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Visual Snow Syndrome in Saudi Arabia: A Cross-Sectional Study Assessing Prevalence, Symptomatology, Awareness, and Associated Factors

Zaki Aqeel Alshammari[1*], Sultan S. Alsabhan[2], Alesifeer, Abdulla Ali[3], Zakariya M. S. Mohammed[4], Sanaa A. Mohammed[5] and Abrar Ali[6]

[1,6]Department of Ophthalmology, College of Medicine, University of Hail, Hai 55476, Saudi Arabia
[2,3]College of Medicine, University of Hail, Hail, Saudi Arabia
[4]Center for Scientific Research and Entrepreneurship, Northern Border University, Arar, Saudi Arabia Department of Mathematics, College of Science, Northern Border University, Arar, Saudi Arabia
[5]Department of Statistics, Faculty of Mathematical Sciences and Informatics, University of Khartoum, Khartoum, Sudan

Author Designation: [1,4]Assistant Professor, [6]Professor, [2,3]Medical Student, [5]Lecturer

*Corresponding author: Zaki Aqeel Alshammari (e-mail: z.allogan@uoh.edu.sa).

Abstract: Background: Visual Snow Syndrome (VSS) is characterized by persistent visual disturbances such as visual static, afterimages, photophobia, and impaired night vision. Despite growing global recognition, data from Middle Eastern populations remains limited, particularly on prevalence, symptomatology, and awareness. **Objectives:** To estimate the prevalence of VSS, evaluate symptom patterns, assess awareness, and identify associated factors among adults in Saudi Arabia. **Methods:** A cross-sectional online survey using convenience sampling through social media was conducted among Saudi adults (≥18 years). The questionnaire collected demographic data, VSS symptoms, awareness, comorbidities (migraine, tinnitus, anxiety, depression), lifestyle factors, family history, and impact on daily life. Data were analyzed using descriptive statistics and Fisher's exact test ($p<0.05$). **Results:** Of 343 respondents, 3.8% met symptom-based criteria for VSS, aligning with international prevalence (2%–5%). Awareness was low (12.8%), mainly via media rather than healthcare providers. Common symptoms were afterimages (32.7%) and photophobia (30.6%). Significant comorbidities included migraine (17.5%), anxiety (20.4%), tinnitus (11.1%), and depression (5%). Extended screen time and low physical activity were common lifestyle factors. Additionally, 16.3% reported a family history of visual disturbances and 8% noted stress exacerbation. **Conclusion:** This study highlights the prevalence, poor awareness, and symptom burden of VSS in Saudi Arabia. Findings underscore the need for targeted education and further research to improve clinical recognition and patient care.

Key Words: Visual Snow Syndrome, Prevalence, Symptomatology, Awareness, Associated Factors, Saudi Arabia

INTRODUCTION

Visual snow syndrome (VSS) is characterized by persistent visual disturbances, predominantly visual static or noise, accompanied frequently by afterimages, photophobia, and impaired night vision [1]. Despite gaining international recognition, VSS remains widely underdiagnosed and often misdiagnosed as migraine aura, hallucinogen-persisting perception disorder (HPPD), or other neuro-ophthalmologic conditions [2–4]. Diagnostic criteria primarily depend on self-reported symptoms due to the current absence of objective biomarkers, which complicates accurate diagnosis and management [1].

Current evidence suggests that VSS originates from widespread cortical hyperexcitability involving visual and thalamocortical networks, as confirmed by functional neuroimaging studies indicating cortical dysfunction beyond visual pathways, including the attentional and limbic areas [5,6]. This neurological basis underpins the complex symptomatology observed in VSS.

Prevalence estimates for VSS vary, with studies from Europe reporting rates of between 2% and 5%. These variations are influenced by differences in the diagnostic criteria and study methodologies [7–9]. Notably, there is a paucity of data regarding the prevalence and characteristics of VSS in Middle Eastern populations, including those in Saudi Arabia. This lack of regional research highlights the need for studies focused on these communities to better understand the impact of the syndrome and inform appropriate clinical responses.

