

How will the way we live look different in the wake of the COVID-19 pandemic? A nutrition survey in Greece

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Demosthenes Panagiotakos¹ , Rena I. Kostis² and Christos Pitsavos³

Abstract

Background: As we move towards a post-pandemic society, a question arises: How will the way we live look different in the wake of the COVID-19 pandemic? **Aim:** The aim of this survey was to evaluate changes in eating habits and other lifestyle behaviours (i.e., exercise and smoking) of people of almost all ages, who live in Greece, during the COVID-19 pandemic. **Methods:** A web-based survey using conventional sampling was conducted from during December 2020, in Greece. A total of 2258 individuals, aged 17 years and older voluntarily participated (912 (40%) men). **Results:** 89 (3.94%) of the participants reported that they had, or currently have been diagnosed with COVID-19. Moreover, 36.4% of the participants reported that they have changed their dietary habits during the pandemic towards a healthier diet – those participants had median age of 35 years, were of both sexes, 17% had co-morbidities and 69% with higher education level; moreover, 19% of those participants have started or increased the frequency of receiving dietary supplements that enhance the immune system, 34% of the participants reported that they gained weight during the pandemic period, whereas 19.8% reported that they have lost weight, and 37% of the participants reported that they have started or increased, as compared to the pre-pandemic time, their frequency of physical activities. **Conclusions:** The COVID-19 pandemic seems to have forced people to discover again habits and traditions towards a more natural and healthier way of living. Long-term consequences and the evolution of these lifestyle changes after the COVID-19 pandemic have to be evaluated relevant to their implications in public health.

Keywords

Lifestyle, diet, behaviour, exercise, COVID-19

Introduction

The first pandemic of the 21st century due to the new coronavirus SARS-CoV-2 (COVID-19) has caused unprecedented geopolitical, economic, and health consequences, and, without any doubt, has changed our lives (World Economic Forum, 2020). As we move toward a post-pandemic society, several surveys have been conducted in many countries by global thought leaders, and thinkers, in order to evaluate the effect of COVID-19 on people's lives.

Since the beginning of the pandemic, empty restaurants and cafés, have been a foretokening the crisis that was coming, leading to the imposed lockdown of our lives. Early studies on the COVID-19 pandemic had pointed out the upcoming mental health issues in the population (Torales et al., 2020), whereas these worries were confirmed later, and in particular among adults at high risk of severe illness from COVID-19 (Flint et al., 2020). It seems that many people have changed their lifestyle habits during the pandemic. In the past months, researchers have begun to

systematically study people's eating habits and behaviours during the pandemic. Although there is no robust data yet, findings from an online international survey demonstrate shifts towards a health-compromising direction (Ammar et al., 2020). However, whether eating habits have changed towards a healthier pattern as a result of the anticipated increased consumption of homemade meals due to home confinement is still a matter of concern since the literature

¹ School of Health Sciences and Education, Harokopio University, Kallithea, Athens, Greece

² Department of Nutrition and Dietetics, School of Physical Education, Sports and Dietetics, University of Thessaly, Trikala, Greece

³ School of Medicine, University of Athens, Athens, Greece

Corresponding author:

Demosthenes Panagiotakos, School of Health Sciences and Education, Harokopio University, Kallithea, Athens, 70 El, Venizelou Avenue, 17676, Athens, Greece.

Email: dbpanag@hua.gr

shows inconsistent results (Alhousseini and Alqahtani, 2020; Cheikh Ismail et al., 2020; Meister, 2020; Di Renzo et al., 2020; Rodríguez-Pérez et al., 2020; Rossinot et al., 2020; Sánchez-Sánchez et al., 2020; Sidor and Rzymiski 2020; Tárrega López et al., 2020).

