



# Is there a correlation between migraine and eating disorders? A systematic literature review

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## ABSTRACT

**Introduction.** Migraine is a common primary headache disorder, which affects mainly young females, usually those with some specific personality traits including neuroticism and obsessive-compulsive disorder. Among many factors that may trigger headache are to be found those associated with eating patterns and behaviours.

Eating disorders are psychiatric disorders of abnormal eating or weight-control behaviours. According to the most up-to-date classification, six main types are identified, including anorexia nervosa, bulimia nervosa, and binge eating disorder. Similar to migraine, eating disorders are mainly diagnosed in young adults and, moreover, personality pattern, in at least some of the eating disorders, is also suggested to be consistent.

**Material and methods.** This systematic review aimed to summarise the available literature related to this topic. We performed an electronic article search through the Embase, PubMed, and Cochrane databases and included 16 articles into analysis in accordance with PRISMA 2020 guidelines.

**Results.** Most of the studies revealed the presence of a putative correlation between migraine and eating disorders, and these encourage further investigations. Moreover, apart from the clinical aspect, also the pathogenesis underlying both disorders is suggested to be similar. More frequent co-occurrence of other psychiatric disorders in migraineurs, such as depression and anxiety, was reported and should be considered in future research. Furthermore, adverse interactions between pharmacotherapy and symptoms of comorbid conditions underline the importance of this problem.

**Conclusions.** A correlation between migraine and eating disorders appears highly probable. However, further investigations are required focusing on diverse aspects such as clinical, psychological, and pathogenic.

**Keywords:** anorexia nervosa, bulimia nervosa, eating disorders, migraine, primary headache disorders

(*Neurol Neurochir Pol* 2023; 57 (6): 457–464)

## Introduction

### Key information about migraine

According to The International Classification of Headache Disorders, 3<sup>rd</sup> Edition (ICHD-3), migraine is a common primary headache disorder with two major types: migraine without aura and migraine with aura, plus a third: chronic migraine [1]. Importantly, in the Global Burden of Disease Study 2015 (GBD2015), it was recognised as one of the leading

causes of disability among young adults [2]. Migraine prevalence worldwide has been estimated at 15% and it affects over 1,000,000,000 people globally [3].

Migraine is more common in women than men at a rate of 3:1 [4], with the highest prevalence in people aged 18 to 44 [5]. Among the known causes of recurrent, disabling attacks are: stress, fatigue, weather changes, menstrual cycle changes, light, noise, and sleep disturbances [6]. Moreover, diverse dietary factors including fasting and particular foods and drinks such

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Received: 6.09.2023 Accepted: 26.10.2023 Early publication date: 1.12.2023

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as chocolate, milk, cheese, nuts, and alcohol (especially red wine), can trigger headache pain [7]. Last but not least, some studies have revealed overeating and obesity to be significantly associated with migraine attacks compared to non-migraine headaches [8, 9].

### Background of eating disorders

Eating disorders (ED) are defined as psychiatric disorders characterised either by abnormal eating or weight-control behaviour [10]. According to the Diagnostic and Statistical Manual of Mental Disorders, 5<sup>th</sup> edition (DSM-V) [11] and the International Classification of Diseases, 11<sup>th</sup> Revision (ICD-11) [12], six main types of ED are distinguished. Apart from the generally known ED including anorexia nervosa (AN), bulimia nervosa (BN), and binge eating disorders, three more have been identified: avoidant-restrictive food intake, pica, and rumination disorder, previously classified as a childhood disorder [13].

An eating disorder not otherwise specified (EDNOS) has been found to be the most common eating disorder, followed by AN, BN, and binge eating disorder. Similarly to migraine, the prevalence of ED is highest among young women, especially adolescents [14]. Importantly, the mortality rate appears to be increased in all types of ED, and quality of life to be reduced compared to the general population [15]. The most striking mortality rate occurs in AN, while statistics for BN and EDNOS are similar [16].

### Arguments for a correlation between migraine and eating disorders

Summarising the above information about the prevalence and patient profile in migraine and ED, similarities can be shown between the two groups. Several behaviours specific to ED, such as fasting or overeating, appear to trigger headache pain. Moreover, fatigue, with an underlying cause of weight loss plus a lack of essential nutritional elements, has been shown to lead to migraine attacks.