VSS frequently co-occurs with conditions such as migraines, tinnitus, anxiety, and depression [2,10,11]. These comorbidities suggest a broader neurological and psychological interplay that warrants comprehensive investigation. Furthermore, lifestyle factors such as prolonged screen time and reduced physical activity have been hypothesized to influence symptom severity, although empirical evidence remains limited.

The evident gaps in clinical awareness and understanding of VSS, especially in underrepresented regions, underscore the necessity for targeted educational initiatives and research efforts. Conducting studies within diverse populations will not only enhance the global comprehension of VSS, but also contribute to the development of effective diagnostic and management strategies tailored to specific community needs.

METHODES

Study Design

A cross-sectional, descriptive study design was used, employing an online, self-administered questionnaire to collect data. This survey aimed to gather insights into the symptomatology, awareness levels, and factors associated with Visual Snow Syndrome (VSS) among the Saudi population.

Participants

Participants included individuals residing in Saudi Arabia recruited via convenience sampling through online platforms and social media channels. The Inclusion criteria were adults aged 18 years or older, capable of providing informed consent, and able to complete an online survey independently.

Data Collection Tool

An electronic questionnaire was developed based on previous studies and the validated literature. The questionnaire consisted of multiple sections covering the following:

- Demographic data (age, gender, region, education, and occupation)
- Awareness of VSS and sources of information
- Symptomatology, specifically assessing visual snow, afterimages, photophobia, and night blindness.
- Associated medical conditions (e.g., migraine, anxiety, tinnitus, and depression)
- Lifestyle and environmental factors (screen time, physical activity, and tobacco use)
- Impact on daily activities, symptom duration, and stress effects

Data Collection Procedure

The finalized questionnaire was distributed electronically through social media platforms, healthcare forums, and direct contact between specific dates. The participants voluntarily completed the online survey after providing informed consent. Anonymity and confidentiality were ensured throughout the data-collection process.

Data Analysis

Data were analyzed using descriptive and inferential statistical methods using SPSS (version 28). Descriptive statistics, including frequencies, percentages, and means, were calculated to summarize demographic characteristics, symptom prevalence, and awareness levels. Fisher's exact test and chi-square test were used to assess the potential associations between the presence of VSS and demographic or lifestyle variables. Statistical significance was set at $p<0.05$.

Ethical Considerations

Ethical approval was obtained from the relevant institutional review board prior to data collection. Participation was entirely voluntary, and respondents were informed of their right to withdraw at any point without consequences. All collected data were stored securely and accessible only to authorized research personnel.

RESULTS

A total of 343 participants were included in this study. Most participants were aged 18–24 years (37%), followed by those aged 25–34 years (30.9%). The majority (76.1%) were female. Regarding region of residence, 57.4% resided in the Northern region, followed by 29.7% in the Central region. In terms of education, 72.9% of participants held a bachelor's degree. Professionally, 48.4% were non-healthcare professionals and 32.9% were students (Table 1).

Regarding awareness of the VSS, only 44 participants (12.8%) had heard of the condition. Among them, 59.1% learned about it from the media, 20.5% from healthcare professionals, 18.2% from friends or family, and 2.3% from other sources (Table 2).

With respect to the distribution of symptoms, 13.1% of the participants reported experiencing visual snow (static) in their vision, 32.7% reported seeing afterimages after looking away from objects, 10.2% reported difficulty seeing at night (night blindness), and 30.6% reported sensitivity to light (photophobia). Additionally, 8.5% reported both visual snow and afterimages, 3.2% experienced both visual snow and night blindness, and 7.3% experienced both visual snow and sensitivity to light. Furthermore, 2.9% experienced visual

