



Research Article

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Received: 27 February 2021 / Accepted: 5 June 2021 / Published: 8 July 2021

Psychometric Properties of the Wechsler Intelligence Scale, WISC-IV for Deaf Intelligence with Wardenburg Syndrome and Level of Intelligence for Different Mental States

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DOI: <https://doi.org/10.36941/jesr-2021-0087>

Abstract

This study aimed to investigate the psychometric characteristics of the Wechsler-4 scale of the intelligence of deaf people with Waardenburg syndrome and the level of intelligence according to the mental state. To achieve the objectives of the study, a descriptive survey method was used. The sample of the study consisted of (17) students from all deaf schools in Jordan, whose ages ranged between (8-17) years, and (WISC-IV) was applied in sign language. Indicators are reached for Construct Validity (2.741 - 0.243). And indications for reliability, where the correlation coefficients ranged between (0.487 - 0.898). The results showed that there were no differences in the IQ level of deaf people with Waardenburg syndrome due to gender. The absence of differences in the IQ level of deaf people with Waardenburg syndrome is due to the mental state variable in favor of the deaf group of those with the borderline between Gifted and Superior, but the overall IQ level of the deaf person with Waardenburg syndrome is within the lower limits (IQ = 71), which is Learning Disability. There are also differences in the level of the sub-tests of the scale for deaf people with Waardenburg syndrome, as the (Cancellation) test was the highest score and then (coding) in second place. The study recommends including this syndrome as part of the hearing impairment categories. Studies have been carried out on the development of the functional section of the Wechsler-4 scale to suit the visual perception of deaf people with Waardenburg syndrome.

Keywords: Deaf, Wechsler Intelligence Scale, WISC-IV, Wardenburg Syndrome

1. Introduction

The (Waardenburg syndrome, WS) syndrome is characterized by sensory nerve deafness, pigmented deformities, and auditory nerve defects. Based on additional symptoms, it is a rare syndrome it classifies the condition into four types (WS₁; WS₂; Klein-Waardenburg syndrome WS₃; and Waardenburg-Shah syndrome WS₄).

This research is considered one of the rare Arab studies (according to the researcher's knowledge) specialized in Wardenburg Syndrome with the impairment hearing. This confirms that the impairment hearing category is of heterogeneous groups, and this syndrome is considered a non-communicable disease, and many books on impairment hearing and theoretical literature have not shown that it is

educationally discovered, which led to the emergence of a new educational syndrome, which is known as deaf with Waardenburg Syndrome if any. The information does not know about this syndrome. For this reason, the measurement and diagnosis of Waardenburg Syndrome for people with impairment hearing is a difficult issue, whether it is medical (the cost of examining the gene causing the syndrome) or psychometric (because of the lack of specialized measures for people with impairment hearing with Waardenburg syndrome, whether for mental ability, perception, and sign language) or educational measures in sign language Fit the characteristics of the syndrome.

Hence, the present study came to explain the characteristics of the mental capacity of deaf people with Waardenburg Syndrome.

2. Literature Review

Dr. Petrus Johannes Waardenburg (1951), a Dutch ophthalmologist, first discovered the disease in 1947, when he noticed that the color of the eyes of some of those deaf varied from one another. Although the prevalence of this disease is one case per (20000-40000) newborn children, it affects about 3% of all those who have been deaf since birth, and which their characteristics are:

- Hearing loss that is present at birth.
- The appearance of a side change in the eye's inner corner.
- Differences in skin pigmentation (albinism).
- Hair graying prematurely in the head's front is white.
- Blue eyes and with iris pigment color variations (Heterochromia Iridium).
- It bound the eyebrows.
- The root of the nose is wide.

Before this condition was coined, it was referred to as (WS₁).

The second form of Waardenburg syndrome was described by Arias (1971). Individuals of the second type (WS₂) share all the characteristics of the first type (WS₁) except for the eye angle, according to Pantke and Cohen (1971).

The classifications of this syndrome have evolved in response to its various symptoms, allowing us to distinguish between these subtypes of Waardenburg syndrome and work to identify communication strategies that are appropriate for the form and severity of the problem.

According to the National Institute of Deafness and Other Communication Disorders, NIDCD (2007) Waardenburg syndrome is a rare genetic condition caused by hearing and pigmentation mutations.

Mentionsed Pingault et al. (2010) Waardenburg syndrome is the leading cause of symptomatic sensorineural hearing loss (SNHL) and which is a condition that induces a visual disturbance, brows, iris separation, and white hair.

Waardenburg (1951) identified 6 major characteristics of Waardenburg syndrome types: Broad nasal root, partial or complete pigmentation variations in the eye's iris, brow attachment, white hair to the front of the head, Tagra et al. (2006) Also assert these traits are all from birth with white hair in front of the head.

Waardenburg syndrome is a hearing condition that affects between (2 -3%) of people with congenital deafness, according to Orphanet (2018) Cases are estimated to affect 2 to 3 cases per 100,000 people around the world, both genders are affected equally.

