



Supplementary Figures

The association between diabetes and migraine: a systematic review and meta-analysis

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Supplementary Table 1. The Newcastle-Ottawa Quality Assessment Scale scores (case-control studies)

Study	Selection				Comparability	Outcome/Exposure			Total score
	1	2	3	4		1	2	3	
Group1									
1	*	*	*	*	*	*	*	*	8
2	*	*	*	*	*		*	*	7
3	*	*	*	*	*		*	*	7
4	*	*	*	*	*		*	*	7
5	*	*	*	*	*	*	*	*	8
6	*	*	*	*	*	*	*	*	8
7	*	*	*	*	*	*	*	*	8
8	*	*	*	*	*		*	*	7
Group2									
1	*	*	*	*	*	*		*	7
2	*	*	*	*	*	*		*	7
3	*	*	*	*	*	*		*	7
4	*	*	*	*	*	*	*	*	8
5	*	*	*	*	*		*	*	7
6	*	*	*	*	*	*		*	7
7	*	*	*	*	*	*		*	7
8	*	*	*	*	*	*		*	7
9	*	*	*	*	*	*	*	*	8
10	*	*	*	*	*	*		*	7
11	*	*	*	*	*	*		*	7
12	*	*	*	*	*	*		*	7
13	*	*	*	*	*		*	*	7
14	*	*	*	*	*		*	*	7
15	*	*	*	*	*	*		*	7
16	*	*	*	*	*		*	*	7
17	*	*	*	*	*	*		*	7

Selection 1 case definition

2 Representativeness of the cases

3 Selection of Controls (community controls)

4 Definition of controls

Comparability of cases and controls on the basis of identified factor

Exposure 1 Ascertainment of exposure (secure record or structured interview)

2 Same method of ascertainment for cases and controls

3 The frequency recorded

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Supplementary Table 2. Characteristics of the included studies (Group 1)

Study ID	Author	Year	Country	Journal	Mean age	Female%	diabetes type
study1	Jielong Wu	2024	China	Diabetes & Metabolism	61.43 ± 9.19 control, 62.80 ± 8.85 DM	control 52.58%, DM 54.24%	type2
study2	Lidiane Lima Florencio	2020	Spain	Journal of Clinical Medicine	15-70 (only 11.1% less than 60 years) for both	50%	any type
study3	Ana López-de-Andrés	2018	Spain	Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy	more than 40 for both	53.6%	any type
study4	Knut Hagen	2017	Norway	Cephalalgia	no DM 58.0 (13.1), type1 56.9 (12.6), type2 67.1 (10.7), all types 66.3 (11.3)	no DM 57.2%, type1 44.4%, type2 49.2%, all types 49.4%	any type, type1, type2
study5	Ippazio Cosimo Antonazzo	2017	Norway	Cephalalgia	27.7 (21.9) type1, 52.7(13.9) type2, 34.4 (21.0) no DM	40.3 type1, 42.5 type2, 49.3 no dm	type1, type2
study6	Fatemeh Sadat Haghghi	2016	Iran	Journal of Diabetes & Metabolic Disorders	30-42	62.6% for diabetes, 68% for control	type2
study7	Berge	2013	Norway	Epidemiology	0-more than 70 for both	Not identified	type1, type2
study8	A. H. Aamodt	2007	Norway	European Journal of Neurology	48.6 (13.4) no DM, 64.7 (14.2) all DM, 61.1 (12.0) type1, 67.1 (10.9) type2	54% no DM, 50.4% for all DM, 43% type1, 49.1% type2	any type, type1, type2

Supplementary Table 2. Characteristics of the included studies (Group 1), continued

