporta niveles óptimos de especificidad y sensibilidad adecuada en los cuestionarios de 12 y 18 meses. Los resultados brindan evidencia positiva para el uso del ASQ: SE-2 como un instrumento recomendado para el cribado del desarrollo socioemocional en la población colombiana.

Palabras clave: desarrollo socioemocional, psicometría, ASQ: SE-2, EAD-3.

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Introduction

Social-emotional development is understood as the capacity to achieve optimum levels of social and emotional competencies, which allow for establishing positive relationships and fulfilling personal goals (Squires et al., 2015). This process involves the development of competencies throughout the cycle of life, such as self-recognition and self-regulation autonomy, cooperation, and social communication, among others (Chalata-Chambi, 2021; Gómez, 2019). The first years of life are crucial because, since birth, children rapidly develop their abilities to experience and express different emotions and to face and handle a variety of feelings (Nieves & Rodríguez, 2016; Salzwedel et al., 2019). Such abilities are produced together with those related to motor control, cognition, and language. In fact, learning how to handle their emotions is, for some children, more difficult than learning to count or read, and, in some cases, this could be an early sign of future psychological problems, such as the difficulty in functionally adapting to a school context and to form successful relationships throughout their lives (Suárez & Castro, 2022).

Likewise, empirical evidence has allowed establishing social-emotional competencies developed during childhood as important predictors of children's mental health, school readiness, well-being, academic success, and easiness of participating in different processes and contexts (e.g., School and family) (Denham, 2019; Gadaire et al., 2021; Im, Jiar, & Talib, 2019). Correspondingly, these competencies have been considered essential for problem-solving, collaboration, and bouncing back from difficulties (Moreno et al., 2018).

However, various factors can hinder social-emotional development. Examples are the lack of early stimulation and the existence of biological risk factors such as diseases during pregnancy and premature birth. Similarly, social risk factors such as economic deprivation, low levels of education or violent contexts, and maternal stress, among others, are also likely to hamper this aspect of development (Aaron & MizeI, 2022; Ibañez & Mudarra, 2014). In Colombia, a study carried out in Bogota to determine the prevalence of developmental delay in preschool-age children showed that 9.8% of the 2,043 children evaluated exhibited some deficit regarding personal-social interactions (González-Reyes et al., 2007). In 2013, according to a survey conducted in around 10,000 Colombian households (out of which 6,000 were urban and 4,000 were rural), 20% of the boys and girls under 5 were at risk of social-emotional delay (Bernal et al., 2015). These figures suggest the need for early detection of developmental delays in order to facilitate timely interventions through social competence measures that are brief, easy to apply, and useful for assessing the construct in preschool children. However, without valid psychometric screening tools, children in need of early intervention may not be identified, referred to, and treated (Dougherty et al., 2015).

The scientific literature reports significant improvements in child development when social-emotional progress issues are timely detected and intervened in. Similarly, when primary caregivers know the correct ways to enhance child progress, developmental lags are leveled out (Galvis-Serna et al., 2021; Im, Jiar, & Talib, 2019). Nevertheless, there is evidence of a gap in the evaluation of social-emotional development in clinical contexts, wherein this parameter is frequently assessed through verification lists that provide either incomplete evaluations or are plainly not valid methods since they tend to detect a lower number of cases than there actually are (Godoy & Carter, 2013).

Therefore, it has been proposed to resort to detection instruments that include the necessary psychometric characteristics to measure the construct in question specifically and are in accordance with the age, cultural values, and circumstances of the context in which the measurement is intended to be carried out (Heo & Squires, 2012). In this sense, validated tools allow for better detection and an increased probability that the children found to be at risk receive treatment for their mental health (Barger et al., 2018); hence, the importance of psychometric research in child-development-care contexts.