Regarding physical activities (PAs), the results of the majority but not all of earlier studies conclude a decreasing trend, especially among middle-aged and older adults (Alomari et al., 2020; Amini et al., 2020; Antunes et al., 2020; Caputo and Reichert, 2020; Cheikh Ismail et al., 2020; Di Renzo et al., 2020; Rossinot et al., 2020; Sánchez-Sánchez et al., 2020). The lockdown established during the pandemic in the majority of the countries, forced people to reduce considerably their mobility and motor activities, which has led to an increase in adopting a sedentary lifestyle contributing to higher anxiety levels (Chen et al., 2020). Although public health authorities in several countries, as well as the World Health Organization which has started the campaign “#HealthyAtHome: Healthy Diet”, have tried to inform people on the way they should behave regarding diet and exercise, during the pandemic, the effect of these recommendations on people’s health is unknown (World Health Organization, 2020). Hence, a crucial question arises: How will the way we live look different in the wake of the COVID-19 pandemic? It is difficult to say that we know the answer.

Thus, the aim of this survey was to evaluate self-perceived changes in eating habits and other lifestyle behaviours (i.e., exercise and smoking) during the COVID-19 pandemic, of adult people who live in Greece.

Methods

Design

A web-based survey based on conventional sampling was conducted. The study’s investigators invited people aged 17 years old and older to participate in the study by providing them the link to the anonymized, structured questionnaire that has been designed for the survey. In the case that the participants could not have Internet access, the study’s investigators provided them a printed questionnaire and asked to them to complete it.

Setting

The survey took place in all seven Greek regions, between 1 and 31 December 2020.

Sample

A total of 2258 individuals voluntarily participated in the survey; of these 912 (40%) were men with mean age of 36 (standard deviation (SD) 18) years old (range 17–101 years) and 1346 (60%) were women with mean age of 33 (SD 18) years old (range 17–92 years). The age–sex distribution of the working sample was slightly different from the age–sex distribution of the reference population (p

<0.05); in particular the participants of this survey were younger (average age of Greece = 45.6 years) and more were females, as compared to the total Greek population.

The study’s sample represents (by age and sex) 0.02% of the total Greek population and it is considered adequate (i.e., statistical power 99%) for the evaluation of 10% differences between levels of the investigated measurements at 0.05 significance level of two-sided hypotheses.

Measurements

The survey’s questionnaire included socio-demographic questions about age, sex, region of residence, and the higher education level achieved by the adult participants (in years of school) which was categorized in three classes: lower education (<6 years or technical training); medium (7–12 years); and higher education (university degree). At this point it should be noted that the education level of the participants was higher than the median level of the Greek population (data from the Organization for Economic Co-operation and Development, accessed at https://www.oecd.org/education/education-at-a-glance/EAG2019_CN_GRC.pdf).

The medical history of diagnosed chronic diseases, that is, cardiovascular, cancer, chronic obstructive pulmonary disease, hypertension, dyslipidaemia, nephropathy and type 2 diabetes mellitus, as well as their management, was also recorded. Moreover, participants were asked whether they have been infected by the new coronavirus SARS-CoV-2 (through reverse transcription polymerase chain reaction testing). Body weight and height were reported, and body mass index (BMI) was then calculated: overweight was defined as BMI >24.9 kg/m²; and obesity as BMI >29.9 kg/m².

Smoking habits were also recorded, and participants were categorized as current smokers (those who smoked at least one cigarette per day during the preceding year), former smokers (those who have stopped smoking for at least one year) and never smokers.

Lifestyle changes that occurred after the onset of the COVID-19 pandemic in Greece (i.e., 26 February 2020) were carefully recorded using a structured questionnaire including specific Likert-type questions (e.g., disagree, no change, and agree). These questions evaluated any change in participants’ eating habits and participation in PAs. In particular, participants were asked to report whether they have changed their frequency of consumption of all main food-groups and beverages, that is, cereals, legumes, vegetables, salads and green vegetables, fish and fisheries, meat and processed meat, drinking water, beverages and alcohol, as well as use of any dietary supplements that strengthen the immune system. Moreover, a healthy diet was defined as a pattern rich in fruits, salads, green vegetables, vegetables, cereals, legumes, use of olive oil instead of other added lipids, and less meat, especially processed meat. Engagement in any type of organized (i.e., group exercise) or not (walking, running, swimming, etc.) PAs

Table 1. Socio-demographic and clinical characteristics, and lifestyle changes during the COVID-19 pandemic period, among 2258 men and women, aged 17–101 years old, from Greece (web-based survey conducted during December 2020, in all Greek regions).

