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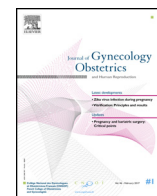
Original Article

The effects of COVID-19 lockdown on lifestyle and emotional state in women undergoing assisted reproductive technology: Results of an Italian survey

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ABSTRACT

Purpose: On March 8, 2020, the Italian Government implemented extraordinary measures to limit viral transmission of COV-19/SARS-CoV-2. We evaluated the impact of COVID-19 lockdown on lifestyle and emotional state in women planning infertility treatments.
Basic Procedures: We performed a quantitative research study using a web-based survey, in 140 women referred to Assisted Reproductive Technologies Center.
Main findings: We observed changes in body weight during lockdown in 80 % of women, and a significant increase in BMI in comparison to that observed before (p = .001). We observed a high percentage of non-adherence to the Mediterranean pattern during lockdown due to higher frequency of consumption of sweet/pastries, cheese and meat, rather than fruit, vegetables and legumes. Before lockdown 36.4 % women were snack consumers while during lockdown 55 % (p = .002). By considering individuals' attitude to snack consumption, we observed an increase related to boredom (p=<.0001) and anxiety (p = .05) during lockdown. Increased levels of anxiety and sadness were observed in about 30 %, and of boredom in 25 %. The percentage of women worried about their planning infertility treatment was more than 50 %.
Principal Conclusions: Quarantine-related restrictions strongly influenced lifestyle psychological behavior leading to an increased burden of cardiovascular disease.

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Introduction

On 11th of March 2020, WHO made the assessment that the novel coronavirus, COV-19/SARS-CoV-2 can be characterized as a pandemic. Since February 2020, Italy has experienced an outbreak of COVID-19 responsible of a high number of deaths. On March 8, 2020, the Italian Government implemented extraordinary measures to limit viral transmission [1].

These exceptional war-like restrictive measures induced a huge effect on psychosocial health and strongly influenced lifestyle habits.

In this scenario, the prolonged lockdown severely affected infertility treatments; ESHRE advised that all patients considering or planning treatments, independently of confirmation or suspicion of COVID-19 infections, should avoid becoming pregnant at this time and consider deferring pregnancy by freezing oocytes or embryos for embryo transfer at a later point [2,3]. It is well known that "time" is a crucial variable, in particular for infertile women with lower Assisted Reproductive Technology (ART) success rate as well as in older women with proven reduced ovarian reserve [4].

Along these lines, it is mandatory to pay attention to negative psychological effects (i.e. anxiety, fear, panic) and changes in lifestyle and nutritional habits COVID-19 lockdown-related, which play a pivotal role in the development and progression of cardiovascular (CV) disease [5,6]. These negative modifications may induce exponential increase in CV risk, commonly associated with infertility treatments [7].

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The aim of this study was to evaluate the impact of COVID-19 lockdown on lifestyle and psychological behavior in women planning infertility treatments.

Materials and methods

We performed a quantitative research study design in a sample of Italian women, referred to the Internal Medicine Clinic at the Assisted Reproductive Technologies Center, using a web-based survey. The survey was conducted in Italian language according to the Checklist for Reporting Results of Internet E-Surveys [8].

The Italian version of the questionnaire was created online using Google Forms, and sent by a University email validated account to 315 Caucasian women seven weeks after the beginning of the lockdown. The survey was addressed from 20 April to 4 May (day of restrictions suspension). We included women aged between 18–49 years planning homologous or heterologous infertility treatments at ART Center the current year, in particular from May to October 2020. Women with ongoing pregnancy after ART and non-Caucasian women were excluded.

In the current year a lower number of fertility treatments were performed. In particular, from March to May, new fertility treatments were suspended, and non-urgent gamete cryopreservation and embryo transfers were cancelled. Therefore, our sample size was representative for infertile female population referring to the Center for ART (Level 3 University Hospital).

The probability sample was considered demographically representative of the women referred to the ART Center for age, socio-economic status and geographical provenience.

An information sheet as the first page of the online survey was set, and participants must have the opportunity to give informed consent, according to Ethical principles of the Declaration of Helsinki, before accessing the survey. All the potential participants were fully informed about the study, extent of privacy, anonymity and confidentiality, the voluntary nature of participating, and the lack of negative consequences in case of decline. The study was approved by the Ethic Committee.