The present work suggests the early evaluation of social-emotional development problems, which is addressed by the Ages & Stages Questionnaires: Social-Emotional, Second Edition (ASQ:SE-2), through the assessment of the main factors determining social-emotional development milestones. This instrument has reported an internal consistency of 91%, measured using Cronbach's alpha coefficient, and a validity of 71% to 90%, obtained through concurrent measurements with an 84% general agreement (Squires et al., 2015). This instrument has been validated in countries such as Norway (Stensen et al., 2018), reporting high specificity and sensitivity in the 30-to-60-month questionnaires. For their part, the 18-to-24-month questionnaires demonstrated more limited efficacy in detecting children at risk. In the Netherlands, good specificity and sensitivity were only observed in the ≥18 months-of-age versions (Krijnen et al., 2021). In Latin America, in countries such as Uruguay (Alvarez-Nuñez et al., 2020) and Perú (Gudiel-Hermoza et al., 2021); in Uruguay, it showed adequate sensitivity, specificity, and criterion validity to detect children whose social and emotional development requires further evaluation or continuous monitoring. Finally, in Perú, the ASQ:SE-2, applied to parents of children from 15 to 48 months of age, proved to be a reliable and valid tool for the surveillance and screening of social-emotional development (Gudiel-Hermoza et al., 2021). However, no data has been found on the sensitivity and specificity of the instrument in a Colombian population. For this reason, the objective of this research is to identify the sensitivity and specificity of ASQ:SE-2 in children from 3 to 36 months, thus contributing to the early detection of social-emotional problems in children and promoting their well-being and healthy development.

Methodology

Research design

The current one is a quantitative investigation aimed at a psychometric instrument design; this includes the design, adaptation, and studies of psychometric properties –namely sensitivity and specificity– of ASQ: SE-2 (Montero & León, 2007).

Participants

The participants were selected by probability sampling, with a 5% margin of error. The sample was composed of 512 children from the city of Tunja, Colombia: 253 boys and 259 girls aged between 3 and 36 months, coming from the Child Development Centres of *Instituto Colombiano de Bienestar Familiar* (ICBF), the Secretariat of Women, Gender equality and Social Development, and private educational institutions. The socioeconomic strata of the participants were the following: 150 boys and girls (29.3%) from 1; 156 (30.5%) from 2; 57 (11.1%) from 3, and 2 (0.3%) from 4. With regards to family type, 242 children (47.3%) reported belonging to a nuclear family (mother, father, and child/children); 141 (27.5%) to an extended family (mother, grandparents, and child/children); 21 (4.1%) to a mixed family (parents, grandparents or uncles/aunts, and children); and 69 (13.5%)

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to a single-parent family (single mother or father and his/her child/children). The inclusion criteria selected children who resided in Tunja and corresponded to the specified age range at the moment of conducting the research. Children diagnosed with some disability (Down syndrome, global developmental delay, mental delay, speech impediment, cerebral palsy) were excluded from the sample.

Instruments

Ages and Stages Questionnaires Social Emotional (ASQ: SE-2)

Originally designed by Jane Squires, Elizabeth Twombly, and Diane Bricker (2015), ASQ:SE-2 evaluates self-regulation, obedience, communication, adaptative behavior, autonomy, affection, and interaction with people. The present work resorted to the adapted Spanish version developed by its original authors, which comprises nine questionnaires to be used according to the age of the children (2, 6, 12, 18, 24, 30, 36, 48, and 60 months). The questionnaires to be validated in the present investigation (6, 12, 18, 24, 30, and 36 months), respectively, have 26, 30, 34, 34, 36, and 38 items to be answered. Within the total number of items, there are four qualitative ones, while the rest are of the Likert type, with four possible responses (Always, Sometimes, Never, and Mark if this concerns you.) ASQ:SE-2 classifies its results into three levels: Within Expectation, Observe (i.e., one standard deviation above the mean), and Consult (i.e., two standard deviations above the mean). ASQ:SE-2 has an internal consistency measured using Cronbach's alpha coefficient (91%), which indicates solid relations between the total scores of the questionnaire and the individual items. The validity was obtained through concurrent measurements and varied from 71% to 90%, with an 84% general agreement (Squires et al., 2015).

Abbreviated Development Scale (Escala Abreviada del Desarrollo - EAD-3)

EAD-3 started as a collaborative project between the Colombian Ministry of Health and the United Nations Fund (UNICEF). To come up with this last version, a consensual dialogue took place among experts from *Pontificia Universidad Javeriana* (2016). The instrument in its current form contains 144 items distributed uniformly in four areas of development: Gross motor skills, Fine motor skills, Hearing and Language, and Personal-social. The Personal-social area includes processes related to the initiation and response to social interaction, dependence and independence, expression of feelings and emotions, and learning behavioral patterns related to child self-care.

