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Scoping review

Salivary uric acid in psychiatric disorders and acute psychosocial stress: a scoping review

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Summary

Introduction. Salivary uric acid (UA) has been proposed as a non-invasive biomarker of oxidative stress and neuroinflammation in psychiatric disorders. This scoping review aimed to map evidence on salivary UA in psychiatric conditions and during acute psychosocial stress, identify methodologies, and highlight gaps.

Methods. PubMed was searched (2014–2025) following JBI scoping review guidelines and PRISMA-ScR. Original human studies measuring salivary UA in psychiatric populations or stress paradigms were included. Data on study characteristics, saliva collection, and main findings were extracted. Risk-of-bias assessment was not performed.

Results. Seven studies (483 participants: psychiatric n=208, healthy stress-exposed n=275) met criteria. Evidence covered acute stress (n=3), dementia/Alzheimer's (n=2), bipolar disorder (n=1), and eating disorders (n=1). Salivary UA was elevated during acute stress and in bipolar disorder, reduced in dementia, unchanged in Alzheimer's, and elevated in eating disorders. Protocols and confounder control were heterogeneous.

Conclusion. Evidence is limited and methodologically diverse. Preliminary findings are promising for stress reactivity and bipolar disorder, but insufficient for clinical application. Future research requires standardized protocols, longitudinal designs, and adjustment for confounders.

Key words: saliva, uric acid, psychiatric disorders, oxidative stress, scoping review

Introduction

Human saliva consists of 99% water and inorganic salts such as sodium, potassium, calcium, chlorate, bicarbonate, and phosphate, as well as organic compounds including uric acid (2,6,8-trihydroxypurine), lactate, hormones, polypeptides, and proteins like immunoglobulins, enzymes, and mucins [1]. Psychiatric disorders arise primarily from dysfunctions in dopaminergic, serotonergic, and glutamatergic neurotransmission, though other factors—neurotrophic, immune,

neuroendocrine, and epigenetic—also contribute. Oxidative stress has been increasingly recognized as a key factor in psychiatric pathophysiology [2].

Uric acid, the end product of purine metabolism, is a peripheral non-enzymatic antioxidant and influences purinergic signaling. It can modulate neuronal activity both pre- and postsynaptically, affecting neurotransmitters involved in psychosis, including dopamine, gamma-aminobutyric acid, glutamate, and serotonin [3]. Salivary uric acid concentrations in healthy individuals are 199 ± 27 μmol/L, comparable to serum levels of 120–400 μmol/L [4]. Earlier studies report a linear correlation between serum and salivary uric acid in most cases [1, 4, 5–8]. Elevated serum uric acid has been linked to neuroprotective outcomes in neurodegenerative disorders such as mild cognitive impairment, Alzheimer's, Parkinson's, and Huntington's disease [9, 10]. Uric acid is also associated with emotion-related psychopathology, including anxiety, mood disorders [11–15], disinhibition, impulsivity, and hyperactivity [16, 17]. Functional MRI studies indicate that uric acid plays a role in regulating stress response neurobiology [18]. Nevertheless, the literature is characterized by diverse methodologies, small sample sizes, and inconsistent findings. To date, no comprehensive mapping of this evidence base exists.

This scoping review aimed to systematically map the available literature on salivary uric acid levels in individuals with psychiatric disorders or exposed to acute psychosocial stress. Specifically, we sought to:

1. identify the extent, range, and nature of research activity,
2. summarize key findings according to diagnostic category or stress paradigm,
3. document methodological approaches (saliva collection, assay, confounder control),
4. identify knowledge gaps to inform future research.

Methods

This scoping review was conducted in accordance with the Joanna Briggs Institute (JBI) methodology for scoping reviews [19] and reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) [20].

A scoping review methodology was selected because the available literature was limited in volume, heterogeneous in design, and methodologically diverse, precluding meaningful quantitative synthesis. The objective was to map the extent, range, and characteristics of evidence rather than to estimate pooled effects or generate graded clinical recommendations, consistent with JBI guidance for emerging research areas [19].