Participants' characteristics	Men (n = 912)	Women (n = 1346)	p-value
Age, years (mean (standard deviation))	36 (18)	33 (18)	0.0003
Higher education, n (%)	566 (62%)	928 (69%)	<0.001
Smoking			<0.001
Current, n (%)	229 (26%)	285 (21%)	
Former, n (%)	184 (20%)	132 (10%)	
Diagnosed cases of COVID-19, n (%)	36 (3.95)	53 (3.94)	0.99
History of hypertension, n (%)	134 (15%)	97 (8%)	<0.001
History of diabetes mellitus, n (%)	50 (6%)	48 (4%)	0.007
History of dyslipidaemia, n (%)	150 (17%)	139 (11%)	0.001
History of renal disease, n (%)	29 (3%)	18 (1.4%)	<0.001
Overweight/obesity, n (%)	477 (52%)	386 (29%)	<0.001
<i>Lifestyle changes during the COVID-19 pandemic period</i>			
Dietary habits change to healthier pattern, yes (%)	313 (34%)	509 (38%)	0.09
Legumes and cereals, increase (%)	212 (24%)	358 (27%)	0.24
Fruits and vegetables, increase (%)	287 (32%)	515 (38%)	0.004
Salads and green vegetables, increase (%)	214 (24%)	356 (26%)	0.25
Fish and fisheries, increase (%)	135 (15%)	262 (20%)	0.005
Meat and processed meat products,			<0.001
Reduction (%)	159 (17%)	300 (22%)	
Increase (%)	216 (24%)	226 (18%)	
Drinking water, glasses/day	5.7 (2.3)	4.6 (2.1)	0.03
Dietary supplements, increase (%)	142 (16%)	297 (22%)	0.001
Habitual physical activity (PA), yes (%)	722 (79%)	1,009 (75%)	0.001
Frequency of PAs, times/week	3.3 (1.5)	2.09 (1.9)	<0.001
PA, increase (%)	325 (36%)	509 (38%)	0.001
Body weight change			0.001
Loss, n (%)	142 (16%)	303 (23%)	
Gain, n (%)	300 (33%)	474 (35%)	

was recorded and compared to the periods before and after the COVID-19 pandemic. Participants were also asked to report their level of satisfaction (0: unacceptable, to 5: excellent) regarding the provided lifestyle guidelines by the public health authorities.

Statistical analysis

Categorical variables are presented as frequencies and relative frequencies. Continuous variables are presented as mean and *SD*. Incidence of COVID-19 was estimated using weighted proportions by sex and age of the countrywide distribution of the diagnosed cases. Associations between categorical variables were evaluated using Pearson's Chi-square test, while mean values' group comparisons were performed using the *t*-test since the continuous variables were normally distributed as evaluated using symmetry plots (quantile-quantile plot). Multiple correspondence analysis (MCA) was applied in order to evaluate the changes in the lifestyle patterns of the participants. Logistic regression analysis (odds ratios and 95% confidence intervals (CIs)) was applied to evaluate participants' characteristics towards the lifestyle changes that occurred during the COVID-19 pandemic. STATA version 16

statistical software was used for the data analyses (TStat, S.r.l., 67039 Sulmona, Italy).

Results

In total, 89 (3.94%) of the participants reported that they had, or currently have been diagnosed with COVID-19; of these, 36 were men (3.95%, mean age 33 (*SD* 13) years) and 53 were women (3.94%, age 32 (*SD* 16) years) (*p*-value for sex comparisons = 0.82). The incidence of COVID-19 observed in this survey is in line (adjusted for period effect) with reports from seroepidemiological studies conducted in Greece during the past months (Bogogiannidou et al., 2020; Tsitsilonis et al., 2020).