EAD-3 covers 12 age ranges which guide the evaluator according to the child's age utilizing a nominal scale with values 0 or 1 (if they present the condition or not). After evaluating a pilot test of this version, the position of some items was adjusted, as well as the formulation of statements, the conditions of observation, and the score criteria. The purpose is to identify, from an early age, the delay risk in the development of Spanish-speaking boys and girls up to 7 years of age. The results of the children in each one of the areas of the scale can be classified as development expected for their age (green region), risk of developmental problems (yellow region), and suspicion of developmental problems (red region). EAD-3 reports two types of scores: direct and typical scores (expressed on a T scale, M=50 and DS=10).

Procedure

The current work, which included a quantitative study and an instrument design process, was developed in three phases: a) Endorsement and informed consent, b) Application and scoring

of the instrument, and c) Data analysis. In the first phase, the research was endorsed by the ethics committee of the *Universidad Pedagógica y Tecnológica de Colombia*. The parents of the selected children were contacted via phone. Later on, they attended a meeting wherein the objective of the investigation and the voluntary character of the participation in it were explained, after which they filled out the informed consent, where the ethical considerations were detailed (Law 1090 of 2006, resolution 8430 of 1993 from the Colombian Ministry of Health). In the third phase, the statistical analysis permitted calculating the sensitivity and specificity of the instrument.

Data analysis

The data were analyzed in SPSS Statistics version 28. First, the descriptive statistics of the social-emotional development of the sample were evaluated by gender. The results obtained from the children evaluated through ASQ:SE-2 were classified based on the criteria established by Squires et al. (2015): Within Expectation, Observe (+1 SD), and Consult (+2 SD). In the second stage, contingency tables containing four types of data (i.e., true positive, false positive, false negative, and true negative data) were developed for each ASQ:SE-2 age interval using cutoff scores (1.0 standard deviation above the mean) to conduct comparisons with EAD-3. Using the data contained in the contingency table, the sensitivity, specificity, false positive rate, false negative rate, positive and negative predictive values, and agreement, percentages were calculated for each ASQ:SE-2 age interval. Sensitivity is the proportion of children correctly identified by the questionnaires as needing further assessment. Specificity is the proportion of children correctly identified by the questionnaires as undergoing typical development processes. The positive predictive value is the proportion of children identified by the questionnaires as needing further assessment who will have intervention needs. The negative predictive value is the proportion of children identified as developing typically, and the agreement percentage is the ratio of concordance between the screening tool and the standardized assessment.

Ethical considerations

The present study conveyed a minimum level of risk because the applied research techniques and methods implied no intervention or intentional modification of the biological, physiological, psychological, or social characteristics of the individuals who participated in the study. The informed consent was correctly filled out, thus guaranteeing the voluntary participation and total confidentiality of the data obtained and analyzed during the investigation, in strict compliance with the constitutional regulations for the protection of personal data. No conflict of interest was involved in the present research. There was no funding from any entity, and its sole purpose corresponds to the dissemination of information for academic purposes, which may serve as input for future investigation.

Results

Risk prevalence in social-emotional development

The prevalence of boys and girls at social-emotional development risk was analyzed (Table 1). The statistical analysis revealed that the average ranges of the total scores did not vary significantly between boys and girls (U Mann Whitney (1, 512) = 3.074, p = 0.08). No significant variation was found either by levels of social-emotional development (Within expectation, Observe and Consult) ($X2$(1, 512)= 4.621, p=.09). However, in the six and twelve-month ranges, there were higher percentages of girls

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requiring observation. In the case of boys, the same situation was observed in the 12 month range. The total percentage of development risk, which included those boys and girls placed at the Observe and Consult categories, was 11.3%. The six-month questionnaire presented the most cases at risk (22%), whereas the least count was found in the 36-month range (6%).

