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BENDER-GESTALT TEST: NORMALIZING THE BENDER VISUAL-MOTOR TEST AMONG 5-7 YEAR-OLD KURDISH CHILDREN

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ABSTRACT

Standard screening tools can facilitate the complicated issue of diagnosis. From among those tools, standard tests that are cheap, easy to implement, valid and reliable are often translated and used after being normalized. Likewise, this study aims at normalizing the Bender visual-motor test among 5-7 year-old Kurdish children of Kalar, Iraqi Kurdistan.

The present study is a descriptive-analytic one. Sampling was conducted in clusters from March to May 2017, and it included 141 children (77 females and 64 males). The instrument was the Bender-Gestalt Visual-Motor Test. Protocols obtained were num¬bered on the basis of the expanded Koppitz scoring system. Data were analyzed by SPSS 22 using descriptive statistics, the Chi-Squared Test and one-way ANOVA.

Findings of the test-retest reliability method showed that the reliability coefficient was significant (P<0.05). The highest error rate (85%) in boys was related to card no.7 and in girls, it was related to the same card (89%), as well. The least frequent errors for boys belonged to cards 2 and 6. Girls experienced the least amount of difficulty with card 8, i.e. rotation. The difference between 5-6 year old girls and boys was significant in cards 5 and 8. For 6-7 year old children, the highest error rate was related to card A (over 84%). In girls, errors of card 8 was more common (82%). The least errors made by the boys were related to cards 1, 2, 5, 6, and 8. Females experienced the least rate of difficulty with cards 5, 6, and 8 (over 3%). The difference between boys and girls was meaningful regarding cards A, 1, 2, and 5.

Despite some differences in error analysis, no significant difference was observed on the basis of gender. Hence, the Bender-Gestalt test can be safely used for any sex group. The result approved the efficiency of the Bender-Gestalt test in the population of this research.

Keywords: Normalization, Reliability Coefficient, Bender-Gestalt.

INTRODUCTION:

In each society, prevention type I is a priority to facilitate treatment and reduce medication costs. In case of diseases or any other complications, prevention type II, i.e. early diagnosis and rendering timely and effective treatment, is required. The timely diagnosis of different growth problems, as well as mental or behavioral disorders, helps parents and authorities take timely corrective actions to prevent the deterioration of the problems. Although diagnosis is mainly based on clinical interviews, aided by the statistical manual of psychological disorders, it is widely accepted that precise diagnosis requires an assessment based on multiple scales (Timbermont et al., 2004). Standard screening tools can facilitate the complicated issue of diagnosis and make it more precise. Among these instruments, standard tests that are cheap, easy to implement, valid and reliable are often translated into other languages and are used after being normalized. One of such instruments is the Bender-Gestalt Test.

This test was developed by Lauretta Bender (1938). It has been widely used as a neuro-psychological test, ever since. It evaluates the visual-motor coordination in children and adults (Rabin, 2005). Bender devised the test emphasizing Wertheimer's theory and depicted that delays in the sensory-motor development, as well as functional or organic deficiencies, disrupt patients' performance (Sadock & Sadock, 2007). For many years after the release of Bender work, no data obtained from the systematic and objective implementation of the test were reported. After a while, Pascal, Haink and Suttel developed a widely accepted scoring procedure for adults (Koppitz, 1963). Koppitz introduced a scoring procedure for children that is extensively applied to assessing the growth process and the sensory-motor coordination (Silverstein et al., 2011).

The Bender Visual-Motor Test is the fifth psychological instrument recommended for clinical evaluations. Although it is often used as a screening instrument to diagnose brain damages, most studies indicate its clinical applications (Groth-Marnat, 2003). In the children society, this test is used for the school readiness assessment, the educational progression prediction, the emotional disorder evaluation, the growth disabilities study, and the non-verbal IQ test (Gilger and Kaplan, 2001). The Bender test, along with the Koppitz scoring procedure, have been used for diagnosis and research purposes in many Asian, European and American studies, yielding similar results.