The occurrence of this syndrome is not limited to one culture clarifying Nayak et al. (2003) that the occurrence of Waardenburg syndrome has been identified in cultures, with clinical characteristics falling into two categories: European origin and South Asian origin. Waardenburg syndrome is estimated to account for 2 to 5% of all cases of congenital deafness, according to the study. It was first identified in northern European regions, particularly among white people.

To talk about the problems of diagnosing this syndrome, he confirms Egbalian (2008) distinct hair and skin changes and with auditory nerve hearing loss characterize Waardenburg syndrome. Symptoms may be suppressed and but not diagnosed until it diagnosed a family member or they test

all family members in this small variation.

And also the instability of their hearing and eye problems, according to researchers Toriello et al. (2004) Deaf people with this condition have visible eye changes, such as each eye being a different color from the other or visible hair or skin. The degree of hearing loss is not always consistent; it can range from mild to severe, and it also can be unilateral or bilateral.

On the contrary, not all with Wardenburg have hearing loss, according to the American National Institute of Medicine, USNLM (2006). Only the hearing impaired (60%) of those diagnosed with the condition are normally affected. This is also confirmed by research Hager et al. (2010) show that Wardenburg syndrome is a rare disease characterized by loss of the sensory nervous system and chromosomal abnormalities of the iris, skin, and hair because of mutations in the gene (PAX3).

Recognize the methods of their evaluation based on the symptoms of this syndrome. We can define this condition using the Wardenburg index (W), which is the measure used to determine the W (mm) index. If there is a suggestion of Wardenburg syndrome (used to assess thickness or diameter), a caliper may be part of an appropriate diagnostic test. It may identify this disorder by measuring the distances between the inner and outer corners of the eyes and using a (W) measure to see whether the eye angle (Dystopia canthorum) is present. Which of the following outcomes may indicate Wardenburg syndrome (WS_i):

1. The distance to the inner eye angle (a).
2. The distance between the two pupils (b).
3. The outer distance of the angle of the eye (c).

It is through the following formula:

$$X = (2a - (0.2119c + 3.909)) / c$$

$$Y = (2a - (0.2479b + 3.909)) / b$$

$$W = X + Y + a / b$$

Mathematical results are an eye angle greater than (W < 1.95 indexes).

Confirm this equation Farrer et al. (1992) through a systematic clinical evaluation and, determination of results and physical features; we can measure the diagnosis of Wardenburg syndrome from birth or early childhood using this equation.

Deaf people have distinct features as a result of the preceding. According to Abu Drei and Alramamneh (2021), deaf people are a diverse group, but they share a set of characteristics articulated through sign language, complete communication, the surrounding environment, events, and cultural clubs, this shared diversity has resulted in the formation of a united community. also, Alramamneh and Sabayleh, et al. (2020) confirm that social problems are low among the deaf for a variety of reasons, the most important of which is that deaf students within the school community are homogeneous in terms of sign language and mental abilities, therefore, social problems are not visible within their community unless they communicate with the community of listeners.

There is a disparity in the mental capacity of Deaf people with Wardenburg syndrome with the relationship between Wardenburg syndrome and mental ability. Show Chen and Harold (2006) that both intellectual disability and developmental distortions are evident in nearly all patients. Also, de Saxe (1984) found that families affected by the syndrome found delayed or impaired academic performance (achievement). Which required special education for (9) people associated with Wardenburg Syndrome.

Another report Pasteris et al. (1992) of a case study of Waardenburg syndrome indicates the presence of symptoms including:

- Mental retardation.
- Significant movement delay.
- Severe disturbance in gait.
- Dysfunction of muscle tension.
- Muscle sclerosis and peripheral neuropathy

Another report Pasteris et al. (1992) of a case study of Waardenburg syndrome indicates the presence of symptoms including:

- Small head size.
- Existence of intellectual disability.
- Severe physical disorders and abnormalities.

Southard-Smith et al. (1998) indicates that there is limited evidence for the relationship between Wardenburg syndrome and intellectual disability. Some researchers have also reported that mental capacity in Wardenburg syndrome does not affect intelligence. But deaf people with Wardenburg syndrome, according to Melville and Cameron (2003) did not report this relationship in the theoretical literature until recently (before acquiring language). We believe that these two people have a striking similarity, which helps us to reflect on potential behavioral patterns by finding cases in which:

- Fragile (X) syndrome.
- German measles.
- Herpes simplex encephalitis.

Not only that, but deaf people with Wardenburg syndrome may also be associated with other categories of special education categories, which as autism, but few studies have shown this. Siedlecka and Smolenska (1997) showed that much of the prevalence of problems related to mental ability or Autism spectrum disorder for this syndrome is not known about it. Also, de Saxe (1984) and Kawabata et al. (1987) confirms the association of Wardenburg syndrome with cognitive delay and other neurological disorders.

