

SOCIAL PARTICIPATION AND SUSTAINABLE AWARENESS IN MEXICO FOLLOWING LOCKDOWN IN RELATION TO SARS-COV-2

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ABSTRACT

This research aims to evaluate endeavors on the part of the population to generate sustainable awareness during the “2020 lockdown”, caused by the international health emergency related to the SARS-CoV-2 virus. For this purpose, a semi-structured survey was applied to the general population using CAWI (Computer Assisted Web Interviewing) methodology, generating a total of 3,125 responses. In order to analyze this, 37 of its 47 variables were selected, and subdivided into four groups. For the evaluation, a Principal Component Analysis was carried out, using multivariate methods; highlighting thirteen factors that explain the 57.2% of total variation. Subsequently, a Cluster Analysis was applied, identifying a total of five population groups; which when integrated revealed heterogeneity in terms of responses, exposing the need to generate efficient communication channels that bring together the importance as a society of participating more in the environment as well as in human healthcare; understanding that these two are closely correlated. The conclusion reached is that the way for more humane sustainable development requires a collective environmental awareness that will undoubtedly bring benefits to individual health.

Keywords: environmental care, health, social distancing, society, sustainability, well-being.

INTRODUCTION

The 2020 lockdown caused by the SARS-CoV-2 virus in December 2019, resulted in a pandemic that ruptured a social normality apparently created since the end of the Second World War, generating a “Trend of globalized uncertainty” concerning health, the economy, education, politics, food, equality and environment (Qian *et al.*, 2020). The global morbidity and mortality rate made this one of the most emblematic pandemics in history (WHO, 2020a), which undoubtedly managed to destabilize every country in the world and their advances in economic, social and environmental development (Cucinotta and Vanelli, 2020). It forced the population to adapt and face this situation, by optimizing the resources that were most available to them (Xu *et al.*, 2020). However, the imposition of social isolation by the health authorities, to safeguard the health of citizens, generated an economic collapse (Gold *et al.*, 2020), which caused a part of the population to carry out their work activities at home. (Cucinotta and Vanelli, 2020). The vulnerability that this historical milestone represents leads us to reconsider awareness concerning the participation of the individual as an element of society able to generate a synergy with ecosystems.

Sustainability represents an allegory of the responsibility that is shared with the environment and the future, however, it is essential to consider and reconsider how one can participate significantly at different levels (Macro, Meso and Micro), attaining benefits

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for the ecosystem in a global panorama. In this sense, factors such as the generation of higher income, environmental preservation and care, in addition to the potential for social development are the cause of the different epistemological approaches to “sustainability” being formulated; modifying their adaptability to rural or urban contexts (Cisneros-Saguilán *et al.*, 2015).

Mexico’s inhabitants are currently estimated at 128 million, and national demographic growth is expected to rise from 35 to 50% by 2050, reaching the highest population growth rate within the human era on planet earth (148 million on average) (National Population Council, 2019). Massive pollution, apathy about the reuse and recycling of waste, little interest in reducing the consumption of single-use plastics, the rise in food demands, the demand for resources in the environment linked to an exponential global population growth, currently represent the highest levels of social risk for the environment (Baeza *et al.*, 2019).

Problems such as urbanization, extensive monoculture, deforestation, the use of agrochemicals and the capitalistic approach have distorted the perception of society as part of natural ecosystems, themselves able to generate sustainable processes (FAOSTAT, 2020). Aspects such as the rise in temperature of 1 to 2 °C caused by the increase in droughts due to out-of-season rains, cause significant migration and death of species and their ecosystems, directly impacting the environment (Fernandes *et al.*, 2012).

New eating patterns affect both human health and the environment and therefore sustainability, as they affect food production systems, which, in response to demand, break with the environmental processes and systems from which they obtain their resources. These processes emit up to 30% of Greenhouse Gases (GHG) (Vermeulen *et al.*, 2012), causing negative environmental change for all species, including humans (Willett *et al.*, 2019).

Excessive food demand generates waste from excessive and constant consumption by a society that manifests a serious problem, as the Mexican population alone produces about 103 thousand tons of waste per day (53.1 million per year) and more than half of this amount is produced in the central region of the Mexican Republic (Secretaría de Medio Ambiente y Recursos Naturales, 2019). Due to this fact and elevated population growth, the reuse of organic waste is the promise of a future based on a circular economy, where economic assets such as a kitchen garden for self-consumption can be generated from this (Bojórquez-Tapia *et al.*, 2019).

Regarding water, approximately 70% of fresh water worldwide is used solely for agriculture, accounting for 40% of land area (Comprehensive Assessment of Water Management in Agriculture, 2007; Foley *et al.*, 2005). In this context, protection and care of water falls on the authorities (national, state and municipal), detracting importance from social responsibility (Suganthi, 2020).

As a result of the social confinement imposed by the World Health Organization (WHO) through the health authorities (WHO, 2020b), demands for water increased, forcing society to take precautionary measures to guarantee that this resource was available. If multiple uses are considered, it is essential to modify the dynamics of water care by society,

to achieve a harmony consistent with the environment and its biodiversity (Martin *et al.*, 2020a).

