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The effect of simulated touch on vital signs, oxygen saturation, and pain in COVID-19 patients: An experimental study

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Abstract

Background and Aims: Considering the highly contagious nature of COVID-19 and the necessity of isolating affected patients with minimal human contact, taking measures such as use of latex gloves filled with lukewarm water seem beneficial as it mimics human touch and reduces isolation-related complications. This study aimed to determine the impact of using simulated touch on vital signs, oxygen saturation, and pain in COVID-19 patients.

Materials and Methods: This experimental study was conducted on 90 patients with COVID-19 hospitalized at Farhikhtegan hospital in Tehran, Iran, 2023. The participants were selected through random sampling method and divided into two groups of intervention and control. Variables including body temperature, heart rate, respiratory rate, systolic blood pressure, diastolic blood pressure, oxygen saturation, and pain were measured and compared in both groups before and after each intervention session. Kolmogorov-Smirnov, paired t-test, the Levene's, independent t-test, mixed analysis of variance, and linear regression were used for data analysis, which was carried out through SPSS-23 software.

Results: The interaction effect of intervention (two sessions with a 20-minute interval) and study groups (intervention and control) was significant only for oxygen saturation ($F=23.016$, $p<0.05$, $Eta2= 0.207$) and pain ($F=31.875$, $p<0.05$, $Eta2= 0.273$). In fact, latex gloves containing lukewarm water had a significant impact only on oxygen saturation and pain in COVID-19 patients.

Conclusion: The results demonstrated that stimulated touch can enhance oxygen saturation and alleviate pain in COVID-19 patients, thereby providing them with greater comfort and relief. Therefore, it is recommended to use alternative methods such as simulated touch in patients with limited touch.

Keywords: Touch, COVID-19, oxygen saturation, vital signs, pain.

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Introduction

Throughout history, humans have dealt with various diseases that affect different aspects of human life on both a national and global scale [1]. For instance, on February 11, 2020, the World Health Organization (WHO) officially named the novel coronavirus pneumonia as Coronavirus Disease 2019 (COVID-19). Simultaneously, the International Committee on Taxonomy of Viruses (ICTV) classified the new coronavirus as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), [2-3].

SARS-CoV-2 infection can remain asymptomatic or cause moderate to severe symptoms, leading to hospitalization. Approximately 20% of hospitalized patients develop acute respiratory distress syndrome (ARDS) and require treatment in the Intensive Care Unit (ICU), [4]. Studies have shown that being in the ICU can be highly stressful for patients, despite the existence of technologically advanced environments in ICUs aimed at better patient care [5-6]. Being in confined and restricted environments, characterized by sensory deprivation or overstimulation, can result in perceptual, cognitive, and emotional disturbances, which disrupt the patient's physiological balance [7]. Being in an unfamiliar ICU environment and separated from family members are the primary sources of patient anxiety, which can increase stress and alter the patient's vital signs [7-8]. Hospitalization in the ICU, along with complications such as anxiety, pain, restlessness, and fear of an unfamiliar environment, can affect hemodynamic stability, and raise blood pressure, pulse rate, and respiration rate. Changes in vital signs can easily affect various systems in the body, including the cardiovascular, pulmonary, and sympathetic nervous systems. On the other hand, control of vital signs is considered a valuable criterion for clinical decision-making and understanding the patient's physiological conditions [9-10].

To facilitate the recovery process and prevent sensory deprivation resulting from hospitalization in ICU, establishing a structured sensory stimulation program can be beneficial. These sensory stimulations may include visual, auditory, tactile, olfactory, gustatory, and balance stimuli [11]. Sensory stimulations activate the nervous system and prevent sensory deprivation, which can hinder patient recovery [12]. One of these sensory stimulations is touch. Touch is an essential aspect of healthcare that affects patient-healthcare worker relationship and the quality of care, and in some cases, it

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becomes an indicator of care quality [13]. Researchers have studied the effect of touch on the interaction between patients and healthcare providers in various ways [14]. Various studies have examined the effects of touch on vital signs and found that tactile stimulation can significantly improve them [15]. Findings suggest that touch can significantly improve pain, nausea, anxiety [16], respiratory rate, and arterial blood oxygen saturation levels in patients [17]. Touch can also reduce the length of hospitalization and, consequently, reduce hospital costs, making it a complementary therapy option. However, for various reasons, such as time constraints, a shortage of human resources, the use of advanced technologies, and the increasing complexity of required care, touch has received less attention, especially in the context of ICU [18]. It is worth noting that there is no evidence to show that sensory stimulation programs can be harmful to patients [19].