In Iran, Tahmasebi et al. (2016) in a research surveyed 523 preschool children in three 4-5 year old, 5-6 year old and 6-7 year old groups. In their research , as to the 4-5 year old group, M (SD) was obtained at14.75(1.82); as to the 5-6 year old group, M(SD) was obtained at 9.67(4.38); also as to children of the 6-7 year old group, M (SD) was obtained at 8.14(4.17). This research showed the visual-motor improvement of the perceptual performance upon the age increase, and it was reported that the koppitz scoring system was applicable to Iranian children protocols. Bahramian et al. (2013) investigated the psychometric properties of Bender Gestalt II for 900 preschool and primary school children in Shiraz (4 to 11 year old children). They reported that reliability coefficients in the copy phase and in the recall phase were 0.94 and 0.76, respectively. The mean of the split-half reliability coefficient for all age groups was 0.80. The results of the validity assessment indicated the high validity of BG II for usage in Iran; a fact suggesting that BG II can be used as a suitable assessment tool in the Iranian culture. Rajabi (2009) carried out another research on normalizing the Bender Gestalt Test among 1014 students, using the Koppit's system for the administration and scoring purposes. He reported that obtaining the indicated test-retest reliability coefficient of 0.81 and the significant negative correlation among GT scores, the Harris Drawing Test and the Colored Progressive Matrices Children Test was good enough. Consistent with the Koppitz's hypothesis, his research showed that the perceptual performance improves upon age increase.

Fernández and Tuset (2007) in a research using the Bender-Gestalt test, investigated 695 Mexican students from 5 to12 years old from different socioeconomic spectra. They reported that upon the age increase of the children, the total number of errors decreased, and it also happened with respect to the socioeconomic status. The comparison of the data with US and Spanish children shows significant differences in all age groups, and the scores of Mexican children were lowest. Özer (2007) in a research titled "Turkish Children's Bender-Gestalt Test Performance" carried out a study to provide preliminary data for norms on the Bender-Gestalt Test for 253 children aging 5 to 11 years old in Turkey. Her research gave the average error score of 4.2 (SD = 3.3) for girls and 3.6 (SD = 3.0) for boys in the Koppitz Developmental Scoring System. She presented and compared the mean error scores obtained for all age groups with other cross-cultural data; accordingly she reported that the sample performed at a higher developmental level than the Koppitz normative sample for the 5 and 6-year age groups, while means were similar to the original U.S. norms for other age groups. Mazzeschi & Lis (2000) investigated the Koppitz's Developmental Scoring System administered to two samples of Italian preschool and primary school children (538 boys and 527 girls). Research findings supported that the rate of development in the vasomotor perception differs among children of various ethnic groups.

Like any other psychological tests, the Bender Test can only be used when the norms for the same society are

available. In fact, the overall response by the majority of the society determines whether a child's performance is normal or abnormal. By the way, there is no serious study carried out in this regard in Iraqi Kurdistan due to numerous reasons. The economic, political and particularly social conditions of the region have driven children towards imbalance, more than ever. A high percentage of these children are in the preschool stage, and their healthy growth and early treatment of disorders require valid prognostic tests. The Bender-Gestalt test is one of the most efficient tools for this purpose. In fact, this test is bound to cultural, regional and temporal factors, and it requires the norms of the target population based on the above-mentioned factors. Hence, the present study aims at normalizing the Bender-Motor Visual-Motor Test in 4 to 7 year-old Kurdish Children of Kalar, Iraqi-Kurdistan.

METHODOLOGY:

The present study was a descriptive-analytic one, and the population included all 5 to 7 year-old children of kindergartens and elementary schools located in Kalar, Iraqi Kurdistan. The sampling was conducted in clusters from March to May 2017, and it included 141 children (77 females and 64 males). The descriptive data are represented in table1.

