



Comparative analysis of long-term self-reported COVID-19 symptoms among pregnant women



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ABSTRACT

Background: The negative effects of COVID-19 infections during pregnancy have been amply described, however, the persistent sequels of this infection have not been explored so far.

Objective: The aim of this study was to describe persisting symptoms after COVID-19 infection in pregnant and non-pregnant women in Ecuador.

Methods: A cross-sectional analysis based on an online, self-reporting questionnaire was conducted in Ecuador from April to July 2022. Participants were invited by social media, radio, and TV to voluntarily participate in our study. A total of 457 surveys were included in this study. We compared risk factor variables and long-term persisting symptoms of pregnant and non-pregnant women in Ecuador.

Results: Overall, 247 (54.1 %) responders claimed to have long-term symptoms after SARS-CoV-2 infection. Most of these symptoms were reported by non-pregnant women (94.0 %). The most common Long-COVID symptoms in pregnant women were fatigue (10.6 %), hair loss (9.6 %), and difficulty concentrating (6.2 %). We found that pregnant women who smoked had a higher risk of suffering fatigue.

Conclusions: The most frequent Long-COVID symptoms in pregnant women were fatigue, hair loss, and difficulty concentrating. Apparently, the patterns of presentation of long-term sequelae of SARS-CoV-2 infection in pregnant women do not differ significantly from reports available from studies in the general population.

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Introduction

Since the announcement of the pandemic caused by SARS-CoV-2 in March 2020, multiple efforts have been made to investigate the disease it causes. A more recent and growing line of research, however, pertains to the unexpected persistence of the virus's effect in some individuals. Specifically, after the first wave of massive infections, many people who recovered from COVID-19 reported that symptoms remained after infection. This condition has been referred to as "Post-COVID Condition" or "Long-COVID" [1]. Frequently reported persistent symptoms include chronic cough, shortness of

breath, chest tightness, cognitive dysfunction, and extreme fatigue [1]. In the United Kingdom, data was collected through a national survey, and it was found that 1 in 5 people infected with COVID-19 had symptoms that lasted up to 5 weeks after the infection ceased. Further, 1 in 10 people had symptoms that lasted up to 12 weeks [1]. A review of the evidence of COVID-19 sequelae found symptoms from 14 days to 3 months after infection [2]. And just like the new cases of COVID-19 the numbers referring to Long-COVID are likely to continue to rise with better identification of the nature of the condition.

Although a better understanding on Long-COVID is being constructed, information on the persistence of COVID-19 symptoms in specific populations is scarce. This is particularly the case of women who acquired the infection during their pregnancy. In the United States, the Center for Disease Control and Prevention (CDC) reports

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that 220,673 pregnant women have had COVID-19 infections as of July 2022 [3]. Previous data from pandemics and seasonal influenza suggest that pregnant women are at higher risk of infection-associated morbidity and mortality [4]. This is due to changes in the cardiorespiratory and immune systems during pregnancy which increase susceptibility to severe infections and hypoxic compromise [5].

In fact, infection-associated mortality within pregnant populations is not insignificant. Viral pneumonia is one of the leading causes of maternal deaths worldwide [6]. In the case of SARS-CoV-2, the risk to pregnant women could be higher, since it enters the cell through the angiotensin converting enzyme receptor 2 (ACE2), which increases its expression during normal pregnancy [4]. While in theory this is possible, elevated risk has not yet been validated empirically. However, whether pregnant patients are at increased risk or not due to this transmission mechanism is not known; at the moment there is no conclusive evidence on the intrauterine vertical transmission of the virus [6].

In relation to acute infection among pregnant women, according to several studies, among pregnant patients with a confirmed diagnosis of COVID-19, the most frequent symptoms are cough (50.3 %), headache (42.7 %), muscle aches (36.7 %), fever (32.0 %), sore throat (28.4 %) and shortness of breath (25.9 %) [7–9]. In addition, the severity of infection in pregnant women showed rates between 0 % and 14 % of severe COVID-19 characterized mostly by admission to the intensive care unit [10]; in this context, several investigations, including those involving the Ecuadorian population, have shown that the severity of the disease has a positive effect on the development of Long-COVID symptoms, nevertheless, these findings have been described only in the general population [11,12]. However, even the World Health Organization (WHO) has reported that there is no apparent difference in the risk of presenting clinical symptoms between pregnant and non-pregnant women [6,13,14]. This is despite admission to intensive care and invasive ventilation being more common among pregnant women with COVID-19 compared to non-pregnant infected women of the same age [14].

Studies to date have shown that the clinical, laboratory and radiological characteristics of COVID-19 in pregnant women are similar to those reported by patients who were not pregnant [6]. For example, in follow-up of cases of COVID-19 cases where COVID-19 sequelae were identified after the infection in 18 pregnant women after 12 months, it was found that the persistent symptoms were chest tightness, myalgia, arthralgia, anosmia, and insomnia, and most respiratory symptoms had resolved [15]. It could therefore be hypothesized that Long-COVID should also present similarly within pregnant and non-pregnant females. While this may be the case, further information and data analysis is needed. In this vein, the present study aims to contribute to the literature by detailing the nature and persistence of symptoms of Long-COVID within pregnant and non-pregnant women in Ecuador.

Materials and methods

Study design and sample selection

We conducted a cross-sectional study by circulating an independent 37 question, self-reporting online questionnaire through the internet-based survey free access platform “Shyni”. We gathered anonymous responses from all over the country using a non-probability sampling method from April to July 2022.

Settings

The study was carried out in Ecuador, one of the smallest Latin American countries, located in the equatorial line and bordering the Pacific Ocean. Ecuador shares borders with Peru and Colombia, and

its current population is estimated to be 17,577,116 inhabitants [16]. We start from the total cumulative incidence of reported COVID-19 infection of 14,100,000 [17].

Population

Participants were all Ecuadorian residents who have received at least one of the available COVID-19 vaccines. According to available data, in 2021, the female population of reproductive age (from 15 to 49 years old) numbered a total of 4,625,576 women in Ecuador [18]. In that sense, with a confidence level of 95 % and a margin of error of 5 %, our minimum estimated sample was 385 responses. The sample size was calculated by using the following formula [19]:

$$x = Z(c/100)2r(100-r)$$

$$n = N x / ((N-1)E^2 + x)$$

$$E = \text{Sqrt}[(N - n)x/n(N-1)]$$

Where “N” is the population size, “r” is the fraction of responses (50 %), “Z(c/100)” is the critical value for the confidence level “c”, “x” is the expected population, and Sqrt is the square root. All responses that were included in the study came from respondents who voluntarily agreed to participate in the study and who completed all 37 questions were included.

