

The time difference between dental calculator calculation and manual calculation in Geriatric Oral Health Assessment IndexPerbedaan waktu antara perhitungan menggunakan kalkulator gigi dan perhitungan manual pada *Geriatric Oral Health Assessment Index***¹Erthasya Aura Abrialihan, ²Yulia Rahmad, ³Utmi Arma, ⁴Ricky Amran, ⁵Valendriyani Ningrum**¹Faculty of Dentistry, Baiturrahmah University^{2,4,5}Department of Preventive and Public Health Dentistry, Faculty of Dentistry, Baiturrahmah University³Department of Oral Medicine, Faculty of Dentistry, Baiturrahmah University

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Corresponding author, e-mail: ⁵valend888@gmail.com**ABSTRACT**

Conventionally, manual measurement of the Geriatric Oral Health Assessment Index (GOHAI) is time-consuming and prone to error. To address this challenge, a dental calculator application was developed as a digital technology-based solution to speed up GOHAI calculations. This study determined the duration of manual GOHAI measurement compared to the use of a digital dental calculator application. This was a quasi-experimental study with a posttest-only group design. Convenience sampling was used, resulting in a total of 70 samples from the population of students at the Faculty of Dentistry, Baiturrahmah University, who met the inclusion and exclusion criteria. The data collection process consisted of manual measurements taken in the first week and digital measurements taken in the third week. It was found that the average GOHAI measurement time using the digital dental calculator application (36.28 seconds) was faster than using paper and pen (88.78 seconds) with a p-value of 0.000 ($p < 0.05$), indicating a significant difference. The average difference in GOHAI measurement time between the manual and digital methods was 52.5 seconds. It was concluded that there was a difference in time between the use of a digital dental calculator and a manual application for GOHAI measurement.

Keywords: GOHAI, time duration, digital dental calculator**ABSTRAK**

Secara konvensional, pengukuran manual *Geriatric Oral Health Assessment Index* (GOHAI) memakan waktu dan rentan terhadap kesalahan. Untuk mengatasi tantangan ini, aplikasi kalkulator gigi dental dikembangkan sebagai solusi berbasis teknologi digital untuk mempercepat perhitungan GOHAI. Studi ini menentukan durasi untuk pengukuran manual GOHAI dibandingkan dengan penggunaan aplikasi kalkulator dental digital. Penelitian quasi-eksperimental dengan desain kelompok posttest-only. Teknik *convenience sampling*, menghasilkan total 70 sampel dari populasi mahasiswa Fakultas Kedokteran Gigi Universitas Baiturrahmah yang memenuhi kriteria inklusi dan eksklusi. Proses pengumpulan data terdiri atas pengukuran manual dilakukan pada minggu pertama, sedangkan pengukuran digital digunakan pada minggu ketiga. Ditemukan bahwa rerata waktu pengukuran GOHAI menggunakan aplikasi kalkulator dental digital (36,28 detik) lebih cepat dibandingkan dengan menggunakan kertas dan pena (88,78 detik) dengan nilai-p sebesar 0,000 ($p < 0,05$), yang menunjukkan adanya perbedaan yang signifikan. Rerata perbedaan waktu pengukuran GOHAI antara metode manual dan digital adalah 52,5 detik. Disimpulkan bahwa terdapat perbedaan waktu antara penggunaan kalkulator dental digital dan aplikasi manual untuk pengukuran GOHAI.

Kata kunci: GOHAI, durasi waktu, kalkulator dental digital

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INTRODUCTION

According to the WHO, the elderly population is defined as individuals over the age of 60.¹ The elderly population is subject to a multitude of physical, mental, and social changes.² As the global population continues to expand, the proportion of elderly individuals will also rise, contributing increasingly to the overall growth of the global population. In 2017, the global elderly population reached 965 million, marking a more than twofold increase since 1980, when the population stood at 382 million. This trend is projected to persist, with a predicted increase to 2.1 billion by the year 2050.³