Table 1: Descriptive data of the sample

Age	Boy	Girl	Total
5- 6 years old	29	43	72
6 - 7years old	35	34	96
Total	**64**	**77**	**141**

The instrument was the Bender-Gestalt Visual-Motor Test used for screening visual-structural capabilities. This test includes 9 (4×6 inch) cards displaying geometrical pictures. There is a sketch on each card. The sketches are given to the participants one by one, and they are required to draw the same on plain pieces of paper (11×8.5 inch) (A4). The children's drawings are evaluated based on recreation, the relation between sketches and their holistic spatial background (Groth-Marnat, 2003). This test has been scored based on diverse methods. We employed the Koppitz scoring procedure. This scoring method is applicable to the diagnosis of brain malfunctions in children, children with emotional disorders, educational development readiness and learning disability (Koppitz, 1975 cited in Groth-Marnat, 2003). Several studies have attested to the validity and reliability of the Bender-Gestalt Test, with the Koppitz's scoring procedure. The amount of agreement on the Koppitz's scoring system is reportedly high, but its retest reliability with a four-month interval is somehow low (58%-66%). The retest reliability scores of the Koppitz's system on the basis of the age and the retest interval are from 0.53 to 0.90. The retest reliability coefficient for total errors is reported at 83%, but there are also certain quite low and unreliable error coefficients. The validity score of 0.65 was obtained based on calculation the correlation using the Frastyk visual perception test (Silverstein et al., 2011).

The test was implemented individually. The cards were placed in front of the subjects in a position that using the cards was convenient for them, yet the vertical orientation of the cards was maintained. The children were allowed to hold the cards by hands, but they were not allowed to turn them over. When the subjects finished the sketches, another card was presented to them. There was no deadline to complete each task, but the start and finish times were written down. During the test, the examiner observed and recorded all verbal and non-verbal behaviors of the children. For ethical reasons, each participant received a small gift. Different stages of the test were implemented by trained examiners, then the data were processed for scoring and analysis. The SPSS-22 software was employed to provide descriptive data (mean and standard), and inferential statistics (Chi-squared, correlation, and one-way analysis of variance).

RESULTS:

The test-retest reliability method was used to assess the reliability of the Bender-Gestalt test. For this purpose, fifty 5-7 year old children were randomly selected from Kalar kindergarten and elementary schools. The Bender-Gestalt test was administered to the sample with a three-week interval. The correlation results of the test-retest reliability method are reported in table 2.

Table 2: Results of the test-retest reliability method with a three-week interval

	Test			Retest			Correlation
	N	M	SD	N	M	SD	
Results	50	7.10	3.60	50	6.48	3.25	0.98

As it can be seen, the reliability coefficient calculated by the test-retest reliability method is significant (P<0.01). The performances of different age groups were analyzed and reported based on gender in tables 3 and 4, respectively.

