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Prevalence of Low Back Pain Among Office Workers During the COVID-19 Pandemic in Various Countries: A Systematic Review

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Abstract

The COVID-19 pandemic has led to the implementation of work from home policies in almost all parts of the world. This policy has increased the onset of musculoskeletal disorders in workers, such as low back pain (LBP). This study aimed to examine the prevalence of LBP among office workers during the COVID-19 pandemic after implementing WFH policies. This study was performed using data from various countries to determine the relationship between LBP and several risk factors, specifically age, sex, physical activity, ergonomic factors, as well as work environment factors such as temperature, humidity, lighting, noise, and work duration. A systematic review was conducted using sub-population studies published from 2020 to 2022. The data was obtained from six electronic databases: ProQuest, ScienceDirect, Embase, Scopus, Ebsco Medline, and Cambridge Core. The prevalence of LBP in office workers was associated with age, ergonomics, and environmental factors: air temperature, humidity, and lighting. There was no specific relationship between sex, physical activity, and working duration when working from home during the COVID-19 pandemic.

Keywords: COVID-19, environment, low back pain, office workers, work from home

Introduction

Low back pain (LBP) refers to pain in the lower back, which is very common in almost everyone at some time.[1] This pain is usually accompanied by hip pain. If the pain persists for 12 weeks or longer, the condition can be classified as chronic and requires immediate treatment.[1] Based on the report from the Global Burden of Diseases (GBD), LBP ranks first as the leading cause of disability in 14 countries and is responsible for around 60.1 million years lived with disability (YLD) in 2015, an increase of 54% since 1990.[2]

During the COVID-19 pandemic, approximately 81% of workers worldwide have to work from home (WFH). However, the working environment at home tends to be inadequate in various aspects, such as the unavailability of ergonomic work equipment.[3] Several studies have associated the incidence of LBP in office workers (desk workers) and the intensity of WFH during the COVID-19 pandemic. A study conducted in Japan showed that the intensity of WFH increased by 31.3% during the COVID-19 pandemic. The incidence of LBP caused by prolonged sitting with poor posture and other environmental factors increased the risk of LBP by 4.1%.[4] However, no similar study has been performed to analyze this issue in Indonesia.

LBP is one of the most common musculoskeletal problems in the world.[5] Generally, the condition is defined as pain localized between the lower edge of the ribs and the buttock.[6] Meanwhile, according to the study by GBD in 2019, LBP is defined as pain on the posterior aspect of the body, extending from the lower margin of the twelfth ribs to the lower gluteal folds, with or without pain in one or both lower limbs, and may last for at least one day.[7]

LBP is classified into three categories based on several clinical characteristics and the duration of symptoms, i.e., acute, sub-acute, and chronic.[8] LBP that lasts less than 4 weeks is considered acute, whereas LBP that persists over a period of 4 to 12 weeks is considered subacute. In comparison, chronic LBP means the condition has persisted for over

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12 weeks.[9] Acute LBP is usually nonspecific, and patients with this condition generally do not seek treatment as they assume that the pain will eventually wear off without medical intervention.[9] On the contrary, chronic LBP has a clear pathological cause to be classified as a disease, not merely a symptom of other illnesses.[10]

Since the condition can be caused by the degeneration of the lumbar spine, LBP is often associated with increasing age. As a result of LBP due to aging, some limitations in social and physical functions, as well as further damage to the musculoskeletal system and more severe pain, may be present.[11] Nowadays, the global prevalence of LBP in adults is approximately 37%, with the highest incidence rates being in older adults and more common for females than males.[2]

Regardless of age, females are more prone to suffer from chronic LBP than males.[12] This notion is based on a previous systematic review study including 40 publications from 28 countries in Africa, Asia, the Middle East, and South America (n = 80,076), stating that LBP was 2.5 times more common in the working population than in the non-working population.[2] Additionally, since females are prone to chronic comorbidities, such as osteoporosis, osteopenia, osteoarthritis, and psychological stress, the risk of having chronic LBP increases.[12] On top of that, female hormones play a vital role in the etiology and pathophysiology of various degenerative musculoskeletal diseases. The incidence rate of LBP, especially in postmenopausal women, has been determined to be higher due to estrogen deficiency, a circumstance that may accelerate the degeneration of the intervertebral discs.[13]

