

Differential Analysis of Diagnostic Dimensions Regarding To Level of the Autism Spectrum Disorder

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ABSTRACT

Weighted sum of scores found over behavioral and perceptual-cognitive dimensions allow set to specific differential diagnosis with high reliability rating for currently three levels of autism spectrum disorder (ASD).

Indeed, a total of 124 people with ASD have participated in this study, 81 with ASD level- 1, 25 with ASD level- 2 and 18 with ASD level- 3 to aim the observations along six basic dimensions that make up disorder basic diagnosis: development, communication, interaction, behavior, attention and cognition.

Differential data found by means of *t* test for independent samples allows conclude there're significant differences relating the ASD level. Therefore it's possible establish differential averages for each ASD level beginning *p* frequencies analysis regarding to total means, being ASD level- 1: between 5.77 and 7.88, ASD level- 2: between 7.89 and 9.01 and ASD level- 3: ≥ 9.02 .

KEY WORDS

Autism Spectrum Disorder, Perception- Cognition, ASD' levels, DSM-5.

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I. INTRODUCTION

Conceptually ASD included as a peculiarity of neurodevelopment, characterized by specific objective behaviors relating limitations in interaction, social communication and possible presence of restricted and stereotyped behaviors symptoms, as well as perceptual- cognitive processing, highly characterized to specific concretions in stimuli perception- reception, cognitive coding and recovery of processed information. Likewise, prevalence of this disorder is around 1/54 people, with incidence three- four times higher in guys than in girls (Maenner et al. 2020; Zheng, Zheng & Zou, 2021).

ASD is basically identified with multifactorial genetic type etiology (Mandy y Lai, 2016; Robinson, Pourcain & Anttila, 2016), which may be associated with other associated deficits, among the anxiety and/or schizotypal stand out (Lai *et al.*, 2019; Zheng, Zheng & Zou 2018). Although there aren't specific biomarkers for diagnostic process, it must be carried out through to measures of specific relational scales observation (Qin et al. 2017; Zheng et al. 2016).

In synthesis, basic characteristics are delimited in six basic dimensions:

- 1) Development, which includes the following evolutionary variables: motor skills, language, sphincter control and daily living skills.
- 2) Communication, which is integrated by oral development ability, tone, social and/or gestural communication.
- 3) Interaction, concerning the social initiation capacity, personal contact, understanding and reciprocal social enjoyment along social contexts.
- 4) Behavior, it may present different stereotypes, sensitivity or sensoriality, recurrent ideas and/or behavioral alterations over interactive social context.
- 5) Attention, which includes variables regarding attention, joint attention, creativity, fiction ability and imagination processes.
- 6) Cognition, which includes basic variables of processing: perception, encoding, semantic processing and information recovery. Both characteristics are measured like specific socio- educational needs; that, according the Intl Classification DSM-5 (APA, 2013), are classified in three levels of intensity, with level 1 being least need and level 3 of maximum diagnosed specific needs.

Well, general criteria of evolutionary development, as well as processes related to social interaction and communication can be observed through two specific tests and/or scales: 1) ADOS-2 test, and 2) ADI-R scale. Observation test to diagnosis of autism, 2nd ed. (ADOS-2) (Lord, Rutter & Le Couteur, 1994; Lord, Rutter, DiLavore & Risi, 1999), has been published by Western Psychological Services and constitutes, in

effect, an empirical test, so highly contrasted experimentally, to support the analysis of creativity, fiction and imagination ability, based on acquired knowledge and the development of semantic narrative relationships synthesized in six basic dimensions (Stichter, Stormont, Buranova, Herzog & O'Donnell, 2021): 1) communication, 2) social interaction, 4) el play, 5) imagination, and 6) restricted and repetitive behaviors.

