BIBLIOMETRIC ANALYSIS OF THE EFFECTS OF PROLONGED PREOPERATIVE FASTING ON PATIENTS

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ABSTRACT

Preoperative fasting is a common practice in the surgical field, which aims to minimize complications and ensure patient safety. Understanding its impact and optimizing protocols are essential in clinical practice. This study analyzed the bibliometric and network overview of publications on the effects of extended preoperative fasting on patients, using VOSViewer. This bibliometric analysis explores the research landscape on the effects of extended preoperative fasting duration on patients. Using VOSViewer, this study identified key contributors and clusters in the literature, highlighting significant research gaps. Bibliometric methods were used to analyze publications regarding the effects of extended preoperative fasting. Using VOSViewer, this study identified key contributors and groups in the literature, which highlighted significant research gaps. Bibliometric methods were used to analyze publications regarding the effects of extended preoperative fasting. Data were aggregated and visualized using VOSViewer to map the publication network and identify thematic clusters. China and the UK emerged as the main contributors with 7 articles each, followed by Brazil and India. Three main clusters were identified: a red cluster focusing on fasting duration, side effects, dehydration risk, and intraoperative management; a blue cluster exploring the effects of fasting on surgical outcomes, hunger, and procedural aspects; and a green cluster addressing guideline development, elective surgery, and preoperative preparation. These findings underscore the importance of extended preoperative fasting in clinical practice and highlight significant research opportunities. Future research could focus on personalized fasting protocols, long-term effects, psychological impact, and innovative monitoring technologies to improve the quality of patient care.

Keywords: Preoperative Fasting, Effects of Prolonged Fasting, Bibliometric Analysis, Vosviewer, Surgical Outcomes, Patient Care

INTRODUCTION

Preoperative fasting is a phase where no peroral liquid or solid intake is allowed for a certain period of time before surgery. The main purpose of preoperative fasting is to prevent pulmonary aspiration. Pulmonary aspiration is the aspiration of gastric contents that occurs either after induction, during the anesthetic procedure, or immediately after anesthesia (Rehatta M, Elizeus Hanindito, Aida R. Tantri, Ike S. Resdeki, R.F. Soenarto, D. Yulianti Bisri, A.M Takdir Musba, Mayang L. Lestari. 2019)

Preoperative fasting in patients who will undergo elective surgery is a must prior to operative action, this is useful to reduce the volume and acidity of the stomach and reduce the risk of regurgitation or aspiration pneumonia better known as Mendelson's syndrome that may occur during anesthesia, especially during induction (Rahman, T., Harmilah, . H., & Lasaara, N. 2023).

This study aims to conduct a bibliometric analysis of the literature related to preoperative fasting, particularly prolonged fasting, with a focus on identifying research trends, key contributors, and key findings. Using keywords such as "operative fasting", "prolonged", "guideline", "avoidance fasting", and "effect of operative fasting", this analysis will provide a comprehensive overview of the research dynamics in this field. This study will identify research trends related to preoperative fasting, including a temporal analysis to understand how the interest and volume of research in this field has evolved over the past few years. By analyzing the number of publications per year, the types of studies conducted, and the topics most frequently covered, this study will provide insight into the direction of development and the main focus of research in the field of preoperative fasting. By analyzing the key findings, this study will provide an overview of the consensus and differences in the literature, as well as the implications for clinical practice.

The ultimate goal of this study is to identify existing research gaps and provide recommendations for future research. By assessing gaps in the existing literature, this study will direct attention to areas that remain under-researched and require further research, including topics that have not been sufficiently explored, methodologies that need to be developed, and patient populations that may be under-represented in research. Through these objectives, this study is expected to make a significant contribution to understanding and developing best practices related to preoperative fasting, as well as directing future research in a more effective and relevant direction.

