

The prevalence of hypertension and diabetes mellitus during the COVID-19 pandemic era: A systematic review

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Abstract

Background: The impact of on blood pressure (BP) and incidence of diabetes mellitus has not yet been elucidated. Therefore, the present study aimed to systematically discuss the prevalence of DM and hypertension in the published studies during the COVID-19 pandemic between 2019 and 2022 and compare these results with results reported in previous studies.

Methodology: This was a comprehensive electronic systematic review that was time and language restricted. The search was conducted depending on different databases including PubMed, Google Scholar, Web of Science, and Cochrane library, for all studies published in the period between 2019 and 2022. Keywords used included COVID-19 OR SARS-CoV-2 OR Coronavirus OR "Corona virus" OR COVID, AND hypertension OR diabetes mellitus OR prevalence OR metabolic disorders AND cardiovascular conditions. The period of the study was chosen based on the fact that COVID-19 started in the beginning of 2019.

Results: The primary search results of the current analysis ended in 875 hits which were reduced to 360 studies after removal of the duplicated studies. From those 360 studies, further evaluation for inclusion and exclusion criteria was conducted ending in 346 excluded studies. The reasons for exclusion included because of title and abstract (216 studies), being not relevant to the subject of the study

(86 studies), being replies to authors (17 studies), books (2 topics), and being other reviews (26 studies). Finally , we included 13 studies in the qualitative synthesis of the current review.

Conclusion: There was no significant increase in the prevalence of diabetes mellitus and hypertension among the general public in different regions of the world during the period of the COVID-19 pandemic compared with previous studies.

Keywords: COVID-19, hypertension, diabetes mellitus

Introduction

In 2019, the first case of coronavirus disease (Covid-19) was reported starting the largest pandemic of the past 100 years, affecting more than 200 countries and affecting millions of people worldwide [1]. The severe acute respiratory syndrome coronavirus (SARS-CoV-2) was identified as the main pathogen of the COVID-19. Moreover, previous reports showed that angiotensin-converting enzyme 2 (ACE 2) was identified to be one of the cellular receptors of SARS-CoV-2 [2]. The spectrum of clinical manifestations of Covid-19 ranges from asymptomatic or mild symptoms in approximately 80% of those infected, based on community surveys, to approximately 2% of deaths in the hospitalized population [3–5]. Although statistical estimates change daily, more than 11 million people have been affected by Covid-19, so as of July 7, 2020, there had been more than half a million deaths worldwide [6].

Hypertension is one of the most common conditions worldwide, and is associated with the incidence of many dangerous complications such as acute heart attack, heart disease and stroke. Therefore, there are many treatment and care challenges faced by the health care systems which are related to the complications associated with hypertension [7–9]. Furthermore, a previous report showed that there is higher risk for more severe COVID-19 conditions in those diagnosed with diabetes mellitus and hypertension [10]. A study of 191 patients found that those with diabetes had a 2.85-fold and 3.05-fold increased risk of mortality, respectively [11]. In addition, the Chinese Center for Disease Control reported that the mortality rate of individuals with diabetes is higher than that of non-diabetics (7.3% and 2.3%, respectively) [3]. Based on the results of published studies and reports, since the beginning of the Covid-19 pandemic, a number of high-risk individuals and groups have been identified with increased risk of mortality and others have serious complications [12–16]. Patients who were diagnosed with hypertension and diabetes mellitus belong to these high-risk group [17,18]. The reason behind the role of hypertension in the pathogenesis of COVID-19 may be associated with the role of ACE 2 which played as a receptor of SARS-CoV-2 virus. In some previous systematic reviews, the authors reported that the prevalence of diabetes mellitus and hypertension in patients who were diagnosed with COVID-19 was between 9.7-11.9 % for diabetes mellitus and 17.1-20 % for hypertension [19–22].

As presented, it was confirmed that hypertension and diabetes mellitus are associated with increased risk of severe COVID-19 and associated with higher mortality rate in those patients, however the impact of COVID-19 on blood pressure (BP) and incidence of diabetes mellitus has not yet been elucidated. Therefore, the present study aimed to systematically discuss the prevalence of DM and hypertension in the published studies during the COVID-19 pandemic between 2019 and 2022 and compare these results with results reported in previous studies.