Survey development and measures

The data was collected using a 37-item online questionnaire to evaluate self-reported Long-COVID symptoms. Consent was obtained from participants at the beginning of the questionnaire with an explanation of the study's objective. Participants could proceed with the full questionnaire only after providing consent by accepting (electronically marking) the Terms and Conditions and consenting to the Participation Agreement. The questionnaire was developed and fielded in Spanish and later translated into English for reporting purposes. The full survey instrument is available in the Additional file 1.

The questionnaire was reviewed for validity by three experts in infectious diseases and biostatistics to identify key issues that may be relevant to Long-COVID symptoms and to assess the questionnaire's relevance and accuracy. After incorporating expert feedback, we pilot-tested the survey instrument online with a group of 30 eligible participants. The 30 participants who completed the pilot-testing did not participate in the final survey and the responses collected during pilot-testing were not included in the final analysis.

Data management

Data were reviewed case by case to ensure the highest possible accuracy in our results. In this process, we identified cases where the answers did not match the questions asked. For example, when a respondent answered that they had not presented Long-COVID symptoms but in the Long-COVID symptoms section they identified a symptom, such survey responses were automatically eliminated. No IP addresses or other sensitive data were recorded. Only symptoms and demographic variables were collected.

Statistical analysis

Measurements of frequency (counts, absolute and relative percentages) were calculated for all categorical variables.

The Jamovi program was used to perform the analyses. The Odds Ratio (OR), and the confidence interval (95 %) were calculated to study whether there is a higher risk of developing Long-COVID

Table 1
Characteristics of the participants.

Characteristics		Pregnant		No pregnant	
		n	%	n	%
Participants	Total	16	100 %	231	100 %
Demographics					
Age (years)	0–10	0	0.0 %	0	0.0 %
	10–20	3	18.7 %	23	9.9 %
	21–30	4	25 %	93	40.3 %
	31–40	8	50 %	83	35.9 %
	41–50	1	6.3 %	29	12.6 %
	51–60	0	0.0 %	2	0.9 %
	61–70	0	0.0 %	1	0.4 %
	71–80	0	0.0 %	0	0.0 %
	81–90	0	0.0 %	0	0.0 %
	Total	16	100 %	231	100 %
Ethnicity	Mestizo	16	100 %	218	94.4 %
	White	0	0.0 %	9	3.9 %
	Montubio	0	0.0 %	2	0.9 %
	Indigenous	0	0.0 %	0	0.0 %
	Afro descendants	0	0.0 %	1	0.4 %
	Other	0	0.0 %	1	0.4 %
	Total	16	100 %	231	100 %
Marital status	Single	6	37.4 %	143	61.9 %
	Married	8	50.0 %	69	29.9 %
	Divorced	1	6.3 %	10	4.3 %
	Civil union	1	6.3 %	7	3.0 %
	Widowed	0	0.0 %	2	0.9 %
	Total	16	100 %	231	100 %
Residence altitude	Above 2500 m	15	93.8 %	194	84.0 %
	Below 2500 m	1	6.2 %	36	15.6 %
	Out of country	0	0.0 %	1	0.4 %
	Total	16	100 %	231	100 %
Occupation	Health care workers	4	25.0 %	66	28.6 %
	Indoor workers	6	37.5 %	83	35.9 %
	Outdoor workers	1	6.2 %	11	4.8 %
	Workers in contact with people	0	0.0 %	16	6.9 %
	Students	3	18.8 %	53	22.9 %
	Unemployment and retired	2	12.5 %	2	0.9 %
	Total	16	100 %	231	100 %
Personal history					
Comorbidities history	Yes	4	25.0 %	43	18.6 %
	No	12	75.0 %	188	81.4 %
	Total	16	100 %	231	100 %
Comorbidities	Arterial hypertension	0	0.0 %	6	2.5 %
	Overweight	0	0.0 %	9	3.9 %
	Obesity	0	0.0 %	3	1.3 %
	Type 2 diabetes	0	0.0 %	0	0.0 %
	Asthma	2	12.5 %	7	3.0 %
	HIV AIDS	0	0.0 %	0	0.0 %
	Diabetes type 1	0	0.0 %	0	0.0 %
	hypothyroidism	2	12.5 %	10	4.3 %
	Cancer	0	0.0 %	1	0.4 %
	Coagulation disorders	0	0.0 %	1	0.4 %
	hyperthyroidism	0	0.0 %	1	0.4 %
	Others	0	0.0 %	10	4.3 %
	Total	4	25.0 %	48	20.8 %
Smoke	No	11	68.8 %	175	75.8 %
	Old smoker	2	12.5 %	31	13.4 %
	Yes, less than 5 cigarettes a day	3	18.7 %	22	9.5 %
	Yes, between 6 and 20 cigarettes per day	0	0.0 %	3	1.3 %
	Total	16	100 %	231	100 %
Alcohol	No	8	50 %	59	25.5 %
	Once every 3 months	6	37.5 %	88	38.1 %
	At least once a month	2	12.5 %	69	29.9 %
	At least once a week	0	0.0 %	14	6.1 %
	More than once a week	0	0.0 %	1	0.4 %
	Total	16	100 %	231	100 %
COVID-19 infection history					
Number of infections	Once	11	68.8 %	181	78.3 %

Table 1 (continued)

Characteristics		Pregnant		No pregnant	
		n	%	n	%
Diagnostic confirmation	Twice	5	31.2 %	44	19.1 %
	More than twice	0	0.0 %	6	2.6 %
	Total	16	100 %	231	100 %
	PCR, antigen, or antibody tests	15	93.8 %	194	84.0 %
Management received	Physician confirmation	0	0.0 %	3	1.3 %
	Infected by someone who lived with me	1	6.2 %	25	10.8 %
	I have the symptoms	0	0.0 %	9	3.9 %
	Total	16	100 %	231	100 %
Vaccine received	None	2	12.5 %	17	7.4 %
	Self-medication	0	0.0 %	36	15.6 %
	Medications prescribed by a physician	11	68.8 %	173	74.9 %
	Hospitalization less than 2 days	2	12.5 %	0	0.0 %
Time of infection	Hospitalization between 3 and 7 days	0	0.0 %	2	0.9 %
	Hospitalization more than 7 days	1	6.2 %	3	1.2 %
	Intensive care unit (ICU) hospitalization	0	0.0 %	0	0.0 %
	Total	16	100 %	231	100 %
Long-term COVID-19 symptoms	No	0	0.0 %	0	0.0 %
	One dose	3	18.8 %	1	0.4 %
	Two doses	5	31.2 %	29	12.6 %
	Two doses and one booster	6	37.5 %	168	72.7 %
Symptoms duration	Two doses and two boosters	2	12.5 %	33	14.3 %
	Total	16	100 %	231	100 %
	Infection before vaccination	8	50.0 %	121	52.4 %
	Infection after vaccination	8	50.0 %	110	47.6 %
	Total	16	100 %	231	100 %
Symptoms evolution	Initiated with infection	4	25.0 %	98	42.4 %
	3–5 weeks after infection	5	31.3 %	82	35.5 %
	5–7 weeks after infection	4	25.0 %	30	13.0 %
	7–9 weeks after infection	2	12.5 %	7	3.0 %
Frequency of presentation	After 9 weeks of infection	1	6.2 %	14	6.1 %
	Total	16	100 %	231	100 %
	Between 1 and 4 weeks	1	6.2 %	40	17.3 %
	Between 4 and 8 weeks	9	56.3 %	41	17.8 %
Symptoms evolution	Between 8 and 12 weeks	0	0.0 %	28	12.1 %
	Between 3 and 6 months	3	18.8 %	49	21.2 %
	Between 6 and 12 months	1	6.2 %	30	12.9 %
	More than 12 months	2	12.5 %	43	18.6 %
Symptoms evolution	Total	16	100 %	231	100 %
	Once a month	2	12.5 %	18	7.8 %
	Once every two weeks	1	6.7 %	15	6.5 %
	Once a week	3	18.8 %	59	25.5 %
Symptoms evolution	Over 3 days a week	7	43.8 %	60	26.0 %
	Daily	3	18.8 %	66	28.6 %
	Not applicable	0	0.0 %	13	5.6 %
	Total	16	100 %	231	100 %
Symptoms evolution	Have improved	7	43.8 %	74	32.0 %