Table 1. Social-emotional development descriptive results evaluated by gender

	Girls						Boys						
ASQ:SE-2 (months)	N	M	SD	Within the expectation f(%)	Observe f (%)	Consult f(%)	N	M	SD	Within the expectation f (%)	Observe f (%)	Consult f (%)	Total children at risk f (%)
6	49	18	12.7	39 (79.6)	8 (16.3)	2 (4.1)	36	14	8.6	35 (97.2)	1 (2.8)	0	11 (22)
12	43	24	11.43	36 (83.7)	6 (14)	1 (2.3)	42	27	17.3	33 (78.6)	5 (11.9)	4 (9.5)	16(18.8)
18	47	24	19.87	43 (91.5)	2 (4.3)	2 (4.3)	50	28	19.40	44 (88)	4 (8)	2 (4)	10(10.3)
24	56	24	15.47	51 (91.1)	5 (8.9)	0	40	28	21.8	35 (87.5)	2 (5)	3 (7.5)	10(10.4)
30	44	29	20.04	41 (93.2)	2 (4.5)	1 (2.3)	55	34	21.2	50 (90.9)	2 (3.6)	3 (5.5)	8 (8)
36	20	36	21.12	19 (95)	1 (5)	0	30	39	23.2	28 (93.3)	1 (3.3)	1 (3.3)	3(6)
Total	259	24.8	16.93	229 (88.4)	24 (9.3)	6 (2.3)	253	28.3	20.2	225(88.9)	15 (5,9)	13(5.1)	58(11.3)

Note: Prepared by the author

The contingency analysis between ASQ:SE-2 and the personal-social subscale of EAD-3 revealed a relationship between the two instruments, both of which were capable of identifying social-emotional development risk through the 6 (*X2*(1. 85)= 7.869, p=.005), 18 (*X2*(1. 97)= 15.966, p=.000), and 36-month (*X2*(1. 50) =11.387, p=.001) questionnaires. The results of the 12, 24, and 30-month questionnaires of ASQ:SE-2 were not statistically significant to confirm their relationship with the scores obtained by EAD-3. These results may be because the EAD-3 and ASQ:SE-2 items differ in the 12, 24, and 30-month protocols. In those age ranges, ASQ:SE-2 includes items addressing dimensions such as Obedience and Adaptative functioning, which are not contemplated in EAD-3.

The information obtained from the agreement percentage analysis of the 6 ASQ:SE-2 questionnaires (see Table 2) indicated the instrument's capability to detect children at social-emotional development risk and those undergoing expected development; this can be observed through the agreement percentage values, which are between 66.7% and 92%. The highest sensitivity value (100%) corresponded to the 18-month questionnaire, followed by the six and thirty-six-month questionnaires, which exhibited values of 50% and 40%, respectively. The sensitivity levels for the 12, 24, and 30-month questionnaires were found to be low, which reveals a weaker capacity of the instrument to detect social-emotional development risk at said age ranges.

Concerning the specificity values, a high capacity of the instrument to identify expected social-emotional development levels is evidenced in all the evaluated questionnaires, which exhibited scores for this parameter ranging between 80% and 97.8%. The 36-month questionnaire showed the highest specificity (97.8%), whereas the 30-month questionnaire had the lowest specificity (80%). According to the sensitivity and specificity data, the questionnaire with the greater ability to identify both risk and expected development was the 18-month questionnaire, with 90.7%. The questionnaire with the lowest potency was

the 30-month one, with 75.8%. Regarding the remaining questionnaires, and despite the high level of specificity they registered, it is necessary to take into consideration the importance of supporting the results obtained in the questionnaires with other screening tools to avoid cases of undetected social-emotional development risk, especially in the 12, 24 and 30-month questionnaires.

Table 2. Descriptive Analysis of the Personal-Social Sub-scale of EAD-3 and ASQ: SE-2

ASQ: SE2 classification	EAD-3 classification			Sensitivity	Specificity	Positive predictive value	Negative predictive value	Agreement percentage
	Risk	Healthy	Total					
Six-month questionnaire				50%	89.8%	27.3%	95.9%	87.1%
Risk	3	8	11					
Healthy	3	71	74					
Total	6	79						
Twelve-month questionnaire				60%	82.5%	12.5%	95.6%	80%
Risk	2	14	16					
Healthy	3	66	69					
Total	5	80						
Eighteen-month questionnaire				100%	90.5%	18.2%	100%	90.7
Risk	2	9	11					
Healthy	0	86	86					
Total	2	95						
Twenty-four-month questionnaire				16.7%	90%	10%	94.2%	85.4%
Risk	1	9	10					
Healthy	5	81	86					
Total	6	90						
Thirty-month questionnaire				33.3%	80%	14.3%	92.3%	75.8%
Risk	3	18	21					
Healthy	6	72	78					
Total	9	90						
Thirty-six-month questionnaire				40%	97.7%	66.7%	93.6%	92%
Risk	2	1	3					
Healthy	3	44	47					
Total	5	45						

Note: Prepared by the authors.