But, to the researcher's knowledge, there are no Arab studies that affirm the understanding and characteristics of deaf people with Wardenburg syndrome. Those cases were discovered as part of Abu Drei (2017) research, this study aimed to legalize the Jordanian image of the (WISC-4) at the school stage for the age group (6 - 16.11) years to measure intelligence in sign language for the deaf. To achieve the objectives of the study, the (WISC-4) were converted after indications of their validity, reliability, and criteria of the (WISC-4) scale in the ordinary and deaf samples were converted into sign language. The sample of study included the deaf and ordinary (831). They also reached the criteria of the scale represented by converting the raw grades to standard degrees and then to an IQ. The results of the study showed:

- There were statistically significant differences ($\alpha = 0.05$) in performance on the sub-tests due to a variable in the ordinary and deaf category and the gender variable in the deaf group.
- There were statistically significant differences ($\alpha = 0.05$) in performance on the sub-tests due to degree of impairment hearing (mild - moderate - severe - cochlear - mild + cochlear) for the category Age (6-16.11) years.
- There are statistically significant differences in performance on the subtests due to the age variable for the deaf in the sign language in favor of the age group (13.00-13.12).

Besides, Abu Drei and Al-Rousan (2021) conducted a study that aimed to identify the psychometric properties of the Jordanian image from the Wechsler Intelligence Scale "for Children - Fourth Edition Adapted for Deaf via Sign Language From (6 - 16.11) years to measure the mental capacity of the deaf. In order to achieve the objectives of the study, they converted the paragraphs of the scale into sign language after reaching Indications of validity and reliability of a deaf sample of sign language. The study sample included (413) deaf male and female students, Construct Validity for correlation coefficients ranged between (0.305 - 0.698), and the correlation coefficients for paragraphs ranged between (0.602-0.823). Indications for the reliability of the scale were also obtained, represented by the use of Cronbach's alpha subtests of the scale ranged between (0.815 - 0.922). The results showed:

- There were statistically significant differences ($\alpha = 0.05$) in performance on the Jordanian Version subtests of the Wechsler Intelligence Scale in favor of the deaf group with a degree of mild hearing impairment.
- The level of deaf intelligence on the scale is broadly equal among groups of deaf students with different degrees of hearing impairment (moderate, severe, cochlear, mild + cochlear).

Drei (2020) also conducted a study this research aimed to find deaf people who had Waardenburg syndrome Type II. For the one case study, the qualitative approach was used to achieve the study's objectives. The study comprised (2) deaf students aged 9-10 from all Jordanian deaf schools. (Wechsler

Intelligence Scale) was used in the language of Performance Scales and Audiometry. The results showed symptoms in Deaf people with Waardenburg syndrome type II in terms of auditory sensory loss. The presence of a side shift to the inner corner of the eyes. Premature graying of hair on the front of the head in white and some on the eyelashes or the eyebrow. They connect the eyebrows. Dark blue or brown eyes with black and pigment color differences in the iris. The root of the nose is wide and the rabbit's lip. The results showed that there is an intense focus during communication in the sign language at the hands of the speaker due to the fact that the color contrast of the eyes led to a dispersion of the focus in the sign language. They also have a sense of the direction of light, which may adversely affect the process of visual communication of sign language. The results of the study also showed that the average hearing impairment was the highest category. Further research and studies on the level of intelligence of deaf people with (WS₂), and studies on visual perception of deaf people with Type (WS₂), is recommended, and incorporating this syndrome as an integral part of the categories of hearing impairment.

Song et al. (2016) conducted a study that aimed to find out the auditory and genetic problems of the syndrome, it calculated the prevalence rates of hearing loss associated with types and genes. A research (73) papers were included in the survey, and it identified 417 patients. The findings revealed:

- Wardenburg Syndrome was found to be (71%) and substantially associated with hearing loss.

Katoch et al. (2019) conducted a study this study aimed to identify the classic features of Wardenburg Syndrome in siblings. The sample included (2) siblings as the female (18) One-year-old and her younger brother was 14 years old, as the female had blue eyes. The presence of the eyebrows and wide distance between the corners of the eyes, and also the front of the hair was white with a gray color, and hypopigmented spots on her hands and feet, and the root of the nose was wide. She was also suffering from a severe hearing loss of 98.3 dB in the right ear and 96.6 dB in the left ear. Her IQ was normal, and her brain's MRI was normal. As for eye examination, the vision was 20/20 in both eyes. Her younger brother had a severe hearing loss of (96.6) dB in the right ear and (98.3) dB in the left ear, as well as a wide nose root. He had a congenital malformation on his right thumb. The IQ was normal, and the brain MRI was normal. As for eye examination, a vision was 20/20 in both eyes. The irises were hypopigmented blue. And the pressure inside the eye was normal.