Touch is an inherent part of nursing interventions and is considered a fundamental aspect of patient-nurse interaction [17]. Before COVID-19 pandemic changing the landscape of healthcare, touching patients was a routine and ordinary aspect of daily professional duties for many healthcare providers. Physical therapists used touch during patient care and treatment [14]. However, with the spread of COVID-19 and the mandatory isolation that even families experienced, there has been a reluctance to use touch. This experience may affect the quality of care and professional well-being [20]. This study aimed to determine the impact of latex gloves containing lukewarm water on vital signs, oxygen saturation, and pain in COVID-19 patients.

Many studies have shown the benefits of touch in patient care, especially in sensory deprived patients. At the time of this study, we found no studies to examine the effects of simulated touch in COVID-19 patients. Given the limitations of touch in the context of COVID-19, using lukewarm water-filled gloves to mimic touch could help reduce physical and psychological distress in patients with minimal risk to healthcare providers. This method may also minimize the side effects of sensory deprivation, and helps to improve patient's vital signs. This study aimed to determine the impact of using latex gloves containing lukewarm water on vital signs, oxygen saturation, and pain in COVID-19 patients.

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Methods

This randomized experimental study with intervention and control groups conducted on 90 patients with COVID-19 hospitalized in the intensive care units of Farhikhtegan Hospitals affiliated with the Islamic Azad University of Medical Sciences, Tehran. The required sample size was calculated to be at least 36 patients in each group at a confidence level of 95% and a test power of 80%. Also, according to previous study of Zolfaghari, 2012(15), the effect size of systolic blood pressure was considered to be 2.31. Yet, for greater certainty and the possibility of sample attrition, 45 patients were considered for each group.

After obtaining a list of hospitalized COVID-19 patients, eligible patients were selected and randomly assigned a number. Patients with odd numbers were placed in the intervention group and patients with even numbers were placed in the control group. At the end, 45 patients were assigned to the intervention group and 45 in the control group. Inclusion criteria included a confirmed diagnosis of COVID-19, age of over 18 years, being alert, and exclusion criteria include diabetic retinopathy, diagnosed mental illness, disability, mental retardation, sensory disorder, or severe skin problems that could make the intervention harmful to patients.

Data collection tools included a self-reporting questionnaire consisting of demographic information and patient characteristics such as Medications used, history of previous COVID-19 infection, COVID-19 vaccination, and comorbidities. Standard instruments were used to measure vital signs, including a manual sphygmomanometer, a digital thermometer, and a pulse oximeter (SPO2), We had previously made sure the instrument was calibrated. Pain was measured using the VAS (Visual Analog Scale) scale.

The intervention involved simulated touch using latex gloves filled with about 320 cc lukewarm water at a temperature of 37 degrees Celsius (to simulate human body temperature), administered by a colleague. The ends of the gloves were tied and placed in the palms of patients during morning shifts. This intervention was carried out for a duration of 20 minutes, and then was repeated again after 20 minutes.

Before and immediately after the interventions, the patient's variables were measured and recorded. The variables included systolic and diastolic blood pressure, heart rate, respiratory rate, oxygen

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saturation, temperature, and pain. The gloves were removed while the variables were being measured and intervention was repeated in a 20-minute time interval (Figure 1).