Study ID	Title/ doi	Study design	Migraine and DM methods of diagnosis
1	Associations of type 2 diabetes and the risk of migraine in Chinese populations https://doi.org/10.1016/j.diabet.2024.101518	retrospective population-based cohort study	Migraine (the International Classification of Headache Disorders-3 (ICHD-3) by an outpatient neurologist.) DM (for individuals with fasting blood glucose levels ≥ 126 mg/dl or glycated hemoglobin ≥ 6.5%) self-reported physician diagnosis
2	Is There an Association between Diabetes and Neck and Back Pain? Results of a Case-Control Study https://doi.org/10.3390/jcm9092867	Case-Control Study	
3	Migraine in adults with diabetes; is there an association? Results of a population-based study https://doi.org/10.2147/DMSO.S170253	population-based cross-sectional study	self-reported physician diagnosis
4	Inverse relationship between type 1 diabetes mellitus and migraine. Data from the Nord-Trøndelag Health Surveys 1995–1997 and 2006–2008 https://doi.org/10.1177/0333102417690488	longitudinal cohort study	Migraine (the HUNT2 questionnaire-based diagnosis), DM (self-reported)
5	Diabetes is associated with decreased migraine risk: A nationwide cohort study https://doi.org/10.1177/0333102417748573	A nationwide cohort study	Migraine and DM identified by prescriptions registered in the Norwegian prescription database
6	Migraine and type 2 diabetes; is there any association? https://doi.org/10.1186/s40200-016-0241-y	cross-sectional study	DM identified by registry of Diabetes Research Center. Migraine (the International Classification of Headache Disorders-3 (ICHD-3)
7	Does Diabetes Have a Protective Effect on Migraine? DOI: 10.1097/EDE.0b013e31827623d0	cross-sectional study	Migraine and DM identified from the National Register of Prescriptions
8	Headache prevalence related to diabetes mellitus. The Head-HUNT study doi:10.1111/j.1468-1331.2007.01765.x	population-based cross-sectional study	Self-reported



Supplementary Table 3. Characteristics of the included studies (Group 2)

Study ID	Author	Year	Country	Journal	Mean age	Female%	Diabetes type
study1	Hyomin Shin	2024	Korea	PLOS ONE	55.2	60%	any type
study2	Kyoung Ohn	2023	Korea	PLOS ONE	56.46 ± 10.91 migraine 54.14 ± 10.4 control	72.34% migraine 48.91% control	any type
study3	Sara Schramm	2021	Germany	Cephalalgia	72.9 ± 5.1	51%	any type
study4	Jiu-Haw Yin	2021	Taiwan	Headache	36.7 ± 12.0 for migraine, 39.0 ± 12.4 for control	69.4% for migraine, 52% for control	
study5	Tobias Kurth	2020	USA	JAMA	54.7 [7.1]	100%	any type
study6	Patricia Noemi Apelbaum	2020	Brazil	American Journal of Hypertension	35–74	for control 45.35%, for migraine w aura 80.30%, for migraine no aura 73.39%	any type
study7	Urvish K Patel	2019	USA	Cureus	for migraine median 48 (16), for control 60 (21)	for migraine 82.11%, for control 58.52%	any type
study8	Guy Fagherazzi	2019	France	JAMA Neurology	for migraine 59.9 (6)	100% for both	type2
study9	Fahimeh Martami	2018	Iran	Neurological Sciences	38.39 (11.81) for migraine, 37.10 (12.76) for control	90.1% for migraine, 82.3% for control	any type
study10	Souvik Sen	2018	USA	Neurology	for migraine 58.4(5.5), no migraine 60.4(5.7)	migraine 77%, no 52%	
study11	Sylvie Streel	2016	Belgium	Cephalalgia	no migraine 46.4 (34.2–57.8), MO 39.4 (30.1–47.2), MA 39.7 (28.7–52.2)	no migraine 44.2%, MO 69.8%, MA 59.5%	any type
study12	Line M Jacobsen	2013	Norway	BMJ Open	controls 67.0 (11.2), migraine 51.5 (12.5)	controls 51.7%, migraine 69.8%	any type
study13	Karen S. Ferreira	2013	Brazil	Arquivos de Neuro-Psiquiatria	Mean age was 42.5 years for migraineurs and 40 years for controls	86% migraine, 79% controls	any type
study14	Yong-Chen Chen	2012	Taiwan	The Journal of Headache and Pain	age and sex matching		any type
study15	Markus Schürks	2012	USA	Cephalalgia	controls 63.9 (7.1), migraine 62.5 (6.3)	100%	any type
study16	Han Le	2010	Denmark	Cephalalgia	44 age and sex nearly matched		any type
study17	Tatjana Rundek	2008	USA	Circulation	61 ± 9 migraine, 71 ± 10 control	72% migraine, 55% control	any type



Supplementary Table 3. Characteristics of the included studies (Group 2), continued

