COVID-19 Pandemic Effect on Maternal Stress Level: An Integrative Literature Review

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COVID-19 팬데믹 상황이 임신부의 스트레스에 미치는 영향: 통합적 문헌고찰

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Abstract This study aimed to determine the characteristics of maternal stress during the COVID-19 pandemic. This review collected data from May 1 to August 10, 2023, focusing on literature published from 2020 on wards in English or Korean using key biomedical (PubMed, Embase, Cochrane Library, and CINAHL) and major Korean databases (RISS, KISS, and the National Library of Korea). The searched terms were "pregnan*," "maternity," "COVID," "corona," "pandemic," "infection," and "stress," as well as their Korean equivalents. In total, 13 papers were selected. The maternal stress level generally increased during the COVID-19 pandemic. The primary factors affecting maternal stress were the medical, psychological, and socio-economic factors. Interventions for stress reduction in pregnant women during the pandemic were found to be effective, such as online education and training This study can be used as a reference for developing stress reduction programs to prepare for novel infectious disease emergencies.

Key Words : COVID-19, Pandemic, Pregnant women, Stress, Literature review

요 약 본 연구는 통합적 문헌고찰을 통해 COVID-19 팬데믹 상황에서의 임신부 스트레스의 특징을 파악하고자 하였다. 자료수집은 2020년부터 출간된 문헌 중 영어 또는 한글로 발표된 논문들을 대상으로 2023년 5월 1일부터 2023년 8월 10일까지 수행하였다. 문헌검색은 PubMed, Embase, Cochrane library, CINAHL의 국외 검색엔진과 RISS, KISS, 국회도서관의 국내 검색엔진을 사용하였는데, 'pregnan*', 'maternity', 'COVID', 'corona', 'pandemic', 'infection', 'stress'코로나, '팬데믹', '감염', 및 '스트레스'의 검색어를 조합하여 실시하였고, 질평가를 거쳐 최종 13편의 문헌이 선정되었다. COVID-19 팬데믹 상황에서 임신부 스트레스 정도는 대체로 증가하였으며, 임신부 스트레스 주요 요인으로는 임신부의 의학적 상태, 정신심리적 요인, 사회경제적 요인이 있었다. COVID-19 팬데믹 상황 하에서 임신부를 대상으로 이루어진 스트레스 감소 중재는 비대면 교육 및 훈련이 효과적인 것으로 나타났다. 본 연구결과를 바탕으로 신종 감염재난 상황을 대비할 수 있는 스트레스 감소 프로그램 개발의 토대가 될 수 있을 것이라 사료된다.

키워드 : COVID-19, 팬데믹, 임신부, 스트레스, 문헌고찰

1. Introduction

Coronavirus Disease 2019 (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus. In March 2020, the World Health Organization(WHO) declared COVID-19 as a "pandemic" [1], and persisted for over 3 years and 4 months, was finally an "endemic" in May 2023, thus ending this public health emergency. However, with the impact of COVID-19 and the effectiveness of prevention and control strategies continuously monitored, it remains a prioritized public health issue [2].

The COVID-19 pandemic has left a significant global socio-economic mark, including changes in daily life and the physical and mental health of individuals [3-5]. The common psychological reactions closely associated with COVID-19 infection included fear, anxiety, frustration, boredom, loneliness, insufficient supplies, inadequate information, and inability to express emotions were identified as related risk factors [4].

People with underlying diseases, pregnant women, and parents with young children were found to experience a high level of fear [1,4]. Furthermore, pregnancy is a vulnerable period for infectious diseases due to significant changes in physiological parameters and immune system. It is also considered a risk factor for serious comorbidities of COVID-19 [6,7]. Thus, pregnant women infected with COVID-19 had higher rates of ICU admission and mechanical ventilation than non-pregnant women, and increased need for extra-corporeal membrane oxygenation (ECMO) along with a higher risk of death [8,9]. In addition, it has been associated with preeclampsia, preterm birth, gestational diabetes, and low birth weight [9-11].

Pregnancy and childbirth are delightful experiences for women, but many experience symptoms of depression and anxiety due to pregnancy related hormonal changes. Moreover, a viral pandemic can trigger a series of mental health problems, exacerbating the emotional instability that pregnant women already experience [12]. Thus, most research related to COVID-19 in pregnant women has focused on its impact on mental health. In addition, the prolonged pandemic has led to an increased incidence of emotional stress, a weakening of social support systems, and an increase in psychological disorders, posing a significant threat to public mental health [4]. The primary mental health risk factors for pregnant women include the fear of infection transmission to the fetus, cancellation of prenatal checkups, and restrictions on the presence of caregivers during or after childbirth, leading to heightened stress levels regardless of pregnancy [12].

During the COVID-19 pandemic, the prevalence of stress, anxiety, and depression among the general population increased to 29.6%, 31.9%, and 33.7%, respectively, high-lighting the profound impact of the novel virus on the mental well-being of community members [5]. The mental health of pregnant women, was further exacerbated by the limited data on the specific pregnancy-related consequences of the novel virus, intensifying fear and diminishing a sense of control. Studies on the mental health of pregnant women during the COVID-19 pandemic have observed increased various emotional stress responses, including anxiety, depression, and other negative emotions [4,12-14]. In addition, qualitative research on the pandemic-related experiences of pregnant women has revealed that they experienced extreme stress during this period [15] and that elevated stress levels have been linked to increased emotional instability, a decline in adherence to prenatal care, and an increased risk of pregnancy complications, such as gestational hypertension, sleep disorders, low birth weight, and preterm birth [11,16]. For example, a study investigating stress and quality of life in the context of the COVID-19 pandemic has established a correlation between stress induced by COVID-19 and poor quality of life [17]. Stress experienced during pregnancy can have detrimental repercussions for both mother and fetus. While most research to date has focused on the im-

pact of mental health problems on pregnant women during the COVID-19 pandemic [12-14], there is a pressing need for an integrative literature review to comprehensively analyze the stress factors influencing pregnant women during this challenging period.

