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ORIGINAL ARTICLE

Retrospective evaluation of children referred to the pediatric neurology department with complaints of vertigo/dizziness

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ABSTRACT

Objective: Vertigo/dizziness is a common symptom in childhood and adolescence. Although it is often not associated with an important underlying disease, sometimes it can indicate a serious illness. This study aimed to evaluate the demographic characteristics, etiology, and clinical and laboratory findings of patients referred to the pediatric neurology outpatient clinic with complaints of vertigo/dizziness.

Material and Methods: The data of 109 patients who were referred to the Pediatric Neurology outpatient clinic between January 2019 and April 2021 with complaints of vertigo/dizziness were evaluated retrospectively.

Results: Of the patients, 60 (55%) were female and 49 (45%) were male. The mean age was 12.5. Seven of the patients (6.4%) were between the ages of 2–5, 13 (11.9%) were between the ages of 5–10, and 89 (81.7%) were between the ages of 10–18. Etiological groups included orthostatic hypotension (23.9%), somatoform causes (15.6%), peripheral vertigo (vestibular neuritis) (11%), vitamin B12 deficiency (10.1%), migraine (8.3%), cardiac causes (4.6%), mastoiditis/sinusitis (4.6%), epileptic vertigo (2.8%), trauma (1.8%), demyelinating lesions (1.8%), benign paroxysmal vertigo (1.8%), hypoglycemia (0.9%), drug side effects (0.9%), visual problems (0.9%), and intracranial mass (0.9%). The most common complaints accompanying dizziness were headache (41.2%), blackout (36.7%), and nausea-vomiting (20.2%). A statistically significant difference was found between age groups in etiology ($p<0.05$). Benign paroxysmal vertigo and life-threatening causes (intracranial mass, demyelinating disease) were prominent in the age group of 2–5 years; migraine and sinusitis between the ages of 5–10 years; and orthostatic hypotension, somatoform problems, and peripheral vertigo between the ages of 10–18 years.

Conclusion: Although the etiological spectrum of vertigo is quite broad, benign causes are more common. Causes prominent in the etiology differ according to the age range. In the presence of accompanying signs and symptoms, differential diagnosis should be made systematically for life-threatening conditions.

Keywords: Childhood, dizziness, etiology, neurology, vertigo.

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INTRODUCTION

Dizziness and vertigo are relatively rare in childhood and adolescence compared to adults and have been studied less extensively than in adults.[1] Although it is a symptom that is often not accompanied by a significant underlying disease and regresses on its own, sometimes it can indicate a serious nervous system disease.[2] Vertigo is a complaint that occurs due to damage or dysfunction of the central vestibular structures in the vestibular nerve, labyrinth, or brainstem. It can be defined as the patient's perception that they or their environment is spinning.[3,4] The subjective feeling of imbalance that occurs without a real sense of rotation is called dizziness.

Patients describe this situation as drunkenness, feeling bad, and the ground slipping under their feet.[4] There are some basic differences between children and adults when evaluating complaints of dizziness/vertigo. The main differences are that children cannot clearly describe their complaints and that diseases causing dizziness differ between adults and children.[5] As children often lack the ability to accurately describe their symptoms, diagnosis relies less on history and much more on clinical examination and laboratory investigations.[6]

When evaluating dizziness and balance in children, the child's developmental stage should also be taken into account.[7] In a retrospective study conducted by O'Reilly in which 561,151 pediatric patients were evaluated, the prevalence of balance disorders related to neuro-otological diagnoses was reported as 0.4%.[8] In another epidemiological study evaluating ten-year-old children (n=6965), the prevalence of vertigo was reported as 5.7%.[9] Another study conducted among school children revealed that 15% of children experienced balance disorders at least once in their lives.[6]

A child presenting with dizziness may have various central vestibular and peripheral causes. Despite advances in diagnostic methods, a detailed history and physical examination still form the basis of diagnosis. When a child or adolescent describes dizziness/vertigo, they are first evaluated by a pediatrician, and a minority of patients are correctly diagnosed with vertigo.[6,10,11]

Additionally, the differential diagnosis of vertigo in childhood varies from that in adults due to certain etiologies being specific to the pediatric population. Moreover, the predominant etiology can vary among different age groups in childhood.[10,12]

The objective of this study was to assess the demographic characteristics, differential diagnosis, as well as clinical and laboratory findings of patients referred to the pediatric neurology outpatient clinic presenting with complaints of dizziness/vertigo.