The self-administered questions were designed to assess the impact of Italian COVID-19 lockdown on lifestyle habits as well as psychological behavior and comprised 60 questions.

Basic demographic data were recorded: age, level of education, and Region of domicile. Socio-economic status comprised types of job before and during lockdown. Clinical data included: types of procedures (homologous or heterologous), height, weight before and during lockdown, menstrual cycle changes during lockdown, presence of chronic diseases.

Nutritional habits, physical activity and smoking habit of women before and during lockdown were assessed (multiple choice). The quality and quantity of sleep during lockdown was evaluated (multiple choice). Emotional state, including anxiety, sadness, anger, boredom and optimism during lockdown, using a numerical and verbal rating scale (1 = not at all, 2=slightly, 3=moderately, 4=very much, 5=extremely) was assessed. The mood of women before attempting to ART was recorded (multiple choice).

Statistical analysis

Statistical analysis was performed by using the SPSS (Statistical Package for Social Sciences, Chicago, USA) software for Windows (Version 26.0). Continuous variables were expressed as mean (±SD). The categorical variables were expressed as frequencies and percentages. Chi-square test was used to test for proportions. The continuous variables were analyzed by using a parametric test (t-Student test). A p-value <0.05 was considered to indicate statistical significance.

Results

The survey was concluded on 4 May 2020; the questionnaire was sent to 315 infertile women and was self-completed by 140 responders (15 questionnaires were excluded because received back after 4 May). Demographic, socio-economic and clinical characteristics of the study population are reported in Table 1. Mean age was 39.4 ± 5 yrs and 52.8% were more than 40 years old. More than 50% lived in Central Italian Regions, about 30% in Northern Italian Regions and 11% in Southern Italian Regions (Supplemental Fig. 1). About 50% of the study population had a high level of education (graduation and post-graduation). A total of 117 (83.6%) women stopped going outside for work reasons (40% smart-working, 43.6% unemployed). Therefore, we considered the sample demographically representative of the women referred to the ART Center for age, socio-economic status and geographical provenience.

Twenty-two (15.7%) out of 140 women were smokers and 6 (27.3%) out of 22 increased cigarettes consumption during lockdown. Thirty-four (24.3%) women were overweight/obese (Table 1).

We observed changes in body weight during lockdown in 112 (80%) women; in 66 (47.1%) body weight was increased and in 46 (32.9%) was decreased. Moreover, we observed a significant increase in Body Mass Index (BMI) mean value during lockdown in comparison to that observed before lockdown (p = .001) (Table 2). At the same time, 32 (22.9%) women stopped physical activity during lockdown, consequently 60 (42.9%) out of 140 women showed a sedentary behavior (p < .0001) (Table 2).

We investigated sleep habits as quality and quantity and about 60% of women reported sleep fragmentation or the use of medications for the treatment of sleep disorders.

Lockdown and Diet

Together with physical activity, we evaluated habitual food intake before and during lockdown.

During lockdown high percentage of women reported changes in nutritional habits. In particular, we observed an increased

Table 1
Demographic, socio-economic and clinical characteristics of study population.

Variables	n = 140
Age, yrs*	39.4 ± 5
Age > 40 yrs, n (%)	74 (52.8)
BMI ≥ 25 kg/m², n (%)	34 (24.3)
Smoking habit, n (%)	22 (15.7)
Homologous ART, n (%)	41 (29.3)
Eterologous ART, n (%)	99 (70.7)
First-time ART, n (%)	58 (41.4)
Geographical distribution, n (%)	45 (32.1)
Northern Italian Regions	79 (56.5)
Central Italian Regions	16 (11.4)
Southern and Islands Italian Regions	
Level of Education, n (%)	16 (11.4)
Middle School	56 (40)
High School	45 (32.2)
Graduation	23 (16.4)
Post-Graduation	
Comorbidities, n (%)	77 (55)
None	39 (27.8)
1	24 (17.2)
≥2	
Work during lockdown, n (%)	23 (16.4)
Active work outside	56 (40)
Smart working	61 (43.6)
Unemployed	

ART (Assisted Reproductive Technology).
* Values are reported as mean ± SD.

Table 2
Lifestyle changes during COVID-19 pandemia.

