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Prevalence of diet and lifestyle factors among patients with corona virus infection with reference to healthy subjects

Abstract

Background: Corona virus infection has become a public health problem in the 2020. This retrospective pilot study aims to determine the prevalence of risk factors and protective factors among patients with COVID-19.

Study Design, case control study in a hospital

Subjects and Methods: This study included 147 cases ofCOVID-19, confirmed by rt PCR test conducted by the Chief Medical Officer of Moradabad, India. Validated questionnaires as instruments/tools were used to diagnose risk factors and protective factors among patients (n=147), and age and sex-matched healthy subjects (n=150), above 18 years of age in both the groups.

Results: The prevalence of risk factors, travel history in areas infected with COVID-19, contact with Jamat, tobacco consumption, Western-type diet were significantly (P< 0.05) were more common among patients with COVID-19 compared to the control group. Congested housing and over-crowding in the house were also significantly (P<0.01) more common among patients compared with control subjects. There was a significantly(P<0.01) lower prevalence of physical activity, music listening, yoga practice, moderate alcohol intake, and intake of herbs and nutraceuticals among COVID-19 patients compared to the control group.

Conclusions: Travel from COVID-19 infected area, contact with Jamat, tobacco consumption, Western-type foods, congested housing, and overcrowding in houses were significant risk factors among patients with COVID-19. Lack of physical activity, quarantine in house, lockdown in house, lockdown in the street, and lockdown in the city as well as Indo-Mediterranean type diets, yoga practice, and moderate alcohol intake were possible protective factors which may inhibit COVID-19 and its complications.

Keywords: diet, immunity, inflammation, infection, protective factors, lifestyle

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Key Message Box

Lack of physical activity, quarantine in house, lockdown in house, lockdown in the street and lockdown in the city as well as Indo-Mediterranean type diets, yoga practice, and moderate alcohol intake were possible protective factors which may inhibit spread of COVID-19 and its complications.

Introduction

On 31 January 2020, the WHO announced coronavirus diseases (COVID-19) as a public health emergency of international concern (PHEIC), and finally a pandemic on 11 March 2020, which was considered by some experts to be a late declaration.[1–3] The cause of delay may be that two-third of patients with COVID-19 infection may be asymptomatic in the early phase of the disease. The rate of complications is about 15% with 5% mortality, and the rest 70-80 % of patients recover at their own, but they infect rapidly to others resulting in the sick population.[4–8] It seems that the occurrence of COVID-19 is lower in Central and Eastern Europe as well as Asia, compared to the USA and Western European countries.[9–12] In India, the first index case was a medical student who came back from Wuhan, China, in January 2020, and then two more cases became positive who came into her contact. In Asia, China, Iran, and India appear to have a high prevalence of COVID-19 infection. It is emerging in Pakistan, Iraq, Malaysia, Indonesia, UAE, Saudi Arabia, and Jordan, among healthcare workers, as well as in public despite being locked down in their houses.[7,12,13] COVID-19 acts by damaging the host's immune system, resulting in a marked decline in immune function with a marked increase in inflammation in the tissues, leading to pneumonia and organ failure.[1–5]

The prevalence and risk factors of COVID-19 infection and death rates differ depending on the virulence of the virus and the host's immunity from one population to another and from one city to another as well as from one country to another.[2,4–6,9] Other environmental factors, such as social class, diet, alcohol, and tobacco, may also influence the risk of infection and complications, but there is little evidence to support it. The role of protective factors such as the use of mask, lockdown in the house, the lockdown of the corona hot spot (case area) in the prevention of COVID-19 infection has not been proven in a cross-sectional survey.[8,14] Therefore, there is a need to find out prevalence and risk factors of COVID-19 infection as well as other diet and lifestyle factors in various communities, cities, and in various countries via conducting cross-sectional surveys and cohort studies. No study demonstrates the role of other protective immunogenic factors; yoga and meditation, physical activity, Indo-Mediterranean style diets, antioxidants, or other protective nutraceuticals on the rate

of infection, complications, and mortality. Our strategy is to determine the occurrence of risk factors and protective factors among patients of COVID-19 in North India because these factors may influence the immunological status of the population.