Social confinement was the reason for human absence at tourist spots or in the productive and social environment, which consequently gave the environment an opportunity to recover tranquility and witness the appearance of fauna and flora in places where their existence had already been forgotten (van Zanten *et al.*, 2020), while also decreasing pollution levels in soils and seas (Bojórquez-Tapia *et al.*, 2019), generating improvements in the quality of water and air (National System of Environmental Information and Natural Resources, 2020). All this made clear that society's development and its network of interactions is not based on the environment, much less is it designed to protect vital resources.

Participation by civil society represents the basis for sustainable water care; the new generations already suffer restrictions and significant deficiencies of this resource, due to lack of consciousness and exploitation by previous generations (Mooij *et al.*, 2019). The relationship between material and social systems is addressed in the Actor-Network Theory (ANT) (Callén *et al.*, 2011), which intends to show the factors that make up an inseparable network of humans, things, devices and natural forces (Latour, 2004). Therefore, during the pandemic, the social actor relied on this network in order to adapt and rebuild interactions for survival.

As part of the network, we find the values and customs practiced within the intra-family social nucleus, which represent the ideal way to strengthen the care and protection of essential resources, considering that water care and organic waste management are derived from a strong bond of family education (Corral *et al.*, 2020). The family is the strongest social nucleus within any community, implying a subjective comprehension of well-being (Weber, 1973); its daily participation is paramount to achieving a beneficial transformation of the environment that will gradually bring benefits to individual and collective health. If natural resources are the basis of human subsistence and are currently vulnerable, it is necessary to highlight the importance of implementing networks for collaboration (State, government and society) in cities, which provide the foundations to lead their communities towards sustainable development. (Khalid *et al.*, 2020). This aims towards the pursuit of collective well-being that guarantees society an optimal standard of health, in terms of resource use (Cervantes *et al.*, 2020), placing in the foreground the need to start reusing organic waste to promote local food production, anticipate shortages and contribute to the sustainable development that nations have promised to achieve (WCED, 1987).

Taking care of drinking water, implementing strategies to strengthen current availability; reusing organic waste to produce new foods, producing less waste, improving separation of waste and its use, as well as recycling and eradicating the use of single-use plastics, would guarantee that the global population enters a state of active consciousness (Asad and Anderson, 2020). This would contribute to improving temporary participation in this era of planet earth, setting the foundations for a more humane process of sustainability.

The aim of this study was to evaluate the actions that people undertook to generate sustainable awareness during the "2020 lockdown", which arose after the international health emergency caused by SARS-CoV-2 virus.

MATERIALS AND METHODS

This research is of a quantitative and cross-sectional type, where data collection was carried out using the CAWI (Computer Assisted Web Interviewing) methodology, developing an electronic survey that was disseminated by means of varied electronic media (Facebook®, WhatsApp®, Outlook®, Gmail® and web pages), named “lockdown 2020: Actions for the environment and a more humane sustainable development”. This tool was active for a 6 month (April to September 2020) period of home isolation in Mexico.

Criteria for inclusion corresponded to being 18 years of age or older, being residents of the Mexican Republic and who expressed consent to answer the survey. 3,125 responses were obtained and the closure of the survey was determined by the saturation and normalization of the data.

The questionnaire was made up of 47 variables, divided into 2 types: social (13 variables) and environmental care actions: water care and organic waste management (34 variables) (Table 1).

Descriptive and inferential statistical procedures were applied to establish characteristics of the social dimension. Likewise, multivariate analyzes were carried out (Montanero, 2008) to identify the Principal Components (PC) in terms of environmental care actions (water care and organic waste management). The purpose of this analysis was to reduce the number of variables, placing them in more specific groups termed factors, which help describe the effect of the COVID-19 pandemic. Varimax rotation was applied to this analysis (Hair *et al.*, 1999).

The Cluster Analysis (CA) made it possible to typify the population, using the statistical program Statgraphics version Centurion XVI.I. in order to group the study population,

Table 1. Variable distribution by type.

Types	Variable
1. Society	Gender, age, country, region, zone, years of schooling, occupation, occupational area, marital status, family integration, time of confinement, current state of health, socioeconomic level. A) Before, during and after contingency: organic waste management, care of water, care of plants, trees or kitchen gardens. B) Before and during: food consumption and use of social networks.
2. Actions for taking care of environment: care of water and organic resource management	C) Before: you separated the rubbish, use of ecological bags and environmental consultation platforms. D) During: acquisition of fruit and vegetables, ecological group, preparation of the kitchen garden, changes in water use, implementation of actions, awareness concerning animal sightings, reflection on animal sightings, physical and mental health care, contingency monitoring in social networks and strategies to deal with food shortages. E) After: repeat confinement, advantages of environmental care, reduction in the use of single-use plastics, use of thermos, actions following lockdown, social conscience, individual conscience, more conscientious as a result of the survey

Source: self-elaborated.

identifying their main differences using Ward's method and the squared Euclidean distance, taking the most significant rise as the cut-off point.

The study was carried out in accordance with the Declaration of Helsinki, and the protocol was approved by the Research Ethics and Bioethics Committee of the Amecameca University Center of the Autonomous University of the State of Mexico and assigned page 003/2019. Likewise, informed consent was obtained previously from all participants involved in the investigation.

