

Changes in coffee and caffeine intake during the pandemic in women smokers and non-smokers: a future challenge for cardiovascular prevention

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Abstract. *Background:* The recent pandemic has led to major lifestyle changes, especially in women, changes that will impact cardiovascular risk. The aim of the present observational study was to evaluate changes occurred during pandemic in coffee and caffeine intake in a group of adult women and compare changes in smoking versus non-smoking women. *Methods:* A web questionnaire was sent through a online survey platform to a group of unselected adult women. The consumption of coffee and caffeine were investigated in 2 groups of women by comparing smokers and non-smokers. *Results:* A total of 435 adult women (256 non-smokers and 179 smokers) answer to all questions. Smokers increase the number of cigarette/days (mean + 3.4 cig/day). Coffee intake was significantly increase in smokers compared to non-smokers (3.1+1.0 versus 1.5+0.6 cups/day $p < 0.01$). In smokers, self-perception of increase stress was related to increased coffee intake ($r = 0.84$; $p < 0.001$), increased sugar- rich foods ($r=0.81$; $p < 0.001$), increased chocolate rich snacks ($r=0.72$; $p < 0.01$), increased sitting time ($r=0.79$; $p < 0.01$). *Conclusions:* These preliminary data must suggest to undertake social campaigns aimed at encouraging a return to a healthy lifestyle that certainly includes a healthy diet but also the suspension of smoking. These observational results need further evaluation with prospective studies in order to quantify the effects of pandemic-induced changes in lifestyle on cardiovascular risk in women. (www.actabiomedica.it)

Key words: Smoking; coffee; caffeine; Women; covid-19 pandemic; cardiovascular prevention

Introduction

The recent pandemic has changed people's lifestyles with a shift to an unhealthy diet and a reduction in physical activity (1-3). These changes have particularly affected women who, for socio-economic reasons, have suffered a greater impact from the global crisis triggered by the pandemic (4,5).

Because of their role in caring for the family and for frail people such as the elderly and children, women have had more job losses than men, and the closure of tourism and clothing businesses, that have

a greater number of women employees, also contributed (4,6).

Due to these disadvantages, there was an increase in depression in women, an increase in the consumption of anxiolytic drugs suggesting increased emotional stress (7,8).

Depression and stress act as major vascular risk factors in women and contribute to the progression of atherosclerosis through activation of the hypothalamus-pituitary axis, activation of the sympathetic adrenergic system and also the adoption of unhealthy behaviors (7,8).

All these factors have led to changes in the diet with an increase in the consumption of so-called comfort foods, foods rich in sugars and fats and this phenomenon had mainly involved women (9,10). In a previous analysis, we identified foods whose consumption increased during the pandemic in a group of premenopausal women and consumption of coffee and caffeine sources were included in these changes (11). Coffee is the most popular active beverage consumed worldwide in the adult population. The cardiovascular effects of coffee and caffeine have been extensively studied, however many concerns remain (12,13).

Furthermore, little is known about lifestyle changes among smokers' women during the pandemic. Smokers are exposed to a high risk of developing CVD (14). Tobacco use is today the "leading preventable cause" of death worldwide (15). Globally, people suffer from tobacco-related health problems, such as cardiovascular disease, stroke, lung cancer, and other respiratory diseases that lead to death in severe cases, which will continue to occur in the future (15). Few studies have analyzed the changes in smoking that occurred during the pandemic and, to our knowledge, none have focused on women.

The aim of the present observational study was to evaluate changes occurred during pandemic in coffee and caffeine intake in a group of adult women and compare changes in smoking versus non-smoking women.

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 (11). 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. Clinical characteristics of study group are shown in Table 1.

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, diet, smoking, physical activity, sitting time, sleep during quarantine, and ways of coping with lockdown during the quarantine.

A question explores the weight before and after 1 month of lockdown. We also ask about the self-perception of stress, fear, stigma and anxiety.