MATERIAL AND METHODS

The data of 109 patients who were referred to the Pediatric Neurology outpatient clinic of our hospital between January 2019 and April 2021 with complaints of vertigo/dizziness were evaluated retrospectively. In the study, IBM SPSS Statistics 22 (IBM SPSS, Türkiye) program was used for statistical analysis. Descriptive and comparative analyses were conducted using Statistical Package for the Social Sciences (SPSS, version 22.0) software.

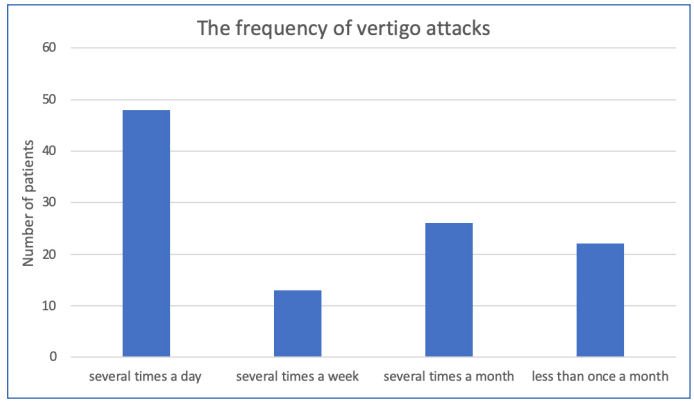

Figure 1: The distribution of the frequency of vertigo attacks according to the number of patients.

Age, gender, dizziness onset time, duration and frequency, accompanying additional symptoms, comorbidities, family history, physical and neurological examination findings, laboratory tests (complete blood count, serum electrolytes, kidney and liver function tests, thyroid function tests, folic acid and vitamin B12 levels), cranial imaging and electroencephalography (EEG) findings, trauma/medication history, and results of consultations with other departments (such as pediatric cardiology, otolaryngology, child psychiatry, and ophthalmology) were obtained from patient files.

In our study, orthostatic hypotension was characterized by a reduction of at least 20 mmHg in systolic blood pressure and at least 10 mmHg in diastolic blood pressure occurring within three minutes after the patient transitioned from a supine to a sitting position or upon standing up.

This study adhered to the principles of the Declaration of Helsinki and received approval from both the Ministry of Health of Türkiye and the ethics committee of our hospital (Zeynep Kamil Maternity and Children Hospital, İstanbul, Türkiye) (approval date: 05/05/2021. approval number: 106).

RESULTS

There were a total of 109 patients in our study, 60 girls and 49 boys (female/male: 1.2). There is no significant difference between etiology rates according to gender ($p>0.05$). The average age at presentation was 12.5 years. A total of 6.4% of the patients were between the ages of 2–5, 11.9% were between the ages of 5–10, and 81.7% were between the ages of 10–18. There is a statistically significant difference between vertigo rates according to age groups ($p<0.05$).

It was noted that 48 (44%) of the patients had vertigo attacks several times a day, 13 (11.9%) of the patients had them several times a week, and 26 (23.8%) of the patients had them several times a month. Twenty-two (20.2%) of the patients had vertigo attacks less frequently (less than once a month). The distribution of the frequency of vertigo attacks according to the number of patients is shown in Figure 1.

Attacks lasted seconds (instant) in 59 (54.1%) of the patients, minutes in 27 (24.7%) patients, up to 1 hour in 8 (7.3%) patients, and longer than 1 hour in 15 (13.8%) patients. The distribution of the duration of vertigo attacks according to the number of patients is shown in Figure 2.

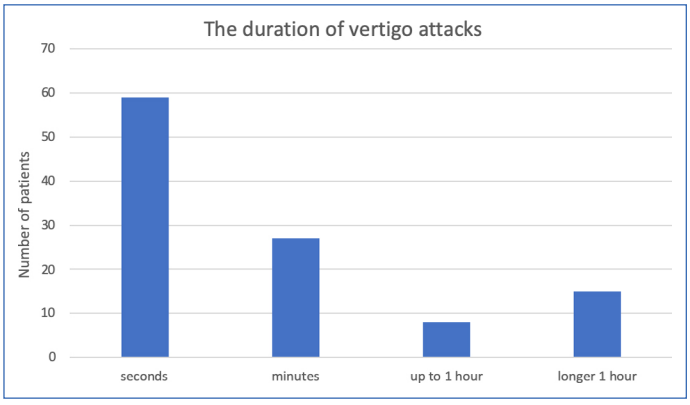

Figure 2: The distribution of duration of vertigo attacks according to the number of patients.