Essential fatty acid (EFA) deficiency is known to increase the susceptibility to infection because both alpha-linolenic acid(ALA) and arachidonic acid are involved in maintaining immune function. Since oxylipins, which are derivatives of EFA, have a critical role in developing immunity and inflammatory responses, and they are derived from polyunsaturated fatty acids (PUFA), it becomes clear that PUFA can influence immunity and inflammation.[15,16] PUFA bound to membrane phospholipids are released on stimulation by hormones, cytokines, and other stimuli, like a viral infection, from cell membranes and become substrates for the production of dodecanol, eicosanoid, and docosanoids. Deficiency of PUFA and other micronutrients in the Western-type diets may decrease these eicosanoids, which decrease T lymphocyte function and immune protection, predisposing to infection.[15–17] Apart from diet, tobacco intake, alcoholism, mental stress, pollutants, viral infections, chronic diseases such as diabetes, heart failure, chronic kidney diseases, lung disease are known to reduce immunity predisposing to infections and other non-communicable diseases (NCDs).[18–23] However, there is an unmet need to determine the role of protective factors that may be immunogenic and may alter the course of the disease resulting in suppression of viral infection and its complications. There is evidence that regular yoga practice, meditation, and mindfulness such as active prayer, moderate physical activity, optimal sleep, Indo-Mediterranean style diets, omega-3 fatty acids, flavonoids, and herbs as well as moderate intake of alcohol, may have beneficial effects and may act as immune-modulators.[24–34]

There is no scientific study to determine the role of diet and lifestyle factors concerning COVID-19 patients in the literature.[34] Because of the variations in the rate of COVID-19, in various cities and countries, the study of diet and lifestyle factors and preventive measures such as lockdown of the communities may have a role to explain the cause of these differences. This retrospective pilot study aims to discover the prevalence of diet and lifestyle factors among subjects with COVID-19, in North India.

Subjects and methods

The study was approved by the ethics committee of the Halberg Hospital and Research Institute. All patients (n=147, male 100, female 47) and corona negative control subjects (n-150, male 106, female 44) were included in this study after verbal consent by themselves, their spouse, or parents. The patients were asked to suggest the control subjects of the same age and sex, From among the family members. Of total 150 control subjects, 102 (68%) had corona negative was recorded in which Rt-PCR was done to rule out COVID-19 infection. Our retrospective study based on the interview of COVID-19 patients recorded in the office of the Chief Medical Officer of Moradabad, India. Clinical history and records made were also verified via an interview of doctors, looking after patients of COVID-19 infection.

Recruitment of all the patients included in this study was made after recovery and discharge from the hospital by an extensive interview by a trained scientist to discover various clinical features of the subjects. We also recruited and examined 150 age and sex-matched control subjects for comparison.

Inclusion criteria, all the patients above 18 years, found positive via rt-PCR at Moradabad (UP), India. Exclusion criteria, non-volunteers (n=2) and age below 18 years (n=5).

Data collection

Case records were completed to record clinical data such as age, sex, body weight, height, waist circumference, past and family history of diseases in all the subjects. Based on available information, the current history of diseases such as diabetes mellitus, hypertension, coronary artery diseases (CAD), stroke, bronchial asthma , chronic obstructive pulmonary disease, pulmonary tuberculosis. The questionnares used for recording data were validated in 20 subjects before starting the study. Validated questionnaires were used to examine behavioral factors, tobacco and alcohol intake, dietary intake, intake of any herbs or nutraceuticals, physical activity, yoga and meditation, prayer, and other health behavior important for developing health scores.

Criteria of diagnosis of risk factors were based on WHO criteria for all the risk factors and diseases. Body weights and heights were measured in underclothes. Body weight was measured in kilograms up to a minimum of 0.5 Kg by a calibrated weighing machine. Height was measured in centimeters after removing shoes, asking the subject to stand on his backside, close to measuring stand. Body mass index(BMI) was calculated, and obesity was defined as a BMI of 30 $kg/m^2$and above, overweight when body mass index 25 kg/m^2 to 29.9 Kg/M.[2]

Statistical analysis

The prevalence rates are given in percent and continuous variables as mean ±standard deviation. Subjects were classified based on age, and the prevalence of various risk factors and protective factors. Significance of risk factors and protective factors was demonstrated by comparing COVID-19 patients with healthy subjects via Chi-square test and Students, t-test. Only p values <0.05 with a two-tailed t-test are considered significant.