Table 1: Distribution of Participants according to Demographic Characteristics

Variables	Variable levels	Count	Percent
Age group	Under 18	1	0.3
	18-24	127	37
	25-34	106	30.9
	35-44	57	16.6
	45-54	23	6.7
	55-64	19	5.5
	65 and older	6	1.7
	Missing	4	1.2
Gender	Male	79	23
	Female	261	76.1
	Missing	3	0.9
Region of Residence	Western (Jeddah, Mecca, etc.)	13	3.8
	Southern (Najran, etc.)	3	0.9
	Northern (Tabuk, etc.)	197	57.4
	Eastern (Dammam, Khobar, etc.)	24	7
	Central (Riyadh, etc.)	102	29.7
	Missing	4	1.2
Highest Level of Education	Less than high school	6	1.7
	High school graduate	53	15.5
	Bachelor's degree	250	72.9
	Master's degree	20	5.8
	Doctoral degree or higher	11	3.2
	Missing	3	0.9
Occupation	Student	113	32.9
	Healthcare Worker	6	1.7
	Professional (non-healthcare)	166	48.4
	Homemaker	30	8.7
	Retired	20	5.8
	Unemployed	8	2.3
Total	343	100	

Table 2: Participants awareness of VSS

Variables	variables	Count	Percent
Have you ever heard of Visual Snow Syndrome (VSS)?	Yes	44	12.8
	No	299	87.2
	Total	343	100
If yes, where did you hear about it?	Healthcare professional	9	20.5
	Media (TV, internet, etc.)	26	59.1
	Friends or family	8	18.2
	Other	1	2.3
	Total	44	100

Table 3: Prevalence of VSS

				Percent	95% CI
	Variables	Variable levels	Count	Lower	Upper
	No	330	96.2	94.2	98.2
VSS	Yes	13	3.8	1.8	5.8

snow, afterimages, and night blindness; 5.2% reported visual snow, afterimages, and sensitivity to light; and 2.3% experienced visual snow, night blindness, and light sensitivity. Finally, 2.0% of the participants reported experiencing all four symptoms: visual snow, afterimages, night blindness, and light sensitivity (Figure 1).

The results indicated a VSS prevalence of 3.8% with a 95% confidence interval of 1.8%–5.8% (Table 3). Fisher's exact test was used to assess the significance of the association between the VSS and demographic characteristics. The results showed no significant associations between VSS and demographic characteristics at the 0.05 significance level, suggesting that participants had a similar prevalence of VSS regardless of their age, gender, region of residence, occupation, or educational attainment (Table 4).

Considering the associated conditions, 17.5% of the participants reported experiencing migraines, 11.1% reported tinnitus, 20.4% reported anxiety, and 5% reported depression. Regarding neurological conditions, 1.5% of the participants were diagnosed with neurological disorders (Table 5).

Regarding lifestyle patterns, 39.7% of participants reported an average daily screen time of 5–7 hours, while 31.8% reported 2–4 hours. In addition, 8.2% of the participants reported using tobacco products. In terms of physical activity levels, 47.2% were slightly active, 28.3% sedentary, and 22.7% moderately active (Table 6).