Some personality traits, especially neuroticism, and symptoms of obsessive-compulsive disorder, or striving for perfection, have been found to be correlated with an elevated risk of both migraines [17, 18] and ED [19], which may suggest an association between both types of disease. However, the data related to this topic is very limited. One of the common monoamines, serotonin (5-HT), is expected to play a role in the aetiology of migraine, as well as of eating disorders. Nevertheless, as yet no particular genetic component has been explicitly stated. This systematic review aimed to summarise the current state of knowledge and analyse a possible correlation between eating disorders and migraine.

### Material and methods

Three databases were screened in accordance with Preferred Reporting Items for Systematic Reviews and Meta-analyses

(PRISMA 2020) [20], including the Embase, PubMed, and Cochrane databases. The search terms were: migraine AND (eating disorders OR eating disorder OR anorexia nervosa OR bulimia nervosa) AND (correlation OR association OR relation OR relationship), and they remained the same for all three databases.

### Inclusion and exclusion criteria

To maintain consistency, inclusion and exclusion criteria were applied. Primary research articles, including clinical and cohort studies, were allowed. But meta-analyses, systematic reviews, narrative reviews, case reports, letters to the editor, and commentaries were excluded. Because of the limited data, in addition to articles, conference abstracts were also accepted based on generally acknowledged recommendations [21].

Only clinical research studies were found, with no preclinical studies. Involved publications focused on the correlation between migraine and diverse ED in patients without or with other conditions, primarily psychiatric. Studies describing only headaches other than migraine, or psychiatric disorders different to ED, were excluded. Studies written in languages other than English were excluded.

### Selection process

After the initial search of three databases based on the aforementioned search strategy, 425 records were identified, of which 79 were duplicates. Out of 346 records assessed by title or type, 257 were excluded. Subsequently, the abstracts' assessment of the 89 remaining research articles identified 27 studies in which complete data was thoroughly analysed. Eventually, the selection process led to the inclusion of 16 studies in our systematic review (Fig. 1).