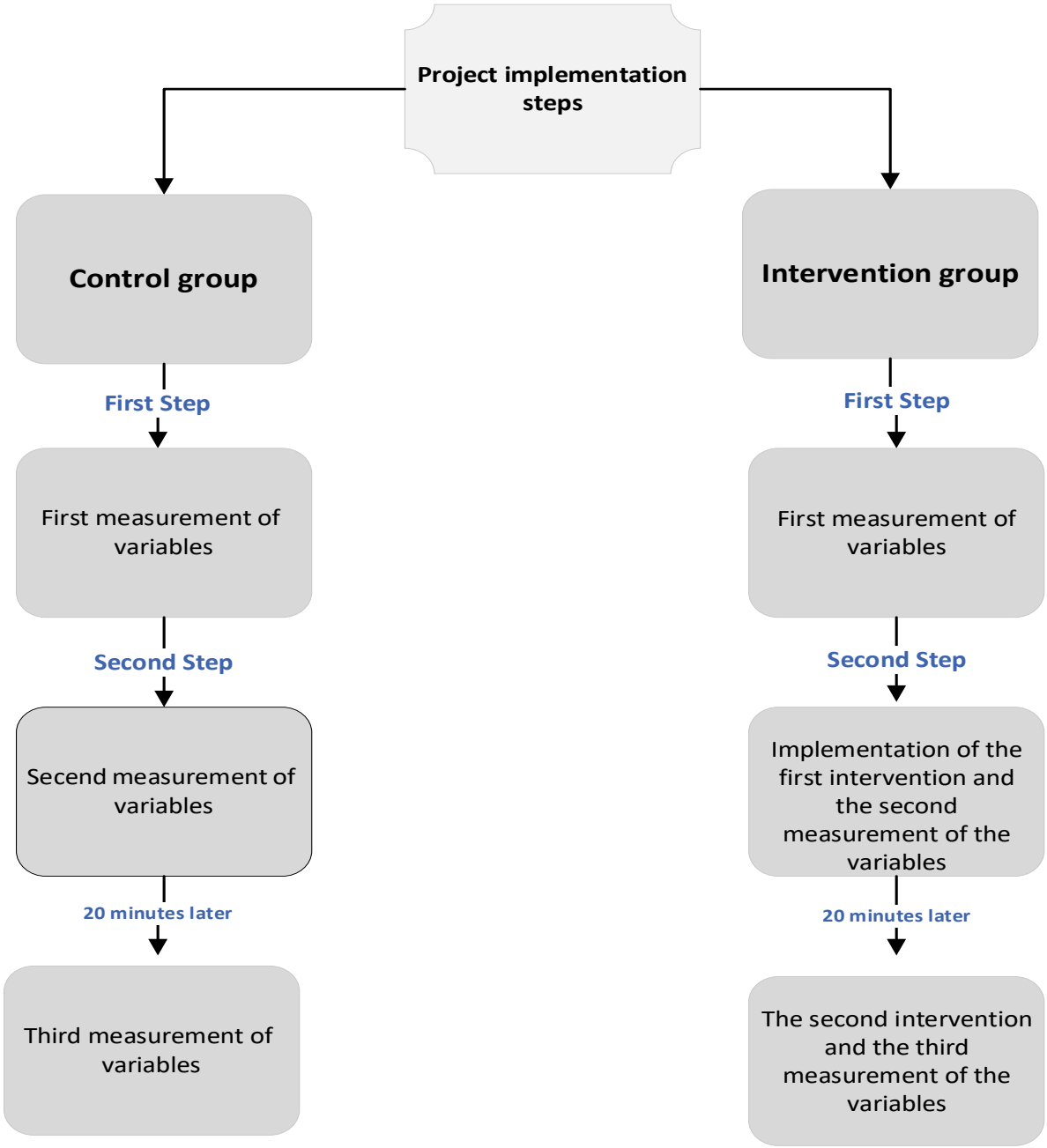

Figure 1: Project implementation steps

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For blinding, another person outside the study was used to collect the questionnaire and record vital signs, pain, oxygen saturation. The control group continued to receive routine care during the research. It is worth mentioning that after the intervention, a training on how to use touch stimuli along with related images and videos, was provided to patients in the control group as a compact disc so that they could use it if they wished to do so. Additionally, the researcher remained in contact with the patients via phone call and Internet to answer their possible questions.

This study was conducted after obtaining ethical approval from the Ethics Committee of the Islamic Azad University of Medical Sciences in Tehran, with the code: ID IR.IAU.TMU.REC.1401.059. Informed consent was also obtained from the patients.

Kolmogorov-Smirnov test and paired t-test were used to assess the normality of variables. The Levene's test was used to assess the homogeneity of variances, and independent t-test, mixed analysis of variance (one within-subjects factor and one between-subjects factor), and linear regression analysis were also used for data analysis, which was carried out through SPSS-23 software.

Results

As seen in table 1, there were 23 female (51.1%) patients in the control group, while in the intervention group, there were 28 female (62.2%) patients. The mean age of patients in the control group was 56.73 years (range of 39-99 years), and in the intervention group, it was 62.56 years (range of 25-92 years). According to the results of Kolmogorov-Smirnov test, there was no significant difference between the two groups in terms of demographic variables such as age, gender, marital status, educational level, and occupation (p>0.05), which is expected since sample selection and allocation were done randomly.