Methodology

This is a systematic review which was conducted according to the PRISMA guideline (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement.

-System for identification of studies to include in the review:

This was a comprehensive electronic systematic review that was time and language restricted. The search was conducted depending on different databases including PubMed, Google Scholar, Web of Science, and Cochrane library, for all studies published in the period between 2019 and 2022. Keywords used included COVID-19 OR SARS-CoV-2 OR Coronavirus OR “Corona virus” OR COVID, AND hypertension OR diabetes mellitus OR prevalence OR metabolic disorders AND cardiovascular conditions. The period of the study was chosen based on the fact that COVID-19 began in 2019.

- Inclusion criteria and selection of studies

In the first step two researchers reviewed the retrieved articles and removed the duplicates. In other steps, the researchers screened the title and abstract of the records and the ineligible studies were removed. Then, the authors surveyed the full text of the remaining studies based on inclusion and exclusion criteria and the eligible studies (case reports, case series, and cross-sectional) were identified.

We excluded the articles which were topic to at least one of the following criteria

• Exclusion criteria:

- Unpublished studies
- Non-original articles including reviews, protocols, and editorials.
- Studies depending on animal samples
- Unpublished and unsupported opinion of expert (not including references or being a letter).
- Clinical trials which were in progress without yet published results.
- Studies which consisted of replies to author/editor and not including new data or information
- Books'/conferences' abstracts.
- Abstract papers, articles without obtainable full text
- Those studies published in other languages without presence of English version
- Published material or conducting of the study prior to 2019.

- Data analysis:

The review was conducted after an extensive search across many databases and throughout references of found studies for eligible studies. We then combined the search terms and limited them to those in English language and in the period between 2019 and 2022. Then duplicated studies were removed and according to PRISMA checklist, articles were screened according to title, abstract, and full text. For each study, title, authors, year of publication, design of the study, sample characteristics (age, gender, BMI, smoking and physical activity), and prevalence of hypertension and diabetes mellitus were collected. Tables and figures were used for presentation of the results.

Results

- Study selection

The primary search results of the current analysis ended in 875 hits which was reduced to 360 studies after removal of the duplicated studies. From those 360 studies, further evaluation for inclusion and exclusion criteria was conducted ending in 346 excluded studies. The reasons for exclusion included because of title and abstract (216 studies), being not relevant to the subject of the study (86 studies), being replies to authors (17 studies), books (2 topics), and being other reviews (26 studies). Finally we included 13 studies in the qualitative synthesis of the current review (Figure 1).

- Studies results:

Among the 13 studies included in the current review, nine studies investigated that prevalence of diabetes mellitus [23–31] and all the included studies investigated the prevalence of hypertension and were conducted and published in the period between 2019 and 2022 [23–35]. All studies were cross-sectional in nature. Two studies were conducted in Saudi Arabia [26,35], while two studies were conducted in India [32,33], three in Ethiopia [23,28,31], one study in France [24], UAE [34], Lebanon [25], Nepal [27], Iran [30], and Malaysia [29]. All studies were conducted among adult public population (Table 1).

The pooled sample size among the 13 studies was 51,975 adults where 21,431 were males (41.23 %) and 28,014 (53.89 %) were females. Moreover, 57.42 % of the participants were older than 35 years old (N=30,849) and 25.80 % were smokers (N=8789). Considering BMI, 49.73 % of the participants of the total sample were overweight or obese while 43.05 % had normal BMI and prevalence of underweight was 7.22 %. Furthermore, 71.63 % of the participants reported good exercise practice (Table 2). Considering the prevalence of hypertension, the pooled results reported a prevalence of 30.56 % ranging between 13.6 % in study of Elbashir et al in Saudi Arabia [35] to 44.91 % in the study of Belay et al in Ethiopia [23]. Considering the prevalence of diabetes mellitus, the pooled results reported a prevalence of 9.23 % ranging between 3.9 % in the study of Takala U et al in Ethiopia [28] to 18.3 % in the report of NHMS in Malaysia [29].