Variables	Before Lockdown	During Lockdown	p
Weight*	62.1 ± 9.8	63 ± 10	<.0001
BMI, n (%)	22.8 ± 3.1	23.1 ± 3.1	.001
Physical activity, n (%)	28 (29)	60 (42.9)	<.0001
No	70 (50)	43 (30.7)	.001
Yes, 1−2/week	33 (23.6)	28 (20)	ns
Yes, 3−4/week	9 (6.4)	9 (6.4)	ns
Yes, >4/week			

BMI (Body Mass Index).
* Values are reported as mean ± SD.

consumption of red meat and meat products (15.8%), sweet and pastries (32.4%), sugar-sweetened beverages (15.1%) and a reduction in fish consumption (13.7%), as well as water intake (23%). On the other hand, virtuous nutritional habits in increased consumption of vegetables (10.8%), fruits (15.8%) and legumes (15.1%) was observed (Fig. 1).

We evaluated 12 dietary factors and we defined for each dietary factor the optimal frequency of intake based on adherence to Mediterranean pattern [9]. We calculated the percentage of non-adherence to the Mediterranean pattern before lockdown and we observed a wide variability among dietary factors investigated, ranging from about 8% to more than 80%. All women used extra virgin olive oil as the main culinary lipid before lockdown; as concern alcohol consumption, we observed that 32.1% were non-drinkers, 65% were occasionally drinkers and 2.9% were 1 unit per day drinkers. During lockdown we did not observed changes in extra virgin olive oil consumption whereas, the percentage of 1 unit per day drinkers was slightly increased (5.7%). The percentage of non-adherence to the Mediterranean pattern before lockdown was far higher than the optimal intake for whole grain, fruit and vegetables, legumes, fish, sweet and pastries, milk/yogurt and red meat and meat products (Fig. 2). We evaluated 12 dietary factors and we defined for each dietary factor the optimal frequency of intake based on adherence to Mediterranean pattern. [9] We

calculated the percentage of non-adherence to the Mediterranean pattern before lockdown and we observed a wide variability among dietary factors investigated, ranging from about 8% to more than 80%.

We further calculated the percentage of non-adherence to the Mediterranean pattern during lockdown and we observed worse frequency of consumption of sweet and pastries, cheese and meat, whereas fruit, vegetables, legumes and milk/yogurt showed increasing trend to Mediterranean pattern adherence (Fig. 2). Moreover, we evaluated the contribution of snacks to daily food intake; before lockdown 51 (36.4%) women were snack consumers and during lockdown 77 (55%) (p = .002) (Fig. 3). We further focused on individuals' motivation of snack consumption before and during lockdown and we observed a markedly increase related to boredom (3.6 vs. 30, p=<.0001) and anxiety (1.4 vs. 5.7, p = .05) (Fig. 3).

