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Prevalence of Scotopic Sensitivity Syndrome among Arab Students with and without Learning Disabilities

Abstract

Scotopic Sensitivity Syndrome (SSS) is neurologically caused by a dysfunction of magnocellular and parvocellular cells in the Lateral Geniculate Nucleus (LGN) of the thalamus. The SSS negatively affects the speed and movement of visual stimuli especially those related to academic skills. Because of the comorbidity of the SSS and learning disabilities (LDs), erroneous diagnoses may be made in differentiating between them, and this led the international scholars and researchers to focus on differential diagnosis. In the Arab context, it is essential to find an Arab indicator of the prevalence of the SSS among students with and without LDs. This research aims at determining the prevalence of the SSS among Arab students with and without LDs, as well as to identify the SSS prevalence in dyslexic students. A total of 1657 participants visited Irlen's clinics in the Arab states. The participants' data are obtained from 6 of these clinics. The results indicated that the general prevalence rates of SSS are 31% among students without LDs, 45% among students with LDs, and 55% among dyslexic students. These rates are in favor of male students.

Keywords: Arab Students, Dyslexia, Irlen's Clinics, LDs, Prevalence, SSS.

Introduction

The developmental LDs include one or more of disturbances in psychological, or cognitive, processes related to attention, perception, and memory in pre-school education (Al-Zoubi & Al-Zoubi, 2020). These processes are the most significant cognitive structures of the child's mental activity. In addition, any disturbance in one or more of these processes may lead to academic LDs that display when the child joins school education. Currently, the term of specific LDs includes developmental and academic LDs. Academically, specific LDs are composed of dyslexia, dysgraphia, and dyscalculia (Bani Abdel Rahman & Al-Zoubi, 2017). According to the Diagnostic and Statistical Manual of Mental Disorders [DSM-5], the LDs category is one of the neurodevelopmental disorders that appears in the individual as specific LDs in reading, writing, and mathematics (Harris, 2014).

LDs may be attributed to functional disturbances in linguistic, cognitive and visual motor development in the central nervous system (Tolbert et al., 2015). LDs may be caused by dysfunction in a specific part of the brain. Thus, children with LDs acquire and process information in a different way from their peers without LDs (Silver et al., 2008). Consequently, cognitive functions can contribute to organizing the response of children with LDs to real life situations and control their thinking. These functions can be shaped as a result of children's interaction with the environment through psychological processes. Perception is one of these processes which can be developed by the child's interaction with the environment (Fabio et al., 2019; Esmmaeelbeyg et al., 2020). This interaction requires the child to be aware of the audio-visual stimuli received from the environment and also helps him or her to learn

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(Broadbent et al., 2018). In other words, a disturbance in the functions of perception may lead to a deficiency in visual or auditory perception, and this is a negative reflection of reading, writing and mathematics skills of students with LDs. In addition, the deficits in the visual analysis skills are an indicator of specific LDs (Balikci & Melekoglu, 2020).

Dyslexia

Dyslexia is the most common academic problems of students with LDs. The students with dyslexia have problems in phonological awareness, decoding, fluency, and reading comprehension (Hallahan et al., 2012). These academic problems can be explained by neuroimaging techniques. These techniques showed anatomical and physiological differences between the brains of students with and without dyslexia, particularly those with dyslexia, that is there is a reduction in grey matter volumes, decreasing in cerebral white matter gyrifications, asymmetry of the cerebellum structure (Elnakib et al., 2014). The reduction of physiological activities of neurons in the left temporal lobe and left parietal cortices increasing left inferior frontal activation and asymmetry of hemispheric functions (Sun et al., 2010). The prevalence of dyslexia does not exceed 10% of any population (Blau et al., 2009; Peterson & Pennington, 2015), but it is estimated at 21.5% among school students (Ferrer et al., 2010).

According to DSM-5 the diagnosis of a specific learning disorder is persistent difficulties in reading, writing, arithmetic, or mathematical reasoning skills during formal years of schooling (Morsanyi et al., 2018). These difficulties must not be better explained by developmental, neurological, and sensory (vision or hearing), or motor disorders and must significantly interfere with academic achievement, occupational performance, or activities of daily living. The dyslexia is considered as an advanced stage of reading disabilities, and is associated with neurological deficits and dysfunctions. The majority of individuals with LDs have reading disabilities or dyslexia (Kohli et al., 2018). The dyslexia as a disorder of constitutional origin manifested by a difficulty in reading, writing or spelling, despite conventional instruction, adequate intelligence, and sociocultural opportunity.