Smoking

Participants were asked whether they smoke "daily", "sometimes/occasionally", or "not at all", and if so they smoke, what type and number of tobacco products they used. Those who smoked 100 cigarettes during their lifetime, at the time of the interview, reported smoking some days or every day were classified as current smokers. Those who had ever smoked at least 100 cigarettes, but had not smoked for the past 30 days, and those who had never smoked at least 100 cigarettes were classified as non-smokers.

Diet

As previously described 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?") were collected (11).

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 alcoholic drinks: wine (glass/day), beer (small size bottle/day), and super alcoholic drinks. Furthermore, we investigated coffee and caffeine consumption. Caffeine intake was analyzed as follows: 1 cup of espresso coffee included 90 mg of caffeine, 1 cappuccino=110 mg of caffeine, 1 cup of American coffee=160 mg, 1 can of cola soda=42 mg, 1 can of energy drink=80 to 120 mg, and one chocolate snack=6 mg (16,17).

We also included evaluation of consumption of tea (Cup/day).

Statistical analysis

Descriptive analyses were performed for all variables. The Shapiro–Wilk test was used to test normal distribution of continuous variables. To determine differences between groups of questions (before and after quarantine) and cohorts (smokers and non-smokers) we used T-test, chi-square test and when appropriate, Fisher's exact test. Univariate and multivariate correlations were conducted.

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 (18). Ethical approval was obtained from the Ethical Committee (prot. 1185/2018 del 2/4/2019). This secondary study was approved by Internal Review Board on February 12, 2020. The ethical characteristics of the study were set out in the presentation of the questionnaire. Indeed, it was stressed that the participant could refuse participation in the protocol whenever she wished. Those interested in participating were given an electronic informed consent form, which recalled the voluntary nature of participation, the confidentiality and the anonymous nature of the information.

Results

A total of 435 women completed the questionnaire. The characteristics of the total population and of the 2 groups (smokers and non-smokers) are shown in table 1.

Coffee intake was significantly increase in smokers compared to non-smokers (3.1+1.0 versus 1.5+0.6 cups/day $p < 0.01$). Caffeine intake from beverages was also increase in both groups as shown in Table 2.

Smokers also increase the number of cigarette/day (mean + 3.4 cig/day).

Women self-reported that they suffered from increased stress and emotional distress which led to an increase in food (mainly sugar rich-food and to a switch to an unhealthy diet (42%),

Comparing smokers and non-smokers we did not find significant difference regarding diet: increase in sugar-rich food (48% versus 45%; $p = ns$), chocolate rich snacks (49% versus 53%; $p = ns$), "eating to cope" (52% versus 57%; $p = ns$).

In smokers, self-perception of increase stress was related to increased coffee intake ($r = 0.84$; $p < 0.001$), increased sugar-rich foods ($r = 0.81$; $p < 0.001$), increased chocolate rich snacks ($r = 0.72$; $p < 0.01$), increased sitting time ($r = 0.79$; $p < 0.01$).

In non-smokers, self-perception of increase stress was related to increased weight ($r = 0.77$; $p < 0.01$), increased sugar-rich foods ($r = 0.76$; $p < 0.01$), increased sitting time ($r = 0.84$; $p < 0.01$).

Discussion

The present study retrospectively analyzed changes in coffee and caffeine during the pandemic in adult smoking and non-smoking women. The questionnaire was administered in the acute phase of the pandemic during the lockdown imposed by the government throughout the country. As revealed by various experiences, women have suffered most from the lockdown phase due to the widespread social belief that women must take care of the most fragile of the family; elderly and children. This attitude is particularly widespread in Italy and has led to an increase in stress in women during the lockdown (2,3). In a previous work

Table 1. Baseline characteristics of population.