RESULTS AND DISCUSSION

General characteristics

The surveyed Mexican population that served as a sample mainly consisted of women (71.4%); the most prevalent age group was between 21 and 30 years (47.2%), with 73% present in urban areas. In terms of the composition of population in Mexico, there is a slight trend in favor of female gender, because according to the National Survey of Demographic Dynamics (NNDD, 2018) 51.1% are women and 48.9% are men, thus we consider that for data collection among large groups, this trend is constant.

The population surveyed according to age group was made up of participants under 20 years of age (26.4%), followed by participants between 21 and 30 years of age (47.2%), then between 31 and 40 years of age (14%), continuing with those aged between 41 and 50 years (8.2%) and finally over 50s (4.1%). Greater representation was observed in states of the central region: Jalisco, Colima, Michoacán de Ocampo, San Luis Potosí, Guanajuato, Querétaro, Aguascalientes, Morelos, State of Mexico, Mexico City, Puebla, Tlaxcala and Hidalgo (91.5%), in comparison with the northern region: Northern and Southern Baja California, Sonora, Chihuahua, Coahuila, Nuevo León, Tamaulipas, Sinaloa, Nayarit, Durango, Zacatecas and Sonora (5%) and the southern region: Guerrero, Oaxaca, Chiapas, Veracruz, Tabasco, Campeche, Quintana Roo, Yucatan (3.5%).

Due to population growth, it is essential to establish priorities and strategies that guarantee a dignified life for every inhabitant. Education, for example, represents a valid tool to bring prosperity through the development of a country and its inhabitants. According to the academic level and its relationship with years of study, it was found that 1.7% of the sample had studies corresponding to secondary and primary education, 8.3% high school, 78% undergraduate and 12% postgraduate. In the world panorama, Mexico is below average (43%) as only 2 out of 10 adults are professionals (INEGI, 2020). 58% are students, 22.9% do not study and depend on their parents or guardians, 8.7% are public servants and 4.8% are unemployed.

Concerning care of water, the surveyed population mentioned taking care of this resource prior to lockdown (77.5%), undertaking two to four endeavors (82.7%) in favor of its care, the most commonly mentioned measures included reusing water from washing machines, repairing any leak immediately and responsible use in daily activities (use of a glass for teeth cleaning and taking short showers). During lockdown, 61% mentioned that they continued to care for this resource and 24% reported an increase in consumption. 81.9% believed that the use of reusable bottles or the use of a thermos for regular water

consumption is essential, in addition to this, 84.5% considered it necessary to adopt habits that help reduce the consumption of plastics and disposables. During lockdown, 70.3% stated that they searched for information on social networks and web pages about the care and consumption of water, 85.9% becoming more aware, as they considered that at the end of social confinement they would continue implementing endeavors for its care. Regarding the management of organic waste, 29.9% said that prior to the pandemic they separated their rubbish, in contrast to 51.5% who mentioned carrying out this activity during lockdown. The number of people who did not implement any strategy to deal with this waste decreased from 71.1% to 48.5%. The most recurrent actions were separation (organic from inorganic) and the preparation of compost to feed farm animals. Prior to lockdown, 39% preferred organic foods over processed foods, increasing to 46.4% during the pandemic. 97.2% made modifications to their diet, increasing their meal times and the consumption of vegetables, fresh fruit, pulses, oleaginous plants, and whole grains during lockdown. 92.1% bought their food in local markets or from small producers, 40.1% considering that these locations provide ideal security in the face of food shortages. 66.9% sought information from social networks and web pages on how to use their waste in the preparation of a kitchen garden, as 59.3% consider its creation to be relevant. 99.8% stated that they used an ecological bag. At the end of lockdown, 73.4% mentioned that they will continue to implement strategies for the reuse and management of organic waste.

With respect to environmental care, prior to lockdown, 57.6% already followed environmental pages on social networks, the most used tools being Facebook® (47.6%) and Google® (30.4%). 92.4% do not belong to any environmental or ecological group. During contingency, 63.4% considered it necessary to participate more in caring for the environment, 92.8% perceived a relationship between caring for the environment and their physical and mental health, 41.3% reported caring for a backyard plant, garden or kitchen garden, dedicating one hour a day to this activity (54.1%).

At the end of lockdown, 81.5% considered that being at home during the pandemic generated well-being, 91.8% considered that social interaction is essential for human well-being. For their part, 90.9% would be willing to repeat social confinement in order to offer rest periods to the planet. 84.9% intend to be more participatory in environmental activities, such as the use of ecological bags, responsible use of potable water and recycling, among others.

Factor analysis

A Principal Components (PC) analysis was carried out, which showed a variance of 57.29% and integrated the sample into 13 CPs to explain this (Table 2). The first Factor termed "Awareness" is made up of the variable, actions after lockdown, in synthesis this denotes the need to modify habits through the level of consciousness generated after experiencing lockdown. In this study, the actions they plan to carry out after lockdown allude to the fact of increasing participation in caring for the environment and rethinking their social role in this activity. It might be argued that the detachment from caring for the environment in terms of habits and societal norms concerning water wastage, were reconsidered in the

Table 2. Principal components by means of multivariate analysis.