Scotopic Sensitivity Syndrome

The educational and psychological research determined the causes of dyslexia. Olive Meares diagnosed visual distortions when some students read the white paper. She believes that the white

spaces between lines and words written in black ink may lead to symptoms of blurred vision and make the words move. In other words, the brightness contrast of black-on-white print may reduce the reading abilities of students with dyslexia (Uccula et al., 2014). She indicated that these symptoms can be reduced using colored plastic sheets instead of white paper and black lines (Meares, 1980). In contrast, Helen Irlen adopted the idea of the relationship between visual distortions and dyslexia. She found that the use of colored overlays and lenses had positive effects on the amelioration of the reading skills of students with dyslexia. Through her practical experiences, Irlen discovered a syndrome associated with dyslexia became known as SSS, Meares-Irlen Syndrome, Irlen Syndrome, or VSS (Kapoor, 2008; Loew & Watson, 2013; Loew et al., 2014). Currently, Irlen Institute is an international institute specialized in the examination, diagnosis, and treatment of syndrome of SSS. This institute affiliated more than 170 clinics worldwide, including 30 clinics in the Arab world. These clinics provide screening and diagnosing services of SSS (Irlen Institute, 2020). Arnold Wilkins invented the Intuitive Colorimeter to control colors through colored lenses (Allen et al., 2012). This invention is effective in reducing symptoms of SSS and improves reading skills for students with dyslexia (Evans & Allen, 2016).

The SSS is a disturbance in perceptual and visual information processing caused by brain dysfunction. Therefore, the SSS is not an optical problem, it is related to the poor processing of the optical spectrum due to sensory perception problems. Accordingly, individuals with SSS have reading difficulties because they don't see the written page in the same way that individuals without SSS do (El-Zraikat & Imam, 2004). Symptoms of SSS are relating to lighting sources, bright light, light wavelength, black print on white paper, and difficulty reading under fluorescent light (Loew & Watson, 2013). These symptoms lead to slow reading, reading fatigue, lack of concentration, dislike reading, and weakness in continuing the reading, writing, and mathematical tasks (Siam & Aljawaldah, 2016). This contributes to decreasing motivation, productivity, and attention of individuals with SSS.

The SSS is a visual perceptual motor deficit affecting understanding of information gathered through visual means due to defects in the way a person's eyes move which results in impairing reading comprehension skills. Consequently, the visual processing is anomaly prevalent among students with dyslexia. This condition is characterized by asthenopia and visual perceptual distortions. So those who suffer from this condition imagine that words move

shimmer or blur (Evans, 2007). In other words, because the diagnostic methods of the SSS and dyslexia are different; the comorbidity between visual stress and dyslexia is clinically investigated. However, dyslexia is classified as a basic symptom of specific LDs while the SSS is optometrically identified or screened by Irlen's method (Caskey & Freney, 2019).

Research Problem

There are many Arab students who are misdiagnosed with dyslexia. The reasons for this misdiagnosis are due to the lack of knowledge for diagnosing dyslexia and SSS, in addition to the similarity of symptoms between them. This misdiagnosis results in the implementation of an inappropriate remedial instruction program for the dyslexic student because he or she suffers from SSS and not dyslexia. As a result, special education teachers spend a lot of time and effort with these inappropriate programs. Moreover, the current research aims to investigate the prevalence of SSS among Arab students with and without LDs through Irlen's clinics in Arab countries. More specifically, the research aims at answering the following questions:

1. What is the prevalence of SSS among Arab students with and without LDs?
2. Does the prevalence of SSS differ according to the category and gender of the participants?

Methodology

Research Design

This research was a quantitative descriptive methodology. This design used exploratory research to investigate the prevalence of the SSS among Arab students with and without LDs. In other words, the current research obtained data and information from Irlen's clinics that are in Arab countries.

Participants

The research participants were 1657 students, 868 of them were males, and 789 were females. The participants' data were obtained from 6 Irlen's clinics. These clinics are distributed in 4 Arab countries: Jordan, Palestine, Oman, and the United Arab Emirates. They are licensed from Irlen's Institute in the USA to screen, diagnose, and treat the SSS.