A comprehensive analysis of the stress experienced by pregnant women during the COVID-19 pandemic can provide essential data for enhancing support systems. This data can be instrumental in alleviating stress, promoting health, and improving the overall pregnancy experience. Furthermore, the results of this study could be pivotal in developing intervention programs aimed at reducing stress and improving the health of pregnant women during an infectious disease pandemic.

This study aimed to conduct an integrative literature review to comprehensively characterize maternal stress during the COVID-19 pandemic by analyzing the characteristics of literature related to stress in pregnant women, and characteristics of stress and its influencing factors in pregnant women during the COVID-19 pandemic. The results of this study can be used as a reference for developing effective stress management interventions in pregnant women during an infectious disease pandemic.

2. Materials and Methods

2.1 Research design

This study utilized an integrative literature review methodology to systematically gather, analyze, and synthesize relevant literature on stress among pregnant women amidst the COVID-19 pandemic, adhering to the five stage framework proposed by Whittemore and Knafl [18]: Problem identification, literature search, data evaluation, data analysis, and presentation.

2.2 Research questions

The research questions posed in this study are: "What are the stress symptoms experienced by preg-

nant women during the COVID-19 pandemic?" and "How can pregnant women's stress be managed during the COVID-19 pandemic?" To address these core questions, the study was structured with the following constituents: the subjects were women who were pregnant during the COVID-19 pandemic; the study encompassed a range of survey-based, interventional, and qualitative research designs relevant to the research questions. There were no specific restrictions regarding the comparison groups and focused on evaluating the stress levels and characteristics of the participants.

2.3 Data collection

This study was approved by the Institutional Review Board of Baekseok University (BUIRB-202305-HR-010). Data collection was performed from May 1 to August 10, 2023. Articles published in English or Korean from January 2020 to April 2023 were searched in international databases (PubMed, Embase, Cochrane Library, and CINAHL) using keywords, such as "pregnan*," "maternity," "COVID," "corona," "pandemic," "infection," and "stress" as search terms, and in Korean databases (RISS, KISS, and the National Library of Korea), using "코로나," "팬데믹," "감염," and "스트레스."

2.4 Inclusion and exclusion criteria

This review included articles published in academic journals, those written in English or Korean, those focusing on women who were pregnant during the COVID-19 pandemic, and those articles on stress as a variable. We excluded articles without original or full text access, those that did not distinguish between pre and postpartum periods, those articles on unpregnant women during the COVID-19 pandemic period, those unpublished thesis or conference papers, and editorials, editor comments, literature reviews, meta analysis studies, and tool studies.

The initial search yielded 3,026 papers: 566 from PubMed, 725 from Embase, 513 from Cochrane
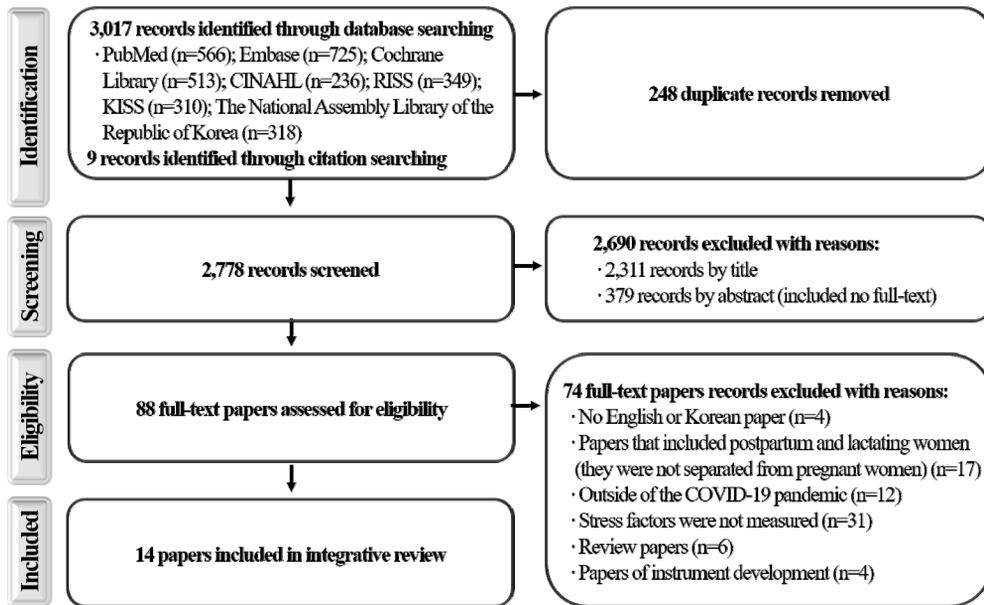
Fig. 1. Prisma Flowchart of study selection process for integrative review

Library, 236 from CINAHL, 349 from RISS, 310 from KISS, 318 from the National Library of Korea, and 9 through citation searching. After removing 248 duplicates and 2,690 articles deemed irrelevant in the title/abstract screening, 88 papers were selected for full-text review. Following a full-text eligibility assessment by two researchers and reaching inter-rater consensus, a total of 14 papers were finally selected for the integrative review (Fig. 1).

2.5 Quality assessment of selected literature

The quality assessment of the 14 selected studies, comprising 12 quantitative and 2 qualitative studies, was conducted using the Joanna Briggs Institute (JBI) Critical Appraisal Tools [19]. Each study was evaluated according to its research methodology, employing the respective checklists: Critical appraisal checklist for analytical cross-sectional studies (8 items) cohort studies (11 items), quasi-experimental studies (9 items), randomized controlled trials (13 items), and qualitative research (10 items). The quality assessment was based on the ratio of 'yes' responses to the total number of items for each

checklist, expressed as a percentage. Studies scoring ≥70% were selected for inclusion. The inter-rater agreement rate was approximately 94%, and any differences in evaluating items were resolved through discussion. Thus, only one RCT paper with an evaluation score of 61.5% was excluded, leaving 13 papers for the final analysis. Detailed assessments are presented in Table 1.