Principal components	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
Gender	-0.07	0.02	-0.11	0.09	0.07	0.00	0.29	-0.15	-0.36	-0.16	-0.33	0.42	-0.01
Age	0.01	-0.17	-0.51	0.23	0.11	-0.06	0.03	0.12	0.18	0.00	0.05	0.01	-0.04
Zone	-0.03	-0.25	-0.11	0.08	0.15	-0.18	-0.01	0.13	-0.00	0.15	-0.17	-0.30	0.05
Years of education	0.06	-0.07	-0.14	0.24	0.06	0.11	-0.33	-0.14	-0.21	-0.18	0.07	0.18	0.05
Employment	-0.00	0.15	0.52	-0.21	-0.12	0.04	0.02	-0.12	-0.16	0.05	-0.05	-0.08	0.01
Separation of rubbish	0.19	0.28	-0.20	0.06	-0.26	0.01	-0.05	0.13	-0.12	0.01	-0.02	-0.09	-0.09
Organic waste management (past)	0.22	0.33	-0.13	0.09	-0.25	0.12	-0.01	0.16	-0.14	-0.06	0.04	-0.11	0.04
Water management (past)	0.23	-0.05	0.10	0.31	-0.01	-0.28	0.09	-0.02	0.07	0.03	0.00	0.01	-0.04
Food consumption	0.16	0.06	-0.02	-0.08	-0.11	-0.07	-0.18	-0.13	0.18	0.07	-0.13	0.02	-0.01
Care of plants, trees or kitchen garden (past)	0.20	0.20	-0.11	0.00	0.29	0.04	0.28	-0.33	0.07	0.10	0.11	-0.03	0.11
Use of ecological bag	0.15	0.04	-0.02	-0.10	0.00	-0.17	-0.23	-0.18	0.06	0.39	0.05	-0.21	-0.08
Use of social networks	0.21	0.08	-0.01	-0.13	0.24	-0.08	-0.32	0.08	-0.04	0.16	-0.08	0.08	-0.09
Environmental consultation platforms	0.05	0.04	0.06	0.07	0.07	0.06	-0.28	0.05	-0.11	0.14	-0.40	0.16	0.63
Ecological group	0.10	0.07	-0.07	-0.01	0.21	0.00	-0.34	0.04	-0.10	0.19	0.01	0.24	-0.21
Acquisition of fruit and vegetables	0.18	-0.13	0.23	0.30	0.03	-0.04	0.08	0.13	-0.01	0.05	0.00	-0.01	0.01
Organic waste management (contingency)	0.25	0.30	-0.08	0.11	-0.18	0.12	0.02	0.13	-0.07	-0.09	0.03	-0.08	0.03
Environmental consultation platforms on kitchen gardens	0.19	0.07	0.06	-0.16	0.37	0.00	-0.05	0.20	0.08	-0.27	-0.08	-0.15	-0.03
Care of plants, trees or kitchen gardens (lockdown)	0.19	0.23	-0.08	-0.01	0.34	0.10	0.28	-0.30	0.04	0.03	0.11	0.02	0.09
Changes in water use	0.04	-0.06	-0.08	0.08	0.07	0.01	0.03	-0.01	-0.27	-0.07	-0.00	-0.50	0.23
Water management (lockdown)	0.19	0.03	0.00	0.01	-0.09	-0.46	0.07	-0.09	0.03	-0.05	-0.05	0.00	0.04

Table 2. Continuation.

Principal components	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
Water management (lockdown)	0.19	0.03	0.00	0.01	-0.09	-0.46	0.07	-0.09	0.03	-0.05	-0.05	0.00	0.04
Environmental consultation platforms on water	0.16	0.06	0.05	-0.22	0.30	-0.17	0.05	0.29	-0.00	-0.29	-0.23	-0.00	-0.14
Animal sighting awareness	0.15	-0.10	-0.00	-0.14	0.02	-0.21	-0.14	-0.20	-0.27	-0.20	0.38	0.03	0.08
Commentary on animal sightings	0.11	-0.21	-0.04	-0.13	-0.05	-0.10	-0.05	0.07	-0.05	-0.30	0.22	-0.05	0.40
Physical and mental health care	0.20	-0.02	0.23	0.22	0.13	0.10	0.08	-0.03	-0.12	0.19	-0.00	-0.06	0.05
Lockdown monitoring on social networks	0.06	-0.07	-0.01	-0.18	0.06	-0.01	0.02	0.07	-0.42	-0.03	0.08	0.01	-0.31
Strategies for food shortages	0.10	0.00	0.09	0.01	0.03	0.32	-0.10	-0.06	0.35	-0.27	0.03	0.05	0.01
Repeat confinement	0.12	-0.13	-0.02	-0.20	-0.10	-0.01	0.08	0.13	-0.08	0.22	0.37	0.23	0.12
Advantages of environmental care	0.22	-0.18	0.25	0.28	-0.00	0.07	-0.00	0.06	0.01	-0.02	0.10	0.09	-0.11
Reduction in the use of single-use plastics	0.18	-0.22	-0.04	-0.12	-0.13	-0.01	-0.07	-0.19	0.01	-0.09	-0.10	0.08	-0.03
Use of thermos	0.13	-0.27	-0.02	-0.05	-0.11	0.16	-0.10	-0.27	0.01	-0.08	-0.13	-0.11	-0.04
Care of water (future)	0.21	-0.12	-0.02	-0.09	-0.18	-0.27	0.17	-0.16	0.11	0.00	-0.24	0.12	0.00
Organic waste management (future)	0.23	0.05	-0.16	-0.11	-0.29	0.03	0.05	0.00	0.05	-0.03	-0.20	0.03	-0.05
Implementation of actions	0.23	-0.16	0.19	0.21	-0.02	0.10	0.03	0.15	0.02	-0.03	0.03	0.09	-0.14
Preparation of kitchen gardens	0.20	-0.18	-0.02	-0.19	0.00	0.32	-0.05	-0.08	0.19	-0.05	-0.03	-0.03	-0.01
Social conscience	0.13	-0.16	-0.13	-0.14	0.01	0.23	0.16	0.18	-0.06	0.35	0.05	0.13	0.10
Individual conscience	0.02	-0.22	-0.09	0.01	0.00	0.22	0.04	-0.19	-0.28	0.06	-0.21	-0.28	-0.25
Awareness improvements by means of interview	0.13	-0.16	-0.00	-0.27	-0.04	0.08	0.27	0.29	-0.01	0.10	-0.07	0.00	0.12