In Table 1, participants' characteristics and certain lifestyle behaviours during the pandemic time are presented, separately for men and women. Almost one out of three of the participants (36.4%) reported that they have changed their dietary habits during the COVID-19 pandemic towards a healthier diet (i.e., a pattern rich in fruits, vegetables, salads, green vegetables, cereals, legumes, use of olive oil instead of other added lipids, and less meat, especially processed meat). Those participants were of median age 35 years (1st and 3rd quartiles 31, 45), were of

both sexes (34% of men vs. 38% of women, $p = 0.09$), 17% had co-morbidities and 69% with higher education level. In addition, 19% of the participants have started or increased the frequency of receiving dietary supplements (vitamins and minerals) that enhance the immune system ($p < 0.001$).

Overall, 34% of the participants reported that they gained weight during the COVID-19 pandemic, whereas 19.8% reported that they have lost weight. Moreover, 40% of the participants with obesity reported that they have gained weight as compared to only 16.9% of them who reported weight loss ($p = 0.001$).

A substantial proportion, that is, 37% of the participants reported that they have started or increased the frequency of engagement in PAs as compared to the pre-pandemic period.

Strong associations were revealed between certain lifestyle changes and the medical history of the participants, after adjusting for age, sex, and education level. Individuals with one or more morbidities were more likely to adopt lifestyle changes as compared to the others. Specifically, individuals with hypertension were 1.42-times (95% CI 1.21, 1.78) more likely to have changed their dietary habits during the COVID-19 pandemic towards a healthier pattern as compared to those who are normotensive. Similarly, individuals with diabetes were 1.51-times (95% CI 1.20, 1.92) more likely to have changed their dietary habits to a healthier pattern, individuals with dyslipidaemia were 1.52-times (95% CI 1.28, 1.78) more likely to have changed their dietary habits to a healthier pattern, and individuals with renal disease were 1.92-times (95% CI 1.28, 2.85) more likely to have changed their dietary habits towards a healthier pattern, after taking into account age, sex and education status. However, no associations were observed between history of COVID-19 and lifestyle changes during the pandemic period (for diet changes $p = 0.86$; and for PA changes $p = 0.46$).

Regarding PAs, a considerable proportion of people reported that they have started or increased the frequency of participating in PAs during the COVID-19 pandemic period (37.17%); however, no significant associations were observed between PAs changes and participants' health status (all $p > 0.35$).

An additional analysis was performed focused on those who changed to healthier pattern of dietary habits and also increased their PAs. It was observed that 26.02% of the participants reported increasing their engagement in PAs without improving their diet, whereas 25.49% reported that they have improved their dietary habits without being more engaged in PAs. In addition, 37.34% reported no improvement either on dietary habits or on PA status, and only 11.14% reported an improvement in both dietary habits and PA status. Data analysis revealed that participants who changed only their dietary habits but not their PAs status were older (35 vs., 30 years old, $p = 0.002$), similarly distributed in both sexes ($p = 0.37$), and with similar education level ($p = 0.99$). Moreover, changes to a healthier dietary pattern were more common among never

smokers as compared to ex-smokers or current smokers (67% vs., 14%, 19%, respectively, $p < 0.001$).

The MCA revealed a dominant "healthy" behavioural pattern of participants' lifestyle habits, as compared to the pre-COVID-19 pandemic period, that explained 67% of the total information of the collected data. This pattern was characterized by participants who adopted healthier eating behaviours, such as eating more fruits, vegetables, salads and green vegetables, fish, legumes, and cereals, and less meat and processed meat, drinking more than six glasses of water per day, and use of dietary supplements, in conjunction with increased PAs, as compared to the pre-COVID-19 pandemic period. This group had a median age of 41 years, was similarly – to the overall sample – distributed in women and men (i.e., 59%/41%), and 65% had higher education level and were more likely to have more than one morbidity (2.4 (0.9) vs. 0.8 (0.2) comorbidities, $p < 0.001$).