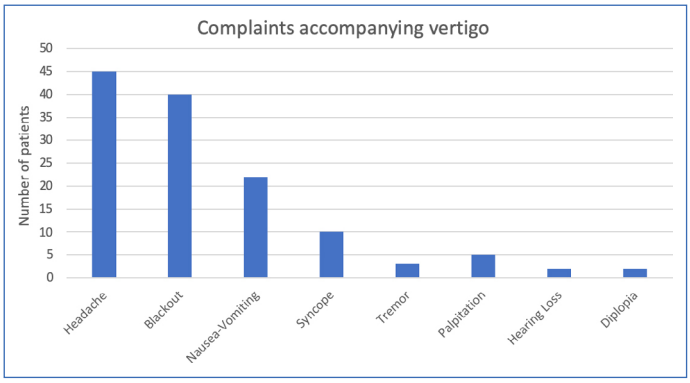

Figure 3: Evaluation of complaints accompanying vertigo according to the number of patients.

The most common complaints accompanying dizziness were headache in 45 (41.2%) patients, blackout in 40 (36.7%) patients, nausea and vomiting in 22 (20.2%) patients, syncope in 10 (9.2%) patients, palpitations in 5 (4.6%) patients, tremor in 3 (2.7%) patients, hearing loss in 2 (1.8%) patients, and diplopia in 2 (1.8%) patients. The evaluation of complaints accompanying dizziness according to the number of patients is shown in Figure 3.

Blood pressure was measured in all patients at the first examination. Hypotension was detected in ten patients and hypertension in one patient. Abnormal findings (loss of muscle strength, hyperactive deep tendon reflexes, ataxia, clonus) were noted in five patients (4.6%) during physical and/or neurological examination.

Etiological groups were orthostatic hypotension (23.9%), somatoform causes (15.6%), peripheral vertigo (labyrinthitis, vestibular neuritis) (11%), vitamin B12 deficiency (10.1%), migraine (8.3%), cardiac causes (4.6%), mastoiditis/sinusitis (4.6%), epileptic vertigo (2.8%), trauma (1.8%), demyelinating lesions (1.8%), benign paroxysmal vertigo (1.8%), hypoglycemia (0.9%), drug side effects (0.9%), vision problems (0.9%), and intracranial mass (0.9%). Since no cause was found in 6.4% of the cases, it was evaluated nonspecifically. There is a statistically significant difference between vertigo rates according to age groups ($p<0.05$).

The etiological distribution and rates of vertigo are summarized in Table 1.

Table 1: The etiological distribution and rates of vertigo

Etiyology	NC	PC
Orthostatic hypotension	26	23.9
Somatoform	17	15.6
Peripheral vertigo (vestibular neuritis, labyrinthitis, otitis media)	12	11
Vitamin B12 deficiency	11	10.1
Migraine	9	8.3
Nonspesific	7	6.4
Cardiac causes	5	4.6
Sinusitis	5	4.6
BPPV	4	3.7
Epileptic vertigo	3	2.8
Trauma	2	1.8
Demyelinating disease	2	1.8
BPVC	2	1.8
Vision problems	1	0.9
Side effect of the drug	1	0.9
Hypoglycemia	1	0.9
Intracranial mass	1	0.9

NC: Number of cases; PC: Percentage of cases; BPPV: Benign positional paroxysmal vertigo; BPVC: Benign paroxysmal vertigo of childhood.

The etiological distribution and rates of vertigo according to age groups are summarized in Table 2. There is a statistically significant difference between vertigo rates according to age groups ($p<0.05$). It was observed that benign paroxysmal vertigo and life-threatening causes (intracranial mass, demyelinating disease) were prominent between the ages of 2–5, migraine and sinusitis between the ages of 5–10, and orthostatic hypotension, somatoform problems, and peripheral vertigo were prominent between the ages of 10–18.