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Table 1: Comparison of demographic information between the intervention and control group

		p	Intervention Group n=45				Control Group n=45			
			Percent	Frequency			Percent	Frequency		
Sex	Female	0.265	62.2	28			51.1	23		
	Male		37.8	17			48.9	22		
			Maximum	Minimum	Std. Deviation	Mean	maximum	Minimum	Std. Deviation	Mean
Age			92	25	18.33	56.62	99	39	16.11	56.73

Kolmogorov-Smirnov test showed that for systolic and diastolic blood pressure, SPo2, temperature, heart rate, respiratory rate, and pain, the significant level was higher than 0.05 in the intervention and control groups. Therefore, the distribution of these variables was not significantly different between the COVID-19 patients. The parametric tests are also used to address the research objectives and hypotheses.

Table 2 shows that the interaction effect of intervention (two sessions) and groups (control and intervention) was significant only for oxygen saturation level (F=23.016, p<0.05 Eta2= 0.207) and pain (F=31.875, p<0.05 Eta2= 0.273). Latex gloves containing lukewarm water had a significant effect on the oxygen saturation level and pain of COVID-19 patients. There was a statistically significant difference between the intervention and control groups in terms of the oxygen saturation level and pain at the second and third measurements. The effect size of simulated touch was 0.207 for oxygen saturation level and 0.273 for pain. The results of Bonferroni post hoc test to examine the differences between the mean scores of oxygen saturation level and pain at different measurements, and the adjusted mean scores for the above variables in COVID-19 patients by intervention steps and groups are as follows:

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Table 2: Mixed variance analysis for the interaction effect of intervention stages and groups

	SS	df	MS	F	sig	Eta²
Systolic BP*	108.807	1.413	77.027	0.337	0.639	0.004
Diastolic BP	4.956	1.176	4.215	0.284	0.632	0.003
SPo2	29.696	1.523	19.499	23.016	0.000	0.207
Temperature	0.207	2	0.104	1.916	0.150	0.021
Pulse	661.356	1.018	644.335	2.392	0.062	0.028
Respiratory Rate	33.385	1.006	33.179	0.459	0.501	0.005
Pain	12.989	1.690	7.684	31.875	0.000	0.273

**Blood Pressure*
*** Sum of Squares*
**** Mean of Squares*

As seen in table 3, there was a significant difference between the oxygen saturation level at the "first to second" and "first to third" stages. In the third stage, there was a slight but statistically insignificant increase in oxygen saturation compared to the second stage. The adjusted mean score of oxygen saturation level in the first stage was 94.600, in the second stage was 95.389, and in the third stage was 95.533.

Table 3 shows a significant decrease in pain level between the "first to second," "first to third," and "second to third" stages. The adjusted mean score of pain level at the first stage was 1.070, in the second stage was 0.748, and in the third stage was 0.502.

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Table 3: Post hoc Bonferroni test to check the difference between the means scores of different measurements

	Steps	Averages Difference	standard error	Sig
SPo2	**1st to 2nd**: Pretest-Posttest	-0.789	0.108	0.001
	1st to 3rd: Pretest-Follow up	-0.933	0.149	0.001
	2nd to 3rd: Posttest -Follow up	-0.144	0.095	0.402
Pain	**1st to 2nd:** Pretest-Posttest	0.322	0.060	0.001
	1st to 3rd: Pretest-Follow up	0.567	0.082	0.001
	2nd to 3rd: Posttest -Follow up	0.245	0.062	0.001

These results for independent groups, as shown in Table 4, demonstrated a significant difference in systolic blood pressure (sig = 0.000), diastolic blood pressure (sig = 0.011), temperature (sig = 0.036), and pain (sig = 0.000) after the first stage of intervention in the intervention group compared to the second stage in the control group. The mean values of other variables did not show any significant difference ($p > 0.05$).