2.6 Data analysis and presentation

To systematically examine the characteristics, influencing factors, and stress reduction interventions for pregnant women during the COVID-19 pandemic, each selected study was subjected to meticulous scrutiny, with its key findings subjected to rigorous analysis. The data analysis process was initially standardized based on the review of two earlier articles, followed by the categorization and identification of the characteristics of the extracted data by the researchers. Collaborative discussions during regular research meetings finalized the synthesis of results. The final synthesis was organized into two primary categories: the stress level and the influenc-

Table 1. Critical appraisal of the selected studies

Studies	1. Analytical cross-sectional studies								
	1-A	1-B	1-C	1-D	1-E	1-F	1-G	1-H	Score(%)
Mei et al. (2021)	Y	Y	Y	Y	U	U	Y	Y	75
Meaney et al. (2022)	Y	Y	Y	Y	U	U	Y	Y	75
Lobel et al. (2022)	Y	Y	Y	Y	U	U	Y	Y	75
Lebel et al. (2020)	Y	Y	Y	Y	Y	U	Y	Y	87.5
Matvienko-Sikar et al. (2020)	Y	Y	Y	Y	U	U	Y	Y	75
Davis et al. (2023)	Y	Y	Y	Y	Y	Y	Y	Y	100
Masjoudi et al. (2022)	Y	Y	Y	Y	Y	Y	Y	Y	100

Studies	2. Cohort studies										
	2-A	2-B	2-C	2-D	2-E	2-F	2-G	2-H	2-I	2-J	2-K	Score(%)
Zilver et al. (2021)	Y	Y	Y	Y	U	Y	Y	Y	U	Y	Y	81.8

Studies	3. Quasi-experimental studies								
	3-A	3-B	3-C	3-D	3-E	3-F	3-G	3-H	3-I	Score(%)
Hashemzahi et al. (2022)	Y	Y	Y	Y	Y	Y	Y	Y	Y	100

Studies	4. Randomized controlled trials												
	4-A	4-B	4-C	4-D	4-E	4-F	4-G	4-H	4-I	4-J	4-K	4-L	4-M	Score(%)
Puertas-Gonzalez et al. (2022)	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	Y	Y	84.6
Guney et al. (2022)	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	Y	Y	84.6
Moosavi Khosravi et al. (2022)	U	U	Y	U	U	Y	U	Y	Y	Y	Y	Y	Y	61.5

Studies	5. Qualitative research									
	5-A	5-B	5-C	5-D	5-E	5-F	5-G	5-H	5-I	5-J	Score(%)
Mortazavi & Ghardashi (2021)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	100
Yang & Cho (2023)	Y	Y	Y	U	Y	Y	Y	Y	Y	Y	90

1-A=Clarity of criteria included in the sample; 1-B=Detailed description of the research topic and setting; 1-C=Whether the exposure was measured in a valid and reliable way; 1-D=Use of objective and standard criteria for measurement of condition; 1-E=Identification of confounding factors; 1-F=Description of strategies for dealing with confounders; 1-G=Whether the outcomes were measured in a valid and reliable way; 1-H=Use of appropriate statistical analysis; 2-A=Whether the two groups were similar and recruited from the same population; 2-B=Whether the exposures measured similarly to assign people to both exposed and unexposed groups; 2-C=Whether the exposure measured in a valid and reliable way; 2-D=Identification of confounding factors; 2-E=Whether strategies to deal with confounding factors stated; 2-F=Whether the groups/participants were free of the outcome at the start of the study; 2-G=Whether the outcomes were measured in a valid and reliable way; 2-H=Whether the follow up time was reported and sufficient to be long enough for outcomes to occur; 2-I=Whether follow up was complete (if not, whether the reasons to loss to follow up were described); 2-J=Whether strategies to address incomplete follow up were utilized; 2-K=Use of appropriate statistical analysis; 3-A=Clearance of cause and effect; 3-B=Whether the participants were included in any comparisons similar; 3-C=Whether the participants were included in any comparisons receiving similar treatment, other than the intervention of interest; 3-D=Whether there was a control group; 3-E=Whether there were multiple measurements of the outcome both pre and post the intervention; 3-F=Complement of follow up (if not, whether differences between groups in terms of their follow up were adequately described and analyzed); 3-G=Whether the outcomes of participants were included in any comparisons measured in the same way; 3-H=Use of appropriate statistical analysis; 4-A=True randomization use for assignment of participants to treatment groups; 4-B=Whether allocation to treatment groups was concealed; 4-C=Whether treatment groups were similar at the baseline; 4-D=Whether participants were blind to treatment assignment; 4-E=Were those delivering the treatment blind to treatment assignment; 4-F=Whether treatment groups were treated identically other than the intervention of interest; 4-G=Whether outcome assessors were blind to treatment assignment 4-H=Whether outcomes were measured in the same way for treatment groups; 4-I=Whether outcomes were measured in a reliable way; 4-J=Whether follow up was complete (if not, whether differences between groups in terms of their follow up were adequately described and analyzed); 4-K=Whether participants were analyzed in the groups to which they were randomized; 4-L=Use of appropriate statistical analysis; 4-M=Whether the trial design was appropriate and any deviations from the standard RCT design were accounted for in the conduct and analysis of the trial; 5-A=Congruity between the stated philosophical perspective and the research methodology; 5-B=Congruity between the research methodology and the research question or objectives; 5-C=Congruity between the research methodology and the methods used to collect data; 5-D=Congruity between the research methodology and the representation and analysis of data; 5-E=Congruity between the research methodology and the interpretation of results; 5-F=Whether there is a statement locating the researcher culturally or theoretically; 5-G=Whether the influence of the researcher on the research, and vice-versa is addressed; 5-H=Whether participants and their voices are adequately represented; 5-I=Whether the research is ethical according to current criteria; 5-J=Whether the conclusions drawn in the research flow from the analysis or interpretation of the data; Y=Yes; N=No; U=Unclear

ing factors for stress experienced by pregnant women during the COVID-19 pandemic. Subtopics within each category were identified, and the key findings from the original data corresponding to these sub-

topics were described in detail.