A review protocol was developed a priori to define eligibility criteria, search strategy, and data charting procedures; however, it was not prospectively registered in a public registry as the study was designed as a scoping review, for which registration was not mandatory.

Research question

What is known from the existing literature about salivary uric acid levels in psychiatric disorders and acute psychosocial stress?

Population–Concept–Context (PCC) framework

The review question was structured using the JBI Population–Concept–Context framework [19]:

Population. Human participants diagnosed with psychiatric disorders (any age group) or healthy individuals exposed to experimentally induced acute psychosocial stress.

Concept. Measurement of salivary uric acid as a biomarker of oxidative stress, neuroinflammation, or stress reactivity.

Context. Clinical psychiatric settings or controlled experimental stress paradigms.

This framework guided eligibility criteria, study selection, data charting, and synthesis.

Eligibility criteria

Inclusion criteria

Peer-reviewed original research articles (observational or experimental)

- Human participants
- Measurement of uric acid in saliva
- Psychiatric population compared with healthy controls or acute psychosocial stress paradigm with pre/post salivary measurement
- Published in English
- Publication period: 1 January 2014 – 31 December 2025
- Indexed in PubMed

Exclusion criteria

- Animal, in vitro, or post-mortem studies
- Studies measuring uric acid exclusively in serum, plasma, or urine
- Studies unrelated to psychiatric or stress contexts (e.g., gout, renal disease, dentistry, oncology)
- Reviews, editorials, conference abstracts, case reports, grey literature
- Non-English publications

Search strategy

A systematic search of PubMed was performed by using the following search string: ("salivary uric acid"[All Fields] OR ("uric acid"[All Fields] AND "saliva"[All Fields])) AND ("psychiatric disorders"[MeSH Terms] OR "psychiatric disorders"[All Fields]. OR "stress"[MeSH Terms] OR "stress"[All Fields] OR "psychosocial stress"[All Fields] OR "mental health"[MeSH Terms] OR "mental health"[All Fields]) AND ("2014/01/01"[PDAT]: "2025/12/31"[PDAT]) AND (humans [Filter])

No additional databases or grey literature sources were searched, reflecting the exploratory scoping focus.

Study selection

Titles and abstracts were independently screened by two reviewers. Full texts of potentially eligible articles were assessed independently. Disagreements were resolved by discussion or consultation with a third reviewer. The study selection process is presented in Figure 1. (PRISMA-ScR flow diagram).

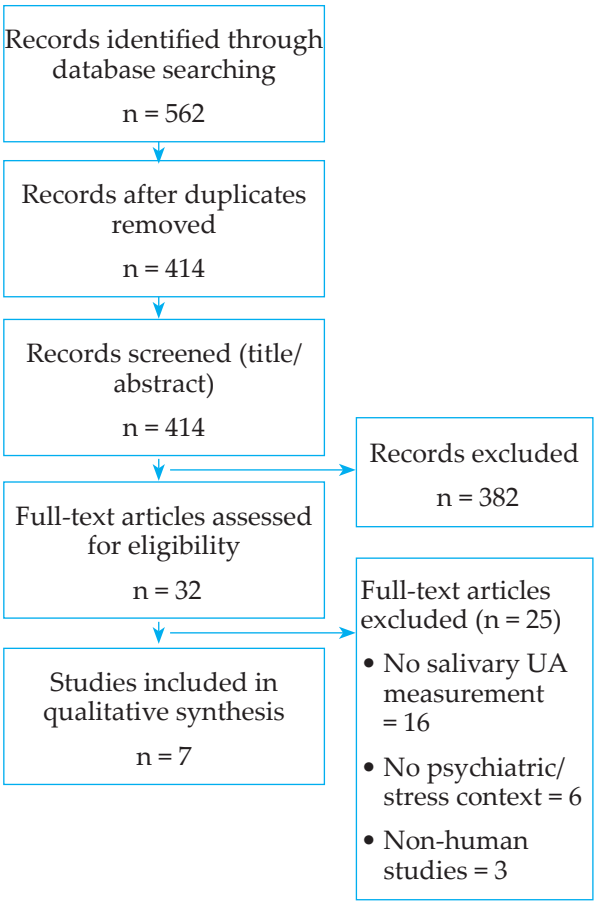

Figure 1. PRISMA-ScR flow diagram of the scoping review study selection process

Data charting

A standardized data extraction process was applied to all included studies, focusing on key methodological and outcome variables as presented in the first table. From each study, the following information was extracted:

- Author(s) and year of publication – for study identification and chronological context (e.g., Zalewska et al., 2021; Hajali et al., 2025).
- Study population – including age group and clinical status, ranging from adolescents with eating disorders to older adults with Alzheimer's disease.
- Psychiatric condition or stress paradigm – capturing the specific diagnosis (e.g., bipolar disorder, dementia) or experimentally induced psychosocial or social stress.
- Saliva sampling method – including stimulated versus non-stimulated collection, timing of sample (e.g., morning, pre/post stress), and number of samples collected.
- Main findings on salivary uric acid (UA) – recording whether UA levels were elevated, reduced, unchanged, or dynamically changed under stress conditions.

Data extraction was conducted independently by two reviewers, and discrepancies were resolved by consensus. This approach enabled consistent mapping of methodological characteristics and UA outcomes across studies, facilitating comparative analysis of salivary UA patterns in psychiatric conditions and stress paradigms.

Critical appraisal of individual sources

Consistent with JBI guidance for scoping reviews [19], a formal risk-of-bias or methodological quality assessment was not undertaken. The aim was to map the evidence base rather than to generate graded clinical recommendations. Methodological limitations of included studies were described narratively.

Data synthesis

Extracted data were synthesized descriptively and narratively. Findings were organized into four thematic categories:

1. Acute psychosocial stress
2. Bipolar disorder
3. Dementia/Alzheimer's disease
4. Eating disorders

Meta-analysis was not performed, as quantitative pooling was beyond the scope of this review.

Results

Study selection

The search yielded 562 records. After removing duplicates, 414 records were screened for titles and abstracts. Full-text review was conducted for 12 articles, and seven studies met all inclusion criteria and were included in the qualitative synthesis (Figure 1). Methodological characteristics of included studies were examined descriptively, and data extraction was performed according to the pre-defined protocol.

Characteristics of included studies

The seven studies included in this scoping review were published between 2016 and 2025, covering various psychiatric disorders, neurodegenerative conditions, and stress paradigms. Sample sizes, age ranges, and saliva collection methods varied across studies (Table 1 for summary).

Synthesis of findings by category

Acute psychosocial stress (n=3)

All three experimental studies reported significant increases in salivary uric acid following acute psychosocial stress. Goodman et al. [18]

Table 1. Characteristics and main findings of studies assessing salivary uric acid in psychiatric and stress-related conditions. Participant age is reported as mean ± SD/ when available, as a range (min–max) when the mean is not provided

Author	(Year)	Study population	Psychiatric condition / Stress paradigm	Saliva sampling method	Main findings
Zalewska et al. [21]	2021	Older adults (81.19 ± 6.77)	Alzheimer's disease	Stimulated saliva (SWS)	No significant differences vs controls
Choromańska et al. [22]	2017	Adults (80.12 ± 0.75)	Dementia	Non-stimulated / Stimulated saliva (NWS/SWS)	Significantly lower UA vs controls
Goodman et al. [18]	2016	Adults (19.58)	Psychosocial stress	Saliva	UA increased during hippocampal activation under stress
Giesser et al. [23]	2020	Adolescents (age not reported)	Eating disorders	Morning saliva	Elevated UA vs controls
Lucas et al. [24]	2020	Adults (31.41 ± 13.84)	Acute social stress	Pre/post stress	UA increased under social stress conditions
Hajali et al. [25]	2025	Adults 18–65 (mean not reported)	Bipolar disorder	Unstimulated saliva	Elevated UA vs controls
Goetz/Granger et al. [26]	2024	Adults (31.41 ± 13.84)	Acute psychosocial stress	Multiple samples	UA dynamics positively correlated with cortisol and DHEA-S

observed increased salivary uric acid during hippocampal activation under stress. Lucas et al. [24] demonstrated elevated uric acid under conditions of acute social stress. Goetz and Granger et al. [26] reported that salivary uric acid dynamics in healthy adults was positively correlated with cortisol and DHEA-S responses, supporting integration within the neuroendocrine stress response.