(continued on next page)

Table 1 (continued)

Characteristics		Pregnant		No pregnant	
		n	%	n	%
Have been consistent	Intermittent (appear - disappear)	7	43.8 %	77	33.4 %
	Have gotten worse	1	6.2 %	10	4.3 %
	Total	16	100 %	231	100 %
Visited a physician	Yes	7	43.8 %	102	44.2 %
	No	9	56.2 %	129	55.8 %
	Total	16	100 %	231	100 %
Medications prescribed by a physician	Yes	5	31.2 %	70	30.3 %
	No	11	68.8 %	161	69.7 %
Self-medication	Total	16	100 %	231	100 %
	Yes	8	50.0 %	78	33.8 %
	No	8	50.0 %	153	66.2 %
	Total	16	100 %	231	100 %

symptoms in the group of pregnant women compared to non-pregnant women.

Reliability and validation

Reliability was examined using a test-retest questionnaire using the final version of the survey. Since this questionnaire was created only for this project, we tested within the cohort of experts previously selected for the informal interviews.

Results

General demographic information

A total of 457 responses were collected from women. 33 were pregnant and 424 were non-pregnant women. From the total number of respondents, 247 claimed to have Long-COVID symptoms, 16 (6.5 %) were pregnant and 231 (93.5 %) were not pregnant. Of the pregnant women, 50.0 % were between 31 and 40 years old, 93.75 % of the participants lived over 2,500 m, 31.3 % stated that they consume or have consumed tobacco and 50.0 % consumed alcohol (Table 1).

Long-COVID symptoms

A total of 54 different Long-COVID symptoms were reported. Between both groups, the most self-reported symptoms were fatigue or tiredness 61.53 % (n = 152), and hair loss 48.58 % (n = 120), while the least reported was glucose alteration (0.81 %).

According to each group distribution, the most common Long-COVID symptoms for pregnant women were fatigue (10.6 %), hair loss (9.7 %), difficulty concentrating and loss of smell (6.2 %); while for non-pregnant participants were fatigue (7.9 %), hair loss (6.1 %), difficulty concentrating, and anxiety (5.2 %) (Fig. 1).

These symptoms were distributed in the following way between the group of pregnant and non-pregnant women; fatigue 12 and 140 (OR: 1.96, CI95 % 0.610–6.23) cases respectively; hair loss 11 and 109 (OR: 2.46, CI % 0.829–7.31) cases; and glucose alteration 2 and 44 (OR: 0.607, CI % 0.133–277) cases. It was observed that there was no statistically significant increase in the risk of developing symptoms of Long-COVID for any group (Table 2).

Cigarette consumption

We found 219 non-smokers participants, 13 (5.9 %) pregnant, and 206 (94.1 %) non-pregnant smokers. In this group it was found that

the most reported symptom was fatigue with 135 cases (6.7 %) within pregnant women and (93.3 %) within non-pregnant women (OR 1.430, CI95 % 0.426–4.79). However, when all symptoms were studied, no statistically significant differences between Long-COVID symptoms in smokers and non-smokers were found (Table 3).

With respect to the participants who reported tobacco use, 3 were pregnant and 25 were not pregnant. In this group, the most reported symptom was tingling in the extremities with 14 cases, 1 (7.1 %) pregnant, and 13 (92.9 %) not pregnant (OR 0.46, 95 % CI 0.0369–5.77). However, in the case of fatigue it was found that pregnant women who smoked had a higher risk of suffering compared with the non-pregnant group (OR 114, 95 %, CI 3.85–3395) (Table 3).

Alcohol consumption

A total of 67 participants did not consume alcohol, 8 (11.9 %) pregnant, and 59 non-pregnant. In this group, the most reported symptom was difficulty concentrating in the pregnant group and fatigue in the non-pregnant group. It was also found that being pregnant and not consuming alcohol is a protective factor against developing of hair loss as a Long-COVID sequela (OR 0.0465, CI95 % 0.00257–0.843) (Table 4).

Among the participants who consumed alcohol, 8 were pregnant and 172 were not pregnant. In pregnant and non-pregnant groups, the most reported symptom was difficulty concentrating 1 (6.7 %) and 14 (93.3 %), respectively. However, no statistically significant differences were found taking alcohol consumption as a risk factor (Table 4).

Altitude effects

A total of 209 respondents affirmed to live over 2500 m, 15 (7.2 %) pregnant and 194 (92.8 %) non-pregnant. The most reported symptom within the high-altitude group was fatigue in 127 cases, 11 (8.7 %) in pregnant group, and 116 (91.3 %) in non-pregnant group. No statistically significant differences were identified related between symptoms experienced by those in high altitude and those in low altitude locations among the studied sample (Table 5).

Discussion

To the best of our knowledge, this is the first study to explore the post-acute sequels of SARS-CoV-2 virus infection in pregnant women.

Although COVID-19 infection acquired during the gestational period has been extensively studied and its effects have been demonstrated, such as substantial increases in the risk of pre-eclampsia [20], increases in maternal and perinatal death rates that occur hand in hand with each wave of the pandemic [21], and increased incidence of neurodevelopmental disorders in infants during the first 12 months postpartum of mothers infected during pregnancy [22], so far there is no scientifically valid literature available that provides information regarding the development of long-term sequelae of COVID-19 infection in pregnant women who have overcome SARS-CoV-2 infection before or during the first weeks of pregnancy. We believe that because of the physiological modifications that women undergo during the gestation period, the behavior of Long-COVID symptoms could be different from that reported in the general population or in women who are not pregnant.