As individuals age, there is an observed decline in physiological function, metabolic rate, and body composition. These changes result in altered nutrient requirements and modified dietary needs. Nutritional problems and diseases influenced by food are common in the elderly.⁴ Consequently, the elderly population exhibits a heightened vulnerability to various diseases, particularly degenerative illnesses when compared to younger demographics.⁵ Degenerative diseases are non-communicable diseases associated with the elderly. These conditions are characterized by a progressive decline in bodily tissue health, resulting from alterations in cellular structures that adversely affect bodily function. The exacerbation of degenerative diseases can be attributed to number of factors, including physical inactivity, unhealthy lifestyles, and dietary indiscretions.⁶ Examples of degenerative diseases include hypertension, coronary heart disease, cancer, diabetes mellitus, osteoporosis, joint disease, asthma, and cataracts.⁷

The oral health of the elderly population necessitates consideration, and the possession of accurate knowledge regarding oral health constitutes a primary method of maintaining health as individuals age. The oral health of the elderly has been demonstrated to play a significant role in their overall health and quality of life. Poor oral health in the elderly is characterized by a significant number of missing teeth, and if these teeth are not treated, masticatory function is compromi-

sed, affecting oral activity.⁸ Common conditions affecting the oral cavity in elderly individuals include dental caries, tooth loss, periodontal disease, dry mouth (xerostomia), and periodontitis.⁹

Aging populations are also subject to oral health challenges. The decline in the number of teeth among the elderly in Indonesia is largely due to the increase in oral diseases, such as dental caries and periodontal disease.¹⁰ These conditions, characterized by the presence of dental caries and periodontal disease, have been identified as the primary contributors to tooth loss in this demographic. Dental caries is a multifaceted disease that primarily targets the hard tissues of teeth, including the enamel and dentin. It arises from a complex interplay between saliva and food, leading to the demineralization of teeth.¹¹ Furthermore, the progression of oral diseases tends to worsen with age, resulting in pain and impaired masticatory function in elderly individuals, thereby affecting their overall health.¹²

Quality of life (QoL) is a valid criterion for evaluating patients in many areas of physical and mental health care, including dental health. In the context of children, the Early Childhood Oral Health Impact Scale (ECHOIS) instrument is employed to assess OHRQoL, while in elderly populations, the Oral Health Impact Profile (OHIP-14) instrument or the Oral Impacts on Daily Performances (OIDP) scale are utilized. The Geriatric Oral Health Assessment Index (GOHAI) is a further instrument of note,¹³ is a multifaceted instrument that assesses quality of life across three distinct dimensions: functional limitations, pain and discomfort, and psychosocial aspects. One of the instruments that can be used to measure quality of life related to the oral cavity in the elderly is the GOHAI questionnaire.¹⁴ The present study will utilize the GOHAI index to assess quality of life in this specific population.

Manual calculations, utilizing paper and pen, represent the most prevalent instrument in global data collection. Paper and pen are frequently employed to collect crucial data and information to fulfill a work agenda.¹⁵ The benefits of employing paper and pen for data collection

include minimal electrical power requirements and cost savings. This has led to a shift in data collection methods, with some individuals transitioning from paper and pen to computers or other electronic devices.¹⁶

The utilization of paper and pen for data collection is accompanied by several drawbacks. These include the constraints imposed on storage capacity and the inevitable accumulation of redundant documents. These documents are typically stored in limited-capacity cabinets. Additionally, the process of transferring data using paper and pen is inefficient, often requiring a significant amount of time, ranging from hours to weeks, to transfer data to its intended destination. Additionally, manual data collection using paper and pen is susceptible to security concerns, as the data can be illegally copied and disseminated to unauthorized parties.¹⁶

The development of science and technology, particularly in recent times, has undergone significant transformations and progressed at an accelerated pace. Technology, a byproduct of human ingenuity, is employed by humans to achieve a myriad of objectives in their lives. Technology, in this sense, functions as a means to attain desired outcomes.¹⁷ The accelerated pace of technological advancement in contemporary society has led to its pervasive presence in nearly all aspects of human life, either directly or indirectly. On a global scale, information and communication technology encompasses all facets involving technology, engineering, and engineering. The three fundamental components of information and communication technology-based learning are computers, multimedia, and telecommunications.¹⁸

This research aims to develop digital dental calculator technology that contains several indices, one of which is the GOHAI. This index is to be incorporated into a digital calculator that will measure a person's quality of life, especially in the field of oral health. Consequently, researchers are interested in conducting research on the difference in time duration between digital and manual calculations.

