Introduction

Gastrointestinal diseases are significantly associated with infectious diseases worldwide (1,2). Common gastrointestinal diseases include diarrhea, nausea and vomiting, and anorexia. Hospital admission of these patients may result in high costs for the health system in all countries (3). Even in some cases, due to gastrointestinal problems, the patient’s health may be compromised, and the patient may die (4).

Diarrhea is a common symptom in developing countries. Prevalence of Gastrointestinal Problems in Patients with COVID-19: A Systematic Review and Meta-analysis

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Background:
Considering the prevalence of COVID-19 worldwide, the present study aimed to determine the prevalence of gastrointestinal problems (anorexia, diarrhea, nausea, and vomiting) in patients with COVID-19.

Materials and Methods:
The purpose of this study was to determine the prevalence of gastrointestinal problems in patients with COVID-19 using Systematic Review and Meta-analysis methodology. The search was conducted independently by two researchers on international databases, including Web of Science (ISI), Scopus, Embase, Science Direct, PubMed/Medline, and Google Scholar Search Engine. Keywords included “Vomiting”, “Anorexia”, “Diarrhea”, “Nausea”, “SARS-CoV-2”, and “COVID-19”. Data were analyzed using STATA statistic software.

Results:
The total sample size was 3602 patients. Initially, 1456 studies were included in the study, which reached 33 articles after the final screening. Regarding the prevalence of gastrointestinal problems in patients, the prevalence rate of diarrhea was 6% (95% CI: 0.06 [0.04, 0.08]), anorexia was 13% (95% CI: 0.13 [0.03, 0.24]), nausea and vomiting was 4% (95% CI: 0.04 [0.03, 0.05]), and pharyngalgia was 16% (95% CI: 0.16 [0.02, 0.30]).

Conclusion:
The results of this study can be used as a guideline for clinical professionals.

Keywords: COVID-19, Gastrointestinal problems, Clinical symptoms, Systematic review, meta-analysis


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Received: 03 Feb. 2020
Edited: 22 May 2020
Accepted: 23 May 2020
countries. The causes of diarrhea in patients include functional disorders such as Crohn's disease and Celiac disease, dysfunction of bile acids, or infectious diseases (5,6). Factors such as inadequate hygiene, lack of access to safe drinking water, and other risk factors are contributing to diarrhea (7-9). Another gastrointestinal problem is nausea and vomiting (10).

Constipation can lead to increased intracranial pressure as well as impaired rehabilitation treatments for patients with difficulty in controlling intestine movement (11, 12). Symptoms of constipation affect the patients and their care so that it can decrease the quality of life of such patients and disrupt their daily lives (13). Factors that can contribute to constipation include lifestyle, income status, education, physical activity, hormonal changes, and infectious diseases (14, 15).

COVID-19 is a pandemic infectious disease that has spread worldwide. One of the complications of this disease is gastrointestinal problems. However, studies of these complications have reported different prevalence (4,16,17).

2. Objectives
The purpose of this study was to determine the prevalence of gastrointestinal problems (anorexia, diarrhea, and nausea and vomiting) in patients with COVID-19 using Systematic Review and Meta-analysis methodology.

MATERIALS AND METHODS

3.1. Protocol
According to Systematic Reviews and Meta-Analyses (PRISMA) statement (18).

3.2. Inclusion and exclusion criteria
PICO elements of the study include, P: patients with Covid-19, I: Clinical symptoms, C: Healthy people. O: anorexia, diarrhea, nausea, and vomiting. Case reports, and Systematic Review and Meta-analysis articles were excluded from the study.

3.3. Information sources and search strategy
The search was conducted on the international databases including Web of Science (ISI), Scopus, Embase, Science Direct, PubMed/Medline, and Google Scholar Search Engine. Keywords included “Vomiting” [Mesh], “Anorexia” [Mesh], “Diarrhea” [Mesh], “Nausea” [Mesh], “SARS-CoV-2” [Mesh], and “COVID-19” [Mesh].

3.4. Study selection
The research team consisted of senior expert nurses (master) (FZ & ES) who did the primary search in international databases, and in case of any discrepancies between the two researchers, the final research was reviewed by another researcher with another senior nurse (master) (MB). Also, any questions about the procedure and the data contained in the articles were reviewed and approved by a gastroenterologist (BB).

3.5. Data collection process and data items
The form of findings included the prevalence (percent) of the three main variables associated with gastrointestinal complications such as diarrhea, nausea, and vomiting. The age, sample size for male and female patients, and the name of the published journal were also listed in the checklist (table1).

3.7. Statistical approach
Data analyses were performed in STATA software, version. 11 (College Station, TX, USA).

RESULTS
The total sample size was 3602 patients. Initially, 1456 studies were included in the study, which yielded 33 articles after the final screening. Regarding the prevalence of gastrointestinal problems in the patients, the prevalence rate of diarrhea was 6% (95% CI: 0.06 [0.04, 0.08]), anorexia was 13% (95% CI: 0.13 [0.03, 0.24]), nausea and vomiting 4% (95% CI : 0.04 [0.03, 0.05]), and Pharyngalgia was 16% (95% CI : 0.16 [0.02, 0.30]) (figures 2-5).