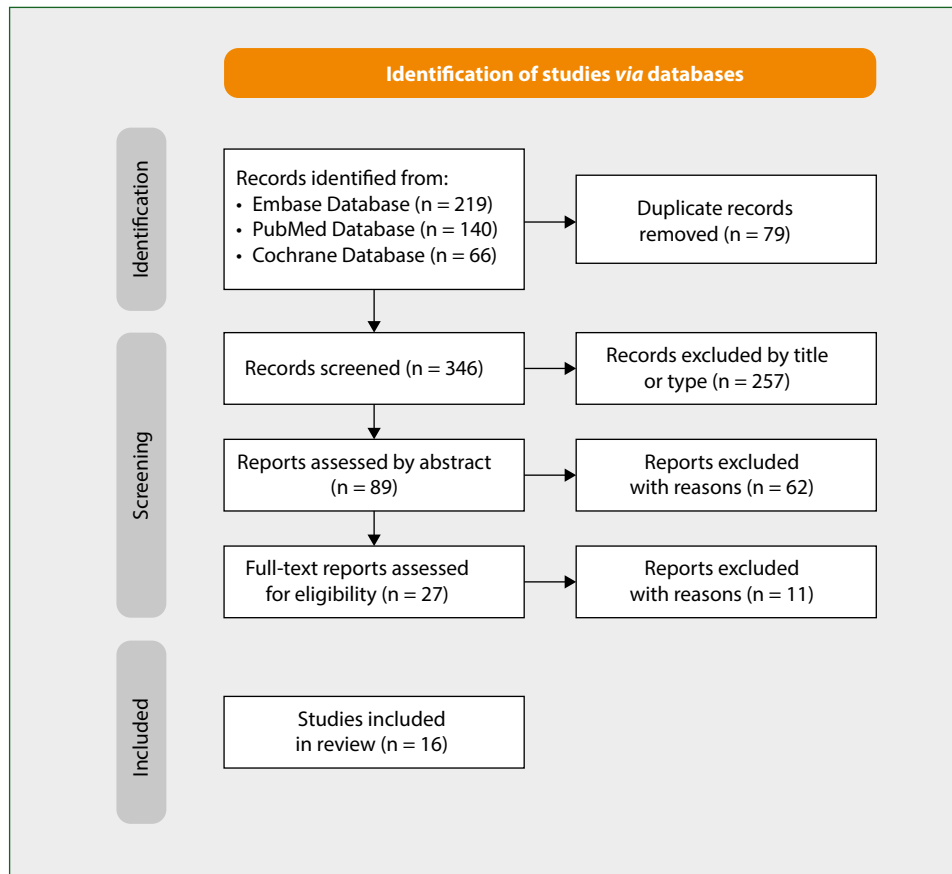
## Results

### Putative correlation between migraine and eating disorders in clinical studies

A possible correlation between migraine and ED has been suggested; however, the number of studies related to this topic is small. To perform the most detailed and precise analysis possible, we divided the involved studies into three parts focusing on different theses, i.e. that: (i) migraine and eating disorders are presumably correlated; (ii) that the correlation may be associated with depression and anxiety; and (iii) uncertainties of putative correlation.

### Migraine and eating disorders are presumably correlated

Several studies have shown a putative correlation between migraine and diverse ED, including anorexia nervosa (AN), bulimia nervosa (BN), and binge eating disorders, the results of which are presented below. Additionally, this association has also been observed in paediatric populations. For instance, an interesting study by de Oliveira-Souza et al. [22] investigated



**Figure 1.** Flowchart of selection process according to guidelines of Preferred Reporting Items for Systematic Reviews and Meta-analyses [20]

the correlation between migraine and ED in children aged 11 to 18. Both migraine and ED were more common in females than males. Importantly, regardless of sex, BN symptoms were positively correlated with migraine. Moreover, the risk of developing ED was higher in female migraineurs. D'Andrea et al. [23] studied female patients suffering from ED, with a specification into AN or BN. Migraine was present in a significant majority of the study group (74.3%), while other types of headaches (tension-type headaches or non-classifiable headaches) were observed only in 9.2%. Furthermore, no significant differences were shown when comparing patients affected by AN to those suffering from BN.

Another research group [24] conducted a study on a paediatric population and compared migraineurs to children without diagnosed migraine headaches or equivalents for the presence of diverse psychiatric disorders. Although the ED rate was higher in the study group, it was not statistically significant. However, with  $p = 0.079$ , the result was close to statistical significance, suggesting it deserves further study. Importantly, the first reports regarding a putative correlation began to appear before the end of the 20<sup>th</sup> century. In a study conducted in 1993, Brewerton et al. [25] investigated female patients suffering from migraine and compared them to healthy controls. Among migraineurs, binge eating disorder was present in 59%

and self-induced vomiting in 26%. Moreover, compared to healthy controls, migraine patients presented elevated scores in four out of eight subscales of the Eating Disorders Inventory.

A slightly different approach to the topic was shown by Lebow et al. [26], who carried out a retrospective study on a small group of adolescents treated with topiramate because of migraine or chronic headache. Four of seven patients were diagnosed with unspecified ED, two with AN, and one with BN. Three patients reported no ED history before the topiramate use, and one patient was in remission with recurrence after the start of topiramate intake. Although this research was conducted on a small group of patients, it highlights the importance of ED and migraine comorbidity in terms of pharmacological treatment. Importantly, significant weight loss should be listed among the main adverse effects of topiramate use.

Interesting observations were demonstrated in another article [27] based on the previously described research by D'Andrea et al. Researchers aimed to verify the hypothesis of a similar pathogenesis of ED to migraine, which suggests catecholamine and trace amine dysregulation in both diseases. Since this has been demonstrated to play a role in migraine [28, 29], similar observations in ED would allow better understanding of some consistent mechanisms underlying both disorders. Therefore, plasma levels of dopamine (DA), noradrenaline

(NA), tyrosine (Tyr), and octopamine (Oct) were measured in BN and AN patients, and compared to healthy controls. Interestingly, increases in Tyr and DA levels were shown when comparing patients suffering from ED to the control group. On the other hand, the NA level was significantly lower in the study group. Moreover, differences were observed between AN and BN patients, with higher levels of Oct in the first group and of Tyr in the second.

### Correlation may be associated with depression and anxiety

Some included studies have not only investigated a correlation between migraine and ED, but also suggested depression and anxiety as factors that may be associated. Mustelin et al. [30] conducted a study on female patients with ED over a lifetime, including either AN or BN, and compared them to healthy controls. Migraine occurred significantly more frequently in the study group. Importantly, the prevalence of major depressive disorder was assessed in the study and control group, and depression was positively correlated with both migraine and ED. Moreover, migraine levels were the highest in patients presenting ED and major depressive disorder. Therefore, there is a great need for further studies on ED in migraine, including the impact of depression.