METHODS

This research design a quasi-experiment or a pseudo experiment, utilizing a posttest only group design. This research design was selected due to the presence of a posttest, which was administered subsequent to the implementation of the treatment on the subjects of the study. The population of this study comprised dental students at Baiturrahmah University who were active from the third semester onwards, with a total of 170 individuals in July 2024. The sampling technique employed in this study was convenience sampling. The minimum sample size was determined using the Slovin formula, which yielded a minimum of 63 subjects.

The instruments and materials utilized in this study encompassed smartphones, stopwatches, stationery, SPSS data processing applications, informed consent forms, GOHAI examination sheets, scenario sheets, and research subject identity numbers. The study commenced with the acquisition of research authorization and ethical clearance from the Faculty of Dentistry, Baiturrahmah University Padang. Subsequently, researchers meticulously selected study participants based on predetermined inclusion and exclusion criteria. The subjects were informed of the purpose of the study and provided with an explanation of the study's purpose prior to the completion of the informed consent forms.

The study was meticulously designed and implemented in two phases, each spanning a duration of two weeks. During the first week, the subjects adhered to the protocol of the manual examination procedure, utilizing the GOHAI sheet. The researcher prepared 70 subjects, who were divided into two groups: 35 subjects on the first day and 35 subjects on the second day. The subjects were instructed to

read the GOHAI measurement scenario provided by the researcher, and each subject was assigned a number. The subjects then proceeded to manually calculate the GOHAI using paper and pen, with the duration of this process recorded using a stopwatch. Following the conclusion of the examination, the duration was recorded, and the process was repeated with the subsequent subject until all subjects had been included.

During the second meeting, the researcher provided the research subject with a tutorial on the utilization of the digital dental calculator application. The subject was then instructed to access the dental calculator application via the browser on their smartphone, tablet, or laptop. They were then directed to enter their username and password to log in. Once logged in, they were instructed to select the GOHAI assessment from the application's main menu. Thereafter, the research subject initiated the measurement and calculation of GOHAI through the digital dental calculator application. The duration of the examination was recorded using the same procedure as in the initial week. This process incorporated a Likert scale assessment (1 to 5), and the GOHAI results were automatically displayed after all values were entered. The results of the study were then subjected to analysis to evaluate the efficiency and accuracy of manual and digital methods in GOHAI measurement.

The validity test is a procedure that is conducted prior to the utilization of a research instrument to ascertain its validity level. This study employs expert validity, wherein the instruments utilized are evaluated by the opinions of subject matter experts. At least two experts with doctoral degrees who possess expertise relevant to the scope of the research are involved in this process.

A data analysis was conducted to compare the time duration of measuring the GOHAI manually using paper and pen with the digital method through the *digital dental calculator* application. The data analysis employed two primary methods: univariate and bivariate analysis. Univariate analysis was employed to describe the characteristics of each research variable by calculating the frequency distribution and percentage to determine the effect of the time of using the *digital dental calculator* application on the measurement of the GOHAI by professional dental students of Baiturrahmah University. Conversely, the Kolmogorov-Smirnov test was employed to assess the normality of the data. In the event that the data were found to be normally distributed, the Independent test was subsequently employed. However, if the data were found to be non-normal, the Mann-Whitney U test was

