



ORIGINAL ARTICLE

# Research performance of biomarkers from biofluids in periodontal disease publications



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Received 1 March 2013; Final revision received 15 June 2013

Available online 5 September 2013

## KEYWORDS

bibliometric;  
biomarkers;  
periodontal disease

**Abstract** *Background/purpose:* The biomarkers in biofluids are useful tools for evaluating the activity of periodontal disease. The purpose of this study is to evaluate the performance of publications on biomarkers and periodontal disease for four categories of biofluid.

*Materials and methods:* A total of 2455 documents of "original article" published in the Science Citation Index database between 1996 and 2010 were analyzed for this study. The biofluids in these original articles were subdivided into four categories of specimen: saliva, serum, plasma, and gingival sulcus fluid (GSF; including gingival crevicular fluid). The total number of articles and the number of citations per publication were defined as quantitative and qualitative indexes in this study. The *h*-index, an indicator of both quality and quantity of scientific publications, was also included in the analysis.

*Results:* The standard errors of the annual citations per publication for periodontal disease articles including topics on serum (2.4) or on saliva (2.9) were less than those for articles including topics on plasma (5.1) or on GSF (4.9). The lesser variation in the number citations

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reflected the consistent quality of periodontal disease articles concerning serum and saliva topics. The *h*-index was not significantly different among articles including plasma (66), serum (59), or saliva (55). The research performance of articles including GSF (*h*-index = 20) was worse than for the other three types of biofluids.

**Conclusion:** Results of *h*-index indicate that biomarkers in saliva, as well as in serum and plasma, are good indicators for use in studying periodontal disease.

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## Introduction

Periodontal disease is an inflammatory disease affecting periodontal tissues including gingiva, alveolar bone, and the periodontal ligament.<sup>1</sup> Studies have shown that the inflammatory response may induce systemic activation and it is thus associated with systemic diseases such as coronary heart disease, vascular diseases,<sup>2,3</sup> and diabetes mellitus (DM).<sup>4</sup> Because periodontal disease is a systemic disease, biomarkers in body fluids were used to assess the inflammatory molecules and other mediators that lead to periodontal disease and other systemic complications.

A biomarker is defined as “a characteristic that is objectively measured and evaluated as an indicator of normal biological processes, pathogenic processes, or pharmacological responses to a therapeutic intervention” by the Biomarkers Definition Working Group of the National Institutes of Health.<sup>5</sup> Biomarkers in biofluids are not only helpful tools for disease diagnosis, disease prognosis, and clinical response after treatment, but can also serve as useful screening tools.<sup>5</sup> Linked animal models and biomarkers can be used to confirm the translation of endogenous metabolism and exposure to environmental hazards to disease mechanisms.<sup>6</sup> The accessibility of biofluids is a key reason for their utilization in biomarker research.

Analysis of metabolites or disease-related biomarkers in biofluids, including plasma, whole blood, serum, urine, saliva, cerebrospinal fluid, synovial fluid, semen, and tissue homogenates, has assisted in clinical diagnosis.<sup>7</sup> Serum and plasma represent a profile of bodily circulation, and the proteins of those specimens represent the performance of the entire body.<sup>8</sup> Saliva offers a noninvasive and highly accessible specimen source, and also contains potential biomarkers of oral disease.<sup>9</sup> Gingival sulcus fluid (GSF) includes gingival crevicular fluids collected from gingival crevices surrounding the teeth and is a serum transudate and content inflammatory exudate.<sup>10</sup> Using biomarkers contained in biofluids is a good way to assess inflammatory mediators that lead to periodontal disease. The purpose of this study was to evaluate the performance of publications on biomarkers and periodontal disease for four categories of biofluids listed in the Science Citation Index (SCI) database between 1996 and 2010.

## Materials and methods

The search engine used in this study was the SCI database of ISI Web of Science, Philadelphia, PA, USA.<sup>11</sup> Document

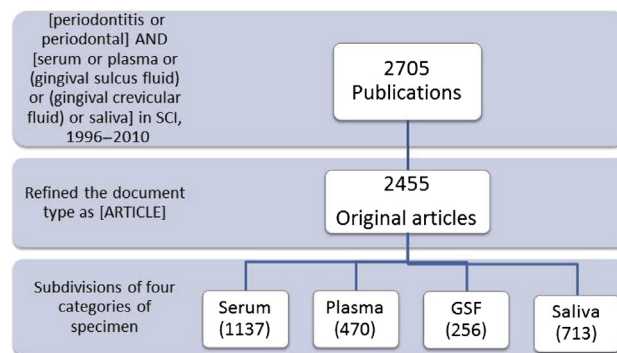
search strategies were limited as follows: the keywords of topics were “periodontitis or periodontal” and “serum or plasma or (gingival sulcus fluid) or (gingival crevicular fluid) or saliva” in the 15 years from 1996 to 2010. Based on these search strategies, a total of 2705 documents were identified.

The 2455 documents were then defined by document type as “Article” for advanced research, and further subdivided by four categories of specimens: serum, plasma, GSF (including gingival crevicular fluid), and saliva (Fig. 1). The publication numbers of original articles concerning serum, plasma, GSF, and saliva were 1137, 470, 256, and 713, respectively.

The total number of publication numbers, page count, author number, citation times, and *h*-index were included as the analyzed parameters in this study. The total article number was defined as a quantitative index in this study. Because the number of publications does not reflect the quality of scientific publications, the citations per publication (CPP) was used as a qualitative index in this study. The *h*-index was first introduced by J.E. Hirsch<sup>12</sup> and can present both quality and quantity of scientific publications. The *h*-index reflects both the number of publications and the number of citations. It takes into consideration productivity as reflecting the importance or impact of the publications: the value of *h* is equal to the number of publications (*N*) in the list that have *N* or more citations.

## Statistical methods

SAS version 9.3 (SAS Institute Inc., Cary, NC, USA) was used for all statistical analyses. The standard error (SE) is a



**Figure 1** Search strategies and process using the Web of Science database. GSF = gingival sulcus fluid.

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