Instrument and Procedures

To achieve the research aims, the researcher constated an instrument to collect data. It includes general information on Irlen's clinic and six questions related to students who visit these clinics. This instrument was distributed via email and WhatsApp to 30 Irlen's clinics in Arab countries from October 2019 to January 2020. Consequently, 6 out of 30 clinics cooperated with the researcher and responded to instrument questions. Due to a lack of data from these clinics, questions related to dysgraphia and dyscalculia have been deleted from the current research.

In the Irlen's clinics, identification of the SSS consists of screening and diagnostic phases. In the screening phase, classification of the syndrome (mild, moderate, or severe) is made, but at the diagnostic phase, the colored lens is chosen for the person with the SSS. Ophthalmic assessment should be done before starting the treatment of the SSS. This treatment is based on changing light wavelength causing Scotopic sensitivity using colored overlays to modify the optic spectrum and improve the concentration of students with the SSS. The optometric methods of diagnosing the SSS are diverse. The most basic one is that the method depending on Irlen's diagnostics. Other methods are the Wilkins Rate of Reading Test which was originally developed to assess the effect of colored filters on reading in children with reading difficulties.

Results

Results related to the first research question: What is the prevalence of SSS among participants? Table 1 showed the percentage of SSS was 1259(76%) out of 1657 participants, while 398(24%) of them didn't have the SSS.

Table 1.

Prevalence the SSS among participants.

SSS	n (%)
Yes	1259(76)
No	398(24)
Total	1657(100)

Results related to the second research question: Does the prevalence of SSS differ according to the category and gender of the participants? To answer this question, descriptive statistics were used. The frequency and prevalence rates according to the category and gender were shown in Table 2.

Table 2.

Prevalence of the SSS according to category and gender

Category	Gender	n (%)	Prevalence rates (%)
Without LDs	Male	392(76.4)	45
	Female	121(23.6)	15
	Total	513 (100)	31
With LDs	Male	427(57.2)	49
	Female	319(42.8)	40
	Total	746(100)	45
Dyslexia	Male	239(57.7)	56
	Female	175(42.3)	55
	Total	414(100)	55

Table 2 showed differences in the prevalence of the SSS according to the category and gender of the participants. Table 2 indicated that 513 students without LDs were diagnosed with the SSS. The general prevalence rates were 31%; 45% of them were males, and 15% were females. Table 2 also showed that 746 students with LDs were diagnosed with the SSS. The general prevalence rates were 45%; 49% of them were males, and 40% were females. Whereas, Table 2 showed that 414 students with dyslexia out of 746 students with LDs were diagnosed with the SSS. The general prevalence rates were 55%; 56% of them were males, and 55% were females.

Discussion

The results showed that the prevalence of 76% of students visiting Arab Irlen's clinics (AIC) had the SSS. This high percentage may be due to that the AICs are specially intended for screening and diagnosing this syndrome, so the visitors of AICs have symptoms of the SSS. This led to increasing the percentage of prevalence in the target participants. Moreover, these clinics have providers and tools that are capable of screening, diagnosing, and treating this syndrome that these clinics follow an integrative and comprehensive approach in all subsidiaries worldwide. Consequently, the high prevalence of the SSS lead us to deeply think about the necessity of re-evaluation and reconsideration of the Arab educational system, particularly in dealing with academic underachievers in Arab general education schools. This may not be due to SSS subnormal mental abilities. This expected explanation may be an impetus to make an early assessment for students in elementary schools to differentiate between the symptoms of the SSS and LDs. In this regard, Singleton and Henderson (2007) indicates that 10-12% of the population has the SSS, while the British Dyslexia Association believes that 5-20% of the population has this syndrome (Jang, 2009). The SSS may affect at least 5% of the general

population (Harries et al., 2015; Kapoor, 2008), and 14% as classified by another specialist (Kriss & Evans, 2005).

Table 2 showed that the general prevalence rates of SSS among students without LDs were 31%, 45% of them were males and 15% were females. Therefore, this syndrome affects students without LDs and is not only associated with students with academic LDs. Symptoms of the SSS may be found in the gifted and talented students. Perhaps it motivates researcher to think about re-diagnosing gifted and talented students with LDs who have been diagnosed in Arab schools with academic LDs but they suffer from the SSS. Loew and Watson (2013) stressed that the SSS affects students with various intellectual abilities, including gifted and talented students. Therefore, symptoms of the SSS are not observed by parents, physicians, and teachers and this explains its prevalence between 50-83% of students with ADHD (Loew et al., 2014). In other words, the SSS affects approximately 25% of students without LDs and dyslexia (Uccula et al., 2014).