Autism Diagnostic Interview-Revised or ADI-R test (Rutter, Le Couteur & Lord, 2003), although it presents an specific evaluation of more evolutionary contents regarding to development location and space, also develops one progressive scale of learned behaviors, based on DSM-5 classification criteria and ICD-10 Classification of Diseases (WHO, 2004), conforming an essential complementary analysis to ADOS-2 test. Application of both scales allow a guarantee for effectiveness and validity of ASD' diagnosis is considerably increased, and, mostly, facilitate the early diagnostic detection so necessary to positive development.

However, both scales don't reflecting the observation of perceptual-cognitive characteristics it make up the specific psycho- neurological information processing of information of people with ASD. Hence, Oosterling *et al.* (2010) integrates one predictive value universal diagnostic test to develop the modified checklist for young children with ASD (MCHAT-R/F), which has been refuted by Robins, Fein y Barton (2001) and Robins, Casagrande, Barton, Chen, Dumont-Mathieu & Fein (2014). Authors conclude the evolutionary deficits based on development explain up to 98% of specific diagnostic process regarding people with developmental-intellectual specific needs deficits, while it's limited to 54.3% for explanatory variance of people with ASD diagnosis.

Other more recent studies lower these expectations to 17.8% regarding developmental-type symptoms in people with ASD (Carbone *et al.*, 2020). Thus, again, there's a need investigate the perceptual-cognitive criteria as specific factors-elements to allow increasing ASD diagnostic effectiveness.

Based these considerations, there're many scales and tests to try integrate the evolutionary behavioral components with the modes of cognitive processing and the particularities of emotional reactions before unexpected situations and emotional reaction of other or joint emotional attention. Mostly, diagnostic detection scale stands out, the Screening Tool for Autism in Toddlers and Young Children (STAT) (Stone, Coonrod, Turner & Pozdol, 2004; 2008; Wu & Chiang, 2014), which constitutes an interactive instrument for preliminary initial screening of people with high-risk ASD, located, above all, about the DSM-5 classification level 2. STAT is made up four social and communication dimensions to analyze social reaction ability in relational situations that must be analyzed throughout the learned processes. Likewise, following evaluation scales are highlighted; - Asperger Syndrome Diagnostic Scale of Myles, Bock & Sympson (2001); the questionnaire of Ehlers, Gillberg & Wing (1999); - Asperger's Syndrome Evaluation Test (Scott, Baron-Cohen, Bolton & Brayne, 2002); - Verification Socio-Communicative Scale of Skuse *et al.* (2005); - Social Communication Scale of Berument, Rutter, Lord, Pickles & Bailey (1999); - the Interactive Screening for Autism in Young Children (RITA-T, 2015; Choueiri & Wagner, 2015); - Behavior Checklist for Ages of de 1½ to 5 y-o (CBCL/1½- 5); - Caregiver-Teacher Report Form (C-TRF) of Achenbach & Rescorla (2000).

This study target respond to following basic aims: 1) specify the general statistical measures of six dimensions that make up the basic diagnosis on people with ASD: development, communication, interaction, behavior, attention and cognition, and 2) differentiate the specific scores found regarding three ASD' levels or degrees of DSM-5 disorder classification.

II. METHOD

Research design

This research is based on experimental longitudinal analysis of ASD' diagnostic dimensional variables, through direct and continuous observation measures, analyzed throughout statistical package SPSS v. 23 for differential means analysis *t* for independent samples.

Participants

A total of 124 participants, corresponding to ASD three levels, from 3 y-o (see Table 1), who get involved about observation specific measures of six dimensions- variables that shape this diagnosis above-said.

Table 1: Participants.

	ASD LEVEL			
	ASD-1	ASD-2	ASD-3	
Guys	58	20	12	90
Girls	23	5	6	34
TOTAL	81	25	18	124

As can be seen, there're 124 participants, of which 90 participants are guys, whom 58 belong to ASD level- 1, 20 to ASD level- 2, and 12 the ASD level- 3. Sample is also made up of 34 girls, of which, 23 belong to ASD level- 1, 5 to ASD level- 2, and 6 the ASD level- 3.