LITERATURE REVIEW

Fasting before surgery aims to reduce the volume of gastric acid, thereby reducing the risk of aspiration and regurgitation (Tsukamoto, M. , Hitosugi, T. , & Yokoyama, T. 2017). Fasting before surgery is very important to avoid complications during surgery and during anesthesia. If the patient does not fast, this may cause the patient to vomit and the vomit may enter the lungs while under anesthesia (Dausawati, AF, Tavianto, D., & Kadarsah, RK. 2015). Fasting before surgery is important to prevent pulmonary aspiration during surgery and to reduce stomach volume and acidity (Hartanto, B., Suwarman., Sitanggang, R.H. 2016). Other studies also mention that

fasting is needed to reduce stomach acid so as not to cause irritation or inflammation in the lungs (Chon T, Ma A, Mun-Price C. 2017). In addition, fasting before surgery is also done to prevent pulmonary aspiration by inhibiting the gag, cough and swallow reflexes (Gul, A., Andsoy, II, & Ozkaya, B. O. 2018).

As medical knowledge has evolved, several guidelines and recommendations have been published to optimize the duration of preoperative fasting and avoid excessively long fasts. The practice of preoperative fasting is based on the premise that fasting allows time for gastric emptying to occur, thereby reducing the risk of aspiration pneumonitis during anesthesia (HamidS. 2014). Preoperative fasting guidelines are systematically developed recommendations that assist practitioners and patients in making decisions about undertaking preoperative fasting. The length of fasting required depends on many factors, such as the type of surgery, the time from the last meal to the start of the procedure (in emergency surgery), the type of diet, and the medication given to the patient before surgery (Xu D, Zhu X, Xu Y, Zhang L. 2017).

Simple guidelines on preoperative fasting have been introduced since the early 20th century, the practice of prolonged fasting starting at midnight before surgery has become a dogma or habit that seems difficult to change[1]. Although there are guidelines for preoperative fasting, in reality, patients often fast for more than 8 hours and some even more than 12 hours. This is because patients are usually asked to fast from midnight until the patient is given surgery. While the patient's surgery schedule is often erratic so sometimes the patient's fasting duration becomes longer. Almost all studies and surveys on preoperative fasting found a longer duration than the ASA recommended preoperative fasting guidelines. Despite efforts to campaign preoperative fasting guidelines to anesthesiologists, surgeons, and ward nurses, this remains difficult to change (El-Sharkawy. A. M, et all. 2021).

Research conducted by Xu, D et al also showed that most patients fasted for more than 12 hours before surgery. This is likely to result in significant patient discomfort as well as thirst and hunger. In addition, prolonged fasting can lead to dehydration and insulin resistance, resulting in poor clinical outcome (Xu D, Zhu X, Xu Y, Zhang L. 2017).

The reasons for the long duration of preoperative fasting experienced by patients have many factors. It may also be the result of poor understanding by the healthcare professional, unscheduled surgery, form of communication, Another important consideration is that even if the preoperative fasting guideline information is well communicated, sometimes the presence of words that are difficult for the patient to interpret becomes a confounding factor (El-Sharkawy. A. M, et all. 2021).

RESEARCH METHODOLOGY

This study used a bibliometric analysis method to evaluate and map the literature related to preoperative fasting, particularly prolonged fasting. This method involves several systematic steps that include literature search, article selection, data collection, and data analysis.

Bibliometric analysis is a quantitative method for analyzing

bibliographic data in articles/journals. This analysis is usually used to investigate the references of scientific articles cited in a journal, mapping the scientific field of a journal, and to group scientific articles that correspond to a research field (Velasco, B., Bouza, JME, Pinilla, JM, & San Román, J. A. 2012). Bibliometric analysis is used to see the distribution of the number of publications and citations of various literatures[2]. Topics in bibliometric analysis can be described both qualitatively and quantitatively (Elishian, C., Zuas, O. 2021).

This research is a literature review in the form of bibliometric analysis. This analysis is a web-based application and is free of charge. This analysis is used to review and analyze the core of a research or author and its relationship by attaching all publications related to a particular topic. The publications studied can be in the form of scientific articles, citations, reports, or patent documents through mathematical and statistical analysis. This analysis method produces quantitative data that is accurate and objective in measuring the impact of an article on knowledge.

First, a literature search was conducted using reputable scientific databases such as Scopus, PubMed, and Web of Science. The keywords used in this search included "operative fasting", "prolonged", "guideline", "avoidance fasting", and "effect of operative fasting". The search focused on journal articles published within the last ten years to ensure relevance and currency of the data. Bibliometric analysis generally consists of 3 stages, including literature search and collection, analysis of research trends, and descriptive analysis. Literature search and collection was conducted on May 28, 2024. Literature search and collection is based on literature titles using keywords in the last 4 years, namely 2019 to 2024. The search database uses Google Schollar and Scopus, because the articles obtained are accredited. This step as a whole was carried out using the Publish or Perish (PoP) application.