Discussion

Studies published since the beginning of the epidemic have focused on evaluating optimal treatment to reduce mortality from COVID-19. Recent studies have also focused on identifying independent predictors of mortality in patients with Covid-19 [36]. Various biomarkers and comorbidities have been identified as independent predictors of severe disease and poor outcome in Covid-19 [37–39]. Regarding hypertension, and its relationship to COVID-19, 19 have been debated since the early stages of the epidemic. A previous systematic review was conducted by

Tadic et al among studies in order to assess the relation between COVID-19 and presence of hypertension and impact of hypertension on outcomes among the patients treated from COVID-19.

The authors reported that arterial hypertension is considered one of the most common comorbidities in patients diagnosed with COVID-19 [40]. However, some authors thought that the relation between hypertension and DM with the mortality and morbidity in COVID-19 could be also in the other direction where some doubts that COVID-19 itself could increase the risk for developing hypertension and DM among the population [34,40]. In the current study, we collected data from very recent studies conducted in different regions of the world to assess the prevalence of hypertension and DM among population in the time of COVID-19. The mean prevalence of hypertension in the current review was 30.56 % ranging between (13.6 % and 44.91 %). This prevalence was slightly higher than reported in some previous studies including a recent systematic review that assessed the prevalence of hypertension among Saudis in the period between 2008 and 2018 just before the COVID-19 pandemic. The authors reported a total prevalence of 28.875 % ranging between 18.5 % and 54.9 % [41] and in India, another systematic review reported an overall prevalence of hypertension of 29.8 % [42]. Moreover, in another systematic review conducted in 2016, based on 135 population-based studies in 90 countries, the authors reported that the prevalence of hypertension was 31.1 % in 2010 [43]. Furthermore, in Brazil, a systematic review conducted among 40 studies included 122,018 subjects and reported that according to JNC criteria for diagnosis of hypertension, the prevalence of hypertension was 28.7 % in 2000 [44]. According to these results, we concluded that prevalence of hypertension does not show a significant increase in the era of COVID-19 however, it is alarming to know that almost one third of the population were patients with hypertension which indicates that there is a need to understand the factors associated with this prevalence and introduce strategies to control and try to reduce it.

Considering diabetes mellitus, the current review reported a prevalence of 9.23 % ranging between 3.9 % and 18.3 %. This is similar to a previous systematic review conducted among studies published 1992 and 2007 in northern Africa which reported a mean prevalence of 9.31 % [45]. While in another systematic review conducted among 25 studies in the Gulf region, the authors reported a pooled prevalence of 12.71 %, higher than reported in the current review [46]. However, our prevalence was significantly higher than reported in a previous systematic review conducted in Ireland in the period between 1998 and 2015 which reported a prevalence between 2.2 % and 5.2 % [47]. These results indicate a non-significant increase in the prevalence of DM among the public population indicating that the COVID-19 pandemic had a lower impact on increasing the developing of DM and hypertension among the general public. However, some previous studies reported that COVID-19 had a negative impact on controlling of hypertension and DM which increased the incidence of complications associated with these conditions [48,49].

In conclusion, no significant increase in the prevalence of diabetes mellitus and hypertension among the general public in different regions of the world during the period of COVID-19 pandemic was reported compared with previous studies. However, more interest should be focused on understanding whether COVID-19 is associated with an increase in the prevalence of hypertension and DM among patients with COVID-19.

Figure 1: The steps of choosing the studies for systematic review according to PRISMA steps