Our results show that slightly more than half n = 247 (54.1 %) of the female participants claimed to have Long-COVID symptoms. For the group of pregnant participants, 48.5 % (n = 16) claimed to have symptoms of long-COVID, while for the non-pregnant group, 54.5 % (n = 231) developed long-term sequelae of COVID-19. This suggests a higher prevalence of Long-COVID symptoms in the non-pregnant

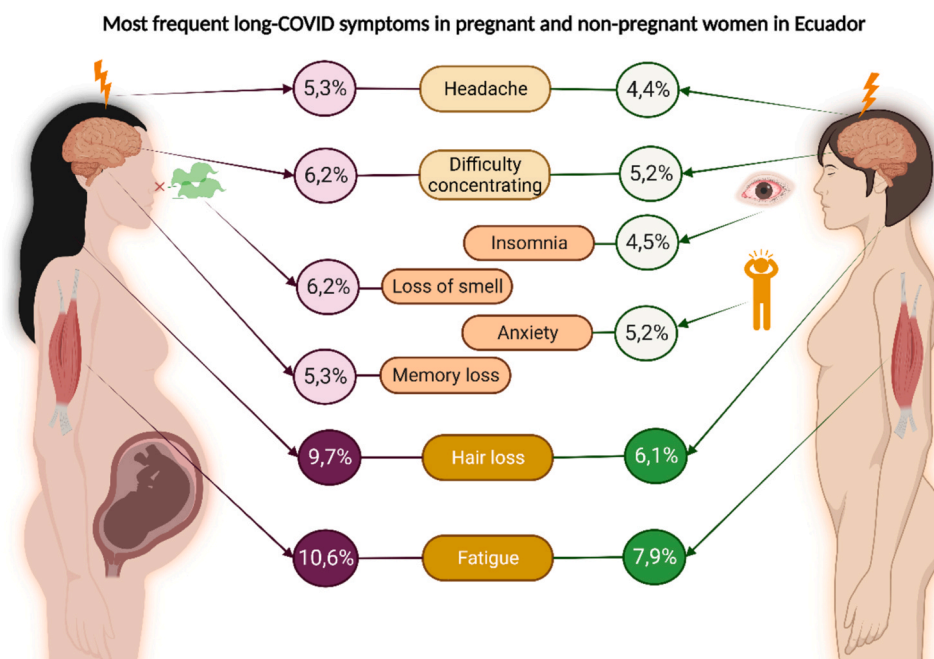


Fig. 1. Distribution of most frequent Long-COVID symptoms for each participants group.

patients, however, this group also accounted for the highest percentage of the analyzed responses. With respect to the number of prior infections, 68.8 % of pregnant women who developed Long-COVID reported having had the infection only on one occasion, while 31.2 % stated they were infected twice. No pregnant woman affirmed having more than two COVID-19 infections.

On the other hand, in addition to the protective effect that vaccines have been shown to have against hospitalization and death from COVID-19, several studies have proposed to evaluate some effect of vaccines on the development of sequelae in general population, but this has not been proven to date [12,23], for its part at the time of response collection (July 2022), in Ecuador approximately 86.7 % of the population has received the complete vaccination schedule (two doses) that includes Pfizer/BioNTech, AstraZeneca and Sinovac vaccines (in homogeneous and mixed schedules) [24], this percentage was reflected in the participants of this study, however, there was no evidence of an effect of vaccination on the development of sequelae in the pregnant population.

Regarding the temporal progression of symptoms, Carvalho et al. in his study showed that 30 days after overcoming the infection, 68 % of the patients had at least 1 symptom, and at 60 days, 66.0 % of the patients persisted with symptoms [25]. The results from our study largely corroborate these results. Specifically, we observe that most of pregnant participants (56.3 %) presented symptoms 3–7 weeks after recovery from the infection.

Other results that we find that can be confirmed in the literature are that the overall prevalence of at least one Long-COVID symptom of our participants was 54.1 %. These results are upheld by Walsh-Messinger et al. who found a 51 % prevalence of Long-COVID in young adults from both sexes [26]. Similarly, Sugiyama et al. obtained comparable results in their study, in which 52 % of participants of all ages of both genders developed Long-COVID [27]. With respect to our study, a total of 52 symptoms were registered by the respondents. These symptoms affected different tissues and systems, including the respiratory system, cardiovascular system, nervous system, gastrointestinal system, and even the skin and integuments.

Within the respiratory system symptoms, the most frequently reported symptom was fatigue, which coincides with several publications that address the respiratory sequelae of COVID-19 in the general population [25,28–32]. According to Wise J., in a study of 1.4 million people who reported symptoms of Long-COVID in the UK, 55 % reported fatigue [33], while in our study both groups reported this symptom 152 times, resulting in a corresponding proportion of 61.5 %. When analyzed separately, pregnant women revealed a higher frequency of reporting fatigue (75.0 %), compared to the non-pregnant group (60.6 %). Nevertheless, this difference was not found to be statistically significant (OR 1.96. CI95 % 0.610–6.23). The subsequent most frequently reported symptom in our sample was hair loss with 120 women reporting having an individual experience of this (48.6 %). These results are similar to those of Xiogn et al. where it was reported that 28.6 % of patients of both sexes who have been discharged from the hospital after a COVID-19 infection present hair loss [34]. Monari et al. have also observed that 31.3 % of their study's participants presented hair loss from an average time of onset of 68.43 days after infection [35]. The cause of this sequela has been attributed to the high levels of proinflammatory cytokines produced during the infection [36]. Although this mechanism has not been demonstrated in all other tissues affected by the virus, it is probably responsible for most Long-COVID symptoms observed. The loss of the sense of taste and smell has also been talked about a lot during the pandemic. According to Mattioli et al. in patients of both sexes with mild to moderate COVID-19 infection history, 19.1 % of the patients present loss of smell, and 10.8 % loss of taste [37]. Our study finds a similar distribution of smell and taste loss with the results showing 23.48 % of the participants developed loss of smell and 14.97 % loss of taste.

Although it is true that most of the Long-COVID symptoms found in pregnant women were mild, such as hair loss, loss of smell, and difficulty concentrating, so that they probably will not have important clinical and quality of life repercussions on those who suffer them. In this sense, although fatigue was the most frequent sequela for both groups (pregnant and non-pregnant), it seems that this

Table 2
Distribution and risk of Long-COVID symptoms among pregnant and non-pregnant participants.