Daftar Partisipan pada Kuisioner GOHAI	Tanggapan				
	Tidak Pernah	Hampir Tidak Pernah	Kadang-kadang	Sering	Sangat Sering
	1	2	3	4	5
Membatasi jumlah atau jenis makanan yang anda konsumsi karena kondisi gigi truan	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mengalami masalah saat mengunyah atau mengigit berbagai jenis makanan, seperti daging yang keras atau buah apel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Merasa nyaman saat menelan	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tidak dapat berbicara dengan jelas karena masalah pada gigi anda	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dapat memakan apa saja tanpa merasa tidak nyaman	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Membatasi diri anda dalam bersosialisasi dengan orang lain karena kondisi gigi truan	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Merasa puas atau senang dengan penampilan gigi truan anda	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Menggunakan obat untuk mengurangi rasa sakit di rongga mulut	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Merasa cemas atau khawatir dengan masalah gigi anda	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Merasa tidak percaya diri karena masalah yang ditimbulkan karena keadaan gigi truan	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Merasa tidak nyaman saat makan di depan orang lain karena keadaan gigi truan anda	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gigi itu gear anda sangat terhalang makanan atau minuman hangat, dingin atau manis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 1 GOHAI measurement using digital dental calculator.

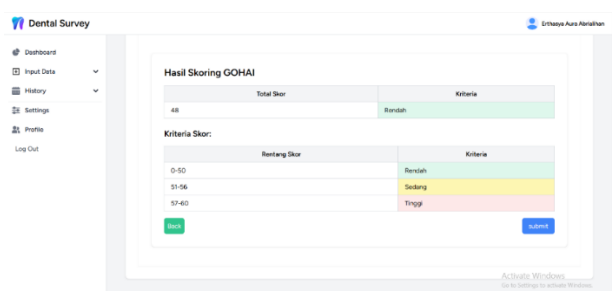


Figure 2 Example result of using digital dental calculator GOHAI.

utilized to assess the disparities between the two groups of data.

The way to use Fig. 1 is to click on the answer that corresponds to the respondent's answer. After filling out Fig. 1, the results will be shown in Fig. 2, where not only the score is displayed it should be noted that the numbers are calculated automatically, and the results are categorized.

RESULTS

Table 1 Frequency distribution based on respondents' gender

Gender	n	%
Male	5	7.1%
Female	65	92.9%
Total	70	100%

Table 2 Frequency distribution based on respondent's age

	Mean	Standard Deviation	Minimum	Maximum
Age (Years)	22.88	0.98	21	26

Table 3 Frequency distribution of manual and digital GOHAI measurement time (seconds)

GOHAI Measurement Time	Min	Max	Mean	SD
Manual Survey	50	138	88.78	22.87
Digital Survey	23	53	36.28	7.82

As illustrated in Table 1, among the 70 respondents, the majority (65 individuals, 92.9%) identified as female, while the remaining 5 respondents (7.1%) identified as male. In Table 2, the mean age of the 70 respondents was 22 years. The youngest participant was 21 years old, while the oldest was 26 years old. These respondents were dental professional students at RSGM Baiturrahmah.

As illustrated in Table 3, the mean completion time for the manual GOHAI measurement was 88.78 seconds, whereas the mean completion time for the digital GOHAI measurement was 36.28 seconds. The discrepancy between the manual and digital usage times for GOHAI results is 52.5 seconds.

Table 4 Kolmogorov Smirnov normality test results

GOHAI Measurement	p Value
Manual	0.200
Digital	0.076

The results of the normality test in Table 4 demonstrate that the p-value of the manual calculation is 0.200, while that of the digital calculation is 0.076. Both of these values are greater than 0.05, indicating that the data is normally distributed (p>0.05). Subsequent analysis involved the implementation of the Independent T-test, a parametric test.

The results of the independent T-test in Table 5 obtained a p-value of 0.000 or probability <0.05, which means H₀ is rejected and H_a is accepted, namely that there is a consistent difference in the time required for the GOHAI using the digital dental calculator application and manually. In light of the aforementioned hypothesis, it can be concluded that there is a discrepancy in the measurement time of the GOHAI when employing a digital survey as opposed to the use of a digital dental calculator.

Table 5 Independent T-test results

Research Variables	p Value
GOHAI calculation time using manual survey and digital survey	0.000

DISCUSSION

The objective of this study was to compare the calculation time of the GOHAI results when using two methods: manual with paper and pen and digital with a digital dental calculator application. The digital application utilized in this study is presented in the form of a web that can be accessed using cellphones, tablets, and laptops. The subjects of this study were dental students from Baiturrahmah University. The data collected encompassed the time required to perform GOHAI calculations manually in the first week and digitally in the third week.