Lockdown and Emotional State

We investigated emotional state during lockdown, and an increased level of anxiety and sadness was observed in about 30%, and of boredom in 25% of women investigated. In about 50% of women higher scores reflect an optimistic inclination for the future (Fig. 4a and b). We further analysed the emotional state according to geographical distribution, age and socioeconomic status. We found higher scores of negative emotional state in women from Central and Southern and Island Italian Regions (more than 30% for anxiety and sadness, and about 40% for boredom) in comparison to Northern Regions (about 15% for anxiety, sadness and boredom). As concerns age, we found a significant higher score of anxiety, sadness and anger in younger women (18-30 yrs) in comparison to older women (31-40 yrs and >40yrs) (anxiety 75% vs. 25.3% vs. 26.2%; p = 0.01); (sadness 87.5% vs. 26.8% vs. 24.6%; p = 0.0009); (anger 75% vs. 13.5% vs. 12.3%; p < 0.0001); whereas, we found no significant differences in emotional state in employed and unemployed women. The percentage of women worried about their planning infertility treatment was more than 50%, in
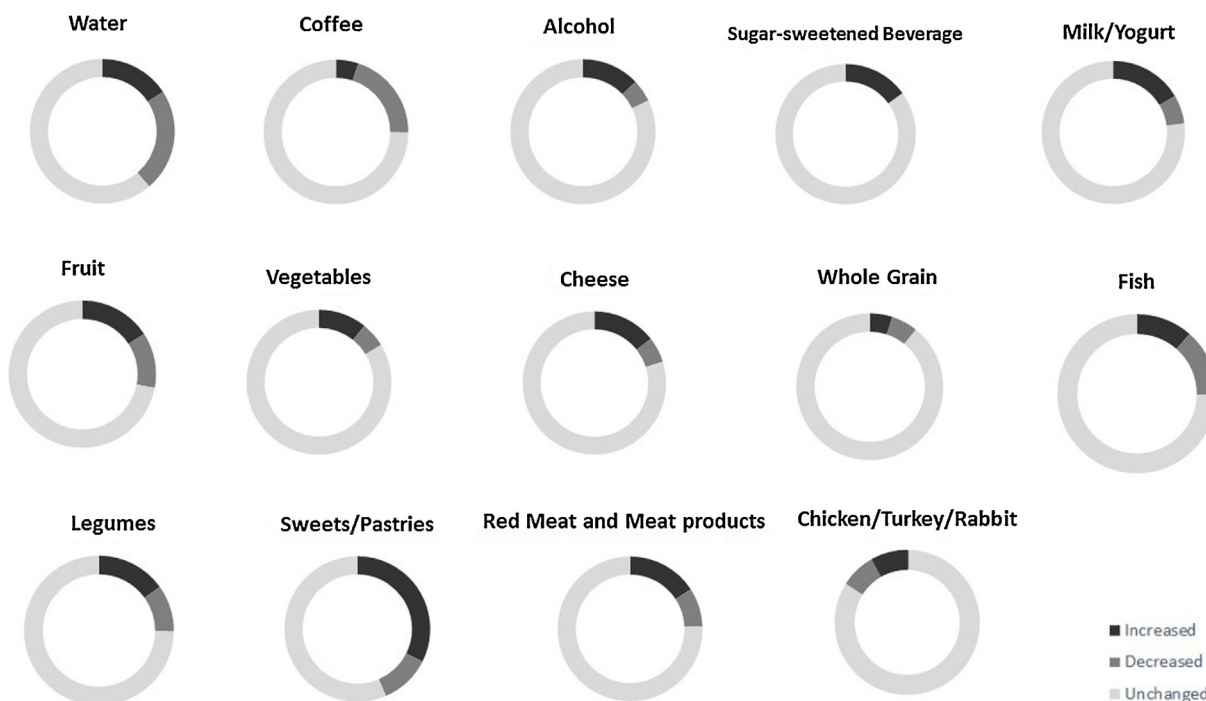

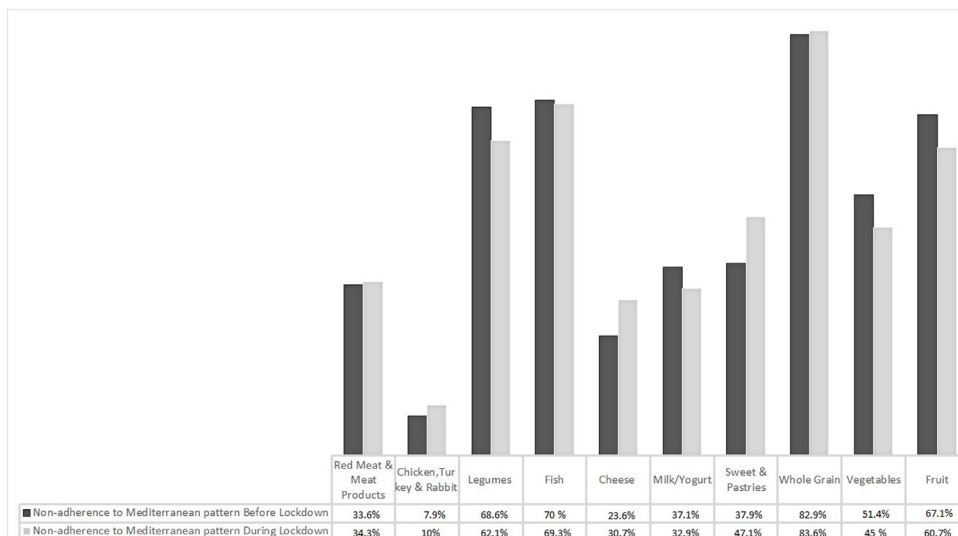**Fig. 1.** Changes in nutritional habits during lockdown by evaluating 14 items.

