The effect of COVID-19 on the risk of falling in old age adult patients: a cross-sectional study

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Abstract. – **OBJECTIVE:** To improve care for the elderly and avoid falls and associated injuries, examining fall risk factors and defining their components is crucial, especially for those who are infected with COVID-19. The purpose of the study was to investigate the effect of COVID-19 on the risk of falling in the elderly in the Kingdom of Saudi Arabia.

SUBJECTS AND METHODS: Eighty-six subjects (42 COVID-19 patients and 44 non-infected participants). The participants were selected from the central, western, and eastern provinces of Saudi Arabia. Their ages ranged from 60-75 years. Two groups of participants were formed: group A, the group infected with COVID-19, and group B, which included subjects not infected with COVID-19. The Missouri Alliance Fall Risk Assessment Tool for Home Care (MAHC-10) questionnaire was used to detect fall risk among the participants.

RESULTS: This study showed that 47.6% of the participants who suffered from COVID-19 had a high falling risk, while only 18.2% of the non-affected participants had a high falling risk. So, there was a significant association between the risk of falling and COVID-19.

CONCLUSIONS: COVID-19 has a negative impact on the risk of falls in elderly people. So, the introduction of balance exercises to these subjects is of high importance to improve their balance and proprioception skills and decrease the fall risk.

Key Words:
   COVID-19, Risk of falling, Elderly.

Introduction

The term elderly is defined in different variations all over the world. Most countries define the elderly as a person who is aged 65 years or older[1]. The rapid growth of the number of elderly people created challenges. In the elderly, sarcopenia is a frequent condition. An individual starts to lose muscle strength at roughly 50 years of age; however, this becomes more noticeable around 70. Many definitions and criteria for sarcopenia have been proposed by prominent research organizations[2]. It is a progressive, systemic musculoskeletal disorder accompanied by an elevated chance of unfavorable outcomes such as fall risks and fractures, physical disability, cardiopulmonary disorders, intellectual impairment, and even death[3]. Physical disability and limited ability to do daily living activities contribute to the decline of the functional independence and quality of life of the elderly[4]. Moreover, Laudisio et al[5], examined the relationship between handgrip strength and health-related quality of life in 331 old age subjects and found that there is a high correlation between muscular strength and both mental and physical health-related quality of life in these individuals.

Additionally, the elderly who have several co-morbidities are frequently affected by neuropathic pain resulting from lesions in the sensorimotor system. The management of neuropathic pain in the elderly requires a multidisciplinary team of medical, social, and psychiatric experts to enhance the patients' quality of life[6].

One of these challenges was confronted during the COVID-19 pandemic[7]. One of the biggest risk factors for COVID-19 complications is old age, with mortality rates ranging from 15 to 20% at the age of eighty[8]. Coronavirus causes different side effects, going from the normal cold to additional extreme illnesses like severe acute respiratory syndrome. Previously unknown in humans, a novel strain of coronavirus has been spreading over the world since 2019[9]. The most common symptoms of COVID-19 are fever, dry cough, exhaustion, muscle or joint pain, and dizziness[10]. As COVID-19 led to the closure of public places, including health centers and gyms, and resulted in a decreased level of motor activity, physiotherapists should be aware of the effect of the COVID-19 pandemic on skeletal muscle health, activity levels and balance. This helps in improving physical activity and balance in subjects during stay-at-home enforcement[9].

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A fall is a sudden, unintentional change in location that causes a person to land at a lower level. Because they place a significant burden on healthcare and healthcare costs and because older people are more likely to experience a fall, the effects of falls pose a serious public health threat. Up to 52.6% (women 29.1% and men 23.5%) of old age adults have suffered a fall[11]. Falls and imbalance have a high rank among other factors that impact old-aged adults. Fall leads to serious complications in the elderly; 10% of the cases suffer from hip fractures, which require hospitalization, and other cases experience hematoma. Being the fifth most common cause of mortality, falls are a highly significant issue. In terms of where a fall occurred, 56% of falls took place outside the home, such as on the sidewalk or in a public space[12]. However, falls that happened within the house made up around 40% of cases, frequently occurring in the bedroom or dining room. As many as 40% of the elderly who live in the community have experienced a fall, it becomes a serious health concern for them[13].