Hamamci et al. [31] investigated patients suffering from episodic migraine and compared them to healthy controls. Significantly more patients from the study group presented ED attitudes. Nevertheless, migraineurs with ED statistically more frequently suffered from other disorders, such as depression and anxiety, than those unaffected by ED, which may have influenced the results.

A similar observation has also been made in a pediatric population. Tarantino et al. [32] investigated adolescent girls suffering from migraine with a specification of attack frequency. ED were present in most of the study group. Specifically, AN symptoms were observed in 42.9% of girls, while 28.6% presented with BN behaviour. Furthermore, bulimic symptoms were positively correlated with school anxiety and depression, but only in the high-frequency group.

Inanc et al. [33] studied patients diagnosed with primary headache disorder (migraine or tension-type headache) and compared them to healthy controls. The mean score in the Eating Attitudes Test (EAT) was significantly higher in the study group than in the control group, with the highest points among migraineurs. Additionally, Beck Depression Inventory (BDI) and Beck Anxiety Inventory (BAI) showed increased points for patients suffering from headaches compared to healthy controls.

Similarly, Demirci et al. [34] compared migraine patients to healthy controls in terms of eating disorder attitudes assessed by EAT. It appears that migraineurs presented statistically significant higher EAT points, with a score of 30 or over

in 11.9%, compared to 2.1% of healthy controls. Moreover, in the study group, levels of anxiety (BAI) and depression (BDI) were increased. Interestingly, the EAT, BAI, and BDI scores among migraineurs positively correlated with the Migraine Disability Assessment Score (MIDAS). All studies are summarised in Table 1.

### Uncertainties of putative correlation

Apart from studies proving the analysed correlation, there have also been some in which results have appeared to be questionable, starting with a study by LeBaron et al. [35] investigating comorbidity of ED and migraine in patients with mood disorders. Although a positive correlation between migraine and ED in general was observed, migraine was shown not to be associated with AN after the specification of ED type. However, a correlation was revealed between migraine and both BN and binge eating disorder in the study group. On the other hand, Roux et al. [36] conducted a follow-up assessment of 97 female patients hospitalised due to AN as adolescents: 6–12 years after hospitalisation, almost a third of the study group had been diagnosed with migraine. Interestingly, the presence of migraine appeared to be negatively correlated with the lifetime occurrence of BN.

Going further, any correlation between migraine and ED was revealed in two included studies. Seidel et al. [37] studied the migraine prevalence in female patients suffering from ED and compared them to their sisters who had no ED history. Among 120 pairs, 80 were concordant (13 were affected by migraine, 67 were unaffected), and 40 were discordant. However, the latter group presented no significant differences between females with and without ED. Among these 40 pairs, migraine co-occurred with ED in 21, while in 19 one sister suffered from ED, and the 40th was a migraineur.

Another research group [38] conducted a large clinical study on adolescent patients, comparing diverse mental disorders to the presence or absence of different headache types. Among mental disorders were included ED. However, it must be emphasised that there was a majority of binge ED over both AN and BN. The results revealed a positive correlation between ED and headaches in general. Nevertheless, ED were demonstrated to be less common in patients with migraine than other types of headache.

Another interesting study was carried out by Wang et al. [39]. Researchers conducted a nationwide cohort study investigating the presence of multiple psychiatric disorders in the offspring of mothers affected or unaffected by migraine. Children born between 1978 and 2012 were assessed with a median follow-up time of 19 years. Interestingly, although multiple significant associations between migraines and psychiatric disorders were demonstrated, no correlation was observed between migraine in mothers and ED in children. All studies are summarised in Table 2.