Symptoms	Total	Pregnant		No pregnant		OR	CI 95 %
	n	n	(%)	n	(%)		
Alopecia	9	0	0.0	9	100.0	0.710*	0.039–12.7
Alteration in the sense of taste	46	2	4.3	44	95.7	0.607	0.133–2.77
Alteration in glucose	2	0	0.0	2	100.0	2.78*	0.128–60.4
Alterations in the menstrual cycle	41	2	4.9	39	95.1	0.703	0.154–3.22
Hallucinations	5	0	0.0	5	100.00	1.25*	0.066–23.6
Anxiety	96	3	3.1	93	96.9	0.342	0.095–1.23
Brittle hair	45	3	6.7	42	93.3	1.04	0.283–3.81
Humor changes	48	2	4.2	46	95.8	0.575	0.126–2.62
Changes in heart rhythm	34	1	2.9	33	97.1	0.400	0.051–3.13
Changes in blood pressure	10	0	0.0	10	100.0	0.639*	0.036–11.4
Confusion	8	0	0.0	8	100.0	0.797*	0.044–14.4
Diarrhea	16	0	0.0	16	100.0	0.396*	0.022–6.89
Difficulty concentrating	99	7	7.1	92	92.9	1.18	0.423–3.27
Difficulty expressing yourself or finding the right words	61	4	6.6	57	93.4	1.02	0.316–3.28
Decreased visual acuity	40	3	7.5	37	92.5	1.21	0.329–4.46
Decreased strength	35	3	8.6	32	91.4	1.44	0.387–5.32
Decreased libido/sexual desire	24	2	8.3	22	91.7	1.36	0.289–6.36
Abdominal pain	17	1	5.9	16	94.1	0.896	0.111–7.22
Headache	84	6	7.1	78	92.9	1.18	0.413–3.36
Chest pain	37	0	0.0	37	100.0	0.157*	0.009–2.68
Pain or burning sensation in the body or any part	15	2	13.3	13	86.7	2.4	0.492–11.7
Unusual muscle aches	20	2	10.0	18	90.0	1.69	0.356–8.03
Usual muscle aches	33	4	12.1	29	87.9	2.32	0.702–7.68
Shaking chills	11	1	9.1	10	90.9	1.47	0.177–12.3
Sneeze	24	1	4.2	23	95.8	0.603	0.076–4.78
Fatigue/tiredness	152	12	7.9	140	92.1	1.96	0.610–6.23
Tingling in the extremities	26	2	7.7	24	92.3	1.23	0.264–5.75
Insomnia (difficulty sleeping)	83	2	2.4	81	97.6	0.265	0.059–1.19
Heat intolerance	4	0	0.0	4	100.0	1.53*	0.079–29.7
Cold intolerance	24	2	8.3	22	91.7	1.36	0.289–6.36
Nausea	21	1	4.8	20	95.2	0.703	0.088–5.60
Neuritis (nerve pain)	18	1	5.6	17	94.4	0.839	0.104–6.74
Other	37	0	0.0	37	100.0	0.157*	0.009–2.68
Palpitations	42	1	2.4	41	97.6	0.309	0.039–2.41
Loss of appetite	12	0	0.0	12	100.0	0.532*	0.030–9.39
Hearing loss	10	0	0.0	10	100.0	0.639*	0.036–11.40
Hair loss	120	11	9.2	109	90.8	2.46	0.829–7.31
Loss of taste	37	4	10.8	33	89.2	2	0.608–6.57
Memory loss	68	6	8.8	62	91.2	1.64	0.570–4.69
Muscle loss	17	0	0.00	17	100.0	0.371*	0.021–6.46
Loss of smell	58	7	12.1	51	87.9	2.75	0.975–7.73
Loss of body hair	2	0	0.0	2	100.0	2.78	0.128–60.4
Skin itch	23	0	0.0	23	100.0	0.269*	0.016–4.63
Reflux	18	1	5.6	17	94.4	0.839	0.104–6.74
Dry skin	47	4	8.5	43	91.5	1.46	0.448–4.74
Thirst	16	2	12.5	14	87.5	2.21	0.457–10.7
Sensitivity/easy crying	56	3	5.4	53	94.6	0.775	0.213–2.82
Excessive sweating	13	0	0.0	13	100.0	1.98*	0.098–39.9
Tremor in extremities	22	1	4.6	21	95.4	0.667	0.084–5.30
Persistent cough	62	1	1.6	61	98.4	0.186	0.024–1.44
Brittle nails	38	3	7.9	35	92.1	1.29	0.350–4.77
Threw up	8	0	0.0	8	100.0	0.797*	0.044–14.4
Total	1894	113	100.0	1781	100.0		

* Haldane-Ascombe correction applied.

sequela occurs more frequently among pregnant women, thus, the lack of energy perceived by pregnant women could be characterized by an apparently hypoxic condition that may have pernicious effects on the fetus during gestation and at birth [38]. However, these are hypotheses based on theoretical precepts and observational findings that will need to be characterized with greater methodological rigor to understand the clinical effects of the sequelae of COVID-19 in pregnant women.

One of the future implications of Long-COVID symptoms in pregnant women may be characterized by an increase in the number of prenatal medical consultations caused exclusively by the sequelae

in pregnant patients as previously demonstrated in the Swiss population [39], which, in addition to representing a significant burden on health care systems, increases the risk of pregnant women acquiring hospital-associated diseases such as infections including COVID-19. Therefore, protective measures will continue to be a tool of great importance for pregnant women suffering from Long-COVID, among which the use of masks, social distancing, and vaccination are the most cost-effective and efficient, in addition, the obstetric management of pregnant women suffering from sequelae should be individualized in order to maintain maternal and fetal well-being [7].

Table 3
Cigarette consumption risk on pregnant and non-pregnant women with Long-COVID symptoms.