Table 4: Comparison of mean and variance of the variables in the intervention group after the first intervention and the control group of the second time measurement intervention

Variables	**Control Group**		**Intervention Group**		T-test			Levene's test	
	Mean	Std. Deviation	Mean	Std. Deviation	sig	df	t	sig	F
Systolic BP*	143.93	28.63	124.20	17.24	0.000	72.213	3.961	0.000	14.837
Diastolic BP	77.31	15.07	70.00	11.41	0.011	81.962	2.594	0.031	4.824
SPo2	94.93	2.64	95.84	2.00	0.068	88	-1.845	0.172	1.901
Temperature	36.38	0.53	36.64	0.65	0.036	88	-2.135	0.334	0.943
Pulse Rate	79.07	23.46	76.64	10.36	0.529	60.542	0.634	0.000	32.432
Respiratory Rate	16.36	2.73	16.93	1.36	0.208	64.421	-1.271	0.000	17.378
Pain	0.10	0.48	1.40	1.23	0.000	58.068	-6.580	0.000	72.282

**Blood Pressure*

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Results of t-test for independent groups, as shown in Table 5, revealed a significant difference in systolic blood pressure (sig = 0.010), diastolic blood pressure (sig = 0.005), SPo2 (sig = 0.007), and pain (sig = 0.000) after the second intervention in the intervention group compared to the third intervention in the control group. The mean values of other variables did not show any significant difference ($p > 0.05$).

Table 5: Comparison of mean and variance of the variables in the intervention group after the second intervention and the control group after the second time measurement

Variables	Control Group		Intervention Group		T-test			Levene's test	
	Mean	Std. Deviation	Mean	Std. Deviation	sig	df	t	sig	F
Systolic BP*	139.53	39.26	122.40	17.86	0.010	61.472	2.665	0.000	15.774
Diastolic BP	77.31	14.75	69.38	11.25	0.005	82.242	2.869	0.049	3.976
SPo2	94.80	2.92	96.27	1.98	0.007	77.437	-2.788	0.012	6.593
Temperature	36.38	0.53	36.51	0.55	0.246	88	-1.168	0.353	0.872
Pulse Rate	79.18	23.62	75.84	10.95	0.394	62.063	0.859	0.000	31.657
Respiratory Rate	16.56	2.81	16.76	1.30	0.666	62.014	-.434	0.000	18.451
Pain	0.07	0.34	0.93	1.05	0.000	53.749	-5.205	0.000	40.681

**Blood Pressure*

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Discussion

Based on the findings, a significant difference was observed in the levels of pain, oxygen saturation, heart rate, respiratory rate, and systolic and diastolic blood pressure of patients before and after using latex gloves containing lukewarm water in the intervention group (p<0.05). Temperature measurements before and after the intervention did not show a significant difference in the intervention group (p> 0.05). These results are consistent with the study of Ramada and colleagues (2013) that demonstrated the significant impact of touch therapy on reducing pulse and respiratory rate, especially in terms of pain relief and inducing relaxation compared to pre-intervention levels [21]. Another study by Marta and colleagues (2010) also showed that tactile stimulation led to pain reduction and improved sleep patterns in the elderly participants [22]. Davis and collogues (2020) also found that touch therapy resulted in significant changes in the hemodynamic status of patients and reduced their pain and restlessness. This method has a soothing effect and is considered a suitable complementary therapy [23].

Another systematic study showed that touch therapy significantly affected the vital signs of patients in the intensive care unit, resulting in a reduction in systolic and diastolic blood pressure, respiratory rate, and pain. Stress and restlessness of patients were also reduced. The results of these studies are consistent with the findings of present study [24]. The similar results can be attributed to the various types of touch therapy interventions.

Salavati and colleagues (2012) conducted a study with the aim of investigating the effect of planned meetings on the physiological indicators of hospitalized patients in the intensive care unit. The results showed that the intervention did not lead to significant changes in the physiological indicators of patients, which is contrary to the findings of present study [25]. Another study by Mehrnejad and colleagues (2014) also indicated that the presence of companions did not have an impact on the physiological indicators of hospitalized patients in the intensive care units [26]. The results of present study differ from these studies, which can be attributed to differences in the type of intervention used. Touch therapy, as opposed to interventions involving only meetings and companionship, had a more pronounced effect on the variables examined in the present study.

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Based on the findings, no significant difference was observed in the oxygen saturation, systolic and diastolic blood pressure, temperature, heart rate, respiratory rate, and pain of COVID-19 patients at the first and second measurements in the control group (p>0.05). The results of a study by Fakhr-Movahedi and colleagues (2015), entitled: "Investigating the effect of touch on the vital signs of restless patients under mechanical ventilation," showed no significant changes in vital sign parameters, including respiratory rate, temperature, and systolic and diastolic blood pressure before administrating the intervention, which is consistent with the results of present study [27].