By a long study of this syndrome also Tamayo et al. (2008) conducted a study aimed at detecting Wardenburg syndrome between (2002 and 2005). The study sample included (1763) deaf individuals all over Colombia, (95) affected individuals and they belonged to (95) families. We verified the clinical diagnosis of Wardenburg Syndrome and reported (45) affected relatives via a family evaluation. To validate the diagnosis, auditory, ophthalmological, and genetic it performed tests. The following are the effects of classifying Wardenburg and using the Wardenburg index:

- The presence of sensorineural deafness.
- The most common feature was the broad nasal root.
- Heterochromatic irises.
- Hypopigmentation of the skin.
- White hair at the front of the head.
- The iris is an intense blue.
- Ptosis.
- Shortage of eyebrows.
- Most individuals have normal psychological development while the remaining (13%) have a growth delay.

Marta et al. (2016) conducted a study aimed at identifying the characteristics of this syndrome as a genetic disorder, and its prevalence is estimated at (1: 42000). Clinical features of Wardenburg syndrome include lateral displacement of the inner eyebrow, enlargement of the eyebrows, a prominent and wide nasal bridge, and congenital deafness, pigmentation of the iris and skin, and white hair on the head. A 4-year-old patient, previously diagnosed by Wardenburg, was referred to the Disability Clinic at the Sacred Heart University of Bauru in Brazil. The results showed:

- Parents showed that the patient had a deformity, especially in the oral region, sinuses.

- Existence of intellectual disability.
- Leg deformities.
- An oral clinical examination revealed a deficiency of teeth, abnormalities in dental formation, extensive tooth decay, and gum disease.

In addition, when looking at the gene that causes this condition, Suzuki et al. (2018) performed research to identify gene-specific mutations (SOX10 and PAX3). The patient (5 years old) first experienced neurological symptoms, which were then accompanied by extreme seizures linked to myelosuppression in the brain. Particularly in (exon 3) from (SOX10), which is linked to Waardenburg syndrome's neurological symptoms. The following were the findings:

- Presence of congenital deafness (severe hearing loss).
- Delayed development.
- Delayed motor development still cannot raise his head.
- Waardenburg Syndrome Index (W: 2.24).
- CT scan of the temporal bone revealed hypoplasia of the semicircular canals and the cochlea in the ears.

3. Research Questions

The study answers the following questions:

1. What are the indications for the validity of the psychometric characteristics of the Wechsler Intelligence Scale for Deaf with Waardenburg Syndrome and the level of intelligence according to the mental state?
2. What are the indications for the reliability of the psychometric properties of the Wechsler Intelligence Scale for Deaf with Waardenburg Syndrome and the level of intelligence according to the mental state?
3. Are there statistically significant differences at the significance level (0.05) in the IQ level of deaf people with Waardenburg syndrome due to the gender variable?
4. Are there statistically significant differences at the significance level (0.05) in the IQ level of deaf people with Waardenburg Syndrome due to the mental state variable?
5. Are there differences in the level of subtests on the Wechsler Intelligence Scale for Deaf with Waardenburg Syndrome?

4. Study Significant

Providing knowledge about the mental capacity of deaf people with Waardenburg syndrome on a Jordanian sample.

First: theoretical importance:

1. Raising interest in learning about Wardenburg Syndrome for the hearing impaired.
2. Knowledge of the mental capacity of deaf people with Wardenburg syndrome.
3. The dearth of Jordanian studies that spoke about the intelligence of deaf people with Wardenburg syndrome.
4. Adding a group related to hearing impairment to the Arab library.

Second: The practical importance:

1. Characterization of deaf people with WS on the curve of a normal distribution of intelligence.
2. Assisting researchers in using the findings of this study to deal with and communicate with deaf people with WS, and assessing their mental ability.

5. Study Limitations

This study has some limitations:

- The results are determined by the limitations of the sample to be studied.

- The researcher was unable, through his research, to reach and identify other cases from a sample (981) deaf from deaf schools in Jordan distributed (north, middle, south) while applying the Wechsler-4 scale of intelligence in sign language for the deaf.

6. Definitions of Terms

1. Deaf: They are people who communicate with each other using sign language, the alphabet, lip language, and other methods, whether or not they use hearing aids, and their Hearing loss range from (25 - 90) decibels.
2. Wardenburg syndrome: It is a group of unusual features that appear on a person who distinguishes them from others, such as the expansion of the root of the nose, which causes expansion of the eyes, and the appearance of a difference in the iris color of both eyes, which causes the shape of the face to be unusual, as well as other changes in their appearance such as White hair (gray hair) in early childhood until before (30) years.
3. Mental ability (intelligence): The subject's performance on the (WISC-4) scale of intelligence in the Jordanian Version in sign language for the deaf.

7. Methodology: Method and Procedures

7.1 Method of study

The researcher used the descriptive survey method for its suitability for the current study. This study aims to verify the psychometric properties of the WISC-4 Scale of Intelligence of the Deaf from those with Waardenburg Syndrome.