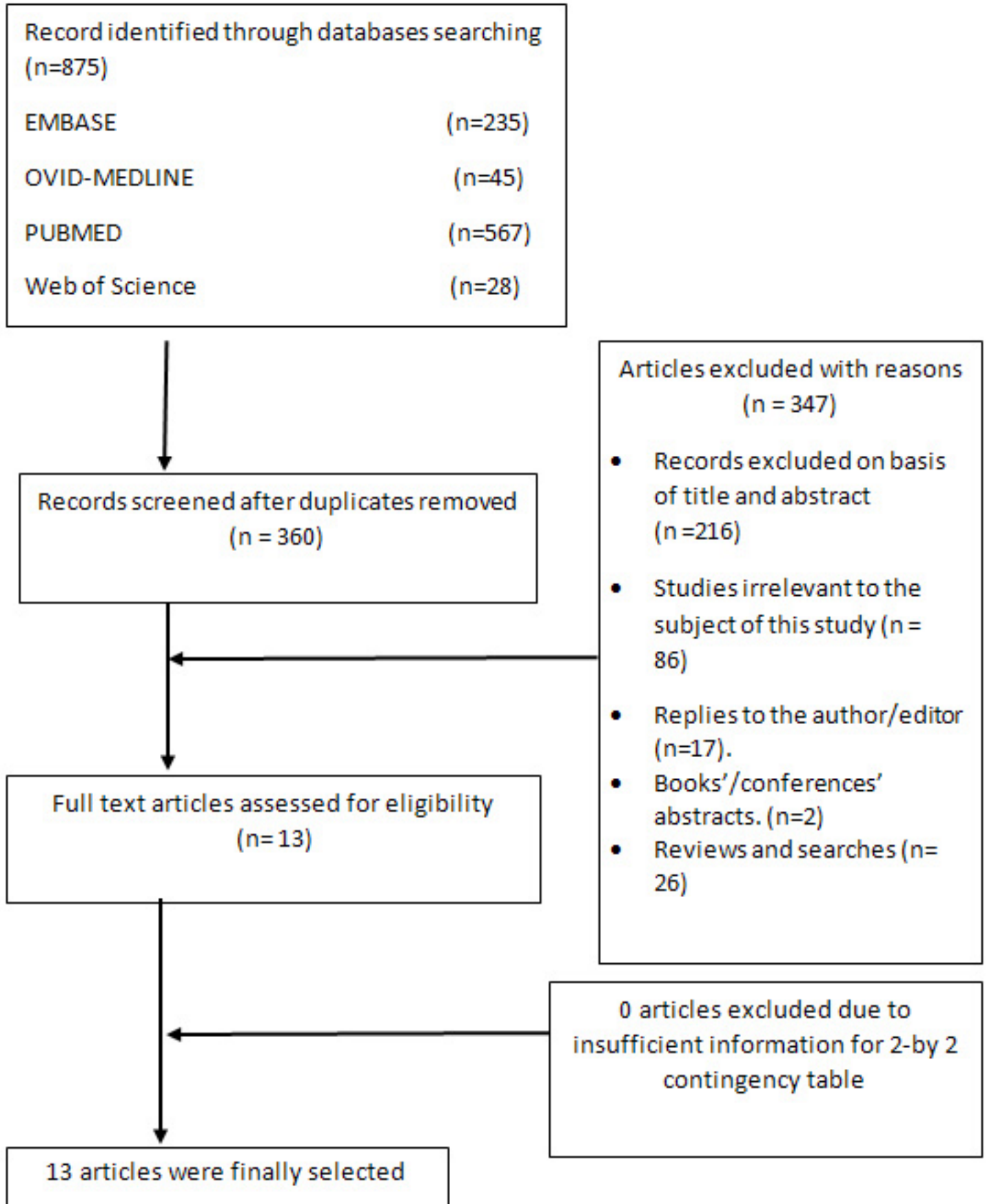


Table 1: The general characteristics of the studies

No.	Authors	Year	setting	Study design	Aims	Population	Prevalence of HTN	Prevalence of DM
1	Elbashir et al [25]	2021	Riyadh, Saudi Arabia	Cross-sectional	The prevalence of hypertension	Adult public population	13.60%	NA
2	Vijina [22]	2022	India	Cross-sectional	To assess prevalence and predictors of hypertension in the rural adult Indian population	Adult public population	31.50%	NA
3	Calas et al [24]	2022	Mayotte, France	Cross-sectional	To assess the prevalence of hypertension, determine the level of awareness, management, and control of this condition	Adult public population	38.40%	7.1 %
4	Mamliouh et al [24]	2022	Dubai, UAE	Cross-sectional	To assess the prevalence of hypertension and pre-hypertension and the related socio-demographic factors, behavioral risk factors and complications among the adult population of Dubai.	Adult public population	32.50%	NA
5	Bayet et al [23]	2022	Northwest Ethiopia	Cross-sectional	To determine the prevalence of hypertension and demographic factors associated with it	Adult public population	44.91%	9.28 %
6	Geewar et al [23]	2022	South India	Cross-sectional	To study the prevalence of hypertension	Adult public population	37.20%	NA
7	Ghaddar [25]	2021	Lebanon	Cross-sectional	To determine the prevalence of hypertension and the level of awareness among adult population	Adult public population	30.70%	7.4 %
8	Khafaji [26]	2021	KAU, Saudi Arabia	retrospective study	Investigate the prevalence and control of diabetes and hypertension among employees at a university in Saudi Arabia	Employees	31%	5 %
9	Shrestha et al [27]	2022	Nepal	Cross-sectional	Prevalence of DM	Adult public population	36.90%	8.5 %
10	Talala Utura [28]	2021	Ethiopia	Cross-sectional	Determine the prevalence of diabetes mellitus and the associated factors among public population in Southern Ethiopia.	Adult public population	16.30%	3.9 %
11	NHIMS [29]	2019	Malaysia	Cross-sectional	To provide community-based data and evidence to the Ministry of Health Malaysia on non-communicable diseases	Adult public population	32.70%	18.3 %