Results

Of 154 patients, seven were excluded due to noncooperation (n=2) and age less than 18 years (n=5). The results of 147 subjects(male=100, female 47) with COVID-19 were compared with 150 age and sex-matched, corona negative healthy control subjects, as given in Table 1. It is clear that most of the subjects with COVID-19 were from the age group of below 50 years (83.7%), and rest 24 (16.3%) subjects were 50 years and above. The prevalence of diabetes mellitus and chronic lung disease were significantly more common among COVID-19 patients compared to control subjects.

Table 1 Clinical data among patients with COVID-19 infection

Data	COVID-19(n=147) n (%)	Control group (n=150) n (%)
Sex, male	100 (68.02%)	106(70.6)
Female	47(31.9)	44(29.3)
Age range,<50 years	123 (83.7)	81(54.0)

Table continue

Data	COVID-19(n=147) n (%)	Control group (n=150) n (%)
51- 60 years	15 (10.2)	41(27.3)
>60 years	9 (6.1)	28(18.6)
Bodyweight, Kg/m2	65.6±6.7	65.1±5.6
Body mass index, kg/m2	24.6±2.6	24.1±2.3
Obesity BMI>25 Kg/m2)	27(27.0)	38(25.3)
Blood pressures, mm Hg, Systolic	134±11.7	131.5±10.6
Diastolic (mmHg)	86.4± 8.8	84.7±7.3
Obesity (BMI 25-29.9 Kg/m^2)	14(9.5)	10(6.7)
Hypertension(>140/90mm Hg)	13(8.8)	15(10.5)
Diabetes mellitus (Fasting blood glucose >126 mg/dl, by records)	28(19.0)*	10(6.7)
Coronary disease (By record))	2(1.4)	5(3.8)
Chronic lung disease (By record)	12(8.1)*	2(1.3)
Chronic kidney disease(By record)	1(0.7)	-
Deaths (by records 0)	8 (5.44)*	-

Causes of deaths; ARDS=4, kidney failure=1, other=3). *= P-value <0.04.

The prevalence of deaths was also significantly more common among patients of COVID-19 cases compared to the control group. The causes of deaths were possibly respiratory failure due to ARDS (n=4), chronic kidney disease (n=1), and others (n=3).

The prevalence of subjects with COVID-19 infection in the community, according to the census of India, is shown in Table 2. The majority of the COVID-19 patients were from the Muslim community. The overall prevalence of COVID-19 patients, according to this study, at Moradabad was 0.06% in April -May 2020 (Figure 1).

Table 2 Prevalence of COVID-19 infection in the exposed population of Moradabad

Street name	Population in the concerned area	Out of population n(%)	Out of total cases n(%), n=147
Galshaheed	10575	29(0.27)	29(19.7)
Lalbagh	6200	8(0.12)	8(5.4)
Ajadnagar	10500	4(0.038)	4(2.7)
Berbalan	64700	28(0.043)	28(19.0)
Hrthala+Himgiri	9260	3(0.032)	3(2.0)
Chao basti	8750	3(0.032)	3(2.0)
Kazipura	4590	1(0.021)	1(0.7)
Chakkarmilak	24450	1(0.004)	1(0.7)
Maanpur	2550	1(0.039)	1(0.7)
Patpuri	1000	1(0.10)	1(0.7)
Garhi(Kanth)	20000	5(0.02)	1(3.4)
Villages	5860	9(0.15)	9(6.1)
Eidgaahbasti (Kanth)	5000	1(0.02)	1(0.7)
Nawabpura	10000	23(0.23)	23(15.6)
Maqbara	15000	22(0.15)	22(15.0)
Tambakuvalan	7100	4(0.056)	4(2.7)
Lalnagari	12000	2(0.016)	2(1.4)
Feelkhana	1785	1(0.056)	1(0.7)
Govind Nagar	14500	1(0.0068)	1(0.7)
Total exposed subjects	2,33,820	147(0.06)	147(100.0)

Note: samples examined > 3059, by rtPCR, May 15, 2020 Total=147 found positive including Deaths=8.

