Physical Activity, Sedentary Behaviour, and Diet in Menopausal Women: Comparison Between COVID19 "first wave" and "second wave" of pandemic in Italy

Francesca Coppi[1], Milena Nasi[2], Alberto Farinetti[3], Antonio Manenti[3], Sabina Gallina[4], Anna Vittoria Mattioli[2]

[1]Cardiology division. Azienda ospedaliero-universitaria di Modena (Italy); [2]Surgical, Medical and Dental Department of Morphological Sciences related to Transplant, Oncology and Regenerative Medicine (University of Modena and Reggio Emilia, Italy); [3] Department of Medical and Surgical Sciences for Children and Adults, University of Modena and Reggio Emilia, Modena, Italy; [4]Department of Neuroscience, Imaging and Clinical Sciences, University of Chieti-Pescara, Chieti, Italy

Abstract. The COVID-19 pandemic has strongly affected young population all over the world. The present study explores the effects of COVID-19 on physical activity, sedentary behaviour, and diet in a population of 435 menopausal women during the first phase of the pandemic (so-called the "first wave") and during the second spread of infections, after the summer release (so-called "second wave"). Women reported an increase in perceived stress and emotional distress which led to an increase in amount of food (42%), an increase in the consumption of snacks and junk food (48%) and to a switch to an unhealthy diet (46%) and weight gain in 51% of subjects. Most women stopped any physical activity, including outdoor walking, except for a small group (54 = 12%) who continued exercising at home. Unexpectedly, the second wave led to similar results as the first wave. Despite the increase in knowledge about the virus, therapies and the rapid development of vaccines to contain the spread of the disease, fear, stress and anxiety have not diminished as expected. In conclusion, the adoption of an unhealthy lifestyle during the pandemic and the persistence of these behaviors has determined and will cause important damage to the health of women in menopause, in particular an increase in obesity and related metabolic diseases is expected

Key words: physical activity, sitting time, Diet, COVID-19, women, pandemic, sleep disorders

Introduction

The recent worldwide pandemic induced by the spread of the SARS-CoV-2 virus has led to a series of changes in people's lifestyle including physical activity, sitting time, Diet and sleep disorders. These changes were partly due to government-induced restrictions on fighting the virus and partly due to the stress and anxiety generated by the fear of the disease (1,2). In Italy, the first lockdown started on March 2020 and ended on May 2020 (3). This first spread of disease was defined as "first wave". Some municipalities

of Northen Italy, including our area, were strongly affected by the disease and reported an extremely high number of deaths. This induced a generalized fear of contracting COVID-19. After the summer, a "second wave" of disease developed leading to further restriction, i.e. closure of gym and sports facilities, closure of schools and University and again the adoption of smart working and distance learning (4).

Recent literature suggests that quarantine restrictions and fear of disease strongly affected women and young. (5-8) The consequences of quarantine on lifestyle included changes in physical activity, sitting time,

diet and sleep quality. Some papers have been published on changes in lifestyle induced by quarantine, however only few of them focused on women (7-9).

The aim of the present study was to explore the effects of COVID-19 on physical activity, sitting time and diet in a population of menopausal women free of peripheral arterial disease during the first and the second waves of COVID 19.

Materials and Methods

Participants

We collected data using an online (anonymous) survey platform (Google platform) as per Italian Government's recommendations to minimise face-to-face or physical interaction as citizens continue to isolate themselves at home. The potential interviewees were invited via a text message and belong to the "primary prevention group for menopausal women" identified by the non-profit organization of Modena and Castelfranco Emilia. Participants completed the survey from March 24 to May 3, 2020 after agreeing to an electronic informed consent requested for each participant. The survey took 20 min to be completed. A total of 435 women completed the questionnaire.

From December 10, 2020 to December 20, 2020 the same questionnaire was send to all participants and 320 women (73,5%) of the first cohort completed the second round of questionnaire concerning the prolonged effects of the restrictions caused by the "second wave" of the disease. Questions were the same but introduction and informed consent specified that we aim to collect the effects of the second wave. Comparison have been made between summertime (before the second wave) and December 2020 (during second wave of COVID-19 disease in Italy).