The frequency and intensity of physical activity are risk factors for LBP. Moderate to vigorous physical activity has been known to increase the risk of LBP in various age groups. A population-based study has shown that moderate-intensity physical activity of at least 30 minutes for five days per week or more, for three days per week or more, is significantly associated with an increased risk of LBP.[12] On the contrary, low-intensity physical activity, such as a 30-minute walk five days per week or more and strength training two days per week or more, is associated with a reduced risk of LBP, adjusted for age and body mass index (BMI).[12]

The other modifiable risk factors for LBP are sitting position and the availability of ergonomic chairs at work. A previous study has revealed that desk workers are at risk of experiencing LBP, especially those who sit for more than 2 hours while using a computer without paying attention to the proper sitting posture.[14] Among 44 back-office workers, it was found that among 40 people (90.9% of the sample size) who needed to improve their sitting posture, 20 (45.5%) complained of LBP with moderate pain.[14]

Poor or too bright lighting at work may cause various problems such as eye strain and fatigue, headaches, stress, and even workplace accidents.[15] In the workplace, glare can come from direct light sources such as lamps and computer screens or light reflecting off equipment with shiny surfaces.[15] In the long run, the situation can become a dominant stressor and cause not only eye strain and fatigue but also discomfort in most parts of the body, including the spine.[16] Such discomfort can negatively affect an individual as the body posture continuously tries to adapt to the conditions of the surrounding environment. This, in turn, causes more flexion of the neck and back, increasing the risk of LBP.[16]

Temperature is a degree of hotness or coldness measured in the Fahrenheit or Celsius scale.[17] Meanwhile, humidity is the amount of water vapor in the air. Indoor humidity is measured in terms of relative humidity, which is the humidity of the air compared to the maximum humidity at a certain temperature.[18] A previous study has suggested the relationship between ambient temperature and humidity and the sensitivity and intensity of back pain.[19]

Temperature change can affect the central nervous system, in which the body is forced to adapt to the surrounding environment.[20] As a result of this adaptation, changes in the blood supply from the cardiovascular system to working muscles may occur. Therefore, it is postulated that an uncomfortable ambient temperature can adversely affect the normal state of the lower back muscles through a combination of the nervous and cardiovascular systems.[20] This condition is also associated with bad mood, headaches, and discomfort, which may affect worker performance due to decreased motivation and increased fatigue and stress.[21] Accordingly, temperatures between 22°C and 24°C have been proven to be best for workplaces and have been associated with higher performance for certain jobs.[21]

The International Labor Organization (ILO) has defined working duration as the time people are hired by the employer to do their jobs, excluding their resting periods during which they do not work.[22] Unless otherwise agreed, this period may not exceed 48 hours a week or more than 8 hours a day. Nevertheless, even though the maximum daily work hours can be set and changed as needed, it should not exceed 10 hours.[22] The relationship between working duration and the incidence of LBP in workers is influenced by sedentary work patterns, where workers are required to sit for more than 7 hours per day.[3] Apart from working duration, LBP in workers also occurs due to multiple risk factors, such as

anthropometric factors, ergonomic factors, age, sex, BMI, sitting posture, the distance between the body and the computer, the availability of adjustable back support on the chair, and psychosocial factors.[3]

The ILO, through its Convention No. 177, has defined work from home (WFH) as the work done by people in their homes or other premises of their choice, other than the workplace provided by their employer for remuneration that produces a product or service as specified by the employer, regardless of the party responsible for providing the equipment, materials, or other inputs used in the process.[23] However, this definition does not apply to (i) work done by people with a degree of autonomy or economic independence to be considered self-employed, (ii) work done by people who occasionally perform their work at home instead of their usual workplace, and (iii) unpaid work, such as household chores.[23] Therefore, this study aimed to investigate the prevalence of LBP in office workers during the COVID-19 pandemic after implementing WFH policies in various countries. Specifically, the purpose was to explore the relationship between LBP and several risk factors, such as age, sex, and physical activity, as well as both ergonomic and environmental factors.