	Total population	Non Smokers	Smokers	P between smokers and non-smokers
Nr of subjects (%)	435	256 (58.9)	179 (41.1)	0.01
Mean age	48.65 ± 2.68	49.4 ± 2.53	47.51 ± 1.76	ns
Normal weight Nr of subjects and (%)	117 (26.9)	54 (46)	63 (54)	ns
Overweight Nr of subjects and (%)	231 (53.1)	138 (60)	93 (40)	0.01
Obese Nr of subjects and (%)	87 (20)	64 (73.5)	23 (26.5)	0.001
Hormon replacement therapy Nr of subjects and (%)	112 (25)	63 (56)	49 (44)	0.01
Cardiovascular risk factors				
Hypertension Nr of subjects and (%)	234 (53.7)	135 (57)	99 (43)	0.05
Diabetes Nr of subjects and (%)	102 (23.4)	54 (53)	48 (47)	Ns
Dyslipidemia Nr of subjects and (%)	157 (36)	83 (53)	74 (47)	ns
Diet				
Med D Score	42.3 + 21.8	43.4 + 18-9	41.7 + 22.6	ns
Vegan Nr of subjects and (%)	23 (5.28)	14 (60)	9 (40)	ns
Vegetarian Nr of subjects and (%)	47 (10.8)	26 (55)	21 (45)	ns
Physical activity				
Sedentary Nr of subjects and (%)	307 (70.57)	156 (51)	151 (49)	ns
High level of physical activities Nr of subjects and (%)	36 (8.2)	20 (55)	16 (45)	Ns

Table 2. Increase in caffeine intake from beverages during pandemic.

Sources of Caffeine and coffee	Smokers	Non smokers	p
Espresso Coffee (cups/day)	3.1+1.0	1.5+0.6	0.01
Cappuccino (cups/day)	1.1+0.3	1.3+0.7	n.s.
Tea (cups/day)	1.5+0.9	2.2+1.4	0.05
Soft caffeinated drinks (can/day)	0.4+0.6	0.5+0.7	n.s.
Energy drinks (can/day)	0.5+0.2	0.6+0.2	n.s.

we analyzed the effects of the pandemic on lifestyle in women, finding a switch towards an unhealthy diet and a significant reduction in physical activity (11). In this manuscript we want to reason by dividing women into 2 smoking and non-smoking groups to verify if there were any differences.

We found an increase in number of cigarettes in smokers as well as an increase in coffee consumption and caffeine consumption in smoking women; conversely non-smokers showed an increase in tea consumption.

Healthy lifestyle, that includes adequate diet, regular physical activity and weight control, is both costly

and time consuming and is a tough challenge, mainly for working women. (19,20) The pandemic has exacerbated this aspect by creating large socio-economic differences between the sexes (4,6). Depression, intimate partner violence, socioeconomic status, and sociocultural roles disproportionately affect women compared with men and are emerging as risk factors in the development of CVD in women (19-22). The increasing stress in women led to changes in lifestyle, mainly in nutrition habits and behavior (2,3,11,22). Among women, smoking has become an increasingly important risk factor of CVD (12). Targeting tobacco smoking has been predicted to reduce premature cardiovascular disease mortality in women in specific regions, such as high-income Asia-Pacific and western Europe (23). During the last years, male smoking prevalence declines rapidly whereas the percentage of female smokers approaches its peak and remains at a plateau (12).

The analysis performed in European Country before pandemic showed that smoking declined less among low educated men and women compared with their more educated subjects. Significant education differences in smoking prevalence trends were seen among Swedish, Finnish, Danish, German, Italian, and Spanish women. Reverse education differences (where declines were greatest among the low educated groups) were seen among British men and women, and among Italian men (24).

The NHANES Study reported a significant decline during the 1999 through 2012 period among both sexes. However, prevalence of smoking long/ultra-long cigarettes was significantly higher among female smokers (52.7% during 2011/2012) compared to males (28.0% during 2011/2012) at all points during the study period (25).

Although overall smoking rates have declined in European Countries, there are alarming trends, with a relentless increase in smoking among women, especially in young women and girls (26,27).