Fig. 2. The percentage of non-adherence to the Mediterranean pattern before and during lockdown.

Fig. 3. The contribution of snacks to daily food intake and individuals' motivation of snack consumption before and during lockdown.

particular 39 (67.2%) first-time ART women had levels of worry higher than women who have had previous unsuccessful treatment (60.2%, p = .6).

Discussion

COVID-19 pandemic induced the Italian Government to enforce restrictions on outdoor activities and collective quarantine on the population. Quarantine is the separation and restriction of movement of people who have potentially been expose to a contagious disease to ascertain if they become unwell, so reducing the risk of them infecting others [10]. Quarantine is an unpleasant experience, which is associated with loss of freedom, uncertainty over disease status, negative psychological effects and changes in lifestyle. On the bases of these observations, we aimed to evaluate if pandemic is affecting lifestyle habits and emotional state in women planning ART. In this scenario, the suspension of new fertility treatments and this prolonged lockdown should be detrimental to women.

To date, the preconceptional period represents an opportunity to identify and modify clinical and behavioral risks, in particular in women undergoing ART, who are older at the time of pregnancy, and who may have comorbidities, such as obesity, dyslipidemia, hypertension, diabetes, metabolic syndrome and unhealthy lifestyle.

Data from the present survey provided evidence that 52.8% of women had more than 40 years. The "time" variable is crucial for

infertile women, in particular in low prognosis for success in ART, and the impact of female age on the success rates of ART is more dramatic in older than younger patients [4]. Moreover, women undergoing ART at a later age had potential age-related CV risk factors, which together with high doses of hormone therapy could further influence CV risk besides pregnancy outcomes [11–13].

As concern lifestyle habits, and in particular smoking habit, before lockdown the percentage of smokers was about 16% despite of the increasing evidence that smoking is harmful for outcomes of ART [14] as well as CV health. In addition, during lockdown 27% of smokers increased cigarettes consumption. The main consequence of lockdown is change in nutritional habits due to limited access to food caused by restricted store opening hours and use of long-life food rather than fresh food. On the other hand, changes in job activity and variations of salaries possibly contributed to modify nutritional habits, thus switching to unhealthy food.

Diet is a vital lifestyle component that affects CV risk through body weight and many other pathways [15]. It is well known that a greater adherence to the Mediterranean Diet is linked to a reduced risk of overall mortality, CV diseases, overall cancer incidence, neurodegenerative diseases and diabetes [16]. Moreover, a greater degree of protection may occur when lifestyle factors are adopted before and throughout pregnancy. Recent data are suggesting that Mediterranean Diet, rich in fruit and vegetables, whole grains, legumes, extra virgin olive oil, fish and low intake of red and processed meat, seems to preserve and improve fertility [17] and increased chances of a successful pregnancy in women undergoing
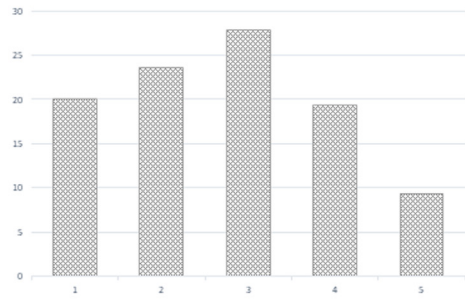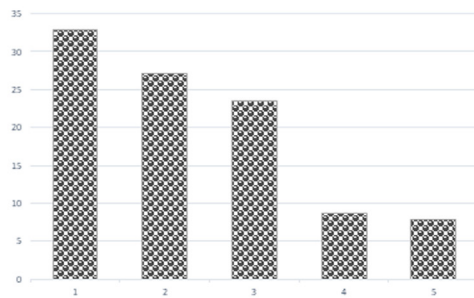
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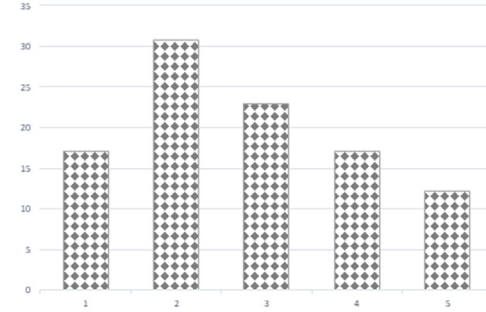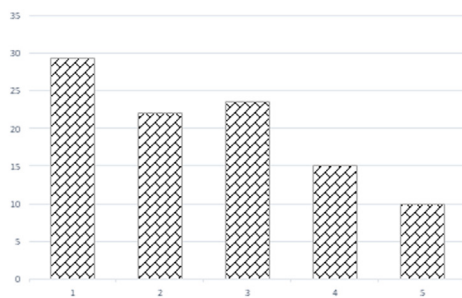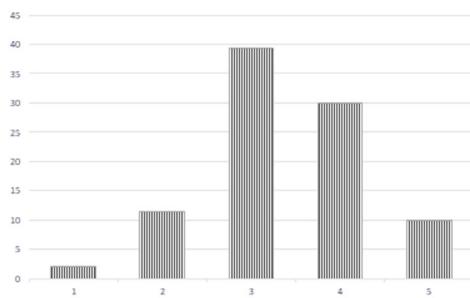
Fig. 4. Emotional state during lockdown analysed by using a numerical and verbal rating scale (1 = not at all, 2=slightly, 3=moderately, 4=very much, 5=extremely).