Furthermore, inclusion and exclusion criteria were applied to screen the articles obtained. Inclusion criteria included peer-reviewed articles, clinical studies, meta-analyses, and systematic reviews that addressed preoperative fasting in a surgical context. Non-peer-reviewed articles, opinion pieces, letters to the editor, and articles in languages other than English were excluded from this analysis. Relevant bibliometric data from the selected articles were then collected, including title, author, year of publication, journal, volume, pages, and DOI. For data organization and reference management, software such as Mendeley, EndNote, or Zotero was used.

The next step of bibliometric analysis is to analyze using the VOSViewer application. VOSViewer is a web-based and unpaid application developed to create an overview of bibliometric analysis[3]. The version used in this study is 1.6.20. The image that will be displayed are circles that will represent several parameters, including articles, authors, keywords, countries, and so on. These circles will have a certain diameter, color, and distance between points. The higher the number of articles, citations, and frequency of occurrence, the larger the diameter of the circle. Circles with different colors indicate different clusters according to the color similarity. In addition, the line

and line distance between 2 circles indicate the relationship and proximity or similarity between subject terms[4].

The final step in this analysis is descriptive analysis. Descriptive analysis was conducted using VOSViewer and Microsoft Excel 2019. for Windows 11. VOSViewer analysis allows for analysis of collaboration between authors or researchers and institutions. In addition, using the VOSViewer application also allows for analysis based on keywords created by the authors. Both analyses were made based on the mapping visualized through this application. Descriptive analysis was also conducted using general statistics in the 2016 Microsoft Excel program for Windows 11, version 23H2. This application was used for descriptive analysis on several indicators, including document growth trends, scientific fields, and productivity levels of authors and institutions[5].

Descriptive analysis was conducted using general statistics in Microsoft Excel program for several indicators such as document growth trends, scientific fields and author productivity levels. The analysis included identification of publication trends per year, journal distribution, analysis of the most productive authors and institutions, and geographical distribution of research. In addition, a topic analysis was conducted to identify the main themes covered in the articles and a co-citation analysis to determine the most frequently co-cited references.

The results of these analyses were interpreted to identify key findings, research gaps, and potential areas for future research. Using this approach, this study is expected to provide a comprehensive overview of the preoperative fasting research landscape and provide recommendations for the development of clinical practice and future research.

RESULTS AND DISCUSSION

The results of this bibliometric analysis include several key aspects that provide a comprehensive overview of research related to prolonged preoperative fasting. From the results of the search and collection of literature conducted on May 28, 2024. Literature search and collection is based on the title of the literature using keywords in the last 5 years, namely 2019 to 2024. The search database uses Google Schollar and Scopus by limiting a maximum of 50 of the most relevant and related searches from each database found a total of 3 documents with each, namely Google Schollar 20 documents and Scopus 13 documents.

The following are the main findings of this analysis:

1. **Publication Trends by Year**

   A temporal analysis of publications related to preoperative fasting showed significant fluctuations in the number of articles published each year. The data showed that the number of publications increased significantly in 2020, but then tended to decrease from 2021 to 2024.

Table 1. Number of documents published by year of publication

Year	Google Schollar	Scopus	Total
2019	3	1	4
2020	9	1	10
2021	5	3	8
2022	2	4	6
2023	1	1	2
2024	0	2	2
	20	12	32

2020 saw a peak in the number of publications, marking the highest point in the last decade. This increase can be attributed to a number of factors, including greater attention to preoperative management and optimization of fasting protocols in the context of the COVID-19 pandemic. Then in 2021-2024, after reaching a peak in 2020, the number of publications began to gradually decline. This decline reflects a trend that may be caused by various factors, such as a shift in research focus due to the pandemic, restrictions in clinical research, or topic saturation in the scientific literature.