DISCUSSION
In this Systematic review and Meta-analysis study, which examines gastrointestinal problems in patients with COVID-19 for the first time in the world, it has been shown that the incidence of diarrhea in patients with COVID-19 is 6% (95% CI: 0.06 [0.04, 0.08]). In a Systematic review and Meta-analysis study by Rodríguez-Morales and colleagues (43), which aimed to assess the clinical symptoms in patients with COVID-19, the prevalence of diarrhea varied
<table>
<thead>
<tr>
<th></th>
<th>Author</th>
<th>Age</th>
<th>Country</th>
<th>N (%)</th>
<th>Male N (%)</th>
<th>Female N (%)</th>
<th>Journal</th>
<th>Diarrhea N (%)</th>
<th>Nausea and vomiting N (%)</th>
<th>Anorexia N (%)</th>
<th>Pharyngalgia</th>
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<td>49.0 (41.0-58.0)</td>
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<td>30(73)</td>
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<td>2</td>
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<td>55.5 (13.1)</td>
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<td>67(68%)</td>
<td>32(32%)</td>
<td>Lancet</td>
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<td>1(1)</td>
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<td>China</td>
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<td>Lancet</td>
<td>1(11)</td>
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<td>China</td>
<td>138</td>
<td>63(45.7)</td>
<td>75(54.3)</td>
<td>JAMA</td>
<td>14(10.1)</td>
<td>5(3.6)</td>
<td>55 (39.9)</td>
<td>24 (17.4)</td>
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<td>640(58.1)</td>
<td>459(41.9)</td>
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<td>China</td>
<td>137</td>
<td>61(44.5)</td>
<td>76(55.5)</td>
<td>Chinese Medical Journal</td>
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<td>1(7.7)</td>
<td>-</td>
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<td>Henry et al (2020) (26)</td>
<td>0-19 (20-83)</td>
<td>14 Countries</td>
<td>82</td>
<td>43(52.4%)</td>
<td>27(32.9%)</td>
<td>-</td>
<td>1(4)</td>
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<td>45.1 ± 13.35</td>
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<td>85</td>
<td>81</td>
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<td>Journal of Infection</td>
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<td>2(1.34)</td>
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<td>45.1 ± 12.8</td>
<td>China</td>
<td>17</td>
<td>9(52.9)</td>
<td>8(47.1)</td>
<td>-</td>
<td>2(11.8)</td>
<td>-</td>
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<td>12</td>
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<td>29-34</td>
<td>China</td>
<td>7</td>
<td>-</td>
<td>-</td>
<td>The Lancet Infectious Diseases</td>
<td>1(14.3)</td>
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<td>13</td>
<td>Pan et al (2020) (28)</td>
<td>40 ± 9 (25 - 63)</td>
<td>China</td>
<td>21</td>
<td>6(29%)</td>
<td>15(74%)</td>
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<td>14</td>
<td>Ng M et al (2020) (29)</td>
<td>56(57-65)</td>
<td>Hong Kong</td>
<td>21</td>
<td>13(62)</td>
<td>8(38)</td>
<td>-</td>
<td>2(10)</td>
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<tr>
<td>15</td>
<td>Song et al (2020) (30)</td>
<td>49 ± 16</td>
<td>China</td>
<td>51</td>
<td>25(49)</td>
<td>26(51)</td>
<td>-</td>
<td>5(10)</td>
<td>3(6)</td>
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<tr>
<td>16</td>
<td>Chung et al (2020) (31)</td>
<td>51 ± 14</td>
<td>China</td>
<td>21</td>
<td>-</td>
<td>-</td>
<td>Radiology</td>
<td>-</td>
<td>1(5)</td>
<td>-</td>
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between 2% and 13.8%. The differences between the results of this study and those of Rodriguez-Morales and colleagues (43) indicate that in this study, the prevalence of diarrhea in patients with COVID-19 were studied in 28 studies, while Rodriguez-Morales and colleagues (43) studied diarrhea in only six articles. Another Systematic Review and Meta-analysis study that investigated the prevalence of diarrhea was done by Nasiri and co-workers (44), with a total prevalence of 5.7 (3.8-8.6) in 13 studies. Anorexia was also reported in five articles with a prevalence of 10.1 (1.0-57.2), which is consistent with Systematic review and Meta-analysis of Nasiri and co-workers (44)

**CONCLUSION**

The results of this study can be used as a guide for clinical professionals.

**Author contributions:**

All authors contributed to the initial discussion.
ACKNOWLEDGMENTS

Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran (3009984) / clinical research development center of Imam Khomeini Hospital affiliated to Ilam University of Medical Sciences, Ilam, Iran.

CONFLICT OF INTEREST

The authors declare no conflict of interests related to this work.

Financial disclosure:

Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran.
REFERENCES


Gastrointestinal Problems in Patients with COVID-19