Table 3: The item-by-item data analysis in 5-6 year old children

Card number		Boy		Girl		Chi-square		Continuity correction	
		Frequency	Percent	Frequency	percent	Value	Sig	Value	Sig
Card A	1- Distortion	9	%45	20	%51.3	0.20	0.64	0.03	0.85
	2-Disproportion	15	%75	27	%66	0.43	0.51	0.12	0.71
	3-Rotation	3	%15	11	%28.2	1.27	0.25	0.64	0.42
	4-Disintegration	8	%40	16	%42	0.06	0.93	0.00	1.00
Card 1	5- Distortion	4	%20	12	%30.8	0.77	0.37	0.32	0.56
	6- Rotation	4	%20	7	%17.9	0.03	0.84	0.00	1.00
	7- Perseveration	3	%15	12	%30.8	1.73	0.18	1.00	0.31
Card 2	8- Rotation	1	%50	5	%12	0.88	0.34	0.23	0.62
	9- Disintegration	4	%20	9	%23.1	0.73	0.78	0.00	1.00
	10- Perseveration	3	%15	7	%17.9	0.08	0.77	0.00	1.00
Card 3	11- Distortion	5	%25	11	%28.2	0.06	0.79	0.00	1.00
	12- Rotation	5	%25	11	%28.2	0.06	0.79	0.00	1.00
	13- Disintegration	11	%55	14	%35.9	1.96	0.16	1.27	0.26
	14- line drawing	2	%10	10	%25.6	1.46	1.14	0.28	1.14
Card 4	15-Rotation	15	%75	27	%69.2	0.21	0.64	0.02	0.87
	16- Disintegration	13	%65	26	%66.7	0.01	0.89	0.00	1.00
Card 5	17- Distortion	2	%10	5	%12.8	0.10	0.75	0.00	1.00
	18-Rotation	8	%40	6	%15.4	4.42	0.03	3.17	0.07*
	19- Disintegration	2	%10	13	%33.3	3.79	0.05	2.66	0.10
	20- line drawing	4	%20	13	%33.3	1.14	0.28	0.58	0.44
Card 6	21- Distortion	4	%20	13	%33.3	1.46	0.28	0.58	0.44
	22- Disintegration	1	%5.4	5	%12.8	0.88	0.34	0.23	0.62
	23- line drawing	8	%40	11	%28.2	0.84	0.35	0.38	0.53
	24- Perseveration	1	%5	4	%10.3	0.47	0.49	0.03	0.84
Card 7	25- Distortion	17	%85	34	%87.4	0.05	0.81	0.00	1.00
	26- Disproportion	16	%80	35	%89.7	1.07	0.30	0.40	0.52
	27-Rotation	4	%20	9	%23.1	0.07	0.78	0.00	1.00
	28- Disintegration	14	%70	32	%82.1	1.11	0.29	0.52	0.46
Card 8	29- Distortion	14	%70	32	%82.1	1.11	0.29	0.52	0.46
	30-Rotation	8	%40	2	%5.1	11.4	0.00	9.07	0.00*

As it is evident in table 3, the highest rate of error (85%) in males is related to card no.7 (the distortion error). The distortion error caused by the same card is also the error of the highest rate in females (89%). The cards of the lowest error rate for boys were 2 and 6 (Rotation, Disintegration and perseveration). Over 5% of the girls experienced the least rate of difficulties in card 8, with rotation. The differences between female and male children in the age group of 5-6 years old are significant in cards 5 and 8. In card 5, the rotation error is more common in boys, and in card 8, more girls made the disintegration error.

Table 4: The item-by-item data analysis in 6-7 year old children

Card number		Boy		Girl		Chi-square		Continuity correction	
		Frequency	percent	Frequency	Percent	Value	Sig	Value	Sig
Card A	1- Distortion	17	%43.6	7	%25	2.45	0.11	1.70	0.19
	2-Disproportion	33	%84.6	14	%50	9.32	0.00	7.70	0.00
	3-Rotation	4	%10.3	6	%21.4	1.60	0.20	0.84	0.35
	4-Disintegration	16	%41	9	%32.1	0.55	0.45	0.23	0.62
Card 1	5- Distortion	6	%15.4	8	%28.6	1.71	0.19	1.01	0.31
	6- Rotation	1	%2.6	4	%14.3	3.24	0.07	1.76	0.18
	7- Perseveration	2	%5.1	7	%25	5.53	0.01	3.95	0.04
Card 2	8- Rotation	2	%5.1	7	%25	5.53	0.01	3.95	0.04
	9- Disintegration	1	%2.6	6	%21.4	6.19	0.01	4.34	0.03
	10- Perseveration	1	%2.6	5	%17.9	4.62	0.03	2.98	0.08
Card 3	11- Distortion	4	%10.3	4	%14.3	2.52	6.16	0.01	0.90
	12- Rotation	3	%7.7	4	%14.3	0.75	0.38	0.21	0.62
	13- Disintegration	12	%30.8	11	%39.3	0.52	0.46	0.21	0.64
	14- line drawing	4	%10.3	5	%17.9	0.81	0.36	0.28	0.59
Card 4	15-Rotation	13	%33.3	13	%46.4	1.17	0.27	0.69	0.40
	16- Disintegration	11	%28.2	12	%42.9	1.55	0.21	0.97	0.32
Card 5	17- Distortion	6	%15.4	7	%25	0.96	0.32	0.44	0.50
	18-Rotation	2	%5.1	1	%3.6	0.09	0.76	0.00	1.00
	19- Disintegration	1	%2.6	9	%32.1	11.23	0.01	2.09	0.00
	20- line drawing	5	%12.8	2	%7.1	0.56	0.45	0.11	0.73
Card 6	21- Distortion	16	%41	11	%39	0.21	0.88	0.00	1.00
	22- Disintegration	1	%2.6	4	%14/3	3.24	0.07	1.76	0.18
	23- line drawing	12	%30.8	9	%32.1	0.14	0.90	0.00	1.00
	24- Perseveration	1	%2.6	1	%3.36	1.41	0.23	0.02	0.86
Card 7	25- Distortion	30	%76.9	23	%82.1	0.26	0.60	0.04	0.83
	26- Disproportion	29	%74	22	%78.6	0.15	0.69	0.01	0.91
	27-Rotation	12	%30.8	4	%14.3	2.43	0.11	1.61	0.20
	28- Disintegration	24	%61.5	22	%78.6	2.19	0.13	1.47	0.22
Card 8	29- Distortion	24	%61.5	22	%78.6	2.19	0.13	1.47	0.22
	30-Rotation	1	%2.6	1	%3.6	0.05	0.81	0.00	1/00