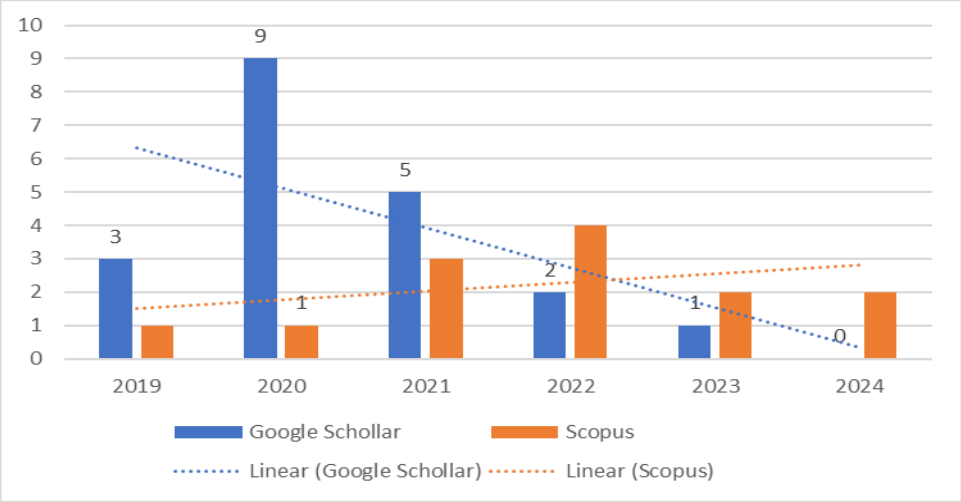

Figure 1. Publication Trends on the Effects of Prolonged Preoperative Fasting on Patients from Google Schollar and Scopus databases using PoP application

The significant upward trend in publications in 2020 can be attributed to several key factors. First, the COVID-19 pandemic brought tremendous attention to medical practices, including pre-surgical management. During the pandemic, there was an increased need to review and update medical protocols to reduce the risk of infections and complications, including in the context of preoperative fasting. This year's publications may reflect efforts to understand and implement new guidelines appropriate to the global medical emergency situation.

In addition, the surge in publications in 2020 could also be triggered by increased research funding and international collaborations aimed at responding to the medical challenges faced during the pandemic. Many research institutions and scientific journals accelerated their review and publication processes to provide relevant and timely information to the medical community.

However, the downward trend observed from 2021 to 2024 suggests some other dynamics. One potential reason is a shift in research focus. After the peak of the pandemic, many researchers may have turned their attention to other topics that emerged as new priorities, such as long COVID or vaccination. In addition, restrictions on clinical research during the pandemic and decreased research funding could also have contributed to the decline in the number of publications.

This decline could also indicate topic saturation in the scientific literature. After the surge in publications in 2020, there is likely to be a reduction in the number of new studies that could add significantly to knowledge or offer truly groundbreaking findings. Researchers may feel that many aspects of preoperative fasting have already been covered extensively, reducing the impetus for further research in the short term.

Overall, this trend reflects the research community's rapid response to the pressing needs of 2020 and adjustments thereafter. Despite the decreasing number of publications, it is important to continue to monitor developments in preoperative fasting research and ensure that guidelines and clinical practices are continually updated based on the latest findings. This analysis also highlights the need for more research focused on underrepresented patient populations and innovative approaches in research methodology to address existing gaps.

2. Journal Distribution

The research was published in various journals with some journals standing out as major contributors. Journals such as Journal of Perianesthesia Nursing, British Journal of Nursing, and Journal of Clinical Anesthesia were among the most frequently published related articles. This distribution suggests that the topic of preoperative fasting is gaining attention from journals with a high reputation in anesthesiology and surgery.

Publications made about the effects of prolonged preoperative fasting on patients on the Scopus and google scholar databases found as many as 32 articles published by 27 scientific journals, with details as shown in Figure 2. In Figure 2, it can be seen that in general, articles about the effects of prolonged preoperative fasting on patients are more in the form of articles published in scientific journals. According to Habibi et al, publications have several purposes, including (a) dissemination of research results, which can be utilized by the public for the development of science and technology (b) publications can be used as personal branding and the existence of expertise in certain fields of science (c) building collaborations and networks with

other researchers to strengthen expertise in the field of science (Habibi, A., Anwar, K., 2023).