C1: Awareness, C2: Zero Waste Management, C3: Health-Environment Ideology, C4: Environmental Awareness, C5: Environmental Care Network, C6: Water and Life, C7: Organic Consumption Trend, C8: Environmental Link Habits, C9: Self-care, C10: Preventive Actor, C11: Communicative Utility, C12: Women, Water and Health, C13: Social ecosystem.
 Self elaborated.

light of indications from the health authorities during lockdown (Cesaro *et al.*, 2020); without failing to acknowledge that social responsibility plays a fundamental role for the environment and ideal sustainable development (Goto and Sueyoshi, 2020).

The second, known as “Zero Waste Management” is made up of the variables of rubbish separation, actions concerning waste management, organic waste management and reduction in the use of plastic and disposables. This set of variables indicates a relationship between consumption habits and waste production. This group is aware that they must play an active role in processes causing greatest environmental pollution, such as high consumption of processed foods, single-use packaging or containers, and production of food waste, highlighting their social awareness concerning this issue. Active awareness of a circular economy based on the reuse of organic waste represents a tangible foundation for sustainability (Donner *et al.*, 2020); although it must be emphasized that all aspects of society without discrimination must practice circular economy, to achieve reduction of consumerism and global pollution (Cervantes *et al.*, 2020).

The third Factor termed “Health-Environment Ideology” consists of the variables age, occupation and physical and mental health care. This group is made up of young adults, mainly women, who are economically dependent (students). Among the activities that they will assertively undertake to improve their quality of life and well-being in future years is reading, exercising, and taking care of plants and pets. The World Health Organization (2020a) invited the world population to mitigate the stress or anxiety caused by social isolation, by practicing recreational activities that strengthen intra-family ties, while ensuring health. Environmental care has a direct impact on individual health, as having greater empathy with nature generates greater protection of mental health (Benítez *et al.*, 2020).

The fourth Factor termed “Environmental Awareness” was made up of the variables of water care prior to lockdown, food modifications and adjustments, and advantages of caring for the environment. This group is aware that water is a non-renewable resource, that its care requires making changes in daily life such as eating habits, giving priority to the consumption of natural foods, realizing that these modifications generate benefits, such as improving air quality, reducing pollution of tributaries and maintaining the biodiversity of ecosystems. According to Migheli (2020), this attitude is governed more by a tendency to adopt than by a dogma or belief, or even a policy to abide by, it is visualized as a participatory act that we are all responsible for placing in our state of consciousness and that of future generations (Martin *et al.*, 2020a).

The fifth Factor named “Environmental Care Network” is composed of the variables concerning information about kitchen gardens, plant care, and information about water management and reuse of organic waste, in the future. For its members, social networks are a tool that allows them to obtain and share information about endeavors in favor of ecosystems, promoting social participation. This group identifies the relevance of virtual media for education on issues that promote care and practices that are friendly to the environment. Social networks and mass media represent the ideal way of reaching large numbers of people, for which Spangenberg *et al.* (2010) establish the relevance

of contributing with new tools for solving new paradigms such as the use of virtual technologies, while the rescue of traditional practices adapted to the new generations will produce significant knowledge, essential for human and environmental health. (Ruiz, 2013).

The sixth Factor termed "Water and Life", is made up of the variable, care of water during and after lockdown and relevance of the kitchen garden, its members consider that water is a non-renewable vital liquid and that it is important to establish strategies for responsible use and care. Daily actions have short- and long-term impacts on water supplies, deriving from this, the importance of practicing positive strategies for its care and sustainability (Martin *et al.*, 2020b). Among the actions they carry out is rainwater harvesting to support organic food production in the vegetable garden, which permits them to identify and understand the arduous process of food production in the home. It is relevant to publicize the food production process from an educational perspective, which will generate a sense of appreciation for natural life, forming an intangible value in terms of the good it does to humans and their environment (Botella *et al.*, 2014).