Asare and colleagues investigated changes in cigarette sales in the US during the pandemic, and found a rise in cigarette sales during the COVID-19 pandemic. They estimated an increase of about 0.34 pack per month per capita, corresponding to 14.1% increase above the expected sales, this trend contrasts with the declines in cigarette smoking seen over the

last decades. (26-31) If these COVID-related trends persist, they may delay progress in meeting the national target to reduce the percent of adults who used a combustible tobacco product every day or some days to $\leq 5\%$ by the year 2030 (32).

Has been described that smokers tend to follow different lifestyle behaviors, and ex-smokers had a higher BMI, a factor that can override the beneficial effects of smoke cessation (33).

Smoking acts on cardiovascular system increasing oxidative stress and inflammation that favor atherosclerotic plaque accumulation and rupture. Healthy diet and regular exercise activity exert contrast these effects, however socioeconomic inequities affect quality of diet and frequency of regular activity in women (4,34,35). Beneficial effects have been reported in women with high adherence to Mediterranean Diet (36,37). Mediterranean Diet include a great variety of healthy food and coffee is also a part of this diet. (37) In the Mediterranean countries, espresso coffee is mainly to be drunk after meals and this is a confounding factor. Furthermore, smokers like to associate cigarette smoking to espresso coffee drinking (36). Has been reported that nicotine-dependent smoker will associate their smoking with coffee in the morning and with alcohol in the evening (38).

We found a more significant increase in coffee consumption in women smokers. Coffee contains several antioxidants compound. Phenolic compounds are the most important phytochemicals in plants and can be found in many foods and beverages, such as coffee, tea, beer, and wine (5). Flavanols supplementation demonstrates a significant decrease in blood pressure, fasting plasma glucose, total cholesterol, low-density lipoproteins, and triglycerides, and a significantly increase of high-density lipoproteins (36, 39-42).

Coffee contains phytochemicals with antioxidant potential that had to be included in the total antioxidant intake from food and beverages (16,36). The intake of antioxidants changes with the preparation of the coffee (espresso, filtered, percolated) as well as with the composition of the coffee which affect the concentration and bioavailability of the antioxidant compounds (16,17). In addition, phenolic compounds are known to have different effects in women than in men (40). In foods and beverages, phenolic compounds are mainly stored as a glycone or, mostly, as glycosidic conjugates

(40,41). In the organism, they are widely metabolized. It is well-known that some CYPs are differently expressed in males and females: CYP2B6, CYP2A6, and CYP3A have higher activity in women than in men, while CYP2D6, CYP2E1, and CYP1A2 have slightly higher activity in men than in women (40). The effects of quercetin, isorhamnetin, gallic acid, and caffeic acid on CYP1A, CYP2A, CYP2E1, and CYP3A are sex-related. Cytochrome P-450-1A (CYP1A) is a major pathway activating carcinogens from tobacco smoke (43,44). Analyzing the increase in coffee and consequently in antioxidants reported in women smokers, it can be hypothesized that antioxidants counteract the negative effects of smoking, however, as frequently happens when analyzing the individual components of a diet, much depends on the dosage and bioavailability of nutrients. Both groups reported an increase in sugar-rich foods. These are commonly identified as “comfort food”. The complex relationship between stress and eating behaviours reveals that some subjects cope with stress by eating in an attempt to feel better (“stress-related eating”). Women are more likely to develop eat for cope and to introduce greater quantity of sugar-and fat-rich food (2,3,7,10). Our results confirm these observations.

The present study has some limitations: the first limitation of the study is that we were no able to exclude other tobacco and nicotine delivery system. In addition, we lack in stratification of study group according to emerging new risk factors in women (i.e. Gestational hypertension and diabetes, premature menopause, polycystic ovary syndrome) (45).

These preliminary data must suggest to undertake social campaigns aimed at encouraging a return to a healthy lifestyle that certainly includes a healthy diet but also the suspension of smoking. These observational results need further evaluation with prospective studies in order to quantify the effects of pandemic-induced changes in lifestyle on cardiovascular risk in women.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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