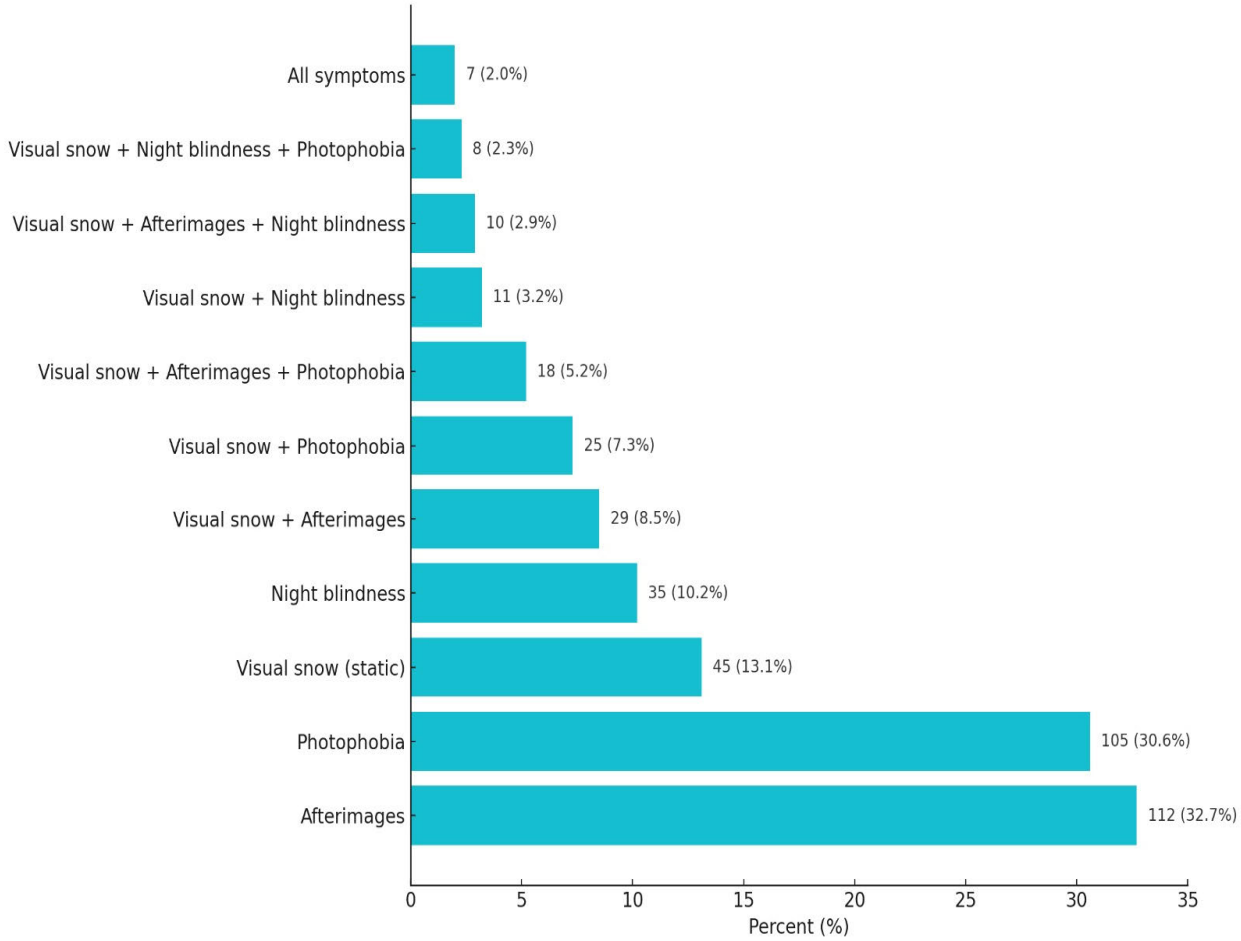

Figure 1: Distribution of Participant according to Presence of Vss Symptoms

Table 4: Association between VSS prevalence and the demographic characteristics:

Variable	Variable levels	VSS	p-value		No	Yes	Total	
		Count	%	Count	%	Count	%	p-value
Age Group	Under 18	1	100	-	-	1	100	0.109
	18-24	120	94.5	7	5.5	127	100	
	25-34	105	99.1	1	0.9	106	100	
	35-44	53	9	4	7	57	100	
	45-54	23	100	-	-	23	100	
	55-64	19	100	-	-	19	100	
	65 and older	5	83.3	1	16.7	6	100	
Gender	Male	75	94.9	4	5.1	79	100	0.509
	Female	252	96.6	9	3.4	261	100	
Region of Residence	Western	13	100	-	-	13	100	0.748
	Southern	3	100	-	-	3	100	
	Northern	190	96.4	7	3.6	197	100	
	Eastern	24	100	-	-	24	100	
	Central	96	94.1	6	5.9	102	100	
Highest Level of Education	Less than high school	6	100	-	-	6	100	0.234
	High school graduate	49	92.5	4	7.5	53	100	
	Bachelor's degree	243	97.2	7	2.8	250	100	
	Master's degree	19	95	1	5	20	100	
	Doctoral degree or higher	10	90.9	1	9.1	11	100	
Occupation	Student	106	93.8	7	6.2	113	100	0.613
	Healthcare Worker	6	100	-	-	6	100	
	Professional (non-healthcare)	161	97	5	3	166	100	
	Homemaker	30	100	-	-	30	100	
	Retired	19	95	1	5	20	100	
	Unemployed	8	100	-	-	8	100	