Family history was positive in 27/109 (24.7%) of the patients. There was a family history of vertigo in 3 patients, migraine in 17 patients, epilepsy in 5 patients, and psychiatric disease in 2 patients.

Laboratory examination revealed vitamin D deficiency in 35 patients, vitamin B12 deficiency in 11 patients, and hyperlipidemia in 3 patients.

All patients had cranial magnetic resonance imaging (MRI) performed before or after admission to the pediatric neurology outpatient clinic. MRI of 101 (92.6%) patients was evaluated as normal. Abnormalities were detected in the cranial MRI of 8 cases (7.3%). Sinusitis-mastoiditis findings were detected in 5 patients, an arachnoid cyst in 1 patient, demyelinating lesions in 2 patients, and an intracranial mass in 1 patient.

Routine awake and/or sleep EEG was performed in 80 of 109 patients (73.4%). Epileptiform anomaly was detected in three (2.75%) patients. Seventy-two of the patients (66%) were evaluated by an otolaryngologist. Sinusitis/mastoiditis findings were detected in five patients, and peripheral vertigo was detected in 12 patients.

Table 2: Etiological distribution and rates of vertigo according to age groups

Age group	Number of cases	Etiology	Percentage of cases (%)
2–5 age	2	BPVC	28.6
	1	Orthostatic hypotension	14.3
	1	Somatoform	14.3
	1	Demyelinating disease	14.3
	1	Nonspesific	14.3
	1	Intracranial mass	14.3
5–10 age	3	Nonspesific	23.1
	2	Migraine	15.4
	2	Sinusitis	15.4
	1	Somatoform	7.7
	1	Cardiac causes	7.7
	1	Vitamin B12 deficiency	7.7
	1	Side effect of the drug	7.7
	1	Hypoglycemia	7.7
	1	BPPV	7.7
10–18 age	25	Orthostatic hypotension	28.1
	15	Somatoform	16.9
	12	Peripheral	13.5
	10	Vitamin B12 deficiency	11.2
	7	Migraine	7.9
	4	Cardiac causes	4.5
	3	Epileptic	3.4
	3	Sinusitis	3.4
	3	Nonspesific	3.4
	3	BPPV	3.4
	2	Trauma	2.2
	1	Vision problems	1.1
	1	Demyelinating disease	1.1

BPPV: Benign positional paroxysmal vertigo; BPVC: Benign paroxysmal vertigo of childhood.

Four of 109 patients were evaluated by pediatric cardiology. Abnormal findings were detected in five patients. Arrhythmia (ventricular extrasystole) was detected in 24-hour Holter electrocardiography in three patients, and valve disorders were detected in two patients.

Forty-two of the patients (38.5%) were evaluated by ophthalmologists, and myopia was detected in only one patient.

Thirty of the patients were evaluated by a child psychiatrist. Anxiety disorder was detected in 10 patients, conversion disorder in three patients, and depression in four patients.

Possible life-threatening etiologies of dizziness/vertigo included an intracranial mass in one patient, demyelinating disease in 2 patients, and cardiogenic causes in 5 patients. Additional neurological symptoms and abnormal examination findings were detected in all patients with emergent neurogenic dizziness/vertigo.

DISCUSSION

Vertigo/dizziness is one of the reasons for hospital admission, with frequency gradually increasing in childhood.[2] The lifetime incidence of dizziness was found to be 5.7% in children aged 10 years and older.[9]

Vertigo and dizziness are dynamic symptoms that cause anxiety in patients and their parents. These manifestations may evolve over time and could indicate complex and/or serious diseases. When dealing with a child experiencing vertigo/dizziness, a thorough assessment is crucial to pinpoint the underlying disorder of the symptoms and alleviate parental concerns.[13]

Vertigo in children is important because of the difficulties in definition and diagnosis. Clearly defining the symptoms, obtaining a thorough medical history, and systematically conducting a differential diagnosis for life-threatening conditions are very important.[5]

Vertigo/dizziness may have a spectrum of various causes. Pediatricians must be skilled in differentiating the common causes of vertigo/dizziness from uncommon but more serious, life-threatening conditions.[2,6]