Table 2 also showed that the general prevalence rates of SSS among students with LDs was 45%, 49% of them were males and 40% were females. This prevalence leads us to believe that the SSS affects students with dysgraphia and dyscalculia and is not limited to students with dyslexia only. In this regard, Khasawneh and Alkhaldeh (2018) revealed that 51% of students with LDs have the SSS and its prevalence among male students was 52% at primary schools in Saudi Arabia. According to Irlen (1997), 46% of individuals with dyslexia and LD have symptoms of the SSS. Alanazi et al. (2016) indicated that the prevalence of dyslexia and the SSS among female medical students at King Saud University was 2% and 6%, respectively.

Table 2 also indicated that the general prevalence rates of the SSS among students with dyslexia were 55%, 56% of them were males and 55% were females. This prevalence is close to the prevalence of SSS of those who experience dyslexia in the United States, which is estimated at 46%, and 75% of those who suffer from dyslexia (Singleton & Henderson, 2007). In the Arab context, research showed that colored overlays and lenses were effective in improving the reading skills of students with LDs (El-Zraigat & Imam, 2004; Alanazi et al., 2016; Siam & Aljawaldah, 2016). Due to the common elements between the SSS and dyslexia, descriptive statistics of obtained data reflect on comorbidity and differential diagnosis between specific learning disabilities whose main features are dyslexia, dyscalculia, and dysgraphia, and the SSS whose symptoms focus on the dysfunctional perception and print of letters.

Internationally, there were some variances in the findings of research studies. Hlengwa et al. (2017) proved the effect of colored overlays on improving the ability of reading and reducing the SSS symptoms. Additionally, Mitchell et al. (2008) indicated that colored filters were influential in reading accuracy and comprehension rates in dyslexic children. Otherwise, relevant studies revealed that there was no effectiveness of colored overlays and lenses in improving reading skills in students with dyslexia and the SSS in the long run (Mitchell et al., 2008). Through, a systematic review of the related literature of the SSS, Griffiths et al. (2016) concluded that the effect of colored overlays and lenses on improving the ability of reading couldn't be demonstrated because of the difficulty assessing the SSS and dyslexia.

The DSM-5 identified visual stress as a recognized disorder. The ability of colored filters to improve reading performance in individuals who report symptoms of visual stress has been widely disputed; because there were no criteria by which visual- perceptual distortions can be diagnosed (Griffiths et al., 2016, Bakkar & Al-Zoubi, 2020). The researcher in the current research thinks that treatment of the SSS is not completely remedial, that is there must be remedial instruction based on individualized educational programs to deal with LDs and dyslexia. Moreover, using colored overlays and lenses will not help to learn reading, but eliminate any obstacles that may hinder from acquiring reading skills. Therefore, students with the SSS using this optic technique should be controlled to ensure that colored filters which are suitable to them.

Conclusion

Findings of prevalence rates of the SSS indicated that this syndrome is common in students with and without LD. This result encourage research to make an early assessment of this syndrome, and reconsider the methods of diagnosing LDs in the Arab world. There were a lot of Arab students with and without LDs who were erroneously diagnosed with LDs because of difficulty differentiating between LDs and the SSS and similarity of symptoms in both as well. This leads to a focus on the differential diagnosis of the SSS. The worst thing here is referring the student to the resource room to receive remedial instruction. This procedure is not suitable for this case; because the student with the SSS may not have LDs. Accordingly, this will lead the teachers to spend more time and effort in remedial instruction in the resource room. Erroneous diagnosis will cause burnout in teachers, frustration, in confidence, and low achievement

in students. Consequently, it is necessary to refer Arab students who are diagnosed with and without LDs to Irlen's clinics to ensure that they don't have the SSS. In the case of comorbidity between LDs and the SSS, the student should join the remedial instruction based on individualized education programs to treat specific LDs. Colored overlays and lenses are not adequate to treat LDs as perceived by some people, instead, they only help improve students' concentration and comprehension rate. Future Arab research is concerned in exploring the prevalence of the SSS among students with dysgraphia and dyscalculia, and prevalence of the SSS according to its degree (mild, moderate and severe).

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