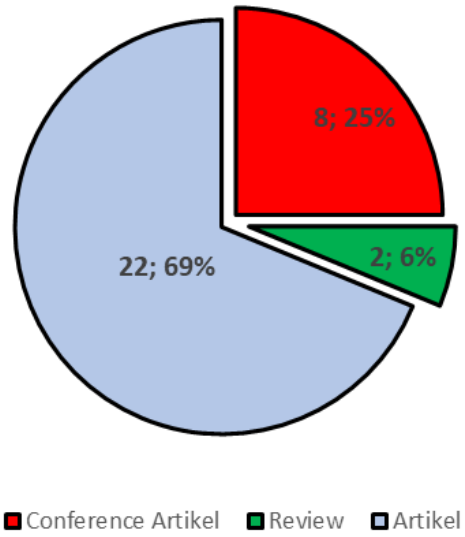

Figure 2. Types of Publications on the Effects of Prolonged Preoperative Fasting on Patients

The type of publication that many researchers tend to publish is journal articles with 22 pieces or 69%, indicating that there are still many new discussions related to pre-surgical fasting. Based on the intended journal, 4 scientific journals were obtained with the most documents. This is presented in table 2.

Table 2. Number of documents published by several scientific journals on the topic of Effects of Prolonged Preoperative Fasting on Patients

Journal Name	Total
Indian Journal of Anaesthesia	2
British Journal of Nursing	2
Journal of Perianesthesia Nursing	2
Journal Of Perioperative Nursing	2

Table 2 shows that bibliometric analysis of the literature related to preoperative fasting revealed that a total of 32 journals published articles in this area. Among these journals, 8 journals stood out as major contributors to the publication of this study. These eight journals were divided into two major groups based on disciplinary focus: 4 journals focusing on anesthesia and 4 journals focusing on general perioperative care.

The distribution of journals publishing articles on preoperative fasting indicates that the topic attracts wide attention from various disciplines, especially anesthesiology and perioperative care. The anesthesia-focused journals reflect the importance of the topic of preoperative fasting

in anesthesiology practice. These four journals often publish studies that explore various aspects of preoperative fasting, including the optimal duration of fasting, physiological effects on patients, and recommended guidelines and protocols. This focus on anesthesia highlights how proper fasting management can affect the safety and effectiveness of anesthesia and reduce the risk of complications during and after surgery. Anesthesiologists are often directly involved in determining preoperative fasting policies and ensuring adherence to existing guidelines, so research in this area is highly relevant to improving clinical practice.

Journals focusing on perioperative care focus on general perioperative care, which includes various aspects of patient management before, during, and after surgery. Publications in these journals often cover broader topics than just fasting management, such as preoperative preparation, management of perioperative complications, and enhancement of postoperative recovery. Research published in these journals shows how preoperative fasting management integrates with the entire perioperative care process to improve clinical outcomes and patient well-being. In addition, these journals also facilitate discussion on the development and implementation of comprehensive clinical guidelines for perioperative management.

This distribution of publications underscores the importance of a multidisciplinary approach in the research and management of presurgical fasting. Anesthesia-focused journals provide in-depth insight into how fasting affects anesthesia and surgical procedures, while general perioperative care journals provide a broader context of overall patient management. Collaboration between anesthesiologists, surgeons, and perioperative care professionals is essential to develop safe and effective fasting protocols.

Furthermore, the concentration of research in these journals indicates a significant consensus and attention to this topic in the medical community. These focused publications in two key disciplines demonstrate that preoperative fasting is not just a field-specific issue, but an integral part of overall surgical patient care. These findings suggest that research related to preoperative fasting is receiving significant attention in both anesthesiology and perioperative care. The large contribution from journals in both disciplines demonstrates that the management of preoperative fasting is considered essential for improving clinical outcomes and patient safety. It also emphasizes the need for a collaborative approach involving various healthcare professionals in developing and implementing effective fasting guidelines. As such, research in this area should continue to be encouraged to ensure best practice in the management of presurgical fasting, with support from a range of related disciplines.

The results of this study can also explain the authors and the number of citations related to this topic. The results of this study are presented in full in the table.