Based on table 4, the highest error statistics are related to card A and the disproportion error (over 84%). In females, card 8 and the distortion error were more common (82%). Cards of the least errors for boys were 1, 2, 5, 6 and 8 with rotation, perseveration, disintegration, and line drawing errors, respectively. Females experienced the least amount of difficulties in cards 5, 6, and 8 with disintegration, perseveration, and rotation (over 3%), respectively. Differences between boys and girls are meaningful in cards A, 1, 2 and 5. Regarding card A, boys make more disproportion mistakes, while considering cards 1, 2 and 5, disintegration, perseveration, and rotation errors are of higher rates among females.

A comparison made between age groups of 5-6 and 6-7 year-old children (diagram 1) indicated that an increase in age significantly reduced the mistakes made by subjects. T-test was employed to study the significance of the relationship between the age and errors. The relationship between the educational degrees, parents' jobs and error rate was studied using ANOVA. The results are given as follows:

T-test indicated a significant difference between the age groups ($t= 11.43$, $p=0.000<0.05$). Based on the means, 6-7 year-old children made fewer mistakes. ANOVA approved that there was no significant relationship between parents' jobs and children's performance on the test ($p>0.05$), but the relationship between parents' education and children's performance was significant ($F=198.10$, $p=0.00<0.05$). Children who came from educated parents made fewer mistakes.

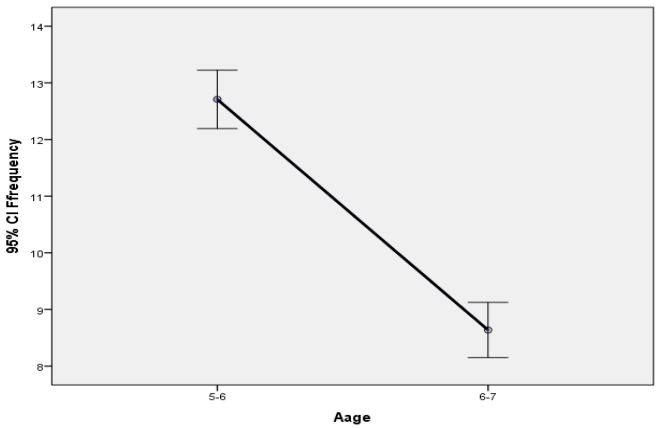

Figure 1: Average errors made by two different age groups

CONCLUSION:

The tests of the visual-motor memory and the perception such as Bender-Gestalt, Benton, Andre Re, and Wechsler Memory Scale are some of the acceptable tests for assessing cognitive functions based on the visual-motor perception (Kisltuk et al., 2008). The timely diagnosis of motor perception problems is vital, especially at the onset of formal education. If children's disorders are identified before entering schools, effective treatments can better prepare them for the school period. The 1st grade students should be equipped with prerequisites required for learning programs. Any delay in the development process hinders students from their educational efforts (Mehrinejad et al., 2012). Therefore, the present study was devoted to normalizing the Bender-Gestalt Test based on the Koppintz scoring system for 5-7 year-old children. The results of a comparison made between norms obtained in the present study and the norms reported in the literature are presented in table 5.