3. Results

3.1 General characteristics of the selected articles

All thirteen selected studies were published in 2020 or later. Two studies employed qualitative methodologies, while eleven used quantitative approaches. Regarding research design, cross-sectional studies were predominant with seven articles. The remaining six comprised one cross-sectional cohort study, two randomized controlled trials (RCTs), one quasi-experimental study, and two phenomenological studies. Geographically, the studies spanned diverse regions: two originated from North America (one from the USA and one from Canada), five from Europe (one from Spain, one from Turkey, two from Ireland, and one from the Netherlands), one from Oceania (Australia), and five from Asia (one from China, three from Iran, and one from South Korea). Nursing interventions evaluated in the RCTs included online cognitive behavioral therapy (o-CBT), mindfulness based stress reduction (MBSR) program, and self-care training via telemedicine in a quasi-experimental study. Concerning the group configuration, seven studies [A4, A5, A7, A9, A10, A12, and A14] conducted individual surveys of pregnant women during the COVID-19 pandemic without a control group, including in-depth interviews. Three studies [A1, A8, and A11] compared pregnant women's stress levels before and during the pandemic, and the remaining three utilized randomly selected control groups. Most studies (n=11) included pregnant women regardless of their COVID-19 infection status. Of the remaining two studies, one [A3] focused on pregnant women diagnosed with COVID-19, while the other [A6] excluded those infected with COVID-19.

The most frequently used stress measurement tool was the Perceived Stress Scale (PSS), which was utilized in five studies. The Pandemic Related Pregnancy Stress Scale (PREPS) and the Depression, Anxiety and Stress Scale (DASS-21) were employed in one study each. The Revised Prenatal Distress Questionnaire (NuPDQ) was notably featured in four studies, including cases where it was used in conjunction with PSS and PREPS. Furthermore, four studies utilized qualitative open-ended questions to specifically explore aspects of stress related to COVID-19.

3.2 Stress levels in pregnant women during the COVID-19 pandemic

The stress level in pregnant women during the COVID-19 pandemic widely varied according to the tools employed in each study. First, among the studies using the PSS, one study reported a high perceived stress levels of 49.3% during the pandemic [A13], while another study found lower stress levels during the pandemic (60.45%) compared to before the pandemic (69.39%) [A1]. Another study that measured COVID-19 related stress as a mean value (M) found a significantly higher mean COVID-19 related stress level compared to the mean stress level irrespective of COVID-19 (15.61 vs. 10.28, $p < 0.001$) [A8]. Studies examining the effectiveness of intervention programs for pregnant women during the pandemic showed that o-CBT and COVID-19 self-care training via telemedicine reduced stress levels post-intervention. The o-CBT intervention reduced PSS from 27.7 (pre-intervention) to 21.5 (post-intervention) (p=.001) [A3], and the telemedicine program reduced PSS from 28.5 (pre-intervention) to 25.3 (post-intervention) (p=.005) [A6].

Second, studies using the NuPDQ showed an increase in pregnancy related stress during the pandemic (M=14.0) compared to the pre-pandemic period (M=12.8) (p=0.028) [A11]. In another study, the mean stress level in pregnant women in the experimental group of the online MRSR program was significantly reduced compared to the control group

(7.47 vs. 13.97, p<0.001) [A3].

Third, in a study employing the PREPS, stress levels among pregnant women in Western high income countries were measured, distinguishing between PREPS-Preparedness and PREPS-Infection. This approach yielded mean values of 3.30 for PREPS-Preparedness and 3.05 for PREPS-Infection, revealing considerable variations across countries. PREPS-Preparedness scores were highest in Poland (M=3.46), followed by Spain (M=3.44) and the USA (M=3.46), with Switzerland recording the lowest (M=2.62). For PREPS-Infection, the highest scores were observed in Spain (M=3.40), then the USA (M=3.27) and Poland (M=2.99), with the lowest again in Switzerland (M=2.46) [A5]. Final-ly, in the study utilizing the DASS-21, the mean stress level during the COVID-19 pandemic was calculated at 6.0 [A12].

In one of the two qualitative studies focusing on the experiences of pregnant women during the COVID-19 pandemic, the theme of "the disruption of peace and daily life" emerged. This theme encapsulated subthemes of intense stress experiences, characterized by fear, anxiety, depression, and loneliness [A9]. The other study derived "stress due to controlled life" as a prevailing theme of stress among pregnant women during the pandemic [A10]. This theme included subthemes, such as restrictions in daily life due to infection prevention measures, the burden of expectations from those around them, and an increase in physical exertion [A10].

3.3 Factors influencing stress in pregnant women during the COVID-19 pandemic

3.3.1 Biological factors

In this study, the age of the pregnant woman, gestational age, obstetric history, and certain medical conditions have been identified as biological factors, with the medical conditions, including high-risk pregnancy and vaginal bleeding. A review of the literature revealed that three articles dis-

cussed these biological factors.

Two studies suggested that the age of pregnant women during the pandemic could be a factor influencing stress, with findings showing that older maternal age correlated with lower stress scores [A5, A12]. Furthermore, gestational age was found to have a weak association with stress and mental health variables (p=0.03) [A5]. Regarding obstetric history, nulliparous women were found to experience significantly higher levels of pandemic and pregnancy related stress (p <0.01) [A5]. A particularly high stress level was associated with high-risk pregnancy (p <0.001) [A5], and an increase in stress levels was also observed in cases of vaginal bleeding (p <0.05) [A1]. These findings indicate that bio-logical factors, such as maternal age, obstetric history, and the presence of high-risk pregnancy conditions are significant contributors to the stress levels experienced by pregnant women during the pandemic.