Table 3. List of authors, article titles, and the number of citations on each of the top 10 most cited citations

Author	Article Titles	Citation
W. J. Fawcett, M. Thomas	Pre-operative fasting in adults and children: clinical practice and guidelines	124
CE Morrison, S Ritchie-McLean, A Jha, Mythen M	Two hours too long: time to review fasting guidelines for clear fluids	53
AM El-Sharkawy, P Daliya, C Lewis-Llyod, A Adimah et al	Fasting and surgery timing (FaST) audit	35
RS Ackerman	How Sweet is this? A Review and evaluation of perioperative carbohydrate loading in the ERAS Model	30
O Yeniay, ZT Tekgul, O Okur, N Koroglu	Unexpectedly prolonged fasting and its consequences on elderly patient under going spinal anesthestics	21
GV Marquini, FES Pinheiro, AUC Vieira et al	Effects of preoperative fasting abbreviation with carbohydrate and protein solution on postoperative symptoms of gynecological surgeries: double-blind randomized controlled clinical trial	20
Dorrance M, Copp M.	Perioperative fasting: A review. Journal of Perioperative Practice.	19
Gang Zhou, Fengxue Zhu, Youzhong An	Prolonged preoperative fasting and prognosis in critically ill gastrointestinal surgery patients	15
Gisele Vissoci Marquini, Francisco Edes da Silva Pinheiro, Alfredo Urbano da Costa Vieira, Rogério Melo da Costa Pinto,	Preoperative fasting abbreviation (Enhanced Recovery After Surgery protocol) and effects on the metabolism of patients undergoing gynecological surgeries under spinal anesthesia: A randomized clinical trial	14
P. Panijar	A prospective survey on knowledge, attitude and current practices of pre-operative fasting amongst anaesthesiologists: A nationwide survey	10

W.J. Fawcett's article "Pre-operative fasting in adults and children: clinical practice and guidelines" is one of the most influential pieces of literature on pre-surgical fasting, as evidenced by 124 citations. The clinical influence of the article may form the basis of guidelines in many medical institutions, helping to minimize the risk of complications during surgery. It also triggers research on the optimal duration of fasting and its effects on patients and can also be used by professional organizations to make health policies regarding preoperative fasting. Although influential, some studies have shown that long durations of fasting can cause discomfort and negative effects such as dehydration. There is a push to review and

update these guidelines based on the latest findings. The J. Fawcett, M. Thomas article contributes greatly to shaping clinical practice and research related to preoperative fasting. The high number of citations indicates its significant relevance and influence, although these guidelines need to be continuously evaluated to keep up with developments in medical science and technology.

Geographical analysis revealed that China and the UK were the most active countries in this study. It was found that China and the UK were the biggest contributors with 7 articles each. Followed by Brazil and India.

Table 4. List of Journal Publishers by Country

Countries	Articles
United Kingdom (UK)	7
China	7
Brazil	4
India	3
Turkey	2
Australia	2
America	1
Japan	1
Indonesia	1
Germany	1
United Arab Emirates (UAE)	1
Italy	1
Malta	1

China and the UK stand out as major contributors in this study. Some factors that may have influenced this include: Both countries have substantial investment in research and development in the medical field, allowing researchers to conduct in-depth studies on preoperative fasting and the advanced healthcare infrastructure in both countries supports the conduct of high-quality clinical research. In addition China and the UK are active in international collaborations, expanding the reach and impact of their research.

The contributions from these countries reflect strong investments in medical research, advanced healthcare infrastructure and a focus on improving the quality of patient care. As such, these studies help provide important diverse perspectives in understanding the effects of prolonging presurgical fasting on patients. This enables the development of more comprehensive and inclusive clinical guidelines, which can be applied globally.

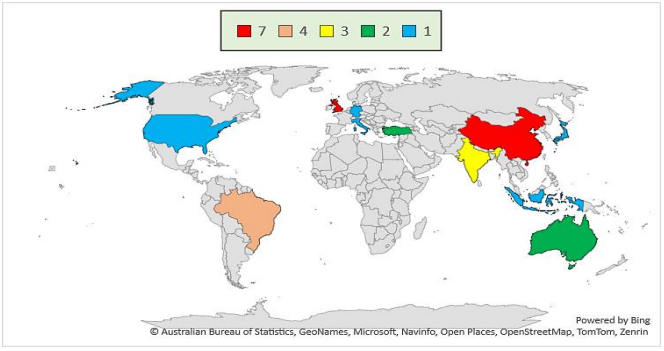

Figure 3. Distribution of countries that published research on the effects of prolonged preoperative fasting on patients

3. Network Overview and Overlay of Publications on the Effects of Extended Preoperative Fasting on Patients

The analysis conducted with the VOSViewer application produces an overview of the relationship between the development of research on the effects of extending preoperative fasting on patients. Based on the results of the VOSViewer analysis, it can be seen that there are 3 clusters, namely red, blue and green clusters.