Table 5: Comparative results of Bender-Gestalt normalizing efforts

		American Norms* 1974			Iranian Norms * Tehran 1998			Turkish Norms** 2007			Iranian Norms* Shiraz 2011			Kurdish Norms 2017		
Age		N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
5- 6	5-5.6	47	13.1	3.3	14	12.93	3.32	-	-	-	199	9.66	4.38	72	12.7	2.19
	5.6-6	130	9.7	3.4												
6-7	6-6.6	175	8.6	3.3	14	7.36	2.23	105	7.29	3.79	124	8.15	4.17	69	8.64	2.02
	6.6-7	60	7.2	3.5												

A comparison made between the performance of the sample of this research and their Iranian counterparts in Shiraz and Tehran, as well as Turkish children shows that the normal children participating in the present study scored lower on the test. However, the norms cited by Koppintz for American children are similar. Consequently, it can be concluded that the subjects of this study are not underdeveloped. As an explanation for the differences, one can refer to the current socio-economic conditions of Iraq that affect all classes of the society. Although Iraqi Kurdistan is independent, it has also suffered from the consequences of a decade of war and conflict in Iraq. Prior studies show the effects of socio-cultural factors on the performance in the Bender-Gestalt test, as well (Ozer, 2007; Fernandez and Tuest, 2007).

The reliability score after a retest with a three-week interval proved to be satisfactory (0.98). The reliability of the test has also been repeatedly demonstrated in various studies (Rajabi, 2009; Bahramian et al., 2014). This confirms the Bener-Gestalt test as a reliable tool for research and clinical purposes.

Based on our findings, the rate of average errors made by subjects (an index reflecting the perception growth in Koppintz's opinion) is 12.7 for the 5-6 year-old age group. This rate significantly descended with the increase in age, so that the average error plummeted to 8.64 in the 6-7 year-old age group (figure 1). These findings are consistent with the theoretical test framework and the literature (Bahramian et al., 2014; Rajabi, 2009; Tahmasebi, 2016). Based on these studies, motor-perception skills develop with the increase in age and the development of the nervous system. The rates of errors are continuously reduced as the children grow up. These findings approve the Bender growth hypothesis and Koppintz's conclusions proposing a relationship between the age and the visual-motor capability (Groth-Marnat, 2003).

It also became evident that children of higher education families performed better on the test. Although Koppitz claimed that socio-cultural factors cannot affect the performance of children taking Bender-Gestalt Test, people

like Masely, Zozler and Stadman (cited in Bahramian, 2014) demonstrated that these factors indeed affected children's performance on the test. There are other studies approving the findings of this research, as well (Bahramian, 2014; Fernandez, 2007; Ozer, 2007; Rajabi, 2009). Children with educated parents are more open to experience new things. They enjoy a more helpful growth environment and experience diverse opportunities. It was also observed over and over that children of less educated people were anxious facing certain sketches particularly cards no. 7 and 8. Some of them even refused to draw any sketch. This may be resulted from their limited experience in new and changing situations.

Despite some differences in error analysis, no significant difference was observed based on the gender. Therefore, it can be claimed that the Bender-Gestalt test can be safely used for any sex group. On the whole, the results approved the efficiency of the Bender-Gestalt test in the research population. The norms provided by the present study form a more solid basis for judging the normal performance of 5-7 year-old children. In fact, more caution must be exercised in generalizing our findings due to some restrictions including the sample and age limits. It is also recommended that future studies be concentrated on the performance of children with certain disorders like Autism and ADHD, well as children of higher age groups.

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