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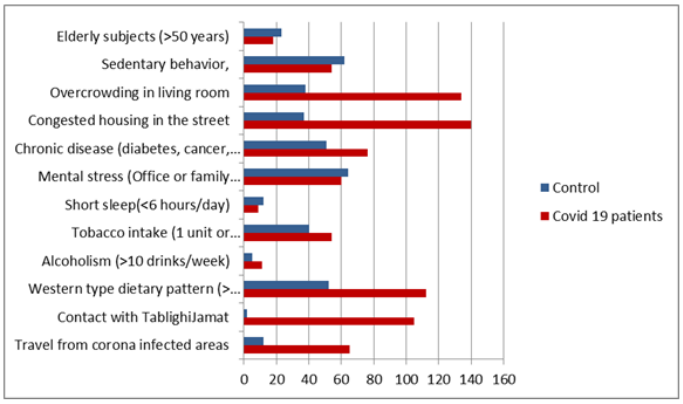

Figure 1 Risk factors percentage more among patients with COVID.

Discussion

This study shows that the prevalence of intake of Indo-Mediterranean type of diets was significantly lower among patients with COVID-19 compared to the control group (P< 0.01) It seems that diet and physical activity are the two most critical nutritional modulators of immunological function, which may protect from diseases.[9–11,20] Indo-Mediterranean type of diet means a combination of Indian foods such as whole grains; red bean, green bean, black bean, kidney bean, gram, millets and peas as well as spices; coriander, cumin, fenugreek, turmeric, and mustard oil along with Mediterranean foods; vegetables, fruits, nuts, olive oil, poultry, fish with low red meat. These foods are rich in flavonoids and polyphenolics, vitamins, A, E, C, D, and beta-carotene; minerals; zinc, copper, magnesium, selenium, chromium, which possess potent antioxidant and immune-modulating effects.[15,16,18,29,35] Travel in corona infected places and contact with Jamat were significantly more common among patients with COVID-19 compared to the control group. We cannot compare our results with other studies because no such studies have been published from India and other countries. Congested housing in a street and over-crowding in the bedroom were also significantly more common in the COVID-19 group, indicating that these health behaviors may have increased the risk of infection among these patients. There is no study to examine the association of these living habits with infection from COVID-19, in other studies.

The consumption of a Western-type diet was significantly more common among subjects with COVID-19 compared to healthy subjects. Western-type diet is characterized by high energy and low micronutrients, which is known to generate free radical-induced oxidative stress, leading to systemic inflammation.[15,16,18] Dietary changes largely blunt the Western diet's effect, but myeloid cell-induced innate immune responses remain augmented and could predispose to proinflammatory NCDs if preventive measures are not taken.[15,16,18] Western diet triggers innate immunity, the nucleotide-binding oligomerization (NOD)-like receptors (NLRs), and IFN signaling pathways. The nucleotide, like receptors precursor 3(NLRP3), can identify sugar, saturated fat, and salt-rich Western foods, which can mediate trained immunity. Thus, the Western diet induces long-lasting trained immunity in myeloid cells and alters the lipopolysaccharides (LPS) responses of cyclic dimeric Guanosine monophosphate (c-di-GMP) and regulate hematopoietic stem cell (HSC). The trained immunity evolves innate and adaptive immune systems. The adaptive immunity arm induces antigen-specific memory formation on an encounter with any pathogen. However, the innate immunity arm rapidly evolves non-antigen-specific protective mechanisms against the pathogens.[15,16,18]

It is proposed, that an energy-rich, nutrient-deficient diet may predispose immunosuppression leading to increased susceptibility of the host, to free radical-induced damage, causing ARDS or organ failure. However, increased intake of Indo-Mediterranean type of foods may potentiate trained immunity leading to increased innate and adaptive immune responses, which can inhibit proinflammatory Toll-like receptors (TLRs) and the NOD-like receptors (NLRs).[15,16,18] There may be a persistent increase in innate and adaptive immunity in the host that may counteract the initiation of adverse effects due to COVID-19. The progression of COVID-19 is associated with inflammatory processes involving cells of the innate immune system, mainly monocyte-derived macrophages. Hence, it is of fundamental and translational importance to explicitly understand the mechanisms that link to the consumption of energy-rich diets to increase inflammation and how certain nutrional factors in the Indo-Mediterranean type of diet can inhibit inflammation.[15–17,29,35]