Numerous evaluation methods that assess fall risks and older adults' susceptibility to falls are mentioned and cited in the literature. The Missouri Alliance Fall Risk Assessment Tool for Home Care (MAHC-10) is one of them. It was created to evaluate a variety of fall risk factors for the elderly. To better care for old-age patients receiving home health care, it is crucial to examine fall risk factors and describe their components to prevent falls and injuries[14].

Preliminary research has shown that some individuals with COVID-19 experience significant musculoskeletal impairment. Little is known about the fall risks in older Saudi Arabian members, and no research has looked at the impact of COVID-19 on this risk. Therefore, the purpose of the current study was to examine the impact of COVID-19 on the risk of falling in the elderly of the Kingdom of Saudi Arabia (KSA).

Subjects and Methods

Subjects

The MAHC-10 questionnaire was sent to eighty-six subjects (42 COVID-19 patients and 44 non-infected participants). The participants were selected from different provinces in KSA for the generalizability and representativeness of the results. Participants received the questionnaire in January 2022. About 79.7% of them were females and 20.3% were males. Their ages ranged from 60-75 years. Two groups of participants were formed: group A, which included patients with COVID-19, and group B, which included non-infected subjects. The subjects were excluded if they suffered from neurological disorders, peripheral neuropathy, vestibular impairments, and arthroplasty. Additionally, they were excluded if they took any medications that may affect balance. They were requested to fill in the MAHC-10 *via* an online survey. A written consent form was signed by each participant before completing the survey. The participants were given the utilized questionnaire through Google Forms. It included an introduction that summarizes the main goal for all participants. Also, it informs them that all data collected from them will be confidential and anonymous. Additionally, they are free to choose not to respond to any question or to leave the study without any concerns. The consent form was assigned before the beginning of the study. Data was collected using spreadsheets.

Detection of Fall Risk

The MAHC-10 was used to detect fall risk among the participants. It was introduced to the participants through an online survey. An online survey is a useful tool for collecting verified information from online respondents while also serving as a cost-effective approach to carrying out research[9]. The MAHC-10 is a many-factor tool that can identify fall risks for old-age people. It evaluates ten factors, and the overall score is between 0 and 10, where 0 denotes the lowest likelihood that an elderly person may fall and 10 denotes the highest fall risk. People having scores of 4 or above on the MAHC-10 are thought to be highly risky. A record of the person's age, co-morbidities, history of falls, level of incontinence, number of medications used, visual impairment, limited functional mobility, environmental dangers, cognitive impairment, and pain are the elements included in the questionnaire. The incidence of these risk factors was described. Four of the ten components of the tool – fall history over the preceding three months, functional mobility, three or more co-existing illnesses, and pain – were accompanied by a higher risk of falling. The most important factor between these factors is the noticeable fall history. The MAHC-10 tool has a high sensitivity of 97%, but its specificity is low at 13.3%[8].

Detection of a COVID-19 Infection

We use the PCR (polymerase chain reaction) test to confirm the COVID-19 infection. It has certain characteristics, such as rapid detection, high sensitivity, and specificity. It is a procedure that produces enough DNA for analysis by amplifying a small, clearly defined segment of DNA many hundreds of thousands of times. This type of test was approved for diagnosing a COVID-19 infection[10].

Ethical Considerations

The ethical committee at Taif University approved the study on 8 April 2021 with approval No. 42-155.

Statistical Analysis

This is a cross-sectional study. The data provided by the MAHC-10 questionnaire were in the form of nominal data. The data were analyzed using SPSS program version 26 (IBM Corp., Armonk, NY, USA). The crosstabs analysis selecting the Chi-square test at an alpha level of 0.05 was conducted to test the null hypothesis "H0=the COVID-19 pandemic and the risk of fall are independent of each other".

Results

The aim of the study was to explore the influence of COVID-19 on the risk of falls in elderly persons. Figure 1 summarizes the questionnaire responses of both groups.