First questionnaire

A 30-question multiple-choice questionnaire was prepared. After providing informed consent, patients completed the questionnaire.

Questionnaire consisted of four sections concerning demographic information, changes in, physical activity, sitting time, diet and sleep during quarantine, and ways of coping with lockdown during the quarantine.

A question explores the weight before and after 1 month of lockdown.

Physical activity and sitting time. We investigated on frequency of exercise before and during quarantine (occasionally, 1-2 times a week, 4-3 times a week, more than 5 times a week). We were not able to collect information about intensity of exercise.

Exercise during the lockdown was considered as practicing at home (indoor exercise bike, treadmill, and resistance training) or jogging/running around the house, given that it was not possible either to participate in organized sports or perform other outdoor activities. n Italy. indoor activities have been closed from February 2020 to May 2020 and again from September 2020 to March 2021.

Sitting time was evaluated as number of hours spent in watching tv. In order to get more information about sitting time we also ask about smart working and the impact on sitting time.

Diet. We collected information about frequency of food consumption before and during quarantine (i.e. "how many spoon of sugar a day did you add to drink and food before quarantine?" and "how many spoon of sugar a day did you add to drink and food during quarantine?") the same question was investigated in the 2 questionnaire in order to compare habits during the 2 waves.

Diet was compared with nutritional habits before quarantine. We specifically investigated changes in quantity and quality of food. Specifically, increase in sugar- and fat-rich food was evaluated as Yes/No. A list of some sugar-and fat - rich food has been included in note.

A snack was considered as every eating occasion between main meals and we specifically investigated number of snacks and quality of snacks (i.e. chocolate bars, commercial snacks, chips, almond and dried fruit).

Fruit and vegetables intake was evaluated as numbers of portion/day.

Changes in drinking habits were also explored with specific questions related to coffee (cup of espresso coffee/day), tea (Cup/day), wine (glass/day),

and beer (small size bottle/day)., Drinking frequency and quantity data were analysed in the current study. Soda cola and energy drinks were specifically evaluated and measured (can/day).

We also ask about the self-perception of stress, fear, stigma and anxiety. Eating for cope and drinking for cope was investigated.

Sleep. Sleep was evaluated as subjective perception of sleeping well or changes in quality of sleep or sleeping worst. We also investigate the number of hours sleeping and changes in time of sleep.

Second questionnaire

We investigated the effects of the "second wave"-induced restriction on physical activity, sitting time, diet, and sleep disorders. The same questionnaire was sent to the same group of subjects. Questions were the same of the first questionnaire, but we add 2 specific questions about the self-evaluation of phychological impact.

Statistical analysis

Descriptive analyses were performed for all variables. The Shapiro–Wilk test was used to test normal distribution of continuous variables. We revised the analytical plan from the preregistration because of differences in age and gender between cohorts (see Table 1). A stepwise regression controlling for these differences and including a dummy-code to compare behaviour before and during quarantine (0 =before quarantine, 1 = after quarantine) and between cohorts (0 = March 2020-may 2020, 1 = December 2020) was conducted. To determine differences between groups of questions (before and after quarantine) and cohorts (data obtained from the first and the second questionnaire) we used T-test, chi-square test and when appropriate, Fisher's exact test. Univariate and multivariate correlations were conducted. We followed up with multiple regressions predicting variables of interest from COVID- 19 stress and potential moderators (main effect and interaction with COVID-19 stress). Categorical moderators were dummy-coded.

SPSS (v25) was used and a two-tailed p -value < 0.05 was considered significant. Missing values were excluded.

Ethical consideration

No personal or private data was collected and similarly, the data collection procedure followed the provisions of the Declaration of Helsinki on human subjects (10). The protocol was approved by Institutional Board.