Recently, antioxidants such as flavonoids and polyphenolics present in the diets, have been demonstrated to possess specific immunomodulatory effects that might be important in the development of many diseases in which immunity is reduced.[29,36] Among several types of immune cells, T lymphocytes play a critical role in protecting the immune system and the pathogenesis of specific autoimmune diseases. In the immune system, mTOR, mainly in T lymphocytes, is an essential mediator of metabolism. Polyphenolics and flavonoids can suppress mTOR activity and may induce the T regulatory subset.[29] There is evidence that several of the dietary flavonoids, including quercetin, naringin, hesperetin, and catechin can influence virulence and replication of herpes simplex virus type 1 (HSV-1), polio-virus type 1, parainfluenza virus type 3, and respiratory syncytial virus (RSV).[31,35] This observation poses the possibility that food and herbs rich in these agents can inhibit the rate of infection and coronavirus infection complications. In cell culture monolayers, quercetin produced a decline in the intensity of infection in a concentration-dependent manner of each virus.[35] Reduced intracellular replication of each of the viruses was observed on treatment with hesperetin. However, catechin inhibited the infectivity without any effects on the replication of RSV and HSV-1 and had insignificant effects on the other viruses. Naringin showed no effect on either the infectivity or the replication of any of the viruses studied.[35] It seems that dietary flavonoids may have a variable spectrum of antiviral activity against specific RNA and DNA viruses, which may inhibit infectivity and replication, indicating that flavonoids might also inhibit these markers in COVID-19.[29–31,35] Apart from foods, herbs and nutraceuticals, containing flavonoids, omega-3 fatty acids, and arachidonic acid have also been found to increase immunity, which may also protect against viral infections.[28,29,32,35]

This study also shows that subjects doing moderate physical activity were significantly(P<0.05) lower in the COVID group compared to the control group indicating that lack of moderate physical activity may have caused reduced immunity with increased susceptibility to COVID-19.[26] It has been reviewed that regular physical activity can increase immunity. However, most of the studies were conducted, either among healthy adults or those suffering from cardio-metabolic problems, while research among older subjects is not commonly reported. The results from these studies indicate that lifestyle modification, such as high-intensity physical activity training, may prevent diseases via attenuation of senescence in immune function.[26] It seems that previous research was conducted among patients or

healthy subjects without many elderly populations, which revealed that physical activity training could modulate immune-senescence.[26]

It is known that tobacco intake, alcoholism, and pollution are essential toxicants that decrease immunity and protective immunological responses of the immune system.[18–20] Tobacco intake was significantly more common among patients with COVID-19 compared to the control group, which may have contributed partly to a decline in immunity and predisposed these patients to coronavirus infection and complications.Apart from the above risk factors, environmental factors, pollutants, foods, toxins, infecting agents may also produce physicochemical stress.[20,21] If the stress is higher than the regular adaptability of the immune system or the immune system is so compromised that it can not cope with physicochemical stress, it may result in a condition of disease due to suppression of immune function. The underlying biological mechanisms may be a persistent increase in cortisol concentrations, glucocorticoids, and glucose, leading to cortisol resistance with impaired anti-inflammatory activity and impaired immune function.[21] The crosstalk of immune cells and signaling networks may be perturbed due to continuous biochemical stress.[22,26]

Regular practice of yoga and meditation, as well as mindfulness and optimal sleep of 7-8 hours daily, have also been demonstrated to improve immunological responses, which may protect against diseases.[37] There is evidence that light to moderate amounts of polyphenol-rich alcoholic beverages like wine or beer could have health benefits by improved immune function.[38] However, alcoholism of any kind may suppress a wide range of immune responses, leading to an increased risk of infectious and other chronic diseases. Recent studies also emphasize the role of nutrition in the course of coronavirus infection and that fish intake may have beneficial effects on immunity.[39–41]

Mechanisms of corona virus infection and immunity suppression

Coronaviruses are enveloped positive-stranded RNA viruses that replicate in the cytoplasm by delivering their nucleocapsid into the host cell by fusing their envelope with the host cell membrane.[42,43] In COVID-19 patients, there are marked alterations in the adaptive and the innate immune system in conjunction with a cytokine storm.[43] There is a marked increase in the release of cytokines and chemokines which perturbs and dysregulates the immune defense of the host leading to tissue damage and organ failure. The underlying changes are decrease in lymphocytes and platelets and a modulation in total neutrophils, with a severe decline in the concentration of various immune cells; β cells and natural killers (NK) cells, T cells, $CD4^+$ cells, $CD8^+$ cells, along with a reduction in eosinophils, monocytes, and basophils which are protective against virus.[44]