The seventh Factor "Organic Consumption Trend" named because of the relationship between its variables, which represent years of schooling, food consumption, following pages with an environmental focus on social networks and belonging to ecological groups. This group is concerned about the type of food they consume, giving priority to organic foods, but shows little empathy in the search for information about the activities carried out by environmental groups, either virtually or in person, despite having an average academic level of bachelor's degree. The Food and Agriculture Organization of the United Nations (FAO) and the WHO (2020^b) have invited the world population to practice healthier, environmentally friendly diets that have the capacity to be sustainable; emphasizing this, Shao *et al.* (2019) highlight that food preference frames the production trend and although environmental risks depend on it, it is necessary to take actions to adjust consumers towards more sustainable diets and ensure that this is profitable for suppliers at all levels.

The eighth Factor termed "Environmental Link Habits" interconnects the variables, care of plants after lockdown, use of thermos and improvements in environmental awareness. This group dedicated at least one hour to caring for their plants during lockdown, which allowed them to establish a link with their environment, generating improvements in environmental awareness. They understood the need to reduce the indiscriminate use of plastic containers, which take several years to degrade. In a study by van Zanten *et al.* (2020) it is emphasized that the use of reusable utensils and government and industrial involvement generates modifications in attitude that are reflected in collective behavior and have a significant impact on compliance with Sustainable Development Goals (General, 2015).

The ninth Factor termed "Self-care" consists of the variables, follow-up information on lockdown, strategies in the face of food shortages and the importance of social interaction. This group kept abreast of the development of the pandemic, considering what would be the viable options for the supply of household supplies, such as buying from local

producers, supermarkets and fixed markets. For the FAO (2019^a) these establishments represent the greatest source of access, availability and distribution of food, as a source of daily sustenance for any society, but simultaneously they are identified as the greatest source of food waste. This group considered that social interaction should be limited during lockdown to take care of their health, which Weber (1973) considers as a method of isolation provided it has valid causal factors, and results in prosperity for human society. The tenth Factor termed “Preventive Actor” consists of the variables, use of the ecological bag and social confinement as a source of well-being, the information collected from this group reveals that the use of the ecological bag was important to them prior to lockdown and used it as a prevention strategy during home isolation, as it allowed them to transport potentially contaminated products in a closed environment to the area of the home intended for disinfection. Dronin *et al.* (2017) mention that actions such as using ecological items is a favorable trend that will mitigate environmental problems resulting from social growth, representing a viable opportunity to care for the environment and monitor our consumption activities as a society.

The eleventh Factor combines the variables of environmental consultation platforms, natural sightings after social confinement and the willingness to repeat home confinement, named, thanks to this interaction as “Communication Utility”. The mass media and social networks represented the main source of assertive communication for this group, enabling them be aware in real time of the most relevant news worldwide of any type of event; with the most significant, being the journalistic records of animal sightings in different parts of the world due to the absence of human gatherings. Kamel *et al.* (2007) indicate that the media should aim to raise awareness and stimulate social participation towards individual and environmental health care, promoting the involvement of more participants every day. This sector refers to agreeing to repeat programmed confinements with the purpose of giving nature the opportunity to repair ecosystems.

The twelfth Factor “Women, Water and Health” is made up of the variables of gender, area and changes in water consumption. Women in urban areas are aware of the need to make changes in their daily life, in order to take care of water. During lockdown they tried to maintain their average water consumption, even though at that time they spent 24 hours a day at home. According to the WHO (2020a), daily water consumption is directly connected to regular health care taking a bio-psycho-social approach; Ahmadi *et al.* (2017) found a positive relationship between environmental care and greater participation on the part of females, Ghasemi *et al.* (2021) ascertain that the empowerment of women in urban and rural areas is paramount for development and care of the environment.

The thirteenth and last Factor, termed “Social Ecosystem” consists of the varied opinions concerning animal sightings during social confinement. The busiest tourist areas of the Mexican Republic and the world closed their doors, had little mobility, enabling fauna and flora to recover their spaces, generating sightings of animals that made society ponder. Giribabu *et al.* (2019) mention that the sense of protection that is characteristic of a community allows it to design valid protection strategies without the need for governmental, industrial or academic approval. The majority restated the need to be more

participatory in caring for the environment, although some considered that caring for this is not society's role, but rather that of the government; according to Bárcena (2011) multilateral government-society participation is essential for building a community based on well-being.

Sample classification

Once the factors were specified, the participants were grouped by means of Cluster Analysis, which generated five well-defined groups, as indicated in Figure 1, highlighting that the cut-off point was made at a squared Euclidean distance of 1100, which was where the most important surge occurred, allowing groups to be defined.

Group one (G1) corresponding to 14.7% of the study population, consists primarily of women (83.6%), with ages ranging between 21 and 40 years (76.8%), currently undergraduate or postgraduate students (80.2 %). This group is known for having little empathy with the management of organic waste before and during lockdown, as 44.2% and 51% respectively report not having taken any action, in addition to 81.1% who state that they did not separate their waste for collection. According to the National Council for the Evaluation of Social Development Policy (CONEVAL, 2020), the collection of these in the Mexican Republic is determined by local regulations; thus, each state establishes the procedure for its collection, transfer and treatment, with a minority requiring that they are separated. Actions in favor of the environment are transmitted within the family and their practice represents more of a value than a social rule (Atisa, 2020).