The majority of the participants (i.e., 1684, 75%) urged for dietary guidelines and the need for better information from the public health authorities during the COVID-19 pandemic; moreover, 43% of men and 39% of women reported that the information received from the authorities and other specialists regarding their diet during the COVID-19 pandemic was poor and limited.

Discussion

The potential changes of eating habits and PAs that have been brought on by the COVID-19 pandemic in Greece were explored through a nationwide survey of 2258 adult individuals. The survey was conducted during the second phase of the COVID-19 pandemic, that is, December 2020, in which Greece experienced a much higher outbreak of COVID-19 cases and related deaths, compared to the first phase in spring 2020. Despite the inherent limitations of the present observational survey, an answer to the question "How will the way we live look different in the wake of the COVID-19 pandemic?" could be given, at least regarding the participants' dietary habits and PAs. The lockdown seems to have forced people to discover again old habits and traditions towards a more natural and healthier way of living, *since* the factors that were responsible for the nutrition transition to more Westernized dietary patterns may well have been less prevalent and, thus, people "re-invented" their dietary origins.

Food-related behaviour is to a great degree subject to habits and routines. Changes in eating patterns are normally occurring rather slowly over long periods of time. Many factors have been proposed that affect human eating behaviour. These factors include cultural, evolutionary, social, family, financial and psychological characteristics of individuals. It has been suggested that people use food as a coping mechanism to deal with emotions such as stress, boredom or anxiety, or even to prolong feelings of joy (Arora and Grey, 2020; Auestad and Fulgoni, 2015; Carins and Rundle-Thiele, 2014; Olson, 2016). Besides which, we

know that food consumption is largely influenced not only by an individual's preferences but also by where they eat and with whom. Since the beginning of the COVID-19 pandemic, society has experienced an unprecedented case that many people have spent much more time at home. That also means many people have eaten more meals at home than before the COVID-19 pandemic. Indeed, in the present study, more than three out of 10 of the participants reported weight gain during the COVID-19 pandemic period, whereas one out of five reported weight loss with more prominent similar trends in participants with obesity (40% vs. 16.9%, respectively), which was in line with other studies, too (Haddad et al., 2020; López-Moreno et al., 2020; Robertson et al., 2020). In particular, the literature suggests that due to home-confinement and in response to this stressful situation, people may change their everyday eating behaviour since they experience higher boredom, higher anxiety, higher fear, and higher anger. Research findings from a cross-sectional web-based online survey conducted in Lebanon showed that the fear of COVID-19 was correlated with more eating restraint, weight, and shape concerns (Haddad et al., 2020). Similar findings were demonstrated in another cross-sectional online survey in Spain, where the authors concluded that 38.8% of the respondents experienced weight gain while 31.1% lost weight during confinement and the prevalence of emotional eating was also high (López-Moreno et al., 2020). In the same context, in a United Kingdom online survey, large differences in perceived changes in eating, exercise, and body image during the COVID-19 pandemic period were revealed. Women were more likely to report increasing struggles with regulating eating, preoccupation with food, and worsening body image, compared to men, and this was more prominent among those with a current or past diagnosis of eating disorders (Robertson et al., 2020).

Relevant to the observed self-perceived shifts towards a more balanced or a Mediterranean diet-oriented pattern, our findings are in line with other studies conducted in the Mediterranean region (Di Renzo et al., 2020; Rodríguez-Pérez et al., 2020; Rossinot et al., 2020; Sánchez-Sánchez et al., 2020; Tárraga López et al., 2020). Conversely, other web-based surveys conducted in Denmark, United Arab Emirates, Poland, and Saudi Arabia, including the International Online Survey, albeit confirming changes in eating habits during the COVID-19 pandemic, suggested an overall deterioration of diet quality (Alhousseini and Alqahtani, 2020; Ammar et al., 2020; Cheikh Ismail et al., 2020; Meister, 2020; Sidor and Rzymiski, 2020). A probable explanation for the observed discrepancy between the Mediterranean countries and the rest could be attributed to the idea of a shared Mediterranean culture mostly related to ancient cultural heritage (Helly, 2018). Hence, probably Mediterranean citizens re-invented instinctively the unique weapon, they had available to cope with the "fear of COVID-19": the Mediterranean diet. Indeed, recent research pointed out that Mediterranean dietary patterns and better diet quality were all positively correlated with