A marked decrease in the levels of an absolute number of circulating $CD4^+$ cells, $CD8^+$ cells, β cells, and natural killers (NK) cells, along with a decrease in monocytes, eosinophils and basophils may be seen.[44] The virus is known to produce genomic RNA in the cytoplasm with activation of the immune response to dsRNA during the replication of the virus. It seems that TLR-4 may also identify S protein and may activate proinflammatory cytokines via new signaling pathways. The release of antiviral proteins depends on the generation of type 1 IFNs, which protects the uninfected tissues. Occasionally, TLR-3 signaling and binding of the dsRNA of the coronavirus, are perturbed via accessory proteins of the virus, which is more so via replication and inhibition of TLR-3 activation to evade the immune response.[43]

It is essential to understand the mechanisms regarding the role of diet and lifestyle factors in the development of immunity to explain their role in the pathogenesis and prevention of COVID-19. It is proposed that diet and lifestyle factors induced immunological protection provided to the host should be recognized as trained immunity. The adaptive immunity arm induces antigen-specific memory formation on an encounter with any pathogen. However, the innate immunity arm rapidly evolves non-antigen-specific protective mechanisms against the pathogens. It seems that several protective receptors with innate immune signaling such as Toll-like receptors (TLRs) and the NOD-like receptors (NLRs) are evoked with counteractive innate immune responses due to infection.[15–17] These receptors may also identify the sterile danger signals known to trigger inflammation in chronic diseases. Counteractive innate immune responses are evoked by the activation of a series of innate immune signaling receptors, such as Toll-like receptors (TLRs) and the NOD-like receptors (NLRs).[15–17] Uncontrolled persistent innate immune activation causes chronic inflammatory diseases or acute inflammatory reaction, due to acute reactants, leading to thrombosis, in vascular cells and fibrosis-sepsis in alveoli- possibly consolidation leading to ARDS. Our study also found that chronic diseases such as heart disease, lung diseases, and diabetes were significantly more common in the COVID-19 group compared to the control group, which may have led to increased susceptibility of these subjects to infection.[23]

We have also found that public health measures such as lockdown in the house, the lockdown of streets, and the lockdown of city, and quarantine were significantly lower among the COVID-19 group than in the control group (Table 3, Figure 2). It seems that lack of use of these measures for transmission of infection from corona patients may be significant in the spread of COVID-19 in the COVID-19 group, compared to the control group where these methods were commonly used as preventive measures. Because of the scarcity of population-based data on COVID-19, it seems to be a prediction based on previous epidemics, that lockdown may be beneficial in the prevention of pandemic due to this disease.[45,46] There is further need to find out if a new wave of an epidemic can emerge after the lockdown is over. There are a few examples of successful containment from Taiwan, South Korea, and China compared to Italy (lower testing rate), mainly on the tracing of contacts by extensive testing of COVID-19 infection.[8,14,45]

Table 3 Behavioral factors and major risk factors among COVID-19 patients and control subjects

Behavior	Covid-19 patients (n=147) Number (%)	Control subjects (n=150) Number(%)
Risk factors		
Travel from corona infected areas	65 (44.21)**	12 (8)
Contact with Jamat without a face mask.	105 (71.4)**	2 (1.33)
Western-type dietary pattern (> 600g/day)	112 (76.19)*	52 (34.66)
Alcoholism (>10 drinks/week)	11 (7.48)	5 (3.33)

Table continue

Behavior	Covid-19 patients (n=147) Number (%)	Control subjects (n=150) Number(%)
Risk factors		
Tobacco intake (1 unit or more/week)	54 (36.73)*	40 (26.66)
Short sleep(<6 hours/day)	9 (6.12)	12 (8.0)
Mental stress (Office or family problems)	60 (40.81)	64 (42.66)
Chronic disease (diabetes, cancer, lung disease)	76 (51.70)*	51 (34)
Congested housing in the street	140 (95.23)*	37 (24.66)
Overcrowding in the living room with no face mask.	134 (91.15)*	38 (25.33)
Sedentary behavior,	54 (36.73)	62 (41.33)
Elderly subjects (>50 years)	18 (12.24)	23 (15.33)
Protective factors		
Indo-Mediterranean type of diet (> 400g/day)	33 (22.44)*	56 (37.33)
Moderate physical activity	25 (17.0)*	55 (36.66)
Meditation and prayer>5 times/day	71 (48.29)	75 (50.0)
Prayer 1-4 times per day	58 (39.45)	75 (50.0)
Yoga posture	3 (2.04)	12 (8.0)
Circadian restricted eating/fasting (Eating once daily)	2 (1.36)	5 (3.33)
Low caloric diet (<1500 KCal/day)	3 (2.04)	6 (4.0)
Mastication(Chewing >15/bite)	140 (95.23)	123 (82.0)
Music(Listening or playing>once/week)	42 (28.57)	54 (36.0)
Intellectual work(reading writing >1 hour daily)	33 (22.44)	41 (27.33)
Moderate alcohol intake,6 to 10 drinks/week	6 (4.08)	15 (10.0)
Good sleep (6-8 hours/day)	135 (91.83)	138 (92)
Intake of herbs and nutraceuticals	7 (4.76)	19 (12.66)
Quarantine	10 (6.80)**	142 (94.66)
Lockdown in houses.	20 (13.60)**	138 (92.0)
Lockdown of the street	20 (13.60)**	122 (81.33)
Lockdown in the whole town.	20 (13.60)**	136 (90.66)