7.2 The sample of study

According to the researcher's work as a specialist in sign language for the deaf, as an expert and assessor of the level of intelligence of the deaf, and when the researcher pursued the deaf community, who numbered (947) deaf according to the Ministry of Education statistics for the year 2016/2017, it was observed during the application of the WISC-4 scale that (17) deaf people according to the age group of (8-17) years, who had symptoms consistent with the symptoms of Waardenburg Syndrome, who were deliberately chosen.

Frequencies and percentages were used to describe the study sample individuals according to gender and mental state

Table (1): Distribution of the study sample according to the gender of the deaf * mental status

		Mental state						Total
		MID	MOID	LD	normal	GS		
Gender	Male	Number	5	1	2	2	0	10
		%	50.0%	10.0%	20.0%	20.0%	0.0%	100.0%
	Female	Number	4	0	2	0	1	7
		%	57.1%	0.0%	28.6%	0.0%	14.3%	100.0%
Total		Number	9	1	4	2	1	17
		%	52.9%	5.9%	23.5%	11.8%	5.9%	100.0%

Note: (Mild Intellectual Disability, MID), (Moderate Intellectual Disability, MOID), (Learning Disability, LD), (The borderline between Gifted and Superior, GS).

7.3 The study tool

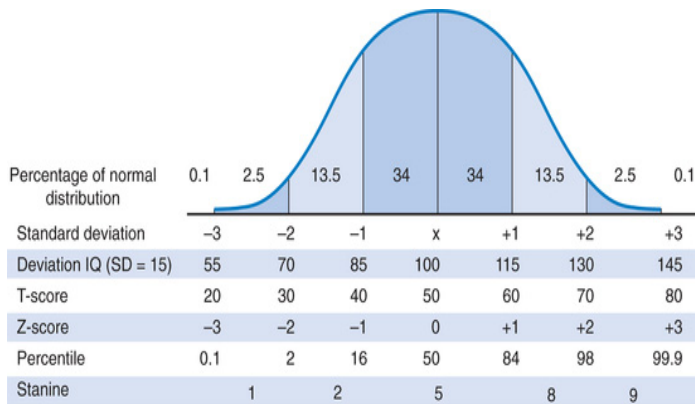
The Wechsler Children's Intelligence Scale (WISC-4), which Abu Drei (2017) performed Standardization a Jordanian Version for Deaf Via Sign Language.

Standard Description: The fourth version of the Wechsler Children's Intelligence Scale appeared in the year (2003) by (Williams, Weiss and Roth, 2003). Evidence of validity, reliability, and standards was available in its primary form. The scale consists of 15 sub-tests:

- Block Design, Similarities, Digit Span, Picture Concepts, Coding, Vocabulary, Letter-Number Sequencing, Matrix Reasoning, Comprehension, Symbol Search, Picture Completion, Cancellation, Information, Arithmetic, Word Reasoning. (Wechsler, 2003).

Divided into four sub-measures:

1. (Verbal Comprehension Index, VCI) scale includes the following sub-tests: (Similarities, Vocabulary, Comprehension, Information, and Word Reasoning).
2. (Perceptual Reasoning Index, PRI) scale includes the following sub-tests: (Block Design, Picture Completion, Matrix Reasoning, and Picture Concepts).
3. (Working Memory Index, WMI) scale includes the following sub-tests: (Digit Span, Letter-Number Sequencing, and Arithmetic).
4. (Processing Speed Index, PSI) scale includes the following sub-tests: (Coding, Symbol Search, and Cancellation).
5. Full-Scale IQ (FSIQ) standard and includes tests: (VCI, PRI, WMI, PSI).



- From 55-70: Deaf with Mild Intellectual Disability.
- From 70-85: Deaf with Learning Disability.
- From 85-115: Deaf is Normal.
- From 115 - 130: Deaf with Gifted.
- From 130 - 145: Deaf with Talent.
- From 145 - and over: No results were reported for the deaf (Genius). Abu Drei (2017)

Figure: IQ distribution over the normal distribution curve:

7.4 Research procedures

It took the following steps to achieve the study's objectives:

1. For deaf students, the following symptoms of the syndrome have been identified:
 - Sensory hearing loss.
 - The appearance of a side change in the eye's inner corner.
 - Skin pigmentation differences.
 - It covers the front of the head with white hair.

- It joins the brows together (frequent eyebrows sticking together in the midline).
 - Blue eyes and iris pigment color variations.
 - The nose's root is wide.
2. The Jordanian Version of the Wechsler-4 scale in sign language, both verbal and performance, was applied to deaf people with Wardenburg syndrome, and results were obtained (n = 17).

8. The Study Results

Study questions will be answered according to their sequence:

Results for the first question: What are the indications for the validity of the psychometric characteristics of the Wechsler Intelligence Scale for Deaf with Waardenburg Syndrome and the level of intelligence according to the mental state?

First: indications of validity of the Wechsler-4 Scale of Deaf Intelligence:

The psychometric properties of the WISC-4 Scale were validated by validating the scale, and by identifying the Construct Validity for sub-tests of the scale. Below are the results:

1. Content Validity for the Jordanian version of the Deaf in sign language:

The Jordanian version of the sign language was presented to (7) translators in the sign language for the deaf, to know the adequacy of the linguistic wording with the grammar and sign language of the deaf and its suitability for the Jordanian environment, and how the paragraph relates to the dimension.