Regarding water, 82.2% already practiced between one and six actions (regulating time in the shower, attending to any leak immediately and reusing water from washing

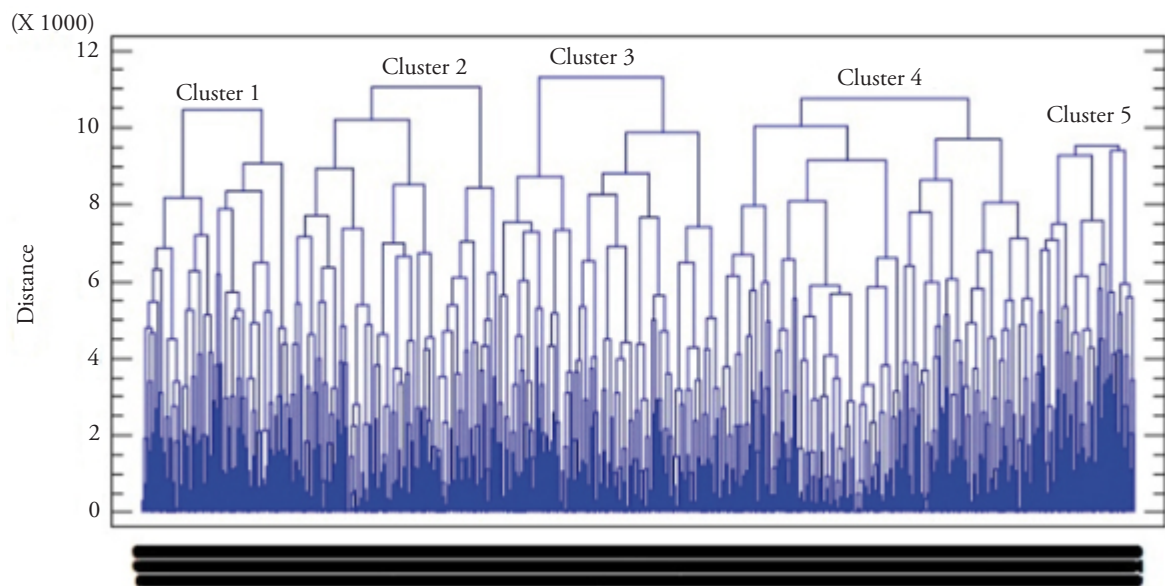


Figure 1. Dendrogram by means of de Ward's method.

machines) in favor of its care, but during the contingency 48.2% stopped practicing these and increased their consumption and only 46.2% plan to continue practicing these after confinement. Although water supplies were not modified during lockdown, there were already public strategies to generate control over their use and protection (Eakin *et al.*, 2020), as apathy and lack of social conscious represent a strong risk for this element (Caser and Cebola, 2017).

This group is known for taking care of their physical and mental health (94.4%), consumes organic rather than processed food (80.2%) and from small producers (44.8%). During lockdown, 98.6% followed the development of the COVID-19 pandemic on the Facebook® platform (59.1%), however, 80.7% report not seeking environmental information; as a result, only 47.6% consider that social participation can reduce global pollution, and improve ecosystems and air quality.

Group two (G2) represents 21% of the study population, consists of 76.6% of female participants, between the ages of 21 and 50, 70% reside in urban areas, 91.8% have an average 17 years of study. The vast majority are students (70.6%) and public servants (25.2%). In terms of waste management, 86.1% separated their rubbish; with responsible consumption, as 93.7% prefer organic foods over processed ones, generating a lower carbon footprint. The United Nations has called on nations and their governments to promote local consumption and regional agriculture as an ecological strategy to reduce the carbon footprint (DESA, 2019). The use of kitchen and vertical gardens are viable options for urban areas, as they promote sustainability and a sense of awareness about the pollution caused by cities (Amritha *et al.*, 2019).

During lockdown, this group separated, reused and recycled their organic waste (82.2%). Plant care increased from 67.1% to 82.3%, the average time dedicated to their care was one hour (70.4%). Gardening is a source of well-being and happiness, despite having little evidence, gardening workers report a conscious state of peace and equilibrium with the environment (Mourão *et al.*, 2018), generating subjective well-being (Diener and Tay, 2015). The main sources of information were YouTube®, WhatsApp®, Google® and social networks (78%). 28.5% belong to an environmental group. Regarding water, 93.3% practiced its care before the establishment of lockdown, 77.1% have reviewed and shared information about its management, primarily on social networks. 97.1% consider continuing with these practices after lockdown. The dissemination of information through the Internet is essential to stimulate social participation; social networks have strengthened sustainable tourism, and have also promoted greater collaboration and social acceptance (Hussain *et al.*, 2018).

55.7% use an ecological bag, 89% are aware of natural sightings due to lockdown; moreover 99.5% would be willing to carry out a voluntary lockdown with the purpose of providing recovery periods for nature. 91.1% consider that staying at home during lockdown generated well-being. Social interaction in the daily life of urban or rural life should be valued, and considering as essential for individual and collective well-being (House *et al.*, 1988), whereas the loneliness caused by lockdown can be risky, if it does not make them feel at ease with their current environment (Holt-Lustand *et al.*, 2015).