Table 2. Stress influencing factors

Category	Factor
Biological factors	Age, gestational age, obstetric history, and medical conditions (high-risk preg-nancy and vaginal bleeding)
Psychological factors	Anxiety, depression, fear, and loneliness
Socio-economic factors	Social restrictions, decreased household income and increased consumption, changes in social support system, and inaccurate information

3.3.2 Psycho-social factors

Unstable emotions, such as anxiety, depression, and fear, were identified as psycho-social factors in this study. Eight articles discussed anxiety and depression in relation to stress [A1, A5, A7, A8, A9, A10, A12, and A13], with the majority showing a close correlation between stress and these emotional states [A1, A5, A7, A12, and A13].

In studies that compared stress levels, depression, and anxiety in pregnant women before and during the COVID-19 pandemic, an increased risk of depression during the pandemic was observed, linking the pandemic to heightened maternal depression

Table 3. Summary of characteristics of selected studies

No	Author (year)	Country	Design	Population	Related variable	Instruments	Major findings
1	Mei et al. (2021)	China	Cross-sectional study	NCP(Novel Coronavirus-pregnant Cohort) :531, HBC(Healthy Baby Cohort): 2352	Demographic information(BMI, education level, parity) anxiety,depression vaginal bleeding	PSS(Perceived Stress Scale)	– The participants in the HBC study exhibited a higher stress rate (69.39%) compared to those in the NCP study (60.45%) (p ⟨0.05). – During the COVID-19 pandemic, pregnant women were found to have a higher risk of depression and a lower rate of stress (p ⟨0.05).
2	Puertas-Gonzalez et al. (2022)	Spain	RCT	207 pregnant women (o-CBT =70, o-PS=69, UC=68)	Online cognitive behavioral therapy, resilience	PSS PDQ	Pregnant women in the o-CBT group not only had lower rates of pregnancy related stress and perceived stress (F=5.02, p ≤.007), but also had higher resilience (F=7.08, p ≤.07) and lower levels of anxiety, depression, and obsession symptoms (⟨0.20).
3	Güney et al. (2022)	Turkey	RCT	84 pregnant women(experimental group :42, control group:42)	MRSR program, Prenatal distress, anxiety, childbirth attitudes	NuPDQ(Revised Prenatal Distress Questionnaire)	– Upon completion of the MBSR program, the experimental group of pregnant women showed significantly lower mean scores for stress, anxiety, and fear of childbirth compared to those in the control group (p ⟨ 0.001). – The MBSR program reduced levels of prenatal distress (t=5.129, p ⟨0.001), anxiety (t=5.442 p ⟨0.001), and fear of child-birth (t=6.357, p ⟨0.001).
4	Meaney et al. (2022)	Ireland	cross-sectional survey	573 pregnant women	Pregnancys-specific stress, social support, altered social network, concerns related to COVID19, occupational & financial concerns, physical manifestations	Qualitative open-ended questions about stress	Lack of access to COVID-19 prenatal care and reduced perceived social support likely contributed to an increase in pregnancy-related stress (beta=.-.29, p ⟨0.001).
5	Lobel et al. (2022)	USA	cross-sectional survey	8148 Pregnant women (Ger-many=1,179 Israel=1,090 Italy=120 Poland=1,050 Spain=201 Switzer-land=120 USA=4,388)	Anxiety, depressive	PREPS NuPDQ	– Stress exhibited a moderate to strong correlation with anxiety and depression, with correlation coefficients ranging from 0.26 to 0.50 (p ⟨0.001). – Age and gestational age were inversely correlated with stress (p ⟨0.001 and p ⟨0.05, respectively). – Women with high-risk pregnancies displayed significantly elevated stress levels compared to those with low-risk pregnancies (p ⟨0.001).
6	Hashemzahi et al. (2022)	Iran	RCT Quasi-experimental study	100 pregnant women	COVID-19 self-care training via telemedicine, anxiety	PSS	After the intervention, the mean PSS score of the intervention group (25.34±6.63) decreased significantly compared to the control group, demonstrating the effectiveness of COVID-19

						self-care training via telemedicine in reducing perceived stress and anxiety in pregnant women during the corona-virus pandemic.
7	Lebel C et al. (2020)	Canada	cross-sectional survey	1987 pregnant	Depression, anxiety social support physical activity	Questionnaire (concerns due to COVID-19 with the following statement) COVID-19 stressors measures on a scale of 0-100	- After the intervention, the mean PSS score of the intervention group (25.34 ±6.63) decreased significantly compared to the control group, demonstrating the effectiveness of COVID-19 self-care training via telemedicine in reducing perceived stress and anxiety in pregnant women during the coronavirus pandemic. - COVID-19 related stressor factors include job loss, threat to life (46.4%), threat to baby's life (51.7), strained relationship with partner (56.3), social isolation (64.1), and concern about not receiving necessary treatment (35.7)
8	Zilver et al. (2021)	Netherlands	Cross-sectional cohort study	1466 pregnant women	Anxiety, depression	PSS-10	- No differences were observed in clinically high levels of anxiety (HADS-A ≥19) and depression (HADS-D ≥19) between women pregnant during and before the COVID-19 pandemic. - Women pregnant during the COVID-19 pandemic showed significantly higher PSS-10 scores compared to women pregnant in the pre-COVID-19 period (p <0.001)
9	Mortazav et al.(2021)	Iran	pheno-menological study	19 pregnant women	Fear, anxiety, depressive, loneliness	In-depth interview(Qualitative open-ended questions)	Four themes were derived: disturbed tranquility of everyday life and routines, new challenges caused by the pandemic, resilience, and strength during crisis, and adaptation to new conditions.
10	Yang&Chol. (2023)	South korea	pheno-menological study	12 pregnant women	Burden and limited daily life physical labor	In-depth interview(qualitative open-ended questions)	The semantic categories underlying pregnant women's stress experience during the COVID-19 pandemic were derived into 4 themes and 12 sub-themes: 1) Confusion caused by inaccurate information, 2) Collapse of antenatal care, stress caused by a controlled life, 3) Manifestations of physical, and 4) Mental adaptation
11	Matvienko & Ghardashi (2022)	Ireland	Cross-sectional study	Pregnant women over the age of 18 years (235 pregnant women during COVID-19/ 210	Sociodemographic data (age, nationality, relationship status, gestation, parity, and the number of other children), antenatal	NuPDQ(using the Revised Prenatal Distress Questionnaire)	Women pregnant during the pandemic had lower social support (t=3.86, p <0.005) and higher stress (t=-2.19, p=0.028) than women who were pregnant before the pandemic.