12	Oraii et al [20]	2022	Tehran, Iran	Cross-sectional	To assess the prevalence of DM and the level of awareness, treatment, and control.	Adult public population	28.10%	16.8 %
13	Endris et al [21]	2022	Northwest Ethiopia	Cross-sectional	To assess the current prevalence of DM, prediabetes and its associated factors in Dessie Town, Northeast Ethiopia	Adult public population	23.50%	6.8 %

Table 2. The general characteristics of the individuals reported in the study

Author	Total sample	Age				Gender				BMI						Smoking		Physical activity	
		< 35		> 35		male		female		Underweight		Normal		Obese		No.	%	Yes	No
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
[1]	934	312	33.40%	622	66.60%	459	49.10%	475	50.90%	NA	NA	NA	NA	NA	NA	185	19.80%	NA	NA
[2]	425	167	39.30%	258	60.70%	225	52.90%	200	47.10%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
[3]	2620	1483	56.60%	939	43.40%	951	36.25%	1669	63.71%	72	3.20%	831	35.20%	1717	61.60%	317	12.10%	901	65.20%
[4]	2530	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
[5]	432	125	28.92%	307	71.08%	125	28.92%	307	71.07%	75	17.36%	313	72.43%	44	27.55%	130	30.08%	280	64.80%
[6]	5,150	1221	23.70%	3929	76.30%	2061	40.01%	3089	59.99%	NA	NA	NA	NA	NA	NA	633	12.70%	NA	NA
[7]	2214	1254	56.65%	960	43.31%	1017	44.20%	1197	55.80%	72	NA	709	32.02%	1433	67.98%	1309	58.70%	1183	53.43%
[8]	1000	NA	NA	NA	NA	365	36.50%	635	63.50%	32	3.20%	283	28.30%	685	68.50%	286	28.60%	NA	NA
[9]	12357	4562	36.92%	7995	63.67%	4808	39.05%	7649	60.95%	1334	12.21%	7156	56.98%	3866	43.02%	3953	31.48%	NA	NA
[10]	410	274	66.82%	136	33.18%	292	71.25%	118	28.71%	13	3.10%	225	54.87%	172	45.13%	19	4.63%	116	28.25%
[11]	14865	7750	51.71%	7215	48.29%	7064	47.23%	7901	52.77%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
[12]	8151	0	0%	8151	100.00%	3731	45.77%	4420	54.23%	222	2.70%	2044	25.07%	3885	74.93%	1920	23.33%	6647	81.54%
[13]	587	250	42.58%	337	57.42%	233	39.68%	354	60.31%	0	0	479	81.60%	108	18.40%	15	2.56%	270	45.98%
total	51575	17588	33.4737%	30849	59.5334%	21431	41.2329%	28014	53.8989%	2020	7.22	12040	43.05	13910	49.73	8789	25.8082%	9397	71.6386%

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