The scale was presented to (5) deaf individuals, to know the appropriateness of the linguistic wording in the sign language and its rules and its relevance to the deaf community in the Jordanian environment. The arbitrators indicated an agreement rate (80%) or more on the linguistic wording in the sign language.

2. Concurrent Validity: By calculating a correlation coefficient between (WISC-4) and the Goodenough- Harris Drawing Test and achievement of the deaf sample (n = 30).

- As the correlation coefficients between performance on the WISC-4 scale and (Goodenough- Harris Drawing Test), the correlation coefficient was (0.688) with a statistically significant indication of (0.01).

- As the correlation coefficients between performance on a scale (WISC-4) with achievement, the correlation coefficient was (0.887) with a statistical significance less than (0.01).

Second: indications of construct validity for the Jordanian Version of the Wechsler-4 Scale of Intelligence of Deaf People with Waardenburg Syndrome:

The Construct Validity of the scale was found in the Jordanian Version for deaf people with Waardenburg Syndrome, where Principle Component Analysis used the scores of the sample members by the orthogonal rotation method (Varimax). The number of sub-factors was determined by four, to be equal to those that make up it the original scale (in its original form), and Table (2) shows the number of sub-tests and the amount of variance explained for each of the tests:

Table (2): Construct Validity Scale for Deaf People with Waardenburg Syndrome (n=17)

Factors	Eigen Value	of variance %	Cumulative%
Verbal Comprehension Index, VCI	2.741	68.537	68.537
Perceptual Reasoning Index, PRI	.638	15.949	84.486
Working Memory Index, WMI	.377	9.433	93.919
Processing Speed Index, PSI	.243	6.081	100.000

It is evident from Table (2) that the Eigen values of the deaf sample with Waardenburg syndrome ranged between (2.741 - 0.243), and that the first factor (VCI) explained what was (68.537%) of the total variance of the scale, and the second factor (PRI) came to explain (15.949%) of the total variance, and

(9.433%) of the scale were interpreted through the third factor (WMI), and finally, the fourth factor (PSI) came to explain the percentage (6.081%) of the total variance of the test, and that what was interpreted It reached (100%).

Results related to the second question: What are the indications for the reliability of the psychometric properties of the Wechsler Intelligence Scale for Deaf with Waardenburg Syndrome and the level of intelligence according to the mental state?

Indications for the reliability of the scale were obtained for deaf people with Waardenburg syndrome, the correlation coefficients between the subtests and the overall score of the scale (total intelligence) were extracted, and the results showed that the correlation coefficients ranged between (0.487 - 0.898) and were statistically significant at the level (0.01.) Or less, and Table (3) explains that:

Table (3): Correlation coefficients between the scale sub-tests and the total score of the deaf sample with Waardenburg syndrome (n = 17)

	VCI	PRI	WMI	PSI	Total
VCI	1	.523*	.752**	.576*	.898**
PRI			.487*	.621**	.779**
WMI				.518*	.794**
PSI					.794**

** : Statistical significance at (0.01) level.

Results for the third question: Are there statistically significant differences at the significance level (0.05) in the IQ level of deaf people with Waardenburg syndrome due to the gender variable?

Arithmetic averages and standard deviations were extracted, and an Independent Sample T-test was used to identify the level of intelligence of deaf people with Waardenburg Syndrome attributable to the gender variable, and Table (4) illustrates this:

Table (4): Independent Sample T-test to identify the differences in IQ among deaf people with Waardenburg Syndrome attributable to the gender variable

Source	Gender	Number	Arithmetic mean	Standard Deviation	Degrees of Freedom	Value (t)	Statistical Significance
VCI	Male	10	65.30	10.29	15	-.677	.509
	female	7	70.86	23.15			
PRI	Male	10	76.40	15.79	15	-.021	.983
	female	7	76.57	16.89			
WMI	Male	10	77.30	25.70	15	-1.317	.208
	female	7	92.29	18.49			
PSI	Male	10	82.20	17.17	15	-.802	.435
	female	7	91.14	28.97			
Total IQ	Male	10	68.80	13.76	15	-.675	.510
	female	7	75.14	24.99			

It is evident from the results shown in Table (4) that there are no statistically significant differences at the level of significance (0.05) in the level of intelligence of deaf people with Waardenburg syndrome due to gender, as the value of the statistic (t) was (-0.677, -0.021, -1.317, -0.802, -0.675) and it is a non-significant value at the level of significance (0.05) or less, this indicates that deaf males and females with Waardenburg syndrome have an equal intelligence level to a large extent, and the differences between the arithmetic averages do not reach the level of statistical significance.

Results related to the fourth question: Are there statistically significant differences at the significance level (0.05) in the IQ level of deaf people with Waardenburg Syndrome due to the mental state variable?