**Table 1.** Summary of studies regarding correlation between migraine and ED

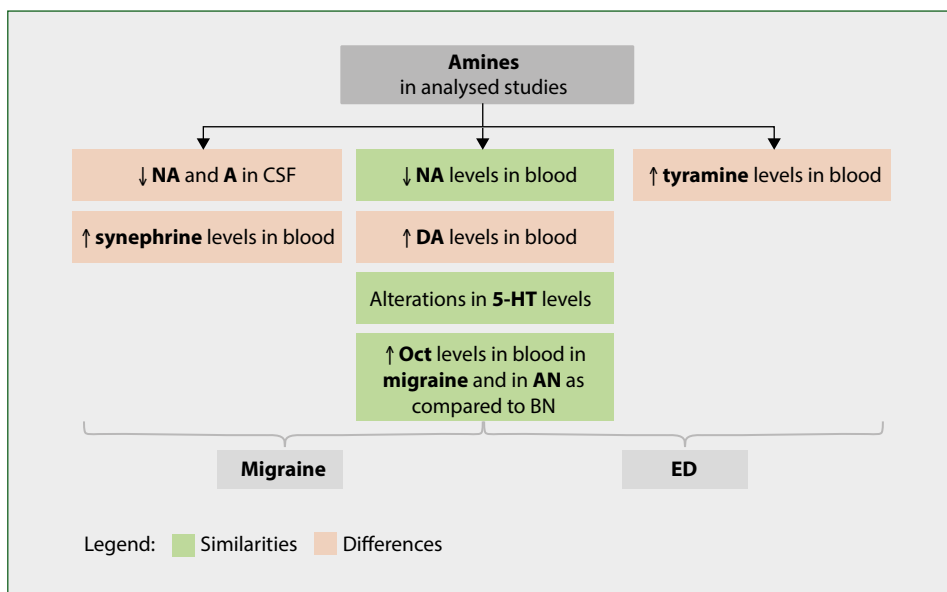
Ref.	Year	Population	Comparison	Outcome	ED diagnosis
de Oliveira Souza et al. [22]	2022	607 adolescents (388 females, 219 males)	Males to females MIG pts to non-MIG pts	43.7% risk of BN in MIG females to 34% risk in non-MIG females 29.6% risk of BN in MIG males to 21.8% in non-MIG males	EAT-26, BITE
D'Andrea et al. [23]	2009	109 ED pts (76 AN, 33 BN)		Migraine present in 81 ED pts; no significant differences between AN and BN	Based on DSM-IV criteria
Kandemir et al. [24]	2018	50 MIG paediatric pts	50 HC	↑ ED rate in MIG pts compared to HC (P = 0.079)	K-SADS-PL, EAT
Brewerton et al. [25]	1993	34 female MIG pts	577 HC	Binge eating disorder in 59% of MIG pts BN behaviour in 26% of MIG pts ↑ in 4/8 EDI subscales in MIG pts compared to HC	EDI, DSED
Lebow et al. [26]	2015	7 topiramate-treated paediatric headache pts		ED beginning during topiramate treatment in 3 pts ED beginning before topiramate treatment in 3 pts ED in remission before topiramate treatment in 1 pt	Based on DSM-IV criteria
D'Andrea et al. [27]	2008	125 ED pts (89 AN, 36 BN)	27 HC	↑ DA and Tyr in ED pts compared to HC ↓ NA in ED pts compared to HC ↑ Oct in AN pts compared to BN pts ↑ Tyr in BN pts compared to AN pts	Based on DSM-IV criteria
Mustelin et al. [30]	2014	55 female AN pts 60 female BN pts	40 non-ED co-twins from FinnTwin16 cohort, 289 non-ED unrelated women	Migraine present in 22% of AN and BN pts, 13% of co-twins, and 12% of unrelated women	Based on DSM-IV criteria
Hamamci et al. [31]	2020	91 MIG pts	87 HC	ED in 23.1% of MIG pts and 9.5% of HC	EAT
Tarantino et al. [32]	2021	35 adolescent MIG pts	High-frequency MIG to low-frequency MIG	AN behaviour in 42.9% and BN behaviour in 28.6% of MIG pts	SAFA test
Inanc et al. [33]	2019	89 MIG pts 87 TTH pts	89 HC	↑ mean EAT points in MIG pts and TTH pts compared to HC	EAT
Demirci et al. [34]	2015	59 MIG pts	HC	EAT ≥ 30 in 11.9% of MIG pts and 2.1% of HC; positive correlation between EAT and MIDAS in MIG pts	EAT

↑ — increased; ↓ — decreased; AN — anorexia nervosa; BITE — Bulimic Investigatory Test, Edinburgh; BN — bulimia nervosa; DA — dopamine; DSED — Diagnostic Survey of Eating Disorders; DSM-IV — Diagnostic and Statistical Manual of Mental Disorders; EAT — Eating Attitudes Test; ED — eating disorders; EDI — Eating Disorders Inventory; HC — healthy controls; K-SADS-PL — Kiddie Schedule for Affective Disorders and Schizophrenia Present and Lifetime Version; MIDAS — Migraine Disability Assessment Score; MIG — migraine; NA — noradrenaline; Oct — octopamine; pts — patients; Ref. — reference; SAFA — Self Adminstrated Psychiatric Scales for Children and Adolescents; TTH — tension-type headache; Tyr — tyramine