In a meta-analysis evaluating ten studies and 724 pediatric cases, the most common etiological reasons in patients were BPVC (18.7%), vestibular migraine (17.6%), trauma (14%), psychogenic vertigo (4.1%), otitis media (3%), Meniere's disease (1.5%), and BPPV (1.8%).[1] While BPVC is the most common cause of dizziness in preschool and primary school children, vestibular migraine has been reported as the most common cause in children 13 years of age and older.[7]

In our study, the most common etiological reasons in patients referred to the pediatric neurology outpatient clinic with complaints of dizziness were orthostatic hypotension (23.9%), somatoform vertigo (15.9%), peripheral vertigo (11%), B12 deficiency (10.1%), and migraine (8.3%). In general, this variability is partly attributed to differences in the populations studied and variations in the screening techniques employed across different studies.

The most common cause of episodic dizziness in children aged 2–6 years has been reported to be BPVC.[2] In our study, BPVC was detected in 2 of 7 children in this age range, and both of them had a family history of migraine. The low rate of BPVC in our series can be explained by the small number of patients in this age group.

Orthostatic hypotension is seen especially in growing children (prepubertal or pubertal period). In patients with suspected orthostatic hypotension, blood pressure should be measured both lying down and standing. The presence of symptoms upon waking up in the morning or after sudden changes in posture is a guide for diagnosis.[14] Orthostatic hypotension has been reported at a rate of 4–55.3% in the etiology of cases evaluated for dizziness in the pediatric neurology clinic.[15–17] Similar to the study of Yıldırım et al.,[17] orthostatic hypotension stands out as the most common etiological factor (23.9%) in our series.

It is thought that this increase may be related to the fact that not enough time is allocated to the anamnesis and physical examination stages in pediatric health and disease polyclinics in our country. Therefore, patient selection may not be adequately and effectively managed when referring patients to the subspecialty outpatient clinic. Additionally, the large number of adolescent patients in our study (81.7%) may have contributed to this result.

Migraine has an important place in some subgroups of children with recurrent vertigo. Migraine-related vertigo is more common in children than adults. While it is responsible for 35% of vertigo in childhood, it accounts for only 6% in the adult age group. It is more common in girls.[18]

BPVC can be considered a precursor to vestibular migraine. Throughout a child's life, the diagnosis of BPVC may transition to vestibular migraine, potentially accounting for the varying prevalence of BPVC and VM across different stages of childhood.[13,19]

In our study, BPVC was involved in the etiology in 2 (1.8%) patients, and migraine in 9 (8.3%) patients. Consistent with the literature, migraine was found in the family history of 55.5% of patients with migraine, and most of the cases were girls. In migraine-related vertigo, episodes of vertigo may occur without, during, or before migraine headaches.[18,20,21] Attack duration was longer than one hour in all migraine-related vertigo patients, as expected.

Psychogenic (somatoform) vertigo needs to be considered in the differential diagnosis, especially in the adolescent age group. Relationship issues, absence from school, and family conflicts can be warning signs for psychogenic vertigo.[22]

In a review evaluating 2470 pediatric cases, the rate of psychogenic vertigo was reported as 11.3%.[14] Somatoform vertigo is more common in girls.[23] In our series, this rate was found to be 15.6%, and 88.2% (n=15) of the cases were adolescents, with most being girls. Psychiatric consultation is important in the management of these cases. Anxiety disorder was found in 10 patients, conversion disorder in three patients, and depression in four patients.

While peripheral vestibular disorders such as labyrinthitis, vestibular neuritis, and Meniere's disease are common in the adult age group (18–41%), they are less common in childhood (8–23.9%).[1,11,13] In our study, peripheral vertigo (vestibular neuritis, labyrinthitis, otitis media) was detected in 12 cases (11%). Audio-vestibular disorders demonstrate an increasing trend with age, and all our cases were adolescents, in line with the literature.

Vitamin B12 deficiency can also lead to dizziness and vertigo.[24,25] We detected B12 deficiency in 11 (10.1%) cases, and it was notable that the majority of these cases were in the adolescent age group. The high rate observed in our series may be explained by the fact that patients in our country are often referred to the pediatric neurology outpatient clinic before completing the initial evaluation steps.