The arithmetic means and standard deviations were extracted, and the One Way ANOVA test was used to identify differences in the level of intelligence of deaf people with Waardenburg syndrome attributable to the mental state variable, and Table (5) illustrates this:

Table (5): The arithmetic means and standard deviations to identify the differences in the level of intelligence of deaf people with Waardenburg syndrome attributable to the mental state variable

	Mental state	Number	Arithmetic mean (IQ)	Standard deviation
IQ	Mild Intellectual Disability	9	62.5556	4.82470
	Moderate Intellectual Disability	1	47.0000	-
	Learning Disability	4	74.0000	4.08248
	Normal	2	89.0000	.00000
	The borderline between Gifted and Superior	1	130.0000	-
	Total	17	71.4118	18.73519

It is evident from Table (5) that there are apparent differences between the arithmetic averages of the IQ level of deaf people with Waardenburg Syndrome attributable to the variable of mental state, and to reveal the significance of the differences, the One Way ANOVA test was used, the results of which appear in Table (6) as follows:

Table (6): One Way ANOVA test to find out the significance of differences in intelligence level among deaf people with Waardenburg Syndrome attributable to a variable of mental status

		Sum of squares	Degrees of freedom	Average squares	Value (F)	Statistical significance
IQ	Between groups	5379.895	4	1344.974	68.324	*.000
	Within groups	236.222	12	19.685		
	Total	5616.118	16			

*: Statistical significance at (0.05) level.

The results of Table (6) showed that there were statistically significant differences at the level of significance (0.05) in the level of intelligence among deaf people with Waardenburg Syndrome due to the variable of mental state, and looking at the previous Table (5), the results showed that the source of the difference in the level of intelligence (IQ) In favor of the borderline between Gifted and Superior category, but the overall intelligence level (IQ) of deaf people with Waardenburg syndrome was within the lower limits of Learning Disability in (IQ = 71) on the normal distribution curve.

Results related to the Fifth question: Are there differences in the level of subtests on the Wechsler Intelligence Scale for Deaf with Waardenburg Syndrome?

The arithmetic mean and standard deviations were extracted to identify differences in the level of subtests from the Wechsler scale for deaf people with Waardenburg syndrome. Table (7) shows that:

Table (7): the arithmetic means, standard deviations, and the lower and upper score to identify the differences in Subtest from the Wechsler scale for deaf people with Waardenburg syndrome arranged in descending order

Subtest	Number	Minor degree	Grand degree	Arithmetic mean	Standard deviation
Cancellation	17	.00	71.00	37.7	24.4
Coding	17	10.00	68.00	28.1	14.0
Block Design	17	.00	33.00	14.8	8.7
Picture Concepts	17	.00	30.00	14.2	9.9
Symbol Search	17	.00	31.00	13.4	8.0
Matrix Reasoning	17	3.00	22.00	11.7	5.5
Letter-Number Sequencing	17	.00	21.00	9.4	4.4

Subtest	Number	Minor degree	Grand degree	Arithmetic mean	Standard deviation
Arithmetic	17	.00	21.00	9.1	5.8
Digit Span	17	.00	16.00	8.5	4.6
Picture Completion	17	.00	15.00	8.4	4.2
Information	17	.00	20.00	7.3	4.5
Vocabulary	17	2.00	34.00	6.4	7.8
Comprehension	17	.00	24.00	6.1	6.3
Similarities	17	.00	11.00	3.2	3.6
Word Reasoning	17	.00	7.00	2.5	2.5

Table (7) shows that there are differences in the sub-test level of the Wechsler scale for deaf people with Waardenburg syndrome, and the results showed that the Cancellation test had the highest score of (37.7) and a standard deviation (24.4), and then Coding came in second place with an average Arithmetic (28.1) and standard deviation (14.0), and these two tests represent the intelligence (PSI) of this sample.

In contrast, the Word Reasoning test came in the last place, with an arithmetic mean (2.5) and a standard deviation (2.5), and in the second place came the Similarities test with arithmetic mean (3.2) and a standard deviation (3.6). These two tests represent intelligence (VCI).

9. Discussion

Discussion of the results of the first question: What are the indications for the validity of the psychometric characteristics of the Wechsler Intelligence Scale for Deaf with Waardenburg Syndrome and the level of intelligence according to the mental state?

The results of the study showed that the validity indications of the deaf sample with Waardenburg syndrome ranged between (2.741 - 0.243).

- The results agreed with each of Abu Drei (2017) also Abu Drei and Al-Rousan (2021) that the correlation coefficients for construct validity ranged between (0.305 - 0.698) and that the correlation coefficients for paragraphs ranged between (0.602-0.823).

The researcher explains: considering the results, this indicates the validity of the scale, as it encourages its use on deaf people with Waardenburg syndrome.

Discussion of the results of the second question: What are the indications for the reliability of the psychometric properties of the Wechsler Intelligence Scale for Deaf with Waardenburg Syndrome and the level of intelligence according to the mental state?