				pregnant women before COVID-19)	stress, social support, health behavior, and stress reduction strategies		Differences between levels of pandemic related restrictions are not statistically significant.
12	Davis et al. (2023)	Australia	cross sectional study	1668 women	Demographics, maternity care, anxiety, stress, and depression, social support	Anxiety and Stress Scales-short form, DASS-21	19% of participants experienced moderate to high anxiety levels and 15.5% experienced stress. The biggest contributing factors to high anxiety, stress, and depression scores were pre-existing mental health conditions, followed by financial difficulties and current pregnancy related complications.
13	Masjoud et al. (2022)	Iran	cross-sectional study	215 pregnant women	Demographics, Pregnancy Self-Care Scale, Fear of COVID-19, COVID-19 Anxiety, Perceived Stress	PSS	Correlation analysis results: fear (r = 0.20; P = 0.004) and anxiety (r = 0.14; P = 0.03) slightly positively correlated with self management; no significant correlation, with only a slight negative correlation (r = −0.14; P = 0.04), between perceived stress and self management − Regression analysis results: 11% of the variance in self-management explained by the three independent variables (β = 0.130, SE = 0.043, P = 0.002).

Abbreviations: NCP: Novel Coronavirus-pregnant Cohort; HBC: Healthy Baby Cohort; PSS: Perceived Stress Scale; RCT: Randomized Controlled Trials; o-CBT: Online Cognitive Behavioral Therapy; o-PS: Online Psychological; UC: Usual Care; MRSR: NuPDQ: Revised Prenatal Distress Questionnaire; PREPS: Pandemic –Related Pregnancy Stress Scale

and stress (p <0.05) [A1]. However, there was no significant change in anxiety levels before and after the pandemic [A1]. In addition, a cohort study comparing pregnant women during and before the COVID-19 period found no significant difference in clinically high anxiety levels (HADS-A ≥19) and depression (HADS-D≥19) among pregnant women during (19.5% and 13.2%, respectively) and before (23.1% and 15.7%, respectively) the COVID-19 period [A8].

Stress among pregnant women from Western high-income countries exhibited a moderate to strong correlation with symptoms of anxiety and depression (rs=0.26-0.50, ps <0.001) [A5]. American women reported the highest frequency of anxiety symptoms, fol-lowed by German and Polish women, while the lowest frequency was observed in Israel. Polish women reported the highest frequency of depression symptoms, followed by Ger-man and American women, with Israel and Switzerland exhibiting the lowest frequency [A5]. A study involving Canadian pregnant women revealed that 37.0% experienced an increased risk of clinical depression, and 56.6% exhibited higher clinical anxiety levels. These increased levels of depression and anxiety were found to be directly associated with COVID-19 related stress [A7]. Furthermore, a direct and significant correlation was ob-served between perceived stress and fear and anxiety about COVID-19 (r=50; medium effect; p <0.001 and r=0.48; medium effect; p <0.001, respectively) [A13].

Content analysis of open-ended questions revealed concerns related to COVID-19 infection, COVID-19 related fears of life-threatening situations for mother and fetus, and worries about not receiving necessary treatment due to COVID-19 as psycho-social factors contributing to stress among

pregnant women during the COVID-19 pandemic [A4, A7]. Phenomenological studies corroborated these findings, identifying unstable psychological states such as anxiety, depression, and fear as significant psychological risk factors [A9 and A10]. These negative emotional responses often culminate in intense stress, disrupting the tranquility and routine of daily life [A9]. Existing mental health conditions emerged as substantial contributors to elevated stress levels, as evidenced by a significant negative correlation between existing mental health conditions and stress scores (Beta=-0.322, Sig=.001) [A12].

3.3.3 Socio-economic factors

Socio-economic factors were defined to include changes in social restrictions and so-cial support systems due to COVID-19, and economic aspects, such as decreased house-hold income resulting from COVID-19 related unemployment, increased financial burdens, and elevated consumption. Seven articles addressed these socio-economic factors [A4, A5, A7, A9, A10, A11, and A12].

Three studies focused on the economic situation of pregnant women during the COVID-19 pandemic, identifying it as a significant stressor. These studies highlighted specific economic factors, such as job loss, income reduction, the heightened financial burden of childcare, and additional costs incurred due to the pandemic [A4, A7, and A12]. One study pinpointed financial difficulties as a prominent stressor, ranking immediately after anxiety and depression, for heightened stress levels during the pandemic (p <0.001) [A12]. Another study revealed that 18.3% of participants had experienced job loss due to COVID-19, further exacerbating their stress [A7]. An analysis of stress related questionnaires employed identified financial issues, such as concerns over income reduction, job loss, additional financial strains related to infant care, and fear associated with insufficient financial support, as eco-

nomic stress factors [A4].