One of the rare causes of vertigo in childhood is epileptic vertigo. In our study, epileptic activity was observed in three patients (2.7%) on EEG, and it was thought that dizziness attacks might be associated with epilepsy. In the literature, epilepsy was found to be the cause in 2.5–15% of patients evaluated with dizziness.[11,16]

In our study, two of the three patients diagnosed with epileptic vertigo had a family history of epilepsy. Since the number of patients diagnosed with epilepsy is low, there is no statistically significant difference; however, if there is a family history of epilepsy in patients presenting with vertigo, epileptic vertigo should be considered in the differential diagnosis.

Ophthalmic disorders, including various conditions such as oculomotor dysfunction or refractive errors, are also considered potential causes of vertigo. Especially in recent years, dizziness has been associated with the widespread use of smartphones in the adolescent age group.[26] In a review of 2470 pediatric cases, the cumulative rate of ophthalmic diseases was reported as 1.5%. In our series, only one case of eye disease was involved in the etiology.

Vertigo associated with cardiovascular disease, including ventricular arrhythmia and valve disorders, was found in around 4.6% of patients. These patients had accompanying syncope and palpitations. Detailed interrogation of syncope and palpitations in the history can help cardiological evaluation without delay and enable early diagnosis.

In our study, demyelinating disease was found in two patients and an intracranial mass in one patient as other possible causes of life-threatening vertigo. In patients with an intracranial mass and demyelinating disease, dizziness was accompanied by syncope and diplopia, along with neurological examination abnormalities. These findings highlight the importance and necessity of cranial imaging in the early detection of possible causes, especially in patients with additional neurological findings and neurological deficits.

In the literature, one of the common etiologies of vertigo during admission to the emergency department has been reported as vertigo developing after head trauma, but only two patients in our study had a history of head trauma.[27] This low rate may be related to the fact that these patients are often first evaluated in the emergency department and only patients evaluated in the pediatric neurology outpatient clinic were included in our study.

In addition, although they were detected in one patient each, metabolic causes such as hypoglycemia and drug side effects should also be kept in mind.

In our study, the main symptoms accompanying dizziness were headache (41.2%), blackout (36.7%), nausea-vomiting (20.2%), and syncope (9.2%). Similarly, in the literature, headache was found to be the most common symptom accompanying dizziness, with a rate of 35–60%.[6,9,10]

In the majority of studies involving children, MRI reveals an occasional incidental finding. Therefore, it is recommended that MRI be preceded by a comprehensive examination and only applied to selected patients to minimize its excessive utilization in cases of vertigo.[16,27]

Magnetic resonance imaging appears as the preferred imaging option in the evaluation of vertigo, avoiding the potential injury of ionizing radiation from CT and providing higher sensitivity.[28] However, the need for sedation in young children and its high cost are among the disadvantages of MRI. All patients in our series underwent brain MRI before or after admission to the pediatric neurology outpatient clinic, and abnormalities were detected in the cranial MRI of 8 patients (7.3%). Out of 109 MRI scans, only 8 revealed abnormal findings, with three of them being responsible for vertigo. This results in a diagnostic yield of 2.75%. Similar rates of abnormal cranial imaging findings were detected in most studies conducted in children.[15,16,27]

On the other hand, vertigo was not detected in isolation in any patient with dizziness/vertigo due to an urgent neurogenic cause (demyelinating disease, intracranial mass), and additional pathological neurological signs and symptoms were detected in all of these patients.

CONCLUSION

Despite improvements in diagnosis rates over the years, the etiology of vertigo still remains uncertain in a small but non-negligible percentage of patients. A comprehensive evaluation is necessary to avoid missing serious pathologies, especially in very young children. Our study suggests that the decision to perform additional evaluation in patients complaining of dizziness should be based on the presence of accompanying signs and symptoms to exclude life-threatening diseases that may require urgent treatment.

Statement

Ethics Committee Approval: The Istanbul Zeynep Kamil Maternity and Children's Diseases Health Training and Research Center Ethics Committee granted approval for this study (date: 05.05.2021, number: 106).

Author Contributions: Concept – EU, NEH; Design – EU, NEH; Supervision – EU, NEH; Resource – MÖ, EU; Materials – MÖ, EU; Data Collection and/or Processing – MÖ, ÖE; Analysis and/or Interpretation – ÖE, EU; Literature Search – EU, NEH; Writing – EU, NEH; Critical Reviews – EU, NEH.

Conflict of Interest: The authors have no conflict of interest to declare.

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