Procedure

These analyzes have been carried out along last 5 years of studies and diagnostic processes, relating to traditional observation scales and experimental observation scales that integrate concepts of perceptive-cognitive psycho- neurological processing (Ojea y Tellado, 2018). Also, other experimental scales have been issued (unpublished).

III. RESULTS

Initial data found through observation analyzes corresponding this study six dimensions, can be seen in Table 2. Data related to rank, minimum, maximum, sum (Σ), mean (μ), standard deviation (σ), variance (σ^2), chi square (x^2) and level of significance (Sig.).

Table 2: Basic statistics.

DIMENSIONS	Rank	Mín.	Máx.	Σ	μ	σ	σ^2	x^2	Sig.
DEVELOPING	3.25	6.50	9.75	1147.25	9.25	1.08	1.17	282.45	.00
COMMUNICATION	6.50	3.25	9.75	743.50	5.99	1.96	3.87	139.96	.00
INTERACTION	6.50	3.25	9.75	743.75	5.99	2.37	5.66	71.69	.00
BEHAVIOR	6.50	3.25	9.75	796.25	6.42	1.90	3.61	99.72	.00
ATTENTION	6.50	3.25	9.75	780.00	6.29	2.12	4.53	142.93	.00
COGNITION	6.50	3.25	9.75	757.25	6.10	2.14	4.60	129.87	.00

As observed the significance level corresponding to x^2 test, data are significant for all study dimensions, which allows conclude there's a significant association between all study dimensions- variables.

Greatest statistical contribution is determined by "development" dimension (x^2 : 282.45), followed by "attention" dimension (x^2 : 142.93), while lowest incidence over "interaction" dimension has been found (x^2 : 71.69). However, these differences aren't interdependent to dimensional- variables, but there's a direct statistical association relational between itself, confirmed by critical levels found.

Indeed, differential data found for six dimensions regarding ASD level show highly significant data. As can be seen in Table 3, *t* comparative- test study contrasted for ASD level, significant differences are found in all study dimensions.

Table 3: Independent Samples *t*-Test*.

		Levene Test		T-Test for means						
		F	Sig.	t	df.	Sig.	Mean differenc	Erro r típ.	95%	
									Lower	Upper
DEVELOPING	$=\sigma^2$	25.08	.00	-2.09	97	.03	-.61	.29	-1.20	-.03
	\neq			-3.99	96.46	.00	-.61	.15	-.92	-.31
COMMUNICA TION	$=\sigma^2$.18	.67	-9.39	97	.00	-3.57	.38	-4.33	-2.82
	\neq			-10.21	27.73	.00	-3.57	.35	-4.29	-2.86
INTERACTIO N	$=\sigma^2$	2.79	.09	-13.77	97	.00	-4.56	.33	-5.22	-3.90
	\neq			-14.08	25.76	.00	-4.56	.32	-5.23	-3.89
BEHAVIOR	$=\sigma^2$.01	.92	-10.52	97	.00	-3.41	.32	-4.06	-2.77
	\neq			-10.02	23.92	.00	-3.41	.34	-4.12	-2.71
ATTENTION	$=\sigma^2$	8.49	.00	-8.11	97	.00	-3.36	.41	-4.19	-2.54
	\neq			-9.62	31.43	.00	-3.36	.35	-4.08	-2.65
COGNITION	$=\sigma^2$	15.83	.00	-10.75	97	.00	-3.92	.36	-4.65	-3.20
	\neq			-13.34	33.97	.00	-3.92	.29	-4.52	-3.32

*Contrast variable: ASD level.

Levene contrast- test critical levels found according ASD level are found significant levels ($\leq .05$) throughout dimensions of this research study, which indicates there's significant differentiation to inter-dimensional data when each dimension compares with ASD levels. Hence, *t*-test for equality of means indicates significant critical levels signed in yellow to six analysis dimensions.