Additionally, changes in social support systems, increased social restrictions, and an overload of roles and responsibilities were identified as key social factors influencing stress during the COVID-19 pandemic [A4, A7, A10]. Notably, social support (sig=.001) was found to serve as a protective factor, contributing to the reduction of stress scores [A12]. In analyzing issues related to social supports, the theme "changes in social support system due to COVID-19" emerged as a significant social factor impacting stress. The most notable changes involved aspects of perinatal care, such as disrupted obstetric care, lack of antenatal education [A7 and A10]. The impact of COVID-19 on perinatal care encompassed issues, such as canceled appointments, a lack of trust in care, the need for formal support from healthcare professionals, inadequate communication and information provision, and restrictions on partner accompaniment during prenatal visits and childbirth [A4]. Specifically, 89% of pregnant women reported pandemic related changes in prenatal care, with 36% facing appointment cancellations and 90% being unable to have a support person present. In addition, 35% had to modify their birth plans, involving changes in support personnel (25%) and childcare preparations (11%). There were also widespread difficulties in accessing other healthcare services, with 74% facing challenges, especially in obtaining massage therapy services (58%), and 9% being unable to access psychological counseling services [A7]. The theme "collapse of prenatal care" was derived from the phenomenological studies, which consisted of the subthemes "lack of prenatal care education" and "discomfort during prenatal visits" [A10]. Pregnant women also experienced a reduction in official support from healthcare professionals along with sudden cancellations of hospital appointments [A4 and A10].

In one study, the social factor "social restrictions" encompassed subcategories, such as social isolation

and loneliness, limited access to family and friends, constraints on group support, and an increased dependence on partners [A4]. Another study identified "strained partner relationships" and "social isolation" as social factors affecting pregnant women during the COVID-19 period [A7]. In addition, "controlled life" was derived as a theme in a qualitative study analyzing the stress experiences of pregnant women during the COVID-19 pandemic, and their subthemes included a restricted daily routine due to strict infection prevention measures, increased burdens imposed by others, and height-ened physical exertion [A10]. Stress factors stemming from social changes during the pandemic also encompassed confusion due to inaccurate information and an overload of roles and responsibilities [A4 and A10]. Subthemes related to roles and responsibilities included the necessity of homeschooling because of COVID-19, the absence of both formal and informal childcare options, and the additional responsibility of caring for other children [A4].

3.3.4 Interventions for reducing stress in pregnant women during the COVID-19 pandemic

Three studies focused on interventions for stress reduction in pregnant women during the COVID-19 pandemic, in which o-CBT, MBS program, and self-care training via telemedicine were validated as effective interventions in mitigating stress among pregnant women [A2, A3, and A6]. Pregnant women participating in o-CBT were observed to have lower levels of pregnancy related stress and perceived stress (p=0.001) [A2]. Similarly, those who underwent the MBSR program experienced significantly lower average stress scores compared to those in the control group (p <0.001) [A3]. In the experimental group that underwent the intervention of COVID-19 self-care training via telemedicine, a significant decrease in the mean PSS score (25.34±6.63) was observed compared to the control group [A6].

Stress management strategies reported in non-intervention studies included maintaining relationships with others (45.5-48.3%) and physical activities (41-40.8%). The most frequently reported form of maintaining relationships was communication with a spouse or partner (20.9%), followed by interactions with other family members, friends, and spending quality time with children. Fitness exercises, such as walking (27.1-33.6%), yoga (7.1%), and swimming (0.9%), were popular physical activities among pregnant women during the pandemic. For leisure activities, which accounted for 11.8-19% of the responses, activities such as listening to music (3.3%), watching television (4.3%), and reading (5.7%) were commonly reported [A4, A11].

4. Discussion

This study elucidated the distinctive characteristics and influencing factors of stress among pregnant women during the COVID-19 pandemic and investigate interventions developed to mitigate their stress levels. Therefore, we conducted a comprehensive literature search and identified a total of 13 studies that met the criteria for an integrative review. The selected studies were published after March 11, 2020, the day the World Health Organization (WHO) declared COVID-19 a global pandemic, highlighting the heightened global awareness and concern regarding the mental health of pregnant women, a group particularly susceptible to viral infection [21].

Our results demonstrated that pregnant women generally experienced heightened stress levels during the COVID-19 pandemic compared to the pre-pandemic period [A2, A8, A9, A10, A11, A12, and A13]. Considering that pregnant women constitute a vulnerable population, already facing additional stressors associated with the pregnancy process [22], becoming pregnant amidst the COVID-19 pandemic may have intensified their stress due to the dual burden of carrying a child and being exposed to

the risk of infection [7, 21]. Therefore, regular monitoring and management of stress levels among pregnant women during infectious disease outbreaks such as the COVID-19 pandemic should be a cornerstone of prenatal care programs. However, a previous study [A1] reported lower stress levels among pregnant women during the pandemic compared to before the pandemic. The participants were primarily in their third trimester of pregnancy during the pandemic, while <6% of the pre-pandemic group were in their third trimester, with the majority in their first or second trimesters [A1]. Considering research indicating that stress levels increase during the first and second trimesters of pregnancy [23], the results of this study may have been influenced more by the stage of pregnancy than by the pandemic; thus, further research should be conducted to clarify this. Considering the research finding in-dicating that stress levels are highest during the first and second trimesters of pregnancy [23], it is believed that the contrasting finding of the aforementioned study is attributable to the stage of pregnancy rather than the impact of the COVID-19 pandemic. Therefore, future research is needed to determine the influence of the pandemic on stress levels at different stages of pregnancy.

Furthermore, a comprehensive analysis revealed that primary factors, such as biological, psychosocial, and socio-economic can influence stress levels among pregnant women during the COVID-19 pandemic.

First, biological factors demonstrated varying results across studies, including age [A1, A4, A5, A7, A8, A11, A12, and A13], gestational age [A1 and A5], and obstetric history [A1, A4, A5, and A8]. However, medical conditions, such as high-risk pregnancy and vaginal bleeding [A1 and A5], were consistently identified as significant contributors to stress. For women with high-risk pregnancies, who already face heightened stress levels due to their pregnancy related conditions [24], the stress asso-

ciated with a novel infectious disease outbreak such as COVID-19 can further exacerbate their emotional well-being. Expanding direct educational and counseling services specifically for high-risk maternal care programs during such infectious outbreaks can be a transformative approach, empowering pregnant women to gain a clear understanding of their medical conditions and develop coping strategies, which may enhance the efficacy of stress management of high-risk pregnancy.