The results of the study showed that the reliability indications of the deaf sample with Waardenburg syndrome ranged between (0.487 - 0.898).

- The results agreed with both Abu Drei (2017) also Abu Drei and Al-Rousan (2021) that the indications for the reliability of the sub-tests ranged between (0.815 - 0.922).

considering the results, this shows the reliability of the scale, as it encourages its use on deaf people with Waardenburg syndrome.

Discussion of the results of the third question: Are there statistically significant differences at the significance level (0.05) in the IQ level of deaf people with Waardenburg syndrome due to the gender variable?

The results of the study showed that there were no statistically significant differences in the IQ level of deaf people with Waardenburg syndrome due to the gender variable.

- The results did not agree or differ with previous studies due to the scarcity of studies on the educational intelligence of this syndrome.

That Waardenburg Syndrome with its mental characteristics and as a category has not been discovered educationally significantly, which led to the existence of a large gap between the deaf heterogeneous groups and therefore the use of sign language with that group through the IQ scale did not explain the existence of a difference attributed to the gender variable and this indicates that Mental

ability, both verbal and performative, was similar.

Discussion of the results of the fourth question: Are there statistically significant differences at the significance level (0.05) in the IQ level of deaf people with Waardenburg Syndrome due to the mental state variable?

The results of the study showed that there were statistically significant differences in the level of intelligence among deaf people with Waardenburg syndrome due to the variable of mental status and that the source of the difference in the level of intelligence in favor of the category of the boundary between excellence and gifted, but the overall intelligence level (IQ) of deaf people with Waardenburg syndrome was within the limits. Minimum Learning Disability (IQ = 71) on the curve of a normal distribution.

- The results agreed with each of Abu Drei (2017) also Abu Drei and Al-Rousan (2021) and that there are statistically significant differences in performance on the Jordanian Version subtests of the Wechsler-4 intelligence scale.
- The results agreed with each of Tamayo et al. (2008) that they have a growth delay.
- The results agreed with Marta (2016) on the existence of intellectual disability.
- The results Suzuki et al. (2018) agreed that there was a delay in development.
- The results differed with each of Katoch et al. (2019) that IQ is normal.

The hearing impairment carries great secrets due to the heterogeneity of that group, especially when searching for a group within the deaf groups, which poses a great challenge, especially during communication in sign language, and therefore one characteristic of this group is their low mental ability, especially for the deaf of the moderate and severe degrees. And that the high level of mental ability in this group is in favor of Mild hearing impairment only.

Discussion of the results of the Fifth question: Are there differences in the level of subtests on the Wechsler Intelligence Scale for Deaf with Waardenburg Syndrome?

The results of the study showed that there are differences in the level of the sub-tests of the Wechsler scale for deaf people with Waardenburg syndrome, and the results showed that the (Cancellation) test was the highest score and then (Coding) came in second place, and these two tests represent the intelligence of the performance section of the scale (PSI) I have this sample. In contrast, the (Word Reasoning) test came in the last place and the second to last place came the (Similarities) test, and these two tests represent the intelligence of the verbal section of the scale (VCI).

- The results agreed with all Song et al. (2016) that hearing loss was (71%) and significantly associated with Waardenburg Syndrome. Also, with the study Tamayo (2008) they had Sensorineural hearing loss. Also, the study Suzuki et al. (2018) had congenital deafness (severe hearing loss). Also, the study Drei (2020) showed intense focus during contact with sign language at the hands of the speaker because the change in eye color led to distraction in sign language and to establish a distance during communication with sign language to see, and this may affect verbal tests.

This syndrome has a defect in verbal tests, especially during communication in sign language, as their linguistic outcome indicates a decline in the level of sign language and educational and scientific. Also, the only grades that distinguished this group significantly were the (Cancellation) test.

10. Conclusion

Since few researchers specialize in sign language at the translation level for the deaf, it's difficult to learn about and discover other issues linked to hearing impairment (such as double disability). As a result, many other cases must be determined areas and levels beyond the hearing impairment category, which enables us to enrich this field. As a result, the secret of this scientific study lies in understanding the features and rules of the researcher's deaf sign language, which allows him to easily distinguish and access other cases that do not appear with the standard measurement tools for these categories.

11. Recommendations

Based on above discussion of results, current study recommended the following: Educational recommendations:

1. The inclusion of this syndrome as an important part of the hearing impairment categories.
2. Teacher training on WS.
3. Training workers to know the visual problems resulting from eye pigmentation, which may add shapes that do not exist.

Research Recommendations:

1. The inclusion of this syndrome as a significant component of the types of hearing impairment.
2. Conducting studies related to the comparison between deaf people with WS and deaf people with intellectual disability.
3. Conducting studies related to the development of the functional section of the Wechsler Scale in proportion to the visual perception of deaf people with WS.
4. Conducting studies related to visual perception in deaf people with WS.

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