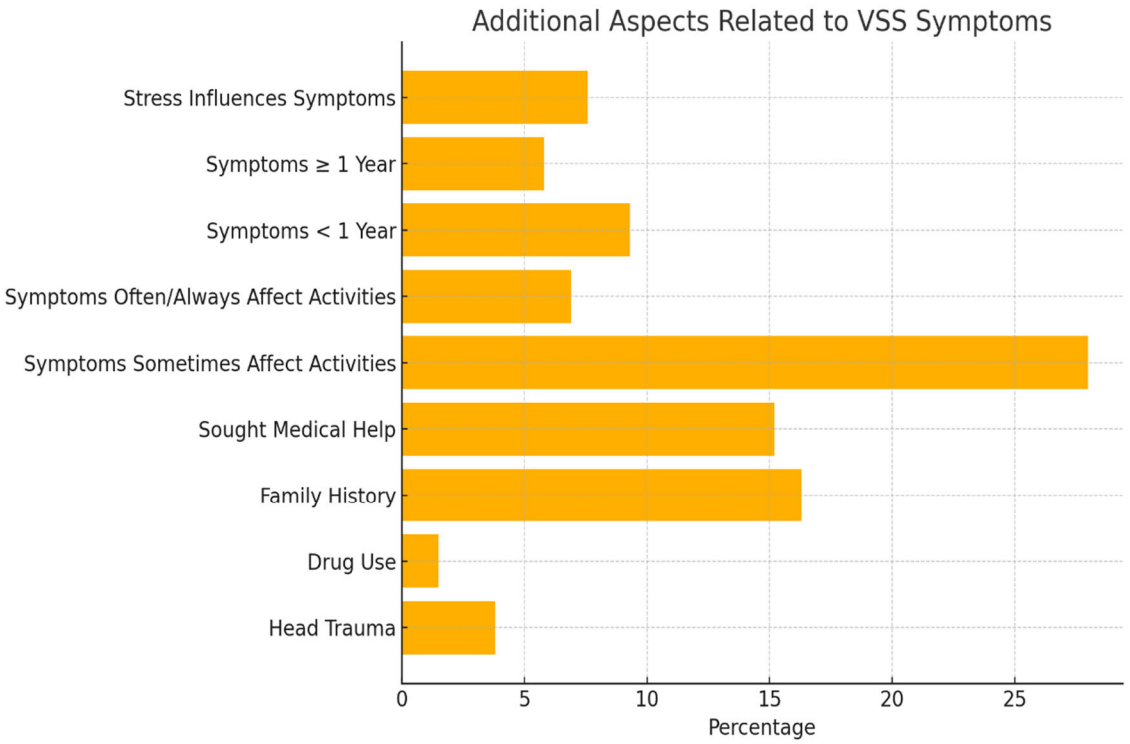

Figure 2: Additional Aspects

Table 5: Associated Health Conditions

Variables	Variable levels	Count	Percent
Migraines	Yes	60	17.5
	No	281	81.9
	Missing	2	0.6
Tinnitus	Yes	38	11.1
	No	303	88.3
	Missing	2	0.6
Anxiety	Yes	70	20.4
	No	271	79
	Missing	2	0.6
Depression	Yes	17	5
	No	324	94.5
	Missing	2	0.6
Have you ever been diagnosed with a neurological condition	Ys	5	1.5
	No	337	98.3
	Missing	1	0.3

Table 6: Lifestyle Patterns

Variables	Variable levels	Count	Percent
Average daily screen time	Less than 2 hours	33	9.6
	2-4 hours	109	31.8
	5-7 hours	136	39.7
	More than 8 hours	64	18.7
	Missing	1	0.3
Do you use tobacco products?	Yes	28	8.2
	No	309	90.1
	Missing	6	1.7
Physical activity level	Sedentary (little or no exercise)	97	28.3
	Lightly active (light exercise/sports 1-3 days/week)	162	47.2
	Moderately active (moderate	78	22.7
	Very active (hard exercise/sports 6-7 days/week)	5	1.5
	Missing	1	0.3
Total	343	100	