Regarding the 1st item in the questionnaire, "Have you fallen within the past 3 months?", the results indicated that people who suffered from COVID-19 had a significantly higher frequency of falls during the last three months ($p<0.05$). The percentage of COVID-19 patients who suffered from falling in the last three months was 40.5%, while that of non-COVID was 2.3% (Table I). Concerning the second item, "Do you suffer from lack of urine control?" the results indicated a non-significant difference between both groups. The percentage of subjects who suffered from lack of urine control was 28.6% and 18.2% for COVID-19 and non-COVID, respectively. So, there is insufficient evidence to conclude that COVID-19 affected urine control (Table I).

About the third item of the questionnaire about suffering from visual problems, 52.4% and 45.5% suffered from visual problems for COVID-19 and non-COVID-19, respectively. The results showed non-significant differences between both groups, which indicated that suffering from visual problems was independent of COVID-19 infection (Table I). According to the fourth item, "Do you suffer from weakness or inability to perform daily activities?", the COVID-19 pandemic was significantly associated with increased weakness affecting daily activities; 52.4% of COVID-19 patients and 20.5% of non-COVID patients suffered from weakness ($p<0.05$) (Table I).

Regarding the fifth item, "Do you have obstacles in your home or outside?", the percentage of persons who had obstacles was 33.3% in COVID-19 patients while it was 22.7% in non-COVID. So, there was a non-significant difference between COVID-19 and non-COVID-19 groups (Table I). Concerning the use of certain medications (6th item), 42.9 % of the COVID-19 patients responded "Yes" and 36.4% of the non-COVID-19 participants responded "Yes" with a non-significant difference between both groups (Table I). The results of the current study indicated that there was a significant association between COVID-19 and the increased occurrence of pain ($p<0.05$). Fifty percent of COVID-19 patients reported pain, compared to 22.7% of non-COVID-19 patients (Table I)[15].

Considering the 8th item, "Does the pain affect the performance of daily activities?" 57.1% of COVID-19 patients had difficulty with activities of daily living (ADL) due to pain, while only 34.1% of non-COVID patients experienced this issue (Table I). Additionally, the questionnaire asked about suffering from certain problems such as behavioral problems, fatty liver, and Alzheimer's. The results indicated that About 7% and 16% of COVID-19 and non-COVID-19 participants, respectively, had these problems, so there was no significant difference between both groups (Table I). Finally, 47.6% of the participants who suffered from COVID-19 had a high falling risk, while only 18.2% of the non-affected participants had a high falling risk. So, there was a significant association between the risk of falling and COVID-19 ($p<0.05$) (Table I).