**Table 2.** Summary of studies showing uncertainties of correlation between migraine and ED

Ref.	Year	Population	Comparison	Outcome	ED diagnosis
LeBaron et al. [35]	2015	153 mood disorders pts		Positive correlation between mig and ed No correlation between mig and an	Based on DSM-IV criteria
Roux et al. [36]	2013	97 adolescent AN pts	Follow-up after 6–12 years	Migraine in 32% of an pts Negative correlation between mig and lifetime BN	Based on DSM-IV
Seidel et al. [37]	2011	120 female ED pts	120 non-ED pts' sisters	13 MIG pairs 67 non-MIG pairs 40 discordant pairs (in 21 MIG was present in ED pts, in 19 in non-ED pts)	Based on DSM-IV criteria
Hommer et al. [38]	2022	2,711 headache pts (1,245 MIG, 1,466 non-MIG)	7,412 non-headache pts	↑ ED in study group compared to HC ↓ ED in MIG pts compared to non-MIG pts	Based on DSM-IV criteria
Wang et al. [39]	2021	51,717 MIG female pts	1,800,517 non-MIG female pts	No correlation with ED in children of MIG and non-MIG mothers	Based on ICD-8, ICD-10 codes

↑ — increased; ↓ — decreased; AN — anorexia nervosa; BN — bulimia nervosa; DSM-IV — Diagnostic and Statistical Manual of Mental Disorders; ED — eating disorders; ICD — International Classification of Diseases; MIG — migraine; pts — patients; Ref. — reference



**Figure 2.** Summary of role of amines in migraine and eating disorders (including similarities and differences) shown in analysed studies. ↑ – increase; ↓ – decrease; 5-HT – serotonin; A – adrenaline; CSF – cerebrospinal fluid; DA – dopamine; ED – eating disorders; NA – noradrenaline; Oct – octopamine

## Conclusions

Most studies have revealed that a correlation between migraine and ED is highly probable based on diverse aspects including clinical approach and pathogenesis.

To summarise the aforementioned studies, five main conclusions can be drawn:

1. Patient profiles in migraine and ED are substantially similar; however, studies related to this issue are lacking
2. Migraine and eating disorders may have a similar pathogenesis, which should be investigated
3. Not all studies have revealed a correlation, which remains to be explained
4. Depressive disorder probably influenced the results of several studies, and therefore it must be considered
5. Pharmacotherapy of these diseases may exacerbate the others.
6. All these statements have been expanded below.

Both analysed types of disease are known to appear in similar patient profiles i.e. a young female, usually with several traits of neuroticism or obsessive-compulsive disorder. Despite this, there is a lack of studies focusing on this issue. Analysis of available literature has allowed us to outline the profile of a typical migraineur, which remains consistent with a person suffering from AN. Based on the analysed data, personality traits such as perfectionism, politeness, and diligence may appear significantly more frequently in these patients. However, in the analysed clinical studies, we did not find any that focused on this part of the problem. Therefore, further research is undeniably required.

One group of researchers has suggested that pathogenesis with alterations of amine levels acknowledged for migraine may be similar in ED (Fig. 2). Furthermore, 5-HT has been shown to be involved in mechanisms underlying both diseases.