Results

A total of 435 women completed the first questionnaire. The characteristics of the population are shown in table 1. As expected, the women self-reported that they suffered from increased stress and emotional distress which led to an increase in amount of food (42%), an increase in the consumption of snacks and junk food (48%) and to a switch to an unhealthy diet (46%) and weight gain in 51% of subjects. Specifically, 291 women developed "eating to cope" but not "drinking wine to cope". Regarding drinks, women showed an increase in coffee consumption. (Table 2)

The vast majority of women stopped any physical activity, including outdoor walking, except for a small group (54 = 12%) who continued exercising at home. Twenty-four subjects reported using specific apps created by coaches for exercise and for maintaining muscle tone and weight. All subjects reported increased sitting time (mean time 3 ± 2.4 hours), with more time spent watching TV. In addition, working from home and smart working also contributed to increasing sitting time. Sleeping time was reduced in 301 women the 69.1% of women and sleep quality worsened in 252 subjects (58%). Moreover, the women in the study reported increased use of sleep-promoting drugs and antidepressants.

We then correlated the self-perception of increased stress due to COVID-19 with variables related to eating, physical activity, sitting time and sleep during quarantine. To do this analysis, the categorical moderators were dummy-coded (i.e. increased sugar-rich food: 0 = yes; 1 = no etc.). Table 3 presents the correlations between these variables. There were broad positive associations between perceived COVID-19 stress and weight gain, changes in diet and physical activity, and sitting time.

Table 1. Baseline characteristics of population.

	Total population
Nr of subjects	435
Mean age	48.65 ± 2.68 (range 45–54 yrs)
Normal weight Nr of subjects and (%)	117 (26.9)
Overweight Nr of subjects and (%)	231 (53.1)
Obese Nr of subjects and (%)	87 (20)
Mean BMI	28.10 ± 3.76
Hormon replacement therapy Nr of subjects and (%)	112 (25)
Cardiovascular risk factors	
Hypertension Nr of subjects and (%)	234 (53.7)
Diabetes Nr of subjects and (%)	102 (23.4)
Dyslipidemia Nr of subjects and (%)	157 (36)
Diet	
Med D Score	42.3 + 21.8
Vegan Nr of subjects and (%)	23 (5.28)
Vegetarian Nr of subjects and (%)	47 (10.8)
Physical activity	
Sedentary Nr of subjects and (%)	307 (70.57)
High level of physical activities Nr of subjects and (%)	36 (8.2)

Table 2. Changes in diet and food choice induced by quarantine.

Changes in weight	Nr of subjects (%)
Increase	222 (51)
Reduction	78 (18)
No change	135 (31)
Changes in quantity of food	
Increase	183 (42)
Reduction	65 (15)
No change	187(43)
Changes in quality of food	
Switch to unhealthy food	200 (46)
Switch to healthy food	74 (17)
No change	161 (37)
Changes in tea drinking	
Increase	53 (12)
Reduction	44(10)
No change	338 (78)
Changes in coffee drinking	
Increase	174 (40.1)
Reduction	69 (15.8)
No change	192 (44.1)
Eating for cope	
Yes	291 (67)
No	144(33)
Drinking wine for cope	
Yes	47 (10.8)
No	388(89.2)
Snacks and junk food	
Increase	209 (48)
Reduction	52 (12)
No change	174 (40)

As would be expected, there also were large associations between eating to cope and gaining weight.

Self-perception of stress was related to weight gain (r = 0.83; p <0.001), increased eating to cope (r = 0.81; p <0.001), increase in sugar- rich foods (r=0.71; p<0.001), increase in snacks consumption (r=0.73; p<0.001), increase in sitting time (r=0,72; p<0.01) (Table 3)

We then compared the data obtained from the questionnaire administered in March 2020 during the "first wave" (March 2020-May 2020) with the data obtained during the "second wave" (October 2020-December 2020). The comparative analysis showed no differences in nutritional habits and physical activity between the cohorts. (Table 4). However, we observed that a large number of subjects revealed further worsening of sleep quality by comparing "first wave" and "second wave" (69% vs 78%; p <0.01) and a reduction in sleep time (58% vs 74; p <0.01) and a further increase in the use of anxiolytic drugs.

Table 3. Correlations among variables related to lifestyle habits developed during quarantine.