These findings are fundamental because it will allow deduce the specific differential measures in *p*- percentage to differentiate the ASD levels throughout of disorder diagnostic processes. In consequence, it can be seen how the joint levels for average sum of statistics mean to all dimensions, elaborated from percentiles (*p*) frequencies found five by five, allow conclude with basic deduction over the ASD levels differential statistical probability (see Table 4).

Table 4: Equivalence of the statistical means sum in differential diagnosis to ASD´ levels.

<i>TOTAL (Σμ)</i>	<i>ASD DIAGNOSTIC LEVELS</i>
5.77-7.88	ASD-1
7.89-9.01	ASD-2
≥9.02	ASD-3

IV. CONCLUSIONS

The inter-dimensions´ differential that make up the ASD diagnosis show significant critical level, which is a substantial scientific aspect, since implies the statistical probabilistic possibility of specifying the ASD diagnosis regarding to specific level or degree of disorder. Therefore, data frequencies analysis through *p* analysis allows scoring range delimits to place each level or grade within the ASD diagnostic agreed to specific needs previously evaluated.

As can be seen about averages of critical levels of x^2 , total sum of the "attention" and "coding" dimensions allows obtaining a highly significant fact: 272.80 (μ : 136.40), which´s, even, higher than sum mean of "interaction" dimension: 272.80 (μ : 136.40).

Mean scores are higher the average whole sum of "interaction" and "behavior" (x^2 : 71.69 and x^2 : 99.72) respectively, being overall average sum, Σ : 171.41 (μ : 85.70).

But, above all, the study importance implies the diagnostic specificity of ASD level-1 or scores approximate to level-1, thus, many times, observable goal behaviors are sensibly imperceptible, which can lead to initial errors of ASD diagnostic conclusions. Thus, e.g. many observational analyzes may not show specific restrictive behaviors nor observe obvious stereotyped behaviors, and, consequently, the diagnostic specific values are lower than expected for ASD positive diagnostic ending. It´s also usual about clinical diagnosis find situations with a significantly low- mean level regarding interaction and communication social, so that would places the diagnosis process below to expected symptoms frequency for an effective conclusion, however, subsequent perceptual-cognitive analysis could conclude a specific level of specific highly differential information psycho- neurological processing, that allows to make conclusions with greater diagnostic precision according the whole dimensional data found.

In synthesis, means sum analysis to whole behavioral and cognitive dimensions delimits best the specific ASD level. In this sense, the sum laid between global means for six dimensions given together has been found: 1) for ASD level-1: μ : 5.77-7.88, 2) for ASD level- 2: μ : 7.89-9.01, and 3) to ASD level- 3: μ : ≥9.02.

But, despite all empirical evidence, currently diagnostic parameters focus above all over communication and behavioral components, while attentional and perceptual-cognitive processes weigh very low along currently observation scales for diagnosis of people with ASD according to explanatory variance of the different dimensions.

Thus, explanatory variance of "attention" dimension is σ^2 : 4.53, while to dimension "cognition" is (σ^2 : 4.60), being average total sum: $\Sigma\mu$: 4.56.

The "development" dimension presents an explanatory level variance: σ^2 : 1.17; while, averages sum for "interaction" and "behavior" dimensions given together indicate a variance index: $\Sigma\mu$ σ^2 : 4.63, which very similar to the attentional and perceptive- cognitive dimensions.

Likewise, variance average sum to "communication", "interaction" and "behavior" dimensions is: $\Sigma\mu$ σ^2 : 5.58.

These empirical evidence requires a critical review regarding basic items make up the diagnostic criteria valued on currently disorder analysis, therefore attentional and perceptual-cognitive dimensions related to psychological specific processing of information should be included, both over specific observation scales, as on psychological and neurologic clinical tests. Scoring values should be may related to weighted percentages of disorder explanatory variance variability in relation to all criteria of ASD levels diagnosis.

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