Overweight: A risk factor for COVID-19 --- A medical conundrum or a reality?

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Abstract

Introduction: Obesity may contribute to the initiation, progression, transmission, and deterioration of COVID-19. However, there was lack of such studies carried out by Indian workers. Materials and Methods: Data of cumulative cases of COVID-19 of various countries as on the day the peak incidence were reported in each country during the first and second waves of the pandemic was obtained from the internet. Data on prevalence of overweight were obtained by doing a thorough search of existing literature. The data so collected were tabulated and analyzed using SPSS version 20 to establish a correlation coefficient between overweight and COVID-19. Data pertaining to overweight status and age profile and COVID-19 status as on 28 Feb 2021 was collated as part of routine surveillance from the Health Department in an urban area. The total population for which the above data was obtained was 1107. The data so collected were subject to statistical analysis using SPSS version 20, to find out the odds ratio of overweight as a risk factor for COVID-19 after adjusting for age. Results: Correlation coefficient between overweight and COVID-19 for data pertaining to the first wave and the second wave 0.95 and 0.94, respectively. Odds ratio of overweight as a risk factor for COVID-19 after adjusting for age works out to 2.95 (95% confidence interval 2.30–3.78). Mean age of the study subjects was 32.61 years (median 32 years, minimum 19 years, maximum 54 years, standard deviation 6.62). Limitations: The limitation of the present study is that the workers could only obtain retrospective data, carry out a case-control study and calculate odd ratio for overweight as a risk factor for COVID-19.

Keywords: COVID-19, odds ratio, overweight

Introduction

An outbreak of pneumonia which emerged in Wuhan City of Hubei Province in China alerted the medical and scientific communities in December 2019. A novel betacoronavirus, which we now know as SARS-CoV-2, was identified to be the causal agent.[¹]

The COVID-19 pandemic has posed a critical threat to public health across the globe.[²]

Materials and Methods

Data of cumulative cases of COVID-19 of various countries across the globe, as on the day the peak incidence of COVID-19

Several workers have carried out studies which have established a relationship, correlation, or links between obesity and severity of COVID-19, greater risk of needing hospitalization, intensive care unit admission, and mechanical ventilation.[³⁻⁹]

Obesity may also contribute to the initiation, progression, transmission, and deterioration of COVID-19.[⁰⁻¹⁸] However, there was lack of such studies carried out by Indian workers. It was keeping in view the importance of overweight/obesity as a risk factor for COVID-19 and severity of COVID-19, coupled with the lack of similar studies in this part of the globe that the present study was carried out.

Keywords: COVID-19, odds ratio, overweight

Introduction

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Materials and Methods

Data of cumulative cases of COVID-19 of various countries across the globe, as on the day the peak incidence of COVID-19
were reported in each country during the first wave of COVID-19 pandemic was obtained from the internet. Similar data for the same countries were obtained during the second wave of the pandemic. Since different countries were in different stages of the pandemic during the first wave and the second wave, dates to which the data for each country pertains during both the waves are different.

Data on population, land mass, and population density of India and various other countries were also obtained from the internet.\textsuperscript{18-17} Data on prevalence of overweight of the same countries were obtained by doing a thorough search of existing literature and the internet; and from the official website of WHO.\textsuperscript{18-23}

The prevalence of overweight was converted into actual numbers of overweight in each country based on the population of that particular country. The data so collected were tabulated and analyzed using SPSS version 20 to establish a correlation coefficient between overweight and COVID-19 after controlling for confounding variables, such as population, land mass, and population density. The above analysis was carried out for both sets of data i.e. data of the first wave and the second wave.

Data pertaining to overweight status and age profile and COVID-19 status as on 28 Feb 2021 were collated as part of routine surveillance from the Health Department of a few wards of municipal corporation in an urban area. The total population for which the above data were obtained was around 1107. The data so collected were subject to statistical analysis using SPSS version 20, to find out the odds ratio of overweight as a risk factor for COVID-19 after adjusting for age.

### Inclusion criteria

Subjects in respect of whom overweight status and COVID-19 status were known were included in the study.

### Exclusion criteria

Subjects in respect of whom COVID-19 status was not known were excluded from the study.