Discussion

The study's objective was to examine the effect of COVID-19 on the risk of falling in the elderly in KSA. The participants were all older Saudi
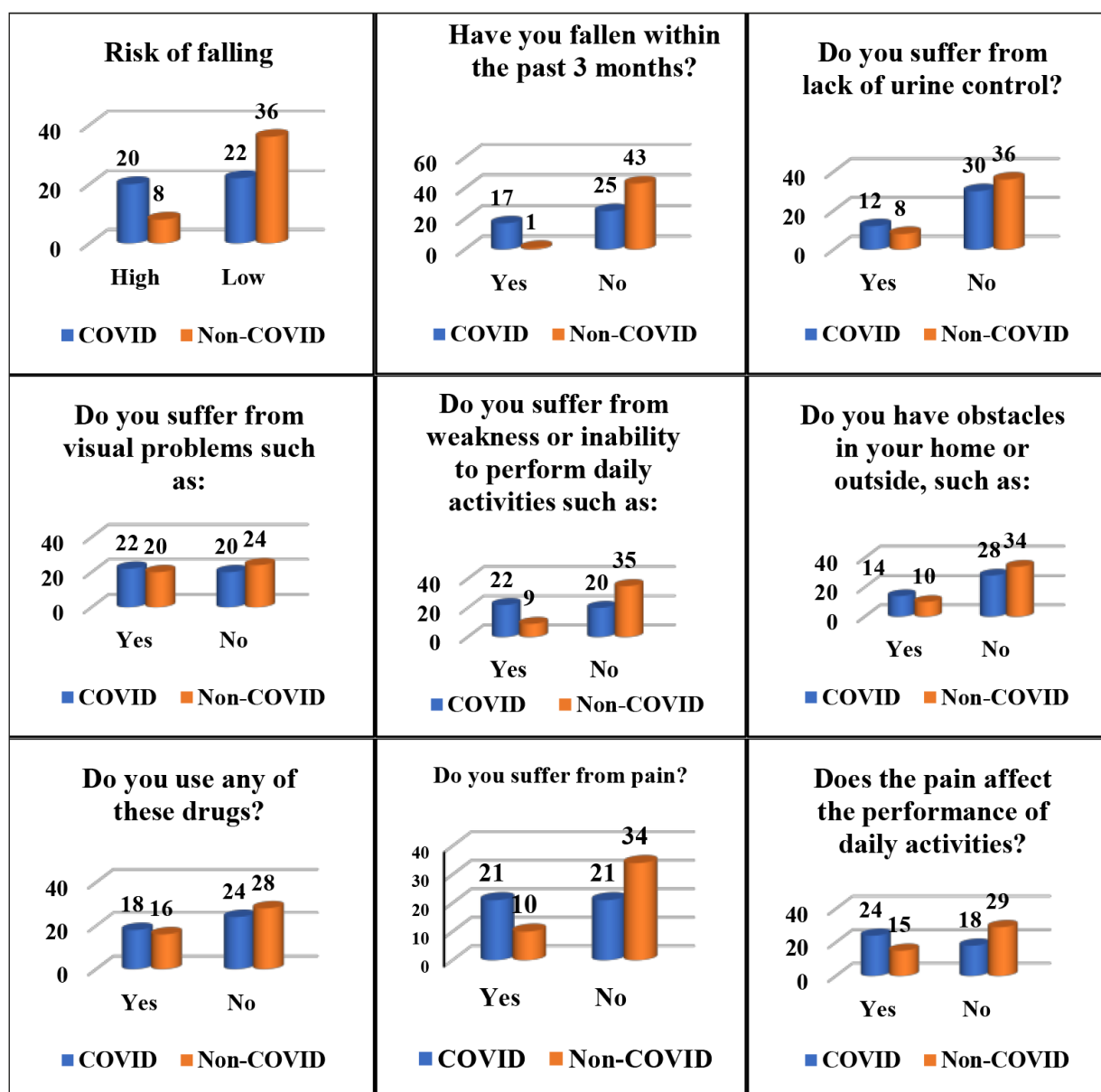
Figure 1. Questionnaire responses of both groups.

people so the findings could only be generalized to this country. In quantitative research, the sample size is an important consideration that enables researchers to generalize their outcomes to a larger population. According to Polit and Beck[16], the generalizability of research findings to the population is enhanced by ensuring that the sample's characteristics reflect those of the public. Therefore, the data was collected from different areas of KSA for the generalizability and representativeness of the results to a wider population.

The results of the current study demonstrated that the fall risk was high in people aged 60 years or older who were infected with COVID-19. The high fall risk may be attributed to balance impairment following the infection with COVID-19. These results come in agreement with Lechien et al[17], who mentioned that there had been reports of COVID-19-related hearing and balance complaints. They stated that COVID-19 may cause infection in certain cells in the inner ear, which may affect hearing and balance. Three distinct pathways, specifically, have been put forth for these manifestations seen in COVID-19 individuals. The invasion of the virus to the vestibular system, vestibular hair cells, and cochlear hair

Table I. Chi-square test for the MAHC-10 items and its total score.

Questionnaire items	Pearson's Chi-square		Continuity correction		Likelihood ratio	
	Value	Asymptotic significance 2-sided	Value	Asymptotic significance 2-sided	Value	Asymptotic significance 2-sided
Have you fallen within the past 3 months?	18.951	.000	16.713	.000	22.005	.000
Do you suffer from lack of urine control	1.3	.254	.783	.376	1.305	.253
Do you suffer from visual problems such as...	.413	.521	.182	.670	.413	.521
Do you suffer from weakness or inability to perform daily activities such as...	9.501	.002	8.167	.004	9.721	.002
Do you have obstacles in your home or outside, such as...	1.201	.273	.732	.392	1.205	.272
Do you use any of these drugs?	.379	.538	.156	.693	.379	.538
Do you suffer from pain	6.933	.008	5.801	.016	7.045	.008
Does the pain affect the performance of daily activities?	4.607	.032	3.724	.054	4.648	.031
Do you suffer from any of these following problems?	1.607	.205	.867	.352	1.588	.208
Influence of COVID-19 on the risk of fall	8.480	.004	7.193	.007	8.680	.003

cells. Therefore, COVID-19 may cause hearing and balance problems through these possible pathways[18-20].