Table 5. VOSViewer overview by cluster

Red	Blue	Green
Fasting	Effect	Guideline
adverse effect	Surgery	Elective Surgery
dehidration	Hunger	Preoperative
operating room	Operating	Practice

Based on the results of the analysis using VOSViewer, publications on the effects of prolonging preoperative fasting on patients formed three main clusters: red, blue and green clusters. Each cluster includes different themes and research focuses, reflecting different aspects of preoperative fasting.

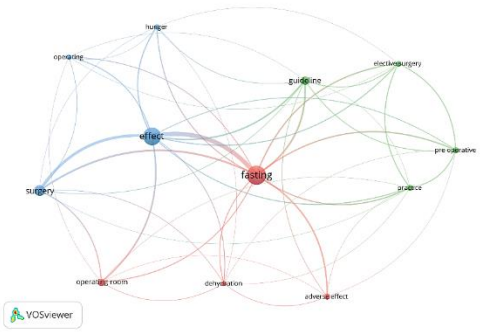

Figure 4. Network Overview and Overlay of Publications on the Effects of Prolonged Preoperative Fasting on Patients

a) Red Cluster: Fasting, Adverse Effect, Dehydration, Operating Room
The red cluster highlights critical issues related to pre-surgical fasting, with a focus on:
   1) Fasting: Studies in this cluster often address the duration and type of fasting recommended before surgery.
   2) Adverse Effects: Many studies explore the side effects of preoperative fasting, such as hunger, discomfort and other medical complications.
   3) Dehydration: One of the main concerns is the risk of dehydration, which can affect the patient's condition during and after surgery.
   4) Operating Room: Research also addresses how a fasting patient's condition affects procedures in the operating room, including intraoperative preparation and management.

b) Blue Cluster: Effect, Surgery, Hunger, Operating
The blue cluster focuses on the effects of preoperative fasting and how this interacts with surgical procedures:
   1) Effect: Studies in this cluster evaluate the various effects of preoperative fasting on surgical outcomes and patient recovery.
   2) Surgery: Studies examine how fasting affects different types of surgeries and their outcomes.
   3) Hunger: The psychological and physiological aspects of hunger before surgery are also a major focus, including how hunger affects patients.
   4) Operating: How fasting affects operations and efficiency in the operating room is also an important concern.

c) Green Cluster: Guideline, Elective Surgery, Preoperative, Practice
The green cluster highlights guidelines and practices related to preoperative fasting, with an emphasis on:
   1) Guideline: Research in this cluster focuses on the development and evaluation of effective preoperative fasting guidelines.
   2) Elective Surgery: Many studies are exploring preoperative fasting in the context of elective surgery, where preparation can be better planned.
   3) Preoperative: Studies have also addressed various aspects of preoperative preparation, including fasting and management of the patient's condition before surgery.
   4) Practice: This cluster includes studies that assess clinical practices related to preoperative fasting and how these guidelines are implemented across different medical institutions.

Analysis using VOSViewer identified three main clusters in publications on the effects of extended preoperative fasting on patients. The red cluster focuses on critical issues such as adverse events and dehydration, the blue cluster explores the effects of fasting on surgery and hunger, while the green cluster highlights guidelines and practices related to preoperative fasting. An understanding of these three clusters helps direct research and clinical practice to improve the outcomes and safety of patients undergoing preoperative fasting.

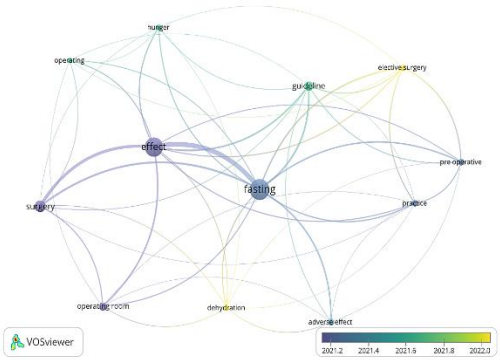

Figure 5. Overview of Network Publications on the Effects of Prolonged Preoperative Fasting on Patients

In addition, the analysis conducted with the VOSViewer application shows an overview of the frequency of keywords that often appear in each year. The description of the keyword frequency can be seen in Figure 5, based on this description, it can be seen the frequency of keywords that often appear and have a relationship with other research in the 2020-2024 range.