The Chi-square test obtained p-value by comparing % in the two groups.*=P<0.05, **=(P<0.01).

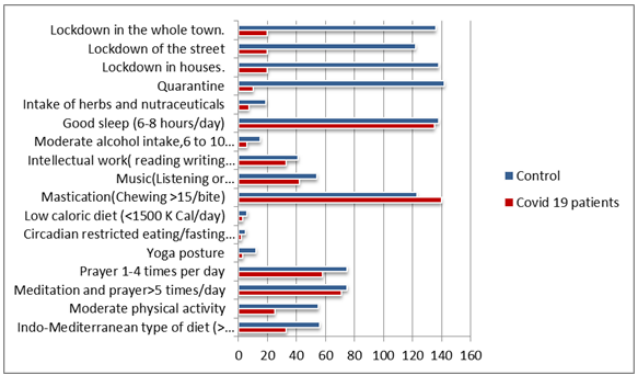

Figure 2 Protective factors among patients with COVID.

In the absence of occurrence and incidence data, including the results of serology testing, it is only speculation to predict the effects of lockdowns of public wherever they are, on the course of the COVID-19 pandemic.[45,46] In a cross-sectional study from China, 1257, healthcare workers in 34 hospitals equipped with fever clinics or wards for patients with COVID-19 were examined.[46] There is no scientific evidence whether implementing a lockdown at a time when many people can infect others could lead people to apply more time in close quarters with the elderly and those who are susceptible. In Italy, both interaction tracing and laboratory testing were more restricted, and lockdown needed to be used as a last, blind measure of desperation.[45] There is limited evidence that public health interventions combined with other measures, can control the outbreak of COVID-19 infection. In a case-control study comprising 32 583 cases, the role of public health interventions was found to provide limited protection.[8]

There is need to examine the effects of policies that are accepted first on the expected wave of patients with seriousness who would develop complications in the later stage.[45–47] In a cohort study, 32 583 (median age 56.7 years) confirmed COVID-19 cases reported, from China, the role of non-pharmaceutical public health interventions including *cordons Sanitaire*, traffic restriction, and community distancing, home confinement, centralized quarantine, and universal symptom survey were examined.[8] It is clear from this case-control study that public health interventions were temporally associated with developed control of the COVID-19 outbreak in Wuhan, China. These findings appear to be essential and need confirmation in other countries and regions. It is desirable to study the effects of the policies adopted first on the expected wave of patients with severe illness who

would develop complications and will need hospitalization as well as on early detection of COVOD-19 infection.[45–47] Further studies in a large number of subjects, based on randomly selected populations are necessary for confirming our results and finding out the adverse effects of public health measures such as lockdown on mental and physical health.[8,14,48,49]

In brief, our study results indicate that travel from COVID-19 areas and contact with Jamat were significant risk factors for the spread of infection. Tobacco intake, presence of chronic diseases, Western-type diet, sedentary behavior, congested housing, and over-crowding were also significant risk factors among COVID-19 patients compared to control subjects. Among non-pharmacological public health measures, lack of quarantine, lockdown in house, the lockdown of street and lockdown of COVID-19 area, intake of Indo-Mediterranean diet, moderate physical activity were critical protective factors observed among these patients. Multivariate logistic regression analysis involving a large sample would be necessary to demonstrate the role of risk factors and protective factors in the pathogenesis of COVID-19.

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Conflicts of interest

Tha authors declare that there was no Conflict of interest.

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