Additionally, Carod-Artal[13] noted that COVID-19 patients have had a few neurological problems. The peripheral nervous system's inflammatory responses or direct invasion of the neural cells are most likely to cause these symptoms. These complications have also been seen as post-neurological issues after the infection recovered[14]. It is common for COVID-19 patients to experience balance problems, which can make maintaining balance difficult. About one-third of patients have reported these issues[15]. Furthermore, Jaszczur-Nowicki et al[21] found that balance skills were significantly worse after COVID-19 infection.

Additionally, according to Çelik et al[22], the balance problems discovered in their study may be brought on by a probable weakening of the respiratory muscles reported after a COVID-19 infection. Future studies should explore this concept. Malayala et al[23] suggested that the decline in balance performance may be due to neurological complications resulting from a viral infection, which can damage the nervous system.

From another point of view, the high risk of falling in the infected patients may be related to muscle weakness following the infection with COVID-19. According to the fourth item of the used questionnaire, "Do you suffer from weakness or inability to perform daily activities?" COVID-19 was significantly associated with increased weakness that affected the activities of

daily living. This comes in agreement with Ruan et al[24] as they reported that the patients infected with COVID-19 are suffering from muscle atrophy, decreased muscle strength and fatigue, weakness, and physical stress that limit their abilities to perform daily living activities. They added that the muscle weakness may be due to a decrease in blood supply to the muscles and the presence of infiltrating inflammatory cells and demyelination occurs in the neural tissues[19]. From the same point of view, muscle catabolism, polyneuropathy, and inflammatory consequences all contribute to musculoskeletal injury. These impairments lead to muscle fatigue and functional limitations.

Additionally, Piotrowicz et al[25] found that COVID-19 infection leads to acute sarcopenia, which can cause physical and functional decline. Additionally, Kirwan et al[26] reported that the metabolic dysfunction reflected by muscle catabolism, which results in muscle fiber alterations and a reduction in muscle mass, dramatically lowers the functional ability of COVID-19 patients. Also, immobilization in bed for longer periods may lead to muscle weakness and muscle damage that increases the risk of falling in infected patients, as mentioned by Kortebein et al[27]. Similarly, the quadriceps muscle of patients infected with COVID-19 decreased on average by 18.5% between the first and seventh day of hospitalization, according to Mayer et al[24]. They added that the COVID-19 infection significantly reduced the large muscle groups' functional ca-

pacity[28]. Following COVID-19, the findings of Paneroni et al[29] showed that 73% of the infected individuals had a 69% reduction in quadricep strength.

Regarding the 7th item in the questionnaire, which asked about pain suffering, and the 8th item, which asked the question, "Does the pain affect the performance of daily activities?", the findings showed a significant link between COVID-19 and the increased occurrence of pain that causes a negative impact on ADL. There was a significant difference between both groups. These findings are consistent with Weng et al[26] as they stated that patients with COVID-19 are more prone to have headache and sore throat symptoms, abdominal pain, chest pain, and myalgia/arthralgia due to the invasion of the virus to different body systems. They added that patients with COVID-19 frequently have generic myalgia which might be caused by skeletal muscle injury[30].

Conclusions

COVID-19 has an impact on the risk of falls in older people above 65 years. So, the introduction of balance exercises to these subjects is of high importance to improve their balance and proprioception skills and decrease the fall risk. Many prospective studies of the effects of COVID-19 on elderly people's motor performance may be based on these findings. The current study depended only on the MAHC-10 in detecting the fall risk and there not any clinical investigation to correlate with it. As a result, this research ought to be conducted in the future using additional objective instruments to compare the balance between subjects who have been infected with COVID-19 and those who have not. Also, knowing whether these balance issues are only present for a short period of time or for an extended period would be helpful.

Conflict of Interest
The authors declare that they have no conflict of interests.

Ethics Approval
The Ethical Committee at Taif University approved the study on 8 April 2021 with approval No. 42-155.

Informed Consent
A written consent form was signed by each participant before completing the survey.

Data Availability
The data is available upon request to the corresponding author.

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