The results of the GOHAI measurement demonstrate a discrepancy between manual and digital calculations. Specifically, the application-based GOHAI calculation time is shorter than the manual calculation time. On average, respondents required 88.78 seconds to perform manual GOHAI calculations, whereas digital GOHAI calculations required only 36.28 seconds. The discrepancy between the manual and digital usage times for GOHAI calculation is 52.5 seconds. This finding aligns with the research conducted by Mariana et al., which reported a time difference of 190.64 seconds between digital and manual methods for measuring the *decayed missing filled tooth* (DMF-T) index.¹⁹ Research conducted by Moryka et al. also explained that a time difference of 139.66 seconds was identified between digital and manual measurements of the *oral hygiene index simplified* (OHI-S) index. (20) This finding is consistent with the findings of the research conducted by Wulandari et al. which demonstrated that the duration of digital and manual time differed by 155.05 seconds during the measurement of the Gingival Index (GI).²¹

The manual survey employed in this study boasts several advantages, including its independence from internet access and its enhanced convenience for certain research respondents. This method has been utilized for an extended period, fostering a sense of familiarity and ease among those who have experienced it. This finding aligns with the research by Mariana et al., which indicates that many researchers continue to opt for paper-based manual surveys due to factors such as convenience and accessibility, not limited to internet access.¹⁹ However, it should be noted that conducting research manually does have certain disadvantages. According to the researcher, these disadvantages include the necessity of carrying a collection of paper examination forms, which are prone to data loss. The researcher must also invest more time in checking the data and is more susceptible to errors when respondents calculate scores. Furthermore, the researcher must bear the expense of conducting manual research. This is evidenced by research conducted by Rana et al., which explains that the data process carried out manually takes a long time to obtain data analysis results. Manual survey results are easier to modify and manipulate, so that the truth of the data cannot be trusted.²²

Digital surveys in use facilitate the storage of data using only a smartphone as a measurement and data storage tool. This results in more accurate, less time-consuming, and easier-to-use results. This finding aligns with the research conducted by Dasman et al., which asserts that digital measurements are more precise than manual ones.²³ Research conducted by Zeleke et al. also explains that data collection time using digital methods is faster than data collection time using paper pens (manual).²⁴

The findings indicated that the utilization of the digital dental calculator application facilitated a more expeditious measurement of the GOHAI in comparison to the conventional manual method. This discrepancy can be attributed to the demographic of the study partici-

pants, who were dental students. Their extensive knowledge of dental health indices, including the GOHAI, facilitated their engagement with research procedures and enhanced their aptitude for digital technology integration. This proficiency is particularly notable when contrasted with other age groups and Gen Z, who frequently utilize electronic devices that are commonly accepted and regarded as the norm. This observation aligns with the findings reported by Fadillah et al. which explains that generation Z Indonesia is also referred to as the *digital native* generation because they were born and raised in the digital era where various technologies developed and became more sophisticated.²⁵ Concurrently, research conducted by Siregar asserts that digital data management systems facilitate process management and the fulfillment of future requirements.²⁶

This study is subject to several limitations. Notably, it did not conduct GOHAI checks directly with patients. The objective of this study was to examine the time interval between the results of manual and digital GOHAI calculations, which necessitate two meetings with the

same GOHAI index calculation results. This approach aligns with the findings of Moryka et al., which highlights the potential limitations that can influence research outcomes, underscoring the necessity for greater emphasis on educating the public about the proper use of digital dental calculator applications.²⁰ Concurrently, research conducted by Mariana et al. asserts that current research endeavors predominantly concentrate on the collection of examinations employing scenarios from respondents regarding the usability and application of novel applications.¹⁹

It is concluded that a significant discrepancy (i.e., a comparison) between the measurement time of the GOHAI when performed manually with a paper and pen and when performed digitally with a digital dental calculator application. This comparison indicates that the digital approach is more efficient. This study substantiates the hypothesis that the utilization of a digital dental calculator application for the measurement of the Geriatric Oral Health Assessment Index results in reduced measurement time.

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