Bipolar disorder (n=1)

Hajali et al. [25] reported significantly elevated salivary uric acid in euthymic adults with bipolar disorder compared to healthy controls.

Dementia and Alzheimer's disease (n=2)

Choromańska et al. [22] found significantly lower salivary uric acid in patients with dementia. Zalewska et al. [21] reported no significant difference in salivary uric acid between Alzheimer's disease patients and controls.

Eating disorders (n=1)

Giesser et al. [23] observed elevated morning salivary uric acid levels in adolescents with anorexia nervosa and bulimia nervosa.

Discussion

This scoping review maps the limited and methodologically heterogeneous body of literature examining salivary uric acid (UA) in psychiatric and stress-related conditions. In accordance with scoping methodology, the objective was to identify research trends, methodological characteristics, and knowledge gaps rather than to establish pooled effect sizes or clinical validity. The available evidence did not demonstrate a consistent direction of

change across disorders. Instead, salivary UA appeared to vary according to clinical context, suggesting condition-specific patterns rather than a uniform biomarker profile.

Biological plausibility for investigating salivary UA is supported by serum research. Both elevated and reduced serum UA concentrations have been associated with neurodegenerative and psychiatric disorders, including Alzheimer's disease, bipolar disorder, schizophrenia, and depression [18, 29]. Higher serum UA levels have been linked to better cognitive outcomes and potential neuroprotective effects through suppression of oxidative stress and neuroinflammation [30–32], whereas lower levels have been associated with impaired antioxidant defense and neurodegenerative processes [18]. Additional methodological investigations have demonstrated that salivary uric acid exhibits moderate-to-strong correlation with serum levels and acceptable intra-individual reliability under standardized conditions, further supporting its potential utility as a non-invasive biomarker in psychoneuroendocrine research [7]. Several biological mechanisms may explain these observations. Uric acid acts as a major endogenous antioxidant, reducing oxidative stress and limiting neuroinflammatory processes. It may also influence neuronal signaling through purinergic receptors and interact synergistically with other antioxidants, including glutathione, vitamin E, and polyphenols, thereby strengthening overall cellular redox defense and reducing oxidative damage to lipids, proteins, and nucleic acids [25, 30–34]. Together, these findings provide a rationale for salivary assessment while underscoring the complex and context-dependent role of UA within redox and inflammatory pathways.

Across the mapped studies, the most consistent finding concerns acute psychosocial stress. Salivary UA increases in experimentally induced and naturalistic stress conditions [24, 26], suggesting rapid responsiveness to stress-related metabolic and oxidative processes. Associations with cortisol and DHEA-S further situate salivary UA within the neuroendocrine stress axis, supporting its potential relevance as a dynamic marker of physiological stress reactivity rather than a stable diagnostic indicator.

Findings in mood, eating, and neurodegenerative disorders are more variable. Elevated salivary UA has been reported in bipolar disorder and eating disorders [23, 25], potentially reflecting alterations in purine metabolism and redox balance. UA may exert antioxidant effects while also promoting inflammasome activation under metabolically dysregulated conditions [23, 31–33]. Reduced salivary UA has been observed in dementia [21], possibly indicating depleted antioxidant reserves, whereas no difference was found in Alzheimer's disease [20], suggesting stage- or subtype-related variability. However, these observations were based on small and predominantly cross-sectional samples and therefore remain exploratory.