Method

This study applied a qualitative approach with a systematic review method to collect the relevant data. The articles to be reviewed were selected according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement, which consists of three main stages: identification, screening, and inclusion. Data were collected from six databases: ProQuest, ScienceDirect, Embase, Scopus, Ebsco Medline, and Cambridge Core. These databases were explicitly selected so that the acquired articles and journals could be obtained legally without any charge using Universitas Indonesia access. The keywords used are "Low Back Pain," "Work From Home", "COVID-19", "Environment," and "Cross Sectional." The selection of keywords used in literature searches employed both Boolean and Nesting operators for better accuracy. Boolean operator includes the use of "AND" and "OR," while Nesting is the use of the (+) or (-) sign for each word fragment.

The inclusion criteria were: a) studies containing variables such as desk workers/office workers, WFH, ergonomics, environmental factors, age, sex, physical activity, COVID-19, and the outcome variable of LBP incidence; b) original research articles (not reviews); c) studies employing a cross-sectional or case-control design; d) publications between March 2020 and March 2022; and e) literature written in English and published in Q1, Q2, or Q3 journals. In contrast, the exclusion criteria were: a) the article is not a complete text or full text, or b) the research is a review or gray literature. This study was conducted from April to June 2022 on relevant studies published from March 2020 to March 2022.

Table 1: Keywords Used in Literature Searches in Electronic Database

Variable 1 *Low Back Pain*	*Low back pain* OR *Back Ache*
Variable 1 *Work From Home*	*Work From Home* OR WFH
Variable 1 COVID-19	COVID-19 OR *Coronavirus Disease 2019* OR *2019-NcoV* OR *2019 Novel Coronavirus*
Istilah 4 *Environment*	*Environment factor*
Variable 1 *Cross-Sectional*	

Results

Following the literature search, 836 articles were collected from ScienceDirect, 2,296 from ProQuest, 6 from Scopus, 2 from Ebsco Medline, 10 from Embase, and 5,224 from Cambridge Core. In total, 8,374 articles were obtained using keyword searches from the six databases. These articles were then inputted into the reference manager application (Mendeley Web Importer) and separated using different folders according to the databases for further assessment.

The screening and elimination of duplicate articles resulted in 8,218 articles being rescreened based on the abstract's relevance to this study's topic. From this process, 8,178 articles were excluded as they were found irrelevant to the research topic. The remaining 40 articles obtained from the abstract screening stage were later selected according to the predetermined inclusion and exclusion criteria.

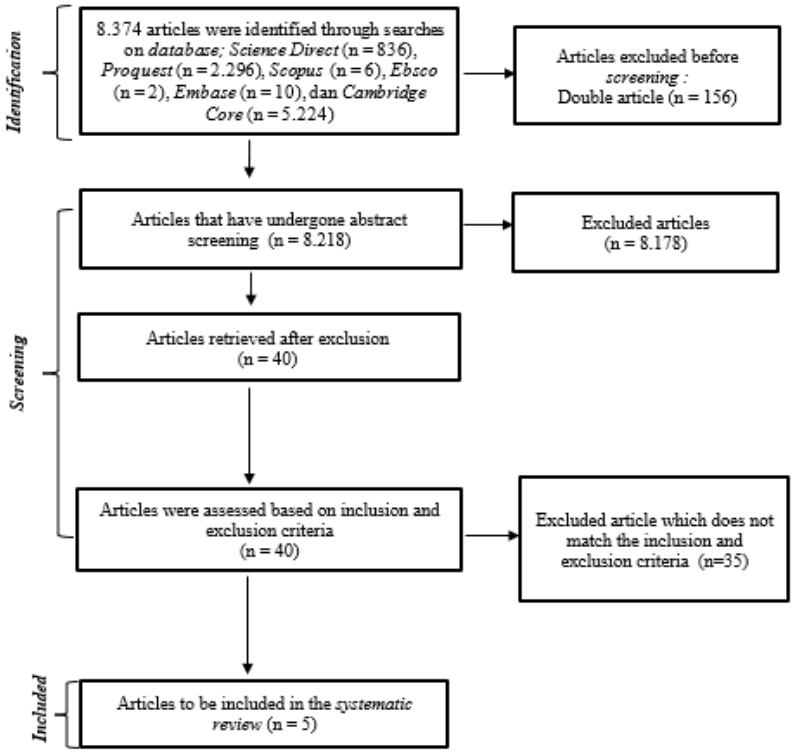

Figure 1: Flow of the Literature Identification Process in Systematic Review with PRISMA Guide

Of all the articles obtained, five articles were included to be reviewed in this study. One was published in 2020 (20%), three were published in 2021 (60%), and one was published in 2022 (20%). One study was carried out in Ohio, the United States (20%), one study was done in Slovakia (20%), one study was conducted in Italy (20%), and two studies were done in Japan (40%); all of them employed a cross-sectional study design (100%), with different research backgrounds and data collection methods. The sample size used varies for each study, ranging from 51 to 12,774.