Symptoms	No smoke					Smoke						
	Pregnant		No pregnant		OR	IC 95 %	Pregnant		No pregnant		OR	IC 95 %
	n	(%)	n	(%)			n	(%)	n	(%)		
Alopecia	0	0.00	8	100.00	0.865*	0.047–15.8	0	0.0	1	100.0	2.33*	0.078–69.3
Alteration in the sense of taste	2	4.9	39	95.1	0.779	0.166–3.66	0	0.0	5	100.0	0.532*	0.023–11.9
Alteration in glucose	0	0.00	2	100.00	3.030*	0.138–66.3	0	0.0	0	0.0	....	....
Alterations in the menstrual cycle	2	5.4	35	94.6	0.888	0.189–4.18	0	0.0	4	100.0	0.683*	0.029–15.7
Hallucinations	0	0.00	4	100.00	1.67*	0.085–32.6	0	0.0	1	100.0	2.33*	0.078–69.3
Anxiety	1	1.2	82	98.8	0.126	0.016–0.988	1	8.3	11	91.7	0.64	0.050–7.96
Brittle hair	2	4.6	41	95.4	0.732	0.156–3.43	1	50.0	1	50.0	12.00	0.527–2.73
Humor changes	2	5.0	38	95.0	0.804	0.171–3.78	0	0.0	8	100.0	0.294*	0.013–6.36
Changes in heart rhythm	1	3.0	32	97.0	0.453	0.056–3.61	0	0.0	1	100.0	2.33*	0.078–69.3
Changes in blood pressure	0	0.00	10	100.0	0.693*	0.038–12.5	0	0.0	0	0.0	....	....
Confusion	0	0.00	6	100.0	1.14*	0.061–21.4	0	0.0	2	100.0	1.34*	0.052–34.2
Diarrhea	0	0.00	14	100.0	0.349*	0.027–8.70	0	0.0	1	100.0	2.33*	0.078–69.3
Difficulty concentrating	6	7.1	78	92.9	1.410	0.456–4.34	1	6.7	14	93.3	0.39	0.031–4.92
Difficulty expressing yourself or finding the right words	3	5.8	49	94.2	0.961	0.254–3.63	1	11.1	8	88.9	1.06	0.083–13.5
Decreased visual acuity	1	3.2	30	96.8	0.489	0.061–3.90	0	0.0	7	100.0	0.352*	0.016–7.68
Decreased strength	1	3.7	26	96.3	0.577	0.072–4.62	2	28.6	5	71.4	8.00	0.598–1.07
Decreased libido/sexual desire	1	4.8	20	95.2	0.775	0.095–6.28	1	33.3	2	66.7	5.75	0.349–94.7
Abdominal pain	0	0.0	15	100.0	0.458*	0.026–8.07	1	100.0	0	0.0	30.6*	0.967–9.68
Headache	4	5.5	69	94.5	0.882	0.262–2.97	2	18.2	9	81.8	3.56	0.282–44.9
Chest pain	0	0.0	36	100.0	0.173*	0.010–2.98	0	0.0	1	100.0	2.33*	0.078–69.3
Pain or burning sensation in the body or any part	1	10.0	9	90.0	1.820	0.213–15.6	1	33.3	2	66.7	5.75	0.349–94.7
Unusual muscle aches	1	6.2	15	93.8	1.060	0.129–8.72	1	33.3	2	66.7	5.75	0.349–94.7
Usual muscle aches	2	8.0	23	92.0	1.450	0.302–6.94	2	28.6	5	71.4	8.00	0.598–1.07
Shaking chills	0	0.0	7	100.0	0.985*	0.053–18.2	1	25.0	3	75.0	3.67	0.250–53.8
Sneeze	1	5.6	17	94.4	0.926	0.114–7.56	0	0.0	6	100.0	0.429*	0.019–9.45
Fatigue/tiredness	9	6.7	126	93.3	1.430	0.426–4.79	3	75.0	1	25.0	114*	3.85–3.395
Tingling in the extremities	1	4.4	22	95.6	0.697	0.086–5.62	1	7.1	13	92.9	0.46	0.036–5.77
Insomnia (difficulty sleeping)	2	2.9	68	97.1	0.369	0.079–1.71	0	0.0	0	0.0	....	....
Heat intolerance	0	0.0	3	100.0	2.15*	0.106–43.9	0	0.0	1	100.0	2.33*	0.078–69.3
Cold intolerance	2	9.1	20	90.9	1.690	0.350–8.17	0	0.0	1	100.0	2.33*	0.078–69.3
Nausea	1	5.6	17	94.4	0.926	0.114–7.56	0	0.0	2	100.0	1.34*	0.052–34.2
Neuritis (nerve pain)	1	6.2	15	93.8	1.060	0.129–8.72	0	0.0	2	100.0	1.34*	0.052–34.2
Other	0	0.0	32	100.0	0.199*	0.011–3.43	0	0.0	4	100.0	0.683*	0.029–15.7
Palpitations	1	2.4	40	97.6	0.346	0.043–2.74	0	0.0	1	100.0	2.33*	0.078–69.3
Loss of appetite	0	0.0	11	100.0	0.630*	0.035–11.3	0	0.0	1	100.0	2.33*	0.078–69.3
Hearing loss	0	0.0	7	100.0	0.985*	0.053–18.2	0	0.0	2	100.0	1.34*	0.052–34.2
Hair loss	9	8.1	102	91.9	2.290	0.685–7.69	2	22.2	7	77.8	5.14	0.400–66.1
Loss of taste	3	9.4	29	90.6	1.830	0.475–7.05	1	20.0	4	80.0	2.63	0.190–36.3
Memory loss	5	9.1	50	90.9	1.950	0.610–6.23	1	7.8	12	92.3	0.54	0.043–6.77
Muscle loss	0	0.0	15	100.0	0.458*	0.026–8.07	0	0.0	1	100.0	2.33*	0.078–69.3
Loss of smell	5	10.0	45	90.0	2.240	0.697–7.17	2	25.0	6	75.0	6.33	0.485–82.7
Loss of body hair	0	0.0	2	100.0	3.03*	0.138–66.3	0	0.0	0	0.0	....	....
Skin itch	0	0.0	21	100.0	0.320*	0.018–5.57	0	0.0	1	100.0	2.33*	0.078–69.3
Reflux	1	7.7	12	92.3	0.653	0.077–5.47	0	0.0	4	100.0	0.683*	0.029–15.7
Dry skin	3	6.8	41	93.2	1.210	0.318–4.59	1	33.3	2	66.7	5.75	0.349–94.7
Thirst	2	14.3	12	85.7	2.940	0.584–14.8	0	0.0	1	100.0	2.33*	0.078–69.3
Sensitivity/easy crying	2	4.3	45	95.7	0.651	0.139–3.04	1	11.1	8	88.9	1.06	0.083–13.5
Excessive sweating	0	0.0	11	100.0	0.630*	0.035–11.3	0	0.0	2	100.0	1.34*	0.052–34.2
Tremor in extremities	1	6.2	15	93.8	1.060	0.129–8.72	0	0.0	6	100.0	0.429*	0.019–9.45
Persistent cough	0	0.0	56	100.0	0.0987*	0.006–1.69	0	0.0	5	100.0	0.532*	0.023–11.9
Brittle nails	2	5.6	34	94.4	0.920	0.195–4.34	1	50.0	1	50.0	12.00	0.52–2.73
Threw up	0	0.0	6	100.0	1.140	0.0611–21.4	0	0.0	1	100.0	2.33*	0.078–69.3

* Haldane-Ascombe correction applied.

Our study also analyzed whether lifestyle habits impacted the risk of experiencing distinct Long-COVID symptoms. The risk analysis indicated that alcohol consumption does not represent a risk condition for the development of Long-COVID symptoms. However, the habit of smoking does increase the risk of developing post-acute symptoms. In our study it was found that pregnant women who smoked had a higher risk of suffering fatigue (OR 114. 95 % CI 3.85–3395). While the symptom characterization differs, other

studies have shown that smoking increases the risk of tachycardia and/or hypertension in the case of the French population, as well as in the United Kingdom (HRa = 1.12; 1.08–1.15), (HRa = 1.08; 1.05–1.11) [40–42];.