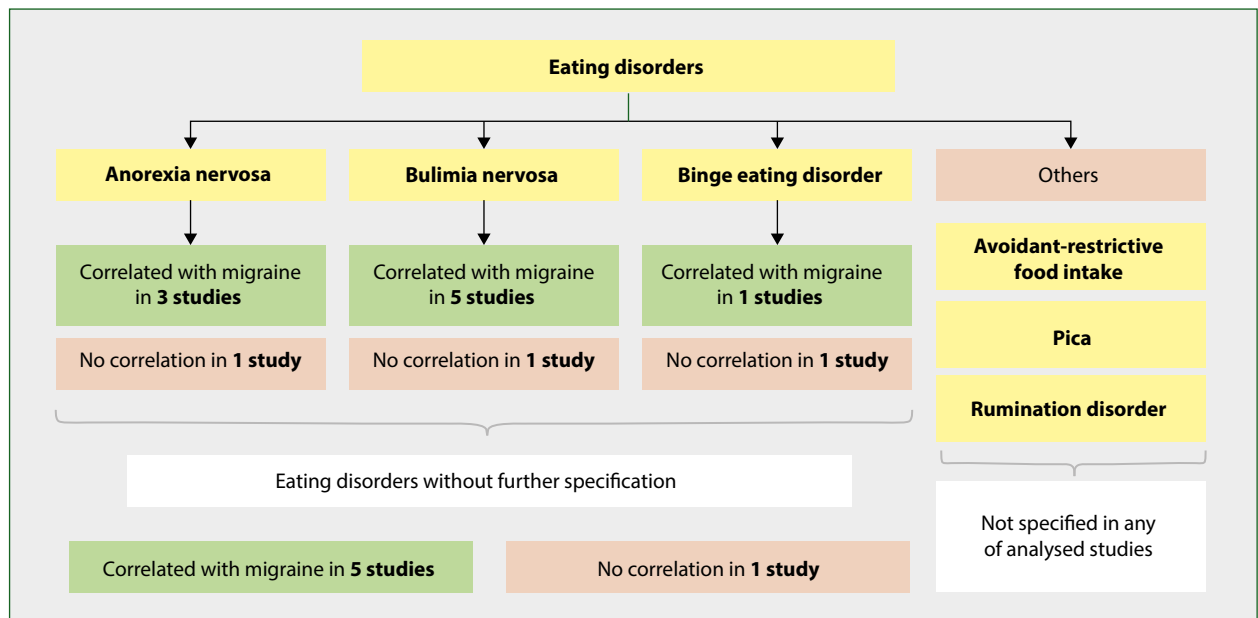
Alterations of common biochemical compounds in both conditions suggest that some particular genes might be responsible for developing these conditions, making genetic backgrounds similar. Moreover, both diseases are likely to occur more frequently in patients with family predispositions. Although several aspects potentially indicate that the role of genetics is at least partly shared in both conditions, the particular connections have yet to be discovered.

Undoubtedly, the fundamentals must be explored to understand better the correlation between migraine and ED. Therefore, further studies regarding the mechanisms and factors underlying the development of both diseases are urgently needed. A consistent biochemical background could clear up many unanswered questions regarding the existence of a putative correlation.

Although a correlation was observed in most studies, several revealed no association between migraine and ED (Fig. 3). Interestingly, those studies had been conducted on a limited group of patients or with a predominance of specific eating disorders, which may be less associated with migraine than the others. Based on risk factors and triggers of migraine headaches, only part of the ED included in the classifications may be positively correlated with migraine.

Analysing the data summarised in our systematic review, primary attention should be paid to AN and BN due to the specific traits of typical patients, and fasting as the triggering





**Figure 3.** Summary of correlation between particular eating disorders and migraine in analysed studies

factor. Moreover, some studies have revealed that overeating may be associated with migraine headache pain. Therefore, binge eating disorder may increase the risk of developing migraine over the course of a lifetime, as demonstrated in most studies reflecting this specific disorder. Studies on expanded and more diverse groups of patients should be conducted.

Finally, depression and anxiety have been shown many times to correlate with migraine and ED, which may influence the results. Further studies should be conducted after minimising the possible impact of these disorders. It is worth underlining that a pharmacological treatment used in one disease may exacerbate the other as a drug side effect, meaning that it should be carefully analysed before a drug is prescribed.

All of the foregoing proves the importance of this topic, and the need for further studies.

### Limitations

Undoubtedly, our results show a high probability of a significant correlation and encourage further investigation. Interestingly, many analysed studies were conducted on very limited groups of patients, usually representing only a few specific EDs or ED in general, with a lack of research on patients suffering from less common EDs. Furthermore, due to a higher prevalence of both migraine and ED in females, there needs to be more research focused on males. Finally, a high coincidence of other psychiatric disorders may influence the results and should be taken into account in future studies.

Additionally, together with psychiatric diseases, other factors related to headaches or abnormal eating behaviours that have not been raised in this systematic review, such as premenstrual syndrome, may interfere with the results.

### Article information

**Conflict of interest:** None.

**Funding:** Article Processing Charge was covered by the Nicolaus Copernicus University in Toruń.

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