The characteristics of the respondents differ from one study to another. This can be seen in the variables associated with the incidence of LBP: age, sex, physical activity, the application of ergonomics, environmental factors, and working duration. These distinct variables affected the prevalence of LBP in desk workers during the COVID-19 pandemic following the implementation of WFH policies. Based on the selected articles, the prevalence of LBP in workers due to the implementation of WFH policies during the COVID-19 pandemic also varied widely. Specifically, the prevalence of LBP was 42.82%, 67.68%, 41.2%, 4.1%, and 21%, respectively. Table 2 presents the characteristics of the respondents in each research article reviewed in this study.

Table 2. Characteristics of Respondents

Authors	Prevalence of LBP	Sample Size	Age	Sex	Physical Activity	Application of Ergonomics	Environmental Factors	Working Duration
Gerding *et al.*[16]	n = 361 (42.82%)	834	<30 years (n = 36) 31-40 years (n = 201) 41-50 years (n = 219) 51-60 years (n = 212) 61-70 years (n = 128) 71 years (n = 24)	Male (n= 289) Female (n= 509)	Walking only 1-4 times a day >5 minutes (n = 570)	Always or frequently using a suitable work chair n = 347 (44.6%) Not using a suitable work chair n = 348 (44.7%)	Inadequate lighting (glare) (n = 426)	Working >1 hour without rest (n = 603)
Prieto-González *et al.*[24]	67.68%	782	18–65 years	Female (n = 782)	0 day/week (n = 108) 1-2 days/week (n = 255) 3-4 days/week (n = 263)	Complying with ergonomic recommendations (n = 376) Not complying with ergonomic	N/A	1-9.9 hours/week (n = 194) 10-19.9 hours/week (n = 401)

Authors	Prevalence of LBP	Sample Size	Age	Sex	Physical Activity	Application of Ergonomics	Environmental Factors	Working Duration
					5-6 days/week (n = 87) 7 days/week (n = 69)	recommendations (n = 99)		20-29.9 hours/week (n = 165) 30-39.9 hours/week (n = 20) >40 hours/week (n = 2)
Moretti *et al.*[3]	n = 21 (41.2%)	51	Mean 46.67±11.26	Male (n = 22) Female (n = 29)	N/A	N/A	N/A	<36 hours/week (n = 26 (51%)) 36 hours/week (n = 25 (49%))
Minoura *et al.*[4]	4.1%	4,227	18-29 years (n = 742) 30-44 years (n = 1,681) 45-59 years (n = 1,804)	Male (n = 2,559) Female (n = 1,668)	Doing physical activity outside (n = 1,735) Not doing any physical activity outside (n = 2,492)	N/A	Overall quality of work environment (unspecified).	<35 hours/week (n = 979) 35-39 hours/week (n = 633) 40-44 hours/week (n = 1,431) >45 hours/week (n = 1,184)
Matsugaki *et al.*[25]	n = 2,686 (21%)	Total sample (n = 12,774) *1 seldom work remotely (n = 9,082) *2 work remotely 1 day/week (n = 873) *3 work remotely 2-3 days/week (n = 953) *4 working remotely 4 days/week (n = 2,886)	*1 mean = 47.2 *2 mean = 47.8 *3 mean = 47.9 *4 mean = 48.9	Male; *1 (n = 4,363) *2 (n = 569) *3 (n = 539) *4 (n = 1,077)	Physical activity (2 days/week) *1 (n = 2,415) *2 (n = 352) *3 (n = 406) *4 (n = 637)	N/A	Quality of work environment; *1 good (n = 5,505) not good (n = 3,577) *2 good (n = 670) not good (n = 203) *3 good (n = 722) not good (n = 231) *4 good (n = 1,577) not good (n = 289) Room temperature and humidity	N/A