Due to the novelty of our study, and as we mentioned previously, studies of similar populations (pregnant women) are not available to compare our results of Long-COVID symptoms. We recommend conducting studies with larger groups, and more diverse populations

Table 4
Alcohol consumption risk on pregnant and non-pregnant women with Long-COVID symptoms.

Symptoms	No Alcohol					Alcohol				
	Pregnant		No pregnant		OR	IC 95 %	Pregnant		No pregnant	
	n	(%)	n	(%)			n	(%)	n	(%)
Alopecia	0	0.0	3	100.0	0.950*	0.045–20.0	0	0.0	1	100.0
Alteration in the sense of taste	1	7.1	13	92.9	0.505	0.056–4.49	0	0.0	5	100.0
Alteration in glucose	0	0.0	0	0.0	....	....	0	0.0	0	0.0
Alterations in the menstrual cycle	0	0.0	12	100.0	0.224*	0.012–4.14	0	0.0	4	100.0
Hallucinations	0	0.0	0	0.0	....	....	0	0.0	1	100.0
Anxiety	1	4.3	22	95.7	0.24	0.027–2.08	1	8.3	11	91.7
Brittle hair	0	0.0	12	100.0	0.224*	0.012–4.14	1	50.0	1	50.0
Humor changes	2	13.3	13	86.7	1.18	0.212–6.55	0	0.0	8	100.0
Changes in heart rhythm	1	12.5	7	87.5	1.06	0.113–9.96	0	0.0	1	100.0
Changes in blood pressure	0	0.0	4	100.0	0.725*	0.035–14.7	0	0.0	0	0.0
Confusion	0	0.0	2	100.0	1.35*	0.059–30.7	0	0.0	2	100.0
Diarrhea	0	0.0	7	100.0	0.412*	0.021–7.89	0	0.0	1	100.0
Difficulty concentrating	4	16.7	20	83.3	1.95	0.441–8.63	1	6.7	14	93.3
Difficulty expressing yourself or finding the right words	1	5.9	16	94.1	0.384	0.043–3.37	1	11.1	8	88.9
Decreased visual acuity	1	9.1	10	90.9	0.7	0.077–6.34	0	0.0	7	100.0
Decreased strength	2	25.0	6	75.0	2.94	0.482–18.0	2	28.6	5	71.4
Decreased libido/sexual desire	0	0.0	5	100.0	0.583*	0.029–11.5	1	33.3	2	66.7
Abdominal pain	1	12.5	7	87.5	1.06	0.113–9.96	1	100.0	0	0.0
Headache	3	12.0	22	88.0	1.01	0.219–4.64	2	18.2	9	81.8
Chest pain	0	0.0	10	100.0	0.277*	0.014–5.19	0	0.0	1	100.0
Pain or burning sensation in the body or any part	0	0.0	4	100.0	0.725*	0.035–14.7	1	33.3	2	66.7
Unusual muscle aches	0	0.0	5	100.0	0.583*	0.029–11.5	1	33.3	2	66.7
Usual muscle aches	0	0.0	4	100.0	0.725*	0.035–14.7	2	28.6	5	71.4
Shaking chills	0	0.0	1	100.0	2.29*	0.086–61.0	1	25.0	3	75.0
Sneeze	0	0.0	8	100.0	0.356*	0.018–6.76	0	0.0	6	100.0
Fatigue/tiredness	0	0.0	38	100.0	0.0328*	0.001–0.597	3	75.0	1	25.0
Tingling in the extremities	0	0.0	6	100.0	0.484*	0.024–9.40	1	7.1	13	92.9
Insomnia (difficulty sleeping)	0	0.0	22	100.0	0.098*	0.005–1.78	0	0.0	0	0.0
Heat intolerance	0	0.0	0	0.0	....	....	0	0.0	1	100.0
Cold intolerance	0	0.0	5	100.0	0.583*	0.029–11.5	0	0.0	1	100.0
Nausea	0	0.0	5	100.0	0.583*	0.029–11.5	0	0.0	2	100.0
Neuritis (nerve pain)	0	0.0	2	100.0	1.35*	0.059–30.7	0	0.0	2	100.0
Other	0	0.0	10	100.0	0.277*	0.014–5.19	0	0.0	4	100.0
Palpitations	0	0.0	10	100.0	0.277*	0.014–5.19	0	0.0	1	100.0
Loss of appetite	0	0.0	5	100.0	0.583*	0.029–11.5	0	0.0	1	100.0
Hearing loss	0	0.0	4	100.0	0.725*	0.035–14.7	0	0.0	2	100.0
Hair loss	0	0.0	33	100.0	0.0465*	0.002–0.843	2	22.2	7	77.8
Loss of taste	0	0.0	10	100.0	0.277*	0.014–5.19	1	20.0	4	80.0
Memory loss	0	0.0	15	100.0	0.169*	0.009–3.10	1	7.7	12	92.3
Muscle loss	0	0.0	2	100.0	1.35*	0.059–30.7	0	0.0	1	100.0
Loss of smell	0	0.0	18	100.0	0.132*	0.007–2.41	2	25.0	6	75.0
Loss of body hair	0	0.0	1	100.0	2.29*	0.086–61.0	0	0.0	0	0.0
Skin itch	0	0.0	3	100.0	0.950*	0.045–20.0	0	0.0	1	100.0
Reflux	0	0.0	3	100.0	0.950*	0.045–20.0	0	0.0	4	100.0
Dry skin	0	0.0	14	100.0	0.185*	0.010–3.40	1	33.3	2	66.7
Thirst	0	0.0	4	100.0	0.725*	0.035–14.7	0	0.0	1	100.0
Sensitivity/easy crying	0	0.0	15	100.0	0.169*	0.009–3.10	1	11.1	8	88.9
Excessive sweating	0	0.0	3	100.0	0.950*	0.045–20.0	0	0.0	2	100.0
Tremor in extremities	0	0.0	2	100.0	1.35*	0.059–30.7	0	0.0	6	100.0
Persistent cough	0	0.0	20	100.0	0.113*	0.006–2.06	0	0.0	5	100.0
Brittle nails	0	0.0	11	100.0	0.248*	0.013–4.62	1	50.0	1	50.0
Threw up	0	0.0	1	100.0	2.29*	0.086–61.0	0	0.0	1	0.0

* Haldane-Ascombe correction applied.

(in terms of ethnic groups), as well as more robust methodologies that provide richer data from which a better understanding regarding the differences in long covid symptoms that may exist in women during the gestational period could be formed.