When investigating additional aspects related to VSS symptoms, 3.8% of participants reported having experienced significant head trauma, and 1.5% had used hallucinogenic or psychoactive drugs. Moreover, 16.3% had a family member with similar visual disturbances and 15.2% had previously sought medical help for visual disturbances. Regarding the frequency with which visual symptoms affected daily activities, approximately 28% reported that symptoms sometimes impacted their activities, whereas approximately 6.9% reported being often or always affected. In terms of symptom duration, 9.3% had experienced symptoms for less than one year, while 5.8% had experienced them for one year or longer. Furthermore, 7.6% of the participants reported that changes in stress levels influenced their symptoms (Figure 2).

DISCUSSION

This study provides important insights into the prevalence, symptomatology, awareness, and associated factors of Visual Snow Syndrome (VSS) in the Saudi Arabian population. Our findings indicate a prevalence of approximately 3.8%, aligning closely with the international prevalence estimates ranging from 2% to 5% [7–9]. Despite the methodological limitations associated with using a convenience sampling method through social media distribution, this estimated prevalence provides essential preliminary data specific to the Saudi context and highlights the relevance of the VSS within this population.

Awareness of VSS among respondents was notably low, with only 12.8% previously aware of the condition, primarily gaining knowledge through the media rather than through healthcare professionals. This limited clinical and public awareness aligns with global trends and underscores a significant barrier to accurate diagnosis and effective management [6,7]. This highlights the urgent need for targeted educational efforts aimed at both health care providers and the general public to improve early recognition and appropriate clinical responses [12,13].

Symptom analysis revealed that afterimages (32.7%) and photophobia (30.6%) were the most common visual disturbances, followed by snow (13.1%) [10]. The frequent occurrence of multiple simultaneous symptoms underscores the complex neurological underpinnings of VSS, consistent with the existing literature proposing cortical hyperresponsivity involving the visual and broader thalamocortical networks [5,14].

Significant comorbid conditions were reported among respondents, including migraine (17.5%), anxiety (20.4%), tinnitus (11.1%), and depression (5%), confirming the findings of previous international studies [8,11]. These associations strengthen the conceptualization of the VSS as part of a broader neurophysiological spectrum involving multisensory hypersensitivity [10,15]. Consequently, clinicians should adopt a multidisciplinary approach to ensure effective management.

Lifestyle factors, such as extended screen exposure and lower levels of physical activity, were prevalent among the participants, although the causative conclusions cannot be drawn from this cross-sectional study [16,17]. Nevertheless, this association warrants further longitudinal investigation to explore potential modifiable lifestyle interventions [18].

The reported family history of visual disturbances in 16.3% of the respondents suggests potential genetic predispositions or shared environmental triggers, consistent with the current hypotheses in the literature [10,19]. This aspect highlights the necessity for further genetic and familial research to better understand hereditary components and environmental contributions to VSS.

Moreover, approximately 8% of the respondents indicated that stress significantly exacerbates their symptoms, aligning with the evidence linking stress to symptom worsening in sensory-processing disorders [20]. Integrating stress management and psychological support into patient care strategies may be beneficial [16,18].

Limitations

The key limitations of this study include the use of convenience sampling through social media platforms, introducing potential selection bias, and limiting generalizability. Additionally, reliance on self-reporting without clinical verification introduces potential recall and response bias [10].

Recommendations and Future Research

Future studies should employ randomized population-based sampling and incorporate the clinical validation of symptoms to enhance accuracy and generalizability. Longitudinal research is recommended to clarify the symptom progression, causal relationships, and effective interventions. Addressing the identified low awareness levels through targeted education campaigns aimed at healthcare professionals and the public is essential.

CONCLUSION

Despite these methodological limitations, this study significantly contributes to the understanding of VSS prevalence, symptom patterns, and associated factors in Saudi Arabia. These findings underscore crucial gaps in clinical and public awareness, highlighting the urgent need for education and research to improve the recognition, diagnosis, and management of VSS [21].

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