ART [18]. In theory in Italy, due to their gastronomic background, people should be facilitated in following the nutritional recommendations. Despite of this observation, we detected weak adherence to Mediterranean diet yet before lockdown.

Data from a recent study performed on a large sample of Italian internet users during lockdown, showed high adherence to the Mediterranean diet, in particular the intake of fruit, vegetables, nuts, legumes and fish [19]. Moreover, another internet-based survey disseminated among specific population of pregnant women in the second or third trimester of pregnancy, evidenced moderate adherence to the MD maintained throughout pregnancy [20]. In our study, during lockdown intake of meat (chicken, turkey, red and meat products) and cheese was mildly increased, whereas sweet and pastries consumption was strongly increased. Together with negative dietary factors, we observed virtuous food behavior related to increased consumption of fruit, vegetables and legumes. It is noteworthy that the increased participation of women in the workforce, lead to short time dedicated to food selection and meal preparation, which further complicates food choices. Because of eating behavior is not a constant phenomenon, but may change with differing circumstances and experiences, we could hypothesize that these virtuous food behaviors are related to pandemic work changes. Indeed, data from survey documented that more than 80% of women did not work outside, thus spending more time in the kitchen. Our data partially support data from Di Renzo et al. and Bivia-Roing et al., probably due to the characteristics of our population. The main reason was that the study was performed in women (mean age 39.4 yrs) planning ART in a particularly vulnerable COVID-19 situation. At the best of our knowledge, this study is the first to investigate the impact of the COVID-19 lockdown on lifestyle changes among women planning ART.

Together with the unhealthy diet, the reduction of physical activity may contribute to weight gain during lockdown. Italian Government prohibited outdoor and social activities; nevertheless, there are several options for exercising and training at home. Despite these options, more than 40% of women had a sedentary behavior, and this datum was in keeping with Di Renzo et al., even if the percentage of those who train ≥5 times/week was slightly increased [19].

Negative emotional factors, such as stress, anxiety, sadness and boredom, may act as modifiable predisposing factor that could increase the burden of CV disease through its potential influences on lifestyle habits [21]. Interestingly, we observed not only a significant increased number of snack consumers during lockdown but also the attitude to consume snacks, in particular boredom and anxiety. This datum is in line with that reported demonstrating that the lockdown seems to have influenced the ability to control the relationship with food in women, who display a higher state of eating anxiety [22].Data from literature demonstrate that negative emotions are a precipitant of emotional eating, particularly among women [23]. Emotional eating which is defined as the tendency to eat in response to negative emotions [24], is associated with elevated consumption of high-calories and high-fat foods, weight gain, obesity and in turn worse CV burden.

Finally, in addition to physical activity and a balanced diet, adequate sleep is an important component of a healthy lifestyle [25]. We observed that during lockdown about 60% of women reported sleep fragmentation or the use of medications for the treatment of sleep disorders.