### Results

The data depicting population of each country, prevalence of overweight, actual numbers of overweight and number of cases

| Country             | Population | Prevalence of overweight | Overweight actual numbers | Number of COVID-19 cases | Prevalence of COVID-19 | Date to which the data pertains |
|---------------------|------------|--------------------------|----------------------------|--------------------------|------------------------|-------------------------------|
| India               | 1380004385 | 19.3                     | 2663408463                 | 5115893                  | 0.370715706            | 16-Sep-20                     |
| Pakistan            | 220892340  | 26.2                     | 578737938                  | 139230                   | 0.06030705             | 14-Jun-20                     |
| Afghanistan         | 38928346   | 19.7                     | 76688841.62                | 18969                    | 0.04872989             | 05-Jun-20                     |
| Sri Lanka           | 21413247   | 24.2                     | 5182006.258                | 2454                     | 0.011460195            | 10-Jul-20                     |
| Nepal               | 29136808   | 19.6                     | 5710814.368                | 144872                   | 0.49721301             | 21-Oct-20                     |
| Vietnam             | 97338579   | 18.3                     | 17812959.96                | 509                      | 0.000522917            | 30-Jul-20                     |
| Thailand            | 69799978   | 34.7                     | 24220592.37                | 599                      | 0.000858166            | 22-Mar-20                     |
| Indonesia           | 273523615  | 28.3                     | 77407183.05                | 266845                   | 0.097585304            | 25-Sep-20                     |
| Bangladesh          | 164689383  | 19                       | 31290982.77                | 153277                   | 0.093070359            | 02-Jul-20                     |
| Malaysia            | 32365999   | 41.7                     | 13496621.58                | 3333                     | 0.010297844            | 03-Apr-20                     |
| Nigeria             | 206139589  | 26                       | 5359293.14                 | 26484                    | 0.012847605            | 01-Jul-20                     |
| Ethiopia            | 114963588  | 18.1                     | 20880409.43                | 37665                    | 0.032762547            | 21-Aug-20                     |
| Egypt               | 102334404  | 61.9                     | 63344996.08                | 52211                    | 0.051019987            | 19-Jun-20                     |
| Congo               | 89561403   | 28.1                     | 25166754.24                | 4628                     | 0.005167405            | 02-Sep-20                     |
| South Africa        | 59308690   | 51.9                     | 30781210.11                | 421966                   | 0.711474153            | 24-Jul-20                     |
| Tanzania            | 59734218   | 24.5                     | 14634883.41                | 480                      | 0.00080356             | 29-Apr-20                     |
| Kenya               | 53771296   | 22.6                     | 12152312.9                 | 17603                    | 0.032736797            | 26-Jul-20                     |
| Uganda              | 45741007   | 19                       | 8609791.33                 | 413                      | 0.0090291             | 30-May-20                     |
| Sudan               | 44033463   | 26.8                     | 11800968.08                | 3138                     | 0.00726398            | 21-May-20                     |
| South Sudan         | 11193725   | 10.8                     | 1208922.3                  | 1317                     | 0.01176582            | 07-Jun-20                     |
| USA                 | 331002651  | 70.2                     | 232368361                  | 4331003                  | 1.308449641            | 24-Jul-20                     |
| Brazil              | 212559417  | 56.9                     | 120946308.3                | 2555518                  | 1.202260543            | 29-Jul-20                     |
| Spain               | 46754758   | 67.2                     | 31419197.38                | 98581                    | 0.21084699            | 20-Mar-20                     |
| Italy               | 60461826   | 64.1                     | 38756030.47                | 53598                    | 0.08864767            | 21-Mar-20                     |
| France              | 65273511   | 62.9                     | 41057038.42                | 52128                    | 0.07986088            | 31-Mar-20                     |
| United Kingdom      | 67866011   | 67.2                     | 45619399.39                | 66705                    | 0.098260303            | 10-Apr-20                     |
| Germany             | 83783942   | 62.8                     | 52616315.58                | 50871                    | 0.06071685             | 27-Mar-20                     |
| Switzerland         | 8654622    | 57.9                     | 5011026.138                | 5615                     | 0.06487628            | 20-Mar-20                     |
| Sweden              | 10099265   | 59.9                     | 6049459.735                | 62680                    | 0.620639225           | 24-Jun-20                     |
| Australia           | 25499884   | 67.2                     | 17135922.05                | 1609                     | 0.006309833            | 22-Mar-20                     |
| New Zealand         | 4822233    | 68                       | 3279118.44                 | 514                      | 0.010658962           | 28-Mar-20                     |

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The data depicting odds ratio of overweight as a risk factor for COVID-19 after adjusting for other confounding variables, such as coronary artery disease, primary hypertension and type II diabetes mellitus is presented in Table 3.