higher psychological resilience, unlike Western-type diets (Bonaccio et al., 2018). This speculation is further reinforced by the fact that in our survey the participants, and in particular participants with underlying diseases, were found to be more likely to adopt healthier lifestyle habits. These findings are justified by other studies that investigated the impact of COVID-19 on people at high risk of severe illness concluding that the "fear of COVID-19" contributes to a negative psychosocial impact in most vulnerable participants (Flint et al., 2020; Grannell et al., 2020). Following the above conjecture, in our survey one out of five participants have started or increased the frequency of receiving dietary supplements as enhancers of the immune system. One could speculate that this observation is presumably interpreted as an attempt to find an easy and quick solution "under the threat of the enemy" although evidence evaluating these supplements in COVID-19 patients is lacking (Adams et al., 2020).

Moreover, our findings revealed that almost four out of 10 of the participants engaged in PAs during the COVID-19 pandemic, and almost one out of 10 reported that they have improved both dietary habits and PAs status. The observation that the engagement in PAs conforms with healthier food choices is in line with the findings of a longitudinal observational study conducted in Italy where the authors suggested that PA was positively correlated with fruit, vegetables and fish consumption, thereby mediating the effects of mood states (Amatori et al., 2020).

Furthermore, as it was observed here people who changed their dietary habits and PA level to a healthier status, compared to the pre-COVID-19 pandemic period, were mainly of high education level. However, overall, the education level of the participants of this survey was higher than the median level of the total Greek population, a fact that may partially explain the tendency in the study participants towards adopting a healthier lifestyle, since it has already been reported that people with higher education level are more likely to adopt healthier lifestyle changes (Cohen and Syme, 2013). Another possible explanation could be that during the COVID-19 pandemic some of the factors that were responsible for the nutrition transition to more Westernized dietary patterns (i.e., limited time for cooking, gathering with the family, work-related stress, etc.) were less prevalent and thus, people re-invented their dietary origins.

Nevertheless, to better understand what consequences these changes in the context of lifestyle have had, for example, in terms of how balanced or unbalanced the diets have been or whether people's PA habits have improved, we need a number of large-scale population-based nutrition/lifestyle studies.

The COVID-19 pandemic has undoubtedly changed how we work, learn, interact and communicate, as social distancing has led to a more virtual existence. Whether the COVID-19 pandemic has changed how people approach their health, as well as health-related behaviours, it is too early to understand. Though much of the world has come to a

“stop” or “delay” during the COVID-19 pandemic, the need for healthier eating has not. Throughout the COVID-19 pandemic, there have arisen both benefits and drawbacks of being cooped up with family for long periods of time. Adopting healthier eating habits and more exercise together with other family members during these “escapes” from the restrictions due to the lockdown, may be some of these benefits. The emerging need for nutrition and exercise guidelines during the COVID-19 pandemic is something that governments and health organizations should pay much more attention to, as COVID-19 seems that it will be present for some time, at least the first six months of the new year, 2022.

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Authors' contributions

DP and CP collected the data. DP performed the data analyses and interpreted the results. DP and RK contributed to writing and CP in reviewing the manuscript. All authors read and approved the final manuscript.

Availability of data and materials

The dataset used and analysed during the current study is available from the corresponding author on reasonable request.

Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

The study was approved by the Ethical Review Board of the University of Thessaly (December 2020). Approval no. authenticating the statement is : 2/25-01-2021.

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ORCID iD

Demosthenes Panagiotakos  <https://orcid.org/0000-0001-8583-153X>

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