Second, the primary psychosocial factors impacting pregnant women during the COVID-19 pandemic were identified as depression [A1, A5, A7, A8, A9, A10, A12, and A13], anxiety [A1, A5, A7, A8, A9, A10, A12, and A13], and loneliness [A9 and A10]. emo-tional states functioned as both causal and consequential variables in the context of pregnancy related stress, demonstrating their complexity and interrelated nature, defying a clear classification as one or the other. In particular, the increase in anxiety, depression, and loneliness among pregnant women during the pandemic [4, 12-14] was found to be closely associated with extensive media coverage about COVID-19 [A9]. The spread of unverified or false information about COVID-19 on social media significantly contributed to these negative emotional responses [25], such as amplification of fear, anxiety, and loneliness, further exacerbated stress levels in pregnant women. Therefore, in anticipation of future infectious disease outbreaks, it is crucial to provide rapid and accurate information to the public through well-established protocols, refine legislation to prevent the dissemination of baseless rumors and ensure that health authorities establish dedicated channels to offer timely and transparent information to pregnant women.

Third, socio-economic factors were identified as significant contributors to stress in pregnant women during the COVID-19 pandemic. They encompass social restrictions [A4, A5, A9, and A10], changes in social support systems [A4, A7, A9, A10, A11, and

A12], and decreased household income and increased consumption due to unemployment, income reduction, and increased childcare costs [A4, A10]. These factors cannot be effectively addressed by a single government department alone but necessitate the integrated support of various government departments to offer practical assistance in reducing the stress experienced by pregnant women [26]. In particular, the intensified isolation guidelines have led to strong social restrictions, resulting in changes in the existing social support system. Pregnant women increasingly experienced lower quality prenatal care due to cancellations of essential medical appointments and a reduction in medical staff available for prenatal care because hospitals enforced isolation guidelines. In addition, they also experienced changes in the social support system related to pregnancy that had been beneficial in the pre-COVID-19 period [A4, A9, and A10]. With the emergence and spread of a novel infectious disease, such as COVID-19, quarantine and isolation guidelines become more stringent, and public health policy guidelines tend to change at short intervals [27], which may have increased the stress levels of pregnant women, particularly in carrying out prenatal care activities and managing daily life. Furthermore, the economic crises resulting from job loss or significant reductions in income due to COVID-19, along with increased childcare costs, have further escalated stress levels among pregnant women, emphasizing the urgent need to develop national-level programs that can assist pregnant women in navigating these social restrictions, changes in social support systems, and economic challenges, focusing on enhancing the quality of prenatal care education.

Finally, three interventional studies [A2, A3, A6] presented effective strategies for reducing stress in pregnant women during the COVID-19 pandemic, and demonstrated the efficacy of online education and training interventions (such as e-CBT, MBSR program, and self-care training) in alleviating stress

among pregnant women, including online cognitive and psychological stimulation and training methods. Mind-body interventions, such as CBT, MBSR, and self-education, were already recognized as highly effective stress-reducing strategies for pregnant women before the COVID-19 pandemic [28]. During the pandemic, however, the same interventions were provided through remote applications instead of physical settings. Considering the heightened social restrictions and evolving quarantine guidelines during the pandemic, the expansion of online prenatal checkups and education programs is essential to minimize disruptions in prenatal care services [A2]. Policies that foster the adoption of these online services should be actively pursued. In addition, other stress-reduction strategies were adopted during the pandemic include exercise and communication [A4, A11]. Moreover, walking was the most common physical activity, accounting for 27.1 to 33.6%, suggesting a preference for individual and aerobic exercises due to the restrictive nature of COVID-19. However, further research is warranted to substantiate this observation. Communication was also found to be a critical factor, with family members being the primary sources of support but strengthening communication with prenatal care medical staff is equally important. Thus, improving prenatal care education and counseling can significantly alleviate stress among pregnant women by making them feel cared for by medical professionals, while also mitigating anxiety stemming from misinformation. Therefore, all hospitals with obstetrics departments should prioritize strengthening and enhancing their prenatal care education programs to ensure the well-being of pregnant women during such challenging times.

In this study, the literature search was limited to pregnant individuals, excluding terms related to the postpartum period, which presents a limitation in analyzing factors affecting stress from a continuous perspective of pregnancy stages. Additionally, in the

context of the COVID-19 situation, only literature that explicitly mentioned stress was considered, potentially excluding studies that focused on symptoms of stress. Despite these limitations, this research could contribute to understanding the characteristics and factors influencing stress among pregnant women in pandemic situations like COVID-19. This understanding could aid in the direction and content development of future stress management programs.

5. Conclusions

The COVID-19 pandemic has thrown the world into a state of unprecedented stress, with pregnant women among those most profoundly affected. This study hypothesized that stress levels in pregnant women can escalate during the pandemic and that these levels may vary due to different stress inducing factors. The analysis of intervention strategies for pregnant women during the pandemic verified the efficacy of remote education and training interventions, along with exercises. This study is significant in that it identifies the stress characteristics and influencing factors in pregnant women under the COVID-19 pandemic, analyzing intervention strategies, and thereby providing insights into managing stress in pregnant women during crisis situations, such as COVID-19. It lays the groundwork for developing stress reduction programs in preparation for future infectious disease emergencies. Therefore, further research is recommended to strengthen the evidence base for stress management in pregnant women during emerging infectious disease crises such as the COVID-19 pandemic. First, there is a need for research that integrates stress management interventions into prenatal care programs, specifically tailored for novel infectious disease emergencies, and assesses the effectiveness of these programs. Second, repeated studies are essential to elucidate the extent and characteristics of stress experienced by pregnant women during such emergencies, considering factors, such as age and stage of pregnancy (gestational age). Third, it is also recommended to conduct research on establishing and validating an integrated support system for pregnant women in the context of novel infectious disease emergencies.

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Appendix A List of Studies Included in an Integrative Review

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