Limitations

Our study has several limitations inherent to the self-reported cross-sectional study design. Given that the questionnaire was

distributed through social networks, there is likely to be selection bias in the sample. For example, information corresponding to the population that does not have adequate resources to access an on-line questionnaire was left out of the study. In addition, there are currently no studies available on COVID-19 in pregnant women in Ecuador, which prevents us from knowing characteristics about the status of pregnant women during infection. A further limitation of this study is the subjective nature of the data as the symptoms are self-reported. For this reason, we cannot rule out that in some cases

Table 5
High altitude risk for pregnant and non-pregnant women with Long-COVID symptoms.

Symptoms	> 2500 m						IC 95 %
	Total	Pregnant	Pregnant %	No pregnant	No pregnant %	OR	
Alopecia	6	0	0.0	6	100.0	0.935*	0.050–17.4
Alteration in the sense of taste	40	2	5.0	38	95.0	0.632	0.137–2.92
Alteration in glucose	2	0	0.0	2	100.0	2.48*	0.114–54.1
Alterations in the menstrual cycle	35	2	5.7	33	94.3	0.751	0.162–3.48
Hallucinations	4	0	0.0	4	100.0	1.37*	0.070–26.5
Anxiety	75	2	2.7	73	97.3	0.255	0.056–1.16
Brittle hair	34	3	8.8	31	91.2	1.31	0.350–4.93
Humor changes	44	1	2.3	43	97.7	0.251	0.032–1.96
Changes in heart rhythm	28	1	3.6	27	96.4	0.442	0.056–3.50
Changes in blood pressure	7	0	0.0	7	100.0	0.806*	0.044–14.8
Confusion	6	0	0.0	6	100.0	0.935*	0.050–17.4
Diarrhea	11	0	0.0	11	100.0	0.515*	0.029–9.16
Difficulty concentrating	86	7	8.1	79	91.9	1.27	0.444–3.65
Difficulty expressing yourself or finding the right words	51	4	7.8	47	92.2	1.14	0.346–3.74
Decreased visual acuity	33	3	9.1	30	90.9	1.37	0.364–5.13
Decreased strength	28	3	10.7	25	89.3	1.69	0.446–6.41
Decreased libido/sexual desire	22	2	9.1	20	90.9	1.34	0.282–6.36
Abdominal pain	13	1	7.7	12	92.3	1.08	0.131–8.95
Headache	71	5	7.0	66	93.0	0.97	0.318–2.95
Chest pain	30	0	0.0	30	100.0	0.174*	0.010–2.99
Pain or burning sensation in the body or any part	13	2	15.4	11	84.6	2.56	0.513–12.8
Unusual muscle aches	18	2	11.1	16	88.9	1.17	0.355–8.26
Usual muscle aches	27	4	14.8	23	85.2	2.7	0.795–9.20
Shaking chills	10	1	10.0	9	90.0	1.47	0.173–12.4
Sneeze	23	1	4.3	22	95.7	0.558	0.070–4.46
Fatigue/tiredness	127	11	8.7	116	91.3	1.85	0.568–6.02
Tingling in the extremities	22	2	9.1	20	90.9	1.34	0.282–6.36
Insomnia (difficulty sleeping)	68	2	2.9	66	97.1	0.298*	0.065–1.36
Heat intolerance	4	0	0.0	4	100.0	1.37*	0.070–26.5
Cold intolerance	21	2	9.5	19	90.5	1.42	0.297–6.76
Nausea	17	1	5.9	16	94.1	0.795	0.098–6.44
Neuritis (nerve pain)	15	1	6.7	14	93.3	0.918	0.112–7.50
Other	33	0	0.0	33	100.0	0.156*	0.009–2.66
Palpitations	30	1	3.3	29	96.7	0.406	0.051–3.21
Loss of appetite	10	0	0.0	10	100.0	0.567*	0.032–10.1
Hearing loss	9	0	0.0	9	100.0	0.630*	0.035–11.3
Hair loss	101	10	9.9	91	90.1	2.26	0.764–6.87
Loss of taste	34	4	11.8	30	88.2	1.99	0.594–6.66
Memory loss	62	6	9.7	56	90.3	1.64	0.559–4.83
Muscle loss	13	0	0.0	13	100.0	0.434*	0.025–7.65
Loss of smell	53	6	11.3	47	88.7	2.09	0.750–6.16
Loss of body hair	2	0	0.0	2	100.0	2.48*	0.114–54.1
Skin itch	19	0	0.0	19	100.0	0.29*	0.017–5.04
Reflux	16	1	6.2	15	93.8	0.852	0.105–6.93
Dry skin	37	4	10.8	33	89.2	1.77	0.532–5.91
Thirst	13	2	15.4	11	84.6	2.56	0.513–12.8
Sensitivity/easy crying	50	2	4.0	48	96.0	0.468	0.102–2.15
Excessive sweating	12	0	0.0	12	100.0	0.471*	0.027–8.34
Tremor in extremities	20	1	5.0	19	95.0	0.658	0.082–5.28
Persistent cough	49	0	0.0	49	100.0	0.0948*	0.006–1.61
Brittle nails	35	3	8.6	32	91.4	1.27	0.338–4.74
Threw up	7	0	0.0	7	100.0	0.806*	0.044–14.8

* Haldane-Ascombe correction applied.

several of these symptoms are being overestimated or underestimated.

Conclusions

The most frequent Long-COVID symptoms in pregnant women were fatigue, hair loss, and difficulty concentrating. The results of this study suggest that the patterns of presentation of long-term sequelae of SARS-CoV-2 infection in pregnant women do not differ significantly from reports available from studies in the general population.

Ethics approval and consent to participate

This project is part of our COVID-19 analysis program, a nationwide study of the epidemiology of COVID-19 in Ecuador, which received an exemption letter from the UDLA's IRB named CEISH on 10 March 2020. The current analysis included anonymized, un-identifiable information and it complies with all local and international guidelines regarding the ethical use of anonymous, non-identifiable information stipulated in such documents as the Declaration of Helsinki and the Good Clinical Practice Guidelines (GCP).

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Authors contribution

JV contributed to the conception and design of the entire project, gained full access to data from the National Statistical Institutes in Ecuador, was primarily responsible for all aspects of the work, and ensure the completeness and accuracy of the investigation.

RF, JIC and KRM contributed to data acquisition and review of the available literature and initial writing of the manuscript. RF and EOP contributed to the statistical analysis and internal validity of the study. ATT, SC, NIC and SJC critically reviewed and edited the manuscript to its final complete version and provided input to the data report and its interpretation.

All authors contributed to the article, review and approved the latest version.

Availability of data

The dataset with the total responses can be obtained from the next link: <https://github.com/covid19ec/CV19Pregnant>.

Competing interests

None declared.

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