Group three (G3) represents 22.4% of the total sample, is headed by women (79.4%) under 30 years of age (73.6%), who are undergoing undergraduate studies (79%), located mainly in urban areas (80.3%). This is the group with least participation in waste management (49.5%), they reported not making any effort in terms of their organic waste either before (55.3%) or during (50%) lockdown. 39.6% indicate that they had not taken care of any plants, garden or kitchen garden; at the time of lockdown, a value which then increased to 53.5%. Voluntary participation is essential to achieve sustainability as a social value; a society with scarce participation generates greater environmental pollution (Lyytimäki *et al.*, 2018).

During lockdown, 58.4% made modifications to their diet, such as consuming more vegetables, fruit, pulses, oil bearing seeds and having more meal times per day. 99.1% do not belong to any environmental or ecologist groups, however, 79.4% considered it necessary to participate more in caring for their environment thanks to reflection inspired by natural sightings. According to Legates *et al.* (2015) agnotology is ignorance caused by misinformation or erroneous information, concerning climatic or ecological aspects, this situation is reflected in social behavior, hence the importance of being well informed.

After lockdown, 77.1% considered that greater participation would bring significant advantages, such as reducing pollution, improving ecosystems, air quality, increasing and protecting biodiversity, and strengthening agriculture. 92.4% considered it necessary to adopt habits that help reduce the consumption of single-use plastics, for 87.9% it is important to use a reusable bottle or thermos for the consumption of beverages, whereas 54% believe that using an ecological bag, the responsible use of water, recycling and responsible management of organic waste are essential activities that should remain after lockdown.

31.7% of the total sample made up group four (G4), which is the largest group and consists of 74.1% women under 40 years of age (85.6%), with a minimum of high school studies (88.2%), living mostly in urban areas (80%). Regarding waste management, 48.5% reported that they sometimes separated their rubbish, in contrast to 56.4% who separated it during lockdown. 78.8% plan to implement strategies (composting, separation for collection or animal consumption) in the reuse of organic waste. Regarding water care, no variation was found, as 83.8% make responsible use of this vital liquid, for their part, 70.3% maintained their consumption of drinking water during lockdown.

87% considered it important to use a reusable bottle or thermos for the consumption of liquids and reduce the consumption of single-use plastics. 96.1% used an ecological bag to make their purchases. 98.1% do not belong to any environmental group; however, 86% used Facebook® and Google® as sources of environmental information. In case of food shortages, 42.9% consider buying in supermarkets and fixed markets as their main strategy. 99% would be willing to repeat lockdown with the purpose of providing rest periods to the environment, for their part, 92.4% consider it necessary to adopt habits that help reduce the consumption of plastics and disposables, 36.2% considered it important that the government become more involved in caring for the environment.

Finally, group five (G5) consists of 10% of the total population, has the same participation on the part of men and women (50%), 71% between 21 and 40 years old, with 85%

representation in urban areas. 81% have undergraduate and postgraduate studies. Regarding the management of organic waste, slight changes were observed before (36%), during (45%) and after (49%) lockdown. 91% prefer organic foods as opposed to processed; faced with food shortages, 40% consider it viable to create a kitchen garden. According to their participation with the environment, 61% did not follow environmental or ecological publications through social networks or web pages prior to lockdown, but during lockdown, this value decreased to 40%; Despite the fact that 48% are aware of animal sightings during lockdown, 25% do not express any thoughts concerning this phenomenon. 59% would not agree to repeat lockdown for ecological purposes, as only 44% considered that being at home during lockdown did not generate well-being, because they mentioned that social interaction is essential for individual well-being (96%).

CONCLUSIONS

The 2020 lockdown managed to arouse the interest of the human population concerning perceptive focus on the role it plays within sustainable development and the importance of its effect in terms of environmental care on a daily basis; care about water and waste management are strongly interconnected with care about human health from an individual perspective; individuals who monitor water consumption think about the importance of its value as a vital liquid, in addition to a level of greater awareness of their long-term protection. Regarding the management of organic waste, there is still much to be done to generate social awareness about added value through its reuse; the circular economy or inclusive public policies, which may be key.

An increase in activities in favor of the environment, greater integration and formation of habits to promote individual and collective health; a conscious attitude to the environment, simultaneously attracts consciousness of health and well-being. Society is obliged to evolve and adapt to any type of condition, its objective is not to perish; the current lockdown drew attention to the environment and a reconsideration of the efficiency and effectiveness of social participation. Taking care of resources today and preserving them for the immediate future represents an environmental awareness, which will cement a more humane sustainable development and be beneficial to the health of all societies.

Limitations to this study included, Collecting information in a period where the population was afraid of being infected and putting their health and life at risk, combined with the use of digital media, were the main limitations that arose concerning this research, because the participating group was mainly in urban areas that had access to the internet, meaning that significant population groups were neglected. The results have made it possible to propose new lines of research, such as monitoring water care strategies and organic waste management after lockdown and evaluating whether the circular economy continues to be a strategy for providing an adequate supply of food.

Special dedication

To my father Juan Carlos Benítez Ramírez (1951-2022), thank you for a wonderful past, a healing present, and a future of beautiful memories. I thank you for the inexhaustible love, the teachings of life and

unwavering courage. I am very proud that you were, are and will be my father and like your wife, children and grandchildren, I loved you, I love you and will forever love you.

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