How many peer-reviewed studies exist on breath biomarkers for metabolic health?

Breath biomarkers for metabolic health: scope of the evidence

Breath analysis is a large and rapidly growing research area. Within this, work specifically linking exhaled volatile compounds to **metabolic health and disease** (e.g., diabetes, obesity-related and other metabolic conditions) already spans dozens to hundreds of peer-reviewed studies, but the exact number cannot be pinned down from these papers alone.

Scale of the Literature

- A 2020 electrochemical-society review cites an estimate of **~140,000 breath-analysis papers since 2000**, across all diseases and applications, showing how large the overall field is (Das & Pal, 2020).
- A 2024 GC-MS breathomics review reports **"almost 1,000" articles** specifically on VOCs in exhaled breath for biomarker discovery across many diseases, including diabetes and other metabolic conditions (Bajo-Fernández et al., 2024).
- A 2020 mini-review focused on dietary intervention, SCFAs, and breath VOCs for metabolic diseases summarizes **multiple clinical trials**, not just single studies (Borras et al., 2021).

Examples Directly Related to Metabolic Health

Metabolic domain	Example breath study type	Citations
Diabetes	Systematic review/meta-analysis including **44 studies, 2699 diabetic patients**; many use acetone or isotopic CO_2 as breath biomarkers (Malik et al., 2026)	(Malik et al., 2026)
Diabetes	Large acetone-breath analyzer study with **>350 subjects** (Weber et al., 2023)	(Weber et al., 2023)
General metabolic / diet	Review of breath VOCs and SCFAs in dietary intervention trials for metabolic diseases (Borras et al., 2021)	(Borras et al., 2021)
Aging & metabolism	Cross-sectional breathomics in 204 healthy females, linking VOCs to endocrine and energy-homeostasis changes with age (Lee & Zhu, 2020)	(Lee & Zhu, 2020)

FIGURE 1 Illustrative slice of metabolic breath-biomarker studies

Reviews Aggregating Many Metabolic Breath Studies

- A systematic review of diabetes breath tests aggregates **44 original studies**, showing substantial peer-reviewed work just for one metabolic disease (Malik et al., 2026).
- Reviews on VOC sensing materials and clinical VOC biomarkers collate **extensive data** on breath markers for diabetes and other metabolically linked conditions (Pathak et al., 2023; Issitt et al., 2022; Malik et al., 2025).
- A 2020 mini-review explicitly identifies **several exhaled-breath studies** examining how diet alters VOC profiles in people with metabolic abnormalities (Borras et al., 2021).

Conclusion

From these sources, breath biomarkers for metabolic health have been studied in **at least dozens of clinical and experimental papers**, and likely many more, but the precise total is not provided. Reviews in diabetes and diet-related metabolomics alone summarize **tens of studies**, within a broader breathomics literature of **hundreds to thousands** of VOC-biomarker papers.

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