Correlation coefficient between overweight and COVID-19 for data pertaining to the first wave and the second wave was 0.95 and 0.94, respectively. Correlation coefficient between population density of various countries and COVID-19 during the first wave and the second wave was a poor 0.019 and 0.004, respectively. Geographical area of various countries and COVID-19 during the first wave and the second wave showed a strong correlation coefficient of 0.65 and 0.67, respectively. Odds ratio of overweight as a risk factor for COVID-19 after adjusting for age works out to 2.95 (95% confidence interval 2.30–3.78). Thus, the strong positive correlation coefficient is further strengthened by the statistically significant odds ratio.

The data of COVID-19 for the first wave are presented in Table 1. Similar data for the second wave are tabulated in Table 2.
deviation 6.62). Age group–wise distribution of the study subjects is tabulated in Table 4. Age group–wise overweight status of the study subjects is tabulated in Table 5. Age group wise COVID-19 status of the study subjects is tabulated in Table 6.

### Discussion

The association of higher prevalence of COVID-19 in countries with higher prevalence of overweight was first hypothesized by Banerjee. A strong correlation of obesity with influenza and other respiratory viral infections has already been established. The association of obesity with various comorbidities strengthens its role as an exponentially important factor in determining the morbidity and mortality risk in SARS CoV2 patients.

Kevin reported a weak positive correlation of 0.289 between prevalence of BMI >40 and COVID-19 cases. Several workers have listed obesity as major risk factor for the initiation, progression, and outcomes of COVID-19.

Ahmed also observed a correlation between obesity and the current COVID-19 pandemic. Obesity as defined by BMI is more prevalent in Italy, as compared to China. This might be contributory factor to the difference in fatality rates between the two countries. Another observation by the same worker is that the United States has a higher prevalence of obesity as compared to China; and also the highest mortality rates from COVID-19.

Obesity has also been shown to have deleterious effects on host immunity, thereby increasing the risk for susceptibility to infection, severity, and adverse endpoints after infection including higher rates of hospitalization, admission to intensive care unit, and death. Obesity has thus been an underappreciated and one of the strongest risk factor for COVID-19. There is increasing evidence to demonstrate a strong correlation between obesity and COVID-19. Gabriel reported a direct correlation between increase in BMI and the proportion of patients with severe COVID-19.

Grazia reported biological and physiological plausibility between overweight/obesity and COVID-19 outcomes. Yue observed an odds ratio of 1.72 (95% CI 1.04–2.85) between obesity and severe or fatal COVID-19.

Popkin et al. observed that overweight increased the risk of COVID-19 by 44.0% (relative risk (RR) = 1.44; 95% CI, 1.08–1.92; \( P \) = 0.0100) and individuals with obesity almost doubled the risk (RR = 1.97; 95% CI, 1.46–2.65; \( P < 0.0001 \)). The primary care physician when he comes across an overweight patient can advise the patient regarding overweight being a risk factor COVID-19. The physician can advise the patient to get himself/herself vaccinated against COVID-19. The overweight patient can also be advised by the primary care physician to reduce his/her weight to within desirable limits by adopting suitable lifestyle modification measures. Although overweight is a major risk factor for various diseases, primary care physicians find managing overweight and obesity a difficult business. Anderson reported favorable outcomes for the effectiveness of individually directed advice in reducing overweight.

### Limitations

The limitation of the present study is that the workers could control only for three confounding variables viz, population, land mass, and population density while calculating the correlation coefficient between overweight and COVID-19, as data of only these three variables was available to accessible by the workers. Data in respect of other confounding variables, such as age distribution of various populations, sex distribution of various populations, were not available to the workers. Another limitation of the study is that the workers could only obtain retrospective data, carry out a case-control study and calculate odd ratio for overweight as a risk factor for COVID-19. Prospective or cohort study could not be carried out due to resource constraints. We therefore recommend that further studies in this field be carried out to validate the results obtained by us. Our study validates the association of overweight and COVID-19 which has been observed by several workers. Our study is one of the pioneering works in establishing a strong positive correlation coefficient between prevalence of overweight and COVID-19.

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### Table 5: Age group-wise overweight status of the study subjects

| Age group  | Number (%) |
|------------|------------|
| <20 years  | 0 (0.00)   |
| 20-39 years| 251 (42.11) |
| 30-39 years| 257 (43.12) |
| 40-49 years| 86 (14.42)  |
| >50 years  | 4 (0.67)   |
| Total      | 596 (100)  |

### Table 6: Age group-wise COVID-19 status of the study subjects

| Age group  | Number (%) |
|------------|------------|
| <20 years  | 001 (0.18) |
| 20-9 years | 180 (33.45) |
| 30-39 years| 279 (51.85) |
| 40-49 years| 077 (14.31) |
| >50 years  | 001 (0.18) |
| Total      | 538 (100)  |
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