As mentioned earlier, our results showed a significant reduction in pain levels in the intervention group, suggesting that the use of latex gloves containing lukewarm water can increase the comfort of patients. In another study conducted by Etkind and colleagues, which aimed to investigate the role of palliative care in improving COVID-19 patients, the care was found to have a significant effect on patients' ability to cope with stress and restlessness [28]. This is in line with the results of the present study. Similarly, in a study by Yekefallah and colleagues that aimed to determine the effect of hand touch on the vital signs of patients with traumatic brain injury in the ICU, the results showed that touch stimulation had an impact on reducing the pulse rate, respiratory rate, and blood pressure of patients. However, it did not affect the body temperature of the patients, which is consistent with the findings of the present study [18]. The only agreement between this study and the present one is observed regarding blood pressure, and the reasons for this might be differences in the interventions used or the study population. Other factors such as the pressure applied during touch, the duration of intervention, and the specific body area being touched are factors that can lead to different autonomic responses in the body. Therefore, variations in results across different studies can be justifiable.

In order to better monitor patients, measurements of variables were repeated 20 minutes after the end of intervention. The interactive effect of intervention stages and groups was significant only for oxygen saturation and pain. In fact, latex gloves containing lukewarm water had a significant effect only on the oxygen saturation and pain in patients with COVID-19. Engle and Graney's study showed that the use of touch therapy techniques had rapid effects on physiological and mental parameters, in a

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way that the intervention has immediate effects on reducing pulse rate and vascular constriction, which lasted only for 10 minutes [29]. In Zare and colleagues' study, immediate and 20-minute post-intervention differences were significant for pulse rate, respiration rate, and temperature compared to the pre-intervention stage, but there was no significant difference in systolic and diastolic blood pressure [8]. While these results are consistent with our findings in terms of some variables, such as blood pressure and temperature, we can see some discrepancies in results regarding heart rate in these studies. One possible reason for this might be the methodology used in each study, which yielded different results. Nevertheless, the study highlights the effects of touch as a complementary approach in pain and heart rate control. Therefore, the use of complementary treatments such as touch stimuli in the present study can be seen as a cost-effective non-pharmacological intervention that can provide many therapeutic and care benefits to patients. It is worth mentioning that although the effect of touch on physiological and autonomic cardiovascular parameters was considerable in the above study, almost no completely consistent results are observed among these studies, and the influence of confounding factors should be considered.

One of the limitations of the present study, given the nature of COVID-19 and respiratory distress, may have been difficulty in obtaining questionnaire-related information. On the other hand, due to the peak periods and reduced COVID cases, accessing samples was challenging.

Conclusion

This study aimed to determine the impact of latex gloves containing lukewarm water (Simulated Touch) on vital signs, oxygen saturation, and pain in COVID-19 patients. Touch therapy, as a scientific complementary approach, has been used by nurses to provide comfort and relief to patients, and also to reduce patient's pain in clinical settings. Therefore, the use of appropriate interventions for controlling patient's conditions appears to be essential.

The results demonstrated a significant effect of simulated touch on oxygen saturation and pain in patients with COVID-19. Indeed, oxygen saturation and pain in patients with COVID-19 at the second and third measurements in the intervention group showed significant changes compared to the control group. Despite the emphasis on pharmacological treatments, our results

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indicate that complementary and non-pharmacological treatments such as suitable touch stimulation can lead to the control of vital signs and pain in COVID-19 patients, providing greater comfort and relief for them. Due to the high workload and shortage of nursing staff, as well as in some cases restrictions on physical contact with patients, it is recommended to use alternative methods, such as simulated touching on the patient's clinical care.

While positive effects of the intervention were evident in this study, there are multiple confounding variables that can lead to differences in research results in different locations and times. Due to the uncertain physiological pathways and intermediary effects of touch, there are no consistent and uniform studies to suggest that tactile stimulation can be beneficial for vulnerable individuals. Therefore, since different studies have shown different results regarding the effects of various touch therapy methods, especially on vital signs and arterial oxygen levels, it is recommended to conduct more extensive research in different settings to examine these physiological parameters. This can enhance the generalizability of our results and provide more reliable findings.

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Conflict of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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