Discussion

Empirical evidence reveals that the problems related to neurodevelopment, and more specifically to social-emotional problems, are often not identified in time due to biased evaluation processes. This may be the case when the evaluations only consider the clinical judgment of the professional, the instruments employed have not been duly validated in specific contexts, or the applied verification lists are not sensitive enough for development risk detection. This difficulty highlights the need to carry out studies that allow the identification of the validity and reliability of the tests that are intended to detect social-emotional development problems (Kyerematen et al., 2014).

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The findings revealed that 88.7% of the participants were at the expected social-emotional development level for their age; 11.3% of the children were at risk, most of the cases being 6 to 12-month-old boys and girls. This can be related to the fact that, during this phase, important self-regulation bases are set where the assistance of caregivers is required. They have a crucial role in the affective expectations of the babies. If babies do not receive such attention, there is a higher chance of a deficit in their social-emotional development (Duschinsky, 2018). At the same time, identifying risk in this phase is vital because brain development and learning are directly dependent on social-emotional experiences (Immordino-Yang et al., 2019). These results are similar to those of other studies conducted in Colombia, which applied both ASQ:SE and EAD-3. These tools respectively identified that 9.8% and 20% of the children under 60 months of age were experiencing social-emotional development risk (Bernal et al., 2015; González-Reyes et al., 2007).

Concerning the validity analysis, a relation was found between the two instruments in terms of their capability to measure social-emotional development in the 6, 18, and 36-month questionnaires. For their part, the results of the 12, 24, and 30-month questionnaires of ASQ:SE-2 are not statistically significant to confirm their relationship with the scores obtained by the Personal-social sub-scale of EAD-3. The existing convergence between the questionnaires could be explained by the similarity of both instruments in the questionnaires of the age ranges in question, which coincides with components such as autonomy, affection, and social communication. In the rest of the questionnaires, the contrast may result from the fact that the Personal-social sub-scale, as opposed to the ASQ: SE-2, does not give relevance to adaptive functioning and obedience/conformity as components of social-emotional development but rather privileges autonomy and social communication.

The levels of specificity of the test were higher than the sensitivity levels; this coincides with what was reported in other studies (Squires et al., 2001; Krijnen et al., 2021) in the sense that, through the instrument, it is easier to tell expected from risky social-emotional development. This could be influenced by the perception of the parents who, despite being the main source of information about the development of their children, could be overlooking risk factors that they do not report at the moment of the test. For this reason, it is recommended that the measures of detection completed by the parents are complemented by using additional methods to compile corroborating information, such as clinical observations and professional evaluation criteria (Squires et al., 2001). In addition, it is important to carry out a continuous screening, including the concerns of the parents and the application of detection tests, as is the case of the checking of biological and environmental risk factors (American Academy of Pediatrics, 2016).

It is suggested that the psychometric research continues by increasing the sample size, which would give more support to the obtained information, especially in the questionnaires of the earlier ages. Likewise, it is valid to suggest the use of the psychometric analysis of ASQ:SE-2 together with other developmental tests and to expand the evidence supporting the validity of the instrument concerning other variables not contemplated in this study. These variables include the quality of the infant-parent attachment, the mother's emotional stability, and violence within the couple, among others which, according to certain studies, could be related to child social-emotional development (Ahlfs-Dunn & Huth-Bocks, 2014; Cheung et al., 2018; Raskin, 2016; Zarra-Nezhad, 2014).

Conclusions

ASQ:SE-2 reports optimal levels of specificity and adequate sensitivity in the 12 and 18-month questionnaires. This instrument facilitates telling those children who present the expected social-emotional development from those who do not. Positive evidence was obtained on the psychometric power of ASQ: SE-2. The instrument identified that 11.3% of boys and girls do not have an expected level of development.

ASQ:SE-2 includes items that assess dimensions such as Obedience and Adaptive Functioning in the 12-, 24-, and 30-month protocols, which are not contemplated in EAD-3. To this end, it is recommended for screening measures completed by parents be complemented by using additional methods to collect corroborative information, such as clinical observations and other professional evaluation criteria.

These results are important in the child development measurement field, especially social-emotional development, as having instruments that adequately identify lags in development is essential to provide timely and comprehensive care.

Disclosure statement

No potential conflict of interest was reported by the authors. The results shown are derived from research project, SGI code 2775 of *Universidad Pedagógica y Tecnológica de Colombia* – UPTC.

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