	Covid-19 self perceived stress	Increase of weight	Increase of coffee drinking	Increase in thè Drinking	Increase in Sugar-rich food	Increase in snacks	Drinking wine to cope	Sitting time	Eating to cope
Covid-19 self perceived stress	0	0,832**	0.65*	0,455	0,7193**	0,7385**	0,5631	0,7246*	0,8163**
Increase of weight		0	-0,4560 *	0,2392	0,6938*	0,7953**	0,4693	0,7843**	0,9001**
Increase of coffee drinking (cup/day)			0	0,0642	0,0516	0,135	0,0061	0,0231	0,0392
Increase in thè Drinking (cup/day)				0	0,0791	0,0243	0,0734	0,5648	0,0418
Increase in Sugar-rich food					0	0,6932*	0,0725	0,0864	0,5818
Increase in snacks						0	0,4212	0,7389**	0,8545**
Drinking wine to cope							0	0,2644	0,0972
Sitting time								0	0,7216*
Eating to cope									0

Table 4. Comparison between "first wave" and "second wave"

Nr of subjects (%)	First wave 345	Second wave 320	p
Changes in weight			
Increase	222 (51)	138 (43)	0.05
Reduction	78 (18)	48 (15)	n.s.
No change	135 (31)	134 (42)	Trend to 0.05
Changes in quantity of food			
Increase	183 (42)	120 (37.5)	n.s.
Reduction	65 (15)	45 (14)	n.s.
No change	187(43)	155 (48.5)	n.s.
Changes in quality of food			
Switch to unhealthy food	200 (46)	128 (40)	n.s.
Switch to healthy food	74 (17)	100 (31)	0.05
No change	161 (37)	92 (29)	0.05
Changes in tea drinking			
Increase	61 (12.2)	45 (14)	n.s.
Reduction	138 (27.6)	74 (23)	n.s.
No change	301 (60.2)	201(63)	n.s.
Changes in coffee drinking			
Increase	143 (28.6)	93(29)	n.s.
Reduction	90 (18)	51(16)	n.s.
No change	267 (53.4)	176 (55)	n.s.
Eating for cope			
Yes	291 (67)	198 (62)	n.s.
No	144(33)	122(38)	n.s.
Drinking wine for cope			
Yes	47 (10.8)	45(14)	n.s.
No	388(89.2)	275(86)	n.s.
Snacks and junk food			
Increase	209 (48)	134 (42)	n.s.
Reduction	52 (12)	50 (15.6)	n.s.
No change	174 (40)	136 (42.4)	n.s.

Discussion

Our study shows that the Italian lockdowns have had a significant impact on the psychological state of postmenopausal women by influencing lifestyle and that the "second wave" of spread of COVID-19 has delayed the return to a healthy lifestyle.

The first observation is the increased perceived stress in the women of our study population. This stress was associated with an increase in the quantity and a change in the quality of food introduced to cope with the stress. The women showed a change in nutritional habits with an increase in "comfort food" and "food cravings" leading to weight gain and obesity (11,12,13).

Women have been severely affected by quarantine for many reasons. First, because of their social role and in the family, the woman often has primary roles as

caregiver towards the elderly and children of the family. Across the world, women and girls earn less, have less access to educational opportunities, are in precarious jobs more often and have limited access to financial resources and digital technology (14). In addition, to investigating these existing inequalities, multiple studies show that the COVID-19 pandemic has a disproportionate economic impact for women and lower income groups (15).

The additional care burden associated with childcare and distance learning during blockages and caring for sick family members can lead to significant psychological distress leading to depression. Stay-at-home measures along with financial and security concerns can put a strain on families, which in some situations can lead to high stress levels in women (16).

The relationship between stress and eating behavior is well known and identifies those who cope with stress by eating and drinking in an attempt to feel better ("stress-related eating"). These stress-driven eaters were more likely to eat unhealthy foods such as snacks, chocolate, soda cola, to reduce fruit and vegetables intake, and to drink wine and spirits more frequently (11,12,13). Food craving refers to an intense desire to consume a specific food. In Western societies, these foods usually have high palatability and are energy dense, usually have high sugar and/or fat content (12,13).

The most common food consumed by women is chocolate (17) Weingarten HP and colleagues explored craving for food in college students and found it in 97% of women and 68% of men. (17) There is also a relationship between food craving, obesity and binge-eating disorders (12).