Study ID	Title/ doi	Study design	Migraine and DM identification methods or diagnosis
1	Association between migraine and the risk of vascular dementia: A nationwide longitudinal study in South Korea https://doi.org/10.1371/journal.pone.0300379	nationwide longitudinal study	From medical records
2	Presence and severity of migraine is associated with development of primary open angle glaucoma: A population-based longitudinal cohort study https://doi.org/10.1371/journal.pone.0283495	A population-based longitudinal cohort study	Migraine (under International Classification of Diseases (ICD)-10)
3	Prevalence and risk factors of migraine and non-migraine headache in older people – results of the Heinz Nixdorf Recall study https://doi.org/10.1177/0333102420977183	Longitudinal population-based study	DM (from records) By prescriptions from medical records
4	Prevalence and association of lifestyle and medical-, psychiatric-, and pain-related comorbidities in patients with migraine: A cross-sectional study 10.1111/head.14106	A cross-sectional study	From medical records
5	Association of Migraine With Aura and Other Risk Factors With Incident Cardiovascular Disease in Women doi:10.1001/jama.2020.7172	Cohort study	Self-reported
6	Migraine and Arterial Stiffness in the Brazilian Longitudinal Study of Adult Health: ELSA-Brasil https://doi.org/10.1093/ajh/hpaa005	Longitudinal Study	Migraine (the International Headache Society criteria) DM (medical records)
7	A Comprehensive Assessment of Vascular and Nonvascular Risk Factors Associated with Migraine 10.7759/cureus.6189	cross-sectional analysis	Migraine (ICD-9-CM code)
8	Associations Between Migraine and Type 2 Diabetes in Women: Findings From the E3N Cohort Study 10.1001/jamaneurol.2018.3960	Cohort Study	DM (self-reported) Self-reported
9	Comorbidity of gastrointestinal disorders, migraine, and tension-type headache: a cross-sectional study in Iran https://doi.org/10.1007/s10072-017-3141-0	cross-sectional study	Migraine (the international classification of headache disorders-III (ICHD III β) DM (By prescriptions from medical records)
10	Migraine with visual aura is a risk factor for incident atrial fibrillation https://doi.org/10.1212/WNL.0000000000006650	Cohort study	Migraine (Modified ICHD-3) DM (medical records)
11	Screening for the metabolic syndrome in subjects with migraine https://doi.org/10.1177/0333102416672494	cross-sectional study	Migraine (ef-ID migraine questionnaire) DM (fasting plasma glucose level ≥ 100 mg/dl or use of medication for hyperglycemia)
12	Urinary albumin excretion as a marker of endothelial dysfunction in migraine sufferers: the HUNT study, Norway https://doi.org/10.1136/bmjopen-2013-003268	Population-based study	Migraine (modified version of the ICHD migraine criteria) DM (self-reported)
13	Comorbidities, medications and depressive symptoms in patients with restless legs syndrome and migraine https://doi.org/10.1590/S0004-282X2013005000007	case-control study	Self-reported
14	Comorbidity profiles of chronic migraine sufferers in a national database in Taiwan https://doi.org/10.1007/s10194-012-0447-4	population-based retrospective matched cohort study	From medical records
15	Migraine and restless legs syndrome in women https://doi.org/10.1177/0333102412439355	Cohort study	Self-reported
16	Co-morbidity of migraine with somatic disease in a large population-based study https://doi.org/10.1177/0333102410373159	Cohort study	Self-reported
17	Patent Foramen Ovale and Migraine: A Cross-Sectional Study From the Northern Manhattan Study (NOMAS) https://doi.org/10.1161/CIRCULATIONAHA.108.771303	Cross-Sectional Study	Self-reported



Supplementary Table 4. Group 1 studies that examined the prevalence of migraine in patients with diabetes and non-diabetics

Study ID	Diabetes type	Total number of diabetics	Number of migraine patients	Total number of patients without diabetes	Number of non-diabetics with migraine
study1	type 2	1722	125	8151	726
study2	any type	2095	185	2095	156
study3a	any type	3441	512	3441	448
study3b	any type male	1598	118	1598	111
study3c	any type	1843	394	1843	337
study4a	female type1	81	10	24779	5007
study4b	type2	1107	173	24779	5007
study4c	any type	1342	202	24779	5007
study5a	type1	7883	109	4184718	179429
study5b	type2	93600	930	4184718	179429
study6	type2	147	41	150	39
study7d	type2 0-50	13755	479	6217279	104391
study7f	type2 50-more than 70	78179	644	2971225	56936
study7g	receiving insulin only 0- 50	15427	219	3100090	52216
study7h	receiving insulin only 50-70	17288	118	1507414	28672
study8a	any type	1499	85	49750	6119
study8b	type1	179	7	49750	6119
study8c	type2	870	40	49750	6119