4. Publication Density Visualization of the Effect of Prolonging Patient's Preoperative Fasting

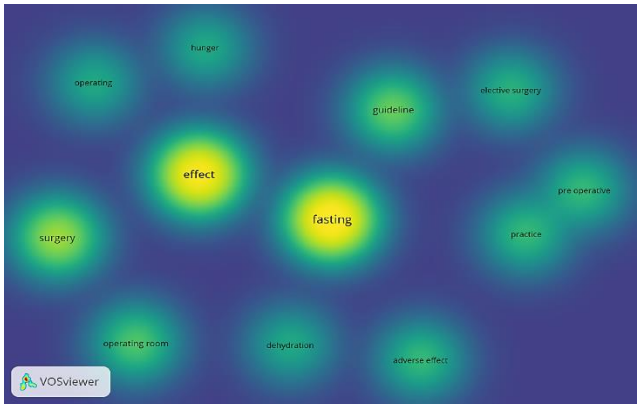

Figure 6. Publication Density Visualization of the Effects of Prolonged Preoperative Fasting on Patients

The results of the analysis using VOSViewer also produce a density visualization that is used to determine the depth of a publication. As can be seen in Figure 6, the lightest color indicates that the topic is often researched. In contrast to the thinnest color, it indicates that the topic is rarely researched.

Based on the density visualization in Figure 6, it can be concluded that research on the effects of prolonged preoperative fasting on patients with fasting and effect subjects has been done quite a lot but on subjects such as adverse effects, dehydration, hunger, gudiline, practice has not been done much. So, there are still opportunities to conduct research on this topic.

CONCLUSION

Based on the results of the analysis, it can be concluded that the trend of publications on the effects of prolonged preoperative fasting on patients Data shows that the number of publications has increased significantly in 2020, but then tends to decrease from 2021 to 2024 so that further research is needed to find out the scientific developments related to preoperative fasting.

Through the analysis conducted, it was found that the article by W.J. Fawcett entitled "Pre-operative fasting in adults and children: clinical practice and guidelines" is one of the most influential literatures on preoperative fasting, as evidenced by 124 citations. The results of the VOSViewer analysis also show that research on the effects of prolonged preoperative fasting on patients with the subject of fasting and effect has been done quite a lot but on subjects such as adverse effects, dehydration, hunger, gudiline, practice has not been done much. So, there are still opportunities to conduct research on this topic.

In the main research clusters such as:

1) Red Cluster: Fasting, Adverse Effect, Dehydration, Operating Room
   a) Focus: Duration of fasting, adverse effects, risk of dehydration, operating room preparation.
   b) Research Gaps: Development of fasting protocols that minimize dehydration and other adverse effects.
2) Blue Cluster: Effect, Surgery, Hunger, Operating
   a) Focus: Effects of fasting on surgical outcomes, interactions with surgical procedures, psychological aspects of hunger.
   b) Research Gaps: Further study of the psychological impact of hunger and how to reduce hunger without increasing aspiration risk.
3) Green Cluster: Guideline, Elective Surgery, Preoperative, Practice
   a) Focus: Development and evaluation of fasting guidelines, elective surgery, preoperative preparation.
   b) Research Gaps: Customization of fasting guidelines based on type of surgery and patient-specific conditions.

Research Opportunities that can be inferred from the results of this analysis are as follows:

1. Individualized Protocol Development: Developing fasting guidelines that are tailored to the patient's individual condition, type of surgery, and specific needs.

2. Long-term Studies: Long-term evaluation of the effects of presurgical fasting on patient recovery and health outcomes.
3. Psychological Effects: Further research into the psychological impact of fasting and ways to reduce patient discomfort.
4. New Technologies: Investigation into the use of new technologies to monitor patient condition during fasting and immediately before surgery.

These conclusions suggest that despite the many studies, there are still many gaps that need to be filled to improve the effectiveness and comfort of preoperative fasting, which may open up further research opportunities.

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