Obesity is a risk factor for COVID-19 disease (18). In addition, there is a known relationship between obesity and depression, however the mechanisms linking depression to obesity has been little studied. The recent pandemic has strongly highlighted this link which leads to an increase in obesity caused by the need to cope with stress also through quantitative and qualitative changes in the diet.

The second questionnaire, that analyses changes in lifestyle during the "second wave", demonstrated the persistence of unhealthy lifestyle habits. The perception reported by women of our study group was an increase in fear, stress and stigma, which resulted in further worsening of the lifestyle. The "second wave" of disease was perceived as much more serious than the "first wave" despite the increased knowledge of the disease that led to effective therapies and vaccine development. Isolation and further economic crisis have contributed to increased depression and low mood in women.

The lockdown and restrictions imposed by governments reduced the access to sport facilities and gyms, leading to a reduction in physical activity and an increase in sitting time in the population (19).

We reported an increase in time spent to watching television. It is well kwon that stress and depression are often associated with an increase in sitting time. Distance work contributed to this unhealthy habit. During quarantine at home, the population tends to adopt a sedentary routine, which could lead to psychosocial distress in form of depression and anxiety (20). On contrary, regular physical activity reduces symptoms of anxiety, reduces inflammation and endothelial dysfunction (21,22,23). In addition, a positive effect of physical activity has been reported in patients suffering from COVID-19 (24,25). Prolonged sitting has been implicated in endothelial cell dysfunction caused by reduction in leg blood flow-induced shear stress (26). Sedentarism, discomfort and boredom caused by social isolation could lead to changes and worsening of lifestyle patterns, also promoting binge eating. Women reported an increase time spent in screen devices. The elevated time in screen devices causes by pandemic has been associated with addictive behaviors, In previous studies television time was associated with increased sweetened food consumption and increased desire to drink (27) Excessive sugar intake has also been considered as an addiction since high-palatable foods activate brain regions, which are responsible for pleasure and reward (28,29). In our population we observed an increased in sugar-rich food. Accordingly, an analysis based on data from IRi (Information resources), a leader in Consumer Goods, Retail and Shopper market data, which has been analyzing consumption trends during the crisis (February 23rd through to March 29th, 2020) showed an increase of the products used for home preparation of bread, pizza and cakes compared to the same period in 2019 (30,31). An inadequate intake of fruits

and vegetables, coupled with an increase in the consumption of simple sugar foods and saturated fats, can expose subjects to specific shortages in micro-nutrients which in turn can compromise their health. Moreover, this led to a poor adherence to Mediterranean Diet in Italy during this pandemic.

We observed a worsening of sleep quality during the lockdown in March 2020 as well as during the second wave of disease (October-December 2020). Sleep disorders during the Italian lockdown for the COVID-19 pandemic have previously been reported. Marelli and colleagues described poor sleep quality and suggested that the COVID-19 outbreak acts as a traumatic event and can produce psychological distress and anxiety symptoms, which negatively impact sleep quality (32).

The present study has some limitation. Questionnaires were self-administered and described a subjective evaluation. No validated tools were used to assess.

Conclusions

The long-lasting pandemic has led to stress and anxiety and unhealthy lifestyle changes in women. Women have been subjected to various stressors over a long period of time. Stress and anxiety have led to the development of an unhealthy lifestyle that favors the onset of obesity in women. Obesity is associated with inflammation and endothelial dysfunction, which are pathophysiological basis for atherosclerosis. Based on these findings, the recent pandemic will severely affect the development of cardiovascular disease and diabetes in the years to come.

Conflict of Interests: None Declared

Author contribution: FC, MN, AVM and SG conceived of the idea at the basis of the article, AVM, MN, FC, AF, AM, developed the different part of the manuscript. AVM, MN, AF and SG performed the final supervision. All authors contributed to and approved the final manuscript.

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Correspondence:
Prof Anna Vittoria Mattioli,
Surgical, Medical and Dental Department of Morphological Sciences related to Transplant,
Oncology and Regenerative Medicine
University of Modena and Reggio Emilia,
Via del pozzo, 71 41100 Modena (Italy)
Email: annavittoria.mattioli@unimore.it