It is well known that positive well-being, including non-smoking, greater physical activity, better dietary patterns and adequate sleep, may act as a modifiable protective factor. In particular, getting sufficient sleep helps to regulate appetite, improves immune system function, and is associated with lower CV risk [25].

A recent survey capturing emotional reactions of people during lockdown, and before fertility clinics announced re-opening, reported more negative than positive emotions, in particular stress, worry, frustration and anger [26]. We found that the percentage of women worried about their planning infertility treatment was more than 50%; this condition together with negative emotional state, in particular anxiety and sadness, were possibly associated with poor ART outcome, beside of CV risk. These findings could help to identify women needing to tailored psychological support during different the stages of infertility treatments.

The lack of validated questionnaire represents a possible limitation of this study; however, the survey was able to focus on specific group of women planning ART, in whom we evidenced an unhealthy lifestyle further worsened during lockdown. Moreover, another limitation of the study is represented by a self-reported questionnaire, which may be associated with the possibility of bias.

These findings provide a viewpoint to help healthcare professionals to better identify priorities and remedies for infertile women lifestyle behaviors and emotional state impacted by the COVID-19 pandemic restrictions. Quarantine-related restrictions strongly influenced lifestyle leading to an increased burden of CV disease. Therefore, there is a need to reevaluate the CV and metabolic risk profile and emotional state before infertility treatments.

A global action supporting healthy diet and physical activity is needed to encourage women to begin a good lifestyle in preconceptional period.

This topic is timely in an era where more women are undergoing ART and in which the correction and/or the management of modifiable CV risk factors are mandatory and represent the main clinical goal for both a safe pregnancy, and lifetime women's health.

Future researches could help to evaluate if the effects of COVID-19 on the emotional state and CV burden in women planning ART would affect ART outcomes.

Funding

Declaration of Competing Interest

The authors declare no conflict of interest.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.jogoh.2021.102079.

References

[1] Remuzzi A, Remuzzi G. COVID-19 and Italy: what next? Lancet 2020;395 (10231):1225–8, doi:http://dx.doi.org/10.1016/S0140-6736(20)30627-9.
[2] ESHRE - European Society of Human Reproduction and Embryology Coronavirus Covid-19: ESHRE Statement on Pregnancy And Conception. 2020.
[3] ASRM. American Society for Reproductive Medicine (Asrm) Patient Management And Clinical Recommendations during the Coronavirus (Covid-19) Pandemic Available from: https://www.asrm.org/news-andpublications/covid-19/statements/patient-management-and-clinicalrecommendations-during-the-coronavirus-covid-19-pandemic/; 2020 [accessed 12 June 2020].. 2021.
[4] Alviggi C, Esteves SC, Orvieto R, et al. COVID-19 and assisted reproductive technology services: repercussions for patients and proposal for individualized clinical management. Reprod Biol Endocrinol 2020;18(1):45.
[5] Sin NL. The protective role of positive well-being in cardiovascular disease: review of current evidence, mechanisms, and clinical implications. Curr Cardiol Rep. 2016;18(11):106.

[6] Mattioli AV, Sciomer S, Moscucci F, et al. Cardiovascular prevention in women: a narrative review from the Italian Society of Cardiology working groups on' Cardiovascular Prevention, Hypertension and peripheral circulation' and on' Women Disease'. J Cardiovasc Med (Hagerstown) 2019;20(9):575–83.

[7] Udell JA, Lu H, Redelmeier DA. Failure of fertility therapy and subsequent adverse cardiovascular events. CMAJ 2017;189:E391–7.

[8] Eysenbach G. Improving the quality of web surveys: the checklist for reporting results of internet E-Surveys (CHERRIES). J Med Internet Res 2004;6(3)e34, doi:http://dx.doi.org/10.2196/jmir.2042] [published correction appears in.

[9] Società Italiana di Nutrizione Umana (SINU). LARN, Livelli di Assunzione di Riferimento di Nutrienti e energia per la popolazione Italiana. SICS; 2014.

[10] Centers for Disease Control and Prevention. Quarantine and Isolation. 2017. . [accessed 15 June 2020] https://www.cdc.gov/quarantine/index.html.

[11] Westerlund E, Brandt L, Hovatta O, et al. Incidence of hypertension, stroke, coronary heart disease, and diabetes in women who have delivered after in vitro fertilization: a population-based cohort study from Sweden. Fertil Steril 2014;102:1096–102, doi:http://dx.doi.org/10.1016/j.fertnstert.2014.06.024.