Discussion

After a thorough assessment of the selected articles, it was found that three out of five articles (60%) stated that age affected the incidence of LBP after the implementation of WFH policies during the COVID-19 pandemic.[3,4,24] Meanwhile, the remaining two articles (40%) did not find a significant impact of age on the incidence of LBP.[16,25] The ILO has explained the relationship between age and the increment of LBP incidence concerning the changes in work patterns over the last decade.[26] As a consequence of technological advances, work demands have substantially increased alongside both pressures and longer working hours. This causes psychosocial and work-related stresses that are consistently associated with various health problems, including musculoskeletal disorders, one of which is LBP.[26]

Two out of five articles (40%) found an influence of sex on the incidence of LBP after the implementation of WFH policies during the COVID-19 pandemic.[3,4] On the other hand, the other three articles (60%) did not indicate a significant effect of sex on the incidence of LBP.[16,24,25] Another study also supports the findings that LBP occurs more frequently in females than males, about 2.5 times more common in the working population.[2] This can be attributed to the more complex psychosocial mechanisms in women, including their pain-coping skills and susceptibility to chemically- or mechanically-

induced pain.[12] In addition, female hormones play a crucial role in the incidence of LBP, as estrogen deficiency has been shown to accelerate the process of intervertebral disc degeneration.[13]

Of the five articles, only one (20%) stated that physical activity has an effect on the incidence of LBP after the implementation of WFH policies during the COVID-19 pandemic,[24] while the remaining four articles (80%) found no significant effect on the topic.[3,4,16,25] Gerding *et al.*'s study did not specifically state the correlation between physical activity and the incidence of LBP but showed a relationship between physical activity and a decrease in static posture and muscle activation in several parts of the body, such as the neck/head, upper back, shoulders, neck, and lower back.[16] Meanwhile, Moretti *et al.*'s study similarly did not discuss the direct relationship between the incidence of LBP and physical activity but linked the pain to a sedentary job pattern.[3] This association is made because some patterns can become a risk factor for LBP, especially when it involves a low activation of the lumbar muscles. When sitting, passive structures such as ligaments and intervertebral discs support the body's weight.[3] Such viscoelasticity of the structures and the deactivation of the lumbar and spinal muscles can, in the long term, trigger deconditioning that causes LBP.[3]

The correlation between the application of ergonomics and the prevalence of LBP was found in most of the articles reviewed in this study. Four out of five articles (80%) revealed the effect of the application of ergonomics on the incidence of LBP after the implementation of WFH policies during the COVID-19 pandemic.[3,16,24,25] In comparison, only one article (20%) did not indicate a significant effect of the use of ergonomics on the incidence of LBP.[4] The relationship between ergonomic factors and the incidence of LBP is in line with the statement of the ILO that environmental and ergonomic factors are associated with an increased risk of musculoskeletal disorders.[27] These ergonomic factors include the availability of a computer desk with an ergonomic chair as well as the computer monitor, keyboard, and mouse adjustable to the needs of workers. Concerning the increase in the prevalence of LBP after the implementation of WFH policies during the pandemic, there were differences in the standards of the office and home environments. For example, inadequate ergonomic equipment and improper work settings can pose health and safety risks due to the adoption of poor posture, which may cause musculoskeletal injuries such as neck pain and LBP.[27]

Three out of five articles (60%) proved that environmental factors affected the incidence of LBP after implementing WFH policies during the COVID-19 pandemic.[4,16,25] Meanwhile, the other two articles (40%) did not find a significant influence of environmental factors on the incidence of LBP.[3,24] The environmental factors associated with the incidence of LBP include lighting, temperature, and humidity. Staying in a room with too bright lighting over an extended period can cause discomfort, eye strain, and fatigue.[15] Based on Occupational Safety and Health (OSH) recommendations, for jobs that require low perception and rough details, such as office work, the optimal lighting in the workplace is a minimum of 100 lux to 200 lux. As for those requiring precision and fine details, such as drawing and assembling certain components, the optimal lighting is around 200 to 500 lux.[15] Glare and the light emitted from computer screens may lead to eye strain and fatigue, affecting sitting posture and eventually causing LBP. To avoid this, the computer monitor needs to be placed in an ideal position, about 10-13 cm below eye level, when sitting upright and about one arm away from the eyes (50-71 cm).[28]