Limitations

The limitations of the current evidence base are substantial and must be explicitly acknowledged. First, the number of available studies is small, restricting the breadth of conclusions that can be drawn. Second, marked methodological heterogeneity limits comparability across studies. Variability in saliva collection procedures (stimulated versus non-stimulated), inconsistent reporting of salivary flow rate, differences in sampling timing, and lack of standardized protocols introduce measurement-related uncertainty. Third, most studies employ cross-sectional designs with limited sample sizes, reducing statistical power and preventing causal inference or clear differentiation between state and trait effects. Fourth, control of confounding variables is frequently inadequate. Key factors such as diet, body mass index, renal function, smoking, medication use, and circadian variation are inconsistently reported or insufficiently adjusted

for, potentially biasing observed associations. Fifth, population diversity is limited, and the restriction to a single database search may have reduced comprehensiveness and introduced selection bias. Finally, the heterogeneity and limited volume of data precluded quantitative synthesis, reinforcing the exploratory nature of the mapped findings.

Taken together, the current literature suggests that salivary UA is biologically plausible and responsive to acute stress conditions, but its role across psychiatric and neurodegenerative disorders remains insufficiently defined. The field is at an early development stage. Future research should prioritize standardized sampling protocols, longitudinal designs, larger and more diverse cohorts, rigorous confounder control, and multimarker approaches to determine whether salivary UA has reproducible and clinically meaningful value in psychoneuroendocrine research.

Future directions

Future studies should prioritize standardized sampling protocols, longitudinal designs, larger multicenter cohorts, rigorous confounder control, and multimarker approaches. The rapid reactivity of salivary UA in acute stress contexts represents its most promising clinical application.

Conclusion

Salivary uric acid represents a biologically plausible but methodologically under-standardized biomarker in psychiatric and stress research. The strongest and most consistent evidence supports its role in acute psychosocial stress reactivity. Findings in psychiatric disorders remain preliminary and context dependent. Robust methodological refinement and longitudinal validation are required before clinical implementation can be considered.

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Salivarna mokraćna kiselina kod psihijatrijskih poremećaja i akutnog psihosocijalnog stresa: pregled mapiranja literature

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Uvod. Salivarna mokraćna kiselina (MK) predložena je kao neinvazivni biomarker oksidativnog stresa i neuroinflamacije kod psihijatrijskih poremećaja. Ovaj skoping pregled imao je za cilj da mapira dokaze o salivarnoj MK kod psihijatrijskih stanja i tokom akutnog psihosocijalnog stresa, identifikuje korišćene metodologije i ukaže na praznine u znanju.

Metode. Pretraga PubMed baze (2014–2025) sprovedena je u skladu sa JBI smernicama za skoping preglede i PRISMA-ScR standardom. Uključene su originalne studije na ljudima koje su merile salivarnu MK kod psihijatrijskih populacija ili u eksperimentalnim stresnim paradigmama. Prikupljeni su podaci o karakteristikama studija, metodama uzimanja pljuvačke i glavnim nalazima. Procena rizika od pristrasnosti nije sprovedena.

Rezultati. Sedam studija (ukupno 483 učesnika: psihijatrijske populacije n=208, zdravi izloženi stresu n=275) ispunilo je kriterijume. Dokazi se odnose na akutni stres (n=3), demenciju/Alchajmerovu bolest (n=2), bipolarni poremećaj (n=1) i poremećaje ishrane (n=1). Salivarna MK bila je povišena tokom akutnog stresa i kod bipolarnih poremećaja, smanjena kod demencije, nepromenjena kod Alchajmerove bolesti i povišena kod poremećaja ishrane. Protokoli i kontrola sporednih faktora bili su heterogeni.

Zaključak. Dokazi su ograničeni i metodološki raznoliki. Preliminarni nalazi deluju obećavajuće za reaktivnost na stres i bipolarni poremećaj, ali nisu dovoljni za kliničku primenu. Buduća istraživanja zahtevaju standardizovane protokole, longitudinalne dizajne i kontrolu sporednih faktora.

Ključne reči: saliva, mokraćna kiselina, psihijatrijski poremećaji, oksidativni stres, skoping pregled