[12] Becerra-Gonzales VG, Martinez Claudia. Clinical challenges for women of modern societies and potential cardiovascular consequences. JACC: Case Reports. 2020;2:159–60.

[13] Savasi VM, Mandia L, Laoreti A, et al. Maternal and fetal outcomes in oocyte donation pregnancies. Hum Reprod Update 2016;22(5):620–33, doi:http://dx.doi.org/10.1093/humupd/dmw012.

[14] Mínguez-Alarcón L, Chavarro JE, Gaskins AJ. Caffeine, alcohol, smoking, and reproductive outcomes among couples undergoing assisted reproductive technology treatments. Fertil Steril 2018;110(4):587–92, doi:http://dx.doi.org/10.1016/j.fertnstert.2018.05.026.

[15] Yu E, Malik VS, Hu FB. Reprint of: cardiovascular disease prevention by diet modification: JACC health promotion series. J Am Coll Cardiol 2018;72(23 Pt B):2951–63, doi:http://dx.doi.org/10.1016/j.jacc.2018.10.019.

[16] Dinu M, Pagliai G, Casini A, et al. Mediterranean diet and multiple health outcomes: an umbrella review of meta-analyses of observational studies and randomised trials. Eur J Clin Nutr 2018;72(1):30–43, doi:http://dx.doi.org/10.1038/ejcn.2017.58.

[17] Garruti G, Depalo R, De Angelis M. Weighing the impact of diet and lifestyle on female reproductive function. Curr Med Chem 2019;26(19):3584–92, doi:http://dx.doi.org/10.2174/0929867324666170518101008.

[18] Karayiannis D, Kontogianni MD, Mendorou C, et al. Adherence to the Mediterranean diet and IVF success rate among non-obese women attempting fertility. Hum Reprod 2018;33(3):494–502, doi:http://dx.doi.org/10.1093/humrep/dey003.

[19] Di Renzo L, Gualtieri P, Pivari F, et al. Eating habits and lifestyle changes during COVID-19 lockdown: an Italian survey. J Transl Med 2020;18(1):229, doi:http://dx.doi.org/10.1186/s12967-020-02399-5.

[20] Biviá-Roig G, La Rosa VL, Gómez-Tébar M, et al. Analysis of the impact of the confinement resulting from COVID-19 on the lifestyle and psychological wellbeing of spanish pregnant women: an internet-based cross-sectional survey. Int J Environ Res Public Health 2020;17(16):5933, doi:http://dx.doi.org/10.3390/ijerph17165933.

[21] Kivimäki M, Steptoe A. Effects of stress on the development and progression of cardiovascular disease. Nat Rev Cardiol 2018;15(4):215–29, doi:http://dx.doi.org/10.1038/nrcardio.2017.189.

[22] Di Renzo L, Gualtieri P, Cinelli G, et al. Psychological aspects and eating habits during COVID-19 home confinement: results of EHLC-COVID-19 italian online survey. Nutrients 2020;12(7):2152, doi:http://dx.doi.org/10.3390/nu12072152.

[23] Litwin R, Goldbacher EM, Cardaciotto L, et al. Negative emotions and emotional eating: the mediating role of experiential avoidance. Eat Weight Disord 2017;22(1):97–104, doi:http://dx.doi.org/10.1007/s40519-016-0301-9.

[24] Arnow B, Kenardy J, Agras W. The Emotional Eating Scale: the development of a measure to assess coping with negative affect by eating. Int J Eat Disord 1995;18:79–90, doi:http://dx.doi.org/10.1002/1098-108X.

[25] Linz D, Kadhim K, Kalman JM, et al. Sleep and cardiovascular risk: how much is too much of a good thing? Eur Heart J 2019;40(20):1630–2, doi:http://dx.doi.org/10.1093/eurheartj/ehy772.

[26] Boivin J, Harrison C, Mathur R, Burns G, Pericleous-Smith A, Gameiro S. Patient experiences of fertility clinic closure during the COVID-19 pandemic: appraisals, coping and emotions. Hum Reprod. 2020;35(11):2556–66, doi:http://dx.doi.org/10.1093/humrep/deaa218.