According to the ILO, an unfavorable environment at home due to uncomfortable temperature, humidity, and lighting can increase the risk of musculoskeletal injuries during the WFH period.[27] Such a condition has been known to affect worker performance and productivity. Another study also found that environmental variables are significantly related to the life satisfaction of workers.[21] The magnitude of the effect of air quality on productivity loss varies depending on the type of work.[29] However, in general, the greatest losses occur in jobs that require analytical thinking.[29] The recommended temperature for good indoor air quality is 18°C-30°C, with humidity of 40-60% Rh and a minimum lighting of 60 lux.[29] The ambient air temperature exceeding 30°C must be reduced by increasing air circulation through ventilation.[29] Conversely, if the room temperature is less than 18°C, heaters that use safe and environmentally friendly energy sources are necessary.[29] Meanwhile, ambient humidity can be optimized by using humidifiers, opening windows, increasing the number or area of windows, and increasing air circulation.[29] In Indonesia, the temperature and humidity in the house can be adjusted according to the Indonesian Ministry of Health Regulation Number 1077/MENKES/PER/V/2011 Concerning the Guidelines for Indoor Air Sanitization.[29]

After reviewing the five articles, it was found that two articles (40%) agreed that working duration could influence the incidence of LBP for workers who work at home during the pandemic.[3,24] Meanwhile, the remaining three articles (60%) showed no significant effect of working duration on the incidence of LBP.[4,16,25] Moretti *et al.* stated that there is a correlation between LBP and sedentary work patterns, particularly those that require workers to sit for more than 7 hours per day. This association was also postulated to be directly related to the multiple risk factors for LBP, such as anthropometric factors, ergonomic factors, age, sex, BMI, sitting posture, the distance of the body from the computer, the

availability of adjustable back support on the chair, and psychosocial factors.[3]

This study employed a systematic review method to identify the prevalence of LBP in office workers during the COVID-19 pandemic after implementing WFH policies in various countries. Risk factors were examined, including age, sex, and physical activity. However, this study only used five research articles due to the limited relevant literature. It restricted full-text access to several research articles, making some relevant literature inaccessible.

Conclusion

The prevalence of LBP in office workers is associated with age, ergonomics, and environmental factors of air temperature, humidity, and lighting. There is no specific relationship between the prevalence of LBP in office workers who worked from home during the COVID-19 pandemic and their sex, physical activity, and working duration. Workers are advised to pay attention to the surrounding work environment when working from home. To avoid direct reflection of light, it is highly recommended to install blinds or curtains, use a lampshade or lamp protector, replace clear glass with frosted glass for windows, and rearrange the layout of the work desk if needed. The use of an ergonomic chair and desk to place the computer and other work equipment, such as mouse and keyboards, that can be adjusted to the needs of each worker is also necessary. For workers to maintain proper sitting posture when working, the computer monitor must be placed in an ideal position, which is about 10-13 cm below eye level when sitting upright and about one arm away from the eyes (50-71 cm). Furthermore, policymakers and employers need to educate workers about creating a proper work environment suitable for working from home, supply the necessary equipment for adequate use, and facilitate workers' optimal physical and mental health.

Abbreviations

LBP: low back pain; GBD: Global Burden of Diseases; WFH: work from home; BMI: body mass index; ILO: International Labor Organization; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

Ethics Approval and Consent to Participate

The study has been approved by the Ethics Commission for Health Research, Faculty of Public Health, Universitas Indonesia (License Number: Ket-455/UN2.F10.D11/PPM.00.02/2022) obtained from the institution for the research project.

Competing Interest

The authors declare that there are no competing interests.

Availability of Data and Materials

Data and information used as study materials can be obtained from the corresponding author upon reasonable request.

Authors' Contribution

YRI was responsible for creating the ideas, conducting the analysis, preparing the manuscript, performing the formal analysis, conducting the investigation, interpreting the results, and writing the original draft. RAW and PY supervised the study, wrote the review, and edited the text. All authors were involved in conceptualization, methodology, validation resources, data curation, review writing, and editing. All authors have made substantial contributions to the final manuscript for publication.

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